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Space engineering

System engineering — Part 7: Product data exchange

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Foreword

This Standard is one of the series of ECSS Standards intended to be applied together for the management, engineering and product assurance in space projects and applications. ECSS is a cooperative effort of the European Space Agency, national space agencies and European industry associations for the purpose of developing and maintaining common standards.

Requirements in this Standard are defined in terms of what shall be accomplished, rather than in terms of how to organize and perform the necessary work. This allows existing organizational structures and methods to be applied where they are effective, and for the structures and methods to evolve as necessary without rewriting the standards.

The formulation of this Standard takes into account the existing ISO 9000 family of documents.

This Standard has been prepared by the ECSS-E-10 Part 7 Working Group, reviewed by the ECSS Engineering Panel and approved by the ECSS Steering Board.

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Introduction

This Standard forms part of the system engineering branch (ECSS-E-10) of the space engineering area of the ECSS System.

Reliable and easy-to-use exchange of computer-interpretable product data between all parties, disciplines and persons involved in space projects, is generally recognized as one of the important means to enable efficient and effective project execution. Product data in this context comprises all data which specifies one or more aspects of a product throughout its life cycle.

Reliable electronic exchange of product data cannot be achieved without the establishment and adoption of formal protocols by the parties exchanging the data. The present standard aims to facilitate the establishment of a set of applicable product data exchange protocols between the parties participating in a space project.

Throughout the present standard reference is made to many parts of ISO 10303 "Industrial automation systems and integration – Product data representation and exchange", more commonly known as the "Standard for the Exchange of Product model data (STEP)". ISO 10303 is the most important, global, cross-industry set of standards for the exchange of product data. The objective of ISO 10303 is explained in the Introduction of ISO 10303-1:

> "ISO 10303 is an International Standard for the computer-interpretable representation and exchange of product data. The objective is to provide a mechanism that is capable of describing product data throughout the life cycle of a product, independent of any particular system. The nature of this description makes it suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases and archiving."

When reading the present standard it is very helpful if the reader has access to information on the ISO 10303 suite of standards.

NOTE This information can be obtained from the national standard bodies representing ISO or from ISO itself and on the world-wide web from SC4ONLINE. See Clause 2 and Annex A for reference details.

The actual exchange of product data is performed via one of the following processes:

1. sending and receiving self-contained exchange datasets in off-line mode in the form of computer files via appropriate media (for example, computer networks, computer tape cartridges, or CD-ROMs);
2. by sharing data on-line through standardized data access interfaces to data stores that are connected to a computer network.

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Scope

This Standard specifies the methods and protocols for the exchange of computer-interpretable product data in space projects. Product data is defined as all data that specifies one or more aspects of a product throughout its life cycle. This Standard specifies which standard protocol to use in what data exchange context by making reference to existing external standards. It does not specify the contents of any product data exchange protocol itself.

Two categories of product data exchange are distinguished:

- exchange of data between alternative tools used within one discipline, where the tools share similar functionality, and
- exchange of data between tools of different disciplines.

For the second category, in most cases only a subset of the product data represented in one discipline can be transferred meaningfully to a representation in another discipline.

Explicitly not within this Standard's scope are:

- identification or availability of software tools to perform product data exchange,
- data compression standards, and
- data encryption standards.

This Standard is applicable to all participants in space programmes and throughout the complete product life cycle. The participants include customers, suppliers and partners at all levels and from all disciplines.

> Space project engineering is a multidisciplinary activity employing a wide range of technologies, with no one person able to master all of the disciplines at the level of expertise required to ensure a successful outcome. Consequently, resources from a number of engineering disciplines generally contribute to the engineering process, at least at the higher levels of complexity (see ECSS-E-00).

When viewed from the perspective of a specific project context, the requirements defined in the present standard should be tailored to match the genuine requirements of a particular profile and circumstances of a project.

NOTE Tailoring is a process by which individual requirements of specifications, standards and related documents are evaluated and made applicable to a specific project, by selection and, in some exceptional cases, modification of existing or addition of new requirements.
[ECSS-M-00-02A, Clause 3]

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Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this ECSS Standard. For dated references, subsequent amendments to, or revisions of any of these publications do not apply. However, parties to agreements based on this ECSS Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references the latest edition of the publication referred to applies.

