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Explosive atmospheres —

Part 41: Reciprocating internal combustion engines

Atmosphères explosives —

Partie 41: Moteurs alternatifs à combustion interne

ISO/TMBG

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CONTENTS

FOREWORD 6
1 Scope 8
2 Normative references 9
3 Terms and definitions 11
4 Ignition hazards 13
5 Safety requirements and measures 13
5.1 Requirements according to EPLs 13
5.1.1 General 13
5.1.2 Ignition hazard assessment 14
5.1.3 Joints 14
5.1.4 Electrical systems 15
5.1.5 Electrostatic discharge 17
5.1.6 Safety and automation systems 18
5.1.7 Flame arresters 25
5.1.8 Spark arresters 27
5.1.9 Engine gas path configuration 28
5.1.10 Fuel system 30
5.1.11 Mechanically generated sparks 31
5.2 Specific requirements for EPL Mb 32
5.2.1 Maximum temperature 32
5.2.2 Gas path 32
5.2.3 Connections 32
5.2.4 Air intake system 32
5.2.5 Exhaust system 32
5.2.6 Fans and other rotating parts 33
5.2.7 Compressed air systems 33
5.3 Specific requirements for EPL Gb and EPL Gc 33
5.3.1 Maximum temperature 33
5.3.2 Configuration of flame arresters and spark arresters 34
5.3.3 Gas path 35
5.3.4 Air intake system 35
5.3.5 Exhaust system 35
5.4 Specific requirements for EPL Db and EPL Dc 35
5.4.1 Maximum temperature 35
5.4.2 Air intake system 36
5.4.3 Exhaust system 36
5.4.4 Cold start devices 36
5.4.5 Mechanically generated sparks 36
5.4.6 Compressed air systems 37
6 EPL Gc gaseous fuelled, spark ignited engine 37
6.1 General 37
6.2 Compression ratio 37
6.3 Fuel system 37
6.4 Ignition system 38
6.5 Purge cycle 38

6.5.1 Engine starting 38
6.5.2 Engine shutdown 38
7 Test setup and testing procedures 38
7.1 General 38
7.2 Documentation 38
7.3 Temperature test 38
7.3.1 Purpose of the test 38
7.3.2 Engine operation 39
7.3.3 Test procedure 39
7.3.4 Acceptance criteria 40
7.3.5 Test report / protocol 41
7.4 Pressure determination test 41
7.4.1 General 41
7.4.2 Test gases 41
7.4.3 Test apparatus 42
7.4.4 Test process 43
7.4.5 Acceptance criteria 43
7.4.6 Test report 43
7.5 Static overpressure test 44
7.5.1 General 44
7.5.2 Test apparatus 44
7.5.3 Test procedure 44
7.5.4 Acceptance criteria 44
7.5.5 Test report 44
7.5.6 Testing in sections 44
7.6 Dynamic overpressure test 44
7.6.1 General 44
7.6.2 Acceptance criteria 45
7.6.3 Test report 45
7.6.4 Testing in sections 45
7.7 Flame non-transmission test 45
7.7.1 General 45
7.7.2 Test apparatus 45
7.7.3 Temperature 46
7.7.4 Sensors and measuring equipment 46
7.7.5 Test mixtures 47
7.7.6 Ignition 47
7.7.7 Required / Minimum input information 48
7.7.8 Turbocharged /supercharged engines 48
7.7.9 Naturally aspirated engines 48
7.7.10 Test procedure 49
7.7.11 Acceptance criteria 50
7.7.12 Test report 50
7.8 Crankcase explosion containment test 50
7.8.1 General 50
7.8.2 Apparatus 50
7.8.3 Test procedure 50
7.8.4 Acceptance criteria 51
7.9 Spark arrester tests 51

