



Diesel-powered machines for use in non-gassy underground mines



Legal Notice for Standards

Canadian Standards Association (operating as “CSA Group”) develops standards through a consensus standards development process approved by the Standards Council of Canada. This process brings together volunteers representing varied viewpoints and interests to achieve consensus and develop a standard. Although CSA Group administers the process and establishes rules to promote fairness in achieving consensus, it does not independently test, evaluate, or verify the content of standards.

Disclaimer and exclusion of liability

This document is provided without any representations, warranties, or conditions of any kind, express or implied, including, without limitation, implied warranties or conditions concerning this document’s fitness for a particular purpose or use, its merchantability, or its non-infringement of any third party’s intellectual property rights. CSA Group does not warrant the accuracy, completeness, or currency of any of the information published in this document. CSA Group makes no representations or warranties regarding this document’s compliance with any applicable statute, rule, or regulation.

IN NO EVENT SHALL CSA GROUP, ITS VOLUNTEERS, MEMBERS, SUBSIDIARIES, OR AFFILIATED COMPANIES, OR THEIR EMPLOYEES, DIRECTORS, OR OFFICERS, BE LIABLE FOR ANY DIRECT, INDIRECT, OR INCIDENTAL DAMAGES, INJURY, LOSS, COSTS, OR EXPENSES, HOWSOEVER CAUSED, INCLUDING BUT NOT LIMITED TO SPECIAL OR CONSEQUENTIAL DAMAGES, LOST REVENUE, BUSINESS INTERRUPTION, LOST OR DAMAGED DATA, OR ANY OTHER COMMERCIAL OR ECONOMIC LOSS, WHETHER BASED IN CONTRACT, TORT (INCLUDING NEGLIGENCE), OR ANY OTHER THEORY OF LIABILITY, ARISING OUT OF OR RESULTING FROM ACCESS TO OR POSSESSION OR USE OF THIS DOCUMENT, EVEN IF CSA GROUP HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, INJURY, LOSS, COSTS, OR EXPENSES.

In publishing and making this document available, CSA Group is not undertaking to render professional or other services for or on behalf of any person or entity or to perform any duty owed by any person or entity to another person or entity. The information in this document is directed to those who have the appropriate degree of experience to use and apply its contents, and CSA Group accepts no responsibility whatsoever arising in any way from any and all use of or reliance on the information contained in this document.

CSA Group is a private not-for-profit company that publishes voluntary standards and related documents. CSA Group has no power, nor does it undertake, to enforce compliance with the contents of the standards or other documents it publishes.

Intellectual property rights and ownership

As between CSA Group and the users of this document (whether it be in printed or electronic form), CSA Group is the owner, or the authorized licensee, of all works contained herein that are protected by copyright, all trade-marks (except as otherwise noted to the contrary), and all inventions and trade secrets that may be contained in this document, whether or not such inventions and trade secrets are protected by patents and applications for patents. Without limitation, the unauthorized use, modification, copying, or disclosure of this document may violate laws that protect CSA Group’s and/or others’ intellectual property and may give rise to a right in CSA Group and/or others to seek legal redress for such use, modification, copying, or disclosure. To the extent permitted by licence or by law, CSA Group reserves all intellectual property rights in this document.

Patent rights

Attention is drawn to the possibility that some of the elements of this standard may be the subject of patent rights. CSA Group shall not be held responsible for identifying any or all such patent rights. Users of this standard are expressly advised that determination of the validity of any such patent rights is entirely their own responsibility.

Authorized use of this document

This document is being provided by CSA Group for informational and non-commercial use only. The user of this document is authorized to do only the following:

If this document is in electronic form:

- load this document onto a computer for the sole purpose of reviewing it;
- search and browse this document; and
- print this document if it is in PDF format.

Limited copies of this document in print or paper form may be distributed only to persons who are authorized by CSA Group to have such copies, and only if this Legal Notice appears on each such copy.

In addition, users may not and may not permit others to

- alter this document in any way or remove this Legal Notice from the attached standard;
- sell this document without authorization from CSA Group; or
- make an electronic copy of this document.

