INTERNATIONAL STANDARD

ISO 9241-20

First edition
2008-03-01

Ergonomics of human-system interaction —

Part 20: Accessibility guidelines for information/communication technology (ICT) equipment and services

Ergonomie de l'interaction homme-système —

Partie 20: Lignes directrices sur l'accessibilité de l'équipement et des services des technologies de l'information et de la communication (TIC)

Reference number
ISO 9241-20:2008(E)

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Published in Switzerland

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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.

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 9241-20 was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 4, *Ergonomics of human-system interaction*.

ISO 9241 consists of the following parts, under the general title *Ergonomic requirements for office work with visual display terminals (VDTs)*:

— *Part 1: General introduction*

— *Part 2: Guidance on task requirements*

— *Part 3: Visual display requirements*

— *Part 4: Keyboard requirements*

— *Part 5: Workstation layout and postural requirements*

— *Part 6: Guidance on the work environment*

— *Part 7: Requirements for display with reflections*

— *Part 8: Requirements for displayed colours*

— *Part 9: Requirements for non-keyboard input devices*

— *Part 11: Guidance on usability*

— *Part 12: Presentation of information*

— *Part 13: User guidance*

— *Part 14: Menu dialogues*

— *Part 15: Command dialogues*

— *Part 16: Direct manipulation dialogues*

— *Part 17: Form filling dialogues*

Guidance on software individualization is to form the subject of a future part 129.

ISO 9241 also consists of the following parts, under the general title *Ergonomics of human-system interaction*:

— *Part 20: Accessibility guidelines for information/communication technology (ICT) equipment and services*

— *Part 110: Dialogue principles*

— *Part 151: Guidance on World Wide Web user interfaces*

— *Part 171: Guidance on software accessibility*

— *Part 300: Introduction to electronic visual display requirements*

— *Part 302: Terminology for electronic visual displays*

— *Part 303: Requirements for electronic visual displays*

— *Part 304: User performance test methods*

— *Part 305: Optical laboratory test methods for electronic visual displays*

— *Part 306: Field assessment methods for electronic visual displays*

— *Part 307: Analysis and compliance test methods for electronic visual displays*

— *Part 308: Surface-conduction electron-emitter displays (SED)* [Technical Report]

— *Part 400: Principles and requirements for physical input devices*

— *Part 410: Design criteria for physical input devices*

— *Part 920: Guidance on tactile and haptic interactions*

Framework for tactile and haptic interaction is to form the subject of a future part 910.

Introduction

The number of people using information/communication technologies (ICT) equipment and services, which combine hardware, software and network technologies, is increasing, as is the variety of ICT equipment and services. Our everyday lives are filled by such equipment and services.

This part of ISO 9241 is intended to help developers enable ICT equipment and services (and forthcoming novel or innovative equipment and services) so that they can be used by the widest range of people, regardless of their capabilities or disabilities, limitations or culture.

This part of ISO 9241 is based on the current understanding of the characteristics of individuals who have particular physical, sensory and/or cognitive impairments. However, accessibility is an issue that affects many people. The users of interactive systems are consumers or professionals with roles such as home occupiers, school pupils, engineers, clerks, salespersons and web designers. The individuals in such target groups vary significantly as regards physical, sensory and cognitive abilities and each target group will include people with different abilities. Thus people with disabilities do not form a specific group that can be separated out and then disregarded. The differences in capabilities may arise from a variety of factors that serve to limit the capability to engage in the activities of daily living, and are a “universal human experience”. Therefore, accessibility addresses a widely defined group of users including

— people with physical, sensory and cognitive impairments present at birth or acquired during life,

— elderly people (a growing percentage of the population), who can benefit from new products and services but who experience reduced physical, sensory and cognitive capacities,

— people with temporary disabilities, such as a person with a broken arm or someone without his or her reading glasses, and

— people who experience difficulties in particular situations, such as a person who works in a noisy environment or has both hands occupied by other activities.

This part of ISO 9241 is prepared as guidance to secure and improve accessibility to ICT equipment, software and services when they are used by people within the widest range of capabilities. It presents:

a) a framework based on the ergonomic concept of context of use, and

b) principles for the accessibility of ICT equipment and services.

Their presentation is intended to assist the users of this part of ISO 9241 in the consideration of accessibility issues. It also describes major product attributes with design examples, provides information for the planning, design and development of ICT equipment and services and acquisition and evaluation of ICT equipment and services. It recognizes the importance of following general ergonomic guidance as well as the more accessibility-specific guidance found in this and other accessibility-specific standards in achieving full use of ICT equipment, software and services.

While many of the requirements and recommendations in this part of ISO 9241 also apply outside the domain of accessibility, they are especially important to this domain. The checklist of Annex B has also been included to help users examine the accessibility features of ICT equipment and services.

Ergonomics of human-system interaction —

Part 20: Accessibility guidelines for information/communication technology (ICT) equipment and services

1 Scope

This part of ISO 9241 is intended for use by those responsible for planning, designing, developing, acquiring, and evaluating information/communication technology (ICT) equipment and services. It provides guidelines for improving the accessibility of ICT equipment and services such that they will have wider accessibility for use at work, in the home, and in mobile and public environments. It covers issues associated with the design of equipment and services for people with a wide range of sensory, physical and cognitive abilities, including those who are temporarily disabled, and the elderly.

A detailed design for particular equipment or a service can be developed based on its recommendations. If a specific detailed standard exists concerning the accessibility of equipment or services, then it can be used in conjunction with that more specific standard. Where such standards are not available, this part of ISO 9241 can then form the basis for the design of the accessibility features of ICT equipment and services.

It also provides general guidelines for acquiring and evaluating ICT equipment and services, including both hardware and software aspects of information processing equipment, electronic communication facilities, office machines, and other similar technologies and services, used at work, in the home, and in mobile and public environments.

In addition, it gives important information about context of use. Accessibility is increased by expanding the range of contexts where equipment and services can be used. Context of use can result from the various components of the equipment or service, including user, task and equipment (hardware, software and materials) characteristics, as well as those of physical and social environments. Context of use can be considered when planning, designing, developing, acquiring and evaluating ICT equipment and services.

NOTE This part of ISO 9241 is a high-level standard applicable to all ICT equipment and services, therefore, detailed descriptions specific to equipment or services have been avoided. It can be referred to for the prevention of barriers to trade or the movement of people in respect of each national, regional and international standardization activity in this area. More specific recommendations on software accessibility are contained in ISO 9241-171.

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

ISO 9241-11:1998, *Ergonomic requirements for office work with visual display terminals (VDTs) — Part 11: Guidance on usability*

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

ISO 9241-13, *Ergonomic requirements for office work with visual display terminals (VDTs) — Part 13: User guidance*

ISO 9241-14, *Ergonomic requirements for office work with visual display terminals (VDTs) — Part 14: Menu dialogues*

ISO 9241-15, *Ergonomic requirements for office work with visual display terminals (VDTs) — Part 15: Command dialogues*

ISO 9241-16, *Ergonomic requirements for office work with visual display terminals (VDTs) — Part 16: Direct manipulation dialogues*

ISO 9241-17, *Ergonomic requirements for office work with visual display terminals (VDTs) — Part 17: Form filling dialogues*

ISO 9241-110:2006, *Ergonomics of human-system interaction — Part 110: Dialogue principles*

ISO 9241-151, *Ergonomics of human-system interaction — Part 151: Guidance on World Wide Web user interfaces* [1)]

ISO 9241-171, *Ergonomics of human-system interaction — Part 171: Guidance on software accessibility* [1)]

ISO 9241-300, *Ergonomics of human-system interaction — Part 300: Introduction to electronic visual display requirements* [1)]

ISO 9241-302, *Ergonomics of human-system interaction — Part 302: Terminology for electronic visual displays* [1)]

ISO 9241-410, *Ergonomics of human-system interaction — Part 410: Design criteria for physical input devices*

ISO 13407:1999, *Human-centred design processes for interactive systems*

ISO 14915 (all parts), *Software ergonomics for multimedia user interfaces*

3 Terms and definitions

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

3.1
accessibility
〈interactive systems〉 usability of a product, service, environment or facility by people within the widest range of capabilities

NOTE 1 The concept of accessibility addresses the full range of user capabilities and is not limited to users who are formally recognized as having disability.

NOTE 2 The usability-oriented concept of accessibility aims to achieve levels of effectiveness, efficiency and satisfaction that are as high as possible considering the specified context of use, while paying attention to the full range of capabilities within the user population.

3.2
assistive technology
hardware or software, added to or incorporated within a system, which increases accessibility for an individual

1) To be published.

3.3
context of use
users, tasks, equipment (hardware, software and materials), and the physical and social environments in which a product is used

[ISO 9241-11:1998, definition 3.5]

3.4
information/communication technology
ICT
technology for gathering, storing, retrieving, processing, analysing and transmitting information

3.5
interactive system
combination of hardware and software components that receive input from, and communicate output to, a human user in order to support his or her performance of a task

[ISO 13407:1999, definition 2.1]

NOTE The term “system” is often used rather than “interactive system”.

3.6
screen reader
assistive technology in combination with information available via the operating system that allows users to navigate through windows, determine the state of controls, and read text through Braille or text-to-speech conversion

3.7
usability
extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use

[ISO 9241-11:1998, definition 3.1]

3.8
user
⟨ICT⟩ individual interacting with the ICT equipment or service

NOTE Adapted from ISO 9241-11:1998, definition 3.7 and ISO 9241-110:2006, definition 3.8.

4 Application

4.1 Principles

Design for accessibility should adhere to the following principles.

a) Suitability for the widest range of use

Suitability for the widest range of use involves designing with the objective of producing solutions that will be useful, acceptable and available to the widest range of users within the user population, taking account of their special abilities, variations in their capabilities, the diversity of their tasks, and their differing environmental, economic and social circumstances.

b) Equitable use

Achieving equitable use will ensure that solutions designed to increase accessibility do not result in loss of privacy, increased risks to personal safety or security, or the stigmatization of individuals, and that solutions provide the same means of use for all users that are identical whenever possible; equivalent when not.

c) Robustness

Robustness involves supporting a wide range of options both in terms of the features provided by ICT equipment or services and in terms of the ability to connect additional ICT equipment, software, and/or services.

