National Differences For

UL 60730-2-9

Standard for Automatic Electrical Controls for Household and Similar Use - Part 2-9: Particular Requirements for Temperature Sensing Controls

National Differences For

UL 60730-2-9

Standard for Automatic Electrical Controls for Household and Similar Use - Part 2-9: Particular Requirements for Temperature Sensing Controls

Edition: 3

Edition Date: October 13, 2010

These revisions are being issued to adopt the requirements covered by Amendment No. 1 of IEC 60730-2-9 and to adopt the North American National Differences to this IEC Amendment.

THE STANDARDS TECHNICAL PANEL FOR UL 60730-2-9 HAS DETERMINED THAT AS OF OCTOBER 19, 2018, THE FIRST EDITION OF UL 60730-2-9 AND THE TWELFTH EDITION OF UL 873 WILL BE WITHDRAWN AND MAY BE USED TO DETERMINE A NEWLY SUBMITTED PRODUCT'S COMPLIANCE UNTIL THIS DATE.

This document provides a single listing of the National Differences included in the UL adoption of the corresponding IEC standard.

Preface

This document provides a single listing of the technical National Differences included in the UL adoption of the corresponding IEC standard.

In its IEC-based standards, UL uses the notations indicated below to identify national difference type, and these types are additionally noted in this document. The standard may not use all types of these deviations.

D1 - These are deviations which are based on basic safety principles and requirements, elimination of which would compromise safety for U.S. consumers and users of products.

D2 - These are deviations based on safety practices. These are deviations for IEC requirements that may be acceptable, but adopting the IEC requirements would require considerable retesting or redesign on the manufacturer's part.

DC - These are deviations based on the component standards and will not be deleted until a particular component standard is harmonized with the IEC component standard.

DE - These are deviations based on editorial comments or corrections.

DR - These are deviations based on the national regulatory requirements.

Each national difference contains a description of what the national difference entails. Typically one of the following words is used to explain how the text of the national difference is to be applied to the base IEC text:

Addition / Add - An addition entails adding a complete new numbered clause, subclause, table, figure, or annex. Addition is not meant to include adding select words to the base IEC text.

Deletion / Delete - A deletion entails complete deletion of an entire numbered clause, subclause, table, figure, or annex without any replacement text.

Modification / Modify - A modification is an altering of the existing base IEC text such as the addition, replacement or deletion of certain words or the replacement of an entire clause, subclause, table, figure, or annex of the base IEC text.

National Differences

1.1.101DV D2 *Modify text of 1.1.101 with the following:*

This standard applies to single operation devices, thermostats for drip-type coffee makers, self-heating thermal protectors (SHTP) for recessed lighting fixtures, and Fan/Heat sequencers as defined in this standard.

2.2.107ADV D2 *Add the following definitions to Clause 2.2 of the Part 2:*

2.2.107ADV.1 Thermostats for Drip-Type Coffee Makers – an automatic thermostat (operating control with type 2 action) intended for use in household Drip-Type Coffee Makers.

2.2.107ADV.2 Set-Point Temperature Rating (T_{s-p}) for thermostats for use in drip-type Coffee Makers – The temperature at which the thermostat's electrical load switching contacts change state upon temperature rise. For adjustable thermostats the Set-Point Temperature Rating (T_{s-p}) is the temperature at which the thermostat's electrical load switching contacts change state, upon temperature rise, with the thermostat adjusted to the maximum temperature setting. This rated value is a nominal figure of a temperature range. The range is defined by the allowable tolerances specified in table 7.2

2.2.107ADV.3 Operating Temperature – Initial ($T_{op-init}$) for thermostats for use in drip-type Coffee Makers – A temperature, measured during the deviation test, at which the thermostat's electrical load switching contacts change state upon temperature rise. If multiple trials of the deviation test are conducted, this value is the arithmetic average of up to three trials.