If you do not agree with any of the terms and conditions contained in this Legal Notice, you may not load or use this document or make any copies of the contents hereof, and if you do make such copies, you are required to destroy them immediately. Use of this document constitutes your acceptance of the terms and conditions of this Legal Notice.



Standards Update Service

CSA M424.2:22

March 2022

Title: *Diesel-powered machines for use in non-gassy underground mines*

To register for e-mail notification about any updates to this publication

- go to www.csagroup.org/store/
- click on **Product Updates**

The **List ID** that you will need to register for updates to this publication is **2429866**.

If you require assistance, please e-mail techsupport@csagroup.org or call 416-747-2233.

Visit CSA Group's policy on privacy at www.csagroup.org/legal to find out how we protect your personal information.

Canadian Standards Association (operating as “CSA Group”), under whose auspices this National Standard has been produced, was chartered in 1919 and accredited by the Standards Council of Canada to the National Standards system in 1973. It is a not-for-profit, nonstatutory, voluntary membership association engaged in standards development and certification activities.

CSA Group standards reflect a national consensus of producers and users — including manufacturers, consumers, retailers, unions and professional organizations, and governmental agencies. The standards are used widely by industry and commerce and often adopted by municipal, provincial, and federal governments in their regulations, particularly in the fields of health, safety, building and construction, and the environment.

More than 10 000 members indicate their support for CSA Group’s standards development by volunteering their time and skills to Committee work.

CSA Group offers certification and testing services in support of and as an extension to its standards development activities. To ensure the integrity of its certification process, CSA Group regularly and continually audits and inspects products that bear the CSA Group Mark.

In addition to its head office and laboratory complex in Toronto, CSA Group has regional branch offices in major centres across Canada and inspection and testing agencies in fourteen countries. Since 1919, CSA Group has developed the necessary expertise to meet its corporate mission: CSA Group is an independent service organization whose mission is to provide an open and effective forum for activities facilitating the exchange of goods and services through the use of standards, certification and related services to meet national and international needs.

For further information on CSA Group services, write to
CSA Group
178 Rexdale Boulevard
Toronto, Ontario, M9W 1R3
Canada

A National Standard of Canada is a standard developed by a Standards Council of Canada (SCC) accredited Standards Development Organization, in compliance with requirements and guidance set out by SCC. More information on National Standards of Canada can be found at www.scc.ca.

SCC is a Crown corporation within the portfolio of Innovation, Science and Economic Development (ISED) Canada. With the goal of enhancing Canada's economic competitiveness and social well-being, SCC leads and facilitates the development and use of national and international standards. SCC also coordinates Canadian participation in standards development, and identifies strategies to advance Canadian standardization efforts.

Accreditation services are provided by SCC to various customers, including product certifiers, testing laboratories, and standards development organizations. A list of SCC programs and accredited bodies is publicly available at www.scc.ca.

Standards Council of Canada
600-55 Metcalfe Street
Ottawa, Ontario, K1P 6L5
Canada



Cette Norme Nationale du Canada n'est disponible qu'en anglais.

Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users to judge its suitability for their particular purpose.

®A trademark of the Canadian Standards Association, operating as “CSA Group”

National Standard of Canada

CSA M424.2:22

***Diesel-powered machines for use in
non-gassy underground mines***



*®A trademark of the Canadian Standards Association,
operating as “CSA Group”*



*Published in March 2022 by CSA Group
A not-for-profit private sector organization
178 Rexdale Boulevard, Toronto, Ontario, Canada M9W 1R3*

*To purchase standards and related publications, visit our Online Store at www.csagroup.org/store/
or call toll-free 1-800-463-6727 or 416-747-4044.*

*ICS 73.100.01
ISBN 978-1-4883-4124-3*

*© 2022 Canadian Standards Association
All rights reserved. No part of this publication may be reproduced in any form whatsoever
without the prior permission of the publisher.*

