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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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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.

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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

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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

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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

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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
$\dot{m}_{huel}$
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

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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.

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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) ($K_{R_{\text{ch}}} = R_{\text{ch}} / P_{\text{ch}} \cdot A_{\text{thr}}$)

Note 1 to entry: The thrust ratio also equals the ratio of the *chamber-specificimpulse* 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) ($\varphi_{\text{ch}} = \text{K}_{\text{t.s}} / \text{K}_{\text{s}}$)

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)

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3.7.29
characteristic velocity
product of the stagnation pressure in the *nozzle throat* (3.14.8), the throat area, and the nozzle flow *coefficient* (3.7.21), divided by the chamber *mass flow rate* (3.7.2)

3.7.30
chamber ideal parameter value
chamber parameter value, corresponding to the equilibrium flow of combustion products (gas generation products) when there is no heat rejection and no friction

3.7.31
gas generator ideal parameter value
gas generator parameter value, corresponding to the equilibrium flow of combustion products (gas generation products) when there is no heat rejection and no friction

3.7.32
wet mass
mass of the engine structure and propellants filling the pipelines and units

3.7.33
engine altitude characteristic
relation of the *engine thrust* (3.7.15) to the ambient pressure at constant values of the mixture ratio and *the chamber pressure* (3.7.11)

3.7.34
engine throttle characteristic
relation of the *engine thrust* (3.7.15) to the *chamber pressure* (3.7.11) at constant values of the mixture ratio and the ambient pressure

3.8 Engine time characteristics, types of operating time and operating life

3.8.1
propellant supply period
time interval from the moment of full opening of the *solenoid valve* (3.21.1) to the moment of full closure of the solenoid valve

3.8.2
design life
period of time during which the engine is expected to operate within its specified design parameters

3.8.3
engine operating time
either the operating duration or the number of the engine cycles of operation, or both

3.8.4
engine service life
total *engine operating time* (3.8.3) accumulated during the *design life* (3.8.2), when the engine is used as intended

3.8.5
engine service life limit
total *engine operating time* (3.8.3) upon reaching which the operation of the engine can be continued only after a decision is made on the possibility to extend this limit

3.8.6
liquid-fuelled thruster (LFT) total service life limit
service life limit (3.8.5) with respect to firing duration for continuous and pulse modes

Note 1 to entry: In addition to the total service life limit for *LFT* (3.1.3) the service life limit is also determined by the following:

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— number of firings;

— impulse mode duration;

— continuous mode duration;

— total propellant consumption for *catalytic LFT* (3.6.1).

3.9 Thruster performance characteristics

3.9.1
liquid-fuelled thruster (LFT) total thrust impulse
LFT (3.1.3) thrust impulse, at which the mean integral value of thrust or *chamber pressure* (3.7.11) is greater or equal to 0,9 of the steady-state value of the thrust or chamber pressure during one firing

3.9.2
liquid-fuelled thruster (LFT) partial thrust impulse
LFT (3.1.3)*thrustimpulse* at which the mean integral value of thrust or *chamber pressure* (3.7.11) is less than 0,9 of the steady-state value of the thrust or chamber pressure during one firing

3.9.3
liquid-fuelled thruster (LFT) unit impulse
LFT (3.1.3) thrust impulse per one firing when operating in the pulse or single firing mode

3.9.4
liquid-fuelled thruster (LFT) total impulse
LFT (3.1.3) thrust impulse during the service life limit

3.9.5
liquid-fuelled thruster (LFT) impulse
force action of *LFT* (3.1.3), characterized by time change of thrust or c*hamber pressure* (3.7.11) during one firing

3.9.6
liquid-fuelled thruster (LFT) rated thrust
LFT (3.1.3) thrust in the steady-state continuous mode and under rated operating conditions

3.9.7
liquid-fuelled thruster (LFT) firing
time interval from the moment when voltage is supplied to the *LFT* (3.1.3) *solenoid valve* (3.21.1) until the moment when voltage is turned off from the LFT

3.9.8
liquid-fuelled thruster (LFT) afterburn impulse duration
time interval from the moment when voltage is turned off from the *LFT* (3.1.3)electric valve until the moment when *thrust* (3.7.10) or the chamber *pressure* (3.7.11) falls to the value equal to 0ю1 of the thrust or the chamber pressure in the steady-state continuous operating mode

3.9.9
liquid-fuelled thruster (LFT) off-time
time interval from the moment when the voltage is removed from the *LFT* (3.1.3) *solenoid valve* (3.21.1) until the moment when the voltage is supplied for the next firing

3.9.10
liquid-fuelled thruster (LFT) firing cycle
total of LFT firing time and *LFT off-time* (3.9.9)

3.9.11
liquid-fuelled thruster (LFT) firing frequency
value which is reciprocal of *LFT firing cycle* (3.9.10)

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3.9.12
liquid-fuelled thruster (LFT) duty cycle
ratio of the *LFT firing cycle* (3.9.10) to the firing

3.9.13
barrier coefficient for liquid-fuelled thruster (LFT) pulse mode
ratio of the *LFT firing* (3.9.7) to the firing cycle

3.9.14
liquid-fuelled thruster (LFT) thrust build-up time
time interval from the moment when voltage is supplied to the *LFT* (3.1.3) *solenoidvalve* (3.21.1) until the moment when thrust or chamber *pressure* (3.7.11) equals 0,9 of the value of the thrust or chamber pressure in the steady-state continuous mode

