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CSA C392:20
National Standard of Canada

Testing of three-phase squirrel cage induction motors during refurbishment

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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.

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Preface

This is the second edition of CSA C392, *Testing of three-phase squirrel cage induction motors during refurbishment*. It supersedes the previous edition published in 2011.

Changes have been made throughout the standard. Test procedures have been reorganized for clarity. Requirements have been updated to reflect current capability of test equipment. Requirements for test procedures have been made mandatory. A new non-mandatory Annex has been added that describes a method to determine efficiency estimation based on no-load tests.

CSA Group acknowledges that the development of this Standard was made possible, in part, by the financial support of BC Hydro, Canadian Electricity Association (CEA), and Hydro Québec, Independent Electricity Service Operator (IESO), Manitoba Hydro, and Natural Resources Canada (NRCan).

This Standard is considered suitable for use for conformity assessment within the stated scope of the Standard.

This Standard was prepared by the Subcommittee on Motor Refurbishment, 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.

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.*
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   b) *provide an explanation of circumstances surrounding the actual field condition; and*
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   a) *Standard designation (number);*
   b) *relevant clause, table, and/or figure number;*
   c) *wording of the proposed change; and*
   d) *rationale for the change.*

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Testing of three-phase squirrel cage induction motors during refurbishment

0 Introduction

This Standard provides guidance to electric motor service centres to assist in verifying that the refurbishing process has maintained or enhanced electric motor (hereafter motor) efficiency. It is also intended to provide a reliable evaluation of any changes in the condition of a motor, with respect to its efficiency, that might have resulted from its failure.

The intent of this Standard is not to prescribe which tests should be performed on any given motor requiring repairs; rather, it is to establish a consistent methodology for conducting the tests described herein. The applicability of these tests depends on the type of failure encountered, the repair work to be performed, and the need to confirm that no change in efficiency has occurred as a result of damage to the motor and its repair. The motor end user and the service centre should mutually determine which tests are applicable or useful in a given situation to establish the scope of testing during the repair process.

Motor efficiency can be depreciated by the damage caused during motor operation or failure mode. In cases where the test results do not comply with the pass/fail criteria, it is not the intent of this Standard to require that the motor be removed from service. However, the test results might assist in future repair/replace decisions and future energy conservation planning.

The tests and pass/fail criteria are standard in the motor service centre industry in North America.

There are many additional tests and inspection procedures employed when refurbishing AC motors that are not part of this Standard because they are not directly related to motor efficiency. Many of these additional tests are available in the publications referenced in Clause 2 and Annex E. Not all of these tests can or should be administered on every motor that is to be refurbished. It is the responsibility of the motor service centre in consultation with the end user to determine which inspections and tests are applicable.

The tables and calculation procedures, provided in this Standard to estimate the impact on motor nominal efficiency, contain typical data and should be used with the understanding that these procedures are estimates based on the information available and that actual results can vary.

1 Scope

1.1

This Standard covers integral horsepower, three-phase, alternating current, squirrel cage induction motors rated up to 15 kV at 50/60 Hz. This Standard also covers inverter duty motors.

Note: *This Standard may also be applied with discretion to products outside the scope of this Standard.*

1.2
The values given in SI units are the units of record for the purposes of this Standard. The values given in parentheses are for information and comparison only.

1.3
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 (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 amendments published thereto.

CSA Group
C22.2 No. 100-14 (R2019)
Motors and generators

C390-10 (R2015)
Test methods, marking requirements, and energy efficiency levels for three-phase induction motors

EASA (Electrical Apparatus Service Association, Inc.)
ANSI/EASA AR100-2015
Recommended Practice for the Repair of Rotating Electrical Apparatus

EASA Technical manual Section 7-2016
Stator Core Testing

EASA/AEMT (Electrical Apparatus Service Association/Association of Electrical and Mechanical Trades)
The Effect of Repair/Rewinding on Motor Efficiency – EASA/AEMT Rewind Study and Good Practice Guide to Maintain Motor Efficiency (2003)

IEEE (Institute of Electrical and Electronics Engineers)
43-2013
IEEE Recommended Practice for Testing Insulation Resistance of Rotating Machinery

112-2004
Standard Test Procedure for Polyphase Induction Motors and Generators