

---

---

**Security and resilience — Authenticity,  
integrity and trust for products and  
documents — Validation procedures  
for the application of artefact metrics**

*Sécurité et résilience — Authenticité, intégrité et confiance pour  
les produits et les documents — Procédures de validation pour  
l'application des métriques d'artéfact*

iTeh STANDARD PREVIEW  
(standards.iteh.ai)

ISO 22387:2022

<https://standards.iteh.ai/catalog/standards/sist/b43908e7-7579-4a7b-98e6-4bb3d1f1793b/iso-22387-2022>



iTeh STANDARD PREVIEW  
(standards.iteh.ai)

ISO 22387:2022

<https://standards.iteh.ai/catalog/standards/sist/b43908e7-7579-4a7b-98e6-4bb3d1f1793b/iso-22387-2022>



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2022

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

Published in Switzerland

# Contents

	Page
Foreword.....	v
Introduction.....	vi
<b>1 Scope.....</b>	<b>1</b>
<b>2 Normative references.....</b>	<b>1</b>
<b>3 Terms and definitions.....</b>	<b>1</b>
<b>4 Conformity.....</b>	<b>5</b>
<b>5 Overview of elements of artefact metric systems.....</b>	<b>5</b>
5.1 Conceptual overview of an artefact metric system.....	5
5.2 Acquisition.....	7
5.3 Enrolment.....	7
5.4 Comparison decision function.....	7
5.5 Artefact metric verification.....	8
5.6 Artefact metric identification.....	8
<b>6 Requirements for planning an evaluation.....</b>	<b>9</b>
6.1 General.....	9
6.2 Appointment and responsibilities of the deployment team.....	9
6.3 Test specification.....	9
6.4 Definition of required functionality.....	10
6.5 Selection of appropriate test artefacts.....	11
6.6 Definition of acquisition conditions.....	11
6.7 Appointment of testers.....	12
<b>7 Requirements for testing, data collection, analysis and reporting.....</b>	<b>12</b>
7.1 General.....	12
7.2 Acquisition and enrolment testing.....	13
7.3 Comparison decision performance testing.....	13
7.3.1 General.....	13
7.3.2 False non-match rate.....	14
7.3.3 False match rate.....	14
7.3.4 Comparison decision recording and reporting.....	14
7.4 Verification testing.....	15
7.4.1 General.....	15
7.4.2 False reject rate.....	15
7.4.3 False accept rate.....	15
7.4.4 Verification recording and reporting.....	16
7.5 Identification testing.....	16
7.5.1 General.....	16
7.5.2 False-negative identification rate.....	17
7.5.3 False-positive identification rate.....	17
7.5.4 Identification recording and reporting.....	17
7.6 Throughput rate testing.....	18
<b>8 Recommendations for phased deployment of artefact metrics.....</b>	<b>18</b>
8.1 Types of performance evaluation.....	18
8.1.1 General.....	18
8.1.2 Acquisition feasibility and comparison decision evaluation.....	19
8.1.3 Laboratory evaluation.....	19
8.1.4 Operational evaluation.....	19
8.2 Guidelines for phased introduction.....	19
8.2.1 General.....	19
8.2.2 Creating the test specification.....	20
8.2.3 Phase 1: Validation of presence of capturable characteristics.....	20
8.2.4 Phase 2: Assessment of comparison decision performance.....	20

8.2.5	Phase 3: Consideration of influences of data acquisition conditions.....	21
8.2.6	Phase 4: Ensuring reliability in intended operation environment.....	21
<b>Annex A</b>	<b>(informative) Artefact metric application.....</b>	<b>22</b>
<b>Annex B</b>	<b>(informative) Application of artefact metrics for self-verification.....</b>	<b>25</b>
<b>Annex C</b>	<b>(informative) Example of data capture conditions and subject artefact conditions.....</b>	<b>27</b>
<b>Bibliography</b>	<b>.....</b>	<b>28</b>

iTeh STANDARD PREVIEW  
(standards.iteh.ai)

ISO 22387:2022

<https://standards.iteh.ai/catalog/standards/sist/b43908e7-7579-4a7b-98e6-4bb3d1f1793b/iso-22387-2022>

## 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](http://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](http://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](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 292, *Security and resilience*.

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](http://www.iso.org/members.html).