3.9.15
liquid-fuelled thruster (LFT) thrust delay
time interval from the moment when voltage is supplied to the LFT solenoid *valve* (3.21.1) until the moment thrust or chamber *pressure* (3.7.11) equals 0,1 of the value of the thrust or chamber pressure in the steady-state continuous mode

3.9.16
liquid-fuelled thruster (LFT) propellant reaction delay
time interval from the moment when propellant is fed to the LFT chamber until the moment when the chamber *pressure* (3.7.11) reaches the value, equal to the pressure when there is no propellant reaction

3.9.17
liquid-fuelled thruster (LFT) propellant ignition delay
time interval from the moment the second propellant enters the *chamber* until the ignition starts

3.9.18
liquid-fuelled thruster (LFT) propellant (fuel, oxidizer) average mass flow rate
ratio of the *LFTpropellant mass flow rate* (3.7.2), consumed per one firing, to the firing

3.10 Engine operating modes

3.10.1
engine operation
performance by the engine of operations necessary to generate thrust or change its values either in direction or magnitude or both, and either provide operational conditions for the components of the moving vehicle or ensure compliance with the established engine requirements or both

3.10.2
engine operating mode
set of the engine parameter values defined by the processes, occurring in the engine

3.10.3
engine main operating mode
engine operating mode (3.10.2) which is critical when performing the main task

3.10.4
engine start
engine operating mode (3.10.2) beginning from the moment the start command is issued and ending when the *main operating mode* (3.10.3) is reached

3.10.5
steady-state operating mode
engine operating mode (3.10.2) when the mean thrust and mixture ratio values remain constant

3.10.6
transient operating mode
engine operating mode (3.10.2) in which the mean thrust and mixture ratio parameters vary over time

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3.10.7
engine preliminary operating mode
steady-state operating mode (3.10.5) in which the thrust is lower than that of the main operating mode

Note 1 to entry: Engine preliminary operating mode is part of the *engine start* (3.10.4).

3.10.8
engine shutdown
eng*ine operating mode* (3.10.2) from the initial shutdown command to the cessation of thrust

3.10.9
engine final operating mode
engine *steady-state operating mode* (3.10.5) prior to the engine shutdown, when the thrust is less than the thrust of the main operating mode

3.10.10
engine firing interval
time interval between the reusable *engine* (3.4.2) shutdown and the first command for the next firing

3.11 Operating modes of liquid-fuelled thruster

3.11.1
liquid-fuelled thruster (LFT) continuous operating mode
LFT (3.1.3) operating mode during one firing with the specific impulse value constant in time

3.11.2
liquid-fuelled thruster (LFT) pulsed operating mode
LFT (3.1.3*)* operating mode with multiple-firing (multiple firings) in which the specific impulse depends on characteristics of each individual firing

Note 1 to entry: Minimum duration of the pulses is limited by the time taken for the thruster valves to open and close, since this limits the repeatability of the process.

3.11.3
liquid-fuelled thruster (LFT) steady-state pulsed mode
LFT pulsed operating mode (3.11.2) when the *pulse shape* (3.9.5) becomes stable at the constant values of *firing frequency* (3.9.11) and shutdown frequency

3.11.4
liquid-fuelled thruster (LFT) operating mode with connected pulses
LFT pulsed operating mode (3.11.2) in which thrust or chamber *pressure* (3.7.11) during pauses between *LFT firings* (3.9.9) decreases to values greater than 0,1 of the steady-state thrust or chamber pressure in continuous operation

3.11.5
liquid-fuelled thruster (LFT) cyclic operating mode
LFT (3.1.3) operating mode consisting of repeating combinations of continuous and pulsed modes or repeating combinations of firings and off-time of different durations

3.11.6
liquid-fuelled thruster (LFT) single-firing mode
LFT (3.1.3) operating mode with off-time periods during which the engine goes back to its original operating state

3.12 Components of the combustion chamber and gas generator

3.12.1
combustion chamber
part of the *chamber* (3.2.1) where propellants burn into combustion products

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3.12.2
combustion chamber of a gas generator
part of the *gas generator* (3.2.4) designed for mixing and converting propellants into gas generation products

3.12.3
thrust chamber injector head
part of the *thrust chamber* (3.2.1) that is a device for feeding either propellants or gas generator exhaust products, or both, into the combustion *chamber* (3.12.1) and for their initial mixing

3.12.4
gas generator injector head
part of the *gas generator* (3.2.4) that is a device for feeding propellants into the *combustion chamber of a gas generator* (3.12.2) and for their initial mixing

3.12.5
bottom of the thrust chamber injector head
element of the thrust *chamber injector head* (3.12.3) that separates the cavities of the propellants or gas generator products (propellants) from each other, or separates them from the combustion space and the external environment

3.12.6
bottom of the gas generator injector head
element of the *gas generator injector head* (3.12.4) that separates the cavities of the propellants from each other, or separates them from the combustion space and the external environment

3.12.7
injector
device for introducing propellants or gas generator products into either the combustion chamber or the gas generator, or both

3.12.8
cooling tract of the chamber
set of channels in the chamber body and the *thrust chamber injector head* (3.12.3) providing either flow cooling or transpiration cooling

3.12.9
cooling tract of the gas generator
set of channels in the chamber body and the *gas generator injector head* (3.12.4) providing either flow cooling or transpiration cooling

3.12.10
chamber film cooling band
element of the *thrust chamber* (3.2.1) designed to introduce one of the propellants or gas generator products (one of the propellants) into the near-wall region of the combustion zone to create a protective layer of liquid or gas

3.12.11
gas generator film cooling band
element of the *gas generator* (3.2.4) designed to introduce one of the propellants or gas generator products (one of the propellants) into the near-wall region of the combustion zone to create a protective layer of liquid or gas

3.12.12
nozzle
part of the *thrust chamber* (3.2.1) that forms a variable cross-section channel, where the thermal energy of combustion products is converted into kinetic energy of the exhaust jet.