Contents

Technical Committee on Underground Mining Mobile Equipment	3
Subcommittee on Diesel-Powered Machines for Use in Underground Mines	6
Preface	8
1 Scope	10
1.1 Inclusions	10
1.2 Exclusions	10
1.3 Terminology	10
2 Reference publications	10
3 Definitions	11
4 Engine requirements	12
4.1 General safety requirements	12
4.2 Fuel system	12
4.2.1 Fuel and fuel tanks	12
4.2.2 Fuel tank filling and venting	12
4.2.3 Fuel shutoff	13
4.2.4 Fuel transfer lines	13
4.3 Engine adjustment and settings	13
4.3.1 Maximum fuel rate	13
4.3.2 Adjustable components	13
4.3.3 Maximum fuel injection rate	13
4.3.4 Fuel	14
4.3.5 Maximum rated output	14
4.3.6 Dynamometer testing	14
4.4 Engine equipment	14
4.4.1 Electrical components	14
4.4.2 Protection and control	14
4.4.3 Starting and charging batteries	14
4.4.4 Engine ignition switch and main switch	14
4.4.5 Starting system	14
4.4.6 Engine intake system	15
4.4.7 Engine crankcase ventilation	15
4.4.8 Engine exhaust system	15
4.4.9 Engine cooling system	15
4.5 Fire prevention requirements	15
4.5.1 Fire-resistant materials	15
4.5.2 Mechanical protection	15
4.6 Exhaust emissions requirements	15
4.6.1 Fuel rate setting	15
4.6.2 Fuel alteration system	16
4.6.3 Exhaust treatment devices	16

4.6.4 Emissions toxicity criterion 16

5 Machine performance tests 17

5.1 Fuel tank leak check 17

5.2 Fire prevention tests 17

5.2.1 Fire-resistant materials tests 17

5.2.2 Hose tests 17

5.3 Dynamometer emissions tests 17

5.4 Assessed ventilation 17

6 Markings 18

Annex A (normative) — Additional requirements for M424.1 coal and gassy mine engines 19

Annex B (informative) — Rationale for removal of the Exhaust Quality Index (EQI) concept 20

Technical Committee on Underground Mining Mobile Equipment

D. A. Young	CanmetMINING, Natural Resources Canada, Ottawa, Ontario, Canada <i>Category: General Interest</i>	<i>Chair</i>
C. Allen	Vale, Copper Cliff, Ontario, Canada <i>Category: User Interest</i>	<i>Vice-Chair</i>
C. Allair	United Steelworkers, Onaping, Ontario, Canada <i>Category: General Interest</i>	
B. M. Baldwin	Baldwin Services Inc., Saskatoon, Saskatchewan, Canada <i>Category: User Interest</i>	
R. Deayton	Mammoth Equipment & Exhaust, Winnipeg, Manitoba, Canada	<i>Non-voting</i>
H. Demers	Barrick Gold — Hemlo Mine, Marathon, Ontario, Canada <i>Category: User Interest</i>	
M. Endicott	J.H. Fletcher & Co., Huntington, West Virginia, USA <i>Category: Producer Interest</i>	
J. Flanagan	Caterpillar Inc., Peoria, Illinois, USA <i>Category: Producer Interest</i>	
M. Gendron	Mines Seleine, Grosse-Île, Québec, Canada	<i>Non-voting</i>
R. Gibbs	Dry Systems Technologies, Woodridge, Illinois, USA	<i>Non-voting</i>
A. Gibouleau	J&S Manufacturing, Spanish, Ontario, Canada <i>Category: Producer Interest</i>	

A. Gillies	Sandvik Mining, Brier Hill, Pennsylvania, USA	<i>Non-voting</i>
A. Griffiths	MacLean Engineering, Collingwood, Ontario, Canada	<i>Non-voting</i>
S. Holmik	Sudbury Integrated Nickel Operations, Falconbridge, Ontario, Canada <i>Category: User Interest</i>	
C. Ingram	Workers' Safety and Compensation Commission (WSCC), Yellowknife, Northwest Territories, Canada	<i>Non-voting</i>
L. Kaskiw	Government of Saskatchewan Ministry of Labour Relations and Workplace Safety, Saskatoon, Saskatchewan, Canada <i>Category: Regulatory Authority</i>	
J. Le	CanmetMINING, Natural Resources Canada, Sudbury, Ontario, Canada	<i>Non-voting</i>
C. J. LeBlanc	Nova Scotia Department of Labour and Advanced Education, Sydney, Nova Scotia, Canada <i>Category: Regulatory Authority</i>	
G. Lobay	CSA Consumer Network, Ottawa, Ontario, Canada <i>Category: General Interest</i>	
C. Matikainen	Ontario Ministry of Labour, Training and Skills Development, Sudbury, Ontario, Canada <i>Category: Regulatory Authority</i>	
G. Mehta	Sandvik, Sudbury, Ontario, Canada	<i>Non-voting</i>
D. Murray	Nutrien Allan Potash, Allan, Saskatchewan, Canada <i>Category: User Interest</i>	

