

Information technology - Security techniques -
Information security controls for the energy utility
industry (ISO/IEC 27019:2017, Corrected version
2019-08)

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN ISO/IEC 27019:2020 sisaldab Euroopa standardi EN ISO/IEC 27019:2020 ingliskeelset teksti.	This Estonian standard EVS-EN ISO/IEC 27019:2020 consists of the English text of the European standard EN ISO/IEC 27019:2020.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 18.03.2020.	Date of Availability of the European standard is 18.03.2020.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 03.100.70

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:
Koduleht www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:

Homepage www.evs.ee; phone +372 605 5050; e-mail info@evs.ee

English version

Information technology - Security techniques - Information security controls for the energy utility industry (ISO/IEC 27019:2017, Corrected version 2019-08)

Technologies de l'information - Techniques de sécurité
- Mesures de sécurité de l'information pour l'industrie
des opérateurs de l'énergie (ISO/IEC 27019:2017,
Version corrigée 2019-08)

Informationstechnik - Sicherheitsverfahren -
Informationssicherheitsmaßnahmen für die
Energieversorgung (ISO/IEC 27019:2017, korrigierte
Fassung 2019-08)

This European Standard was approved by CEN on 2 March 2020.

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

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

CEN and CENELEC members are the national standards bodies and national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



**CEN-CENELEC Management Centre:
Rue de la Science 23, B-1040 Brussels**

European foreword

The text of ISO/IEC 27019:2017 has been prepared by Technical Committee ISO/IEC JTC 1 "Information technology" of the International Organization for Standardization (ISO) and has been taken over as EN ISO/IEC 27019:2020 by Technical Committee CEN/CLC/JTC 13 "Cybersecurity and Data Protection" the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2020, and conflicting national standards shall be withdrawn at the latest by September 2020.

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

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

Endorsement notice

The text of ISO/IEC 27019:2017 has been approved by CEN as EN ISO/IEC 27019:2020 without any modification.

Contents

Page

Foreword	vii
0	viii
Introduction	viii
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Structure of the document	4
4.1 General.....	4
4.2 Refinement of ISO/IEC 27001:2013 requirements.....	4
4.3 Energy utility industry specific guidance related to ISO/IEC 27002:2013.....	4
5 Information security policies	4
6 Organization of information security	4
6.1 Internal organization.....	4
6.1.1 Information security roles and responsibilities.....	4
6.1.2 Segregation of duties.....	5
6.1.3 Contact with authorities.....	5
6.1.4 Contact with special interest groups.....	5
6.1.5 Information security in project management.....	5
6.1.6 ENR – Identification of risks related to external parties.....	5
6.1.7 ENR – Addressing security when dealing with customers.....	6
6.2 Mobile devices and teleworking.....	6
6.2.1 Mobile device policy.....	6
6.2.2 Teleworking.....	7
7 Human resource security	7
7.1 Prior to employment.....	7
7.1.1 Screening.....	7
7.1.2 Terms and conditions of employment.....	8
7.2 During employment.....	8
7.2.1 Management responsibilities.....	8
7.2.2 Information security awareness, education and training.....	8
7.2.3 Disciplinary process.....	8
7.3 Termination and change of employment.....	8
8 Asset management	8
8.1 Responsibility for assets.....	8
8.1.1 Inventory of assets.....	8
8.1.2 Ownership of assets.....	9
8.1.3 Acceptable use of assets.....	9
8.1.4 Return of assets.....	9
8.2 Information classification.....	9
8.2.1 Classification of information.....	9
8.2.2 Labelling of information.....	10
8.2.3 Handling of assets.....	10
8.3 Media handling.....	10
9 Access control	10
9.1 Business requirements of access control.....	10
9.1.1 Access control policy.....	10
9.1.2 Access to networks and network services.....	10
9.2 User access management.....	11
9.2.1 User registration and de-registration.....	11
9.2.2 User access provisioning.....	11
9.2.3 Management of privileged access rights.....	11