Note 1 to entry: The engine nozzle may be either fixed or movable relative to the stationary parts of the *thrust chamber* (3.2.1), and may also include a movable section for thrust vector control

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3.13 Engine nozzle types

3.13.1
axisymmetric nozzle
nozzle (3.12.12) whose internal surface on the side of combustion products flow is symmetric relative to its axis

3.13.2
circular nozzle
axisymmetric nozzle (3.13.1) in which any cross-section of the combustion products flow perpendicular to the symmetry axis is a full circle

3.13.3
conical nozzle
round nozzle (3.13.2), whose diverging part, beginning near the throat section, has a straight contour

3.13.4
contoured nozzle
nozzle (3.12.12) in which the expanding part has a curvilinear contour shaped to increase the efficiency of the nozzle

3.13.5
annular nozzle
axisymmetric nozzle (3.13.1) in which some or all cross-sections of the combustion products flow, perpendicular to the symmetry axis, are ring shaped

3.13.6
pin nozzle
annular nozzle (3.13.5), in which the contour of the expanding part almost entirely or completely lacks an external section

3.13.7
dish-shaped nozzle
annular nozzle (3.13.5), in which the contour of the expanding part almost entirely or completely lacks an internal section

3.13.8
extendable nozzle
nozzle (3.12.12) with one or several extendable skirts that, when deployed, serve as a continuation of the expanding part of the nozzle

3.13.9
skewed nozzle
nozzle (3.12.12), exit of which is inclined to the nozzle axis at the angle, different from the right angle

Note 1 to entry: A skewed nozzle consists of the main axisymmetric part and a small non-axisymmetric part.

3.13.10
adjustable nozzle
nozzle (3.12.12) with a variable expansion ratio that can be changed during operation

3.14 Nozzle components

3.14.1
nozzle profile
line of intersection of the *nozzle* (3.12.12) surface with the plane, passing through the main axis

3.14.2
optimized nozzle profile
contoured nozzle profile, in which the expanding part is determined either through calculations or through experiments, or both, to achieve the require engine performance characteristics

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3.14.3
uniform characteristic nozzle profile
contoured nozzle profile, in which the expanding part provides a parallel flow at the *nozzle exit section* (3.14.10) with a constant velocity at any point of the section

3.14.4
shortened nozzle profile
contoured nozzle profile, in which the expanding part corresponds to the initial section of the expanding contour of a nozzle with a uniform characteristic

3.14.5
nozzle profile with an angular point
nozzle profile (3.14.1) with a break in the contour

3.14.6
nozzle exit section profile
closed line drawn through exit endpoints of all *nozzle profiles* (3.14.1)

3.14.7
initial nozzle cross-section
flow section of the chamber followed by a sharp reduction in the flow section area

3.14.8
nozzle throat
cross-section of the *nozzle* (3.12.12) which has minimum area

3.14.9
critical nozzle cross-section
flow section of the *nozzle* (3.12.12) where combustion products speed is equal to the local sound speed

3.14.10
nozzle exit section
engine nozzle cross-section, which is perpendicular to the central axis and which passes through endpoint of the *nozzle profile* (3.14.1)

Note 1 to entry: For the *annular nozzle* (3.13.5), the exit section runs through the endpoints of the external area of the nozzle *profile* (3.16.1); for the skewed *nozzle* (3.13.9) the exit section runs through the endpoint of the shortest contour.

3.14.11
nozzle converging section
part of the *nozzle* (3.12.12) between the *initial nozzle cross-section* (3.14.7) and the *nozzle throat* (3.14.8)

3.14.12
nozzle diverging section
part of the *nozzle* (3.12.12) between the *nozzle throat* (3.14.8) and the nozzle exit

3.15 Nozzle characteristics

3.15.1
nozzle geometric expansion ratio
ratio of the *nozzle exit section* (3.14.10) to the *nozzle throat* (3.14.8)

3.15.2
gas expansion ratio in the nozzle
ratio of the combustion product total pressure in the *initial nozzle cross-section* (3.14.7) to the static pressure in the exit section

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3.16 Nozzle operating modes

3.16.1
rated operating mode of the nozzle
operating mode of the nozzle, when the gas pressure at the exit section is equal to the ambient pressure

3.16.2
nozzle under-expansion mode
operating mode of the nozzle, when gas pressure in the exit section is higher than the ambient pressure

3.16.3
nozzle over-expansion mode
operating mode of the nozzle, when gas pressure in the exit section is lower than the ambient pressure

3.16.4
nozzle design altitude
altitude above the sea level where the nozzle operating mode is rated under standard atmospheric conditions

Note 1 to entry: Instead of the altitude above the sea level, it is allowed to use the corresponding ambient pressure