7.9.1 Dry type 51
7.9.2 Liquid type 51
7.10 Static charge of non-metallic material 51
7.11 Verification of engine control, alarms and shutdown 52
7.12 Leak test for ducts 52
7.13 Conductivity test 52
7.13.1 Test process 52
7.13.2 Acceptance criteria 52
8 Instructions 52
8.1 General 52
8.2 Accompanying documents 53
8.2.1 Group I Mining 53
8.2.2 Group II Flammable gas and vapours 53
8.2.3 Group III Combustible dust 53
8.3 Maintenance inspections 53
8.3.1 Group I Mining 53
8.3.2 Group II Flammable gas and vapours 54
8.3.3 Group III Combustible dust 54
9 Marking 55
9.1 General 55
9.2 EPL Mb 55
9.3 EPL Gb and EPL Gc 56
9.4 EPL Db and EPL Dc 56
Annex A (informative) Engine conditions and ignition sources – Group I equipment 57
A.1 Engine conditions 57
A.1.1 Normal operating conditions 57
A.1.2 Expected malfunctions 57
A.1.3 Rare malfunctions 57
A.2 Ignition sources 58
A.2.1 Hot surfaces 58
A.2.2 Flames and hot gases 58
A.2.3 Sparks 58
A.2.4 Adiabatic compression 58
Annex B (informative) Engine conditions and ignition sources – Group II and Group III equipment – Flammable gas, vapour and combustible dust atmospheres 59
B.1 General 59
B.2 Engine conditions 59
B.2.1 Normal operating conditions 59
B.2.2 Expected malfunctions 59
B.2.3 Rare malfunctions 59
B.3 Ignition sources 60
B.3.1 Hot surfaces 60
B.3.2 Flame and hot gases 60
B.3.3 Sparks 60
B.3.4 Adiabatic compression 60
Annex C (informative) Ignition hazard assessment for reciprocating internal combustion engines 61
C.1 General 61
C.2 Procedure of ignition hazard assessment 61

C.2.1 Formal Ignition hazard identification and assessment 61
C.2.2 Assessment with malfunctions 62
C.2.3 Basic information necessary for the ignition hazard assessment 62
C.3 Ignition hazard assessment report 62
Annex D (informative) Identification of ignition hazards 63
Annex E (informative) Test reports 121
Annex F (normative) Test set up schematics 134
Annex G (informative) Engine types 146
Bibliography 148

Figure 1 – Basic gas path configurations 29
Figure 2 – Pressure determination test 43
Figure 3 – Non-transmission test 46
Figure F.1 – Explosion pressure on the exhaust side under atmospheric condition in a pressure resistant chamber 134
Figure F.2 – Explosion pressure on the exhaust side under atmospheric condition in a closed pipe 135
Figure F.3 – Flame transmission on the exhaust side under atmospheric conditions in a plastic bag and heated flame arresters 136
Figure F.4 – Flame transmission on the exhaust side under atmospheric conditions in an explosion proof chamber and heated flame arresters 137
Figure F.5 – Flame transmission on the exhaust side under atmospheric conditions with plastic bags 138
Figure F.6 – Explosion pressure on the Intake side under atmospheric conditions 139
Figure F.7 – Explosion pressure on the intake side under overpressure conditions in a plastic bag 140
Figure F.8 – Explosion pressure on the intake side under overpressure conditions in an explosion proof chamber 141
Figure F.9 – Explosion pressure on the intake side under overpressure conditions in a closed pipe 142
Figure F.10 – Flame transmission on the intake side under atmospheric conditions in a plastic bag 143
Figure F.11 – Flame transmission on the intake side under overpressure conditions in an explosion proof chamber 144
Figure F.12 – Flame transmission on the intake side under overpressure conditions in a closed pipe 145
Figure G.1 – Engine types 146
Figure G.2 – Engine types – Fuels used 147