2.2.107ADV.4 Operating Temperature – Final (T_{op-fin}) for thermostats for use in drip-type Coffee Makers – A temperature, measured during the drift test conducted after the endurance test sequence, at which the thermostat's electrical load switching contacts change state upon temperature rise. If multiple trials of the final drift test are conducted, this value is the arithmetic average of up to three trials.

2.2.107ADV.5 Maximum Normal Use Temperature Rating (T_{max}) for thermostats for use in drip-type Coffee Makers – The maximum temperature permitted on the thermostat's sensing surface during normal operation of the coffee maker. This temperature is equal to or greater than T_{s-p}.

2.2.107ADV.6 Maximum Dry Operation Temperature Rating (T_{dry}) for thermostats for use in drip-type Coffee Makers – The maximum temperature permitted on the thermostat's sensing surface during abnormal (dry) operation of the coffee maker. This temperature is equal to or greater than T_{max}.

2.2.107ADV.7 Reset Temperature (T_{reset}) for thermostats for use in drip-type Coffee Makers – A temperature at which the thermostat's electrical load switching contacts change state upon temperature fall. This value is a performance-based value noted during the endurance test. This temperature need not be declared by the manufacturer. Deviation and Drift tolerances are not applied to T_{reset}.

2.2.107BDV D2 *Add the following definition to the Part 2:*

2.2.107BDV.1 Fan/Heat Sequencer – a combination control (operating control with type 2 action) that may be used alone or with other devices to sequentially control a fan and heater or heating elements in electric central air-heating equipment.

2.2.107CDV D2 *Add the following definition to the Part 2:*

2.2.107CDV.1 Self-heating thermal protectors (SHTP) – a thermal protective device consisting of a temperature sensitive switching element and a load voltage heater within a common housing.

When mounted on a non-Type IC recessed fixture, the SHTP is intended to cycle under field related abnormal heating conditions. An SHTP is a protective control as defined in this standard.

4.2.1DV D2 *Modify Clause 4.2.1 by adding the following:*

Additional samples of the Self-heating thermal protectors (SHTP) are required for the tests of clauses 15, 17 and 27.

4.3.5.101DV D2 *Add Clause 4.3.5.101DV.1 to the Part 2:*

4.3.5.101DV.1 The values in annex CC.2 apply for the testing of INDEPENDENTLY MOUNTED, FREE STANDING and cord-connected temperature SENSING CONTROLS in Clause 17. Unless otherwise specified in the appropriate equipment standard, the values in Annex CC.2 also apply for INTEGRATED and INCORPORATED CONTROLS.

6.7.103ADV D2 *Add Clause 6.7.103ADV.1 to the Part 2:*

6.7.103ADV.1 Thermostats for use in household drip-type coffee makers.

6.7.103BDV D2 *Add Clause 6.7.103BDV.1 to the Part 2:*

6.7.103BDV.1 Self-heating thermal protectors for use in recessed lighting fixtures.

Table 7.2DV D2 *Addition of the following to Table 7.2:*

Table 7.2DV.1

Information		Clause or subclause	Method
117ADV	Date code of manufacturing for INDEPENDENTLY MOUNTED CONTROLS 105ADV		C
117BDV	Set-point Temperature Rating (T_{s-p})	2.2.107BDV, 15.5.6ADV, 15.5.6BDV, 17.16.102ADV.1	X
117CDV	Operating Temperature – Initial ($T_{op-init}$)	2.2.107ADV.3, 15.5.6ADV, 15.5.6BDV, 17.16.102ADV.1	–
117DDV	Operating Temperature - Final (T_{op-fin})	2.2.107ADV.4, 15.5.6ADV, 15.5.6BDV, 17.16.102ADV.1	–
117EDV	Maximum Normal Use Temperature Rating (T_{max})	2.2.107ADV.5, 15.5.6ADV, 15.5.6BDV, 17.16.102ADV.1	X
117FDV	Maximum Dry Operation Temperature Rating (T_{dry})	2.2.107ADV.6, 15.5.6ADV, 15.5.6BDV, 17.16.102ADV.1	X
117GDV	Reset Temperature (T_{reset})	2.2.107ADV.7, 15.5.6ADV, 15.5.6BDV, 17.16.102ADV.1	X
117HDV	Number of Timings	2.2.107BDV, 15.5.6BDV, 15.5.6CDV, 15.5.6CDV.1.2, 17.16.102BDV.1	X
117IDV	Time-to-open (“off”), sec (range) for a given ambient temperature	2.2.107BDV, 15.5.6BDV, 15.5.6CDV, 15.5.6CDV.1.2, 17.16.102BDV.1	X
117JDV	Time-to-close (“on”), sec (range) for a given ambient temperature	2.2.107BDV, 15.5.6BDV, 15.5.6CDV, 15.5.6CDV.1.2, 17.16.102BDV.1	D

