DC 4-86 6470247 0000683 0 A-27-05

NEMA STANDARDS PUBLICATION NO. DC 4

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Warm-Air Limit and Fan Controls

NEMA

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION ■ 2101 L STREET, N.W., WASHINGTON, D.C. 20037

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WARM-AIR LIMIT AND FAN CONTROLS

Published by

National Electrical Manufacturers Association
2101 L Street, N.W.
Washington, D.C. 20037

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Foreword

This Standards Publication has been developed in the public interest and is designed to promote a better understanding between the manufacturer and the user and to assist the user in selecting and obtaining the proper limit and fan control for his particular need.

These standards are periodically reviewed by the Residential Controls Section of NEMA for any revisions necessary to keep them up to date with advancing technology. Proposed or recommended revisions should be submitted to:

Manager, Engineering Department
National Electrical Manufacturers Association
2101 L Street, N. W.
Washington, D. C. 20037

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Scope

This Standards Publication describes the characteristics of temperature actuated electric devices intended to control the temperature of air through air-heating equipment intended primarily for residential use.

Excluded are limit controls for use on baseboard heaters.

History of Standards

The Residential Controls Section of NEMA was formed in 1940 to promote the standardization of products within the scope of the Section. These product standards cover definitions, ratings, performance, testing, and dimensions. NEMA Standards are voluntary and are designed to eliminate misunderstandings between the purchaser and the manufacturer.

This publication is one of a series sponsored by the Residential Controls Section. Other publications in this series are identified as Pub. No. DCXX- (followed by the year of approval).

The Technical Committee of the Residential Controls Section of NEMA first formed a subcommittee to develop standards for warm-air limit and fan controls in 1951. The deliberations of this committee resulted in the issuance of the NEMA Standards Publication for *Dial Arrangement of Warm-Air Limit and Fan Controls*, DC 4-1959, which was rescinded in July 1972, and subsequently superseded by NEMA Standards Publication for *Warm-Air Limit and Fan Controls*, DC 4-1975. Publication DC 4-1975 was reaffirmed in 1980. This Standards Publication, DC 4-1986, supersedes DC 4-1975 (R 1980).

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WARM-AIR LIMIT AND FAN CONTROLS

Section 1

REFERENCED STANDARDS AND DEFINITIONS

1.1 REFERENCED STANDARDS

The following publications are adopted, in whole or in part as indicated, by reference in this Standards Publication. Copies are available from the indicated sources.

American National Standards Institute
1430 Broadway
New York, NY 10018

ANSI/UL 353-1974	*Standard for Limit Controls*
ANSI/UL 873-1981	*Standard for Temperature-Indicating and -Regulating Equipment*
ANSI/UL 310-1986	*Standard for Electrical Quick-Connect Terminals*

National Electrical Manufacturers Association
2101 L Street, N.W., Suite 300
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DC 2-1986	*Quick-Connect Terminals*

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1.2 DEFINITIONS

1.2.1 FAN CONTROL

A thermally actuated electrical device which acts to control the operation of an air circulation fan between predetermined temperatures.

1.2.1.1 ADJUSTABLE FAN CONTROL

A fan control which has means for varying the required air temperature for fan operation.

1.2.1.2 ADUUSTABLE DIFFERENTIAL FAN CONTROL

A fan control which has means for varying the required difference in the sensed air temperature between fan ON and OFF.

1.2.1.3 ADJUSTABLE OR FIXED-TIME-DELAY FAN CONTROL

A device which, on energization, acts to start the fan after a time delay. The device shall be permitted to shut off the fan upon de-energization after a time delay or shall be permitted to be shut off by a lowering of the circulated air temperature.

1.2.1.4 TWO-SPEED FAN CONTROL

A device consisting of a means for providing two-speed operation of the fan.

1.2.1.5 VARIABLE-SPEED FAN CONTROL

A device consisting of a means for providing a variable fan speed.

NEMA Standard 11-20-1986.

1.2.2 Differential

The difference in air temperature at the sensor in degrees C (degrees F) between the temperature value at which the control initiates action and the temperature value at which the control terminates action.

NEMA Standard 11-20-1986.

1.2.3 Fan-And-Limit Control

A control which combines independent fan control and limit control functions in one unit, using either one air temperature sensor for both functions or independent air temperature sensors for each function.

NEMA Standard 11-20-1986.

1.2.4 Fixed Setting

The temperature setting which, because of the nature of the actuator, either cannot be changed or can only be changed by means of a special tool.

NEMA Standard 11-20-1986.

