

## בטיחות מכונות – מערכת אותות סכנה ואותות מידע קוליים וחזותיים

Safety of machinery - System of auditory and visual danger and information signals

*מסמך זה הוא הצעה בלבד*

תקן זה הוכן על ידי הוועדה הטכנית 6604 – סימנים וסמלים בבטיחות, בהרכב זה:

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**הודעה על מידת התאמת התקן הישראלי לתקנים או למסמכים זרים**  
תקן ישראלי זה זהה לתקן של הוועדה האירופית לתקינה (CEN)  
EN 981:1996+A1 :September 2008

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**מילות מפתח:**

בטיחות ציוד, אותות שמע, אותות חזותיים, תכן, ארגונומיה, צבעי בטיחות, בטיחות תעסוקתית, התקני אזהרה, מערכות אזעקה, תאורת אזהרה, התקני נעילה.

**Descriptors:**

Equipment safety, acoustic signals, visual signals, design, ergonomics, safety colours, occupational safety, warning devices, alarm systems, warning lights, locking devices.

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*This national standard is the identical implementation of EN 981:1996+A1 and is adopted with the permission of the European Committee for Standardization - CEN, Avenue Marnix 17, B-1000 Brussels, Belgium*



## הקדמה לתקן הישראלי

תקן ישראלי זה הוא התקן של הוועדה האירופית לתקינה (CEN) EN 981:1996+A1 מספטמבר 2008 שאושר כלשונו כתקן ישראלי.

התקן כולל, בסדר המפורט להלן, רכיבים אלה:

- תרגום סעיף חלות התקן האירופי (בעברית)

- התקן האירופי (באנגלית)

- סעיף אזכורים נורמטיביים (בעברית)

**חלות התקן** (תרגום סעיף 1 של התקן האירופי)

**הערה:**

תקן זה מפרט מערכת של אותות סכנה ואותות מידע, תוך התחשבות ברמות הדחיפות השונות, כדי לצמצם סיכונים הנוגעים לפירוש מוטעה של אותות סכנה חזותיים ושל אותות סכנה קוליים. תקן זה חל על כל אותות הסכנה ואותות המידע שיש לקלוט אותם בבירור ולהבחין ביניהם בבירור כמפורט בסעיף 5.3 של התקן האירופי EN 292-2:1991 או לפי דרישות אחרות או לפי המצב הנתון במהלך עבודה. תקן זה חל על כל רמות הדחיפות – מדחיפות גבוהה ביותר ועד למצב של "הכול תקין". אם האותות החזותיים משלימים את אותות השמע, מפורט מאפיין האות עבור שני סוגי האותות. תקן זה אינו חל על תחומים מסוימים שעליהם חלים תקנים מיוחדים או אמנות אחרות בתוקף (בין-לאומיים או לאומיים); במיוחד, אזעקות אש, אזעקות רפואיות, אזעקות המשמשות בתחום התחבורה הציבורית, אותות ניווט ואותות לתחומי פעילות מיוחדים (למשל, כוחות ביטחון). יחד עם זאת בעת תכנון של אותות חדשים, רצוי להביא בחשבון את התקן הזה כדי להימנע מחוסר עקיבות. עבור אותות שמע, שיטת איפיון האותות משמשת קו מנחה לשפת האותות המבוססת על סיווג דחיפות המסרים. אותות מסוימים מפורטים עבור מסרים הדורשים זיהוי בטוח ומהיר. בקטגוריות מסוימות ייתכנו אפשרויות לגרסות שונות, לדוגמה אותות בקרה ואזהרה במקומות עבודה שבהם האיתות מיועד לעובדים שקיבלו הכשרה מיוחדת. עבור אותות חזותיים, תקן זה אינו משפיע על המשמעויות המקובלות של צבעי אזהרה. עבור צרכים שונים, שויכו משמעויות משלימות לאותות בעזרת דפוסי תזמון, ובמקרים ספורים, לפי צבעים משתנים.

## אזכורים נורמטיביים

- במקום חלק מהתקנים האירופיים המאוזכרים בתקן והמפורטים בסעיף Normative references בתקן האירופי חלים תקנים ישראליים, כמפורט להלן:

הערות	התקן הישראלי החל במקומו	התקן האירופי המאוזכר
(המידע המפורט בעמודת ההערות נכון ליום הכנת תקן זה)		
התקן הישראלי זהה לתקן הבין-לאומי ISO 7731- Second Edition: 2003-11-01	ת"י 1845 חלק 1 – ארגונומיה – אותות התרעה לאזורים ציבוריים ולסביבות עבודה – אותות התרעה נשמעים	EN 457:1992 (ISO 7731)
התקן הישראלי זהה לתקן האירופי EN 842: June 1996	ת"י 1854 – בטיחות מכונות – אותות סכנה חזותיים - דרישות כלליות, תכן ובדיקות	EN 842:1996