NOTE 1 Although it is not feasible to make all ICT operable without add-on assistive technologies, the application of this part of ISO 9241 can help designers develop equipment and services that increases accessibility without the use of assistive technologies. Additionally, by providing the necessary interface information, its application will enable assistive software and devices to operate effectively and efficiently when used.

NOTE 2 ICT can promote integration of assistive technologies by providing information that can be read by those technologies, and by communicating through standard application-to-application communication protocols. For example, systems that provide built-in screen magnification can enable many more users to read the text and see the images that are presented. However, if the necessary integration information is available, users can also attach the screen magnification program of their choice to suit their particular needs.

4.2 Application framework

Accessibility results when ICT equipment and services can be used by all members of a population in which individuals differ in their capabilities. Design solutions that support accessibility are not design for average members of a population but for the widest possible range of users, including those with various disabilities. The goal of these design solutions is to create ICT products and services that can be used by populations including the widest possible range of individual differences. It is recognized (see ISO 9241-11) that the usability of particular ICT equipment and services will vary between users within a population and depending on the context of use. Accessibility, therefore, is not about achieving an equal level of usability for all individuals, but rather about achieving at least some usability by all individuals. The guidance given by this part of ISO 9241 can help achieve accessibility (in general) for diverse populations and help improve the levels of accessibility for many individuals, when combined with an understanding of their context of use.

Design solutions that support accessibility result from understanding and application of specific user requirements, including those user requirements specific to accessibility. These design solutions can benefit from the guidance found in a range of International Standards, including this and other parts of ISO 9241.

Its recommendations are related to information accessibility policy and to user, task, equipment and service, and environmental characteristics. It can be used to provide high level accessibility guidance together with other International Standards, including the more detailed accessibility standard ISO 9241-171. Other ergonomics standards, which may or may not have their own accessibility-related guidance (e.g. ISO 9241-151 and ISO 14915), are also important in ensuring aspects of usability, which is the goal of accessibility when applied to populations of users with differing capabilities.

Figure 1 shows how this part of ISO 9241 can be applied to improve the accessibility of ICT equipment and services, used together with other parts of ISO 9241 and ISO 14915 to identify user requirements for the accessibility of a product or service, and considering the context of use of the product or service. This context of use includes user, task, equipment, service and environmental characteristics.

The resulting set of user requirements for accessibility can be used to form the basis for a design solution of the product or service, which can then be evaluated against the identified user requirements for accessibility.

4.3 Implementing the recommendations

Individual recommendations of Clauses 6 to 10 should be evaluated for their applicability, taking account of context of use.

A recommendation should not be implemented if there is evidence that to do so would cause deviation from the design objectives.

NOTE A design objective is non-discriminatory if it does not exclude users because of diversity of capabilities.

4.4 Conformance

If ICT equipment or services are claimed to have met the provisions of this part of ISO 9241, then the procedures used to establish user requirements and to evaluate the equipment or service shall be specified. The level of detail of the specification is a matter of negotiation between the involved parties. (Annex B provides assistance in documenting conformance.)

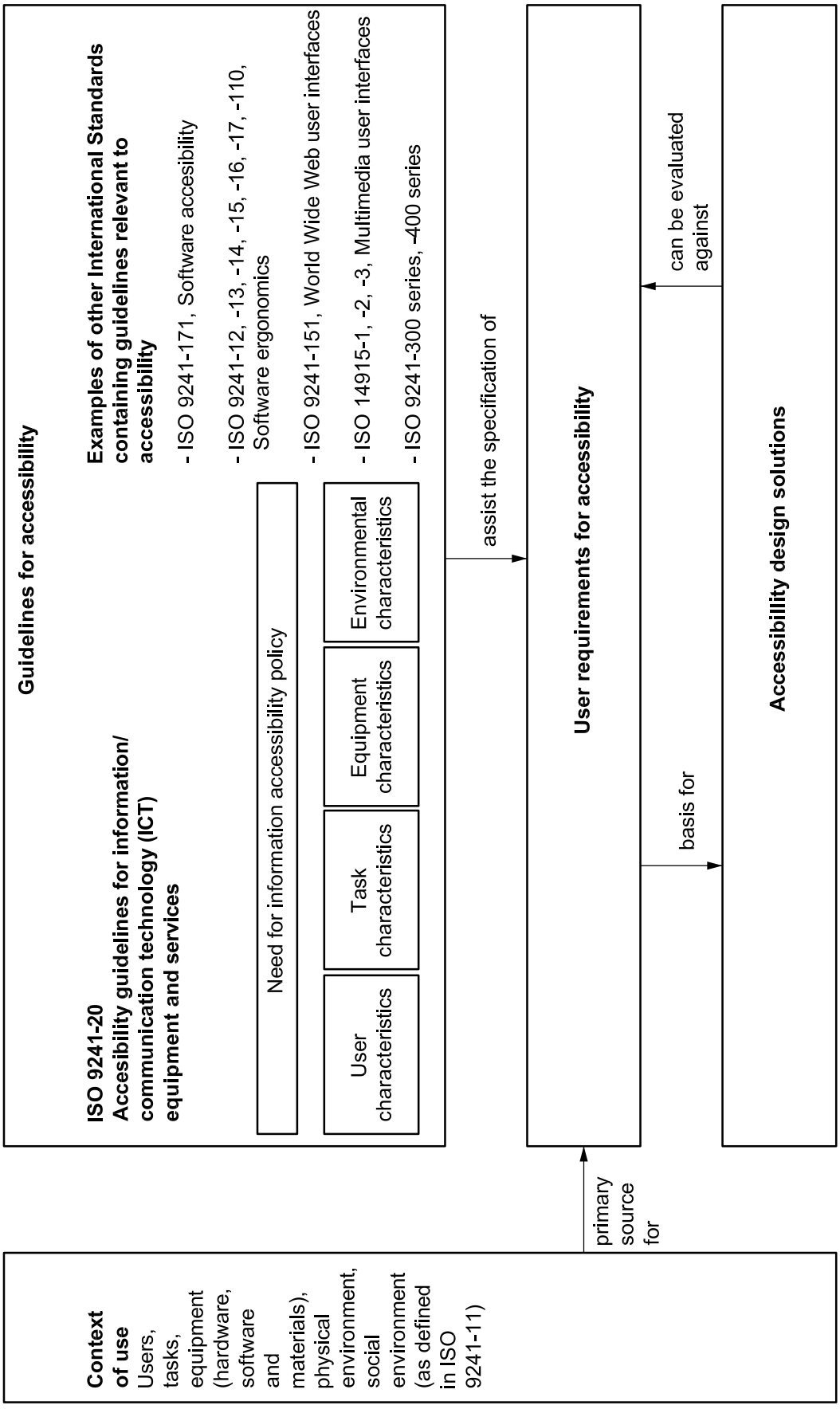

Figure 1 — Application of ISO 9241-20

5 Accessibility

5.1 General

ICT equipment and services are generally designed for a limited range of contexts of use. Accessibility is only achieved when the ICT equipment or service is designed to take sufficient account of the goals, abilities and limitations of users and to support successful interaction. Factors that can limit accessibility arise from one or more components of the context of use (i.e. user, task, equipment and/or environment) as well as interactions between them. ICT equipment and services developed for a limited range of contexts of use risk having more accessibility problems than systems developed for a wider range of context of use.

NOTE ICT equipment and services can be composed of many hardware and software components, including assistive technologies.

Accessibility exists at various levels of equipment and services, within an individual user's specific environment, and can be different for different users. Accessibility can be improved by addressing users, tasks, equipment and services and environment or the fit between these different elements in the context of use.

However, the improvement of individual elements cannot guarantee accessibility or even the improvement of accessibility. What is needed is a holistic approach that seeks to optimize all of the elements. This can involve training users, structuring tasks to suit the users, improving the environment and improving the design of equipment and services.

5.2 Context(s) of use and accessibility

It is important to identify the context or contexts of use, involving users, tasks, social, and physical and technical environments, which applies to the ICT equipment or service being developed or evaluated. Guidance on the identification of the context of use is provided in ISO 9241-11, which shall be consulted when applying this part of ISO 9241.

National accessibility legislation in many countries provides guidance and requirements that are not addressed in this part of ISO 9241 but which should be considered within the context use.

In specifying the user groups, particular attention should be paid to identifying the range of user characteristics that can be found within the user population, since the aim is to meet the needs of the widest possible range of users. The accessibility of the equipment or service increases to the extent of the variation in the user characteristics that is supported where users are able to achieve task goals.

The following approaches should be considered, in order to take account of the variation in user characteristics.

a) ICT equipment and services are designed for use by the user population without need for any modification or the connection of assistive technologies. This approach is important for ICT equipment and services designed for use by the general public and/or on a "walk up and use" basis.

b) ICT equipment and services are designed to be configurable to meet individual user needs. This allows users with different capabilities and preferences to select the ways in which they interact with the equipment or service to optimize their effectiveness, efficiency and satisfaction.

c) Where approaches a) and b) above are not possible or are not appropriate, a range of ICT equipment or services is provided which covers the needs of the whole user population. Each item in the range is designed to meet the needs of subgroups of the user population and can be acquired on an individual basis. This is particularly applicable in non-public situations where people are able to make a personal choice.

d) While approaches a), b) and c) above can meet the needs of most people, it is possible that some people will still have to use assistive technologies to support their interaction with ICT equipment and services. The ability to connect assistive technologies, while not an accessibility approach on its own, provides the basis for these users to create their own accessibility approaches.