ECSS-P-001	Glossary of terms
ISO 31	Quantities and units
ISO 1000	SI units and recommendations for the use of their multiples and of certain other units
ISO 10303-203:1994	Industrial automation systems and integration - Product data representation and exchange - Part 203: Application protocol: Configuration controlled 3D designs of mechanical parts and assemblies
ISO 10303-209:2001	Industrial automation systems and integration - Product data representation and exchange - Part 209: Application protocol: Composite and metallic structural analysis and related design
ISO 10303-210:2001	Industrial automation systems and integration - Product data representation and exchange - Part 210: Application protocol: Electronic assembly, interconnection, and packaging design
ISO 10303-212:2001	Industrial automation systems and integration - Product data representation and exchange - Part 212: Application protocol: Electrotechnical design and installation
ISO 10303-214:2001	Industrial automation systems and integration - Product data representation and exchange - Part 214: Application protocol: Core data for automotive mechanical design processes
ISO 10303-232:2002	Industrial automation systems and integration - Product data representation and exchange - Part 232: Application protocol: Technical data packaging core information and exchange

STEP-TAS STEP-based Application Protocol - Thermal Analysis for Space - ESA/ESTEC [1)]

PDF Reference, 3rd Edition, Adobe Portable Document Format, Version 1.4 [1)]

[1)] See download information in Annex A.

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Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ECSS-P-001 and the following apply.

3.1.1
application
a group of one or more processes creating or using product data

[ISO 10303-1]

3.1.2
application protocol
part of ISO 10303 that specifies a complete and consistent data model satisfying the scope and information requirements for a specific application

[adapted from ISO 10303-1]

3.1.3
conformance class
a subset of an application protocol for which conformance may be claimed

[ISO 10303-1]

3.1.4
product data
a representation of information about a product in a formal manner suitable for communication, interpretation or processing by human beings or by computers

[ISO 10303-1]

3.2 Abbreviated terms

The following abbreviated terms are defined and used within this document:

Abbreviation	Meaning
AP	application protocol
BREP	boundary representation
CAD	computer aided design
CAE	computer aided engineering
CAM	computer aided manufacturing

CC	conformance class
CSG	constructive solid geometry
ECLS	environmental control and life support
FTP	file transfer protocol
IETF	Internet Engineering Task Force
RFC	request for comment
MAIT	manufacturing, assembly, integration and test
PDE	product data exchange
PDF	portable document format
PDM	product data management
SI	international system of units - système internationale des unités NOTE It is specified in ISO 31 and ISO 1000.
STEP	standard for the exchange of product model data NOTE STEP is the commonly known name for ISO 10303.

4

Requirements

4.1 Principles

4.1.1 Disciplines

This Standard specifies the protocols to be used for product data exchange between all relevant combinations of disciplines. The following eight groups of disciplines are recognized:

1. system engineering
2. electrical-electronic
3. mechanical
4. software
5. communications engineering
6. control engineering
7. production engineering
8. operations engineering

Each of these disciplines consists of a number of "subdisciplines" which take care of specific aspects of the overall system that constitutes a complete space product.

NOTE For a description of the engineering disciplines involved in a space project see ECSS-E-00A, subclause 5.3.

Table 1 lists the disciplines addressed in the present standard for product data exchange, with their associated ECSS Standards.

Table 1: List of applicable disciplines for product data exchange and their associated ECSS Standards