English Version

## Safety of machinery - System of auditory and visual danger and information signals

Sécurité des machines - Système de signaux auditifs et visuels de danger et d'information

Sicherheit von Maschinen - System akustischer und optischer Gefahrensignale und Informationssignale

This European Standard was approved by CEN on 21 October 1996 and includes Amendment 1 approved by CEN on 14 August 2008.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

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## Foreword

This document (EN 981:1996+A1:2008) has been prepared by Technical Committee CEN/TC 122 "Ergonomics", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2009, and conflicting national standards shall be withdrawn at the latest by December 2009.

This document includes Amendment 1, approved by CEN on 2008-08-14.

This document supersedes EN 981:1996.

The start and finish of text introduced or altered by amendment is indicated in the text by tags  $\boxed{A_1}$   $\boxed{A_1}$ .

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

$\boxed{A_1}$  For relationship with EU Directive(s), see informative Annexes ZA and ZB, which are integral parts of this document.  $\boxed{A_1}$

On the international level the International Standard ISO 11429 "Ergonomics – System of auditory and visual danger and information signals" has been prepared by WG 3 "Danger signals and speech communication in noisy environments" of ISO/TC 159/SC 5 "Ergonomics of the physical environment". The technical content of both the European Standard  $\boxed{A_1}$  EN 981  $\boxed{A_1}$  and the International Standard ISO 11429 is identical, with the exception of the emergency evacuation signal which is not dealt with in this European standard, however the limits of applicability of the standards to other technical fields are different.

Due to the different limits of applicability still existing on the European and international level direct transformation of the International Standard into a European Standard is not possible. The reason is that EN 981 has been prepared in order to fulfil the essential safety and health requirements of annex I of the Council Directive 89/392/EEC of 14 June 1989 on the approximation of the laws of the Member States relating to machinery: Essential health and safety requirements relating to the design and construction of machinery (see Annex A of EN 292-2:1991/A1:1995) and that therefore the limits of applicability of the European Standard is restricted to this Directive.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

## 1 Scope

To reduce risks associated with misinterpretation of visual and auditory danger signals, a system of danger and information signals is specified taking into account the different degrees of urgency.

This European Standard is applicable to all danger and information signals which have to be clearly perceived and differentiated as specified in 5.3 of EN 292-2:1991, by other requirements or by the work situation, and to all degrees of urgency – from extreme urgency to an ALL CLEAR situation. Where visual signals are to be complementary to sound signals, the signal character is specified for both.

This European Standard does not apply to certain fields covered by specific standards or other conventions in force (international or national); in particular, fire alarms, medical alarms, alarms used in the field of public transport, navigation signals and signals for special fields of activity (for example, military). When new signals are being planned, however, this European Standard should be considered in order to avoid inconsistency.

For auditory signals, the system of signal character is a guideline for a signal language based on message categories which are classified according to urgency. Certain characters are specified for purposes which require safe and rapid recognition. Certain categories allow possibilities for variants, e.g. control and warning signals at workplaces where the signalling is intended for personnel with specific training.

For visual signals, the established meanings of the safety colours are not affected by this European Standard. For different needs, complementary meanings have been assigned to the signals by timed patterns, and in a very few cases by alternating colours.

## 2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 292-2:1991/A1:1995, *Safety of machinery – Basic concepts, general principles for design – Part 2: Technical principles and specifications.*

EN 457:1992, *Safety of machinery – Auditory danger signals – General requirements, design and testing (ISO 7731:1986 modified).*

EN 842:1996, *Safety of machinery – Visual danger signals – General requirements, design and testing.*

EN 60073, *Coding of indicating devices and actuators by colours and supplementary means (IEC 73:1991).*

ISO 8995, *Principles of visual ergonomics – The lighting of indoor work systems.*

ISO 9921-1, *Ergonomic assessment of speech communication – Part 1: Speech interference level and communication distances for persons with normal hearing capacity in direct communication (SIL method).*

## 3 Definitions

For the purposes of this standard the following definitions apply:

### 3.1

#### **alternating sound [light]**

shifts between two or three acoustical [optical] spectra, with equal duration of the segments, at least 0,15 s each

### 3.2

#### **bursts of sound**

normally recurrent group of sound pulses with short but distinct interruptions, the pulse period, including interruption, being between 0,25 s and 0,125 s

### 3.3

#### **character of a signal**

combination of one or more auditory or visual components differentiating one signal from another

**3.4****flash**

light of duration less than 0,5 s.

**3.5****quick-pulse**

sound of duration less than 0,5 s.

