



IEC 62443-4-1

Edition 1.0 2018-01

INTERNATIONAL STANDARD



**Security for industrial automation and control systems –
Part 4-1: Secure product development lifecycle requirements**

IECNORM.COM : Click to view the full PDF of IEC 62443-4-1 ed 1.0:2018

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 25.040.40; 35.030

ISBN 978-2-8322-5239-0

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD	6
INTRODUCTION	8
1 Scope	11
2 Normative references	11
3 Terms, definitions, abbreviated terms, acronyms and conventions	11
3.1 Terms and definitions	11
3.2 Abbreviated terms and acronyms	16
3.3 Conventions	17
4 General principles	17
4.1 Concepts	17
4.2 Maturity model	19
5 Practice 1 – Security management	20
5.1 Purpose	20
5.2 SM-1: Development process	21
5.2.1 Requirement	21
5.3 Rationale and supplemental guidance	21
5.4 SM-2: Identification of responsibilities	21
5.4.1 Requirement	21
5.4.2 Rationale and supplemental guidance	21
5.5 SM-3: Identification of applicability	21
5.5.1 Requirement	21
5.5.2 Rationale and supplemental guidance	22
5.6 SM-4: Security expertise	22
5.6.1 Requirement	22
5.6.2 Rationale and supplemental guidance	22
5.7 SM-5: Process scoping	22
5.7.1 Requirement	22
5.7.2 Rationale and supplemental guidance	23
5.8 SM-6: File integrity	23
5.8.1 Requirement	23
5.8.2 Rationale and supplemental guidance	23
5.9 SM-7: Development environment security	23
5.9.1 Requirement	23
5.9.2 Rationale and supplemental guidance	23
5.10 SM-8: Controls for private keys	23
5.10.1 Requirement	23
5.10.2 Rationale and supplemental guidance	24
5.11 SM-9: Security requirements for externally provided components	24
5.11.1 Requirement	24
5.11.2 Rationale and supplemental guidance	24
5.12 SM-10: Custom developed components from third-party suppliers	24
5.12.1 Requirement	24
5.12.2 Rationale and supplemental guidance	25
5.13 SM-11: Assessing and addressing security-related issues	25
5.13.1 Requirement	25
5.13.2 Rationale and supplemental guidance	25

5.14	SM-12: Process verification	25
5.14.1	Requirement.....	25
5.14.2	Rationale and supplemental guidance.....	25
5.15	SM-13: Continuous improvement	25
5.15.1	Requirement.....	25
5.15.2	Rationale and supplemental guidance.....	26
6	Practice 2 – Specification of security requirements	26
6.1	Purpose	26
6.2	SR-1: Product security context.....	27
6.2.1	Requirement.....	27
6.2.2	Rationale and supplemental guidance.....	27
6.3	SR-2: Threat model.....	27
6.3.1	Requirement.....	27
6.3.2	Rationale and supplemental guidance.....	28
6.4	SR-3: Product security requirements.....	28
6.4.1	Requirement.....	28
6.4.2	Rationale and supplemental guidance.....	28
6.5	SR-4: Product security requirements content	29
6.5.1	Requirement.....	29
6.5.2	Rationale and supplemental guidance.....	29
6.6	SR-5: Security requirements review	29
6.6.1	Requirement.....	29
6.6.2	Rationale and supplemental guidance.....	29
7	Practice 3 – Secure by design	30
7.1	Purpose	30
7.2	SD-1: Secure design principles	30
7.2.1	Requirement.....	30
7.2.2	Rationale and supplemental guidance.....	30
7.3	SD-2: Defense in depth design.....	31
7.3.1	Requirement.....	31
7.3.2	Rationale and supplemental guidance.....	32
7.4	SD-3: Security design review	32
7.4.1	Requirement.....	32
7.4.2	Rationale and supplemental guidance.....	32
7.5	SD-4: Secure design best practices	32
7.5.1	Requirement.....	32
7.5.2	Rationale and supplemental guidance.....	33
8	Practice 4 – Secure implementation	33
8.1	Purpose	33
8.2	Applicability	33
8.3	SI-1: Security implementation review	33
8.3.1	Requirement.....	33
8.3.2	Rationale and supplemental guidance.....	34
8.4	SI-2: Secure coding standards	34
8.4.1	Requirement.....	34
8.4.2	Rationale and supplemental guidance.....	34
9	Practice 5 – Security verification and validation testing.....	34
9.1	Purpose	34