Discipline	Associated discipline-specific ECSS standards
System engineering	ECSS-E-10 Part 1 Space engineering – System engineering – Part 1: Requirements and process
Configuration management	ECSS-M-40 Space project management – Configuration management
Information/documentation management	ECSS-M-50 Space project management – Information/documentation management
Integrated logistic support	ECSS-M-70 Space project management – Integrated logistic support
Mission analysis	ECSS-E-10 Part 1 Space engineering – System engineering – Part 1: Requirements and process
Space environmental effects	ECSS-E-10-04 Space engineering – Space environment
Human factors engineering	ECSS-E-10 Part 11 [a] Space engineering – System engineering – Part 11: Human factors engineering
Electronics	ECSS-E-20 Space engineering – Electrical and electronic
Electrical power	ECSS-E-20 Space engineering – Electrical and electronic
Electromagnetic compatibility	ECSS-E-20 Space engineering – Electrical and electronic
Radio-frequency systems	ECSS-E-50 Part 1 Space engineering – Communications – Part 1: Principles and requirements
Electrical interfaces and interconnections	ECSS-E-20 Space engineering – Electrical and electronic
Optical	ECSS-E-20 Space engineering – Electrical and electronic
Mechanical – CAD	ECSS-E-30 Part 2 Space engineering – Mechanical – Part 2: Structural ECSS-E-30 Part 7 Space engineering – Mechanical – Part 7: Mechanical parts ECSS-E-30 Part 8 Space engineering – Mechanical – Part 8: Materials
Mechanical – Thermal	ECSS-E-30 Part 1 Space engineering – Mechanical – Part 1: Thermal control
Mechanical – Structures	ECSS-E-30 Part 2 Space engineering – Mechanical – Part 2: Structural

Table 1: List of applicable disciplines for product data exchange and their associated ECSS Standards *(continued)*

Discipline	Associated discipline-specific ECSS standards
Mechanical – Mechanisms	ECSS-E-30 Part 3 Space engineering – Mechanical – Part 3: Mechanical parts
Mechanical – ECLS	ECSS-E-30 Part 4 [a] Space engineering – Mechanical – Part 4: ECLS
Mechanical – Propulsion	ECSS-E-30 Part 5 [a] Space engineering – Mechanical – Part 5: Propulsion
Mechanical – Pyrotechnics	ECSS-E-30 Part 6 Space engineering – Mechanical – Part 6: Pyrotechnics
Software [b]	ECSS-E-40 Part 1 Space engineering – Software – Principles and requirements
Communications engineering	ECSS-E-50 Part 1 Space engineering – Communications – Part 1: Principles and requirements
Control engineering	ECSS-E-60 Space engineering – Control engineering ECSS-E-20 Space engineering – Electrical and electronic
Manufacture, assembly, integration and test (MAIT)	ECSS-E-10-02 [c] System engineering – Verification ECSS-E-10-03 [d] System engineering – Testing ECSS-E-70 Part 1 Space engineering – Ground systems and operations – Principles and requirements ECSS-M-70 Space project management – Integrated logistic support ECSS-Q-70 Space product assurance – Materials, mechanical parts and processes
Materials, mechanical parts and processes	ECSS-Q-70 Space product assurance – Materials, mechanical parts and processes ECSS-E-30 Part 7 Space engineering – Mechanical – Part 7: Mechanical parts ECSS-E-30 Part 8 Space engineering – Mechanical – Part 8: Materials
Operations engineering	ECSS-E-70 Part 1 Space engineering – Ground systems and operations – Principles and requirements

[a] To be published.

[b] Exchange of software product data is limited to configuration items as defined in 4.2.3.

[c] To be replaced by ECSS-E-10 Part 2B.

[d] To be replaced by ECSS-E-10 Part 3B.

4.1.2 Structure of the requirements

The requirements for product data exchange in the present standard are split into two categories:

- general requirements pertaining to all product data exchange;
- specific requirements pertaining to product data exchange in a given product data exchange context.

A product data exchange context is defined by three elements:

- a source discipline, which holds the source representation of the product data;
- a destination discipline, which receives the data and converts it into its target representation of the product data;
- the intended purpose for the transfer, which describes the product data to be transferred.

NOTE The source and the destination discipline can be the same, in case of exchange of data between two tools used for one discipline or in case of long term data archiving for one tool.

The general requirements are given in the subclause 4.2.

The specific requirements are given as subclauses under subclause 4.3, and written in a structured way. For each discipline listed in Table 1 there is a level 3 subclause (4.3.x) which designates the source discipline. Each source discipline subclause contains a collection of applicable destination disciplines, referenced as 4.3.x.y. The body of all specific requirement subclauses adheres to the following template:

Table (example)

Reference	Source representation	Destination representation	Product data to be transferred	Standard reference to apply
4.3.x.y				

The destination disciplines include a sequence number between parentheses in order to uniquely identify multiple exchange possibilities between a source and a destination discipline for different product data classes.