5.3 Process

The following activities should be performed to ensure accessibility:

— understand and specify context of use, paying particular attention to the variation of user characteristics and the impact of task, equipment and environmental characteristics that affect accessibility;

— identify and specify the users' needs for accessibility;

— produce design solutions paying particular attention to accessibility considerations;

— evaluate accessibility design solutions of ICT equipment and services with users whose characteristics reflect the targeted user groups.

For details, ISO 13407 shall be consulted.

NOTE 1 ISO/TR 16982 also provides guidance on usability methods that support human-centred design

NOTE 2 Evaluation of accessibility design solutions includes obtaining user test results and other available forms of user feedback.

NOTE 3 In developments involving multiple parties, the means of achieving accessibility is a matter of negotiation and agreement.

6 Recommendations related to managing development

6.1 Information accessibility policy

General managers and development managers should have an information accessibility policy.

EXAMPLE A company establishes a general information accessibility policy that includes a statement of accessibility goals, a person responsible for ensuring that the company meets these goals, and the identification of particular accessibility standards that it expects to meet.

6.2 Development accountability

General managers and development managers should ensure that the information accessibility policy is followed in the planning, design, development and evaluation of ICT equipment and services.

The best outcome is usually achieved and at lower cost when information accessibility is addressed very early in the design process.

7 Recommendations related to user characteristics

7.1 General

7.1.1 Supporting a range of user characteristics

The range of user characteristics supported by the ICT equipment and services should be sufficient to allow the widest possible range of users to perform the tasks intended in the design.

Specific users may present combinations of disabilities that require specific solutions. A simple combination of the solutions for each individual disability is not adequate. For instance, users who are deaf-blind often do not benefit from auditory output of text like users who are blind nor from text output of audio like users who are deaf.

EXAMPLE A system avoids imposing excessive loads on a user's permanent or temporary memory and learning abilities and limitations.

7.1.2 Supporting multiple interaction mechanisms

ICT equipment and services should support as many alternative means of interaction as possible in order to support the accessibility needs of different groups of users.

When the operation of a particular mental or physical function is difficult for some group of users, an alternative mental or physical function can be used to provide these users with access to the operation performed by that function.

EXAMPLE 1 Voice recognition is provided as an alternative for people with difficulties typing/spelling.

EXAMPLE 2 An assistive technology uses keyboard equivalent input (such as the use of a keyboard or Braille input device instead of a touch screen) for equipment or a service to meet the needs of people within the widest range of capabilities.

EXAMPLE 3 For a graphical interface, users without vision are provided text equivalents for graphic objects through a screen reader.

7.1.3 Supporting simultaneous use of alternate interaction mechanisms

ICT equipment and services should support simultaneous use of alternative means of interaction to meet the accessibility needs of users in different or changing contexts.

This involves the use of multiple interaction channels (see also 7.3.10).

EXAMPLE A screen reader is able to access text output from the operating system and sends it in speech or Braille in addition to a display screen Individualization

7.1.4 Supporting individualization

ICT equipment and services should support individualization by users (7.3.8 and 7.6.7 provide guidance on two specific uses of individualization).

EXAMPLE 1 The user is allowed to select which input and output devices to use for a given task.

EXAMPLE 2 The physical repositioning of individual devices can be easily accomplished by the user.

EXAMPLE 3 The user is allowed to rearrange the layout of components on a display by dragging and dropping.

7.1.5 Changing configurations

A method that does not require users to reconfigure or restart the equipment or service should be provided to allow users to utilize alternative available means of interacting with ICT equipment or services and to select accessibility related settings.

It is important for users to be able to deselect different means of interaction as well as to select them.

EXAMPLE 1 The user is allowed to use a keyboard instead of a mouse to control a screen pointer.

EXAMPLE 2 The user is allowed to select a colour scheme that does not conflict with his/her colour-blindness.

EXAMPLE 3 The user is able to separately adjust the volume on the speaker and on the microphone of a system.

EXAMPLE 4 The user is allowed to adjust physical operational functions, including distances and pressures used by a tactile input device.

EXAMPLE 5 Input from a touch screen is turned off to avoid inadvertent contact by a user who uses a finger to help read the contents of the screen and the functionality normally performed by the touch screen is performed by some other input method.

EXAMPLE 6 An assistive technology can easily be activated or deactivated by a keyboard command that is always available to the user.

7.1.6 Returning to default configuration

A method that does not require users to reconfigure or restart the equipment or service should be provided to allow users to reset ICT equipment or a service to its default configuration.

This is especially important for ICT equipment and services that are intended to be shared between multiple users.

7.1.7 Saving and retrieving customized configurations

Where possible, a means should be provided to save and retrieve a user's customized configuration.

The ability to load a user's saved customized configuration is especially important in situations where creating the configuration is beyond the cognitive capabilities of the user.

7.1.8 Supporting assistive technologies

Standard interface mechanisms should be provided to support assistive technology.

Although it is intended that systems should be designed to meet accessibility needs, it is recognized that the only way in which some users will be able to interact with them is by using assistive technologies. The following is a list of commonly used assistive technologies:

— those for the aid of users without vision, including screen readers which present information through speech and/or Braille output;

— those for the aid of users with limited vision, including large monitors, large fonts, high contrast, and hardware or software magnification to enlarge portions of the display;

— those for the aid of users who cannot hear, including captioning and showing of sounds;

— those for the aid of users with limited hearing, including volume amplifiers and hearing aids;

— those for the aid of users who cannot speak, including voice synthesizers;

— those for the aid of users with limited speech capabilities, including external speech enhancers;

— those for the aid of users with limited mobility, including eye movement trackers, headsticks, mouthsticks, and remote controllers;

— those for the aid of users who cannot hear and who are without vision, including Braille outputs and TTY (text telephone) inputs.

7.1.9 Avoiding user fatigue

ICT equipment and services should avoid causing user fatigue and ensure user comfort over extended periods of time, by

a) avoiding requiring minute and precise joint movements, and

b) avoiding requiring static positions at or near the extreme range of movement.

NOTE Differences in the stamina of users create differences in the amount of physical and mental work that they can perform before experiencing fatigue.

In order to deal with user differences, it is helpful if users are enabled to pause and restart tasks in order to rest whenever fatigue occurs.

7.2 Vision

7.2.1 Users without vision

ICT equipment and services should support users who do not have vision or who are unable to see due to environmental conditions.

See 7.2.2 to 7.2.5 for specific guidelines that are especially important for users without vision. Additional general guidelines from 7.1 and additional specific guidelines can also be important for these users.

7.2.2 Providing information using sound

Users should be enabled to have information provided by sound, whether or not accompanied by a visual presentation.

NOTE 1 Individuals who have learned Braille can take advantage of software and hardware that will provide screen readers that will produce Braille output. Those who become blind later in life are less likely to learn such specialized skills; however, they might learn some new auditory skills and thus might rely on additional, simple or more special auditory methods to obtain information.

NOTE 2 Since many users with no vision read screens by means of synthesized speech output, they might find it difficult or impossible to attend to auditory outputs that occur while they are reading.

It is important to ensure that the presentation of information by sound is synchronized with the presentation of any accompanying visual information.

7.2.3 Supporting navigation in audible environments

Users should be provided with the capability of navigating using audible queues among controls and display objects.

NOTE Navigation which is based on understanding a spatial metaphor or seeing graphically represented objects disadvantages users with no vision.

7.2.4 Providing location and function information by auditory and/or tactile means

Users should be able to have location and function information about controls and display objects provided by auditory and/or tactile means.

7.2.5 Providing control using non-visual mechanisms

Users should be enabled to control focus, navigation and other functions by keyboard, voice or other non-visual mechanisms.

EXAMPLE Users are provided with auditory feedback when a control is encountered (such as when a cursor is moved to a location at which the control can be selected).

7.2.6 Users with limited vision

ICT equipment and services should support users with limited vision.

See 7.2.7 to 7.2.12 for specific guidelines that are especially important for users with limited vision. Additional general guidelines from 7.1 and 7.2.2 to 7.2.5, and additional specific guidelines, can also be important for these users.

7.2.7 Adjusting contrast of displayed objects

The capability to adjust the contrast of displayed user interface objects should be provided.

7.2.8 Adjusting size of displayed objects

The capability to adjust the size of displayed text, task-related character fonts, icons and other user interface objects should be provided.

7.2.9 Magnifying contents of a display

The capability to magnify (or enlarge) portions of the screen or display should be provided.

NOTE Magnification applies to a portion of a display regardless of the user interface objects and/or parts of user interface objects contained in that portion of the display.

7.2.10 Inverting display of objects

An option that provides for light user interface objects on a dark background should be provided.

NOTE Some users with limited vision (e.g. those with cataracts) find white backgrounds to have an extreme amount of glare and prefer dark backgrounds.

7.2.11 Users with limited colour vision

If colour is used for providing information, additional coding such as shape, position or text labels should be provided (so that colour is not the sole method of coding).

EXAMPLE An emergency stop knob, which is coloured red, is also labelled “Emergency”.

7.2.12 Users who react to flicker

Flicker rates of flashing or blinking text, objects or video screens should avoid frequencies that are most likely to trigger visually induced seizures.

In addition to the frequency of the flickering, the size and luminous intensity of the stimuli is also significant. The greater the intensity and larger the size of the flickering stimuli, the greater the danger of provoking photosensitive effects (e.g. seizure, distraction from other content).

7.3 Hearing

7.3.1 Avoiding harmful audio

Audio output should avoid volumes that are likely to harm hearing.

Providing a mechanism to cap or dampen audio output can protect hearing.

EXAMPLE If a sound suddenly gets louder, the system dampens it, enabling the user to decrease/limit the volume without discomfort or damage to their hearing.

7.3.2 Providing verbal information visually

All verbal information (textual information presented via audio) should also be provided in visual form (e.g. text, highlighting techniques, sign language videos).

It is important to ensure that the presentation of verbal information in visual form is synchronized with the presentation of any accompanying audio information.