3.17 Nozzle flows

3.17.1
equilibrium nozzle flow
nozzle flow, characterized by power, chemical and phase balance of combustion products

3.17.2
non-equilibrium nozzle flow
nozzle flow, which lacks energy, chemical and phase equilibrium of combustion products or at least one of these kinds of equilibrium

3.17.3
chemically frozen nozzle flow
nozzle flow, characterized by constant chemical composition of combustion products

3.17.4
multiphase nozzle flow
nozzle flow, characterized by the availability of gaseous, liquid and solid phases of combustion products

3.17.5
nozzle velocity lag
velocity difference of the condensed phase particle and the gaseous environment in the *nozzle* (3.12.12)

3.17.6
nozzle thermal lag
temperature difference of the condensed phase particle and the gaseous environment in a *nozzle* (3.12.12)

3.17.7
loss of specific impulse in the nozzle
deviation of real values from the ideal of the combustion product parameters in the *nozzle* (3.12.12)

3.18 Turbopump: components

3.18.1
pump
engine unit designed for oxidizer or fuel feed

3.18.2
pre-stage pump inducer
pump impeller (rotating wheel with blades made along a helical surface), installed upstream of the centrifugal pump

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3.18.3
screw centrifugal pump
centrifugal pump with a pre-stage inducer

3.18.4
turbo-screw pump
screw pump with the *turbine* (3.18.5) impeller mounted on the outer surface

3.18.5
turbine
engine unit designed to generate power or driving *pumps* (3.18.1) of the *turbopump* (3.2.2) and other engine systems

3.18.6
booster turbine
gas or hydraulic *turbine* (3.18.5) designed to drive *pumps* (3.20.1) of the booster *turbopump* (3.2.3)

3.18.7
starting turbine
turbine (3.18.5) which provides the *turbopump* (3.2.2) rotor spin-up at the engine *start* (3.10.4)

3.18.8
starting nozzle
nozzle (3.12.12) or a group of nozzles in the stator of the *turbine* (3.18.5) which provides rotor spin-up of the *turbopump* (3.2.2) during engine start

3.18.9
axial unloading automatic device of the turbopump
device that unloads the bearings of the *turbopump* (3.2.2) from axial forces by automatic rotor equilibration

3.18.10
axial unloading automatic device of the booster turbopump
device that unloads the bearings of *the booster turbopump* (3.2.3) from axial forces by automatic rotor equilibration

3.19 Pump characteristics

3.19.1
propellant head
mechanical energy of 1 kg of propellant

3.19.2
pump head
increment of the *propellant head* (3.19.1) which has passed through the *pump* (3.18.1)

3.19.3
pump cavitation stall
sharp reduction of *pump head* (3.19.2) due to cavitation

3.19.4
pump stalling pressure
total pressure at the inlet of the *pump* (3.18.1) which can cause cavitation stall

3.19.5
net positive suction head
NPSH
excess of the *propellant head* (3.19.2) at the pump inlet over the head, corresponding to the saturated-vapour pressure of the liquid

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3.19.6
pump operating design conditions
design conditions
set of conditions defined by constant values of propellant temperature, inlet pressure, flow rate, propellant density and pump angular velocity as specified in the design

3.19.7
pump cavitation characteristic
dependence of the *pump head* (3.21.2) on the pressure on the *pump* (3.18.1) inlet under the *design conditions* (3.19.6)

3.19.8
pump throttling cavitation characteristic
pump cavitation characteristic (3.19.7) in the stall pressure area

3.19.9
head-capacity curve of the pump
dependence of the *pump head* (3.19.2) on the flow rate of the propellant, passing through the pump under *design conditions* (3.19.6)

3.19.10
pump capacity characteristic
dependence of the pump capacity on the flow rate of the propellant, passing through the *pump* (3.18.1) under *design conditions* (3.19.6)

3.19.11
pump efficiency characteristic
dependence of the *pump* (3.18.1) efficiency on the flow rate of the propellant, passing through the pump *under design conditions* (3.19.6)

3.20 Turbopump performance characteristics

3.20.1
turbopump specific mass
turbopump (3.2.2) mass per unit of power, generated by *turbine* (3.18.5)

3.20.2
turbopump unit efficiency
ratio of the total power output of *pumps* (3.18.1) to the total isentropic power of the gas *turbine* (3.18.5)

3.20.3
booster turbopump unit efficiency
ratio of the total power output of *pumps* (3.18.1) to the isentropic power of the gas turbine or theoretical power of the hydraulic turbine

3.21 Engine control devices

3.21.1
solenoid valve
engine valve, the locking device of which is activated by the electromagnet, which is a part of the valve

3.21.2
monopropellant solenoid valve
solenoid valve (3.21.1) which has an oxidizer cavity or a fuel cavity

3.21.3
bipropellant solenoid valve
solenoid valve (3.21.1) which has an oxidizer cavity and a fuel cavity

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3.21.4
hydraulic solenoid valve
engine valve, the locking device of which is activated by the electromagnet and hydraulic drive, which are a part of the valve

3.21.5
chamber pressure switch
device which is triggered when the *chamber pressure* (3.7.11) reaches a specified value

3.22 Devices and methods to create the engine steering efforts

3.22.1
steering chamber
auxiliary *chamber* (3.2.1) designed to create steering efforts

3.22.2
steering nozzle
auxiliary *nozzle* (3.12.12) designed to create steering efforts