## Introduction

### 0.1 Artefact metrics

All manufactured objects (artefacts) have variation when studied in detail. Even where artefacts are manufactured using the same material under the same manufacturing conditions during the same period, artefacts generally have some distinguishing characteristic. For example, paper sheets from the same lot made at the same time with the same material and by the same manufacturing process seem to be the same by the human eye. However, when comparing magnified areas (on the same or different sheets), the paper fibres are quite different from each other and no two areas are identical. This is similar to human fingerprints or other biometric attributes.

In some cases, manufacturing techniques and processes can be designed or engineered to impart or cause to emerge distinguishing characteristics artificially to each object.

Using such distinguishing characteristics, individual components can be recognized by procedures similar to those used for biometrics.

A database is often used to support the use of artefact metrics. For artefacts that are to be recognized in this way, unique measurements of distinguishing characteristics for each artefact are acquired and enrolled in a database. When object recognition is performed, the unique measurements of distinguishing characteristics of the target artefact are acquired and compared with entries in the database. Details of this process and its application are explained further in this document.

While many artefact metric systems make use of a database, this is not always necessary and for some applications the measurements of artefacts can be encoded and attached to or associated with the artefact. There are some important differences in this case and a description of such a system is given in [Annex B](#).

This document describes two types of recognition: artefact metric identification and artefact metric verification.

For artefact metric identification, measurements of the single artefact to be identified are compared with measurements of artefacts previously enrolled in a database (one to many) and a candidate list usually comprising one or more identifiers of the closest matching artefact(s) is returned. In this way, artefact metric identification allows a part or a product to be identified. Where information such as manufacturing conditions is associated with the reference, this data can be used to recall this and other artefacts manufactured under the same conditions. Identification also facilitates other functions such as track and trace and authentication.

For artefact metric verification, measurements of artefacts are enrolled and associated with an identifier. This identifier, e.g. a unique number in the form of a barcode, is directly associated with the artefact. The artefact is then subsequently measured, and these measurements are compared with the database entry associated with the identifier in order to verify the artefact's identity (one to one). By performing artefact metric verification, the target artefact is recognized as being the same as that recorded in the database or as an imposter.

**NOTE** In cases where no database is used, there is no enrolment process and the measurements are encoded directly on the artefact. See [Annex B](#) for details.

### 0.2 Traceability throughout supply chains

With the increase in safety awareness, many manufacturers are required to ensure product quality in their supply chain. In cases where a defect is found in a part included in a product, the manufacturer must locate and recall all parts with the same defect. In order to do so, it is necessary for manufacturers to locate the factory, in which batch, by whom and under what manufacturing conditions defective parts were made.

Manufacturers are required to record sufficient information at the time of manufacturing for all materials, parts, and products and to ensure that processes are in place that will allow the product to be

located subsequent to its manufacture to enable their recall. Similar product management is required throughout the supply chain to ensure product integrity.

Damage caused by counterfeit products is an increasingly serious concern for many interested parties in supply chains. There have been many cases where counterfeit products have been mixed into the commercial flow of genuine products, and in some cases, the retailer can unknowingly receive and re-sell these counterfeit products to customers. In order to protect their reputation and to keep customer confidence, retailers have a strong motivation to eliminate these counterfeit products.

