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**Robotics — Application services
provided by service robots — Safety
management systems requirements**

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Contents

	Page
Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Context of the organization	8
4.1 Understanding the organization and its context.....	8
4.2 Understanding the needs and expectations of interested parties.....	9
4.3 Determining the scope of the application service safety management system.....	9
4.4 Application service safety management system.....	9
5 Leadership	10
5.1 Leadership and commitment.....	10
5.2 Policy.....	10
5.3 Roles, responsibilities and authorities.....	11
6 Planning	11
6.1 Actions to address risks and opportunities.....	11
6.2 Application service safety objectives and planning to achieve them.....	11
6.3 Planning of changes.....	12
6.4 Safety risk assessment.....	12
6.4.1 General.....	12
6.4.2 Preparation of safety risk assessment.....	12
6.4.3 Safety risk analysis.....	13
6.4.4 Safety risk evaluation.....	14
6.5 Activities for safety risk reduction.....	14
6.5.1 General.....	14
6.5.2 Determination of safety risk reduction measure.....	14
6.5.3 Determination of compliance obligations on the operation.....	15
6.5.4 Planning implementation of the safety risk reduction measures.....	16
7 Support	16
7.1 Resources.....	16
7.2 Competence.....	16
7.3 Awareness.....	17
7.4 Communication.....	17
7.4.1 General.....	17
7.4.2 Internal communication.....	18
7.4.3 Communication with interested parties.....	18
7.5 Documented information.....	18
7.5.1 General.....	18
7.5.2 Creating and updating documented information.....	18
7.5.3 Control of documented information.....	18
8 Operation	19
8.1 Operational planning and control.....	19
8.2 Communication with users.....	19
8.3 Consideration for the third party of application service.....	20
8.4 Emergency preparedness and response.....	20
8.5 Managing hazardous events.....	21
9 Performance evaluation	22
9.1 Monitoring, measurement, analysis, and evaluation.....	22
9.2 Internal audit.....	23
9.2.1 General.....	23
9.2.2 Internal audit programme.....	23

9.3	Management review	24
9.3.1	General	24
9.3.2	Management review inputs	24
9.3.3	Management review results	24
10	Improvement	24
10.1	Continual improvement	24
10.2	Nonconformity and corrective action	25
Annex A	(informative) Example of interested parties in application service and relationship to the defined terms	26
Annex B	(informative) Classification of the relationship between operation contents of application service and robot use restriction intended by robot system providers	27
Annex C	(informative) Examples of information for use of service robots	29
Annex D	(informative) Examples of hazards in operation and their causes	33
Bibliography	41

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 299, *Robotics*.

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

Introduction

When operating service robots that coexist with people, proper management of their residual safety risks is needed. To achieve this, in the same manner as with general machineries, application service providers, who intended to start application services provided by service robots, need to consider the safety in operation as well as the robot system providers need to consider the safety in design. For application service providers to safely operate service robots with residual safety risks, communication between the robot system providers and the application service provider is important. For example, the robot system providers provide appropriate information for use when application service providers operate robots based on the comprehension of this information for use communicated by the robot system providers of the service robot. The application service providers then give feedback to the robot system providers on the safety-related information obtained from actual operation.

For some service robots, the design safety requirements have already been standardized in ISO 13482. There have been application service providers that operate robots within the scope of these standards. Although these application service providers have operated their application services safely, based on a certain level of knowledge and experience, their methodology has not yet been systematized, nor have the terms been standardized. It is considered that by systemizing and documenting an optimal methodology to operate application services provided by service robots safely, the criteria to be satisfied by new application service providers would be clarified which would then promote sound development of the industry.

The purpose of this document is to provide application service providers using service robots with the safety management system requirements for application services provided by service robots as a safe operating framework.

The safety management system for the application services provided by service robots is based on the concept of Plan-Do-Check-Act (PDCA). The PDCA model provides an iterative process used by organizations to achieve continual improvement. It can be briefly described as follows:

- Plan: establish safety objectives and processes necessary to deliver results in accordance with the organization's safety policy
- Do: implement the processes as planned.
- Check: monitor and measure processes against the safety policy, including its commitments, safety objectives and operating criteria, and report the results.
- Act: take actions to continually improve.

In this document, the following verbal forms are used:

- “shall” indicates a requirement;
- “should” indicates a recommendation;
- “may” indicates a permission;
- “can” indicates a possibility or a capability.

Information marked as “Note” is intended to assist the understanding or use of the document.

Robotics — Application services provided by service robots — Safety management systems requirements

1 Scope

This document specifies the requirements of safety management systems for application services provided by service robots [application service safety management system (hereafter ASSMS)] that an application service provider can use for the safety of its users and its third parties when it provides application service in unstructured human spaces with trained and untrained persons (e.g. giving directions for visitors in airport or shopping mall, carrying goods to patients in hospital, delivering food to customers in restaurant.)

This document is applicable to any organization that wishes to:

- a) improve safety performance of application services provided by service robots,
- b) establish, implement, maintain and improve safety management systems for application services provided by service robots,
- c) assure itself of conformity with its stated application service safety policy, and
- d) demonstrate conformity with this document.

The requirements of this document can be conformed to by integrating safety management systems for application services provided by service robots into, or making it compatible with, other management systems or processes within the organization.

The requirements of this document can be conformed to by multiple organizations without omission depending on what is done as an organization and safety management.

Although intended for application services provided by service robots, this document can also be applied to services using robots other than service robots.

This document is not intended to be used as a product safety standard.

NOTE There are cases where the safety management systems for application services provided by service robots established in accordance with the requirements of this document cannot apply directly when the service robots to be used, robot systems, contents of service, places of operation, users or so, differ.

2 Normative references

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

ISO 13482:2014, *Robots and robotic devices — Safety requirements for personal care robots*

ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13482 and the following apply.

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

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

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

3.1 organization

person or group of people that has its own functions with responsibilities, authorities and relationships to achieve its *objectives* (3.6)

Note 1 to entry: The concept of organization includes, but is not limited to, sole-trader, company, corporation, firm, enterprise, authority, partnership, association, charity or institution, or part or combination thereof, whether incorporated or not, public or private.

Note 2 to entry: If the organization is part of a larger entity, the term “organization” refers only to the part of the larger entity that is within the scope of the application service safety *management system* (3.4).

3.2 interested party

person or *organization* (3.1) that can affect, be affected by, or perceive itself to be affected by a decision or activity

Note 1 to entry: A robot system provider is an interested party related to ASSMS.

3.3 top management

person or group of people who directs and controls an *organization* (3.1) at the highest level

Note 1 to entry: Top management has the power to delegate authority and provide resources within the organization.

Note 2 to entry: If the scope of the *management system* (3.4) covers only part of an organization, then top management refers to those who direct and control that part of the organization.

3.4 management system

set of interrelated or interacting elements of an *organization* (3.1) to establish *policies* (3.5) and *objectives* (3.6), as well as *processes* (3.8) to achieve those objectives

Note 1 to entry: A management system can address a single discipline or several disciplines.

Note 2 to entry: The management system elements include the organization’s structure, roles and responsibilities, planning and operation.

3.5 policy

intentions and direction of an *organization* (3.1) as formally expressed by its *top management* (3.3)

3.6 objective

result to be achieved

Note 1 to entry: An objective can be strategic, tactical, or operational.

Note 2 to entry: Objectives can relate to different disciplines (such as finance, health and safety, and environment). They can be, for example, organization-wide or specific to a project, product or *process* (3.8).

