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Pulse Endurance Test for Film-Insulated Magnet Wire

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Foreword

This technical publication reflects the input of magnet wire manufacturers and of various magnet wire user industries. All information in this publication is Authorized Engineering Information.

NEMA magnet wire publications are periodically reviewed by the NEMA Magnet Wire Section and revised as necessary, to keep them current with technological changes. Proposed revisions should be submitted to:

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This technical publication was developed by the Magnet Wire Section. Section approval of the standard does not necessarily imply that all section members voted for its approval or participated in its development. At the time it was approved, the Magnet Wire Section was composed of the following members:

CONDUMEX—Mexico City, Mexico
Elektrisola, Inc.—Boscawen, NH
Essex Furukawa—Fort Wayne, IN
Magnekón—San Nicolas de los Garza, NL, Mexico
MWS Wire Industries—Oxnard, CA
New England Wire Technologies Corporation—Lisbon, NH
Rea Magnet Wire Company, Inc.—Fort Wayne, IN
Virginia Insulated Products—Saltville, VA

1 Scope

The scope of this Authorized Engineering Information (AEI) is to determine the relative endurance of magnet wire under high frequency rectangular voltage pulses at elevated temperature. This method is meaningful in assessing the relative insulation lifetime of magnet wire in conditions similar to those found in motors being operated by IGBT drives.

2 Introduction

Inverter duty grade magnet wire is broadly used in electrical machinery controlled by pulse width modulation (PWM) drives with insulated gate bipolar transistor (IGBT) drives. The speed control of motors by IGBT drives is common; however, during operation, short transient pulses may arise. These transients above the magnet wire partial discharge inception voltage (PDIV) are linked to degradation and premature aging of the insulation due to partial discharges, leading to corona erosion of magnet wire insulation.

This phenomenon may lead to the shortening of the economic lifetime of the windings and motors. The present AEI purpose is to present an accelerated aging method that can be employed by magnet wire manufacturers and users to assess the suitability of a magnet wire to be designated as an inverter duty wire.

Different aging factors are present in a motor insulation system during operation, including voltage characteristics (frequency, voltage, spikes), operation temperature, and environmental factors such as relative humidity. For simplicity, this AEI will investigate the synergetic aging of rectangular wave voltage and temperature, in which frequency, rise time, voltage, and temperature are used as accelerated factors.

3 Reference Publications

This publication references the following standards, which can be acquired online or from the mailing addresses provided. Unless otherwise specified, reference is made to the most recent edition.

ASTM International
100 Barr Harbor Drive
Conshohocken, PA 19428
www.astm.org

ASTM D2275	*Voltage Endurance of Solid Electrical Insulating Materials Subjected to Partial Discharges (Corona) on the Surface*
ASTM D171	*Standard Terminology Relating to Electrical Insulation*
ASTM D5423	*Standard Specification for Forced-Convection Laboratory Ovens for Evaluation of Electrical Insulation*