**3.6****segment**

one of a number of parts in a sound or light signal during which the signal character is constant

**3.7****spectrum of sound [light]**

intensity or sound pressure level of sound [light] represented as function of frequency or wavelength

**3.8****sweeping [sound]**

continuously or discretely varying frequency

## **4 Ergonomic principles for the design and application of auditory and visual signals**

### **4.1 General**

**4.1.1** Auditory and visual signals shall be rapidly recognizable under all environmental conditions anticipated for their use. The recognition of a signal depends on many physical and psychophysical characteristics.

To ensure that signal effectiveness is not compromised by lack of reliability of signals, false alarm should be minimized or eliminated.

Signals shall be effective under all conditions of use, including conditions of environmental disturbance of the recognition process and in situations involving the highest degree of importance and urgency for action. Signal intensity shall be in accordance with EN 457 and EN 842.

**4.1.2** The risk of panic caused by signalling is to be considered, but should not be overestimated. In principle, two steps of panic reaction can be apparent:

The first sound impulse or flash of light can generate unintended fright. To avoid this shock-effect, the initial intensity of the sound should not be too high but should increase during the duration of the signal.

The sudden question: "What is happening?" can generate feelings of uncertainty and panic. Therefore, regular information is most essential.

### **4.2 Principles for distinctive characters**

The primary requirement for a signal is some kind of typical pattern, which makes the signal message unambiguous and ensures recognition under different difficult environmental conditions. The necessary variations can be produced in several ways, but are basically achieved by variation in intensity or in spectrum of light or sound.

Although there is an analogy between the spectrum of light and sound, there are limitations to how this analogy can be used to make auditory and visual signals similar. For example, it is not wise to try to use sweeping colour like the sweeping pitch of sounds. For light, five colours are used which each carry the same meaning, while for sound five analogous constant pitches are not used because pitch is a major tool which makes the signal audible with respect to the acoustical environment. In practice, any physical similarity

between sound and light signals shall be based on temporal variation (i.e. variation in intensity over time) like characters from e.g. Morse Code.

Most people have the ability to remember and identify only very few different time patterns of signals. Echoes and acoustical delay can change the perceived character of a signal, especially when separate sound sources are used.

### 4.3 Qualities of auditory signals

The design of auditory signals shall be in accordance with EN 457. The use of speech signals shall be in accordance with ISO 9921-1.

A priority classification of auditory signal character according to importance or urgency has been applied (see table 1). Signals with frequency variation – sweeping or alternating – are reserved for the most dangerous situations. Signals with constant frequency segments can be short grouped pulses (bursts), or sequences of equal or unequal segments. More than two different lengths of sound in each sequence shall not be used. The ratio of lengths should not be less than 1:3. Higher pitch is associated with greater urgency, but particular frequency distributions are not specified.

Variants in character (maintaining specified features) are available for numerous specific purposes within the two message categories DANGER and CAUTION. By applying the main scheme (see table 1) which specifies significant but not detailed character, a number of variants will be available.

### 4.4 Qualities of visual signals

The design of visual signals shall be in accordance with EN 842 and ISO 8995.

Certain special light sources for extremely short but high intensity flashes play an important role for warning, but the requirements of 4.2.2 of EN 842:1996 shall be met.

NOTE Reduction in the duration of a light also reduces its brightness. This effect applies also to sound pulses lasting less than approximately 0.2 s. However, short flashes and sound pulses are often preferred for technical reasons.

## 5 System of auditory and visual signals

### 5.1 Scheme of purposes and character

The principal requirements for the system of signals are summarized in tables 1 and 2. More detailed design parameters and remarks are listed in table 3 for sound coding and in table 4 for colour coding. According to the degree of urgency, the message category as well as the appropriate signal character shall be chosen from table 1.

In case of public alarm, table 2 shall be applied.

### 5.2 Scheme of auditory signal character

Additional character of auditory signals are given in table 3.

### 5.3 Scheme of visual signal colours

Additional character for visual signals are given in table 4.

## 6 Testing

Regular routine tests according to clause 6 of EN 457:1992 and clause 6 of EN 842:1996 shall be carried out, including testing for detection of character and understanding of their meaning.