Table 1 – Minimum integrity for a safety system for ignition source control 21
Table 2 – Alarms and shutdown 21
Table 3 – Classification of maximum temperatures 34
Table 4 – Configuration of Gb and Gc flame arresters and spark arresters 34
Table 5 – Test gas mixture for the determination of maximum explosion pressures 41
Table 6 – Test gas mixtures for propagation tests 47
Table D.1 – Possible ignition sources 63
Table D.2 – Ignition hazard assessment for EPL Gc or Dc 64

Table D.3 – Ignition hazard assessment for EPL Mb or Gb or Db 92
Table E.1 – Temperature type test report – Relevant data for protocolling 121
Table E.2 – Maximum explosion pressure test - Relevant data for protocolling 125
Table E.3 – Static overpressure test - Relevant data for protocolling 127
Table E.4 – Dynamic overpressure test - Relevant data for protocolling 129
Table E.5 – Flame transmission test - Relevant data for protocolling 131

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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Explosive atmospheres - Part 41: Reciprocating internal combustion engines

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ISO/IEC 80079-41 has been prepared by ISO/IEC subcommittee 31M: Non-electrical equipment and protective systems for explosive atmospheres, of IEC technical committee 3: Equipment for explosive atmospheres. It is an International Standard.

It is published as a double logo International Standard.

The text of this International Standard is based on the following documents:

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31M/XX/FDIS	31M/XX/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table. In ISO, the document was approved by XXX P members out of YYY having cast a vote.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the ISO/IEC 80079 series, published under the general title *Explosive atmospheres*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

– reconfirmed,

– withdrawn, or

– revised.

1 Scope

This part of ISO/IEC 80079 specifies the technical requirements for design, construction, conversion, testing, marking, and the information required for use to avoid or minimise the possibility of ignition which could result from a reciprocating internal combustion engine intended for use in explosive atmospheres including:

– Group I EPL Mb for use in mines susceptible to firedamp,

– Group II EPL Gb and EPL Gc for use in explosive gas atmospheres, and

– Group III EPL Db and EPL Dc for use in explosive dust atmospheres.

For EPL Gc and Dc engines, only normal operating conditions are to be considered. There is no need to consider malfunctions (see B.2.1).

This document includes those tests of the engine and its ancillary devices that are required to verify compliance with this document.

This document applies to reciprocating internal combustion engines with compression ignition for EPL Mb, Gb, Gc, Db, Dc and gaseous fuelled, spark ignition, engines for EPL Gc. (see Annex G.)

This document does not define requirements relating to the driven machinery and equipment.

This document does not apply to

– explosive mixtures of vapours and gases, which tend to self-decompose (for example carbon disulphide (CS_2), ethylene oxide (C_2H_4O), acetylene (C_2H_2) or which are chemically unstable;

– hydrogen fuelled engines;

– engines used in areas for the processing, manufacture or storage of explosives;

– gasoline and other spark ignited engines where the fuel is injected into the combustion chamber as a liquid; or

– electrical ignition spark systems.

NOTE 1 Spark ignition systems used with equipment included in ISO/IEC 80079-41 are covered by IEC 60079-45.

This document solely deals with explosion protection requirements. Requirements on gaseous or particulate exhaust emissions are not covered by this document.

General safety requirements are not included in this document.

NOTE 2 General safety requirements for compression ignition engines are covered, for the EU, in EN 1679-1:1998-A1:2011.

This document does not specify requirements for safety, other than those directly related to the possibility of ignition of flammable mixtures in the surrounding atmosphere, which can lead to an explosion.

This document supplements and modifies the general requirements of IEC 60079-0 and ISO 80079-36. Where a requirement of this document conflicts with a requirement of IEC 60079-0 and ISO 80079-36 as is applicable for Ex engines, the requirement of this document takes precedence.

The standard atmospheric conditions (relating to the explosion characteristics of the atmosphere) under which the engine can be operated are:

– temperature –20 C to +60 C

– pressure 80kPa (0,8bar) to 110kPa (1,1bar); and

– air with normal oxygen content, typically a volume fraction of 21%.