NOTES

Additional notes

105A) The date code shall be the date or other dating period of manufacture not exceeding any three consecutive months. The date of manufacture may be abbreviated; or may be in a nationally accepted conventional code or in a code affirmed by the manufacturer, provided that the code:

a) Does not repeat in less than 20 years, and

b) Does not require reference to the product records of the manufacturer to determine when the product was manufactured.

11.11.101DV D2 *Addition of 11.11.101DV.1 – 11.11.101DV.3 to 11.11 to the Part 1:*

11.11.101DV.1 A cut-out or limiter incorporating a transformer, relay, or the like shall be supplied by a one-side grounded system with a voltage rating not exceeding 120 volts nominal. A switch or protective device shall be connected in the ungrounded supply conductor circuit.

11.11.101DV.2 A mercury switch shall be enclosed. Wire leads shall be as short as possible and terminate at eyelets or the equivalent, or in soldered connections at terminal plates in the supporting box or shall be fastened so that no strain is placed on the mechanism.

11.11.101DV.3 An INDEPENDENTLY MOUNTED CONTROL with manual reset shall be resettable from the exterior of the enclosure.

14.4.3.1DV D2 *Modification by adding the following to Clause 14.4.3.1 of the Part 2:*

Where the whole control has been declared as the SENSING ELEMENT (see table 7.2, requirement 47) the heating test shall be conducted under the conditions of 14.4.3.1.