Table 1 — Signals for general purposes, listed after degree of urgency

Message category	Auditory signal		Visual signal
	Character available for ON phase	Temporal pattern	
DANGER Urgent action for rescue or protection	<ul style="list-style-type: none"> <li>— Sweeping</li> <li>— Bursts</li> <li>— Alternating pitch (two or three frequency steps)</li> </ul> <p>NOTE Urgency can be implied by rapid rhythm, dissonance or high pitch</p>	<p>Continuous or alternating ON/OFF</p> <p>Alternating ON/OFF</p> <p>Continuous or alternating ON/OFF</p> <p>Any DANGER signal shall have a temporal pattern clearly differentiated from EMERGENCY EVACUATION</p>	Red
CAUTION Act when necessary	Only one sound with constant spectrum, minimum duration 0,3 s.	<p>Alternating ON/OFF</p> <p>Clearly distinct from EMERGENCY EVACUATION</p> <p>At most two different lengths of ON segments in pattern; the first one long</p>	Yellow
COMMAND Need for mandatory action	Two or three different sounds, each with constant spectrum	Continuous or alternating ON/OFF	Blue (see EN 60073)
ANNOUNCEMENT INFORMATION Public instruction	Two-tone chime	High-low non-recurrent (followed by instruction)	No light signal, normally. If needed: Yellow non-recurrent double flashes
ALL CLEAR Danger past	Sound with constant spectrum	<p>Continuous, at least 30 s</p> <p>Signal following a preceding warning signal</p>	Green
NOTE Synchronism between sound and light is not generally required, but can improve perception.			

Table 2 — Character of signals for public alarm

Message category	Auditory signal		Visual signal	Remarks
	Character available for ON phase	Temporal pattern		
PUBLIC ALARM  Important action required for personal safety	<ul style="list-style-type: none"> <li>— Sweeping</li> <li>— Constant spectrum</li> </ul>	<ul style="list-style-type: none"> <li>Continuous</li> <li>Alternating ON/OFF, period 4 s to 20 s</li> </ul>	Red intermittent light	<ul style="list-style-type: none"> <li>— Standing instructions for indoors or shelter protection (gas),</li> <li>— Radio message follows</li> </ul>
NOTE Synchronism between sound and light is not generally required, but can improve perception.				

Table 3 — Scheme for character of auditory signals

Sound	Light	Meaning	Remarks
SWEEPING  Sliding increase or decrease in frequency at a rate of 5 Hz/s to 5 Hz/ms (variation permitted during cycle)	RED	Danger, act urgently	Highest sweeping rate principally for high tone frequencies, and vice versa. Lowest rate not to be used for sound segments shorter than 5 s, and not for tone frequencies above 400 Hz
BURSTS, quick-pulses  When grouped, at least five pulses in each group. Pulse frequency 4 Hz to 8 Hz (pulse length 60 ms to 100 ms)	RED	Danger, act urgently	Reverberation can cause perceptual difficulty at pulse frequencies above 5 Hz. See EN 457
ALTERNATING  Stepwise sequence of two or three distinct pitches, each segment 0,15 s to 1,5 s	RED	Danger, act urgently	Intensity as well as duration of the ON phase of sound segments equal
SHORT sound  Constant spectrum, minimum duration 0,3 s	YELLOW	Caution, be alert	When different sound segment lengths are used, a ratio of 1:3 is recommended
SEQUENCE  Two or three different sounds, each with constant spectrum	BLUE	Command, mandatory action	-
PROLONGED sound  Constant spectrum	GREEN	Normal condition  All clear	Signal given after PUBLIC ALARM shall not be interrupted within 30 s



Table 4 — Scheme for colours of visual signals

Colour	Meaning	Objective	Remarks
RED	Danger Abnormal condition	Emergency Alarm Stop Prohibition Failure	Red flashes shall be used for EMERGENCY EVACUATION
YELLOW	Caution	Attention required Change of condition Intervention	-
BLUE	Indication of need for mandatory action (see EN 60073)	Action Protection Special attention Safety-related regulation or priority arrangement	For objectives not unambiguously covered by Red, Yellow or Green
GREEN	All clear Normal condition	Revert to normal Proceed	For energized device monitoring (normal)

## Annex ZA (informative)

### A1 Relationship between this European Standard and the Essential Requirements of EU Directive 98/37/EC, amended by 98/79/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 98/37/EC on machinery, amended by 98/79/EC.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.

**Table ZA.1 - Correspondence between this European Standard and Directive 98/37/EC, amended by 98/79/EC**

Clause(s)/sub-clause(s) of this EN	Essential Requirements (ERs) of Directive 98/37/EC, amended by 98/79/EC	Qualifying remarks/Notes
All clauses	Annex I: 1.2.2, 1.7.0, 1.7.1, 3.6.1	-

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard. A1

## Annex ZB (informative)

### A1 Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 2006/42/EC on machinery.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard given in Table ZB.1 confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.

**Table ZB.1 — Correspondence between this European Standard and Directive 2006/42/EC**

Clause(s)/sub-clause(s) of this EN	Essential Requirements (ERs) of Directive 2006/42/EC	Qualifying remarks/Notes
All clauses	Annex I: 1.1.6, 1.2.2, 1.7.1, 1.7.1.2, 1.7.2, 3.6.1	-

**WARNING** — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard. A1