



BSI Standards Publication

Space systems — Liquid rocket engines and test stands — Vocabulary

National foreword

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**Space systems — Liquid rocket
engines and test stands —
Vocabulary**

*Systèmes spatiaux — Moteurs de fusée liquides et stands d'essai
— Vocabulaire*

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CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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This document was prepared by Technical Committee TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

This second edition cancels and replaces the first edition (ISO 17540:2016), which has been technically revised.

The main changes are as follows:

- several terms are revised, including "rocket engine", "liquid rocket propulsion system", "high-altitude firing test", etc.;
- redundant terms are deleted.

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.

Space systems — Liquid rocket engines and test stands — Vocabulary

1 Scope

This document provides terms and definitions for design, tests, reliability analysis and quality control of liquid rocket engines. The terms can be used in all types of documentation and subject-matter literature, related to standardization or use of the results of field-specific works.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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 General

3.1.1

rocket engine

RE

reaction engine that contains within itself, or carry along with itself, all the substances necessary for its operation or for the consumption or combustion of its fuel, not requiring any outside substance

3.1.2

liquid rocket engine

LRE

rocket engine (3.1.1) which uses liquid propellant

3.1.3

liquid-fuelled thruster

LFT

liquid-propellant propulsion device which is used as an actuator in launch vehicles, spacecraft and descent vehicle control systems for acceleration, attitude control, stabilization, trajectory correction, rendezvous, docking, braking, descent, landing and other manoeuvring operations, as well as for generating gravity by imparting acceleration

3.1.4

liquid rocket propulsion system

LRPS

system consisting of *LRE* (3.1.2), propellant tanks, propellant (propellants) feeding system, thrust vector control system and engine control system

3.1.5

clustered liquid rocket propulsion system

CLRPS

liquid rocket propulsion system ([3.1.4](#)) consisting of rocket engines of various applications, which are fed from common propellant tanks, but have autonomous (independent) propellant feed systems

3.1.6

pressure-fed system

system in which propellants are supplied to the *chamber* ([3.2.1](#)) by their expulsion from propellant tanks

3.1.7

pump-fed system

system in which propellants are supplied from the tanks to the *chamber* ([3.2.1](#)) by pumps driven by a turbine, which together form the turbopump unit

3.2 Major engine units

3.2.1

thrust chamber chamber

engine unit where the liquid propellants are metered, injected, atomized, mixed, and burned to form hot, gaseous reaction products, which in turn are accelerated and ejected at high velocity

3.2.2

turbopump TPU

engine unit (component) designed to pump propellant into the *chamber* ([3.2.1](#)), *gas generator* ([3.2.4](#)) and engine control devices and consisting of *pumps* ([3.18.1](#)) and the driving *turbines* ([3.18.5](#))

3.2.3

booster turbopump BTPU

auxiliary *turbopump* ([3.2.2](#)) of the engine designed to increase propellant pressure in the pipelines upstream of the engine *pumps* ([3.18.1](#))

3.2.4

gas generator

engine unit where propellant is chemically converted into exhaust gas

3.3 Engine types based on the cycle configuration

3.3.1

closed cycle engine

engine, in which exhaust gas of the gas generator, after having been used to drive the *turbopump* ([3.2.2](#)), is fed to the *chamber* ([3.2.1](#))

3.3.2

open-cycle engine

engine, in which exhaust gas of the gas generator, after having been used to drive the *turbopump* ([3.2.2](#)), is released into the environment

3.4 Engine types by reusability and multiple-firing capability

3.4.1

expendable engine

engine, designed for a single use as intended

3.4.2

reusable engine

engine, designed for multiple use as intended

3.4.3

single-start engine

engine which performs a single firing during one use as intended

3.4.4

multiple-start engine

engine which performs multiple firings during one use as intended

3.5 Engine types by purpose

3.5.1

main engine

engine, designed to accelerate the vehicle being moved

3.5.2

correction engine

engine, designed to change the velocity when correcting the trajectory of the space vehicle being moved during the coasting flight

3.5.3

control engine

engine, designed to control the velocity vector of the space vehicle being moved during the powered phase