Note 3 to entry: An objective can be expressed in other ways, e.g. as an intended result, as a purpose, as an operational criterion, as an application service safety objective or by the use of other words with similar meaning (e.g. aim, goal, or target).

Note 4 to entry: In the context of application service safety *management systems* (3.4), application service safety objectives are set by the *organization* (3.1), consistent with the application service safety *policy* (3.5), to achieve specific results.

3.7 risk

effect of uncertainty

Note 1 to entry: An effect is a deviation from the expected — positive or negative.

Note 2 to entry: Uncertainty is the state, even partial, of deficiency of information related to, understanding or knowledge of, an event, its consequence, or likelihood.

Note 3 to entry: Risk is often characterized by reference to potential events (as defined in ISO Guide 73) and consequences (as defined in ISO Guide 73), or a combination of these.

Note 4 to entry: Risk is often expressed in terms of a combination of the consequences of an event (including changes in circumstances) and the associated likelihood (as defined in ISO Guide 73) of occurrence.

Note 5 to entry: In this document, where the term “risks and opportunities” is used this means *safety risks* (3.39), *safety opportunities* (3.40) and other risks and other opportunities for the management system.

Note 6 to entry: This constitutes one of the common terms and core definitions for ISO management system standards given in Annex SL of the Consolidated ISO Supplement to the ISO/IEC Directives, Part 1. Note 5 to entry has been added to clarify the term “risks and opportunities” for its use within this document.

3.8 process

set of interrelated or interacting activities that uses or transforms inputs to deliver a result

Note 1 to entry: Whether the result of a process is called an output, a product or a service depends on the context of the reference.

3.9 competence

ability to apply knowledge and skills to achieve intended results

3.10 documented information

information required to be controlled and maintained by an *organization* (3.1) and the medium on which it is contained

Note 1 to entry: Documented information can be in any format and media and from any source.

Note 2 to entry: Documented information can refer to:

- the *management system* (3.4), including related *processes* (3.8);
- information created in order for the organization to operate (documentation);
- evidence of results achieved (records).

3.11 performance

measurable result

Note 1 to entry: Performance can relate either to quantitative or qualitative findings.

Note 2 to entry: Performance can relate to managing activities, *processes* (3.8), products, services, systems or *organizations* (3.1).

3.12 continual improvement

recurring activity to enhance *performance* (3.11)

3.13 effectiveness

extent to which planned activities are realized and planned results are achieved

**3.14
requirement**

need or expectation that is stated, generally implied or obligatory

Note 1 to entry: “Generally implied” means that it is custom or common practice for the *organization* (3.1) and *interested parties* (3.2) that the need or expectation under consideration is implied.

Note 2 to entry: A specified requirement is one that is stated, e.g. in *documented information* (3.10).

**3.15
conformity**

fulfilment of a *requirement* (3.14)

**3.16
nonconformity**

non-fulfilment of a *requirement* (3.14)

**3.17
corrective action**

action to eliminate the cause(s) of a *nonconformity* (3.16) and to prevent recurrence

**3.18
audit**

systematic and independent *process* (3.8) for obtaining evidence and evaluating it objectively to determine the extent to which the audit criteria are fulfilled

Note 1 to entry: An audit can be an internal audit (first party) or an external audit (second party or third party), and it can be a combined audit (combining two or more disciplines).

Note 2 to entry: An internal audit is conducted by the *organization* (3.1) itself, or by an external party on its behalf.

Note 3 to entry: “Audit evidence” and “audit criteria” are defined in ISO 19011.

**3.19
measurement**

process (3.8) to determine a value

**3.20
monitoring**

determining the status of a system, a *process* (3.8) or an activity

Note 1 to entry: To determine the status, there can be a need to check, supervise or critically observe.

**3.21
application service safety performance**

measurable result related to the safety of an *application service* (3.26)

Note 1 to entry: Examples of metrics to measure *performances* (3.11) relevant to the safety of an application service are:

- continuous operation time without an *accident* (3.43);
- the number of near-hits (generally known as an incident which is a *hazardous event* (3.41) but does not cause a *harm* (3.41) as a result);
- the number of improvement proposals;
- the number of persons with safety-related qualification;
- the number of emergency tests.

3.22**outsource** (verb)

make an arrangement where an external *organization* (3.1) performs part of an organization's function or *process* (3.8)

Note 1 to entry: An external organization is outside the scope of the *management system* (3.4), although the outsourced function or process is within the scope.

3.23**robot**

programmed actuated mechanism with a degree of autonomy to perform locomotion, manipulation or positioning

[SOURCE: ISO 8373:2021, 3.1]

3.24**service robot**

robot (3.23) in personal use or professional use that performs useful tasks for humans or equipment

[SOURCE: ISO 8373:2021, 3.7]

3.25**robot system**

system constructed for an *application service* (3.26), including *service robots* (3.24), safeguarding and complementary protective measures independently installed by an *application service provider* (3.30), communication networks, and so on

3.26**application service**

action to provide benefit to a *user* (3.27) by interaction between a *service robot* (3.24) or a *robot system* (3.25) and the *user* (3.27)

Note 1 to entry: Trials are regarded as an application service.

3.27**user**

beneficiary, person who receives the benefit, of the *application services* (3.26) provided by the *service robot* (3.24)

Note 1 to entry: In some applications, a user could be both the operator and the beneficiary.

3.28**user limit**

limit or condition to limit to be a *user* (3.27) by his/her category and/or characteristics

Note 1 to entry: Examples of user limit are body height, body mass, age, skill, disease, clinical history, body condition or so.

3.29**user's behaviour limit**

limit or condition to limit the behaviour of a *user* (3.27)

Note 1 to entry: Examples of user's behaviour limit are acting in accordance with the operation procedure of a service robot specified by the *robot system provider* (3.33), putting on a protective equipment or so.

3.30

application service provider

organization (3.1) that initiatively performs planning, implementation and providing *application service* (3.26) and has overall responsibility of *application service* (3.26) including safety. In the case of that application service provider *outsources* (3.22) operation task to *operator agency* (3.31), it provides a *robot system* (3.25) to an *operator agency* (3.31) for a defined use

Note 1 to entry: There are several cases in market to establish robot system for application service. The simplest case is using general-purpose robot system which robot system provider supply. However, in many cases, integration of robot system according to each application service are needed. When application service provider performs system integration by itself, it takes on the role and responsibilities of a *robot system provider* (3.33) including to certify that the robot system meets relevant safety standards if necessary. When application service provider outsourced system integration, outsourcing partner takes on these role and responsibilities depends on contract.

Note 2 to entry: When application service provider performs planning application service, it can apply organizational measures, and/or person-based measures to ensure the safety of application service.

3.31

operator agency

organization (3.1) that has the responsibility to manage and operate a *service robot* (3.24)

Note 1 to entry: *Operator agency* (3.31) can be a part of *application service provider* (3.30), otherwise can be a different *organization* (3.1) which outsourced by *application service provider* (3.30).

EXAMPLE 1 The application of a delivery robot for transporting food and food-related items between an *operator agency* (3.31) such as a restaurant, and a *user* (3.27) such as a restaurant customer. The restaurant, the *operator agency* (3.31), that manages a person, the *operator* (3.23), who programs the delivery destination and initiates the *service robot* (3.4) to accomplish the delivery task.

EXAMPLE 2 The application of an exoskeleton robot for personal mobility assistance by an *operator agency* (3.31) such as a rehabilitation facility, to aid a *user* (3.27) such as a rehabilitation client. The rehabilitation facility, *operator agency* (3.31), that manages a rehabilitation staff member, the *operator* (3.32), who provides rehabilitation services to clients, *users* (3.27).