4.2 General requirements for product data exchange

4.2.1 Units for physical quantities

a. Throughout all product data exchanges the units for all values of all physical quantities shall be explicitly specified in the protocol.

b. Throughout all product data exchanges SI units should be used for all values of physical quantities.

c. The conversion rule from the actually used unit to the equivalent SI unit shall be explicitly included in the protocol, in case the values of physical quantities are not specified in SI units.

d. The conversion of units should conform to ISO 31 and ISO 1000.

e. If the conversion rule deviates from ISO 31 or ISO 1000 the origin of the conversion rule shall be specified.

f. The applicable units and conversion rules shall be specified and agreed prior to starting exchange of data by the parties involved the data exchange.

NOTE The specification is usually initiated by the sending party.

4.2.2 Media for product data exchange

The media for transfer of the product data to be exchanged shall be agreed by the parties involved.

EXAMPLE Suitable media are, for example, CD-ROM, 4 mm DAT cartridge, and FTP server connected to the Internet.

4.2.3 Specific limitation for product data exchange to and from the software engineering discipline

For software configuration items or software products the present standard only takes into account the exchange of the associated configuration control data (i.e. item and version identification, and possibly a functional description).

Software items are considered to be parts of a product, implementing specified functionality in software. Software items are part of a larger containing product.

NOTE For the exchange of actual software specification, analysis and design models as well as software implementations see ECSS-E-40.

4.3 Specific requirements for product data exchange

4.3.1 Source: System engineering

To transfer product data from a system engineering representation to the destination representation and for the product data stated in Table 2, the standard reference specified in such a table shall be used.

Table 2: Data transfer from a system engineering representation

Reference	Source representation	Destination representation	Product data to be transferred	Standard reference to apply
4.3.1.1	System engineering	Mechanical - CAD (1)	Physical system breakdown	ISO 10303-203 CC1

4.3.2 Source: Configuration management

To transfer product data from a configuration management representation to the destination representations and for the product data stated in Table 3, the standard references specified in such a table shall be used.

Table 3: Data transfer from a configuration management representation

Reference	Source representation	Destination representation	Product data to be transferred	Standard reference to apply
4.3.2.1	Configuration management	Mechanical – CAD (1)	PDM data configuration controlled design information without shape	ISO 10303-203 CC1
4.3.2.2	Configuration management	Configuration management (1)	PDM data configuration controlled design information without shape	ISO 10303-203 CC1

4.3.3 Source: Information - documentation management

a. To transfer product data from an information-documentation management representation to the destination representations and for the product data stated in Table 4 , the standard references specified in such a table shall be used.

b. In the case specified in Table 4, reference 4.3.3.1, the applicable CC shall be mutually agreed.

Table 4: Data transfer from an information-documentation management representation

Reference	Source representation	Destination representation	Product data to be transferred	Standard reference to apply
4.3.3.1	Information – documentation management	Information – documentation management (1)	Technical data package	ISO 10303-232
4.3.3.2	Information – documentation management	Information – documentation management (2)	Document for read-only access	PDF

4.3.4 Source: Integrated logistic support

To transfer product data from an integrated logistic support representation to the destination representations and for the product data stated in Table 5, the standard references specified in such a table shall be used.

NOTE PDM data typically contains the product assembly tree, bill of materials, and release status of all configuration items or parts.

Table 5: Data transfer from an ILS representation

Reference	Source representation	Destination representation	Product data to be transferred	Standard reference to apply
4.3.4.1	Integrated logistic support	Integrated logistic support (1)	PDM data: configuration controlled design information without shape	ISO 10303-232 CC1
4.3.4.2	Integrated logistic support	Mechanical – CAD (1)	PDM data: configuration controlled design information without shape	ISO 10303-232 CC1

4.3.5 Source: Mission analysis

The standard reference to be used to exchange data from a mission analysis representation to any applicable discipline listed in Table 1 is presently under consideration.

4.3.6 Source: Space environmental effects

The standard reference to be used to exchange data from a space environmental effects representation to any applicable discipline listed in Table 1 is presently under consideration.

4.3.7 Source: Human factors engineering

The standard reference to be used to exchange data from a human factors engineering representation to any applicable discipline listed in Table 1 is presently under consideration.

4.3.8 Source: Electronics

a. To transfer product data from an electronics representation to the destination representations and for the product data stated in Table 6, the standard references specified in such a table shall be used.

b. The applicable CC shall be mutually agreed.

