INTERNATIONAL STANDARD

ISO 17540

First edition
2016-12-15

Space systems — Liquid rocket engines and test stands — Terms and definitions

Systèmes spatiaux — Moteurs de fusée liquides et stands d'essai — Termes et définitions

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 17540:2016
https://standards.iteh.ai/catalog/standards/sist/041eada7-c695-4ce8-97c7-971a6e932065/iso-17540-2016

Reference number
ISO 17540:2016(E)

© ISO 2016

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 17540:2016
https://standards.iteh.ai/catalog/standards/sist/041eada7-c695-4ce8-97c7-971a6e932065/iso-17540-2016

COPYRIGHT PROTECTED DOCUMENT

© ISO 2016, Published in Switzerland

All rights reserved. Unless otherwise specified, 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
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

 © ISO 2016 – All rights reserved

Contents

Page

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 17540:2016
https://standards.iteh.ai/catalog/standards/sist/041eada7-c695-4ce8-97c7-971a6e932065/iso-17540-2016

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 17540:2016
https://standards.iteh.ai/catalog/standards/sist/041eada7-c695-4ce8-97c7-971a6e932065/iso-17540-2016

 © ISO 2016 – All rights reserved

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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

For an explanation on 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.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

The committee responsible for this document is ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

ISO 17540:2016
https://standards.iteh.ai/catalog/standards/sist/041eada7-c695-4ce8-97c7-971a6e932065/iso-17540-2016

© ISO 2016 – All rights reserved

Introduction

This International Standard is intended to be applied for all types of rocket engines which use a liquid propellant.

The terms in this International Standard are specified in scope of design, testing, reliability analysis and quality control of liquid rocket engines.

The terms are intended to be required for use in all types of documentation and literature including in scope of standardization or using results of this activity.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 17540:2016
https://standards.iteh.ai/catalog/standards/sist/041eada7-c695-4ce8-97c7-971a6e932065/iso-17540-2016

© ISO 2016 – All rights reserved

Space systems — Liquid rocket engines and test stands — Terms and definitions

1 Scope

The International Standard provides terms and definitions in scope of design, testing, reliability analysis and quality control of liquid rocket engines. The terms are required for use in all types of documentation and literature including in the scope of standardization or using the results of this activity.

2 Terms and definitions

2.1 General

2.1.1
rocket engine
RE
reaction engine producing thrust for vehicle movement with the help of substances and energy sources contained within the vehicle being moved

iTeh STANDARD PREVIEW
(standards.iteh.ai)

2.1.2
liquid rocket engine
LRE
rocket engine (2.1.1) using propellants in liquid form

ISO 17540:2016
https://standards.iteh.ai/catalog/standards/sist/041eada7-c695-4ce8-97c7-971a6e932065/iso-17540-2016

2.1.3
low-thrust engine
LTE
rocket engine (2.1.1) of a thrust not more than 5 000 N

2.1.4
liquid rocket propulsion system
propulsion system including engine, propellant tanks, avionics for control sub-systems, pressure vessels and control devices for pneumatic and hydraulic control sub-systems, propellant feed system, actuators for steering sub-systems, and auxiliary equipment

2.1.5
clustered engine
liquid rocket propulsion system (2.1.4) consisting of multiple *rocket engines* (2.1.1), common propellant tanks, and autonomous (independent) propellant feed systems

2.2 Engine units

2.2.1
chamber
engine assembly where propellant and/or gas generation products, as a result of chemical reactions, are converted into products of combustion, created at the expiration of the reactive force

2.2.2
turbo-pump
TP
engine component designed to pump propellant into the *chamber* (2.2.1), gas generator sets and automatic engine

© ISO 2016 – All rights reserved

2.2.3
booster turbo-pump
BTP
turbo-pump (2.2.2) engine support designed to increase propellant pressure in the pipelines to *pump* (2.20.1)

2.2.4
gas generator
unit of engine wherein propellant, as a result of chemical reaction, is converted in gaseous products of reaction at relatively low temperature

2.2.5
automatic engine controller
engine assembly designed for automatic control, regulation or maintenance of engine

2.3 Engine types by way of work process

2.3.1
engine with afterburning
engine where gas generation products after their use are used to drive the *turbo-pump* (2.2.2) assembly

2.3.2
engine without afterburning
engine where gas generation products after their use to drive the *turbo-pump* (2.2.2) assembly are released into the environment

iTeh STANDARD PREVIEW
(standards.iteh.ai)

Note 1 to entry: Engine without afterburning have a *pump* (2.20.1) or a pressurized fuel supply.