Note 2 to entry: An *operator agency* (3.31) is responsible for the safe operation of the *service robot* (3.24) for the defined use of the *application service provider* (3.30). This responsibility can be identified in a contract between the *application service provider* (3.30) and the *operator agency* (3.31), or by safe operating instructions in an operating manual that is provided by the *application service provider* (3.30) to the *operator agency* (3.31).

3.32

operator

person or agency designated to make parameter and program changes, and to start, monitor, and stop the intended operation of the *service robot* (3.24)

[SOURCE: ISO 8373:2021, 2.17, modified]

3.33

robot system provider

organization that supplies robotic components, subsystems, or systems for *application service provider* (3.30). These include hardware for the physical system of a *robot* (3.23), and software for operation of the hardware and control interfaces

Note 1 to entry: A manufacturer can be regarded as a robot system provider.

Note 2 to entry: A system integrator can be regarded as a robot system provider.

Note 3 to entry: A seller can be regarded as a robot system provider.

3.34**information for use**

information that has a safety specification of a *robot* (3.23), a *robot use restriction* (3.35), a compliance matter to assure safe and proper operation of machines or a residual *safety risk* (3.39)

Note 1 to entry: In general, information for use is provided by a robot system provider as a user manual.

3.35**robot use restriction**

condition of use intended by a *robot system provider* (3.33) during designing including an operational environment of *robot* (3.23), a *user limit* (3.28), a *user's behaviour limit* (3.29), *competence* (3.9) required to use, education and training contents to obtain the *competence* (3.9), a period for safety-related *performance* (3.11) to be maintained, and necessary maintenance and inspection

Note 1 to entry: Robot use restriction is equivalent to "limits of machinery" specified in 5.3 of ISO 12100:2010.

Note 2 to entry: "Machinery" and "machine" is changeable to "robot" in this document.

3.36**life cycle of application service**

consecutive and interlinked stages of a *management system* (3.4) related to an *application service* (3.26), from transportation and installation of *service robots* (3.24) to final disposal

Note 1 to entry: The life cycle of application service stages include transportation of *service robots* (3.24), installation, use, change of contents of a service, inspection, maintenance, end-of-life treatment and final disposal.

Note 2 to entry: Adapted from ISO 14001:2015, 3.3.3.

3.37**third party of application service**

person who is in the operation space of an *application service* (3.26) but is not *user* (3.27) nor in charge of the *application service* (3.26) as a member of the *application service provider* (3.30).

Note 1 to entry: In general, third party of application service do not have prior knowledge and information relevant to the safety of a specific *robot* (3.23).

3.38**third party who has special knowledge**

person or *organization* (3.1) that can be regarded to have knowledge of machinery safety

Note 1 to entry: For example, a certifier or a person who has knowledge of machinery safety [e.g. system safety engineer, safety assessor (part), industrial safety consultant (part)].

Note 2 to entry: A member of an *application service provider* (3.30) can be a third party who has special knowledge.

3.39**safety risk**

combination of the probability of occurrence of *harm* (3.41) and the severity of that *harm* (3.41)

3.40**safety opportunity**

circumstance or set of circumstances that can lead to improvement of *application service safety performance* (3.21)

3.41**harm**

injury or damage to the health of people, or damage to property or the environment

[SOURCE: ISO/IEC Guide 51:2014, 3.1]

3.42

hazardous event

event that can cause *harm* (3.41)

[SOURCE: ISO 12100:2010, 3.9]

3.43

accident

hazardous event (3.42) which result actual *harm* (3.41)

3.44

inherently safe design

measures taken to eliminate *hazards* (3.45) and/or to reduce *safety risks* (3.39) by changing the design or operating characteristics of the product or system

[SOURCE: ISO/IEC Guide 51:2014, 3.5]

3.45

hazard

potential source of *harm* (3.41)

[SOURCE: ISO/IEC Guide 51:2014, 3.2]

3.46

ASSMS

application service safety management system

4 Context of the organization

4.1 Understanding the organization and its context

The organization shall determine external and internal issues that are relevant to its purpose and that affect its ability to achieve the intended result(s) of its ASSMS.

The organization shall monitor and review information about these external and internal issues.

NOTE "Issue" means an important topic or problem for debate or discussion. It can have a positive or negative impact on the organization.

EXAMPLE 1 External issues are:

- cultural, social, legal, technological, economic and natural surroundings and market competition, whether international, national, regional, or local;
- situation of competitors;
- relationships with its external interested parties;
- changes in relation to any of the above.

EXAMPLE 2 Internal issues are:

- the organizational activities, the strategies, the culture in the organization, competence (capital, time, human resources and processes)
- relationships within its internal interested parties;
- changes in relation to any of the above.

The organization shall determine whether climate change is a relevant issue.

4.2 Understanding the needs and expectations of interested parties

The organization shall determine:

- the interested parties that are relevant to the application service safety management system;
- the relevant requirements of these interested parties;
- which of these requirements will be addressed through the application service safety management system.

NOTE 1 Relevant interested parties can have requirements related to climate change.

When determining the interested parties relevant to the ASSMS, the organization shall consider:

- the owners of the robot;
- the field owners;
- the relevant administrative bodies;
- the relevant organizations to be outsourced such as operator agency;
- the robot system providers;
- the users.

NOTE 2 Generally, instructions which the robot system provider specifies in the information for use are included in the relevant requirements of the interested parties.

NOTE 3 When the purpose of the application service changes from trial to a commercial use, generally the interested parties that are relevant to the ASSMS and the relevant requirements of these interested parties change. The trials are an action to provide benefit to the user while the problems (e.g. the safety and/or the values) for practical application are verified by using the robots in the real situations.

NOTE 4 The robot system providers, even when they provide the robot for free, are considered to bear the equivalent responsibilities to the case for a fee. For example, to provide information for use appropriately so on.

NOTE 5 An example of interested parties in application service and relationship to the defined terms in this document are shown in [Annex A](#).

4.3 Determining the scope of the application service safety management system

The organization shall determine the boundaries and applicability of the ASSMS to establish its scope.

When determining this scope, the organization shall consider:

- the external and internal issues referred to in [4.1](#);
- the requirements referred to in [4.2](#).
- the contents of the application service to be operated (see [6.4.3.2](#)).

The scope shall be available as documented information.

4.4 Application service safety management system

The organization shall establish, implement, maintain and continually improve an ASSMS, including the processes needed and their interactions to assure the application service safety performance, in accordance with the requirements of this document.

Conformity to this document may only be claimed if the requirements determined as not being applicable do not affect the organization's ability or responsibility to ensure the conformity of its services.

5 Leadership

5.1 Leadership and commitment

Top management shall demonstrate leadership and commitment with respect to the ASSMS by:

- ensuring that the application service safety policy and application service safety objectives are established and are compatible with the strategic direction of the organization;
- ensuring the integration of the ASSMS requirements into the organization's business processes;

NOTE 1 Reference to "business" in this document can be interpreted broadly to mean those activities that are core to the purposes of the organization's existence.

- ensuring that the resources needed for the ASSMS are available;

NOTE 2 Specifically, it is to ensure human resources, facilities and budgets necessary to the safe operation of the application service and to implement the plan.

- communicating the importance of effective application service safety management and of conforming to the ASSMS requirements to workers under control of the organization and the interested parties;

NOTE 3 Specifically, it is to announce the importance of the safe operation of the application service as well as the conformity to this document via meetings, house journals, electrical bulletin boards, e-mails or so.

