NEMA DC 12

Residential Controls—Hot-water Immersion Controls

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NEMA Standards Publication DC 12-1985 (R1991, R1996, R2002)

Residential Controls – Hot-water Immersion Controls

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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 hot-water immersion control for their 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:

Vice President, Engineering Department
National Electrical Manufacturers Association
1300 North 17th Street
Rosslyn, Virginia 22209

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This Standards Publication was developed by the Residential Controls 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 group was composed of the following members:

Apcom Inc.—Franklin, TN
Emerson Electric Company, White-Rodgers Division—St. Louis, MO
First Technology—Standish, ME
GE Industrial Systems—Morrison, IL
Honeywell, Inc.—Golden Valley, MN
Johnson Controls, Inc.—Milwaukee, WI
Texas Instruments, Inc.—Attleboro, MA
Therm-O-Disc—Mansfield, OH

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Section 1
GENERAL

1.1 SCOPE

This Standards Publication covers the operating range, differential, electrical ratings, and dimensions of electric-switch-type hot-water immersion controls intended primarily for application to hot-water boilers and heaters used in residential heating systems.

1.2 REFERENCES

In this publication, reference is made to the standards listed below. Copies are available from the indicated sources.

1.2.1 Normative References

The following normative documents contain provisions, which through reference in this text, constitute provisions of this Standards Publication. By reference herein these publications are adopted, in whole or in part as indicated, in this SP.

American National Standards Institute (ANSI)
11 West 42nd Street
New York, NY 10036

ANSI/UL 353-1994 *Limit Controls*
ANSI/UL 873-1994 *Temperature-Indicating and -Regulating Equipment*

National Electrical Manufacturers Association
1300 North 17th Street
Suite 1847
Rosslyn, VA 22209

DC 3-1989 (R1996) *Wall Mounted Room Thermostats*

1.3 DEFINITIONS

control, circulator: A control which is intended to prevent the circulation of water when the water is below a minimum temperature.

control, combination: A control which combines one or more of the functions of low-limit, high-limit, and circulator controls with other control functions.

control, dual: A control having two switching functions and combining any two of the following controls: low-limit, high-limit, and circulator.

A dual control shall be permitted to have a single temperature sensor.

control, high-limit: A control which is intended to prevent the water from exceeding a predetermined temperature.

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control, hot-water immersion: A control having a temperature-sensitive element intended for well or directed immersion and normally used to provide high- or low-limit control of the water temperature or control of a water circulator or valves, or combination thereof.

control, low-limit: A control which is intended to prevent the water from going below a predetermined temperature.

control, triple: A control which combines all of the functions of the following controls: low-limit, high-limit, and circulator.

A triple control shall be permitted to have a single temperature sensor.

control, differential: The difference in the water temperature at the sensing element 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.

immersion, direct: The sensing element is immersed directly in the water, without a well.

immersion, well: The sensing element is inserted in a well which is immersed in the water.

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

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

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

temperature settings: The temperature to which the control is set.

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Section 2
RATINGS AND CLASSIFICATIONS

2.1 RATINGS

Hot-water immersion controls may have one or more of the following ratings:

Volts AC	Amperes Full Load	Amperes Locked Rotor
120	7.4	44.5
	8	48
	10	60
	14	84
240	3.7	22.2
	4	24
	5	30
	6	36
	7	42
24	6 amperes maximum or 50 volt-amperes pilot duty	
0.250 to 12 volts DC	1 ampere maximum	
120 to 240 Volts ac pilot duty	125 volt-amperes	

2.2 SCALE MARKINGS

The scale markings on hot-water immersion controls shall be within a minimum of 37.8°C (100°F) and a maximum of 143.3°C (290°F).