14.102ADV D2 *Addition of the following Clauses to the Part 2:*

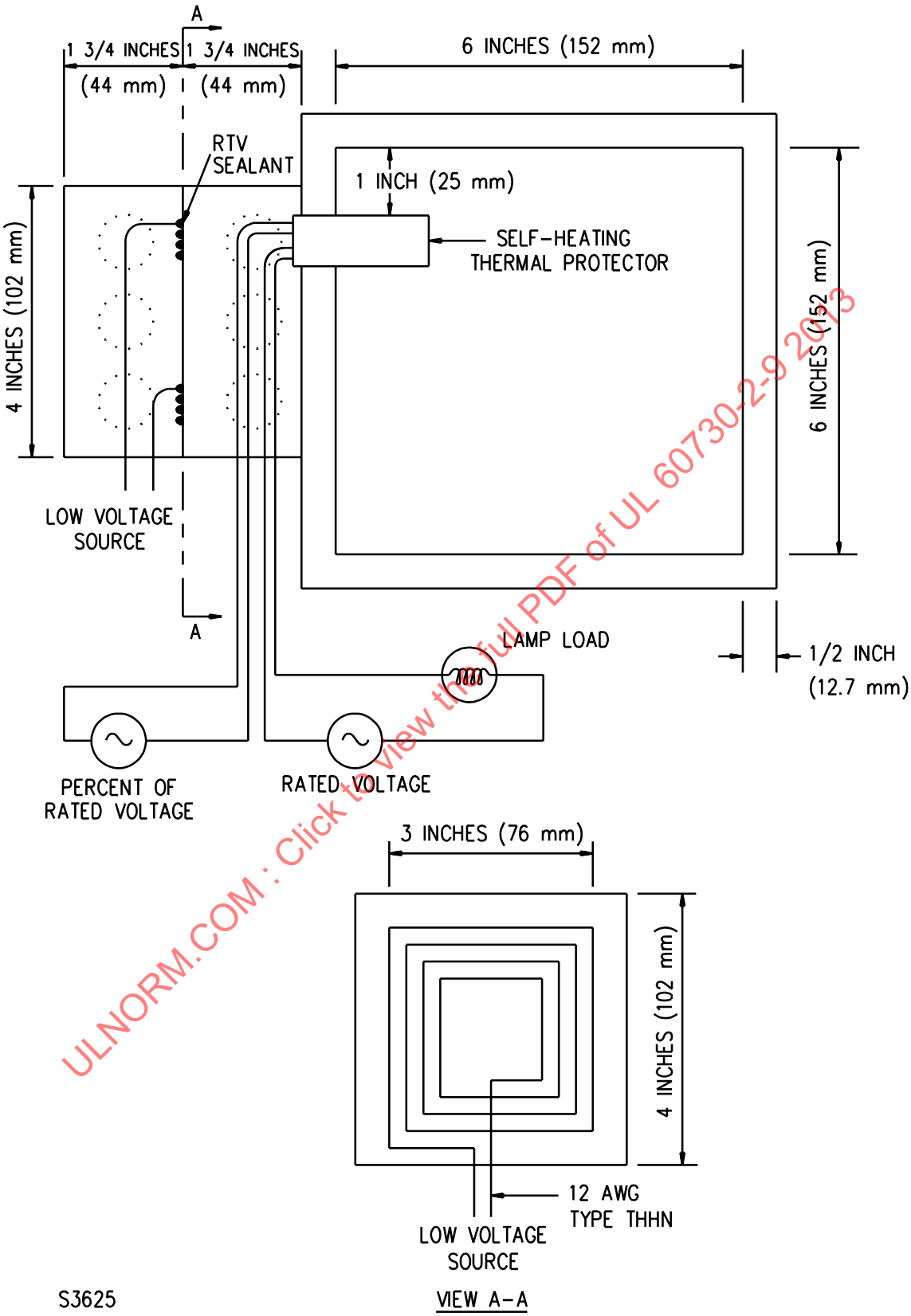
14.102ADV.1 The following is applicable to controls classified under 6.7.103BDV.

14.102ADV.2 A control (SHTP) is to be installed in a 152 by 152 by 152 mm (6 by 6 by 6 inch) box constructed of 12.7 mm (1/2 inch) thick Grade A - D fir plywood. A control (SHTP) with measurement thermocouples attached is to be inserted through an open hole in the box such that the back of the body of the device is flush with the outside of the box. The open hole in the box is to have dimensions only as large as necessary to accommodate the protector (snug fit). The open hole is to be located in the side of the box such that it is centered horizontally and the top of the open hole is 25.4 mm (1 inch) below the top of the box.

14.102ADV.3 The box is to be completely filled (flush with the top of the box) with expanding polyurethane foam. A 12.7 mm (1/2 inch) thick plywood top is to be provided on the box.

14.102ADV.4 A control (SHTP) is to be connected to two separate supply sources. One supply source is to be adjusted to rated voltage and connected through the integral thermal protector across the maximum rated lamp load. The other supply source is to be connected to the SHTP heater and adjusted to the maximum voltage that will not result in the integral thermal protector cycling within 7-1/2 hours (this usually will result in operating the heater at less than rated voltage). If the thermal protector will not trip within 7-1/2 hours at rated voltage and under the test conditions specified, two 102 by 102 by 44.5 mm square (4 by 4 by 1-3/4 in) trade size metal outlet boxes are to be secured to the wood test box over the base of the SHTP as shown in Figure 14.102ADV.1. A length of 2.0 mm^2 (12 AWG), Type THHN wire is to be arranged as shown and secured in place by RTV sealant. With the supply voltage to the SHTP heater at rated voltage, the box heater conductors are to be energized by a low voltage source of supply with the supply adjusted to the maximum current that will not result in the thermal protector cycling within 7-1/2 hours. The lamp load is to be located such that any heat produced by it will not affect the operation of the thermal protector. Temperature measurements are to be made at various parts of the product using methods described in Clause 14.

