
Ergonomic design of control centres —
Part 10:
Introduction to the control room
design series of standards

Conception ergonomique des centres de commande —

*Partie 10: Introduction aux séries de normes relatives à la conception
des centres de commande*

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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 documents 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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 159, *Ergonomics*, Subcommittee SC 4, *Ergonomics of human-system interaction*.

A list of all parts in the ISO 11064 series can be found on the ISO website.

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

Ergonomics is the scientific discipline and systematic study concerned with the understanding of the interactions among human and other elements of a system. The term also describes the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.

The ISO 11064 series provides general guidance, principles and recommendations. The requirements focus on the interaction between human and system and also the processes and methods required to achieve usable and accessible interactive systems.

The ISO 11064 series covers a wide range of topics including architectural requirements, computer interface design and furniture design. This document provides guidance on the overall structure of the series and offers advice on where specific requirements are discussed. This document is designed to help the potential users identify which of these is relevant to their needs.

The principles, recommendations and requirements given in the ISO 11064 series can help users with:

- user consultation;
- matching functional design with purpose;
- avoiding abortive design and unnecessary iterations;
- contributing to multi-disciplinary team coordination;
- minimizing the mistiming of critical inputs from stakeholders.

The ISO 11064 series enables users to:

- apply a systematic process to the design of control rooms;
- lay out the group of rooms closely associated with the control room;
- arrange furniture and major displays in a control room;
- design and specify ergonomic layouts of workstations;
- specify the design of the user interfaces including computer systems, communications equipment and CCTV systems;
- identify and specify the environmental requirements for lighting, acoustics and thermal environments;
- evaluate existing control rooms.

The ISO 11064 series covers all types of control centres typically employed in the process industries, transportation and command, communications and control. Although the ISO 11064 series is primarily intended for non-mobile control centres, many of the principles specified in this document can be applicable to mobile control centres, such as those found on ships and aircraft.

The ISO 11064 series provides information which is relevant to the following stakeholder groups:

- ergonomists;
- usability professionals;
- control room designers;
- architects;
- interior designers;

- heating and ventilation engineers;
- project managers;
- control room staff;
- certification bodies;
- procurers.

The terms "human factors" and "ergonomics" are used interchangeably in this document and are considered as synonyms.

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Ergonomic design of control centres —

Part 10:

Introduction to the control room design series of standards

1 Scope

This document describes the different parts of the ISO 11064 series. The overall content of each of the parts is presented, the most likely users of that part and the relevance of each part to different stages in the control room design process.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

4 Selecting the appropriate standard to use

The control room requirements presented in the ISO 11064 series are likely to be addressed by a range of professions. Certain parts of the ISO 11064 series can be of particular relevance to specific individuals in the design team (for example, those requirements relating to control suite layout are likely to be of particular concern to architects). [Figure 1](#) shows how various members of the control room design team can use the different parts of the ISO 11064 series. The figure is illustrative, not prescriptive, and in practice which professions require to address which parts can depend on the composition of the team and the nature of the project. Familiarity with all parts of the ISO 11064 series, and the requirements and recommendations they contain, can be helpful to the human factors engineer. The model is not based on any specific industry and draws together some commonality to be found in many control room projects.