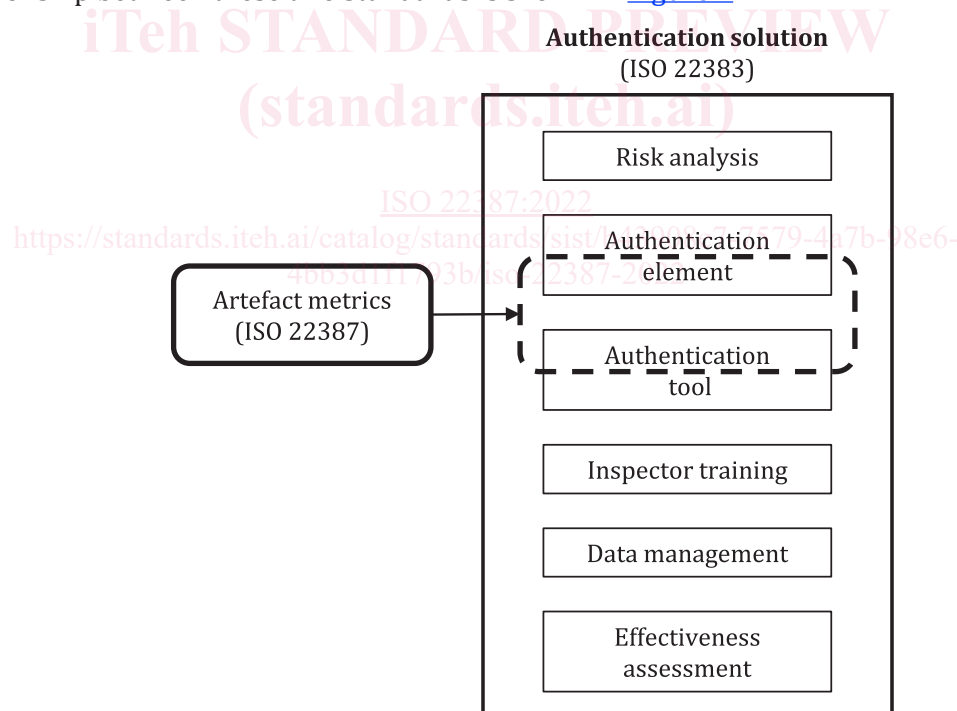
Quality assurance and anti-counterfeiting are therefore of major concern in supply chains and some form of object recognition technology for products or parts is required to address these concerns. Artefact metrics provide this object recognition capability in a way that is very difficult (impossible in most case) to clone.

Examples of the use of artefact metric systems are provided and explained in [Annex A](#).

### 0.3 The use of artefact metrics for authentication

This document does not specify all requirements needed to provide an authentication solution but does provide some important measures of an artefact metric system's performance in the recognition of artefacts. When used in conjunction with other measures, artefact metrics can be used as the basis for effective authentication solutions.

Where authentication is needed, this document is intended to be used in conjunction with ISO 22383<sup>[2]</sup>. The relationship between these two standards is shown in [Figure 1](#).



**Figure 1 — Use of artefact metrics as part of an authentication solution**

As [Figure 1](#) shows, since artefact metrics can use measurements of distinguishing characteristics that are unique to each object, they can provide a very effective basis for authentication. The performance measures described in this document provide a way to measure the effectiveness of the artefact metric system based on the technology evaluated.

## 0.4 Overview of this document

This document is primarily designed to help manufacturing organizations prepare for the introduction of artefact metric systems.

- [Clause 5](#) provides an overview of typical artefact metric systems and describes their main functions.
- [Clause 6](#) provides requirements and guidance on how to conduct a set of tests so that they can provide reliable performance metrics.
- [Clause 7](#) describes the set of tests and reporting requirements.
- [Clause 8](#) describes the set of steps required for the introduction of artefact metric systems to an organization.

## 0.5 Additional considerations

As with the deployment and use of any system, a risk assessment should be carried out before deployment and risks should continue to be assessed throughout the system's life cycle. In addition to general risks that apply to the operation of any system, risks related to the system integrity need to be considered.

Similarly, throughout its life, the system's performance and reliability should be reviewed and when possible improved.

When artefact metrics are used as a basis for authentication, the artefact metric system's performance provided in this document along with other aspects shown in [Figure 1](#) should be considered. ISO 22383 provides guidelines for these aspects and these should be applied for the deployment and use of artefact metric systems.

(standards.iteh.ai)

[ISO 22387:2022](#)

<https://standards.iteh.ai/catalog/standards/sist/b43908e7-7579-4a7b-98e6-4bb3d1f1793b/iso-22387-2022>



# Security and resilience — Authenticity, integrity and trust for products and documents — Validation procedures for the application of artefact metrics

## 1 Scope

This document specifies a process to qualify the suitability, reliability and effectiveness of artefact metrics as well as artefact metric recognition principles for identification and verification.

The artefact metric recognition described in this document can be used to identify or verify artefacts using one or more measurements of their characteristics, each of which is unique to an individual artefact and is supposedly impossible to reproduce.

This document is applicable to artefact metrics throughout the life cycle processes of products.

Measurement of the resilience of the system where the distinguishing characteristic is degraded is out of the scope of this document.

This document is applicable to performance testing of artefact metric systems and algorithms through analysis of the comparison scores and decisions output by the system, without requiring detailed knowledge of the system's algorithms or of the underlying distribution of characteristics in the objects of interest.