7.3.3 Users that cannot hear

ICT equipment and services should support users who cannot hear.

Verbal information can be provided by icons and common symbols, text format or “show sounds/captions” features that notify software to present audio information in visual form.

See 7.3.4 to 7.3.6 for specific guidelines that are especially important for users who cannot hear. Additional general guidelines from 7.1 and 7.3.2, and additional specific guidelines, can also be important for these users.

7.3.4 Providing visual versions of alarms

Alarms and critical event notification that are normally presented in auditory form should be presented visually using appropriate highlighting techniques.

NOTE Appropriate highlighting techniques consider the need for getting the user's attention, the importance of the alarm or critical attention, and the potential for distracting the user from other equally or more critical activities.

7.3.5 Providing tactile versions of alarms

Where vision is not available or required, alarms and critical event notification that are normally presented in auditory form should be presented using a tactile stimulus.

EXAMPLE Cell phone users are informed of receiving a message by the vibration of the phone.

7.3.6 Supporting sign language

The incorporation of information in sign language should be considered.

NOTE There are regional, national, and linguistic variations in sign languages (see also 7.6.10).

EXAMPLE 1 A Web site provides a sign language video with a description of the goals and structure of the Web site.

EXAMPLE 2 An ICT product includes, in addition to a paper based user manual, a DVD with a sign language video describing the main functionality of the product.

7.3.7 Users with limited hearing

ICT equipment and services should support users with limited hearing.

NOTE Some individuals with limited hearing cannot produce speech that is recognizable by voice-input systems.

See 7.3.8 to 7.3.10, 7.4.2, 7.4.5, and 7.4.6 for specific guidelines that are especially important for users with limited hearing. Additional general guidelines from 7.1, 7.3.1, 7.3.2, and additional specific guidelines can also be important for these users.

7.3.8 Providing volume control

The capability to increase and decrease the volume of any information presented in auditory format should be provided.

This is particularly important in noisy environments.

7.3.9 Managing sound frequencies

The capability to adjust the frequency of non-speech sounds should be provided where appropriate to the task.

Where this is not possible, consider using frequencies that are not in the higher ranges.

7.3.10 Providing independent controls for different channels

Where speech and non-speech audio coming from different sources (channels) are presented, the capability to adjust the volume of the non-speech audio should be provided.

7.4 Speech

7.4.1 Supporting text entry of inputs

All inputs should be supported by the use of a keyboard or text entry device.

EXAMPLE The keyboard is used to provide text equivalent input in an application using voice to control an operation.

7.4.2 Supporting alternatives to voice input

Where voice input is used to activate a process, alternatives such as keypads or the use of video monitoring of gestures should be provided.

NOTE Some deaf individuals cannot produce speech that is recognizable by voice-input systems.

7.4.3 Users that cannot speak

ICT equipment and services should support users who cannot speak.

NOTE Some people who cannot speak also cannot hear.

See 7.4.1, 7.4.2, and 7.6.8 for specific guidelines that are especially important for users who cannot speak. Additional general guidelines from 7.1 and additional specific guidelines can also be important for these users.

7.4.4 Users with limited speech capabilities

ICT equipment and services should support users with limited speech capabilities.

NOTE Some individuals with limited hearing cannot produce speech that is recognizable by voice-input systems.

See 7.4.1, 7.4.2, 7.4.5 and 7.4.6 for specific guidelines that are especially important for users with limited speech capabilities. Additional general guidelines from 7.1 and additional specific guidelines can also be important for these users.

7.4.5 Controlling the speed of voice input

Speed of voice input should be controllable by the user.

NOTE People with speech problems often take much more time than other people to pronounce words and sentences.

7.4.6 Providing speech input enhancement

The capability to enhance speech input should be provided where possible. The use of a speech enhancer can enable many people to use speech recognition software who could not otherwise do so because of their soft, inaudible voice or unclear speech.

7.5 Physical capabilities

7.5.1 Limited physical movement

ICT equipment and services should support users who have limited physical movement.

EXAMPLE Controls are arranged close to one another to avoid requiring excessive limb movement.

See 7.5.2 to 7.5.7 for specific guidelines that are especially important for users with limited movement capabilities. Additional general guidelines from 7.1 and additional specific guidelines can also be important for these users.

7.5.2 Providing adjustable location of controls

The placement of controls and displays should be adjustable to heights and locations that the users can reach. This is relevant for people with limited mobility such as wheelchair users, walking aids users, or users with chronic joint pain.

7.5.3 Supporting either or only one hand

Controls should be operable using either hand and should avoid the need for simultaneous use of both hands.

7.5.4 Limiting physical force requirements

Controls should be movable with the minimum force required (within the constraints of the operation being performed). The use of movement and force are often combined.

Different applications of force include pressing, grasping, pinching, and twisting.

This is particularly relevant for people with limited physical force such as users who have experienced a stroke.

EXAMPLE Controls are designed taking into account shape, size, adequate spacing and surface finish so that they are easier to select, manipulate and grip/grasp/operate.

7.5.5 Limiting motor control requirements

ICT equipment and services should support users with limited motor control and should not require high dexterity.

EXAMPLE For users with limited motor control, voice control is provided.

7.5.6 Compensating for limitations in fine motor control capabilities

Controls should be designed to compensate for limitations in fine motor control (e.g. tremors) capabilities.

EXAMPLE 1 A tracking device has a built in damper to compensate for tremors.

EXAMPLE 2 Mouse tracking responsiveness can be set to use large physical movements to cause small cursor movements.

7.5.7 Providing user control of response timing

If a task requires users to make responses (e.g. press a button or type information) within a limited time in order for that response to be valid (a timeout), the time range should be adjustable by the user, including the option to turn off all timing requirements.

It is important that ICT equipment and services be designed so that timeouts are not an essential part of interaction, or that at least one of the following is the case:

— the user is allowed to deactivate the time-out;

— the user is allowed to adjust the time-out over a wide range which is at least ten times the length of the default setting;

— the user is warned before time expires, allowed to extend the time-out with a simple action (e.g. “hit any key”) and given time to respond;

— the timeout is an important part of a real-time event (e.g. an auction), and no alternative to the time-out is possible;

— the timeout is part of an activity where timing is essential (e.g. competitive gaming or time-based testing) and time limits cannot be extended further without invalidating the activity.

7.6 Cognitive capabilities

7.6.1 Limitations in cognitive capabilities

ICT equipment and services should support users who have limitations in their cognitive capabilities.

See 7.6.2 to 7.6.10 for specific guidelines that are especially important for users with limitations in various cognitive capabilities. Additional general guidelines from 7.1 and additional specific guidelines can also be important for these users.

7.6.2 Avoiding unnecessarily high cognitive demands

ICT equipment and services should avoid unnecessarily high cognitive demands on users by ensuring that the basic activities required to operate the equipment or to use the service are as straightforward and simple as possible. The use of consistency can help to decrease the cognitive demands on users, while the ability to review information can help decrease cognitive demands.

EXAMPLE 1 A system provides context dependent help to avoid imposing excessive loads on a user's memory and learning abilities.

EXAMPLE 2 Biometric measures are used to avoid the need for users to remember passwords.

7.6.3 Aiding understanding

Information should be presented and organized in a manner that will aid understanding by users.

The layout of information and controls will determine how easy they are to read by someone with a visual or cognitive impairment. Factors to consider include logical grouping of information and controls, use of appropriate labels and headings, line length of text, relevance of information and relationship of controls to actions to be undertaken.

EXAMPLE Consistency of physical location, ordering, grouping and spacing of control buttons on recording devices aids in understanding the purposes of the individual controls.

7.6.4 Using understandable vocabulary

The vocabulary used to describe and operate ICT equipment and services should use expressions and terminology that are as easy as possible to understand, irrespective of the level of expertise and cognitive capabilities of users.

An explanation or glossary can be offered to help users understand expressions and vocabulary that they might not know.

EXAMPLE 1 The commonly used term “blood poisoning” is used rather than the term *septicaemia* in an application that will be used by the general public.

EXAMPLE 2 Links from specialized terms, abbreviations, and acronyms to entries in an on-line glossary are provided, when these terms are necessary within the context of use.

7.6.5 Providing information pictorially

Where possible, information should be provided in symbolic or pictorial form to enhance the user’s ability to comprehend the information. People who cannot speak often have trouble reading textual information and communication speed is enhanced by conveying textual information in symbolic or pictorial form.

EXAMPLE Icons are used for people with limited language skills.

7.6.6 Providing appropriate cues

ICT equipment and services should provide appropriate cues to assist users in paying attention to important information (e.g. control status).

EXAMPLE A banking machine provides a highlighted message: “Please remove your card”.

7.6.7 Adjusting speed of interaction

Where possible, the speed of interaction should be adjustable by the user. Users with cognitive difficulties may need additional time to perform certain activities.

EXAMPLE The user is enabled to control the rate at which an automated presentation advances.

7.6.8 Enabling pausing or stopping

Whenever moving, blinking, scrolling or auto-updating information is presented, the user should be enabled to pause or stop this dynamic presentation. Pausing and stopping can also help users to control the speed of interaction.

NOTE ISO 14915-2 provides additional guidance on controls for the dynamic presentation of information.

7.6.9 Minimizing the need for training

The design of ICT equipment and services should relate to common user experiences and thus minimize the need for special training.

EXAMPLE A proprietary messaging system mimics the layout and functionality of a commonly used e-mail client.

7.6.10 Supporting cultural and linguistic differences

The vocabulary used to describe and operate ICT equipment and services should use expressions that can be understood by users with differences in culture or language.

ICT equipment and services that exclusively make use of the English language can create accessibility problems for a user who does not understand English, unless their interactions are mediated by translation to and from the language of the user.

The use of icons designed for international use is one method for improving understanding by users with different cultures and languages.

EXAMPLE Installation information is available in a variety of languages and includes information on how to select the language to be used to operate the ICT equipment or service.