The scale markings may comprise a single value within these limits

2.3 DIFFERENTIAL

The differential shall be:

Adjustable – within 2.8°C (5°F) minimum, 25°C (45°F) or maximum; or
Fixed – 5.6°C (10°F) or less

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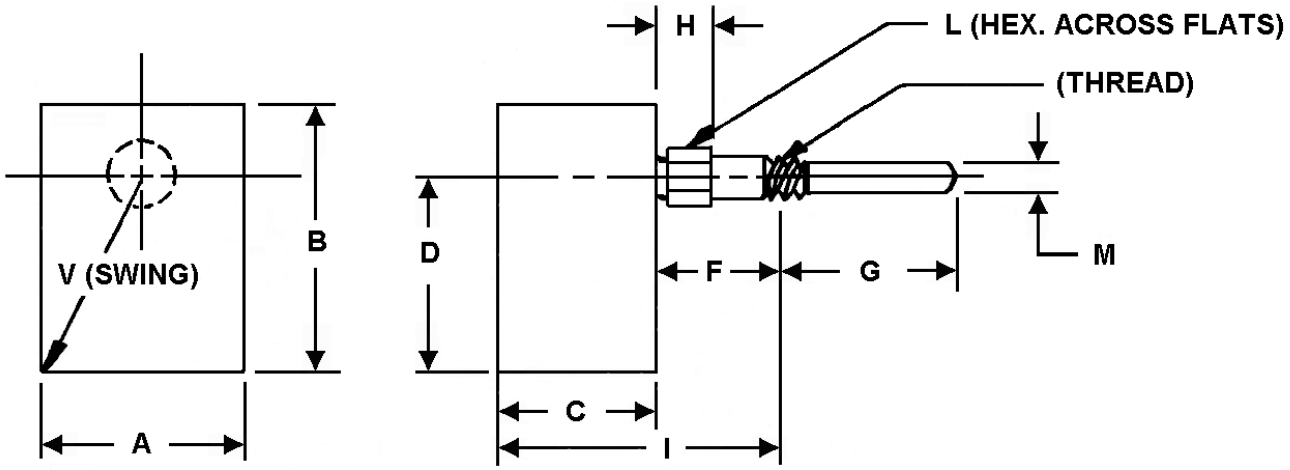
Section 3
CONSTRUCTION

3.1 DIMENSIONS

Dimensions for direct- and well-immersion-type hot-water immersion controls shall be in accordance with Figure 3-1 and Table 3-1.



NOTE - F, G, and I dimensions are to the fifth thread.

Figure 3-1
DIMENSIONS FOR DIRECT- AND WELL-IMMERSION-TYPE HOT-WATER IMMERSION CONTROLS

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Table 3-1
DIMENSIONS FOR DIRECT- AND WELL-IMMERSION-TYPE HOT-WATER IMMERSION CONTROLS