J. V. Robinson	British Columbia Ministry of Energy, Mines and Low Carbon Innovation, Smithers, British Columbia, Canada <i>Category: Regulatory Authority</i>	<i>Non-voting</i>
B. Rubeli	CanmetMINING, Natural Resources Canada, Ottawa, Ontario, Canada	<i>Non-voting</i>
D. Schmidt	Kovatera, Lively, Ontario, Canada	<i>Non-voting</i>
P. Sparenberg	MTU America Inc., Novi, Michigan, USA	<i>Non-voting</i>
M. St-Pierre	Commission des normes, de l'équité, de la santé et de la sécurité du travail (CNESST), Val d'Or, Québec, Canada <i>Category: Regulatory Authority</i>	
E. J. Stirling	Columbus, Indiana, USA	<i>Non-voting</i>
P. Summers	Miller Technology Inc., North Bay, Ontario, Canada <i>Category: Producer Interest</i>	
B. Surampudi	Southwest Research Institute, San Antonio, Texas, USA <i>Category: Producer Interest</i>	
A. Tchouvelev	A.V. Tchouvelev & Associates Inc., Mississauga, Ontario, Canada <i>Category: General Interest</i>	
R. Tiangco	Vale, Copper Cliff, Ontario, Canada	<i>Non-voting</i>
T. Donovska	CSA Group, Toronto, Ontario, Canada	<i>Project Manager</i>

Subcommittee on Diesel-Powered Machines for Use in Underground Mines

B. Rubeli	CanmetMINING, Natural Resources Canada, Ottawa, Ontario, Canada	<i>Chair</i>
A. Bentley	Cummins Inc., Columbus, Indiana, USA	
R. Deayton	Mammoth Equipment & Exhaust, Winnipeg, Manitoba, Canada	
H. Demers	Barrick Gold — Hemlo Mine, Marathon, Ontario, Canada	
J. Flanagan	Caterpillar Inc., Peoria, Illinois, USA	
R. Gibbs	Dry Systems Technologies, Woodridge, Illinois, USA	
A. Gibouleau	J&S Manufacturing, Spanish, Ontario, Canada	
J. Le	CanmetMINING, Natural Resources Canada, Sudbury, Ontario, Canada	
C. J. LeBlanc	Nova Scotia Department of Labour and Advanced Education, Sydney, Nova Scotia, Canada	
G. Lobay	CSA Consumer Network, Ottawa, Ontario, Canada	
C. Matikainen	Ontario Ministry of Labour, Training and Skills Development, Sudbury, Ontario, Canada	
G. Mehta	Sandvik, Sudbury, Ontario, Canada	

D. Murray	Nutrien Allan Potash, Allan, Saskatchewan, Canada	
J. V. Robinson	British Columbia Ministry of Energy, Mines and Low Carbon Innovation, Smithers, British Columbia, Canada	
D. Schmidt	Kovatera, Lively, Ontario, Canada	
P. Sparenberg	MTU America Inc., Novi, Michigan, USA	
E. J. Stirling	Columbus, Indiana, USA	
P. Summers	Miller Technology Inc., North Bay, Ontario, Canada	
R. Tiangco	Vale, Copper Cliff, Ontario, Canada	
D. A. Young	CanmetMINING, Natural Resources Canada, Ottawa, Ontario, Canada	
T. Donovska	CSA Group, Toronto, Ontario, Canada	<i>Project Manager</i>

Preface

This is the third edition of CSA M424.2, *Diesel-powered machines for use in non-gassy underground mines*. It supersedes the previous editions published in 1990 and 2016.