Table 6: Data transfer from an electronic system representation

Reference	Source representation	Destination representation	Product data to be transferred	Standard reference to apply
4.3.8.1	Electronic systems	Mechanical – CAD (1)	Mechanical interfaces and layout	ISO 10303-210

4.3.9 Source: Electrical power

a. To transfer product data from an electrical power representation to the destination representations and for the product data stated in Table 7, the standard references specified in such a table shall be used.

b. In all the cases specified in Table 7, the applicable CC shall be mutually agreed.

Table 7: Data transfer from an electrical power representation

Reference	Source representation	Destination representation	Product data to be transferred	Standard reference to apply
4.3.9.1	Electronic systems	Mechanical – CAD (1)	Mechanical interfaces and layout	ISO 10303-210

4.3.10 Source: Electro-magnetic compatibility

The standard reference to be used to exchange data from a electro-magnetic compatibility representation to any applicable discipline listed in Table 1 is presently under consideration.

4.3.11 Source: Radio-frequency systems

The standard reference to be used to exchange data from a radio-frequency systems representation to any applicable discipline listed in Table 1 is presently under consideration.

4.3.12 Source: Electrical interfaces and interconnections

The standard reference to be used to exchange data from a electrical interfaces and interconnections representation to any applicable discipline listed in Table 1 is presently under consideration.

4.3.13 Source: Optical

The standard reference to be used to exchange data from a optical representation to any applicable discipline listed in Table 1 is presently under consideration.

4.3.14 Source: Mechanical – CAD

To transfer product data from a mechanical-CAD representation to the destination representations and for the product data stated in Table 8, the standard references specified in such a table shall be used.

Table 8: Data transfer from a mechanical – CAD representation

Reference	Source representation	Destination representation	Product data to be transferred	Standard reference to apply
4.3.14.1	Mechanical - CAD	Configuration management (1)	PDM data: configuration controlled design information without shape	ISO 10303-203 CC1
4.3.14.2	Mechanical - CAD	Integrated logistic support (1)	PDM data: configuration controlled design information without shape	ISO 10303-203 CC1

Table 8: Data transfer from a mechanical – CAD representation
(continued)

Reference	Source representation	Destination representation	Product data to be transferred	Standard reference to apply
4.3.14.3	Mechanical – CAD	Mechanical – CAD (1)	Configuration controlled design information and shapes represented by manifold surface models with topology	ISO 10303-203 CC4
4.3.14.4	Mechanical – CAD	Mechanical – CAD (2)	Configuration controlled design information and shapes represented by facetted boundary-representation models	ISO 10303-203 CC5
4.3.14.5	Mechanical – CAD	Mechanical – CAD (3)	Configuration controlled design information and shapes represented by advanced boundary-representation models	ISO 10303-203 CC6
4.3.14.6	Mechanical – CAD	Mechanical – CAD (4)	Component design with 3D shape	ISO 10303-214 CC1
4.3.14.7	Mechanical – CAD	Mechanical – CAD (5)	Assembly design with 3D shape	ISO 10303-214 CC2
4.3.14.8	Mechanical – CAD	Mechanical – CAD (6)	Component drawings with wireframe or surface shape representation	ISO 10303-214 CC3
4.3.14.9	Mechanical – CAD	Mechanical – CAD (7)	Assembly drawings with wireframe, surface or solid shape representation	ISO 10303-214 CC4
4.3.14.10	Mechanical – CAD	Thermal analysis (1)	3D surface shape models	ISO 10303-203 CC4
4.3.14.11	Mechanical – CAD	Thermal analysis (2)	3D explicit shape models with advanced BREP for thermal radiative analysis	ISO 10303-203 CC6
4.3.14.12	Mechanical – CAD	Mechanical – Structures (1)	3D explicit shape model with advanced BREP	ISO 10303-203 CC6

Table 8: Data transfer from a mechanical – CAD representation
(continued)

Reference	Source representation	Destination representation	Product data to be transferred	Standard reference to apply
4.3.14.13	Mechanical - CAD	Mechanical – Structures (2)	3D CSG model	ISO 10303-214 CC4
4.3.14.14	Mechanical - CAD	Ground systems and operations (1)	PDM data: configuration controlled design information without shape	ISO 10303-203 CC1
4.3.14.15	Mechanical - CAD	Ground systems and operations (2)	3D explicit shape model with advanced BREP for shape representation	ISO 10303-203 CC6

4.3.15 Source: Mechanical – Thermal

To transfer product data from a mechanical-thermal representation to the destination representations and for the product data stated in Table 9, the standard references specified in such a table shall be used.