This document excludes performance testing where deliberate attacks undermine the artefact metric system.

## 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 22300, *Security and resilience — Vocabulary*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 22300 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

#### **artefact**

object made directly or indirectly by a person

Note 1 to entry: An object can be a product, a document or a component part thereof suitable for measurement of their characteristics.

Note 2 to entry: In some cases, artefacts can be naturally occurring objects.

### 3.2 artefact metric

measurement of a characteristic of an *artefact* (3.1)

Note 1 to entry: The measurement can be based either on a natural (intrinsic) characteristic of the object itself or on a characteristic expressed during manufacturing.

Note 2 to entry: The use of the term “artefact metrics” is proposed as being conceptually similar to “biometrics”, for which uniqueness in biological entities is utilized. Unlike biometrics, artefact metrics utilizes uniqueness in physical objects/things, physical processes or their combinations. In some cases, this document uses the term “artefact metrics” in this way but the meaning is generally clear from the context<sup>[5]</sup>.

### 3.3 distinguishing characteristic

characteristic shared by a set of *artefacts* (3.1) from which measurements can be made that are unique for each artefact

### 3.4 artefact metric signal

data that represents the measured characteristic and which are functionally related to the *artefact* (3.1)

Note 1 to entry: A signal can include an image, electrical signal, measurement of physical characteristic, structural geometry, etc.

Note 2 to entry: Unique measurements are extracted from this signal and used as *probes* (3.7) or *references* (3.8).

### 3.5 artefact metric recognition

automated recognition of single *artefacts* (3.1) based on their *distinguishing characteristics* (3.3)

Note 1 to entry: Artefact metric recognition describes both *artefact metric verification* (3.16) and *artefact metric identification* (3.19).

[SOURCE: ISO/IEC 2382-37:2022, 37.01.03, modified — “artefact metric” replaced “biometric” in the term. “single artefacts” replaced “individuals” and “distinguishing” replaced “biological and behavioural” in the definition. Notes to entry replaced by a new Note 1 to entry.]

### 3.6 artefact metric system

system for *artefact metric recognition* (3.5) of objects based on *distinguishing characteristics* (3.3)

[SOURCE: ISO/IEC 2382-37:2022, 37.02.03, modified — “artefact metric” replaced “biometric” in the term. “artefact metric recognition” replaced “the purpose of the biometric recognition”, “objects” replaced “individuals”, and “distinguishing” replaced “biological and behavioural” in the definition. Note 1 to entry deleted.]

### 3.7 probe

artefact metric data set input to an algorithm for comparison to *reference(s)* (3.8)

Note 1 to entry: Measurement (pre-processed sensor data) of a *distinguishing characteristic* (3.3) of a single artefact is the artefact metric data used as a probe in this document.

[SOURCE: ISO/IEC 2382-37:2022, 37.03.14, modified — “biometric” deleted from the term. “artefact metric data” replaced “biometric sample or biometric feature”, “a biometric” deleted. Notes to entry replaced by a new Note 1 to entry.]

### 3.8 reference

enrolled artefact metric data used as the object of comparison

Note 1 to entry: Measurement (pre-processed sensor data) of a *distinguishing characteristic* (3.3) of a single artefact is the artefact metric data used as a reference in this document.

[SOURCE: ISO/IEC 2382-37:2022, 37.03.16, modified — “biometric” deleted from the term. “enrolled artefact metric data” replaced “one or more stored biometric samples, biometric templates or biometric models attributed to a biometric data subject and”, “biometric” deleted. Example deleted. Notes to entry replaced by a new Note 1 to entry.]

### 3.9

#### comparison decision

determination of whether the *probe(s)* (3.7) and *reference(s)* (3.8) are from the same *artefact* (3.1), based on a comparison score(s), decision policy(ies) including a threshold, and possibly other inputs

[SOURCE: ISO/IEC 2382-37:2022, 37.03.26, modified — “biometric” deleted before “probe(s)” and “reference(s)”, “are from the same artefact” replaced “have the same biometric source”. Note 1 to entry deleted.]