Additional consideration and additional testing are necessary for Ex engines operating outside the standard atmospheric conditions. The ignition hazard assessment, ignition protection provided, additional testing (if necessary), manufacturer's technical documentation and instructions to the user are intended to clearly demonstrate the engine's suitability for the conditions.

NOTE 3 Changes in temperature and pressure have an influence on the characteristics of the explosive atmosphere, including ignitability.

NOTE 4 IEC TS 60079-43 gives information for equipment used in explosive atmospheres in environmental conditions which include ambient temperatures below –20 °C and additional adverse conditions, including maritime applications.

NOTE 5 Reciprocating internal combustion engines are not considered to be pressure vessels.

NOTE 6 Ongoing inspection, maintenance and repair aspects play an important role in control of hazardous area installations and the user's attention is drawn to IEC 60079-17, IEC 60079-19 and IEC 60079-14 and manufacturer's instructions for further information concerning these aspects.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60034-5, *Rotating electrical machines - Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) - Classification*

IEC 60079-0, *Explosive atmospheres - Part 0: Equipment - General requirements*

IEC 60079-1, *Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures "d"*

IEC 60079-10-1, *Explosive atmospheres - Part 10-1: Classification of areas - Explosive gas atmospheres*

IEC 60079-10-2, *Explosive atmospheres - Part 10-2: Classification of areas - Explosive dust atmospheres*

IEC 60079-14:2024, *Explosive atmospheres - Part 14: Electrical installation design, selection and installation of equipment, including initial inspection*

IEC 60079-29-2, *Explosive atmospheres - Part 29-2: Gas detectors - Selection, installation, use and maintenance of detectors for flammable gases and oxygen*

IEC 60079-29-3, *Explosive atmospheres - Part 29-3: Gas detectors - Guidance on functional safety of fixed gas detection systems*

IEC TS 60079-32-1, *Explosive atmospheres - Part 32-1: Electrostatic hazards, guidance*

IEC 60079-32-2, *Explosive atmospheres - Part 32-2: Electrostatics hazards - Tests*

IEC 60079-45, *Electrical ignition systems for internal combustion engines*

IEC TS 60079-46, *Explosive atmospheres - Part 46: Equipment assemblies*

IEC 60204-1:2016*, Safety of machinery - Electrical equipment of machines - Part 1: General requirements*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 61340-2-3, *Electrostatics - Part 2-3: Methods of test for determining the resistance and resistivity of solid materials used to avoid electrostatic charge accumulation*

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

IEC 61511 (all parts), *Functional safety - Safety instrumented systems for the process industry sector*

ISO 1813, *Belt drives - V-ribbed belts, joined V-belts and V-belts including wide section belts and hexagonal belts - Electrical conductivity of antistatic belts: Characteristics and methods of test*

ISO 2710-1, *Reciprocating internal combustion engines - Vocabulary - Part 1: Terms for engine design and operation*

ISO 7967-1, *Reciprocating internal combustion engines - Vocabulary - Part 1: Terms for engine design and operation*

ISO 7967-2, *Reciprocating internal combustion engines – Vocabulary of components and systems - Part 1: Structure and external covers*

ISO 7967-3, *Reciprocating internal combustion engines – Vocabulary of components and systems – Part 2: Main running gear*

ISO 7967-4, *Reciprocating internal combustion engines – Vocabulary of components and systems – Part 4: Pressure changes and air/exhaust gas ducting systems*

ISO 7967-8, *Reciprocating internal combustion engines – Vocabulary of components and systems – Part 8: Starting systems*

ISO 9563:2015, *Belt drives - Electrical conductivity of antistatic endless synchronous belts - Characteristics and test method*

ISO 12100, *Safety of machinery - General principles for design - Risk assessment and risk reduction*

ISO 15510, *Stainless steels - Chemical composition*

ISO 29463 (all parts), *High efficiency filters and filter media for removing particles in air*

ISO 80079-36, *Explosive atmospheres - Part 36: Non-electrical equipment for explosive atmospheres - Basic method and requirements*