TYPE OF CONTROL	A MAX.	B MAX.	C MAX.*	D MAX.	F MIN.	G MAX.	H MIN.	I MAX.	L NOM.	M NOM.	V	THREAD
Single	86 (3-3/8)	152.5 (6)	76.5 (3)	124 (4-7/8)	38 (1-1/2)	87.5 (3-7/16)	13 (1/2)	140 (5-1/2)	22.5 (7/8)	13 (1/2)	127 (5)	1/2 NPT
	86 (3-3/8)	152.5 (6)	76.5 (3)	124 (4-7/8)	38 (1-1/2)	87.5 (3-7/16)	13 (1/2)	140 (5-1/2)	27 (1-1/16)	22.5 (7/8)	127 (5)	3/4 NPT
Dual	108 (4-1/4)	152.5 (6)	76.5 (3)	124 (4-7/8)	38 (1-1/2)	87.5 (3-7/16)	13 (1/2)	140 (5-1/2)	22.5 (7/8)	13 (1/2)	140 (5-1/2)	1/2 NPT
	108 (4-1/4)	152.5 (6)	76.5 (3)	124 (4-7/8)	38 (1-1/2)	87.5 (3-7/16)	13 (1/2)	140 (5-1/2)	27 (1-1/16)	22.5 (7/8)	140 (5-1/2)	3/4 NPT
Triple	108 (4-1/4)	152.5 (6)	76.5 (3)	124 (4-7/8)	38 (1-1/2)	87.5 (3-7/16)	13 (1/2)	140 (5-1/2)	22.5 (7/8)	13 (1/2)	140 (5-1/2)	1/2 NPT
	108 (4-1/4)	152.5 (6)	76.5 (3)	124 (4-7/8)	38 (1-1/2)	87.5 (3-7/16)	13 (1/2)	140 (5-1/2)	27 (1-1/16)	22.5 (7/8)	140 (5-1/2)	3/4 NPT
Combination, Vertical Case (B greater than A)	143 (5-5/8) **143 (5-5/8)**	181 (7-1/8) **181 (7-1/8)**	102 (4) **102 (4)**	124 (4-7/8) **124 (4-7/8)**	38 (1-1/2) **38 (1-1/2)**	87.5 (3-7/16) **87.5 (3-7/16)**	13 (1/2) **13 (1/2)**	171.5 (6-3/4) **171.5 (6-3/4)**	22.5 (7/8) **27 (1-1/16)**	13 (1/2) **22.5 (7/8)**	… …	1/2 NPT **3/4 NPT**
Combination, Horizontal Case (A greater than B)	181 (7-1/8) **181 (7-1/8)**	143 (5-5/8) **143 (5-5/8)**	102 (4) **102 (4)**	124 (4-7/8) **124 (4-7/8)**	38 (1-1/2) **38 (1-1/2)**	87.5 (3-7/16) **87.5 (3-7/16)**	13 (1/2) **13 (1/2)**	171.5 (6-3/4) **171.5 (6-3/4)**	22.5 (7/8) **27 (1-1/16)**	13 (1/2) **22.5 (7/8)**	… …	1/2 NPT **3/4 NPT**

All dimensions in mm (inches).
* Including all protrusions.

3.2 MOUNTING

The control mounting means shall be sufficiently rigid to withstand the normal vibration and shock encountered in the shipping of a boiler or heater

3.3 CONNECTIONS

3.3.1 Terminals

Terminals shall be of the type which meets the requirements of UL 873 and UL 353.

3.3.2 Wiring

If external lead wires are provided as a part of the control, the size of wire shall be in accordance with UL 873 and UL 353.

3.4 MATERIALS

3.4.1 Corrosion Protection

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

Parts made of copper alloy, except for the threaded fitting of a well immersion or direct immersion control, which come in contact with boiler water, shall resist dezincification.

3.4.2 Strength

Hot-water immersion controls shall be so designed that installation stresses will not affect their calibration.

3.4.3 Enclosures

Enclosures for hot-water immersion controls shall be in accordance with UL 873 and UL 353.

3.5 ASSEMBLY

Hot-water immersion controls shall be assembled in a manner so as to afford normal protection to the installer and user with regard to sharp edges, surfaces, adjusting means, and so forth.

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Section 4
PERFORMANCE

4.1 GENERAL

Hot-water immersion controls shall meet the appropriate requirements specified in UL 353 and UL 873.

4.2 DIFFERENTIAL TESTS

The bulb and 76.5 millimeters (3 inches) of capillary tubing shall be placed in a well agitated liquid bath which shall be raised at a rate not to exceed 0.56°C (1°F) per minute to the point of switch operation and lowered at the same rate to again effect switch operation.

The body of the control shall be in an ambient temperature of (23.9 ± 2.8) °C, (75 ± 5) °F.

The operating differential shall be within the limits specified by the manufacturer.

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Section 5
MARKINGS

5.1 CONTROL MARKINGS

5.1.1 Hot-water Immersion Controls

Hot-water immersion 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 (on combination controls and on dual and triple controls)
   a. High limit
   b. Circular
   c. Low limit
5. Date of manufacture (preferably by indicating the last two digits of the calendar year, followed by the number of the week of manufacture)

5.1.2 Labels, Stampings, or Decalcomanias

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

5.1.3 Markings After Installation

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 after installation.

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Section 6
APPLICATION

6.1 GENERAL

The manufacturer should supply suitable installation and service instructions and, in addition, warnings against damaging practices.

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