9.2.4	Management of secret authentication information of users.....	11
9.2.5	Review of user access rights.....	11
9.2.6	Removal or adjustment of access rights.....	11
9.3	User responsibilities.....	11
9.3.1	Use of secret authentication information.....	11
9.4	System and application access control.....	12
9.4.1	Information access restriction.....	12
9.4.2	Secure log-on procedures.....	12
9.4.3	Password management system.....	12
9.4.4	Use of privileged utility programs.....	12
9.4.5	Access control to program source code.....	12
10	Cryptography.....	12
10.1	Cryptography controls.....	12
10.1.1	Policy on the use of cryptographic controls.....	12
10.1.2	Key management.....	12
11	Physical and environmental security.....	13
11.1	Secure areas.....	13
11.1.1	Physical security perimeter.....	13
11.1.2	Physical entry controls.....	13
11.1.3	Securing offices, rooms and facilities.....	13
11.1.4	Protecting against external and environmental threats.....	13
11.1.5	Working in secure areas.....	13
11.1.6	Delivery and loading areas.....	13
11.1.7	ENR – Securing control centres.....	13
11.1.8	ENR – Securing equipment rooms.....	14
11.1.9	ENR – Securing peripheral sites.....	15
11.2	Equipment.....	16
11.2.1	Equipment siting and protection.....	16
11.2.2	Supporting utilities.....	16
11.2.3	Cabling security.....	16
11.2.4	Equipment maintenance.....	16
11.2.5	Removal of assets.....	16
11.2.6	Security of equipment and assets off-premises.....	17
11.2.7	Secure disposal or re-use of equipment.....	17
11.2.8	Unattended user equipment.....	17
11.2.9	Clear desk and clear screen policy.....	17
11.3	ENR – Security in premises of external parties.....	17
11.3.1	ENR – Equipment sited on the premises of other energy utility organizations.....	17
11.3.2	ENR – Equipment sited on customer’s premises.....	18
11.3.3	ENR – Interconnected control and communication systems.....	18
12	Operations security.....	18
12.1	Operational procedures and responsibilities.....	18
12.1.1	Documented operating procedures.....	18
12.1.2	Change management.....	19
12.1.3	Capacity management.....	19
12.1.4	Separation of development, testing and operational environments.....	19
12.2	Protection from malware.....	19
12.2.1	Controls against malware.....	19
12.3	Back-up.....	20
12.4	Logging and monitoring.....	20
12.4.1	Event logging.....	20
12.4.2	Protection of log information.....	20
12.4.3	Administrator and operator logs.....	20
12.4.4	Clock synchronization.....	20
12.5	Control of operational software.....	20
12.5.1	Installation of software on operational systems.....	20
12.6	Technical vulnerability management.....	21

	12.6.1	Management of technical vulnerabilities.....	21
	12.6.2	Restrictions on software installation.....	21
	12.7	Information systems audit considerations.....	21
	12.8	ENR – Legacy systems.....	21
	12.8.1	ENR – Treatment of legacy systems.....	21
	12.9	ENR – Safety functions.....	22
	12.9.1	ENR – Integrity and availability of safety functions.....	22
13		Communications security.....	22
	13.1	Network security management.....	22
	13.1.1	Network controls.....	22
	13.1.2	Security of network services.....	22
	13.1.3	Segregation in networks.....	22
	13.1.4	ENR – Securing process control data communication.....	23
	13.1.5	ENR – Logical connection of external process control systems.....	23
	13.2	Information transfer.....	24
14		System acquisition, development and maintenance.....	24
	14.1	Security requirements of information systems.....	24
	14.1.1	Information security requirements analysis and specification.....	24
	14.1.2	Securing application services on public networks.....	24
	14.1.3	Protecting application services transactions.....	24
	14.2	Security in development and support processes.....	24
	14.2.1	Secure development policy.....	24
	14.2.2	System change control procedures.....	24
	14.2.3	Technical review of applications after operating platform changes.....	24
	14.2.4	Restrictions on changes to software packages.....	24
	14.2.5	Secure system engineering principles.....	24
	14.2.6	Secure development environment.....	24
	14.2.7	Outsourced development.....	24
	14.2.8	System security testing.....	25
	14.2.9	System acceptance testing.....	25
	14.2.10	ENR – Least functionality.....	25
	14.3	Test data.....	25
15		Supplier relationships.....	25
	15.1	Information security in supplier relationships.....	25
	15.1.1	Information security policy for supplier relationships.....	25
	15.1.2	Addressing security within supplier agreements.....	25
	15.1.3	Information and communication technology supply chain.....	25
	15.2	Supplier service delivery management.....	26
16		Information security incident management.....	26
	16.1	Management of information security incidents and improvements.....	26
	16.1.1	Responsibilities and procedures.....	26
	16.1.2	Reporting information security events.....	26
	16.1.3	Reporting information security weaknesses.....	26
	16.1.4	Assessment of and decision on information security events.....	26
	16.1.5	Response to information security incidents.....	26
	16.1.6	Learning from information security incidents.....	26
	16.1.7	Collection of evidence.....	26
17		Information security aspects of business continuity management.....	26
	17.1	Information security continuity.....	26
	17.2	Redundancies.....	26
	17.2.1	Availability of information processing facilities.....	26
	17.2.2	ENR – Emergency communication.....	27
18		Compliance.....	28
	18.1	Compliance with legal and contractual requirements.....	28
	18.1.1	Identification of applicable legislation and contractual requirements.....	28

18.1.2	Intellectual property rights	28
18.1.3	Protection of records.....	28
18.1.4	Privacy and protection of personally identifiable information	28
18.1.5	Regulation of cryptographic controls	28
18.2	Information security reviews.....	28
18.2.1	Independent review of information security.....	28
18.2.2	Compliance with security policies and standards	28
18.2.3	Technical compliance review	29
Annex A (normative)	Energy utility industry specific reference control objectives and controls	30
Bibliography	33

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

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 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC 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 on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 27, *IT Security techniques*.