3.5.4

retrorocket engine

engine, designed to reduce the velocity of the space vehicle being moved

3.6 Thrusters types based on the cycle configuration

3.6.1

catalytic liquid-fuelled thruster (LFT)

LFT ([3.1.3](#)) in which propellant is converted into gaseous chemical reaction products using a catalyst

3.6.2

thermo-catalytic liquid-fuelled thruster (LFT)

catalytic LFT ([3.6.1](#)) in which the catalyst is heated by the external heat source

3.6.3

electro-thermo-catalytic engine

thermo-catalytic LFT ([3.6.2](#)) which uses an electrical power source

3.6.4

radio-thermo-catalytic liquid-fuelled thruster (LFT)

thermo-catalytic LFT ([3.6.2](#)) which uses a radioactive power source

3.6.5

thermal liquid-fuelled thruster (LFT)

LFT ([3.1.3](#)) in which the conversion of propellant into gaseous combustion products and the increase in exhaust velocity are achieved by heating the propellant with an external source of energy

Note 1 to entry: Power is supplied to the propellant or products of chemical reactions.

3.6.6

electro-thermal liquid-fuelled thruster (LFT)

thermal LFT ([3.6.5](#)) which uses an electrical power source

3.6.7

radio-thermal liquid-fuelled thruster (LFT)

thermal LFT ([3.6.5](#)) which uses a radioactive power source

3.6.8

electrolytic liquid-fuelled thruster (LFT)

monopropellant LFT (3.1.3) in which where the electrolysis of the propellant is part of the engine cycle

3.6.9

throttleable liquid-fuelled thruster (LFT)

LFT (3.1.3) which has a throttling device

3.7 Basic parameters and performance characteristics of the engine

3.7.1

rated engine operating conditions

set of rated engine parameter values according to the specification

3.7.2

propellant mass flow rate

$\dot{m}$

mass of a propellant passing through a corresponding feed line or valve per unit of time

3.7.3

oxidizer mass flow rate

$\dot{m}_{ox}$

mass of oxidizer passing through a corresponding feed line or valve per unit of time

3.7.4

fuel mass flow rate

$\dot{m}_{fuel}$

mass of fuel passing through a corresponding feed line or valve per unit of time

3.7.5

propellant volume flow rate

Q

volume of a propellant passing through a corresponding feed line or valve per unit of time

3.7.6

oxidizer volume flow rate

Q_{ox}

volume of oxidizer passing through a corresponding feed line or valve per unit of time

3.7.7

fuel volume flow rate

Q_{fuel}

volume of fuel passing through a corresponding feed line or valve per unit of time

3.7.8

prestart flow rate

mass flow rate of a propellant during the period of time, starting from the moment the first firing command is given until the *thrust* (3.7.10) builds up to the value, equal to 5 % of the nominal thrust

3.7.9

engine mass mixture ratio

r_m

ratio of the *oxidizer mass flow rate* (3.7.3) to the *fuel mass flow rate* (3.7.4) during engine operation

3.7.10

engine volume mixture ratio

r_v

ratio of the *oxidizer volume flow rate* (3.7.6) to the *fuel volume flow rate* (3.7.7) during engine operation

3.7.11 chamber pressure

p_c
average static pressure of combustion products at the entry section of the *combustion chamber* (3.12.1) near the *thrust chamber injector head* (3.12.3)

3.7.12 gas generator pressure

p_{gg}
average static pressure of combustion products at the entry section of the *combustion chamber* (3.12.1) near the *gas generator injector head* (3.12.4)

3.7.13 propellant combustion products exhaust velocity exhaust velocity

c_e
exhaust flow velocity at the *nozzle* (3.12.12) exit plane of the engine, determined in a one-dimensional approximation

3.7.14 engine reaction force

resultant of gas and hydrodynamic forces, acting on the internal surfaces of the engine during the expulsion of combustion products

3.7.15 chamber thrust

F
result of the *engine reaction force* (3.7.14) and the ambient pressure forces acting on the engine external surfaces, excluding external aerodynamic drag forces