14.102ADV.5 After the test the control shall be evaluated as in 14.1.2.



15.1DV D2 *Modification of 15.1 of the Part 2:*

In the U.S.A., the values of MANUFACTURING DEVIATION and DRIFT shall be in accordance with annex AA.

15.5.6ADV D2 *Addition of the following to Clause 15.5.6:*

15.5.6ADV.1 The Operating Temperature-Initial ($T_{op\text{-}init}$) of a thermostat intended for drip-type coffee makers shall not vary from the Set-point Temperature Rating ($T_{s\text{-}p}$) by more than the deviation values specified in annex AA.

15.5.6BDV D2 *Addition of the following to Clause 15.5.6:*

15.5.6BDV.1 After the endurance test, the Operating Temperature-Final ($T_{op\text{-}fin}$) of a thermostat intended for drip-type coffee makers shall not vary from the Operating Temperature-Initial ($T_{op\text{-}init}$) by more than the drift values specified in annex AA.

15.5.6CDV D2 *Addition of the following to Clause 15.5.6:*

15.5.6CDV.1 Fan/heat sequencer – Initial time-calibration test I

15.5.6CDV.1.1 Initial time-calibration tests shall be conducted on separate samples having the shortest, average, and longest rated time settings, and on samples of different assigned production time tolerances, to represent the intended variations in a line of devices. One test is to be conducted on each sample; or, at the manufacturer's request, the time setting is to be recorded as the average of three tests.

15.5.6CDV.1.2 For the time-to-close calibration-verification test, the device is to remain at room temperature with the bimetal heater de-energized, until conditions have stabilized. The bimetal heater is then to be energized at rated voltage, and the time for each load circuit to close is to be determined and recorded. The current through the load circuit is to be a value sufficient for detection purposes.

15.5.6CDV.1.3 Room temperature is to be nominally 25°C (77°F), except that if the timing is severely affected by ambient air temperature, the manufacturer's specified ambient-air-temperature range is to be used.

15.5.6CDV.1.4 For the time-to-open calibration-verification test, the device is to be at room temperature as noted in 15.5.6CDV.1.2 with the bimetal-heater energized at rated voltage and:

a) Maximum rated current through all load-circuit contacts, or

b) Maximum rated current through all load-circuit contacts, or

15.5.6CDV.1.5 When thermal equilibrium is attained, the bimetal heater is to be de-energized, and the time for each load circuit to open is to be determined and recorded.

14.5.6DDV D2 *Addition of the following to Clause 15.5.6:*

15.5.6DDV.1 Fan/heat sequencer – Initial time-calibration test II

15.5.6DDV.1.1 Additional initial time-calibration-verification tests shall be conducted using the method described in 15.5.6CDV.1.2 to 15.5.6CDV.1.5 except that the test conditions shall be:

a) Rated bimetal-heater voltage and an ambient-air temperature of 0°C (32°F) or as declared, whichever is lower;

b) Rated bimetal-heater voltage and an ambient-air temperature equal to the maximum rating, but not less than 66°C (151°F);

c) Eighty-five percent of rated bimetal-heater voltage and room temperature; and

d) One hundred-ten percent of rated bimetal-heater voltage and room temperature.

15.5.6DDV.1.2 Under the conditions noted in 15.5.6CDV.1.2 – 15.5.6CDV.1.4 and 15.5.6CDV.1.1, the operating times of a fan/heat sequencer shall not vary from the declared values specified in items 117IDV and 117JDV of table 7.2DV.1 respectively for each timing (item 117HDV).

15.5.6EDV D2 *Addition of the following to Clause 15.5.6:*

15.5.6EDV.1 The following is applicable to controls classified under 6.7.103BDV.