### 3.10

#### false match

*comparison decision* (3.9) of match for a *probe* (3.7) and a *reference* (3.8) that are from different individual *artefacts* (3.1)

[SOURCE: ISO/IEC 2382-37:2022, 73.09.08, modified — “biometric” deleted before “probe” and “reference”, “individual artefacts” replaced “biometric capture subjects”. Note 1 to entry deleted.]

### 3.11

#### non-mated comparison trial

comparison of a *probe* (3.7) and a *reference* (3.8) from different *artefacts* (3.1) as part of a performance test

Note 1 to entry: A set of non-mated comparison trials need not contain all possible comparisons of probes and references from different artefacts.

[SOURCE: ISO/IEC 2382-37:2022, 37.09.02, modified — “biometric” deleted from the term. “biometric” deleted before “probe” and “reference”, and “artefacts” replaced “biometric data subjects”. Note 1 to entry deleted. Note 2 to entry renumbered as Note 1 to entry and modified: “biometric” deleted before “non-mated”, “probes” and “references”, and “artefacts” replaced “biometric data subjects”.]

### 3.12

#### false match rate

##### FMR

proportion of the completed *non-mated comparison trials* (3.11) that result in a *false match* (3.10)

Note 1 to entry: “Completed” refers to the computational processes required to make a comparison decision, i.e. failures to decide are excluded.

[SOURCE: ISO/IEC 2382-37:2022, 37.09.09, modified — “biometric” deleted before “non-mated”. Notes 1 and 2 to entry deleted. Note 3 to entry renumbered as Note 1 to entry.]

### 3.13

#### false non-match

*comparison decision* (3.9) of non-match for a *probe* (3.7) and a *reference* (3.8) that are from the same *artefact* (3.1) and of the same artefact metric characteristic

[SOURCE: ISO/IEC 2382-37:2022, 37.09.10, modified — “biometric” deleted before “probe” and “reference”, “artefact” replaced “biometric capture subject”, “artefact metric” replaced “biometric”. Note 1 to entry deleted.]

### 3.14

#### **mated comparison trial**

comparison of a *probe* (3.7) and a *reference* (3.8) from the same *artefact* (3.1) and the same artefact metric characteristic as part of a performance test

[SOURCE: ISO/IEC 2382-37:2022, 37.09.01, modified — “biometric” deleted in the term. “biometric” deleted before “probe” and “reference”, “artefact” replaced “biometric capture subject”, “artefact metric” replaced “biometric”. Note 1 to entry deleted.]

### 3.15

#### **false non-match rate**

##### **FNMR**

proportion of the completed *mated comparison trials* (3.14) that result in a *false non-match* (3.13)

[SOURCE: ISO/IEC 2382-37:2022, 37.09.11, modified — “biometric” deleted before “mated”. Notes 1 and 2 to entry deleted.]

### 3.16

#### **artefact metric verification**

process of confirming that a *probe* (3.7) is from the same *artefact* (3.1) as a specified *reference* (3.8)

Note 1 to entry: This method is known as one-to-one comparison.

### 3.17

#### **false reject rate**

##### **FRR**

proportion of artefact metric transactions with true artefact metric claims erroneously rejected

[SOURCE: ISO/IEC 19795-1:2021, 3.20, modified — “artefact metric” replaced “biometric”.]

### 3.18

#### **false accept rate**

##### **FAR**

proportion of transactions with false artefact metric claims erroneously accepted

[SOURCE: ISO/IEC 19795-1:2021, 3.21, modified — “artefact metric” replaced “biometric”.]

### 3.19

#### **artefact metric identification**

process of comparing a *probe* (3.7) with a set of *references* (3.8) to find the identity of an *artefact* (3.1)

Note 1 to entry: A set of identifiers of the closest matching artefacts can be returned.

Note 2 to entry: The return can indicate that the probed individual artefact is not enrolled in the database.

Note 3 to entry: This method is known as one-to-many comparison.

### 3.20

#### **false-negative identification rate**

##### **FNIR**

proportion of the completed identification trials that the result returned through the trials does not include the individual *artefact* (3.1) same as the *probe* (3.7)

Note 1 to entry: In some cases, true-positive identification rate is used. True-positive identification rate = 1 - false-negative identification rate.

### 3.21

#### **false-positive identification rate**

##### **FPIR**

proportion of the completed identification trials that the result of matched *reference(s)* (3.8) is returned through the trials when there are no references in the database which is the same individual *artefact* (3.1) as the *probe* (3.7)