- ensuring that the ASSMS achieves its intended result(s);
- directing and supporting persons who work under control of the organization and the interested parties to contribute to the effectiveness of the ASSMS;
- promoting continual improvement;

NOTE 4 Specifically, it is to set an incentive for improvement proposals.

- supporting other relevant managerial roles to demonstrate their leadership as it applies to their areas of responsibility.

5.2 Policy

Top management shall establish an application service safety policy that:

- a) is appropriate to the purpose of the organization;
- b) provides a framework for setting application service safety objectives;

NOTE 1 Provision of a framework for setting application service safety objectives is, for example, to establish a process(es) for the meetings to decide the safety objectives of a term at the beginning of the term.

- c) includes a commitment to meet applicable requirements;
- d) includes a commitment to continual improvement of the ASSMS.

NOTE 2 The application service safety policy can include:

- reference to the importance of safety ensuring for the users and the third party of the application service;
- compliance with the relevant legislations;
- conformity to the requirements for ASSMS;
- allocation of appropriate resources to application service safety performance improvement;
- thorough preparation to respond to emergency situations;
- continual improvement led to enhance of application service safety performance.

The application service safety policy shall:

- be available as documented information;
- be communicated within the organization;
- be available to interested parties, as appropriate.

5.3 Roles, responsibilities and authorities

Top management shall ensure that the responsibilities and authorities for relevant roles are assigned and communicated within the organization.

Top management shall assign the responsibility and authority for:

- a) ensuring that the ASSMS conforms to the requirements of this document;
- b) reporting on the performance of the ASSMS to top management.

6 Planning

6.1 Actions to address risks and opportunities

When planning for the ASSMS, the organization shall consider the issues referred to in [4.1](#) and the requirements referred to in [4.2](#) and determine the risks and opportunities that need to be addressed to:

- give assurance that the ASSMS can achieve its intended result(s);
- prevent, or reduce, undesired effects;
- achieve continual improvement.

The organization shall plan:

- a) actions to address these risks and opportunities;
- b) how to
 - integrate and implement the actions into its ASSMS processes;
 - evaluate the effectiveness of these actions.

6.2 Application service safety objectives and planning to achieve them

The organization shall establish application service safety objectives at relevant functions and levels.

The application service safety objectives shall:

- a) be consistent with the application service safety policy;
- b) be measurable (if practicable);
- c) take into account applicable requirements;
- d) be monitored;
- e) be communicated;
- f) be updated as appropriate;
- g) be available as documented information.

EXAMPLE The application service safety objectives can be:

- continuous operating time without an accident;
- the number of near-hits;
- the number of improvement proposals;
- the number of persons with safety-related qualification;
- the number of emergency drills.

NOTE Although a person concerned can hesitate to report hazardous events occurred if the number of hazardous events such as near-hits are used as the application service safety objectives, it is important for the organization to acquire information about hazardous events and use it for improvement purposes. To this end, providing incentives for reporting hazardous events are needed.

When planning how to achieve its application service safety objectives, the organization shall determine:

- what will be done;
- what resources will be required;
- who will be responsible;
- when it will be completed;
- how the results will be evaluated.

6.3 Planning of changes

When the organization determines the need for changes to the ASSMS, the changes shall be carried out in a planned manner.

6.4 Safety risk assessment

6.4.1 General

The organization shall carry out a safety risk assessment for each application service according to ISO 12100:2010 including a safety risk analysis and a safety risk evaluation. The organization should hear opinions from the third party who has special knowledge on the validity of the safety risk assessment. The organization shall document the results of the safety risk assessment and maintain the document.

The requirements of [6.4](#) shall apply for all application services.

6.4.2 Preparation of safety risk assessment

The organization shall specify the necessary competence to carry out a safety risk assessment. In accordance with the specified competence, person(s) to carry out a safety risk assessment shall be determined.

The organization shall determine the criteria to judge the necessity of safety risk reduction actions in the safety risk evaluation.

For the determination, if necessary, participation of the interested parties that are relevant to the ASSMS, which is specified in [4.2](#), shall be considered.

The organization shall obtain the information for use from the robot system provider.

6.4.3 Safety risk analysis

6.4.3.1 Information for use

The organization shall consider the contents of the information for use of the service robot(s) and all other components of the robot system during carrying out the safety risk analysis.

If there are unclear points and insufficiency in the information for use, the organization shall carry out the safety risk analysis after solving the unclear points and the insufficiency via communication with the robot system provider and so on.

The organization should hear opinions from the third party who has special knowledge on the validity of the information for use. In case of a service robot whose conformity to international safety standards is confirmed by the third party who has special knowledge, it may be considered that opinions from the third party who has special knowledge on its information for use have already been heard.

NOTE The international safety standard for service robots is ISO 13482.

The organization shall, if necessary, obtain the information of the facilities or places where the application service is implemented from the field owners and consider the contents during carrying out the safety risk analysis.

6.4.3.2 Specification of the operation contents of the application service

The organization shall specify and document the operation contents of the application service.

When the organization specifies the operation contents of the application service, it shall consider:

- the relationship between operation contents of application service and robot use restriction intended by robot system providers included in the information for use (see [Figure B.1](#), [Figure B.2](#) and [Figure B.3](#) of [Annex B](#));
- whether the service robot is used for trials or for a commercial use.

NOTE 1 Items to specify the operation contents of the application service can include, for example, the above and:

- benefits to be provided;
- robots to be used;
- places where the application service is implemented.

NOTE 2 When the organization selects service robots to be used for the application service, it can select service robots whose conformity to safety standards is confirmed. When the organization uses service robots whose conformity to safety standards is not confirmed, it can seek the opinion of a third party who has special knowledge on the relationship between the operation contents of application service and the restrictions on robot use restriction intended by robot system providers included in the information for use. For example, the relationship can correspond to Case 2 or Case 3 of [Annex B](#).

When the organization changes the operation contents of the application service, it shall check the conformity to [Clauses 6](#) through [9](#) before the change.

6.4.3.3 Specification of the user limit of the application service

The organization, if necessary, shall specify, document and maintain user limits to ensure the safety during the operation of the application service.

The organization shall consider the user limits specified by the robot system providers included in the information for use.

NOTE [Annex C](#) indicates examples of information for use of service robots including user limit.

6.4.3.4 Hazard identification

The organization shall identify hazards relevant to the application service to be provided in accordance with the life cycle of application service and contents.

NOTE 1 [Annex D](#) indicates examples of hazards assumed in application services.

NOTE 2 Further hazards tables can be found in ISO 13482:2014, Annex A and ISO 12100:2010, Annex B.

6.4.3.5 Safety risk estimation

To estimate the safety risks of the application service to be provided, the organization shall carry out the following measures a) and b):

- a) estimate the probability of occurrence and the severity of harm caused by the hazards;
- b) estimate the safety risk of the hazards by combining the probability of occurrence and the severity of harm estimated in a).

For the safety risk estimation, the organization shall consider the following c) and d):

- c) safety risks to the third party of application service resulting from application service.
- d) unusual situations and reasonably foreseeable emergency situations.

When the safety risk assessment is carried out again because of a change of the application service, the impact of the change shall be considered.

6.4.4 Safety risk evaluation

The organization shall extract the safety risks that need to be reduced by applying the criteria to judge the necessity of safety risk reduction actions ([6.4.2](#)) to the results of the safety risk estimation ([6.4.3.5](#)).

The organization shall maintain the documented information relevant to the safety risks that are judged to be excessive and, therefore, require reduction.

6.5 Activities for safety risk reduction

6.5.1 General

The organization shall determine and implement safety risk reduction measures based on the results of the safety risk assessment referred to in [6.4](#).