ISO 80079-37, *Explosive atmospheres - Part 37: Non-electrical equipment for explosive atmospheres - Non-electrical type of protection constructional safety "c", control of ignition source "b", liquid immersion "k"*

ISO/IEC 80079-38, *Explosive atmospheres - Part 38: Equipment and components in explosive atmospheres in underground mines*

ISO/IEC 80079-49, *Explosive atmospheres - Part 49: Flame arresters - Performance requirements, test methods and limits for use*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 2710-1, ISO 7967-1, ISO 7967-2, ISO 7967-3, ISO 7967-4, ISO 7967-8, IEC 60079-0, IEC 60079-10-1, IEC 60079-10-2, ISO 80079-36, ISO 80079-37, ISO/IEC 80079-38 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

– IEC Electropedia: available at https://www.electropedia.org/

– ISO Online browsing platform: available at https://www.iso.org/obp

3.1
maximum surface temperature
highest temperature which is attained in service under the most adverse operating conditions (but within the recognized tolerance) by any relevant part or surface of the Ex equipment

Note 1 to entry: The maximum surface temperature marked on the equipment includes safety margins depending on the EPL of the equipment.

Note 2 to entry: The surface temperature which is relevant can be internal or external depending upon the Type of Protection concerned.

Note 3 to entry: For Ex equipment in an explosive dust atmosphere, this temperature occurs on the external surface of the enclosure and can include a defined dust layer condition.

Note 4 to entry: This includes exhaust gas temperature and other fluid temperatures that may come in contact with explosive atmospheres.

[SOURCE: IEC 60079-0:2026, 3.62, modified – definition modified and Notes to entry added]

3.2
maximum exhaust gas temperature
highest temperature under the most adverse operating conditions measured at the point where the gas stream first meets the surrounding atmosphere

3.3
gas path
parts of an engine through which air and exhaust gas passes when the engine is running

3.4
flame arrester
FA
device fitted to the opening of an enclosure, or to the connecting pipe work of a system of enclosures, and whose intended function is to allow fluid flow but prevent the transmission of flame

3.5
closed joint
assembly between two parts which is intended to be gas or dust tight or both

3.6
open joint
joint between two parts designed to reduce the heat energy from a gas explosion to the point where it will not ignite an external explosive atmosphere

3.7
spark arrester
device, system, or method which controls the emission from an engine exhaust of particles potentially capable of igniting combustible material in the vicinity by virtue of their size and temperature

3.8
engine control module
ECM
electronic processor managing the transfer of data between engine sensors, actuators, control elements, and information-storage and display units

3.9
safety devices
devices intended for use on, or associated with, an explosion protected engine that are required for, or contribute to, the safe functioning of equipment and protective systems with respect to the risks of explosion

Note 1 to entry: Safety devices differ from the term devices used in the IEC 61508 and IEC 61511 series. Safety devices are comparable to the terms like "safety-related system (IEC 61508)" or "safety instrumented system (IEC 61511)".

Note 2 to entry: In this document the safety devices are intended to reduce the likelihood of a potential ignition source becoming effective.

[SOURCE: ISO 80079-37:2016, modified – "on the engine" and Notes 1 and 2 to entry have been added]

3.10
performance requirements
verifiable requirements related to properties of safety devices and shutdown systems to ensure that the safety function is effective

Note 1 to entry: IEC TS 60079-42 includes information for diagnostics, capacity, functionality, response, effectiveness, integrity, reliability, availability, ability to withstand loads and robustness.

3.11
abnormal combustion
unintended or uncontrolled combustion in the engine

3.12
explosion protection
application of one or more types of protection to minimise the risk of a piece of equipment, apparatus, component, fitting or device causing an ignition of a surrounding explosive gas, vapour, mist or dust atmosphere

3.13
explosion-protected engine
engine with measures applied to the construction to prevent it becoming an ignition source when in an explosive atmosphere