2.3.3
single-mode engine
engine with one major mode

ISO 17540:2016
https://standards.iteh.ai/catalog/standards/sist/041eada7-c695-4ce8-97c7-971a6e932065/iso-17540-2016

2.3.4
multimode engine
engine with several basic modes

2.4 Engine types by multiplicity of use and integration

2.4.1
expendable engine
engine intended for a specific purpose and used only one time

2.4.2
nonexpendable engine
engine intended for a specific purpose and used multiple times

2.4.3
single-start engine
engine started only once for a specific purpose

2.4.4
multi-start engine
restartable engine
engine started multiple times for one specific purpose

2.5 Engine types by purpose

2.5.1
main engine
engine intended to accelerate the space vehicle

© ISO 2016 – All rights reserved

2.5.2
correction engine
engine intended to correct the speed during the correction of trajectory of the space vehicle

2.5.3
control engine
engine intended to control the correction of the vector of the space vehicle in the active phase of the trajectory of motion

2.5.4
retrorocket engine
engine intended to reduce the speed of the space vehicle

2.6 Low-thrust engine types by way of work process

2.6.1
catalytic engine
LTE (2.1.3) where the transformation of propellant into gaseous chemical reaction products is performed with the help of a catalyst

2.6.2
thermo-catalytic engine
catalytic LTE where the catalyst is heated by the external heat source

2.6.3
electro-thermo-catalytic engine
thermo-catalytic LTE using an electrical source of energy

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 17540:2016
https://standards.iteh.ai/catalog/standards/sist/0418ada7-c695-4ce8-97c7-971a6e932065/iso-17540-2016

2.6.4
radio-thermo-catalytic engine
thermo-catalytic LTE using a radioactive source of energy

2.6.5
thermal engine
LTE (2.1.3) where the conversion of propellant in the gaseous products of chemical reactions is affected by heating the fuel from an external source of energy which increases their rate of expiration

Note 1 to entry: Energy is fed to the propellant or products of chemical reactions.

2.6.6
electro-thermal engine
thermal LTE using an electrical energy source

2.6.7
radio-thermal engine
thermal LTE using a radioactive energy source

2.6.8
electrolytic engine
one-component of the *LTE* (2.1.3) where the electrolysis of the propellant is part of operating process

2.6.9
adjustable engine
low-thrust engine (2.1.3) that has a device to change the thrust

2.7 General parameters and performance of engine

2.7.1
rated performance
set of nominal values of the engine designated in the specifications

© ISO 2016 – All rights reserved

2.7.2
mass flow rate
mass of fluid passing a specified line or gate in unit time

2.7.3
volume flow rate
volume of fluid passing a specified line or gate in unit time

2.7.4
pre-start consumption
propellant mass consumption during the time interval from the first start command until the thrust build-up to a specified value equal to 5 % of the nominal

2.7.5
mixture ratio
ratio of oxidizer *mass flow rate* (2.7.2) to the fuel mass flow rate

2.7.6
volume ratio
ratio of oxidizer *volume flow rate* (2.7.3) to the fuel volume rate

2.7.7
pressure
<in chamber> average static pressure of combustion products at the beginning of the *combustion chamber* (2.12.1) at the mixing system chamber

iTeh STANDARD PREVIEW
(standards.iteh.ai)

2.7.8
pressure
<in gas generator> average static pressure of gas generation at the beginning of the *combustion chamber* (2.12.2) at the mixing system gas generator