This first edition cancels and replaces the first edition of ISO/IEC TR 27019:2013, which has been technically revised.

The main changes compared to the previous edition are as follows:

- the scope has changed to include the energy oil sector;
- this document has been changed from a Technical Report to an International Standard;
- the previous edition was aligned with ISO/IEC 27002:2005. The new structure has been aligned with ISO/IEC 27002:2013;
- the title has been changed.
- where appropriate the technical content has been revised and updated to reflect current technological developments in the energy sector.

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.

This corrected version of ISO 27019:2017 corrects "should" into "shall" in [Table A.1](#), 11.1.7

0 Introduction

0.1 Background and context

This document provides guiding principles based on ISO/IEC 27002:2013 “Code of practice for information security controls” for information security management applied to process control systems as used in the energy utility industry. The aim of this document is to extend the contents of ISO/IEC 27002:2013 to the domain of process control systems and automation technology, thus allowing the energy utility industry to implement a standardized and specific information security management system (ISMS) that is in accordance with ISO/IEC 27001:2013 and extends from the business to the process control level.

In addition to the security objectives and measures that are set forth in ISO/IEC 27002:2013, the process control systems used by energy utilities and energy suppliers are subject to further special requirements. In comparison with conventional ICT environments (e.g. office IT, energy trading systems), there are fundamental and significant differences with respect to the development, operation, repair, maintenance and operating environment of process control systems. Furthermore, the process technology referred to in this document can represent integral components of critical infrastructures. This means they are therefore essential for the secure and reliable operation of such infrastructures. These distinctions and characteristics need to be taken into due consideration by the management processes for process control systems and justify separate consideration within the ISO/IEC 27000 family of standards.

From the viewpoint of design and function, process control systems used by the energy utility sector are in fact information processing systems. They collect process data and monitor the status of the physical processes using sensors. The systems then process this data and generate control outputs that regulate actions using actuators. The control and regulation is automatic but manual intervention by operating personnel is also possible. Information and information processing systems are therefore an essential part of operational processes within energy utilities. This means that it is important that appropriate protection measures be applied in the same manner as for other organizational units.

Software and hardware (e.g. programmable logic) components based on standard ICT technology are increasingly utilized in process control environments and are also covered in this document. Furthermore, process control systems in the energy utility sector are increasingly interconnected to form complex systems. Risks arising from this trend need to be considered in a risk assessment.

The information and information processing systems in process control environments are also exposed to an increasing number of threats and vulnerabilities. It is therefore essential that, in the process control domain of the energy utility industry, adequate information security is achieved through the implementation and continuous improvement of an ISMS in accordance with ISO/IEC 27001:2013.

Effective information security in the process control domain of the energy utility sector can be achieved by establishing, implementing, monitoring, reviewing and, if necessary, improving the applicable measures set forth in this document, in order to attain the specific security and business objectives of the organization. It is important to give particular consideration here to the special role of the energy utilities in society and to the economic necessity of a secure and reliable energy supply. Ultimately, the overall success of the cybersecurity of energy industries is based on collaborative efforts by all stakeholders (vendors, suppliers, customers, etc.).

0.2 Security considerations for process control systems used by the energy utilities

The requirement for a general and overall information security framework for the process control domain of the energy utility industry is based on several basic requirements:

- a) Customers expect a secure and reliable energy supply.
- b) Legal and regulatory requirements demand safe, reliable and secure operation of energy supply systems.

- c) Energy providers require information security in order to safeguard their business interests, meet customers' needs and comply with the legal regulations.

0.3 Information security requirements

It is essential that energy utility organizations identify their security requirements. There are three main sources of security requirements:

- a) The results of an organization's risk assessment, taking into account the organization's general business strategies and objectives. Through a risk assessment, risk sources and events are identified; potential consequences and likelihood of the occurrence of the risks are assessed.
- b) The requirements which result from legislation and bye-laws, regulations and contracts which have to be fulfilled by an organization, and sociocultural requirements. Particular examples include safeguarding a reliable, effective and secure energy supply as well as the reliable fulfilment of the requirements of a deregulated energy market, in particular the reliable and secure transfer of data with external parties.
- c) The specific principles, objectives and business requirements placed on information processing, which were developed by the organization for supporting its business operations.

NOTE It is important that the energy utility organization ensure that security requirements of process control systems are analysed and adequately covered in policies for information security. The analysis of the information security requirements and objectives include the consideration of all relevant criteria for a secure energy supply and delivery, e.g.