1.2.5 Limit Control

A thermally actuated device which limits the outlet air temperature. Resetting shall be either automatic or manual.

NEMA Standard 11-20-1986.

1.2.6 Manual Fan Switch

An optional switching device on a fan control which permits manual switching to a position in which the fan is caused to be continuously operated.

NEMA Standard 11-20-1986.

1.2.7 Millivoltage Circuit

A circuit which is supplied by a thermoelectric source.

NEMA Standard 3-12-1975.

1.2.8 Range, Operating

The difference, in degrees C (degrees F), between the minimum and maximum temperature settings.

NEMA Standard 11-20-1986.

1.2.9 Range Setting Stop

The means which prevents the user from adjusting the control beyond a specified temperature setting(s).

NEMA Standard 11-20-1986.

1.2.10 Scale Markings

The temperature settings marked on the control in degrees C (degrees F).

NEMA Standard 11-20-1986.

1.2.11 Temperature Setting

The temperature to which the control is set.

NEMA Standard 11-20-1986.

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Section 2
RATINGS AND CLASSIFICATIONS

2.1 ELECTRICAL RATINGS

The electrical ratings of the fan control, limit control, or fan-and-limit control may be one or more of the following:

Voltage	Amperes, Full Load	Amperes, Locked Rotor
120 Vac	16	96
	14	84
	10	60
	8	48
	7.4	44.5
	6	36
	5.8	34.8
	4	24
240 Vac	12	72
	7	42
	6	36
	4	24
	3.7	22.2
	3	18
	2.9	17.4
	2	12
240 Vac	25 amperes or less, noninductive	
24 Vac	6 amperes maximum or 50 voltampere pilot duty	
0.25 to 12 volts DC	1 ampere	
120 to 240 Vac pilot duty	Expressed in voltamperes as specified by the manufacturer	

Authorized Engineering Information 11-20-1986.

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2.2 SCALE MARKINGS AND DIFFERENTIALS

The scale markings and differentials shall be within the following values:

2.2.1 Scale Markings

1. Fan Control—10 °C (50 °F) minimum to 129.4 °C (265 °F) maximum.*
2. Limit Control—37.8 °C (100 °F) minimum to 176.7 °C (350 °F) maximum.*

NEMA Standard 11-20-1986.

2.2.2 Differentials

1. Fan Control—Adjustable—4.4 °C (8 °F) minimum to 30.6 °C (55 °F) maximum.*
2. Limit Control—Fixed—11.1 °C (20 °F) minimum to 27.8 °C (50 °F) maximum.*

NEMA Standard 11-20-1986.

* Fixed settings in the same range may be provided in lieu of an adjustable setting. (Note approved as Authorized Engineering Information.)

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Section 3
CONSTRUCTION

3.1 ENCLOSURES

Limit and fan controls may be constructed with or without enclosures.

Authorized Engineering Information 3-12-1975.

3.2 CONNECTIONS

Terminals shall be of a type which meets the requirements of ANSI/UL 310, ANSI/UL 353, ANSI/UL 873 and NEMA Standards Publication DC 2.

NEMA Standard 11-20-1986.

3.3 CORROSION PROTECTION

Iron and steel parts (except for bimetals, bearings, etc. where such protection is impracticable) shall be suitably protected against corrosion by enameling, galvanizing, plating, or other equivalent means.

NEMA Standard 3-12-1975.

3.4 ASSEMBLY

Limit and fan controls shall be assembled in a quality and workmanlike manner to afford normal protection to the installer and user with regard to sharp edges, surfaces, adjusting means, etc.

NEMA Standard 3-12-1975.

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Section 4

TEST AND PERFORMANCE

4.1 GENERAL

Limit and fan controls shall meet the applicable requirements specified in ANSI/UL 353 and ANSI/UL 873.

NEMA Standard 11-20-1986.

4.2 DIFFERENTIAL

The operating differential of fan controls shall be tested in accordance with the following and shall be within the limits specified by the manufacturer.

1. The control shall be mounted in its normal mounting position.
2. The body of the control shall be in an ambient temperature of 26.7°C ± 2.8°C (80°F ± 5°F).
3. The air temperature sensor shall be placed in an air stream having a velocity not less than 1.52 m/s (300 feet per minute) nor more than 3.05 m/s (600 feet per minute).
4. Using an oven which delivers essentially convected heat to the sensor, the temperature of the air stream shall be raised rapidly to within 8.3°C (15°F) of the control set point, allowed to reach equilibrium, further raised at not more than 0.56°C (1°F) per minute to the point at which the switch operates and then lowered at the same rate to again effect operation of the switch.