When determining the safety risk reduction measures, the organization shall consider the participation of the interested parties that are relevant to the ASSMS, which is specified in [4.2](#).

The organization shall consider the opinion of the interested parties to implement the safety risk reduction measures on the implementation and maintain its contents as the documented information.

6.5.2 Determination of safety risk reduction measure

The organization shall consider and implement the safety risk reduction measures until the residual safety risks are judged acceptable based on the results of the safety risk assessment.

The safety risk reduction measures shall be considered according to the following sequence from a) and be applied in the order that are found reasonably applicable:

- a) inherently safe designs;
- b) safeguarding and complimentary protective measures;

c) compliance obligations on the operation.

NOTE 1 The above safety risk reduction measures are listed in the order of effectiveness.

NOTE 2 Inherently safe design measures which application service provider can take is change robot use in application service to other lower safety risk robot.

NOTE 3 In the compliance obligations on the operation, operations necessary to implement a) and b) can be included.

NOTE 4 Compliance obligations on the operation are similar to organizational measures and person-based measures of TOP principle for occupational safety.

The organization should hear opinions from the third party who has special knowledge on the validity of the safety risk reduction measures.

The organization shall maintain the documented information relevant to:

- the contents of the safety risk reduction measures;
- the rationale for the selection of the safety risk reduction measures.

6.5.3 Determination of compliance obligations on the operation

The organization shall:

a) determine the compliance obligations on the operation for safety risk reduction;

The compliance obligations on the operation shall include:

- 1) the inspection and the maintenance that are judged necessary for the service robots by the organization including those specified by the robot system providers;
- 2) the inspection and the maintenance needed to maintain the safeguarding and the complimentary protective measures that are judged necessary by the organization in the determination of the safety risk reduction measures (6.5.2);
- 3) the compliance obligations on the operation that are judged necessary by the organization in the determination of the safety risk reduction measures (6.5.2);
- 4) the compliance obligations on the operation based on the information for use obtained by the robot system providers.

b) determine how the compliance obligations on the operation apply to the organization and communicate it to workers under control of the organization;

c) take these compliance obligations on the operation into account when establishing, implementing, maintaining and continually improving its ASSMS.

The organization shall maintain documented information of its compliance obligations on the operation.

NOTE The documented information of the compliance obligations on the operation, for example, can include the information below. Because the loss of confidentiality and inappropriate use of such information can degrade the application service safety performance, the control of the documented information (7.5.3) is of particular importance:

- the passwords to use and configure the service robots and the robot systems;
- the information to disable the safeguarding and the complimentary protective measures that are implemented by the organization.

6.5.4 Planning implementation of the safety risk reduction measures

To implement the safety risk reduction measures, the organization shall plan:

- a) how to integrate and implement the safety risk reduction measures into its ASSMS processes;

NOTE 1 Specifically, for example, it is to clarify its contents of the determined safety risk reduction measures (6.5.2) and a responsible person to implement.

- b) how to evaluate the effectiveness after implementation of the safety risk reduction measures and its criteria;

- c) the contents of the agreement of the interested parties to implement the safety risk reduction measures;

NOTE 2 Examples of the contents of the agreement of the interested parties to implement the safety risk reduction measures are:

- the safety risks that need to be reduced;
- the detail of the safety risk reduction measures:
 - the contents;
 - the rationale for the selection;
 - organization or person(s) to implement
 - the resources necessary to implement and organization or person(s) to bear them.

NOTE 3 The involvement of top management can be needed to determine the contents of the agreement of the interested parties to implement the safety risk reduction measures.

7 Support

7.1 Resources

The organization shall determine and provide the resources needed for the establishment, implementation, maintenance and continual improvement of the ASSMS.

7.2 Competence

The organization shall:

- determine the necessary competence of person(s) doing work under its control that affects its application service safety performance. For the determination, if necessary, the competence required to implement the safety risk reduction measures determined by the organization shall be considered; if the competence required by the robot system provider is included in the information for use, it shall be considered;

NOTE 1 The person(s) doing work under its control that affects its application service safety performance is, for example, installation personnel, maintenance personnel, operators and safety manager.

- ensure that these persons are competent on the basis of appropriate education, training, or experience. For the education and training, if necessary, the education content specified by the robot system provider shall be considered;

NOTE 2 There is the case where it is necessary to ensure that there are multiple persons with the same competence in anticipation of a day when the person with the competence that is essential for the application service is absent.

- where applicable, take actions to acquire the necessary competence, and evaluate the effectiveness of the actions taken.

Appropriate documented information shall be available as evidence of competence.

NOTE 3 Applicable actions can include, for example, providing training to, the mentoring of, or the re-assignment of currently employed persons, or the hiring or contracting of competent persons.

7.3 Awareness

The organization shall ensure that persons doing work under the organization's control are to be aware of:

- the application service safety policy;
- the aspects that significantly diminish or are capable of diminishing the safety to the related actual or potential safety risks associated with their work;

NOTE In practice, they can be indicated to workers under the organization's control as the objective of safe use in their own work.

- their contribution to the effectiveness of the ASSMS, including the benefits of improved application service safety performance;
- the implications of not conforming with the ASSMS requirements.

7.4 Communication

7.4.1 General

The organization shall establish, implement and maintain the process(es) needed for internal communication and external communications with interested parties relevant to the ASSMS, including:

- on what it will communicate;
- when to communicate;
- with whom to communicate;
- how to communicate;
- who will communicate.

The organization shall retain documented information as evidence of its communication, as appropriate.

EXAMPLE The documented information as evidence of its communication are:

- a) electronic media:
 - communication histories of e-mails;
 - log of collaboration tools;
- b) paper media:
 - minutes of meetings;
 - records of seminars.

7.4.2 Internal communication

The organization shall:

- a) internally communicate information relevant to the ASSMS among the various levels and functions of the organization, including changes to the ASSMS, as appropriate; consider the compliance obligations on the operation specified by the organization in [6.5.3](#) as the information relevant to the ASSMS;
- b) ensure its communication process(es) enable(s) persons doing work under the organization's control to contribute to continual improvement.

7.4.3 Communication with interested parties

The organization shall communicate information relevant to the ASSMS with interested parties, as established by the organization's communication process(es).

NOTE Examples of communication with interested parties are:

- obtainment of information from the field owners on the changes of the facilities and the environments where the application service is implemented;
- provision of information to the field owners on the changes of the application service.

7.5 Documented information

7.5.1 General

The organization's ASSMS shall include:

- a) documented information required by this document;
- b) documented information determined by the organization as being necessary for the effectiveness of the ASSMS.

NOTE The extent of documented information for an ASSMS can differ from one organization to another due to:

- the size of organization and its type of activities, processes, products and services;
- the complexity of processes and their interactions;
- the competence of persons.

7.5.2 Creating and updating documented information

When creating and updating documented information, the organization shall ensure appropriate:

- identification and description (e.g. a title, date, author, or reference number);
- format (e.g. language, software version, graphics) and media (e.g. paper, electronic);
- review and approval for suitability and adequacy.

7.5.3 Control of documented information

Documented information required by the ASSMS and by this document shall be controlled to ensure:

- a) it is available and suitable for use, where and when it is needed;
- b) it is adequately protected (e.g. from loss of confidentiality, improper use, or loss of integrity).

For the control of documented information, the organization shall address the following activities, as applicable:

- distribution, access, retrieval and use;
- storage and preservation, including preservation of legibility;
- control of changes (e.g. version control);
- retention and disposition.

Documented information of external origin determined by the organization to be necessary for the planning and operation of the ASSMS shall be identified as appropriate and controlled.