Table 9: Data transfer from a mechanical-thermal representation

Reference	Source representation	Destination representation	Product data to be transferred	Standard reference to apply
4.3.15.1	Thermal analysis	Mechanical – CAD (1)	3D surface shape model	ISO 10303-203 CC4
4.3.15.2	Thermal analysis	Mechanical – CAD (2)	3D CSG model	ISO 10303-214 CC4
4.3.15.3	Thermal analysis	Thermal analysis (1)	Thermal-radiative analysis model with basic geometry	STEP-TAS CC1
4.3.15.4	Thermal analysis	Thermal analysis (2)	Thermal-radiative analysis model with basic geometry and kinematic model	STEP-TAS CC2
4.3.15.5	Thermal analysis	Thermal analysis (3)	Thermal-radiative analysis model with basic and constructive geometry	STEP-TAS CC3
4.3.15.6	Thermal analysis	Thermal analysis (4)	Thermal-radiative analysis model with basic and constructive geometry and kinematic model	STEP-TAS CC4
4.3.15.7	Thermal analysis	Thermal analysis (5)	Thermal-radiative analysis model with basic geometry, kinematic model and space mission aspects	STEP-TAS CC5
4.3.15.8	Thermal analysis	Thermal analysis (6)	Thermal-radiative analysis model with basic and constructive geometry, kinematic model and space mission aspects	STEP-TAS CC6

4.3.16 Source: Mechanical – Structures

a. To transfer product data from a mechanical-structures representation to the destination representations and for the product data stated in Table 10, the standard references specified in such a table shall be used.

b. In the case specified in Table 10, reference 4.3.16.3, the applicable CC shall be mutually agreed.

Table 10: Data transfer from a mechanical-structures representation

Reference	Source representation	Destination representation	Product data to be transferred	Standard reference to apply
4.3.16.1	Mechanical - Structures	Mechanical – CAD (1)	3D explicit shape model with advanced BREP for structural analysis	ISO 10303-203 CC4
4.3.16.2	Mechanical - Structures	Mechanical – CAD (2)	3D CSG model for structural analysis	ISO 10303-214 CC4
4.3.16.3	Mechanical - Structures	Mechanical – Structures (1)	Linear static finite element analysis model	ISO 10303-209

4.3.17 Source: Mechanical – Mechanisms

The standard reference to be used to exchange data from a mechanical-mechanisms representation to any applicable discipline listed in Table 1 is presently under consideration.

4.3.18 Source: Mechanical – ECLS

The standard reference to be used to exchange data from a mechanical-ECLS representation to any applicable discipline listed in Table 1 is presently under consideration.

4.3.19 Source: Mechanical – Propulsion

The standard reference to be used to exchange data from a mechanical-propulsion representation to any applicable discipline listed in Table 1 is presently under consideration.

4.3.20 Source: Mechanical – Pyrotechnics

The standard reference to be used to exchange data from a mechanical-pyrotechnics representation to any applicable discipline listed in Table 1 is presently under consideration.

4.3.21 Source: Software

To transfer product data from a Software representation to the destination representations and for the product data stated in Table 11, the standard references specified in such a table shall be used.

Table 11: Data transfer from an electrical power representation

Reference	Source representation	Destination representation	Product data to be transferred	Standard reference to apply
4.3.21.1	Software	Configuration management (1)	PDM data: Configuration controlled design information without shape	ISO 10303-203 CC1
4.3.21.2	Software	Integrated logistic support (1)	PDM data: Configuration controlled design information without shape	ISO 10303-203 CC1

4.3.22 Communication engineering

The standard reference to be used to exchange data from a communication engineering representation to any applicable discipline listed in Table 1 is presently under consideration.

4.3.23 Source: Control engineering

The standard reference to be used to exchange data from a control engineering representation to any applicable discipline listed in Table 1 is presently under consideration.