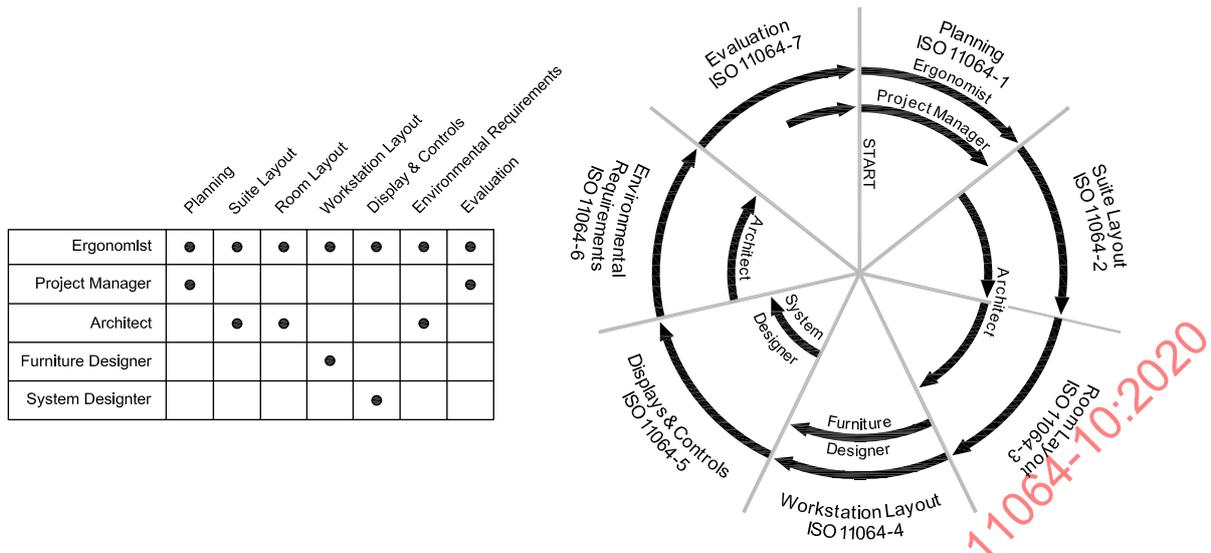


Figure 1 — Control room standard series and primary stakeholder interest

The actual involvement of each stakeholder can vary depending on the nature of the control room project. The relevance of the ISO 11064 series on control suite design, for example, can be less relevant for a control room upgrade than for a "greenfield" design. Similarly, the relevance of guidance on early planning, as presented in ISO 11064- 1, can be irrelevant where furniture is being replaced.

5 Summary of parts

5.1 General

The design of control centres is covered in seven separate parts. General requirements for the planning, design and evaluation of control centres are covered in ISO 11064-1 and ISO 11064-7 supported by specific requirements on working environments, human system interfaces and workstation design.

Subclauses 5.2 to 5.10 present a summary of each part and those stakeholders who can have a particular interest in the requirements presented.

5.2 ISO 11064-1, Principle for the design of control centres

ISO 11064-1 includes requirements and recommendations concerning the control room design process. It can be applied to both the elements of a control room project, such as workstations and overview displays, as well as to the overall planning and design of entire projects. Other parts of the ISO 11064 series deal with more detailed requirements associated with specific elements of a control centre. A core consideration is ensuring that the design process has a user-centred focus.

ISO 11064-1 can be of particular interest to those planning new control rooms or managing projects which include a control room. It presents a set of 9 high-level principles which have been distilled from the experience of numerous control room projects and can assist control room design teams in managing a user-centred process.

ISO 11064-1 presents an 11-phase framework for undertaking control room design programmes and offers guidance on what tasks should be undertaken at each phase.

ISO 11064-1 includes an annex to assist control room designers in clarifying operational goals and identifying key constraints associated with the control room design programme.

5.3 ISO 11064-2, *Principles of control suite arrangement*

ISO 11064-2 covers ergonomic design principles for control centres and, more specifically, the various arrangements of rooms and spaces in a control suite. The principles are based on an analysis of functions and tasks that need to be undertaken by the control room and its functionally related rooms. They include identifying functional areas, estimating the space provisions for each of these areas, determining operational links between functional areas and developing preliminary control suite layouts which reflect these required links.

ISO 11064-2 can be of particular interest to those members of the design team concerned with the building within which the control room is housed. Amongst other things, ISO 11064-2 addresses such issues as cabling, proximity of spaces, communication patterns and any constraints imposed by levels of flexibility in job and work organization. Requirements are also presented where the physical location of a control room in a building is critical, for example reception areas and some security rooms.

A 5-step process is presented for the design of the control suite and ISO 11064-2 includes an annex presenting common requirements associated with such areas as "welfare" and "equipment and maintenance".

5.4 ISO 11064-3, *Control room layout*

ISO 11064-3 lists ergonomic principles for the layout of control rooms. It includes requirements, recommendations and guidelines on control room layouts, workstation arrangements, the use of off-workstation visual displays and the needs of maintenance engineers.

ISO 11064-3 can be of particular interest to architects and others concerned with the building as well as human factors engineers. ISO 11064-3 offers the designer a process for generating control room layouts starting with the identification of requirements and ending with ergonomic layouts which accommodate these operational needs.