3.22.3
jet vane
shaped rotatory component mounted on the combustion product flow near the *nozzle exit section* (3.14.10), which has two acting surfaces streamlined by the flow

3.22.4
nozzle gas injection
introduction of an additional gas flow into the *nozzle diverging section* (3.14.12), causing occurrence of a lateral unbalanced force

3.22.5
nozzle liquid injection
introduction of an additional liquid flow into the *nozzle diverging section* (3.14.12), causing occurrence of a lateral unbalanced force

3.23 Engine cooling

3.23.1
external cooling
heat removal from the engine structural elements to the cooler or into the environment

3.23.2
flow cooling
engine *external cooling* (3.23.1) performed by the cooling agent, flowing through the channels in the wall of the *cooling tract of the chamber* (3.12.8), either *gas generator* or the gas passage, or both

3.23.3
autonomous cooling
engine *flow cooling* (3.23.2) where removed heat is not transferred to propellants

3.23.4
regenerative cooling
engine *flow cooling* (3.23.2) where removed heat is transferred to propellants

3.23.5
radiation cooling
engine *external cooling* (3.23.1) performed by heat emission to the environment

3.23.6
internal cooling
reduction of the heat influx towards engine structural elements by creating a protective liquid or gas layer near their surface

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3.23.7
film cooling
internal cooling (3.23.6) of the engine, in which the protective liquid or gas layer flows along the wall through dedicated film cooling bands of either a chamber or gas generator, or both

3.23.8
transpiration cooling
engine *internal cooling* (3.23.6) performed by gas or steam injection into the gas boundary layer through the porous or perforated wall

3.23.9
capacitive cooling
prevention of the engine structural elements overheating through heat absorption by a material without ablation

3.23.10
ablation cooling
prevention of the engine structural elements overheating through heat absorption by a material with ablation

3.24 Engine thermal protection

3.24.1
thermal protection
set of measures implemented in the engine and the vehicle, which is being moved, that provides an acceptable thermal state

3.24.2
engine thermal state
engine condition characterized by a set of temperatures at its various points

3.24.3
liquid-fuelled thruster (LFT) thermal bridge
LFT (3.1.3)*thermal protection* (3.24.1) element designed as a device with a thermal resistance, intended to modify the heat flow directed towards LFT structure

3.25 Engine test: general

3.25.1
engine test
test designed to assess the engine health or analyse the processes, running in the engine

3.25.2
design development test of the engine
test for engine development, including:

— investigation tests of prototypes of the engine and its components;

— design and technological documentation update based on the test results;

— final design development and interagency tests of prototypes made according to the updated documentation.

3.26 Engine test types: thermal loads

3.26.1
firing test
engine test (3.25.1) with propellant combustion or reaction

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3.26.2
cold test
engine test (3.25.1) without propellant combustion or reaction

3.27 Engine test types: by connection with the vehicle being moved

3.27.1
integrated test
engine test (3.25.1) with the engine as part of the *propulsion system* (3.1.4) or the vehicle being moved

3.27.2
independent test
engine test (3.25.1) outside of the *propulsion system* (3.1.4)

3.28 Engine test types: by test site

3.28.1
ground firing test
simulated engine *firing test* (3.26.1)

3.28.2
engine flight test
engine test (3.25.1) with the engine as part the vehicle being moved, under actual operating conditions in order to determine the engine potential for its use as intended

3.29 Engine test types: by organizational factor and test site

3.29.1
flight development test
FDT
test of the newly designed or upgraded engine as part the vehicle, which is being moved, under actual operating conditions for the purpose of the design and manufacturing documentation update

3.30 Engine test types: by test conditions

3.30.1
high altitude firing test
engine *firing test* (3.26.1) under the low ambient pressure to simulate high altitude conditions

3.30.2
vacuum test
engine *firing test* (3.26.1) in a vacuum chamber under the pressure, lower than1 Pa

3.31 Engine test types: by accelerated data acquisition

3.31.1
accelerated test
accelerated *engine test* (3.25.1) based on the intensification of processes that cause failures or defects

3.32 Engine test types: by test purpose

3.32.1
modifying test
engine investigation test, performed in order to determine the parameter value range, within which the engine is operational

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3.32.2
development test
engine investigation test performed in order to obtain information required for the *engine final design,* (3.44.5), which is in compliance with the specification requirements

3.32.3
final development test
development test (3.32.2) of the *engine final design* (3.44.5) for the purpose of confirming its performance to technical specification requirements and approval for the acceptance test

3.32.4
acceptance test
engine proof test performed at the acceptance inspection, based on the results of which the decision is made on the engine availability for delivery and operation

3.32.5
qualification test
firing test (3.26.1) performed before the start or renewal of a full-scale production for the purpose of confirming the manufacturer availability to produce engines in compliance with the design documentation requirements

3.32.6
model test
proof test of the manufactured engines performed in order to assess that the changes made to the item design and manufacturing process are efficient and practical

3.32.7
technological test
proof test of each sample engine for the purpose of the manufacturing process qualification

Note 1 to entry: technological test may be either firing or cold, with or without overhaul.

