ANSI/NEMA KS 3-2023

Guidelines for Inspection and Preventive Maintenance of Switches Used in Commercial and Industrial Applications

Secretariat

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Approved: July 27, 2023

Published December 20, 2023

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Foreword

This is the first edition of NEMA Standards Publication KS 3. To ensure that a meaningful publication was being developed, draft copies were sent to a number of individuals and organizations in the public sector having an interest in or responsibility for the purchase, testing, application, use, and preventive maintenance of these products. Their resulting comments and suggestions provided vital user and general-interest input prior to final NEMA approval and resulted in a number of substantive changes in this publication. This publication will be periodically reviewed by the Switches Voting Classification of NEMA for any revisions necessary to keep it up to date with advancing technology. Proposed or recommended revisions should be submitted to:

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This standard was developed by the NEMA Switches Voting Classification. Approval of this standard does not necessarily imply that all voting classification members voted for its approval or participated in its development. At the time it was approved, the Switches Voting Classification had the following members:

ABB Control, Inc.—Wichita Falls, TX
Boltswitch, Inc.—Crystal Lake, IL
Cooper Bussman—St. Louis, MO
Eaton Corporation—Pittsburgh, PA
General Electric—Plainville, CT
Hubbell Inc.—Bridgeport, CT
Mersen USA-Newburyport, MA
Siemens Industry, Inc.—Alpharetta, GA
Schneider Electric—Palatine, IL

Introduction

ANSI/NEMA KS3 deals with guidelines for the inspection and preventive maintenance of switches used in commercial and industrial applications. These guidelines are to be used to identify switches requiring maintenance or replacement. Good practice includes periodic switch maintenance during plant shutdown or during a regular maintenance period as specified, for example, in NFPA 70B. When a switch operates automatically, good practice dictates that the source of the overcurrent should be located, and if it is suspected that the operation was at or near the interrupting rating, the switch condition should be checked prior to circuit re-energization.

When appropriately maintained, switches provide reliable protection for many years. The exact lifetime of the switch, however, is determined by the switch's operational duty and by its environment.

With respect to operational duty, for some circuits there will be occasional overload conditions or low-current fault conditions. Here, the operating life will be tens of years. In other circuits, there may be high short-circuit-current faults, but it should be noted that bolted faults at the switch interrupting rating are rarely encountered. These will reduce the operating life of the switch and may necessitate replacement of the switch. Switches in this guideline are evaluated to three different UL standards: UL 98, *Enclosed and Dead-Front Switches*; UL 997, *Fused Power-Circuit Devices*; and UL 1429, *Pullout Switches*. They are subjected to thousands of endurance test operations; overload test operations; and two interrupting tests at maximum short-circuit-current rating. Thus, switches have an extensive but finite interrupting capability, and switches that experience multiple high short-circuit-current faults should receive a thorough inspection and be replaced if necessary.

With respect to environmental effects, switches are sometimes exposed to high ambient temperatures, high humidity, and other ambient conditions that are hostile to long-term performance. For example, industries may have corrosive environments or could be associated with dusty environments that could affect operating parts.

It is not intended that switches be disassembled for inspection. Rather, NEMA KS-3 should be referenced during periodic maintenance or during specific inspection following a high short-circuit-current fault. This document is intended to ensure that switches are well maintained, and provides guidelines for switch replacement.

This document is divided into separate sections as follows:

Section 1 presents the scope and reference standards.

Section 2 details the safety procedures to be followed.

Section 3 deals with general guidance.

Section 4 deals with inspection procedures and describes thermal checks (4.2) and visual checks (4.3) of the enclosure and switch condition. Overheating of the switch would necessitate further investigation, and cracks in the insulation systems would certainly necessitate switch replacement.

Section 5 deals with preventive maintenance and ensures that the switch's life is not compromised by external conditions. The objectives are that the switch operates in a clean environment and that the terminals are in good condition (5.2), that fuses (if required) are connected properly (5.3), and that wire connectors are in good condition and are correctly torqued (5.4).

Section 6 deals with nondestructive test procedures that can be used to verify specific operating characteristics of switches. These include mechanical operation tests (6.2), insulation resistance tests (6.3), and individual pole resistance tests (millivolt drop test) (6.4). Non-compliance to one or more of these tests could lead to switch replacement.

Section 7 deals with the operation of accessory devices. Failure of an accessory would lead to replacement of that accessory, or switch replacement if accessories are not removable.

In summary, following an automatic overcurrent interruption at or near its interrupting rating, the condition of any protective device should be checked prior to circuit re-energization. Switches that have experienced multiple high short-circuit-current faults, as evidenced by conditions at the source of the faults, should receive a thorough inspection per the guidelines of NEMA KS 3. This document should also be used for recommended, periodic, and preventive maintenance.

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1 General

1.1 Scope

NEMA Standards Publication KS 3 sets forth, for use by qualified personnel[1], a number of basic procedures that may be used for the inspection and preventive maintenance of switches used in industrial and commercial applications rated up to and including 600 V 50/60 Hz AC or AC/DC.

NOTE: Consult the manufacturer for other manufacturer's specific ratings.

The *National Electrical Code*® defines several switch types: general use switch, isolating Switch, motor-circuit switch, and double-throw switch. In most cases, a switch is capable of interrupting/disconnecting its rated current at its rated voltage. An isolating switch does not have an interrupting rating and is actuated after the circuit has been opened by some other means. A motor-circuit switch is rated in horsepower and is capable of interrupting the maximum overload current of a motor with the same horsepower rating.

The methods outlined may be used to verify specific characteristics of a switch that was originally built and tested in compliance with the requirements of NEMA Standards Publication KS 1. These methods are intended for field application and are, therefore, nondestructive in nature. Accordingly, these methods cannot be used to verify all performance capabilities of a switch since verification of some capabilities requires tests of a destructive nature.

Many tests, including those of a destructive nature (as defined in KS 1), are performed on representative samples of switches by the manufacturer as part of a routine program of factory inspection.

This publication is not intended, nor is it adequate, to verify proper electrical performance of a switch that has been disassembled, modified, rebuilt, refurbished, or handled in any manner not intended or authorized by the original manufacturer. Such switches should be removed from service.

1.2 Referenced Standards

National Electrical Manufacturers Association
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KS 1	*Guidelines for Inspection and Preventive Maintenance of Molded Case Circuit Breakers Used in Commercial and Industrial Applications*
KS 2	*Application Guide for Ground Fault Protective Devices for Equipment*
250	*Enclosures for Electrical Equipment (1000 Volts Maximum)* *Guidelines for Handling Water Damaged Electrical Equipment*

1 For purposes of these guidelines, a qualified person is one who has skills and knowledge related to the construction and operation of the electrical equipment and installation and has received training to recognize and avoid the hazards involved. In addition, the person is trained:
- and authorized to test, energize, clear, ground, tag, and lock out circuits and equipment in accordance with established safety practices.
- in the proper care and use of protective equipment, such as rubber gloves, hard hat, safety glasses or face shields, and flash-resistant clothing, in accordance with established safety practices.
- in first aid.