8 Recommendations related to task characteristics

8.1 Performing tasks based on context of use

ICT equipment and services should support users to easily perform tasks in the manner most suited to the contexts of use.

EXAMPLE 1 The user can choose to perform a task either step-by-step using a wizard or directly using a complex dialog.

EXAMPLE 2 The user can choose to use a screen reader in a quiet environment or a Braille output in a noisy environment.

8.2 Providing alternative ways of performing tasks

ICT equipment and services should enable users to choose between alternative ways of performing tasks (if appropriate).

NOTE In some circumstances, a task is specified as using a certain system and/or to be performed in a certain environment. These systems and/or environments can impose their own limitations.

EXAMPLE 1 A system allows the user to determine the order of performing steps in a task, where the order is not required by the task.

EXAMPLE 2 A wizard is used to perform a complicated task, whereby the user is given a choice to do a “standard” (i.e. default), full, or customized set of steps to complete the task.

8.3 Performing maintenance and other non-task related operations

ICT equipment and services should minimize the need for maintenance, set-up and other support operations.

EXAMPLE 1 The system automates routine tasks such as disk cleanup.

EXAMPLE 2 The system retains user accessibility settings at system shutdown and reuses them when the user restarts.

9 Recommendations related to equipment and service characteristics

9.1 General

9.1.1 Supporting basic and auxiliary functions

The following are recommended.

a) Basic functions needed to perform the main tasks that the ICT equipment or service is designed to perform should be capable of being used, to the widest extent possible, by all users.

b) Auxiliary functions that support or extend the basic functions should be capable of being used by most users.

EXAMPLE Since text entry is a basic function of a word processing program, a variety of ways of text entry is provided to the widest possible range of users.

9.1.2 Maintaining consistency

Related equipment or services should have common accessibility functions and specifications.

EXAMPLE All ICT equipment and services within a series handle accessibility in a consistent manner.

9.1.3 Providing user guidance

The accessibility of user guidance should be comparable to the accessibility of other functions of the ICT equipment or service.

NOTE User guidance includes prompts, feedback, status information, error management and on-line help. See ISO 9241-13 makes recommendations on user guidance.

9.1.4 Providing safety information

Information about hazards related to equipment and services and their components and their use should be presented using formats that allow this information to be understandable to users.

EXAMPLE For materials that are poisonous or likely to cause allergic reactions are used in the equipment, a permanent warning label that can be read and understood by users (e.g. text and Braille) is affixed to the equipment.

9.1.5 Providing interoperability

ICT equipment and services intended to work with other ICT equipment or services should not interrupt or invalidate any accessibility-related functions of these other ICT equipment and services.

EXAMPLE A device has a large number of USB ports so that it can support the independent connection of a variety of devices simultaneously, including multiple assistive technologies.

9.1.6 Providing error tolerance

All users should be protected from the consequences of accidental or unintended actions.

This is particularly important for the people with limited capabilities because they are more likely to experience difficulty in recovering from errors.

EXAMPLE 1 Elements are arranged to minimize errors.

EXAMPLE 2 Warnings of the consequences of errors are provided.

EXAMPLE 3 Fail-safe features are provided.

9.1.7 Providing undo or confirm

The following recommendations follow a general ergonomic principle, nevertheless, undo mechanisms are particularly important for users who have disabilities that significantly increase the likelihood of an unintentional action. These users can require significant time and effort to recover from such unintentional actions.

a) Users should be able to reverse (“undo”) actions made by the system in response to their commands.

b) For actions that are impossible to undo, the user should be required to confirm the action before it is performed by the system.

EXAMPLE A user with Parkinson’s disease may inadvertently input a sequence of keystrokes, thereby activating several dialogues that need to be undone. The use of several steps of the undo function may permit the user to conveniently recover the original state.

9.1.8 Safeguarding features

The risk of inadvertently activating or deactivating accessibility features should be minimized.

9.1.9 Biometric data

Alternative means should be provided for users who cannot supply specified biometric data.

EXAMPLE Voice authentication or a thumb print is used so that users who don’t have hands or who cannot produce speech can both pass the security measure.

9.2 Other standards for ICT equipment and services

9.2.1 Applying relevant standards

ICT equipment and services should be in accordance with the following International Standards. This is important both in terms of meeting user expectations and in terms of facilitating the connection of assistive technologies.

9.2.2 Input devices

For guidance on input devices of ICT equipment, ISO 9241-410 shall be consulted.

9.2.3 Visual displays

For guidance on output devices of ICT equipment, ISO 9241-300 and ISO 9241-302 shall be consulted.

9.2.4 Work stations

For work stations of ICT equipment, ISO 9241-5 shall be consulted.

9.2.5 Software

For software components of ICT services, ISO 9241-171, ISO 9241-110, ISO 9241-12, ISO 9241-13, ISO 9241-14, ISO 9241-15, ISO 9241-16 and ISO 9241-17 shall be consulted.

9.2.6 Multimedia software

For multimedia software components of ICT services ISO 14915-1, ISO 14915-2 and ISO 14915-3 shall be consulted.

9.2.7 Web software

For software components of ICT services involving the World Wide Web, ISO 9241-151 shall be consulted.

9.3 Assistive technologies

9.3.1 Connecting assistive technologies

The connection of assistive technologies should be supported to provide modes of interaction which are not provided by the ICT equipment or service.

Some closed systems do not allow connection of assistive technologies. In such cases, it is important to design the closed system so that people within the widest range of capabilities can use it without any connected assistive technologies.

If ICT equipment or services allow the users to perform all input functionality, including navigation, using only non-time dependent keyboard (or keyboard equivalent) input, assistive technologies connected to the equipment or services can use this to support alternative forms of input.

If ICT equipment or services provide a text equivalent to all outputs, assistive technologies connected to the equipment or services can be used to support alternative forms of outputs.

9.3.2 Supporting combinations of assistive technologies

Combinations of multiple assistive technologies should not disturb the functions of individual assistive technologies.

This may be achieved by allowing all information to pass through an assistive technology to any other assistive technologies that are connected to it.

If incompatibilities are known, it is important that information about these incompatibilities be available to the user.

EXAMPLE The outside of a product's packaging clearly lists incompatibilities.

9.4 Selection and operation of ICT equipment and services

9.4.1 Providing accessibility information

Information about the accessibility of ICT equipment or services should be available in formats that can be used by people with widest range of capabilities.

When users are purchasing and using ICT equipment and services, it is important that they have information that is readily available about the accessibility of the ICT equipment and/or service so they can determine if it meets their needs.

9.4.2 Providing information on intended contexts of use

The following are recommended.

a) Where possible, information about the range of contexts of use for which the ICT equipment or service is designed should be included in the on-line help of the equipment or service.

b) Where it is not possible to include information about the range of contexts of use for which the ICT equipment or service is designed in the on-line help, then this information should be provided in the printed and other forms of documentation for the equipment or service.

9.4.3 Maintaining compatibility in replacement equipment or service

A new version (e.g. an upgrade or new model) of an ICT equipment or service should be capable of being used by at least the same range of users as the existing version.

9.5 Preparation and completion of operation

9.5.1 Providing installation information

When the user is expected to install ICT equipment, the information necessary to complete this task should be provided in alternative formats available to all types of users.

EXAMPLE An installation manual with instructions that the user may not have anticipated is understandable by the widest range of users.

9.5.2 Making installation activities achievable

When the user is expected to install ICT equipment, the activities necessary to complete this task should be achievable by the widest possible range of users.

9.5.3 Switching off equipment

It should be easy to switch off equipment.

EXAMPLE 1 The on/off switch is in an easy-to-access location where it is not likely to be accidentally activated.

EXAMPLE 2 A system can be switched off either by using the physical on/off switch or by issuing a software command to turn the equipment off.

9.5.4 Storing equipment

It should be easy to store equipment.

EXAMPLE 1 A large piece of equipment includes storage compartments for related cables and other small accessories.

EXAMPLE 2 A set of small devices are designed to connect with each other so that they can be easily stored together.

9.5.5 Disconnecting equipment

It should be easy to logically and physically disconnect the equipment (e.g. from power supplies, peripheral devices and networks).

EXAMPLE Connections are located on the sides (rather than the back) of a device for easy access.

10 Recommendations related to environmental characteristics

10.1 Operating in a range of environments

ICT equipment and services should be able to be operated in a range of environments specified in the context of use.

ICT equipment and services are used in multiple environments, including the office, home and remote/temporary environments (e.g. a hotel room while travelling). Many ICT services are used on a variety of hardware platforms, including public computers, personal computers, notebook computers and portable digital assistants.

EXAMPLE 1 Glare from bright lights negatively affects visual conditions.

EXAMPLE 2 Background noise affects auditory conditions.

EXAMPLE 3 Constrained workspaces affect physical movement conditions.

EXAMPLE 4 Distractions and other tasks needing attention affect cognitive conditions.

EXAMPLE 5 Distractions decrease the amount of time available to satisfy temporal conditions.

10.2 Designing environments

Special consideration should be given to the needs of users in respect of the following when designing environments.

a) Lighting and surface treatments.

   EXAMPLE Indirect lighting is used to minimize glare on ATMs.

b) Layout and use of space.

   EXAMPLE Sufficient space is provided for wheelchair users to manoeuvre.

c) Acoustics.

   EXAMPLE The space is designed to reduce echo.

d) Thermal characteristics.

   EXAMPLE Controls on equipment intended to be operated in extreme environments take into account the physical limitations of users clothing (e.g. protective mitts).

10.3 Impacting the environment

The operation of ICT equipment or an ICT service should not negatively influence its environment or neighbouring persons.

EXAMPLE Equipment limits the amount of heat that it releases so that accidental touching will not create burns to users or other people in the environment.

Annex A
(informative)

Overview of the ISO 9241 series

This annex presents an overview of ISO 9241: its structure, subject areas and the current status of both published and projected parts, at the time of publication of this part of ISO 9241. For the latest information on the series, see:

http://isotc.iso.org/livelink/livelink?func=ll&objId=651393&objAction=browse&sort=name.