3.32.8
random test
proof test of one engine selected from those manufactured within a specified production period

3.32.9
periodic certification test
engine periodic test conducted for the purpose of making the decision to perform the acceptance inspection of each sample manufactured within a specified production period

3.32.10
special periodic test
engine periodic test conducted in order to assess whether the quality of the engines, manufactured to be delivered for operation, is in compliance with the level achieved upon the completion of the design development test

3.33 Types of tests, specific for thrusters

3.33.1
thermal test
thermo-catalytic LFT (3.6.2) or thermal LFT test without propellant feed, with heat supply from an external source

3.33.2
thermal-vacuum test
LFT vacuum test (3.30.2) at the specified temperature of propellants and structural elements

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3.34 Engine test procedures

3.34.1
test profile
either graphical representation or numerical description, or both, of the program of the *engine test* (3.35.1) conditions changes

3.34.2
engine adjustment
setting of the engine control elements in order to provide the specified operating modes

3.34.3
engine thermal conditioning
bringing the temperature of the engine to the specified value and keeping it in the specified range within the specified period

Note 1 to entry: Engine thermal conditioning may be performed simultaneously with propellants conditioning or independently.

3.34.4
propellants thermal conditioning
bringing the temperature of the propellants to the specified value and keeping it in the specified range within the specified period

3.34.5
engine purge
removal of combustion products, *exhaust gas*, atmospheric air and propellant from the engine internal cavities, using excess pressure

3.34.6
engine neutralization
engine processing to either remove the remaining propellant or neutralize the unremoved residue, or both

3.34.7
engine cavities passivation
engine cavity surface processing which results in the filming of material and which does not act on propellants and is inert to their attack on engine cavities

3.34.8
engine fault detection
engine dismantling and health analysis after tests for the purpose of faults detection

3.35 Engine test conditions

3.35.1
test conditions
set of *engine operating modes* (3.10.2), environmental conditions and operating time during tests

3.35.2
operating test conditions
engine *test conditions* (3.35.1) which are in conformance with the conditions specified by the design documentation for the intended use in operation

3.35.3
warranty test conditions
expanded engine test conditions, as compared to the *operating test conditions* (3.35.2), within which, if a failure is detected, measures are taken to remove its cause, or it is confirmed that it is impossible for the failure to occur under operating conditions

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3.35.4
standard test conditions
engine *test conditions* (3.35.1), the parameter values of which are realized during initial nominal stand and *engine adjustment* (3.34.2), and which are characterized by random combinations of external influencing factors within the limits, specified for operation

3.35.5
special test conditions
engine *test conditions* (3.35.1), which are provided by special adjustment of the *stand* (3.45.1) or by *adjustment of the engine* (3.34.2), or special requirements to the environmental factors, or by a combination of these

3.35.6
firing test high-altitude conditions
engine test conditions (3.35.1) which provide complete gas expansion in the *nozzle* (3.12.12)

3.36 Test results

3.36.1
conclusive test result
test result, based on which conclusions can be drawn about the engine health, suitable for its reliability or quality analysis

Note 1 to entry: The same test result, depending on the objectives, set for the reliability and quality analysis, may be considered both conclusive and inconclusive.

3.36.2
inconclusive test result
test result, based on which conclusions cannot be drawn about the engine health, suitable for its reliability or quality analysis

3.37 Engine reliability

3.37.1
engine reliability
engine property to maintain an operable state under specified *operating conditions* (3.40.1)

3.37.2
engine operable state
engine state when it is able to generate thrust at the specified value and direction, meeting the specified requirements to provide specific impulse, mixture ratio and operational conditions for the components of the vehicle, which is being moved

Note 1 to entry: Compliance with the requirements to the engine, specified by the customer, is ensured during the design development tests and deliveries for operation.

3.37.3
non-operable state
engine state when it is not able to fulfil at least one of the requirements, which ensure an operable state

3.37.4
engine health qualification
identification of the status of the engine technical condition

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3.38 Engine defects

3.38.1
structural defect
engine defect caused by inadequate design documentation or violation of either the established design rules or standards, or both

Note 1 to entry: Design documentation is considered to be inadequate, if, when all its requirements are met during the engine manufacturing, it doesn't provide an operable state during operation.

3.38.2
manufacturing defect
engine defect caused by failure to comply with the requirements of the design documentation, inadequate requirements or failure to comply with the requirements of manufacturing documentation during its either manufacturing or repairs, or both

3.38.3
operational defect
engine defect caused by failure to comply with the specified operational conditions

3.39 Engine failure modes

3.39.1
engine failure
event which is disturbance of the *engine operable state* (3.37.2) or identification of non-operable state during tests or operation

3.39.2
engine structural failure
engine failure (3.39.1) resulted from the *structural defect* (3.38.1)

3.39.3
engine manufacturing failure
engine failure (3.39.1) resulted from the *manufacturing defect* (3.38.2)

3.39.4
engine operational failure
engine failure (3.39.1) resulted from the *operational defect* (3.38.3)

3.40 Engine operation

3.40.1
operating conditions
set of conditions specified by the design documentation for engine operation

Note 1 to entry: The set of conditions comprises:

— external influencing factors at all the states of *LRE* (3.1.2) operation;

— 1 *LRE design life* (3.8.2);

— regulations and rules of storage, transportation, maintenance and repairs;

— operating modes and engine operating *time* (3.8.3) when used as intended.

3.40.2
operation cycle
recurrent part of operation from its start till the end of the engine intended use or the moment it is returned for either maintenance or repair, or both, after its intended use

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3.40.3
failure-free operation
operation when the engine remains in operable state during storage, transportation and intended use

Note 1 to entry: For *reusable engines* (3.4.2), *failure-free operation* (3.40.3) comprises also the engine recovery to the *operable state* (3.37.2) of the engine during the period between flights within the time interval, not exceeding the specified one.