Changes to this edition include:

- a) the Scope has been expanded to include larger and more varied types of diesel-powered machines;
- b) non-engine related general machine safety requirements have been transferred to CSA M424.0;
- c) engine emissions testing pass/fail criteria have been lowered to reflect modern technologies;
- d) EQI concept for ventilation rate determination has been removed;
- e) ventilation rate determination for retrofit emission control devices has been enabled; and
- f) various Clauses throughout the Standard have either been updated or renumbered to comply with current administrative requirements.

CSA group acknowledges that the development of this Standard was made possible, in part, by the financial support of CanmetMINING, Lands and Minerals Sector, Department of Natural Resources Canada.

This Standard was developed by CSA Group with funding support provided by the Canadian Association of Administrators of Labour Law — Occupational Safety and Health (CAALL-OSH), including provincial and territorial governments, as well as the Government of Canada. CSA Group is solely responsible for the content of this Standard, and CSA Group and the funding bodies disclaim any liability in connection with the use of the information contained herein.

This Standard was prepared by the Subcommittee on Diesel-Powered Machines for Use in Underground Mines, under the jurisdiction of the Technical Committee on Underground Mining Mobile Equipment and the Strategic Steering Committee on Occupational Health and Safety, and has been formally approved by the Technical Committee.

This Standard has been developed in compliance with Standards Council of Canada requirements for National Standards of Canada. It has been published as a National Standard of Canada by CSA Group.

Notes:

- 1) *Use of the singular does not exclude the plural (and vice versa) when the sense allows.*
- 2) *Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.*
- 3) *This Standard was developed by consensus, which is defined by CSA Policy governing standardization – Code of good practice for standardization as “substantial agreement. Consensus implies much more than a simple majority, but not necessarily unanimity”. It is consistent with this definition that a member may be included in the Technical Committee list and yet not be in full agreement with all clauses of this Standard.*
- 4) *To submit a request for interpretation of this Standard, please send the following information to inquiries@csagroup.org and include “Request for interpretation” in the subject line:*
 - a) *define the problem, making reference to the specific clause, and, where appropriate, include an illustrative sketch;*
 - b) *provide an explanation of circumstances surrounding the actual field condition; and*
 - c) *where possible, phrase the request in such a way that a specific “yes” or “no” answer will address the issue.*

Committee interpretations are processed in accordance with the CSA Directives and guidelines governing standardization and are available on the Current Standards Activities page at standardsactivities.csa.ca.

- 5) *This Standard is subject to review within five years from the date of publication. Suggestions for its improvement will be referred to the appropriate committee. To submit a proposal for change, please send the following information to inquiries@csagroup.org and include "Proposal for change" in the subject line:*
- a) *Standard designation (number);*
 - b) *relevant clause, table, and/or figure number;*
 - c) *wording of the proposed change; and*
 - d) *rationale for the change.*

CSA M424.2:22

Diesel-powered machines for use in non-gassy underground mines

1 Scope

1.1 Inclusions

This Standard describes the technical requirements and procedures necessary for the design, performance, and testing of new or unused diesel engines for use in non-gassy underground mines.

Note: See CSA M424.1 for additional explosion-proof construction and performance requirements for diesel-powered machines for use in gassy underground coal mines.

1.2 Exclusions

Machine design and performance requirements are not included in the Scope of this Standard.

Braking system performance requirements and proof tests are not included in the Scope of this Standard.

Notes:

- 1) See CSA M424.0 and CSA M424.4 for general underground mining vehicle performance requirements.
- 2) See CSA M424.3 for brake construction, stopping performance, and test requirements.

1.3 Terminology

In this Standard, “shall” is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the standard; “should” is used to express a recommendation or that which is advised but not required; and “may” is used to express an option or that which is permissible within the limits of the Standard.

Notes accompanying clauses do not include requirements or alternative requirements; the purpose of a note accompanying a clause is to separate from the text explanatory or informative material.

Notes to tables and figures are considered part of the table or figure and may be written as requirements.

Annexes are designated normative (mandatory) or informative (nonmandatory) to define their application.

2 Reference publications

This Standard refers to the following publications, and where such reference is made, it shall be to the edition listed below, including all amendments published thereto.

CSA Group

C22.1:21

Canadian electrical code, Part I (25th edition), Safety Standard for Electrical Installations