NEMA Standard 11-20-1986.

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Section 5
MARKING

5.1 MARKING

5.1.1 Limit and fan controls shall have the following minimum markings.

1. Company name or trademark
2. Catalog number or the equivalent
3. Voltage rating and the ampere, wattage, or pilot duty rating.
4. Control function
   a. Fan (or F)
   b. Limit (or L)
5. The date of manufacture, including the year and week of manufacture.*

NEMA Standard 11-20-1986.

5.1.2 Labels, stampings, or decalcomanias shall be of a permanent nature and located where they will not be exposed to mechanical damage.

NEMA Standard 3-12-1975.

5.1.3 Markings shall be visible after installation. (Markings which are on the base or inside of a cover and which are exposed when the cover is removed shall be considered to be visible).

NEMA Standard 11-20-1986.

5.1.4 Component limit and fan controls sold only to original equipment manufacturers for incorporation in other equipment need not be marked with electrical rating and control function information if the marking provided constitutes a unique type reference.

Authorized Engineering Information 11-20-1986.

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* The preferred method of marking is to indicate the date of manufacture in the form of the last two numbers of the year followed by the number of the week of manufacture. (Note approved as Authorized Engineering Information.)

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Section 6

INSTALLATION AND SERVICE INSTRUCTIONS

6.1 GENERAL

The manufacturer should make suitable installation and service instructions available, including precautions against damaging operating practices.

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NEMA STANDARDIZATION

The purpose of NEMA Standards, their classification and status, are set forth in certain clauses of the NEMA Bylaws, which are quoted below:

Purpose of Standards

National Electrical Manufacturers Association Standards are adopted in the public interest and are designed to eliminate misunderstandings between the manufacturer and the purchaser and to assist the purchaser in selecting and obtaining the proper product for its particular need. Existence of a National Electrical Manufacturers Association Standard does not in any respect preclude any member or nonmember from manufacturing or selling products not conforming to the standard.

(Bylaw—Art. V, Sec. 1)

Definition of a Standard

A standard of the National Electrical Manufacturers Association defines a product, process, or procedure with reference to one or more of the following: nomenclature, composition, construction, dimensions, tolerances, safety, operating characteristics, performance, rating, testing, and the service for which they are designed.

(Bylaw—Art. V, Sec. 2, Subsection A)

Dimensions

Where dimensions are given for interchangeability purposes, alternate dimensions satisfying the other provisions of the standards publication may be capable of otherwise equivalent performance.

(NEMA Policy Memorandum 84-2, dated June 7, 1984)

Classes of Standards

National Electrical Manufacturers Association Standards are of two classes:

1. NEMA Standard, which relates to a product commercially standardized and subject to repetitive manufacture, which standard has been approved by at least 90 percent of the members of the Subdivision eligible to vote thereon;
2. Suggested Standard for Future Design, which may not have been regularly applied to a commercial product, but which suggests a sound engineering approach to future development, which standard has been approved by at least two-thirds of the members of the Subdivision eligible to vote thereon.

(Bylaw—Art. V, Sec. 6, 1st Sentence)

Authorized Engineering Information

Authorized Engineering Information consists of explanatory data and other engineering information of an informative character not falling within the classification of NEMA Standard or Suggested Standard for Future Design.

(Bylaw—Art. V, Sec. 6, 1st Sentence)

Official Standards Proposal

An Official Standards Proposal is an official draft of a proposed standard which is formally recommended to an outside organization(s) for consideration, comment, and/or approval.

(Bylaw—Art. V, Sec. 4, Subsection A)

Identification of Status

Standards in NEMA Standards Publications are identified in the foreword or following each standard as "NEMA Standard" or "Suggested Standard for Future Design." These indicate the status of the standard. These words are followed by a date which indicates when the standard was adopted in its present form by the Association.

The material identified as "Authorized Engineering Information" and "Official Standards Proposal" is designated similarly.

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RESIDENTIAL CONTROLS SECTION
OF THE
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Controls Division
Carol Stream, IL 60187

Emerson Electric Company
White-Rodgers Division
St. Louis, MO 63123

Fenwal, Incorporated
Ashland, MA 01721

General Electric Company
Morrison, IL 61270

GTE Products Corporation
Control Device Operation
Standish, ME 04084

Hamilton Standard Controls, Inc.
Fort Wayne, IN 46859

Honeywell, Inc.
Minneapolis, MN 55422

Johnson Controls, Incorporated
Control Products Division
Milwaukee, WI 53209

Mallory Timers Company
Division of Emhart Industries, Inc.
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