3.41 Engine health analysis

3.41.1
operable state parameter
engine parameter used for reliability analysis to characterize one of the engine properties, which ensures the operable state

3.41.2
critical value of the operable state parameter
value of the *operable state* (3.41.1) parameter beyond which the engine is considered to be in *non-operablestate*

3.41.3
operable state parameter margin
difference between the value of the engine *operable state* (3.41.1) parameter during engine tests or operation and its critical value

3.41.4
operational margin of the operable state parameter
operable state parameter margin (3.41.3) under *operatingconditions*

3.41.5
warranty margin of the operable state parameter
margin of the *operable state parameter* (3.41.1) under warranty conditions

3.42 Engine reliability factors

3.42.1
probability of failure-free operation
probability that the engine remains in an operable state under *operating conditions* (3.40.1)

3.42.2
probability of failure-free service life
probability that the engine remains in an operable state throughout all the stages of operation under the specified *operating conditions* (3.40.1)

3.43 Engine quality control

3.43.1
preliminary acceptance inspection
quality control of each engine sample prior to the *acceptance test* (3.32.4)

3.43.2
quality control plan
set of data on the control type and structure, control operations scope, the number of engines tested, the tests frequency and conditions and decision-making rules

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3.43.3
production period
calendar time of the engine production, after which the results of works performed to ensure the quality of engine manufacturing are summed up, decisions are made to improve manufacturing and revise the *quality control plan* (3.43.2), the possibility to start the next engine production is determined, and the report document is released

Note 1 to entry: The manufacturing period can also be determined by the number of engines produced.

3.43.4
disruption of engine production
time from the production of the last engine sample until the renewal of engine production according to the manufacturer plan

3.44 Structural and functional analysis of the engine reliability

3.44.1
structural and functional reliability analysis
quantitative reliability analysis based on engine consideration as the assembly of statistically independent *structural and functional elements* (3.44.2)

3.44.2
structural and functional element
engine component which nominally has one of the properties necessary to ensure its operable state

3.44.3
engine structural and functional diagram
engine diagram presented as *structural and functional elements* (3.44.2)

3.44.4
coefficient of testing conditions exaggeration
ratio of the *engine failure* (3.39.1) possibility at exaggerated *tests* (3.31.1) to the possibility of its failure at normal tests

3.44.5
engine final design
engine design which meets the design documentation requirements, effective by the time of reliability analysis implementation

3.45 Test stands: general

3.45.1
engine test stand
set of technological and support systems placed in a fixed installation, which provide engine testing in order to experimentally determine or confirm the quantitative and (or) qualitative characteristics

3.45.2
test facility
assemblage of the *engine test stand* (3.45.1) and facilities required for the incoming inspection and post-run services

3.45.3
test complex
set of several test stands and other production facilities, combined by a common purpose and providing the execution of a specified scope of work for the preparation and performance of various types of engine tests

3.45.4
test facility base
set of *test complexes* (3.45.3) available to an enterprise or an organization

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3.45.5
stand system
set of structurally interconnected parts and components (united by design documentation) designed to perform one or more tasks to ensure *engine test* (3.25.1)

3.45.6
stand system component
part of the *stand system* (3.45.4) which performs the specified functions and cannot be structurally broken down

3.45.7
liquid rocket engine (LRE) test bay
test bay
test facility area intended for conducting firing tests of a single engine or an engine cluster

3.45.8
auxiliary equipment
set of devices designed to ensure the engine test *stand* (3.45.1) operations for the engine transportation, loading, unloading, mounting and removal

3.46 Test stand types

3.46.1
vertical test stand
engine test stand (3.45.1) with the engine mounted in a starting position so that its gas dynamic axis has vertical or nearly vertical direction

3.46.2
horizontal test stand
engine test stand (3.45.1) with the engine mounted in a starting position so that its gas dynamic axis has vertical or nearly horizontal direction

3.46.3
single-position test stand
engine test stand (3.45.1) with one *test bay* (3.45.6)

3.46.4
multi-position test stand
engine test stand (3.45.1) with several *test bays* that enables testing of two or more engines or their units in a specified sequence

3.47 Stand systems

3.47.1
propellants feed system
stand system (3.45.5) designed to feed propellants to the engine during tests

3.47.2
compressed gas feed system
stand system (3.45.5) designed to feed compressed gas to the stand facilities and the engine

3.47.3
propellants gas saturation system
stand system (3.45.5) designed for propellants saturation with gas

3.47.4
control system
stand system (3.45.5) designed for program control of the engine units actuators and stand systems

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3.47.5
television control system
stand system (3.45.5) designed for television monitoring of the engine or its unit condition when preparing for a test, during a test and during post-run servicing

3.47.6
information and measuring system
stand system (3.45.5) designed to receive, convert and provide the customer with information about parameters of a certain type

3.47.7
toxic disposal neutralization system
stand system (3.45.5) that prevents the arbitrary emission of toxic gas disposal into the atmosphere and ensures their neutralization under special conditions

3.47.8
ventilation system
stand system (3.45.5) facility that provides controllable air exchange in the room of the *stand* (3.47.1)