NOTE Access can imply a decision regarding the permission to view the documented information only, or the permission and authority to view and change the documented information.

8 Operation

8.1 Operational planning and control

With consideration for each step of the life cycle of application service, the organization shall plan, implement and control the processes needed to meet requirements, and to implement the actions determined in [Clause 6](#), by:

- establishing criteria for the processes;
- implementing control of the processes in accordance with the criteria;

Documented information shall be available to the extent necessary to have confidence that the processes have been carried out as planned.

The organization shall control planned changes and review the consequences of unintended changes, taking action to mitigate any adverse effects, as necessary.

The organization shall ensure that externally provided processes, products or services that are relevant to the application service safety management system are controlled.

The organization, if necessary, shall communicate the relevant requirements for the safety to the organization or the person(s) having the responsibility of the outsourced processes.

The organization and person(s) outsourcing processes shall consider the protection of personal information if the information to be communicated to them includes personal information about the users.

8.2 Communication with users

The organization shall, based on the user limit specified in [6.4.3.3](#), communicate with the users the following:

- a) if necessary, inform the user limit to the users before the beginning of the service;
- b) if necessary, before the beginning of the service, check the information necessary to judge whether the users satisfy the user limit;

NOTE 1 To obtain the information needed to judge whether users satisfy the user limit, one can measure body height and/or mass, check ID card, enforce testing, interview).

- c) as the result of b), in case that the users do not satisfy the user limit, stop providing the service.

When communicating with the users, diversity shall be considered.

NOTE 2 The diversity to be considered can be age, culture, disability, language, literacy, sex.

The organization, if necessary, shall specify, document, maintain and implement the instruction and/or training for the users to learn the skills necessary to ensure the safety during the application service. When specifying the instruction and/or training, if necessary, the organization shall consider the instruction and/or training necessary for the users to learn the skills required by the robot system providers in the information for use.

NOTE 3 The contents of the instruction and/or training can be:

- the communication of the precautions that the users follow;
- the communication of the way to respond to the possible events.

The results of the instruction and/or training, if necessary, shall be documented and retained.

NOTE 4 When the organization selects, as a way of the instruction and/or training, the verbal communication or the communication by a notice board for unspecified large number of the users, it is considered difficult to document the results of the instruction and/or training. In that case, only the fact that the verbal communication or the communication by a notice board are carried out can be recorded.

The organization, if necessary, shall document and maintain the user's behaviour limit and the safety risks of not following it.

The organization shall inform the user's behaviour limit and the safety risks of not following it to the users before the beginning of the service.

The organization shall endeavor to obtain the feedback about the safety of the application service including complaints from the users.

8.3 Consideration for the third party of application service

The organizations, if necessary, for the third party of the application service, shall conduct public awareness activities about the safety of the application service.

NOTE Public awareness means can be:

- Visual (distribution of leaflets, installation of signboards, installation of digital signage);
- Auditory (announce, alarm).

The organization, if necessary, shall consider the infringement of the rights including life, body, property and the privacy rights of the third party of the application service.

8.4 Emergency preparedness and response

The organization shall establish, implement and maintain the process(es) needed to prepare for and respond to potential emergency situations.

The organization shall:

- a) specify emergency situations that is needed to address as an organization;
- b) prepare to respond by planning actions to prevent or mitigate reduction of safety from emergency situations;
- c) respond to actual emergency situations;
- d) take action to prevent or mitigate the consequences of emergency situations, appropriate to the magnitude of the emergency and the potential impact;

- e) report at least the results of c) to top management soon after emergency situations become evident;
- f) periodically test the planned response actions, where practicable;
- g) periodically review and revise the process(es) and planned response actions, in particular after the occurrence of emergency situations or tests;
- h) provide relevant information and training related to emergency preparedness and response, as appropriate, to relevant interested parties, including persons working under its control;
- i) prepare compensation means for liability for damages in case of an accident.

NOTE 1 Examples of emergency situations that need to be considered for the application service are:

- failures of the service robot and the robot system leading to unacceptable safety risks;
- accidents during the application service;
- external events such as earthquake and typhoon;
- internal events such as fire and power failure.

NOTE 2 Compensation means for liability for damages in case of an accident is, in general, taking out liability insurance.

The organization, if necessary and possible, shall gather the information of the users and the third party of the application service that are needed to respond to emergency situations before the beginning of the service. If gathering the information is judged not needed or impossible, its rationale shall be documented.

NOTE 3 Examples of the information that are needed to respond to emergency situations are name, emergency contact, need for special aid and chronic disease.

NOTE 4 Depending on the characteristics of the application service, there is the case where it is impossible to gather the information from the users and the third party of the application service. In this case, to obtain the necessary information soon after emergency situations occur, it can be needed to coordinate means to obtain the information and communication path and so on between the interested parties.

The organization shall properly gather, store and use the information of the users and the third party of the application service in conformity to laws, regulations and other requirements.

The organization shall conduct public relations for the users concerning emergency response plans before the beginning of the service.

The organization shall maintain documented information to the extent necessary to have confidence that the process(es) is (are) carried out as planned.

8.5 Managing hazardous events

Management of hazardous events are as follows:

- a) The organization shall establish and maintain the process(es) for documenting and reporting hazardous events that have occurred. The contents of the documented information on hazardous events shall be under consideration of the requirements from the interested parties and include the following 1) to 10):
 - 1) the operation contents of the application service;
 - 2) date and time;
 - 3) location;
 - 4) participants (users, staff);

- 5) what happened;
- 6) probable causes;

NOTE 1 Probable causes can be, for example, information relevant to newly found vulnerability on the safety of the service robots and the robot systems. Because the loss of confidentiality and inappropriate use of such information degrades the application service safety performance, the control of the documented information (7.5.3) is of particular importance.

NOTE 2 When probable causes cannot be identified, it is important to write this down accordingly.

- 7) response, including any medical treatment;
- 8) consequences (e.g. resulting situation of damage);
- 9) corrective actions;
- 10) source of the information

The organization shall specify what criteria is necessary for reporting hazardous events and shall report the hazardous events in accordance with the criteria. The criteria shall be under consideration of requirements from the interested parties, be documented and maintained.

- b) The organization shall specify what criteria is necessary for reporting hazardous events to robot system providers and shall report hazardous events to the robot system providers in accordance with the criteria. The criteria should be those where all hazardous events caused by the service robots are reported. The contents to be reported to the robot system providers shall include 1) to 10) of a) and, if possible, the following 1) to 6):
 - 1) model number of the service robot;
 - 2) serial number of the service robot;
 - 3) version of software;
 - 4) history of maintenance;
 - 5) data stored in the service robot that record the transition of operating conditions at the time of the accident;
 - 6) if applicable, whether an excess of robot use restriction intended by robot system providers and its contents.

NOTE 3 Based on the report of hazardous events, robot system providers can improve their service robots and then the future safety of the service robots and the application services using them can be expected to improve.

- c) The organization shall review the safety risk assessment process (6.4 and 6.5) to prevent recurrence of such hazardous events. If necessary, organization shall take corrective action according to 10.2.

9 Performance evaluation

9.1 Monitoring, measurement, analysis, and evaluation

The organization shall determine:

- what needs to be monitored and measured;
- the methods for monitoring, measurement, analysis and evaluation, as applicable, to ensure valid results;

- when the monitoring and measuring shall be performed;
- when the results from monitoring and measurement shall be analysed and evaluated.

Documented information shall be available as evidence of the results.

The organization shall evaluate the performance and the effectiveness of the ASSMS.