Part no.	Subject/title	Current status
1	General introduction	International Standard (intended to be replaced by ISO/TR 9241-1 and ISO 9241-130)
2	Guidance on task requirements	International Standard
3	Visual display requirements	International Standard (intended to be replaced by the ISO 9241-300 subseries)
4	Keyboard requirements	International Standard (intended to be replaced by the ISO 9241-400 subseries)
5	Workstation layout and postural requirements	International Standard (intended to be replaced by ISO 9241-500)
6	Guidance on the work environment	International Standard (intended to be replaced by ISO 9241-600)
7	Requirements for display with reflections	International Standard (intended to be replaced by the ISO 9241-300 subseries)
8	Requirements for displayed colours	International Standard (intended to be replaced by the ISO 9241-300 subseries)
9	Requirements for non-keyboard input devices	International Standard (intended to be replaced by the ISO 9241-400 subseries)
11	Guidance on usability	International Standard
12	Presentation of information	International Standard (intended to be replaced by ISO 9241-111 and ISO 9241-141)
13	User guidance	International Standard (intended to be replaced by ISO 9241-124)
14	Menu dialogues	International Standard (intended to be replaced by ISO 9241-131)
15	Command dialogues	International Standard (intended to be replaced by ISO 9241-132)
16	Direct-manipulation dialogues	International Standard (intended to be replaced by ISO 9241-133)

Part no.	Subject/title	Current status
17	Form filling dialogues	International Standard (intended to be replaced by ISO 9241-134)
20	Accessibility guidelines for information/communication technology (ICT) equipment and services	International Standard
Introduction		
100	Introduction to software ergonomics	Planned
General principles and framework		
110	Dialogue principles	International Standard
111	Presentation principles	Planned to partially revise and replace ISO 9241-12
112	Multimedia principles	Planned to revise and replace ISO 14915-1
113	GUI and controls principles	Planned
Presentation and support to users		
121	Presentation of information	Planned
122	Media selection and combination	Planned to revise and replace ISO 14915-3
123	Navigation	Planned to partially revise and replace ISO 14915-2
124	User guidance	Planned to revise and replace ISO 9241-13
129	Individualization	Planned
Dialogue techniques		
130	Selection and combination of dialogue techniques	Planned to incorporate and replace ISO 9241-1:1997/Amd 1:2001
131	Menu dialogues	Planned to replace ISO 9241-14
132	Command dialogues	Planned to replace ISO 9241-15
133	Direct-manipulation dialogues	Planned to replace ISO 9241-16
134	Form-based dialogues	Planned to replace ISO 9241-17
135	Natural language dialogues	Planned
Interface control components		
141	Controlling groups of information (including windows)	Planned to partially replace 9241-12
142	Lists	Planned
143	Media controls	Planned to partially revise and replace ISO 14915-2

Part no.	Subject/title	Current status
Domain-specific guidance		
151	Guidance on World Wide Web user interfaces	International Standard
152	Interpersonal communication	Planned
153	Virtual reality	Planned
Accessibility		
171	Guidance on software accessibility	Under preparation
Human-centred design		
200	Introduction to human-centred design standards	Planned
210	Human-centred design of interactive systems	Planned to revise and replace ISO 13407
Process reference models		
220	Human-centred lifecycle processes	Planned to revise and replace ISO/PAS 18152
Methods		
230	Human-centred design methods	Planned to revise and replace ISO/TR 16982
Ergonomic requirements and measurement techniques for electronic visual displays		
300	Introduction to electronic visual display requirements	To be published
302	Terminology for electronic visual displays	To be published
303	Requirements for electronic visual displays	To be published
304	User performance test methods	To be published
305	Optical laboratory test methods for electronic visual displays	To be published
306	Field assessment methods for electronic visual displays	To be published
307	Analysis and compliance test methods for electronic visual displays	To be published
308	Surface conduction electron-emitter displays (SED)	To be published (Technical Report)
Physical input devices		
400	Principles and requirements for physical input devices	International Standard
410	Design criteria for physical input devices	International Standard
411	Laboratory test and evaluation methods for the design of physical input devices	Planned

Part no.	Subject/title	Current status
420	Selection procedures for physical input devices	Under preparation
421	Workplace test and evaluation methods for the use of physical input devices	Planned
Workstation		
500	Workstation layout and postural requirements	Planned to revise and replace ISO 9241-5
Work environment		
600	Guidance on the work environment	Planned to revise and replace ISO 9241-6
Application domains		
710	Introduction to ergonomic design of control centres	Planned
711	Principles for the design of control centres	Planned to revise and replace ISO 11064-1
712	Principles for the arrangement of control suites	Planned to revise and replace ISO 11064-2
713	Control room layout	Planned to revise and replace ISO 11064-3
714	Layout and dimensions of control centre workstations	Planned to revise and replace ISO 11064-4
715	Control centre displays and controls	Planned to revise and replace ISO 11064-5
716	Control room environmental requirements	Planned to revise and replace ISO 11064-6
717	Principles for the evaluation of control centres	Planned to revise and replace ISO 11064-7
Tactile and haptic interactions		
900	Introduction to tactile and haptic interactions	Planned
910	Framework for tactile and haptic interactions	Under preparation
920	Guidance on tactile and haptic interactions	Under preparation
930	Haptic and tactile interactions in multimodal environments	Planned
940	Evaluation of tactile and haptic Interactions	Planned
971	Haptic and tactile interfaces to publicly available devices	Planned

Annex B
(informative)

Sample checklist for assessing applicability and conformance of ICT equipment and services

B.1 General

This annex provides an example of a checklist (see Table B.1) that can be used to determine whether the applicable recommendations in this part of ISO 9241 have been met. The checklist can be used either during product development or for evaluation of a completed product. It contains all recommendations from this part of ISO 9241, presented in sequence.

It should be noted that the procedure described is itself provided as guidance and is not an exhaustive process to be used as a substitute for the standard itself. The use of the checklist provides a basis for

— determining which of the recommendations are applicable,

— determining whether the applicable recommendations have been followed, and

— providing a list in support of a claim of conformance and a systematic listing of all the applicable recommendations that have been adhered to.

The majority of the recommendations are applicable to all ICT equipment and services where they are intended to enable use by people from populations within the widest possible range of capabilities. However, in some circumstances, what is needed depends upon the context of use (the users, tasks, environment and technology) of the ICT equipment and service.

Where a conditional “if” appears in a recommendation it is necessary to determine whether or not the context of use for which the ICT equipment and service is intended falls within the conditions covered by the “if” statement. For each context-dependent requirement or recommendation, information on applicable circumstances is given in the clause or subclause. If the conditional statement does not apply and thus the recommendation is not applicable, this should be noted in the relevant column in the checklist, and a brief explanation should be provided in the “Comments” column.

The next step involves determining whether the equipment and services being evaluated conforms to each recommendation (where applicable). The exact method for making this decision could vary from an inspection-based judgment of whether a feature is or is not present to testing the equipment and services with users.

Whatever the method of evaluation considered most appropriate, the checklist provides space to give an indication of the level of conformity, and comments on the method used or the judgment made under the “Comments” column.

The completed checklist can be used in support of statements relating to conformance of ICT equipment and services with this part of ISO 9241 (see 4.4), providing a list of all the applicable requirements and those to which the user has conformed.

B.2 How to use the checklist

Clause/subclause numbers and titles are presented in the “Clause” column of the checklist. Some or all the subclauses in a clause may be applicable.

All clauses need to be checked in relation to the design context of specific ICT equipment or services being developed or assessed.

Use the “Applicable” column to indicate whether the recommendation in each clause or subclause is applicable or not (“Y” or “N”). Where a recommendation is not applicable, include a brief note giving the reason or reasons in the “Comments” column.

Use the “Met” column to indicate whether an applicable recommendation has been satisfied or not: “Y” for fully satisfied, “P” for partially satisfied, or “N” for not satisfied. Where a recommendation is judged to be either only partially or not satisfied, include a brief note giving the reason or reasons in the “Comments” column.

Table B.1 — Applicability and conformance checklist

Clause		Applicable (Y/N)	Met (Y/P/N)	Comments
6 Recommendations related to managing development				
6.1 Information accessibility policy				
6.2 Development accountability				
7 Recommendations related to user characteristics				
7.1 General		—	—	—
7.1.1 Supporting a range of user characteristics				
7.1.2 Supporting multiple interaction mechanisms				
7.1.3 Supporting simultaneous use of alternative interaction mechanisms				
7.1.4 Supporting individualization				
7.1.5 Changing configurations				
7.1.6 Returning to default configuration				
7.1.7 Saving and retrieving customized configurations				
7.1.8 Supporting assistive technologies				
7.1.9 Avoiding user fatigue	a)			
	b)			
7.2 Vision		—	—	—
7.2.1 Users without vision				
7.2.2 Providing information using sound				
7.2.3 Supporting navigation in audible environments				
7.2.4 Providing location and function information by auditory and/or tactile means				
7.2.5 Providing control using non-visual mechanisms				

Table B.1 (*continued*)

Clause	Applicable (Y/N)	Met (Y/P/N)	Comments
7.2.6 Users with limited vision			
7.2.7 Adjusting contrast of displayed objects			
7.2.8 Adjusting size of displayed objects			
7.2.9 Magnifying contents of a display			
7.2.10 Inverting display of objects			
7.2.11 Users with limited colour vision			
7.2.12 Users who react to flicker			
7.3 Hearing	—	—	—
7.3.1 Avoiding harmful audio			
7.3.2 Providing verbal information visually			
7.3.3 Users that cannot hear			
7.3.4 Providing visual versions of alarms			
7.3.5 Providing tactile versions of alarms			
7.3.6 Supporting sign language			
7.3.7 Users with limited hearing			
7.3.8 Providing volume control			
7.3.9 Managing sound frequencies			
7.3.10 Providing independent controls for different channels			
7.4 Speech	—	—	—
7.4.1 Supporting text entry of inputs			
7.4.2 Supporting alternatives to voice input			
7.4.3 Users that cannot speak			
7.4.4 Users with limited speech capabilities			
7.4.5 Controlling the speed of voice input			
7.4.6 Providing speech input enhancement			
7.5 Physical capabilities	—	—	—
7.5.1 Limited physical movement			
7.5.2 Providing adjustable location of controls			
7.5.3 Supporting either or only one hand			
7.5.4 Limiting physical force requirements			
7.5.5 Limiting motor control requirements			
7.5.6 Compensating for limitations in fine motor control capabilities			
7.5.7 Providing user control of response timing			