3.7.16 thrust impulse

I_t
time integral of the *chamber thrust* (3.7.15)

3.7.17 engine afterburn impulse

engine thrust impulse (3.7.16) over a time interval that determines the *engine shutdown* (3.10.8)

3.7.18 engine specific impulse

I_{sp}
ratio of *chamber thrust* (3.7.15) to the propellant *mass flow rate* (3.7.2) of the engine ($I_s = R / \dot{m}$)

Note 1 to entry: Thrust *engine (chamber) specific impulse* (3.7.13) is determined in vacuum ($I_{sp,vac}$) and at sea level ($I_{sp,sl}$).

Note 2 to entry: *engine specific impulse* (3.7.18) also equals the derivative of the *thrust impulse* (3.7.16) with respect to mass or volume of the usable propellant.

Note 3 to entry: For LFT the term “specific impulse” is used for steady-state continuous mode, single firings mode and the steady-state impulse mode.

3.7.19 engine volume specific impulse

$I_{sp/V}$
ratio of the *chamber thrust* (3.7.15) to the *propellant volume flow rate* (3.7.5) of the engine ($I_{sp/V} = F/Q$)

Note 1 to entry: *engine volume specific impulse* (3.7.19) also equals the derivative of the *engine thrust impulse* (3.7.16) with respect to the volume of usable propellant.

3.7.20**chamber thrust coefficient****CF**

ratio of the *chamber thrust* (3.7.15) to the product of the stagnation pressure at the *nozzle throat* (3.14.8), area and the *nozzle flow coefficient* (3.7.26)

3.7.21**chamber specific thrust coefficient** η_i

ratio of the actual chamber specific impulse in vacuum to the ideal (design) value (3.7.25), defined by the same values of mixture ratio, *chamber pressure* (3.7.11) and the *nozzle geometric expansion ratio* (3.15.1)

3.7.22**total chamber specific thrust coefficient**

chamber specific thrust coefficient (3.7.21), defined at the mixture ratio, corresponding to the maximum ideal (design) value

3.7.23**chamber flow characteristic****flow characteristic**

product of the combustion pressure at a specified section of the *thrust chamber* (3.2.1) and the *nozzle throat* (3.14.8), divided by the *propellant mass flow rate* (3.7.2) through the chamber

Note 1 to entry: the specified section of the thrust chamber (3.2.1) may be:

- the initial cross-section of the thrust chamber (3.12.1) near the injector head, when analysing stability of chamber characteristics during serial production;
- the initial nozzle cross-section (3.14.7), when analysing multiphase flows (3.17.4).

3.7.24**thrust ratio**

ratio of the chamber thrust to the product of the gas pressure at the given section of the thrust chamber (3.2.1) and the *nozzle throat* (3.14.8) ($K_{R_{ch}} = R_{ch} / P_{ch} \cdot A_{thr}$)

Note 1 to entry: The thrust ratio also equals the ratio of the *chamber-specific impulse* to the *chamber flow characteristic* (3.7.23).

3.7.25**flow characteristic coefficient**

ratio of the actual *chamber flow rate characteristic* (3.7.23) to the ideal (design) value, determined at the same propellant mixture ratio and chamber pressure

3.7.26**nozzle flow rate coefficient****flow rate coefficient**

ratio of the actual rate of gas flow through the *nozzle* (3.12.12) to the ideal (design) value, defined by the same values of the temperature and stagnation pressure in the *nozzle throat* (3.14.8), gas constant and the local adiabatic exponent

3.7.27**nozzle coefficient**

ratio of the actual *chamber thrust coefficient* (3.7.20) in vacuum to the ideal (design) value, defined by the same values of the mixture ratio, *chamber pressure* (3.7.11) and the *nozzle geometric expansion ratio* (3.15.1) ($\varphi_{ch} = K_{t,s} / K_s$)

3.7.28**chamber coefficient**

ratio of the actual *characteristic velocity* (3.7.29) in the chamber to the ideal (design) value, defined by the same values of the mixture ratio and the *chamber pressure* (3.7.11)