3.47.9
accumulated hazard materials detection system
stand system (3.45.5) designed for environment composition control at the *stand* (3.47.1) with appropriate audible and luminous signal warnings when the quantity of hazard materials exceeds permissible limits

3.47.10
alarm system
stand system (3.45.5) designed to provide luminous and audible signal warnings when performing hazardous activities at the *engine test stand* (3.45.1)

3.47.11
fire-fighting system
stand system (3.45.5) designed for fire sources extinguishing fires in compartments and rooms of the *engine test stand* (3.45.1)

3.47.12
noise protection system
stand system (3.45.5) that prevents propagation noise from the running engine

3.47.13
stand power supply system
stand system (3.45.5) designed to supply the stand devices with power

3.47.14
stand water supply system
stand system (3.45.5) designed to supply the stand with cold (non-potable and potable) and hot water, intended for service operations

3.47.15
vacuum pumping system
stand system (3.45.5) that provides sub-atmospheric pressure in the cavities of the stand systems and the engine

3.47.16
engine thermal conditioning system
stand system (3.45.5) that ensures bringing the engine structure to a specified temperature and maintaining it within a specified range for a certain period of time

3.47.17
propellants thermal conditioning system
stand system (3.45.5) that ensures bringing propellants to a specified temperature and maintaining it within a specified range for a certain period of time

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3.48 Post-test processing systems

3.48.1
industrial waste water neutralization system
system designed for the neutralization of water contaminated by propellants

3.48.2
engine post-test processing system
system designed to remove residual propellants and combustion products from the engine

3.49 Stand systems devices and components

3.49.1
stand tank
stand system component (3.45.6) for propellant feed which is a vessel to supply propellant during the time period specified by the technical documentation

3.49.2
main stand tank
stand tank (3.49.1) used to store propellants with the volume required for the engine testing under actual operating modes

3.49.3
starting stand tank
stand tank (3.49.1) used to store propellants with the volume required for the engine start and the thrust build-up

3.49.4
stand tank for post-test propellant dump
stand tank (3.49.1) used to receive propellants remaining in either the main or starting tank, or both, and pipelines after testing

3.49.5
emergency discharge stand tank
stand tank (3.49.1) used to receive propellants from either main or starting tanks and pipelines, or all the above, in case of emergency

3.49.6
stand pipeline
piped component of the stand system (3.45.6) for propellant feed

3.49.7
main pipeline
stand pipeline (3.49.6) which runs from the *main stand tank* (3.49.2) to the starting stand tank or directly to the engine

3.49.8
starting pipeline
stand pipeline (3.49.6) which runs from the *starting stand tank* (3.49.3) to the engine

3.49.9
fuelling pipeline
stand pipeline (3.49.6) which runs from the propellant storage to either the main or *starting stand tanks* (3.49.3), or both

3.49.10
flow measuring pipeline section
section of the stand *pipeline* (3.49.6) where instruments that measure the flow rate of the propellant supplied through this pipeline are installed

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3.49.11
gas flow pipe
stand device designed to maintain negative pressure at the engine *nozzle* (3.12.12) exit

3.49.12
gas protective facility
stand facility designed to remove and neutralize toxic fuel propellants ejected from the engine during start and the engine shutdown modes and during post-run services at the *engine test stand* (3.45.1)

3.49.13
after-burner
stand device designed to neutralize toxic and explosive propellants by afterburning

3.49.14
altitude chamber
stand device with the intentional pressure change in its cavity designed to simulate the operating conditions of *LFT* (3.1.3) or its unit located in it

3.49.15
thermal altitude chamber
altitude chamber (3.49.14), in the cavity of which the specified temperature can be either changed or maintained, or both

3.49.16
thrust measuring device
stand device designed to measure force generated by the engine during tests

3.49.17
stand armour plate
stand device which protects the *stand systems components* (3.45.6) and stand equipment from damage in case of emergency

3.49.18
gas vent
stand device designed for closed exhaust of the jet of combustion products in the required direction

3.49.19
flame deflector
gas deflector
firing test stand device (3.28.1) designed to deflect combustion products exhaust jet in the safe direction

3.50 Stand room

3.50.1
firing module
stand room designed to mount and conduct a *firing test* (3.26.1) of the engine or cluster of engines

Note 1 to entry: *Firing module* (3.50.1) is built as an explosion-resistant room, which provides protection for personnel and related facilities in case of emergency during testing.

3.50.2
support compartment
stand room designed to locate support equipment in it

3.50.3
gas distribution compartment
stand room designed to accommodate gas distribution switch boards/panels of the *compressed gas feed system* (3.47.2) in it

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3.50.4
fuel compartment
stand room designed to accommodate *stand tanks* (3.49.1) and other components of the *propellantfeed system* (3.47.1)

3.50.5
oxidizer compartment
stand room designed to accommodate *stand tanks* (3.49.1) and other components of *propellantfeed system* (3.47.1)

3.50.6
propellants thermal conditioning compartment
stand room designed to accommodate propellants thermal conditioning system in it

3.50.7
non-potable water compartment
stand room designed to accommodate water tanks and components of the *stand water supply system* (3.49.14) for the tests of engine, or its components, or devices, or all the above

3.50.8
switching and signal conditioning instrumentation compartment of the measurement system
MS compartment
stand room designed to accommodate converting and switching instrumentation of the information and measuring system

3.50.9
switching instrumentation compartment of the control system
CS compartment
stand room designed to accommodate the control system switching instrumentation in it

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