ISO 17540:2016
https://standards.iteh.ai/catalog/standards/sist/041eada7-c695-4ce8-97c7-971a6e932065/iso-17540-2016

2.7.9
combustion temperature
<in chamber> stagnation temperature of combustion products at the exit from the *combustion chamber* (2.12.1)

2.7.10
combustion temperature
<in gas generator> stagnation temperature of gas generation at the exit from the *gas generator* (2.2.4)

2.7.11
exhaust velocity
velocity of exhaust stream through the *nozzle* (2.12.16) or a reaction engine, relative to the nozzle

2.7.12
engine reactive force
gas and fluid flow resultant force acting on the thrust chamber internal surfaces resulting from the combustion gases

2.7.13
engine thrust
resultant of the *engine reactive force* (2.7.12) and the environment pressure forces acting on the engine external surfaces (excluding external aerodynamic drag forces)

2.7.14
engine impulse
time integral of engine thrust

2.7.15
cut-off impulse
impulse (2.9.5) of engine thrust for the time interval defining the engine tail-off

© ISO 2016 – All rights reserved

2.7.16
specific impulse

ratio of engine thrust to the mass flow of propellant $\left(I_s = \frac{R}{\dot{m}}\right)$

Note 1 to entry: Thrust engine (chamber) specific impulse is converted in a vacuum and at sea level.

Note 2 to entry: Thrust engine (chamber) specific impulse is also an equalled derivative from the thrust engine (chamber) impulse by weight or volume of propellant consumed.

Note 3 to entry: For *LTE* (2.1.3), the term "specific impulse" is used for steady-state continuous mode, single inclusions mode and the steady-state impulse mode.

2.7.17
volume specific impulse

ratio of engine thrust to the propellant volume flow rate $\left(I_{s,v} = \frac{R}{\dot{v}}\right)$

2.7.18
thrust coefficient
ratio of chamber thrust to the product of the nozzle stagnation pressure (or chamber total pressure at nozzle inlet) and the area of nozzle throat

2.7.19
coefficient of specific impulse
ratio of actual specific impulse to the theoretical value that is defined by the same values of *mixture ratio* (2.7.5), the nozzle stagnation pressure or chamber total pressure at nozzle inlet

iTeh STANDARD PREVIEW
(standards.iteh.ai)

2.7.20
total coefficient of specific impulse
coefficient of *specific impulse* (2.7.16) defined at the *mixture ratio* (2.7.5) to be the maximum ideal value

ISO 17540:2016
https://standards.iteh.ai/catalog/standards/sist/041eada7-c695-4ce8-97c7-971a6e932065/iso-17540-2016

2.7.21
consumable complex of chamber
consumable complex
product of the combustion pressure in a given section of the *chamber* (2.2.1) to a nozzle throat area, referred to the mass flow of the propellant in chamber

Note 1 to entry: Given section of the *chamber* (2.2.1) is in analysis of camera characteristics stability during serial production [initial section of *combustion chamber* (2.12.1) at (near) *mixing system* (2.12.3)] and in analysis of multiphase flows (2.19.4) [initial section of *nozzle* (2.12.16)].

2.7.22
thrust complex
ratio of engine thrust chamber pressure and the product of combustion products in a given section of the *chamber* (2.2.1) for an area of minimum section of the *nozzle* (2.12.16)

Note 1 to entry: Thrust complex is also equal to the ratio of camera-specific impulse to *consumable complex* (2.7.19).

