

CSA Standard M424.1 - 2022

Flameproof non-rail-bound diesel-powered machines for use in gassy underground coal mines

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Some History

- French & Mildon report in 1978;
- Canmet - Canadian Explosive Atmospheres Laboratory
– In-house draft document

PRELIMINARY DRAFT (ITERATION NO. 2):

THE CERTIFICATION OF FLAMEPROOF DIESEL-POWERED, RUBBER-TIRED, TRACKLESS, SELF-PROPELLED VEHICLES FOR USE IN UNDERGROUND COAL MINES IN CANADA

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CANADIAN EXPLOSIVE ATMOSPHERES LABORATORY

July, 1979

Prepared as a working document for use by the CSA working group charged with finalizing certification standards

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Some History (continued)

- Creation of M424.1, pub. 1988, 2016
- Reaffirmations 2011, 2020
- M424.1 2022 is 3rd edition

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Three Guiding Principles for New Edition

1. Harmonization as much as possible with MSHA
30CFR Chapter I, Subchapter B, Parts 18 and 36
 - Part 18: Electric Motor-Driven Mine Equipment and Accessories
 - Part 36: Approval Requirements For Permissible Mobile Diesel-Powered Transportation Equipment
2. Explosion protection using IEC principles – IEC 60079 series
3. IEC/ISO 80079-41 - *Reciprocating internal combustion engines*

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Three Guiding Principles for New Edition - Why

- Much equipment is imported from the US;
- Explosion protection technology has advanced but MSHA regs have not – only explosion-proof and one kind of IS are recognized;
- Canada already uses IEC hazloc system;
- ISO/IEC 80079-41
 - Follows IEC system of explosion protection
 - Comprehensive (we have missed some elements)
 - Doesn't recognize MSHA 😞

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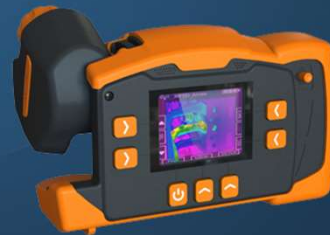
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Explosion Protection - MSHA



Explosion proof
Motors,
switchgear, some
illumination



Intrinsically safe
Portable stuff
Controls
Instrumentation

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Explosion Protection - IEC

Type of Protection Method	Equipment Code	Description	International Standard	Suitable for Zones
Intended to prevent a potential ignition arising	Ex e	Increased safety	IEC 60079-7	1, 2
	Ex nA	Type -n protection	IEC 60079-15	2
Intended to limit the ignition energy of the equipment	Ex ia	Intrinsic safety 'ia'	IEC 60079-11	0, 1, 2
	Ex ib	Intrinsic safety 'ib'	IEC 60079-11	1, 2
	Ex ic	Intrinsic Safety 'ic'	IEC 60079-11	2
	Ex nL	Type -n protection	IEC 60079-15	2
Intended to prevent the explosive atmosphere contacting the ignition source	Ex p	Purge/pressurized protection	IEC 60079-2	1, 2
	Ex px	Purge/pressurized protection 'px'	IEC 60079-2	1, 2
	Ex py	Purge/pressurized protection 'py'	IEC 60079-2	1, 2
	Ex pz	Purge/pressurized protection 'pz'	IEC 60079-2	2
	Ex m	Encapsulation	IEC 60079-18	1, 2
	Ex ma	Encapsulation	IEC 60079-18	0, 1, 2
	Ex mb	Encapsulation	IEC 60079-18	1, 2
	Ex o	Oil immersion	IEC 60079-18	1, 2
Intended to prevent an ignition from escaping outside the equipment	Ex nR	Type -n protection	IEC 60079-15	2
	Ex d	Flameproof protection	IEC 60079-1	1, 2
	Ex q	Sand / powder (quartz) filling	IEC 60079-5	1, 2
Special	Ex nC	Type -n protection	IEC 60079-15	2
Special	Ex s	Special protection	See IEC 60079-0	0, 1, 2

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ISO/IEC 80079-41 - *Reciprocating internal combustion engines*

- Draft standard under preparation;
- Canada and US have a few members on committee, most are European members;
- Covers coal as well as non-coal hazardous locations;
- Covers engines and treatment devices only – not emissions;
- Scheduled to be published late 2023;
- Broad scope means many parts not applicable to u/g coal;
- Could ultimately be used for non-coal hazloc applications – and possibly coal, although does not recognize MSHA at all;
- Some components have been adopted for M424.1, e.g. Ignition Hazard Assessment

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ISO/IEC 80079-41 - *Reciprocating internal combustion engines*

- May be adopted as Canadian Standard, with Canadian deviations;
- Does not cover emissions;
- Will be useful for non-coal hazardous locations – petrochemical industry primarily
 - Gas hazards
 - Dust hazards
 - Both
- CSA ICHL committee

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Regulatory/Legislation

- BC: Occupational Health and Safety Regulation, BC Reg 296/97 (M424.1-88)
- Alberta: Occupational Health and Safety Code 2009 Order, Alta Reg 87/2009 (M424.1-88)
- Quebec: Regulation respecting occupational health and safety in mines, CQLR c S-2.1, r 14 (M424.1-88)
- NS: Underground Mining Regulations, NS Reg 296/2008, M424.1-88 (R2007)
- Canadian Association of Chief Inspectors of Mines provided the link between the published standard and inclusion in mines regulations

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Key Changes

- M424.1 is now supplementary to, or amendatory of, M424.0 – General Requirements
 - As a result many clauses were deleted;
- Added references to MSHA and ISO/IEC 80079-41
- Liquid seal flame arresters – requirement for backup flame arrester removed;
 - harmonizes with MSHA based on many years of experience;
 - IEC/ISO 80079-41 also recognizes liquid seal;
- Explosion Protection Level - EPL Mb (4.1)
 - has sufficient security that it is unlikely to become a source of ignition in normal operation or during expected malfunctions in the time span between there being an outbreak of gas and the equipment being de-energized.

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Key Changes (continued)

- Ignition hazard assessment (4.5)
 - a general checklist for explosion safety;
 - hot surfaces; mechanical sparks; flames, hot gases and hot particles; electrical sparks; stray electric currents and cathodic corrosion protection; static electricity; adiabatic compression; and chemical reaction.
- Air intake shutoff valve – now only required to function in event of engine overspeed;
- Intra-machine wiring
 - Removed the requirement for cable shielding (harmonizes with MSHA)
 - Harmonized many wiring requirements with ISO/IEC 80079-41

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Key Changes (continued)

- Foreseeable electrostatic charge-generating mechanism (ISO/IEC 80079-41)
 - normally moving parts, such as fan impellers, V-belts, and conveyor belts
 - Harmonized with ISO/IEC
- Air intake system
 - Air intake shutoff valve now only required to function in event of engine overspeed;
 - Intake velocity at idle to be >3 m/s at flame arrester to limit flame stabilization;
 - Clear permission to allow turbocharger;

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Key Changes (continued)

- Intra-machine wiring
 - Removed the requirement for cable shielding (harmonizes with MSHA)
 - Harmonized many wiring requirements with ISO/IEC 80079-41 (general workmanship issues)
- Exhaust system
 - Recognizes 4 types of flame arresters (liquid seal, stacked-plate, crimped metal ribbon, porous media;
- Braking system
 - Only temperature issues retained;
- Lighting, hydraulics, pneumatics, fire protection

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