9.2	SVV-1: Security requirements testing	35
9.2.1	Requirement	35
9.2.2	Rationale and supplemental guidance	35
9.3	SVV-2: Threat mitigation testing	35
9.3.1	Requirement	35
9.3.2	Rationale and supplemental guidance	35
9.4	SVV-3: Vulnerability testing	36
9.4.1	Requirement	36
9.4.2	Rationale and supplemental guidance	36
9.5	SVV-4: Penetration testing	36
9.5.1	Requirement	36
9.5.2	Rationale and supplemental guidance	36
9.6	SVV-5: Independence of testers	37
9.6.1	Requirement	37
9.6.2	Rationale and supplemental guidance	37
10	Practice 6 – Management of security-related issues	38
10.1	Purpose	38
10.2	DM-1: Receiving notifications of security-related issues	38
10.2.1	Requirement	38
10.2.2	Rationale and supplemental guidance	38
10.3	DM-2: Reviewing security-related issues	38
10.3.1	Requirement	38
10.3.2	Rationale and supplemental guidance	39
10.4	DM-3: Assessing security-related issues	39
10.4.1	Requirement	39
10.4.2	Rationale and supplemental guidance	39
10.5	DM-4: Addressing security-related issues	40
10.5.1	Requirement	40
10.5.2	Rationale and supplemental guidance	40
10.6	DM-5: Disclosing security-related issues	41
10.6.1	Requirement	41
10.6.2	Rationale and supplemental guidance	41
10.7	DM-6: Periodic review of security defect management practice	42
10.7.1	Requirement	42
10.7.2	Rationale and supplemental guidance	42
11	Practice 7 – Security update management	42
11.1	Purpose	42
11.2	SUM-1: Security update qualification	42
11.2.1	Requirement	42
11.2.2	Rationale and supplemental guidance	42
11.3	SUM-2: Security update documentation	42
11.3.1	Requirement	42
11.3.2	Rationale and supplemental guidance	43
11.4	SUM-3: Dependent component or operating system security update documentation	43
11.4.1	Requirement	43
11.4.2	Rationale and supplemental guidance	43
11.5	SUM-4: Security update delivery	43
11.5.1	Requirement	43

11.5.2 Rationale and supplemental guidance.....	43
11.6 SUM-5: Timely delivery of security patches.....	44
11.6.1 Requirement.....	44
11.6.2 Rationale and supplemental guidance.....	44
12 Practice 8 – Security guidelines.....	44
12.1 Purpose	44
12.2 SG-1: Product defense in depth	44
12.2.1 Requirement.....	44
12.2.2 Rationale and supplemental guidance.....	45
12.3 SG-2: Defense in depth measures expected in the environment.....	45
12.3.1 Requirement.....	45
12.3.2 Rationale and supplemental guidance.....	45
12.4 SG-3: Security hardening guidelines	45
12.4.1 Requirement.....	45
12.4.2 Rationale and supplemental guidance.....	46
12.5 SG-4: Secure disposal guidelines	46
12.5.1 Requirement.....	46
12.5.2 Rationale and supplemental guidance.....	46
12.6 SG-5: Secure operation guidelines.....	46
12.6.1 Requirement.....	46
12.6.2 Rationale and supplemental guidance.....	47
12.7 SG-6: Account management guidelines.....	47
12.7.1 Requirement.....	47
12.7.2 Rationale and supplemental guidance.....	47
12.8 SG-7: Documentation review.....	47
12.8.1 Requirement.....	47
12.8.2 Rationale and supplemental guidance.....	47
Annex A (informative) Possible metrics	48
Annex B (informative) Table of requirements	50
Bibliography.....	52
 Figure 1 – Parts of the IEC 62443 series.....	9
Figure 2 – Example scope of product life-cycle	10
Figure 3 – Defence in depth strategy is a key philosophy of the secure product life-cycle	18
 Table 1 – Maturity levels	20
Table 2 – Example SDL continuous improvement activities	26
Table 3 – Required level of independence of testers from developers	37
Table B.1 – Summary of all requirements.....	50

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SECURITY FOR INDUSTRIAL AUTOMATION
AND CONTROL SYSTEMS –****Part 4-1: Secure product development lifecycle requirements****FOREWORD**

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.

3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.

4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.

5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.

6) All users should ensure that they have the latest edition of this publication.

7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.

8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

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

International Standard IEC 62443-4-1 has been prepared by IEC technical committee 65: Industrial-process measurement, control and automation.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
65/685/FDIS	65/688/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62443 series, published under the general title *Security for industrial automation and control systems*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

IECNORM.COM : Click to view the full PDF of IEC 62443-4-1 ed 1.0:2018

INTRODUCTION

This document is part of a series of standards that addresses the issue of security for industrial automation and control systems (IACS). This document describes product development life-cycle requirements related to cyber security for products intended for use in the industrial automation and control systems environment and provides guidance on how to meet the requirements described for each element.

This document has been developed in large part from the Secure Development Life-cycle Assessment (SDLA) Certification Requirements [26]¹ from the ISA Security Compliance Institute (ISCI). Note that the SDLA procedure was based on the following sources:

- ISO/IEC 15408-3 (Common Criteria) [18];
- Open Web Application Security Project (OWASP) Comprehensive, Lightweight Application Security Process (CLASP) [36];
- The Security Development Life-cycle by Michael Howard and Steve Lipner [43];
- IEC 61508 Functional safety of electrical/electronic/ programmable electronic safety-related systems [24], and
- RCTA DO-178B Software Considerations in Airborne Systems and Equipment Certification [28].

Therefore, all these sources can be considered contributing sources to this document.

This document is the part of the IEC 62443 series that contains security requirements for developers of any automation and control products where security is a concern.

Figure 1 illustrates the relationship of the different parts of IEC 62443 that were in existence or planned as of the date of circulation of this document. Those that are normatively referenced are included in the list of normative references in Clause 2, and those that are referenced for informational purposes or that are in development are listed in the Bibliography.

¹ Figures in square brackets refer to the bibliography.