15.5.6EDV.1.1 The resistance of the heater in 3 previously unenergized SHTPs shall be measured by a suitable ohmmeter in the unheated condition and then as specified in 15.5.6EDV.1.2 and 15.5.6EDV.1.3 with the device in the unheated condition and the heated condition. The internal resistance of the 3 SHTPs shall not differ by more than 5 percent of the average resistance of all 3 devices for each test method (ohmmeter or voltage drop) and test condition (heated and unheated) specified. The average resistance of the internal resistance in a heated condition may differ by more than 5 percent of the average resistance measured in the unheated condition.

15.5.6EDV.1.2 Each SHTP shall be connected to a source of supply adjusted to rated voltage, as illustrated by Figure 15.5.6EDV.1.2.

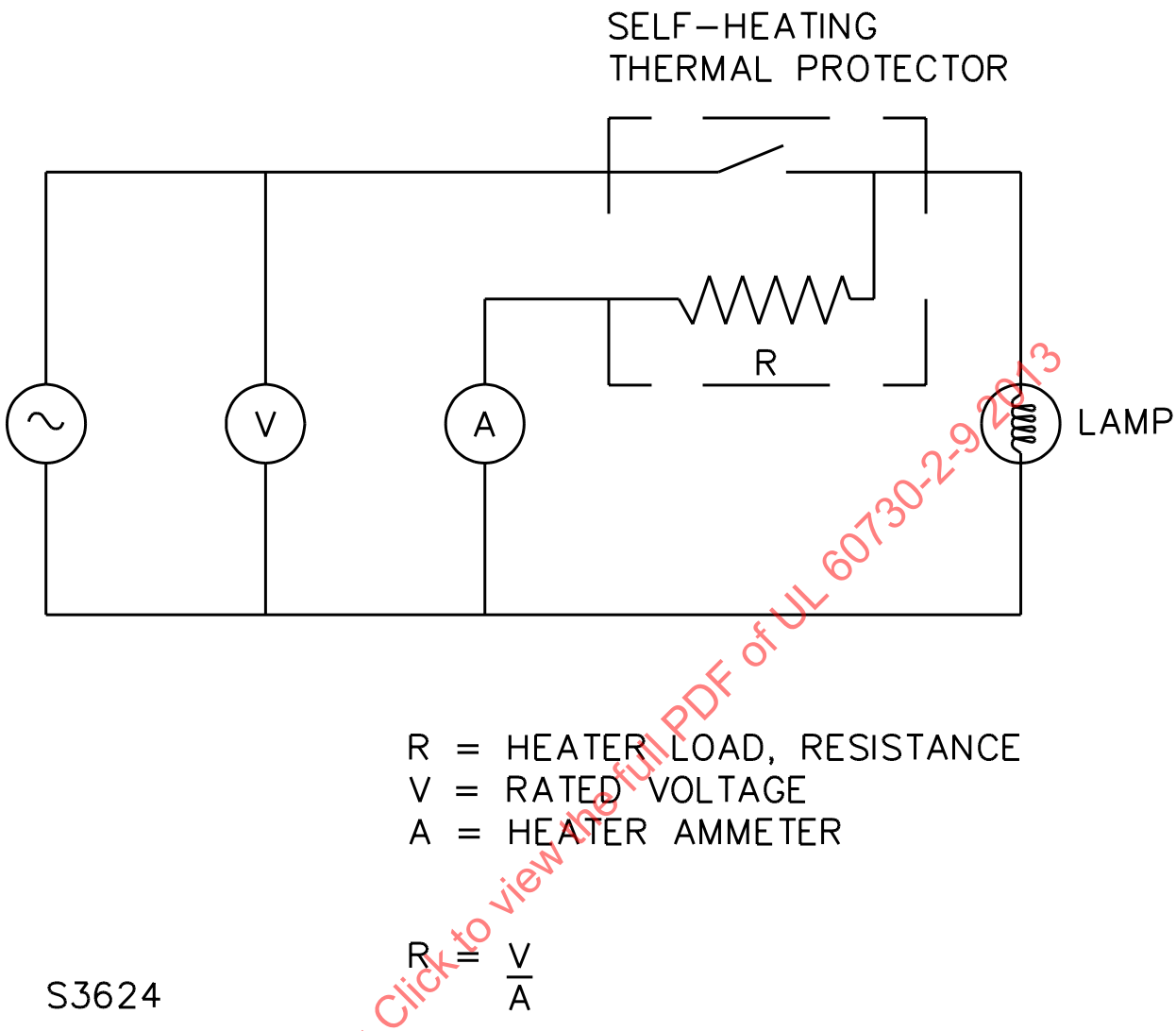


Figure 15.5.6EDV.1.2 – Circuit connections for parameter measurements

15.5.6EDV.1.3 The internal resistance shall be calculated based on the voltage and current measurements taken within 30 seconds of energizing the circuit and at three hours after energizing the circuit.

15.5.6EDV.1.4 The cutout temperature of a SHTP, shall not differ by more than 5°C (9°F) from the rated cutout temperature or by more than 5 percent from the rated Fahrenheit cutout temperature, whichever is greater when measured before and after the tests specified in this standard.

15.5.6EDV.1.5 The cutout time of 3 SHTPs tested as specified in 15.5.6EDV.1.6 and 15.5.6EDV.1.7 shall not differ by more than 30 percent of the average cutout time if the average time is less than 3 hours, or 10 percent of the average cutout time if the average time is 3 hours or greater before and after the tests specified in this standard.

15.5.6EDV.1.6 Three previously unenergized SHTPs are to be tested under the same test conditions specified for the temperature test in 14.102ADV.2 - 14.102ADV.4 with the internal heater of the SHTP connected to the rated supply voltage and, if necessary, the outlet box heater.

15.5.6EDV.1.7 The test conditions are to be the same for each SHTP tested, including the supply voltages to the SHTP and the supply voltage to the outlet box heater.

17.16.102A D2 *Addition of the following to Clause 17.16:*

17.16.102ADV.1 Thermostat for Drip-Free Coffee Makers