2.7.23
coefficient of consumable complex
ratio of the actual spending of the complex chamber rocket engine to the ideal that defined the same values of the ratio components fuel pressure in the *chamber* (2.2.1)

2.7.24
coefficient of nozzle flow
coefficient of flow
ratio of the actual flow of gas through the rocket engine nozzle to the theoretical value, as defined under the same temperature and total pressure in the nozzle throat, under the conditions for the gas constant and the local adiabatic exponent

© ISO 2016 – All rights reserved

2.7.25
nozzle coefficient
ratio of the actual thrust coefficient in a vacuum to the ideal that defined the same values of the *mixture ratio* (2.7.5) and combustion pressure in the *chamber* (2.2.1) and the geometric expansion ratio nozzle

2.7.26
chamber coefficient
ratio of the real characteristic velocity in the *chamber* (2.2.1) to the ideal defined by the same values of the *mixture ratio* (2.7.5) and the combustion chamber pressure

2.7.27
characteristic velocity
product of the nozzle stagnation pressure and nozzle throat area, referred to the mass consumption of propellant in chamber

2.7.28
ideal parameter value
<of chamber> parameter value of *chamber* (2.2.1), corresponding to the equilibrium flow of combustion products in the absence outlet heat and friction

2.7.29
ideal parameter value
<of gas generator> parameter value of *gas generator* (2.2.4), corresponding to the equilibrium flow of products gas generation in the absence outlet heat and friction

2.7.30
wet mass
mass of engine designed with propellants and other consumption articles filling its pipelines and aggregates

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 17540:2016
https://standards.iteh.ai/catalog/standards/sist/041eada7-c695-4ce8-97c7-971a6e932065/iso-17540-2016

2.7.31
relative mass
ratio of the *wet mass* (2.7.30) to the maximum thrust on the main steady-state operation

2.7.32
engine altitude characteristic
dependence of the thrust rocket engine on the environment pressure at constant values of the ratio of the propellant components and the pressure in the *chamber* (2.2.1)

2.7.33
engine throttle characteristic
dependence of the engine thrust from the chamber pressure at constant values of the *mixture ratio* (2.7.5) of propellants and the ambient pressure

2.8 Engine time characteristics, types of operating and resources

2.8.1
period of propellant flow
time interval from the moment of complete opening of the solenoid valve until it is completely closed

2.8.2
designed operating life
period of time during which the engine is expected to operate within its specified design parameters

2.8.3
engine operating time
operation duration and/or operation cycle number of the engine

© ISO 2016 – All rights reserved

2.8.4
engine verification time
mean time engine specified in the request for the proposal

2.8.5
engine specified resource
engine operating time (2.8.3) specified in the request for the proposal

2.8.6
engine working resource
total running time of engine during a specified period of service, used as directed

2.8.7
engine single working resource
work resource of engines, or part thereof, during one cycle operation

2.8.8
engine designated resource
total operating time after the expiry of which the use of the engine should be stopped

2.8.9
LTE total designated resource
operation duration assigned for continuous and pulse modes

Note 1 to entry: In addition to total designated resourse, for *LTE* (2.1.3), it is also determined designated resource according to the following:

iTeh STANDARD PREVIEW
(standards.iteh.ai)

— number of *inclusions* (2.9.8);

— duration at impulse mode;

— duration at continuous mode;

— total propellant consumption for catalytic LTE.

ISO 17540:2016
https://standards.iteh.ai/catalog/standards/sist/041eada7-c695-4ce8-97c7-
9f7a4fe032f0/iso-17540-2016

2.9 Low-thrust engine performance

2.9.1
full thruster impulse
thruster impulse of *LTE* (2.1.3) at which the mean integrated value of thrust, or chamber pressure, is more or equal to 0,9 of the steady-state value of the thrust, or chamber pressure, for the firing

2.9.2
part-thrust impulse
thruster impulse of *LTE* (2.1.3) at which the average integral value of thrust, or *pressure* (2.7.7) in the *chamber* (2.2.1), is less than 0,9 the steady-thrust, or pressure in the chamber, at a switch

2.9.3
unit impulse
thruster impulse of *LTE* (2.1.3) or one firing (*on-time* (2.9.10)) in the pulse or single firing operation mode

2.9.4
total impulse
thruster impulse of *LTE* (2.1.3) over the operating duration

2.9.5
impulse
forceful impact of *LTE* (2.1.3) characterized by changes in traction or *pressure* (2.7.7) in the *chamber* (2.2.1) at the time of a switch

© ISO 2016 – All rights reserved