4.3.24 Source: Manufacture, assembly, integration and test (MAIT)

The standard reference to be used to exchange data from a manufacture, assembly, integration and test (MAIT) representation to any applicable discipline listed in Table 1 is presently under consideration.

4.3.25 Source: Materials, mechanical parts and processes

The standard reference to be used to exchange data from a materials, mechanical parts and processes representation to any applicable discipline listed in Table 1 is presently under consideration.

4.3.26 Source: Operations engineering

The standard reference to be used to exchange data from an operations engineering representation to any applicable discipline listed in Table 1 is presently under consideration.

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Annex A (informative)

References to electronic copies

At the time of the publication of the present standard, electronic copies of referenced documents can be found at:

ISO-website	The official website of ISO. For electronic copies of documents http://www.iso.ch
SC4ONLINE	The official website of ISO Technical Committee 184 "Industrial automation systems and integration" / Subcommittee 4 "Industrial data", which is responsible for the ISO 10303 (STEP) standardization. http://www.tc184-sc4.org
STEP-TAS	STEP-based Application Protocol – Thermal Analysis for Space – ESA/ESTEC http://www.estec.esa.int/thermal/tools/standards.html
PDF	PDF Reference, 3rd Edition. Adobe Portable Document Format, Version 1.4, December 2001, ®Adobe Systems Incorporated, ISBN 0–201–75839-3 (*size of pdf-file around 9 MB, 987 pages*) http://partners.adobe.com/asn/acrobat/docs/File_Format_Specifications/PDFReference.pdf

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Bibliography

The following references were used in preparing the present standard:

ECSS-E-00	Space engineering - Policy and principles
ECSS-E-10 Part 1	Space engineering - System engineering - Part 1: Requirements and process
ECSS-E-10 Part 11 [2)]	Space engineering - System engineering - Part 11: Human factors engineering
ECSS-E-10-02	Space engineering - Verification
ECSS-E-10-03	Space engineering - Testing
ECSS-E-10-04	Space engineering - Space environment
ECSS-E-20	Space engineering - Electrical and electronic
ECSS-E-30 Part 1	Space engineering - Mechanical - Part 1: Thermal control
ECSS-E-30 Part 2	Space engineering - Mechanical - Part 2: Structural
ECSS-E-30 Part 3	Space engineering - Mechanical - Part 3: Mechanisms
ECSS-E-30 Part 4 [2)]	Space engineering - Mechanical - Part 4: ECLS
ECSS-E-30 Part 5 [2)]	Space engineering - Mechanical - Part 5: Propulsion
ECSS-E-30 Part 6	Space engineering - Mechanical - Part 6: Pyrotechnics
ECSS-E-30 Part 7	Space engineering - Mechanical - Part 7: Mechanical parts
ECSS-E-30 Part 8	Space engineering - Mechanical- Part 8: Materials
ECSS-E-40 Part 1	Space engineering - Software - Part 1: Principles and requirements
ECSS-E-50 Part 1	Space engineering - Communications - Part 1: Principles and requirements
ECSS-E-60	Space engineering - Control engineering
ECSS-E-70 Part 1	Space engineering - Ground systems and operations - Part 1: Principles and requirements
ECSS-M-00-02A	Space project management - Tailoring of space standards
ECSS-M-40	Space project management - Configuration management

[2)] To be published.

ECSS-M-50	Space project management - Information/documentation management
ECSS-M-70	Space project management - Integrated logistic support
ECSS-Q-70	Space product assurance - Materials, mechanical parts and processes
ISO 10303-1:1994	Industrial automation systems and integration - Product data representation and exchange - Part 1: Overview and fundamental principles

ECSS Document Improvement Proposal

1. Document I.D.	2. Document date	3. Document title
ECSS-E-10 Part 7A	25 August 2004	System engineering — Part 7: Product data exchange

4. Recommended improvement (identify clauses, subclauses and include modified text or graphic, attach pages as necessary)

5. Reason for recommendation

6. Originator of recommendation

Name:	Organization:	
Address:	Phone: Fax: e-mail:	**7. Date of submission:**

8. Send to ECSS Secretariat

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Note: The originator of the submission should complete items 4, 5, 6 and 7.

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