Table B.1 (*continued*)

Clause		Applicable (Y/N)	Met (Y/P/N)	Comments
7.6 Cognitive capabilities		—	—	—
7.6.1 Limitations in cognitive capabilities				
7.6.2 Avoiding unnecessarily high cognitive demands				
7.6.3 Aiding understanding				
7.6.4 Using understandable vocabulary				
7.6.5 Providing information pictorially				
7.6.6 Providing appropriate cues				
7.6.7 Adjusting speed of interaction				
7.6.8 Enabling pausing or stopping				
7.6.9 Minimizing the need for training				
7.6.10 Supporting cultural and linguistic differences				
8 Recommendations related to task characteristics				
8.1 Performing tasks based on context of use				
8.2 Providing alternate ways of performing tasks				
8.3 Performing maintenance and other non-task related operations				
9 Recommendations related to equipment and service characteristics				
9.1 General		—	—	—
9.1.1 Supporting basic and auxiliary functions	a)			
	b)			
9.1.2 Maintaining consistency				
9.1.3 Providing user guidance				
9.1.4 Providing safety information				
9.1.5 Providing interoperability				
9.1.6 Providing error tolerance				
9.1.7 Providing undo or confirm	a)			
	b)			
9.1.8 Safeguarding features				
9.1.9 Biometric data				

Table B.1 (*continued*)

Clause		Applicable (Y/N)	Met (Y/P/N)	Comments
9.2 Other standards for ICT equipment and services		—	—	—
9.2.1 Applying relevant standards				
9.2.2 Input devices				
9.2.3 Visual displays				
9.2.4 Work stations				
9.2.5 Software				
9.2.6 Multimedia software				
9.2.7 Web Software				
9.3 Assistive technologies		—	—	—
9.3.1 Connecting assistive technologies				
9.3.2 Supporting combinations of assistive technologies				
9.4 Selection and operation of ICT equipment and services		—	—	—
9.4.1 Providing accessibility information				
9.4.2 Providing information on intended contexts of use	a)			
	b)			
9.4.3 Maintaining compatibility in replacement equipment or service				
9.5 Preparation and completion of operation		—	—	—
9.5.1 Providing installation information				
9.5.2 Making installation activities achievable				
9.5.3 Switching off equipment				
9.5.4 Storing equipment				
9.5.5 Disconnecting equipment				
10 Recommendations related to environmental characteristics				
10.1 Operating in a range of environments				
10.2 Designing environments	a)			
	b)			
	c)			
	d)			
10.3 Impacting the environment				

Annex C
(informative)

User needs

This annex maps this part of ISO 9241 to user needs according to Version 1.0 of the User Needs Summary developed by the special working group on Accessibility of ISO/IEC JTC 1.

See Table C.1.

Table C.1 — ISO 9241-20 and user needs

User needs listed in User Needs Summary 1.0			Subclause(s) of this part of ISO 9241	
Category		**User needs** (non-exhaustive)	**Same level of user need**	**Related to user needs**
1. Perceive visual information				
1	1	Visual information also available in auditory form	7.2.2 7.2.3 7.2.4 7.2.5	7.2.1
	2	Visual information also available in tactile form	7.2.4	7.2.1 7.2.5
	3	Sufficient brightness for visually presented information (luminance for displays — illumination for printed)	10.2	10.1
	4	Sufficient contrast between all visual information and its background	7.2.7	7.2.10
	5	Any information (other than the colour itself) that is presented through colour to be also presented in another way that does not rely on colour	7.2.11	
	6	Ability to change the colours of information	7.2.11	
	7	Text readable with reduced visual acuity EXAMPLE Automatically scroll large print text horizontally or vertically on-screen without the need to manually manipulate the source material.	7.2.8 7.2.9	
	8	Information within viewable range of those of short stature or seated in wheelchairs	7.5.2	
	9	Ability to avoid reflective glare	10.2	10.1
	10	Ability to avoid glare from excessive brightness (of material or surrounding)	10.2	10.1
	11	Ability to pause, and re-play information presented using audio, video or animation	7.6.7 7.6.8	

Table C.1 (*continued*)

User needs listed in User Needs Summary 1.0			Subclause(s) of this part of ISO 9241	
Category		**User needs** (non-exhaustive)	**Same level of user need**	**Related to user needs**
2. Perceive auditory information				
2	1	Auditory information also available in visual form	7.3.2	
	2	Auditory information also available in tactile form		7.2.1
	3	Ability to adjust the volume to a suitable level	7.3.1 7.3.8	7.3.10
	4	Auditory events, alerts etc., be multi-frequency		7.3.9 7.3.10
	5	When vibration is used as a substitute for different auditory events, then some need vibration to have different vibration patterns (rather than vibration frequency or strength)	[a]	
3. Perceive existence and location of actionable components				
3	1	Locate and identify all keys and controls via non-visual means without activating them EXAMPLE Touch-sensitive or very light touch controls located where they will not be touched while tactilely finding keys they must use to operate device.	9.1.6	7.2.4 9.1.7
	2	To have non-actionable elements (logos, decorative details) not look or feel like buttons or controls	7.6.3	
	3	Sufficient landmarks to be able to quickly re-find controls tactilely during use EXAMPLE Tactile landmarks such as nibs, groupings, spacing.	7.6.3	
	4	Controls that visually contrast with their surroundings NOTE There is some benefit stemming from the ability to adjust colours of on- screen controls.	7.6.3	
	5	Controls be in places where they can be easily found with low vision and with no sight	7.2.4 7.2.5	
	6	Controls within viewable range of people of short stature or seated in wheelchairs		7.5.1 7.5.2
	7	Focus and pointing indicators that are visible with low vision		7.2.7 7.2.10
	8	Information describing the layout of the operational parts	7.2.4	9.5.1
4. Perceive status of controls and indicators				
4	1	Non-visual equivalent to any visual indicators or operational cues, designed (power light) or intrinsic (e.g. visual movements)	7.2.5	7.2.1 7.2.2 7.2.3
	2	Non-audio indicator for any auditory indicators or operational cues, designed (e.g. beeps, lights) or intrinsic (e.g. machine sounds, visual movements)	7.3.4	7.3.3 7.3.7

Table C.1 (*continued*)

User needs listed in User Needs Summary 1.0			Subclause(s) of this part of ISO 9241	
Category		**User needs** (non-exhaustive)	**Same level of user need**	**Related to user needs**
	3	Non-tactile alternative to any subtle tactile feedback		7.5.1 9.3.1
	4	When different signals are used (e.g. different ring tones, or tactile or visual indicators), then some users need alternatives that are also different	7.3.10	7.3.9
	5	Visual indicators (e.g. LEDs, on screen indicators, mouse cursors) that are visible with low vision		7.2.6
	6	Controls and indicators that are perceivable without relying on colour	7.2.11	
	7	Sufficient quality (e.g. volume, direction, clarity, frequency) for audio cues	7.3.8 7.3.9 7.3.10	
	8	Tactile indicators (i.e. for those who need indicator to be both non-visual and non-auditory)		7.3.5
5. Perceive feedback from operation				
5	1	Feedback to be audio or tactile (i.e. non-visual)	7.2.5	
	2	Feedback to be tactile (i.e. both non-visual and non-auditory)	7.2.5	
	3	Visual or auditory alternative to any subtle tactile feedback		7.5.1 9.3.1
	4	When different signals are used (e.g. different ring tones, or tactile or visual indicators) then some users need alternatives that are also different		7.3.9 7.3.10
	5	Visual feedback that is obvious with low vision	7.2.7 7.2.8 7.2.9 7.2.10	7.2.6
	6	Feedback perceivable without relying on colour	7.2.11	
	7	Ability to adjust the colours to make things easier to read		7.2.11
	8	Sufficient quality (e.g. volume, direction, clarity, frequency) for audio feedback	7.3.8 7.3.9	
	9	Audio feedback that does not require tone differentiation		7.3.9
	10	Visual or tactile feedback to occur at the same location as the control		7.3.4 7.3.5
	11	Clear feedback of connector engagement (e.g. power cord, PC card, USB connector, etc.)	9.5.1 9.5.2	

Table C.1 (*continued*)

User needs listed in User Needs Summary 1.0			Subclause(s) of this part of ISO 9241	
Category		**User needs** (non-exhaustive)	**Same level of user need**	**Related to user needs**
6. Be able to invoke and carry out all actions including maintenance and setup				
6	1	Operate all functionality using only tactilely discernable controls coupled with non-visual feedback NOTE In order to operate products efficiently and in available time (see items 7 and 12), some need to be able to access all computer software functionality from the keyboard (or keyboard emulator) without any visual feedback.	7.2.5	7.2.1
	2	To access all functionality without having to use touch or very light touch activated controls	7.5.6	7.5.5
	3	Method to fully operate the product that does not require a pointing device		7.5.1 9.3.2
	4	Ability to access all computer software functionality from the keyboard (or keyboard emulator) with only visual feedback		7.3.2 7.4.1 7.4.2 7.6.5
	5	Alternative method to operate any speech controlled functions	7.4.3 7.3.4	7.4.1 7.4.5
	6	Method to fully operate product that does not require simultaneous actions		7.5.3
	7	Method to fully operate product that does not require much force	7.5.4	7.5.1
	8	Method to fully operate product that does not require much continuous force	7.1.9	
	9	Method to fully operate product that does not require much stamina (includes sustained or repeated activity without sufficient rest)	7.1.9	
	10	Method to fully operate product that does not require much reach (weakness, stature or wheelchair)	7.5.2	7.5.1
	11	Method to fully operate product that does not require tight grasping	7.5.4	
	12	Method to fully operate product that does not require pinching	7.5.4	
	13	Method to fully operate product that does not require twisting of the wrist	7.5.4	
	14	Method to fully operate product that does not require direct body contact		7.2.2
	15	Method to fully operate product that does not require much accuracy of movement NOTE Some need the customization of the object area where a double click is effective.	7.5.5 7.5.6	