The organization shall establish, implement and maintain the process(es) needed to evaluate the fulfilment of its compliance obligations on operation.

The organization shall:

- a) determine the frequency with which compliance will be evaluated;
- b) evaluate the status of implementation of the compliance obligations on the operation and, if it is less than the defined criteria, improve it;
- c) maintain knowledge and understanding of its compliance status.

The organization shall retain documented information as evidence of the compliance evaluation result(s).

9.2 Internal audit

9.2.1 General

The organization shall conduct internal audits at planned intervals to provide information on whether the ASSMS:

- a) conforms to:
 - the organization's own requirements for its ASSMS;
 - the requirements of this document;
- b) is effectively implemented and maintained.

9.2.2 Internal audit programme

The organization shall plan, establish, implement and maintain an audit programme(s) including the frequency, methods, responsibilities, planning requirements and reporting.

When establishing the internal audit programme(s), the organization shall consider the importance of the processes concerned and the results of previous audits.

The organization shall:

- a) define the audit objectives, criteria and scope for each audit;
- b) select auditors and conduct audits to ensure objectivity and the impartiality of the audit process;
- c) ensure that the results of the audits are reported to relevant managers;
- d) take appropriate correction and corrective actions for nonconformity without undue delay.

Documented information shall be available as evidence of the implementation of the audit programme(s) and the audit results.

9.3 Management review

9.3.1 General

Top management shall review the organization's ASSMS, at planned intervals, to ensure its continuing suitability, adequacy and effectiveness.

9.3.2 Management review inputs

The management review shall include:

- a) the status of actions from previous management reviews;
- b) changes in:
 - the operation contents of the application service;
 - external and internal issues that are relevant to the ASSMS;
 - the needs and expectations of interested parties that are relevant to the ASSMS;
 - the results of the safety risk assessment and the safety risk reduction measures;
- c) information on the application service safety performance, including trends in:
 - the extent to which the safety objective has been achieved;
 - nonconformities and corrective actions;
 - monitoring and measurement results;
 - audit results;
 - emergency situations;
 - hazardous events;
- d) safety opportunities and other opportunities for continual improvement;
- e) the adequacy of resources.

9.3.3 Management review results

The results of the management review shall include decisions related to continual improvement opportunities and any need for changes to the ASSMS.

Documented information shall be available as evidence of the results of management reviews.

10 Improvement

10.1 Continual improvement

The organization shall continually review and improve the suitability, adequacy and effectiveness of the ASSMS.

10.2 Nonconformity and corrective action

When a nonconformity occurs, including any arising from complaints, the organization shall:

- a) react to the nonconformity, and as applicable:
 - take action to control and correct it;
 - deal with the consequences;
- b) evaluate the need for action to eliminate the cause(s) of the nonconformity, in order that it does not recur or occur elsewhere, by:
 - reviewing the nonconformity;
 - determining the causes of the nonconformity;
 - determining if similar nonconformities exist, or can potentially occur;
- c) implement any action needed;
- d) review the effectiveness of any corrective action taken;
- e) make changes to the ASSMS, if necessary.

Corrective actions shall be appropriate to the effects of the nonconformities encountered.

Documented information shall be available as evidence of:

- the nature of the nonconformities and any subsequent actions taken;
- the results of any corrective action.

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Annex A (informative)

Example of interested parties in application service and relationship to the defined terms

Figure A.1 shows an example of the interested parties in the application service and their relationship to the defined terms. The service flow described in the Figure A.1 will differ depending on the type of application service, the type of service robot or contract between each stakeholder. Application service providers will include direct buyers of the robot, service integrators who rent/lease the robot from dealers or distributors in order to provide a specific service to its public recipients. Operators can be a part of the service providers, or separate contractors who have a contract with service providers.

Ex. Food delivery service in restaurant

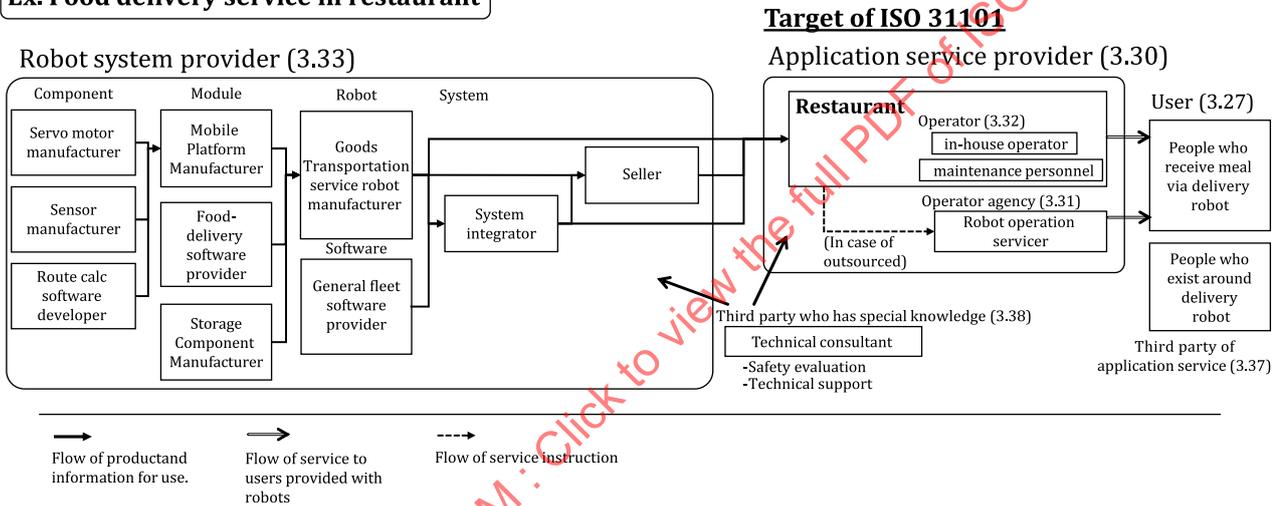


Figure A.1 — Example of interested parties in application service and relationship to the defined terms

Annex B (informative)

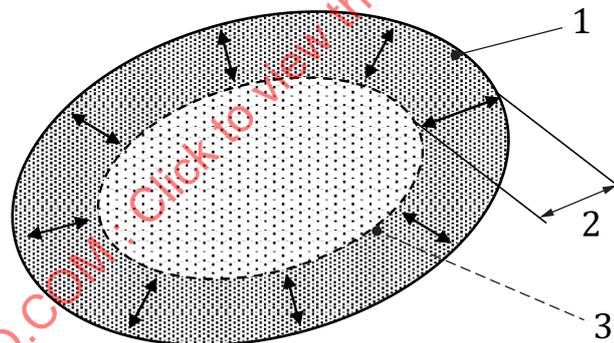
Classification of the relationship between operation contents of application service and robot use restriction intended by robot system providers

B.1 General

Classification of application services from the point of view of ensuring safety is shown in [B.2](#) to [B.4](#).

B.2 Case 1 Basic example

Case 1 is defined as the case where an application service provider operates its application service within the robot use restriction intended by the robot system providers during the design process. Even in Case 1, when the safety risks are reduced by compliance obligations on the operation as a result of the safety risk assessment and the determination of safety risk reduction measures, unacceptable safety risks can occur depending on the status of the operation. That is, compliance with the requirements of this document is considered necessary.



