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**C838-13**

# Energy efficiency test methods for three-phase variable frequency drive systems

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# Preface

This is the first edition of CSA C838, *Energy efficiency test methods for three-phase variable frequency drive systems*.

Variable frequency drives (VFDs) have the ability to vary the speed of the motor from 0% to its full range at an infinite range of torque. This Standard defines a testing methodology that provides performance information that can assist with the process of selecting a VFD adequate to the motor driven process. It is estimated that 30% of all industrial motor systems can potentially be improved by the use of VFDs to control speed and torque, resulting in large energy savings.

CSA acknowledges that the development of this Standard was made possible, in part, by the financial support of BC Hydro, Efficiency Nova Scotia, Hydro-Québec, Manitoba Hydro, Natural Resources Canada (NRCan), the Ontario Ministry of Energy (OME), the Ontario Power Authority (OPA), and the Canadian Electricity Association (CEA).

This Standard was prepared by Subcommittee on Variable Frequency Drives under the jurisdiction of the Technical Committee on Industrial Equipment and the Strategic Steering Committee on Performance, Energy Efficiency, and Renewables, and has been formally approved by the Technical Committee.

## 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.
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  - (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](http://standardsactivities.csa.ca).
- (5) This Standard is subject to periodic review, and 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](mailto: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.



# C838-13

## ***Energy efficiency test methods for three-phase variable frequency drive systems***

### **1 Scope**

#### **1.1**

This Standard establishes the testing procedure for determining efficiencies under varying loads and speeds for three-phase output variable frequency drives (VFDs) with rated voltage up to 750 V. This test procedure is limited to a combination of one motor with one drive.

This Standard applies to voltage source inverter (VSI) pulse-width modulated (PWM) drives for squirrel-cage induction motors and other three-phase VFD technologies commonly used with permanent magnet and reluctance motor-drive systems.

This Standard does not cover VFDs with a rated voltage rating greater than 750 V.

Ancillary equipment are not to be included unless they are contained within the confines of the input and output terminals of the VFD device, or a mandatory requirement for the operation of the VFD.

**Note:** *Small motors supplied with special purpose VFDs of the single-phase type are covered by CSA C747.*

#### **1.2**

In CSA standards, “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 (non-mandatory) 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**

C22.1-12

*Canadian Electrical Code, Part I*

CSA C22.2 No. 14-10

*Industrial control equipment*

CSA C22.2 No. 100-04 (R2009)

*Motors and generators*