ISO 11064-3 presents basic requirements associated such matters as the selection of appropriate spaces, dealing with future expansion and the location of windows, entrances and exits. Alternative workstation groupings within a control room are discussed and an annex presents a selection of these together with their advantages and disadvantages. The requirements associated with the sitting of off-workstation displays, maintenance spaces and wheelchair access are presented.

For determining design dimensions, the practice of providing formulae, into which appropriate user population data is inserted, is adopted. A table presents anthropometric data.

5.5 ISO 11064-4, *Workstation layout and dimensions*

ISO 11064-4 specifies ergonomic principles, recommendations and requirements for the design of workstations found in control centres.

The emphasis of ISO 11064-4 is on layout and dimensions of control room workstations. This document covers primarily seated, visual-display-based workstations although sit/stand workstations are also addressed. These workstations are to be found in applications such as transportation control, the process industry, utilities and security installations. ISO 11064-4 series can be of particular interest to those concerned with furniture design and to human factor engineers.

ISO 11064-4 offers a process starting with a consideration of the control room operator work tasks leading through to the development of layouts which take account of operators' abilities to reach controls and see displays. Key workstation dimensions are presented for seated and standing operators and the process whereby these dimensions can be derived from basic anthropometric data spelt out. ISO 11064-4 includes an annex which describes in detail how ergonomic arrangements with different combinations of displays can be achieved.

5.6 ISO 11064-5, *Displays and controls*

ISO 11064-5 presents principles, requirements and recommendations, for displays, controls and their interaction.

The purpose of ISO 11064-5 is to maximize the safe, reliable, efficient and comfortable use of displays and controls in control centre applications. To this end, rules and recommendations based on ergonomic findings are established for:

- selecting the appropriate display and control types;
- structuring and presenting information on screens and shared off-workstation displays; and
- establishing control and dialogue procedures.

The wide range of control and displays used in control rooms, and the rapid changes in technology, make it impracticable to provide requirements meeting all situations. The approach adopted in this document is to identify general principles of good practice. Supplementary information, from human factors publications and other ergonomics standards, can also be helpful.

ISO 11064-5 offers a 7-step design process for display and control specification. A special section is included on control room alarms covering the design of these systems, the organization of alarms and alarm metrics. Detailed annexes provide guidelines on the design of screen-based control systems including advice on the presentation of "trends", "graphs", "data fields" and "bar charts". Guidance is also offered on dialogue types in relation to task requirements as well as control device selection. The last annex provides human factors guidance relating to closed circuit television (CCTV) and communications systems.

5.7 ISO 11064-6, *Environmental requirements for control rooms*

ISO 11064-6 specifies environmental requirements for the ergonomic design, upgrading or refurbishment of control rooms and other functional areas within the control suite.

The following aspects are covered:

- thermal environment;
- air quality;
- lighting environment;
- acoustic environments;
- vibration;
- aesthetics and interior design.

ISO 11064-6 does not cover the influence of electromagnetic fields. Guidance on electromagnetic fields and visual display image quality is given in ISO 9241-5.

The environmental aspects in control rooms need to be addressed since poor environments can seriously affect operator performance. Control room environments, in addition to the usual office requirements, need to take into account shift work, time pressures and the additional quantities of equipment often found in control rooms. ISO 11064-6 offers 9 general principles for good environmental design. A process which relates operational requirements to environmental specifications is presented. The requirements associated with each major element of the control room environment is described and how major factors, such as tasks and equipment, are taken into account. ISO 11064-6 also presents interior design and aesthetic recommendations. An annex offers some sample values for key environmental features.

5.8 ISO 11064-7, Principles for the evaluation of control centres

ISO 11064-7 provides a framework for the evaluation of control centres and presents ergonomic principles which can be used for compliance assessment. It includes requirements, recommendations and guidelines on evaluation of each of the different elements of the control centre, i.e. control suite, control room, workstations, displays and controls, and the working environment. ISO 11064-7 covers both verification and validation (V&V) requirements.