- Impairment of the security of energy supply;
- Restriction of energy flow;
- Affected share of population;
- Danger of physical injury;
- Effects on other critical infrastructures;
- Effects on information privacy;
- Financial impacts.

The necessary security measures or controls are determined by the methodical assessment of security risks. It is necessary that the cost of controls be balanced against the economic losses that can be incurred due to security issues. The results of the risk assessment facilitate:

- the definition of adequate management actions and priorities for the management of information security risks; and
- the implementation of the controls chosen to protect against these risks.

The risk assessment should be repeated periodically in order to take all changes into account, which can affect the results assessed.

Requirements for the risk assessment and control selection are given in ISO/IEC 27001:2013.

0.4 Selecting controls

Once the security objectives and risks have been identified and decisions taken on how to deal with the risks, appropriate controls are then selected and implemented in order to ensure that the risks are reduced to an acceptable level.

In addition to the controls provided by a comprehensive information security management system, this document provides additional assistance and sector-specific measures for the process control systems used by the energy utility sector, taking into consideration the special requirements in these environments. If necessary, further measures can be developed to fulfil particular requirements. The

selection of security measures depends upon the decisions taken by the organization on the basis of its own risk acceptance criteria, the options for dealing with the risk and the general risk management approach of the organization. The selection of measures should also take relevant national and international law, legal ordinances and regulations into consideration.

0.5 Audience

This document is targeted at the persons responsible for the operation of process control systems used by energy utilities, information security managers, vendors, system integrators and auditors. For this target group, it details the fundamental measures in accordance with the objectives of ISO/IEC 27002:2013 and defines specific measures for process control systems of the energy utility industry, their supporting systems and the associated infrastructure.

Information technology — Security techniques — Information security controls for the energy utility industry

1 Scope

This document provides guidance based on ISO/IEC 27002:2013 applied to process control systems used by the energy utility industry for controlling and monitoring the production or generation, transmission, storage and distribution of electric power, gas, oil and heat, and for the control of associated supporting processes. This includes in particular the following:

- central and distributed process control, monitoring and automation technology as well as information systems used for their operation, such as programming and parameterization devices;
- digital controllers and automation components such as control and field devices or Programmable Logic Controllers (PLCs), including digital sensor and actuator elements;
- all further supporting information systems used in the process control domain, e.g. for supplementary data visualization tasks and for controlling, monitoring, data archiving, historian logging, reporting and documentation purposes;
- communication technology used in the process control domain, e.g. networks, telemetry, telecontrol applications and remote control technology;
- Advanced Metering Infrastructure (AMI) components, e.g. smart meters;
- measurement devices, e.g. for emission values;
- digital protection and safety systems, e.g. protection relays, safety PLCs, emergency governor mechanisms;
- energy management systems, e.g. of Distributed Energy Resources (DER), electric charging infrastructures, in private households, residential buildings or industrial customer installations;
- distributed components of smart grid environments, e.g. in energy grids, in private households, residential buildings or industrial customer installations;
- all software, firmware and applications installed on above-mentioned systems, e.g. DMS (Distribution Management System) applications or OMS (Outage Management System);
- any premises housing the above-mentioned equipment and systems;
- remote maintenance systems for above-mentioned systems.

This document does not apply to the process control domain of nuclear facilities. This domain is covered by IEC 62645.

This document also includes a requirement to adapt the risk assessment and treatment processes described in ISO/IEC 27001:2013 to the energy utility industry-sector-specific guidance provided in this document.

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/IEC 27000, *Information technology — Security techniques — Information security management systems — Overview and vocabulary*

ISO/IEC 27001:2013, *Information technology — Security techniques — Information security management systems — Requirements*

ISO/IEC 27002:2013, *Information technology — Security techniques — Code of practice for information security controls*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 27000 and the following apply.

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/>

3.1

blackout

widespread electrical power outage

3.2

Computer Security Incident Response Team

CSIRT

team of security experts to support the handling of information security incidents

3.3

critical asset

asset which can have a direct impact on production or generation, transmission, storage and distribution of electric power, gas, oil and heat

3.4

critical infrastructure

set of organizations and facilities that are essential for the functioning of society and the economy as a whole

Note 1 to entry: A failure or malfunction of such organizations and facilities can result in sustained supply shortfalls, make a significant impact on public security and have other wide ranging impacts.

3.5

debugging

action of analysing malfunctions in computer systems

3.6

distribution system

distribution grid for the transport of electrical energy using a high, medium or low voltage grid, or a local or regional distribution network for the transport of gas, oil or heat

3.7

energy management system

EMS

equipment/infrastructure used to monitor, measure and control the energy consumption in private households, residential buildings or industrial customer installations

Note 1 to entry: The term EMS is also commonly used to refer to a set of applications used by operators of transmission power grids to monitor, control, and optimize the performance of the generation and/or transmission system.