Table C.1 (*continued*)

User needs listed in User Needs Summary 1.0			Subclause(s) of this part of ISO 9241	
Category		**User needs** (non-exhaustive)	**Same level of user need**	**Related to user needs**
	16	Ability to adjust the speed and acceleration of input devices NOTE Some need a setting for adjusting the acceleration of a pointer.	7.6.7	7.5.6 7.6.6
	17	Operate product with only a left or only a right hand	7.5.3	
	18	Operate product without use of hands		7.2.2 7.5.1
	19	Operate using only speech		7.2.1 7.2.3
	20	Alternatives to biometric means of identification	9.1.9	
7. Be able to complete actions and tasks within the time allowed				
7	1	Much more time to read displayed information	7.5.7 7.6.7	
	2	Much more time to complete actions — and no feeling of time pressure	7.5.7 7.6.7	
	3	Information necessary to plan their actions in advance	7.6.2 9.1.3	9.5.1
	4	Ability to avoid visual or auditory distractions that prevent focusing on a task		7.6.1 7.6.2
8. Won't accidentally activate actions				
8	1	Products designed so they can be tactilely explored without activation	7.1.9 9.1.6	7.2.4
	2	Ability to operate controls with tremor or spasmodic movements without inadvertent entries	7.1.9 7.5.5 7.5.6	
	3	Controls that are not so easy to activate that they are activated by a slight brush of hand	7.1.9 7.5.5 7.5.6	
9. Be able to recover from errors				
9	1	Notification when the product detects errors made by the user	9.1.6	7.3.4 7.3.5
	2	Unambiguous guidance on what to do in the event of a reported error	9.1.6	7.6.3 7.6.9
	3	Mechanism to go back and undo the last thing(s) they did	9.1.7	
	4	Ability to reset (to initial condition)	7.1.6	

Table C.1 (*continued*)

User needs listed in User Needs Summary 1.0			Subclause(s) of this part of ISO 9241	
Category		**User needs** (non-exhaustive)	**Same level of user need**	**Related to user needs**
10. Have equivalent security and privacy				
10	1	Private listening capability when using audio alternatives to visual information in public places		10.1 10.2 10.3
	2	Protection of the privacy of their information even if they are not able to do the “expected” things to protect it themselves		10.1 10.2 10.3
	3	Security of their information even if they are not able to do the “expected” things to protect it themselves		10.1 10.2 10.3
11. Not cause personal risk (e.g. seizure, etc.)				
11	1	Products where hazards are obvious and easy to avoid, difficult to trigger		9.1.4
	2	Products that do not rely on specific senses or fine movement to avoid injury EXAMPLE Products that do not assume body parts will never stray into openings or that only gentle body movements will occur around the products.	[b]	
	3	Use products safely without seeing hazards or warnings		7.2.1 7.2.6
	4	Use products safely without hearing hazard warnings		7.3.3
	5	To avoid visual patterns that causes them to have seizures		7.2.12
	6	To avoid auditory patterns that causes them to have seizures		7.2.12
	7	Products that do not give off electromagnetic radiation that that they are allergic to		9.1.4
	8	Products that do not give off chemicals that that they are allergic to		9.1.4
12. Be able to efficiently operate product				
12	1	Alternative modes of operation that are effective given the time constraints of the task		7.1.2 7.1.3 7.6.6 7.6.7 7.6.8
	2	Cursor movement that is controlled by keyboard to follow data entry or control order	7.2.5	
	3	The ability to increase the rate of audio alternatives (unless there are minimal audio alternatives)		7.2.1 7.2.6
	4	System level accessibility preference settings that apply across applications	9.1.2	

Table C.1 (*continued*)

User needs listed in User Needs Summary 1.0			Subclause(s) of this part of ISO 9241	
Category		**User needs** (non-exhaustive)	**Same level of user need**	**Related to user needs**
	5	To have applications not override or defeat built-in accessibility features	9.3.1	9.3.2
	6	Accessibility preference settings preserved unless asked NOTE Need to have any applications that want to change accessibility features ask the user first, and return the setting when the application ends.	7.1.5	7.1.6 7.1.7
	7	Preference settings to change immediately preferably without requiring system reboot	7.1.7	7.1.5
	8	Ability to save and restore individual preference settings	7.1.7	
	9	Accessibility functions that can be returned to an initial state individually or together after each user	7.1.6	
	10	Hardcopy documents to be usable with one hand or mouthstick	[a]	
	11	Structure when navigating long audio material		7.6.3
13. Understand how to use product (including discovery and activation of any access features needed)				
13	1	Ability to get overview and orient themselves to product and functions/parts without relying on visual presentation or markings on product	7.2.4	9.1.2
	2	Wording, symbols, and indicators used on products that are as easy to understand as possible given the device and task NOTE Information and feedback to be "salient," and "specific" rather than subtle or abstract in order to understand it.	7.6.2 7.6.3 7.6.4	
	3	Products to use standard conventions, words and symbols for their culture (cross-cultural if possible)	7.6.3	7.6.10
	4	Clear and easy activation mechanisms for any access features	9.4.1 9.3.1	8.2
	5	Navigation that supports different thinking styles		7.6.3 7.6.10
	6	Ability to understand product if they have trouble thinking hierarchically		7.6.3
	7	Any text read aloud to them		7.2.1 7.2.2
	8	Steps for operation that are minimized and clearly described	7.6.4	7.6.2 8.1
	9	Interfaces that limit the memorization required of the user to operate them successfully	7.6.2 7.6.3	
	10	Cues to assist them in multi-step operations	7.6.6	
	11	Simple interfaces that only require them to deal with the controls they need (advanced or optional controls removed in some fashion)	7.6.2	8.2 9.1.1

Table C.1 (*continued*)

User needs listed in User Needs Summary 1.0			Subclause(s) of this part of ISO 9241	
Category		**User needs** (non-exhaustive)	**Same level of user need**	**Related to user needs**
	12	Each function on its own key rather than having keys change their functions but look/feel the same		7.6.2
	13	Know that a product is usable by them and how to set it up to work for them	9.5.2	9.5.1
14. Understand the output or displayed material (even after they perceive it accurately) — see also "perceive"				
14	1	Textual material to be worded as clearly and simply as possible	7.6.3 7.6.4	7.6.9 7.6.10
	2	Text, illustrations and diagrams in spoken form	7.2.2	9.1.3
	3	To not have device noise or regular audio output interfere with ability to understand accessibility audio		7.3.8 7.3.9 10.1 10.2
	4	Visual information generated by access features (such as captions) not occur simultaneously with other visual information they must view (e.g. captions not displayed at same time as critical information on screen)	7.5.7 7.6.6	7.6.7
	5	Image resolution and speed be sufficient to understand any sign language presented	[b]	
	6	Ability to slow audio, video, or animated information down slightly	7.5.7 7.6.6	
	7	Ability to replay, pause, change speed in order to understand information	7.6.7 7.6.8	
	8	Ability to replay auditory information	9.1.7	7.6.7 7.6.8
	9	Enlargable text wordwrap so that it stays on screen and is understandable	7.2.8	
	10	Feedback using pictures or symbols	7.3.2 7.3.4	
	11	Ability to silence audio output	7.3.8	
15. Ability to use their assistive technology (AT) to control the product				
NOTE Examples of assistive technology include electronic aids, manipulators, specialized assistive software, switches, alternative keyboards, alternative mouse pointers, on-screen keyboards, artificial limbs, mouth-sticks.				
15	1	Product not interfere with AT (e.g. no electrical noise interference with hearing devices)		9.1.5
	2	Ability to use their AT with the device (e.g. alternate display, amplifiers, or alternate controls)	9.1.5 9.3.1 9.3.2	
	3	Full and efficient functional control of a product using their AT, including pass-through of user feedback and notifications such as error messages	9.3.1 9.3.2	
	4	AT to be available that will work with new technologies, at the time of release of the new technology	9.1.5	9.4.3

Table C.1 (*continued*)

User needs listed in User Needs Summary 1.0			Subclause(s) of this part of ISO 9241	
Category		**User needs** (non-exhaustive)	**Same level of user need**	**Related to user needs**
16. Cross cutting issues				
16	1	New technologies that are accessible when they are released	9.4.3	
	2	Ability to access the controls that allow them to turn on and adjust the built in accessibility features	7.1.5	7.1.4
	3	Accessible path and ability to position self within reach of installed products		7.5.2
	4	Timely access to trained customer service personnel (e.g. Help Desk)	9.4.2	
	5	Accessible training and support materials	9.4.1	
	6	Electronic access to copyrighted and otherwise protected material	[c]	
	7	Product to be usable by those with multiple disabilities	7.1.1 9.3.1	5.2 7.1.3 9.3.2
	8	Ability to provide feedback about improvements to accessibility to meet their particular needs	5.3	
	9	Product accessibility information to be disseminated to distributors, retailers, installers, system integrators, customer organizations, and people with disabilities	9.4.1	
	10	To have their accessibility functions available at all times, without disruption		9.3.1 9.3.2

[a] Too detailed to cover in this part of ISO 9241.

[b] This is a general ergonomics requirement.

[c] Outside the scope of this part of ISO 9241.

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ICS 13.180; 35.180

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