ISO 11064-7 provides recommendations on the preparation of a V&V plan and offers guidance on such matters as the scope of a V&V plan, assessment criteria to be applied, inputs required and exemplar methods. A comprehensive checklist is presented in an annex for checking that an effective V&V plan has been developed. Another annex presents guidance on V&V techniques including the use of paper-based and observational techniques as well as mock-ups and full-scope simulations.

5.9 Human-centred design process for interactive systems (ISO 9241-210)

There are 4 linked human-centred design activities that should take place during the design of any interactive system. [Figure 2](#) illustrates the interdependence of these activities. [Figure 2](#) does not imply a strict linear process. Rather, it illustrates that each human-centred design activity uses outputs from other activities. If a specific human-centred design activity has not taken place, the next human-centred design activity will be based on assumptions, thus increasing the risk of errors.

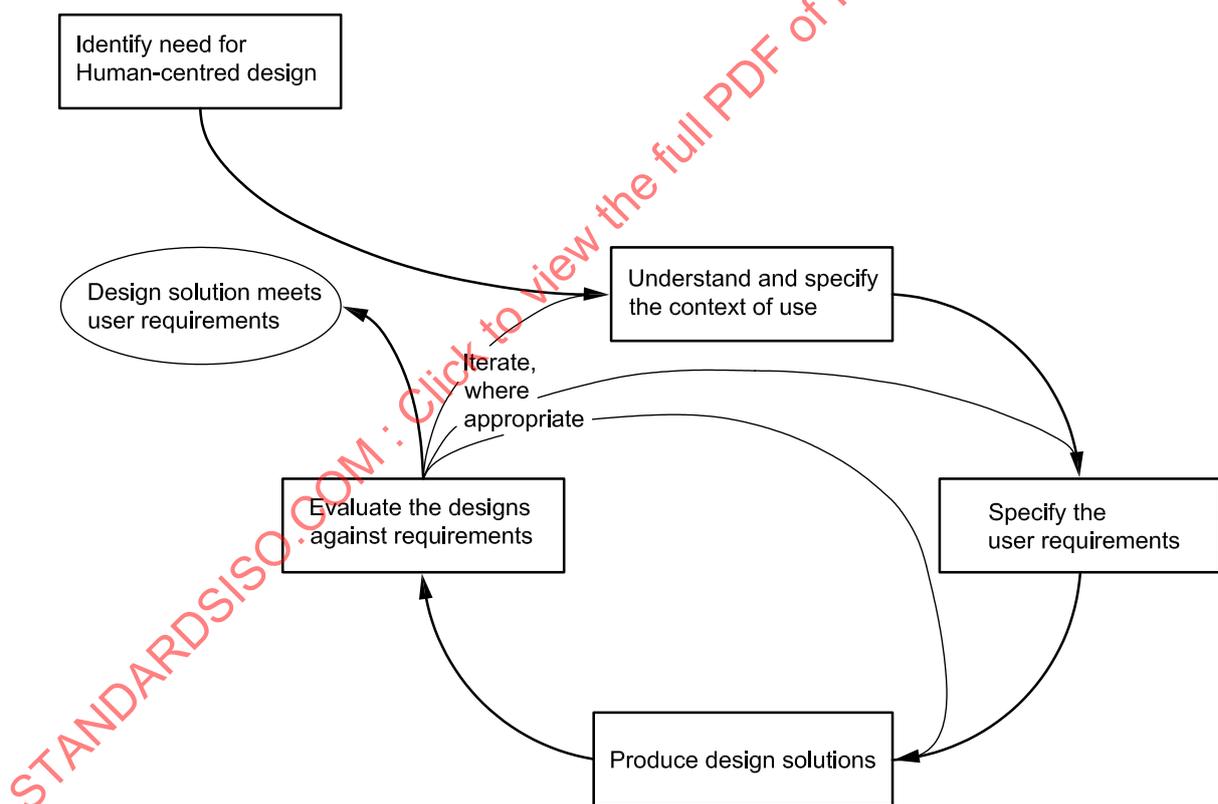


Figure 2 — Interdependence of human-centred design activities (ISO 9241-210:2019, Figure 1)

5.10 Ergonomic requirements for people with special needs

A number of ergonomic standards address the particular requirements for people with special needs concerning ICT accessibility (ISO 9241-20), software (ISO 9241-171) and hardware (ISO/IEC 29138).