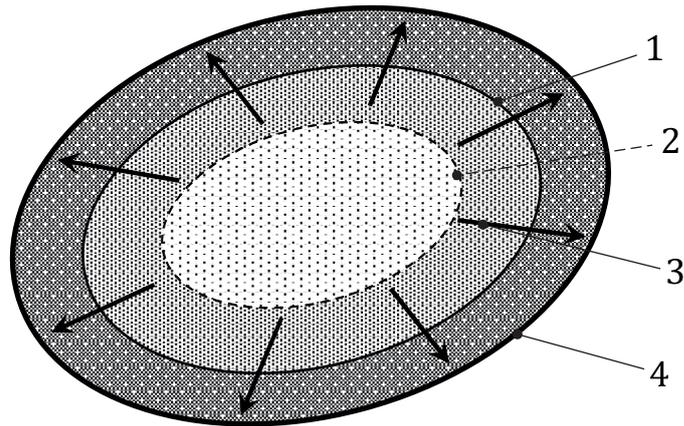
Key

- 1 use restriction of the service robots intended by the robot system provider during the design process
- 2 safety margin that changes depending on the status of the operation
- 3 range of use of the service robot for the operation based on this document

Figure B.1 — Case 1: Basic example

B.3 Case 2 Extended example

Case 2 is defined as the case where an application service provider operates its application service by extending the robot use restriction intended by the robot system providers during the design process. When a residual safety risk is deemed unacceptable following the safety risk assessment, safety risk reduction measures should be implemented by the application service provider. When the service robots used do not comply with international safety standards, the robot use restriction intended by the robot system providers during the design process may not be validated; this case can be categorized as Case 2.



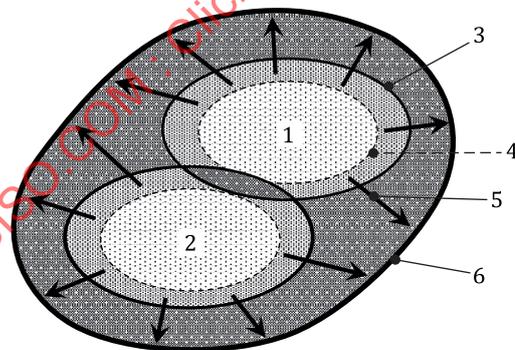
Key

- 1 use restriction of the service robots intended by the robot system provider during the design process
- 2 range of use of the service robot before its extension
- 3 risk reduction measures implemented by the application service provider
- 4 extended range of use of the service robot or the robot system

Figure B.2 — Case 2: Extended example

B.4 Case 3 Integrated example

Case 3 is defined as the case where an application service provider operates its application service by combining multiple service robots or control systems. When a residual safety risk is deemed unacceptable following the safety risk assessment, safety risk reduction measures should be implemented by the application service provider.



Key

- 1 service robot "A"
- 2 service robot "B" or a control system
- 3 use restriction of the service robots intended by the robot system provider during the design process
- 4 range of use of the service robot before its extension
- 5 risk reduction measures implemented by the application service provider
- 6 extended range of use of the robot system after integration

Figure B.3 — Case 3: Integrated example

Annex C (informative)

Examples of information for use of service robots

C.1 General

This annex indicates examples of information for use of typical service robots: a mobile servant robot, a person carrier robot and a physical assistant robot.

C.2 Example of information for use of a mobile servant robot

[Figure C.1](#) is an example of a mobile servant robot and [Table C.1](#) is an example of information for use of the robot.

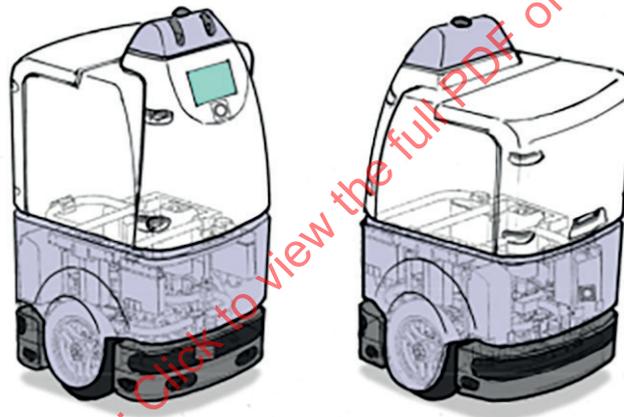


Figure C.1 — An example of a mobile servant robot

Table C.1 — An example of information for use of a mobile servant robot

Items	Specifications
Objects to be carried	— General amenity goods and/or beverage PET bottles
Transport capacity	— 20 kg at the maximum
Operating environment	<ul style="list-style-type: none"> — Indoor — Temperature: 10 °C to 40 °C — Lighting (illumination): 150 lx to 1 000 lx — Use of water: IPx4 splashing of water in IEC 60529 — Obstacles to avoid (size): wider than 10 cm, higher than 50 cm — Characteristics of the third party: limited to those who have been briefed on robot safety

Table C.1 (continued)

Items	Specifications
Travel surface	<ul style="list-style-type: none"> — Minimum width of corridor: 120 cm — Maximum inclining angle: 10° — Maximum level difference: 20 mm — Maximum groove width: 10 mm — Assumed material of travel surface: tiles
Operation management	<ul style="list-style-type: none"> — Safety manager: needed — Periodical inspection: needed (the details such as its frequency and its contents will be specified in another document. It is noted that this example is just an example, so the document does not exist.)

C.3 Example of information for use of a person carrier robot

Figure C.2 is an example of a person carrier robot and Table C.2 is an example of information for use of the robot.



Figure C.2 — An example of a person carrier robot

Table C.2 — An example of information for use of a person carrier robot

Items	Specifications
Speed	<ul style="list-style-type: none"> — 6 km/h at the maximum
Operating environment	<ul style="list-style-type: none"> — Outdoor — Temperature: 10 °C to 40 °C — Lighting (illumination): 150 lx to 1 000 lx — Use of water: not used — Obstacles to avoid (size): wider than 10 cm, higher than 50 cm — Characteristics of the third party: limited to those who are trained

Table C.2 (continued)

Items	Specifications
Travel surface	<ul style="list-style-type: none"> — Minimum width of alley: 120 cm — Maximum inclining angle: 10° — Maximum level difference: 20 mm — Maximum groove width: 10 mm — Assumed material of travel surface: tiles
Users	<ul style="list-style-type: none"> — Educated to drive — Physical ability (strength, eyesight, etc.) — Judgement ability — Body mass: 45 kg to 100 kg
Operation management	<ul style="list-style-type: none"> — Safety manager: needed — Maintenance: needed (the details such as who is the maintenance personnel and the contents of the maintenance will be specified in another document. It is noted that this example is just an example, so the document does not exist.) — Periodical inspection: needed (the details such as its frequency and its contents will be specified in another document. It is noted that this example is just an example, so the document does not exist.)

C.4 Example of information for use of a physical assistant robot

[Figure C.3](#) is an example of a physical assistant robot and [Table C.3](#) is an example of information for use of the robot.

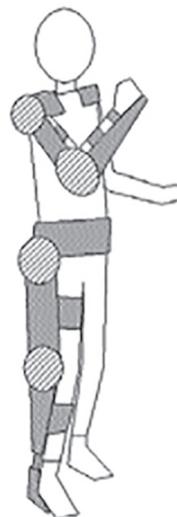


Figure C.3 — An example of a physical assistant robot

Table C.3 — An example of information for use of a physical assistant robot

Items	Specification
Operating environment	<ul style="list-style-type: none"> — Indoor — Temperature: 10 °C to 30 °C — Humidity: 30 % to 80 % (no condensation)
Users	<ul style="list-style-type: none"> — Physical ability (the details such as strength and eyesight will be specified in another document. It is noted that this example is just an example, so the document does not exist.) — Body shape (less than 80 kg body mass, smaller than 180 cm tall)

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