17.16.102ADV.1.1 A sample of the thermostat intended for use in drip-free coffee makers shall be subjected to an overload test as described in clause 17.7, consisting of making and breaking for 50 cycles of OPERATION, at a rate of six cycles per min, a value of current described in table 17.2.2. During each cycle of operation, the thermostat is to be exposed to a temperature range from the Reset Temperature (T_{reset}) to the Maximum Normal Use Temperature Rating (T_{max}).

17.16.102ADV.1.2 The temperature-regulating thermostat that has been subjected to the test of clause 17.16.102ADV.1.1 is to be subjected to the test as described in 17.16.102ADV.1.3 and 17.16.102ADV.1.4.

17.16.102ADV.1.3 The endurance test is to consist of making and breaking the rated current at a unity power factor at rated voltage for 100,000 cycles of operation. During the first 5,000 cycles of the endurance test, the thermostat is to be exposed to a temperature range from the Reset Temperature (T_{reset}) to the Maximum Dry Operation Temperature Rating (T_{dry}). During the remaining 95,000 cycles of the test, the thermostat is to be exposed to a temperature range from the Reset Temperature (T_{reset}) to the Maximum Normal Use Temperature Rating (T_{max}).

17.16.102ADV.1.4 The temperature-regulating thermostat is to be operated by alternately heating and cooling the sensing surface. The thermocouple for measuring the temperature of the sensing element and the insulating materials is to be located at the periphery of the thermostat face that normally is in contact with the part being sensed.

Note – The manufacturer may supply the test sample with the thermocouple attached.

17.16.102BDV D2 *Addition of the following to Clause 17.16:*

17.16.102BDV.1 Fan/Heat Sequencers

17.16.102BDV.1.1 A sample of the control having the highest heating effect from the bimetal-heater shall be subjected to an overload test, as described in clause 17.7. The control shall make and break a load for 50 cycles at maximum current and maximum rated ambient temperature. The heater is to be cycled using rated ambient temperature and rated voltage.

17.16.102BDV.1.2 The control that has been subjected to the test of clause 17.16.102BDV.1.1 is to be subjected to the test as described in 17.16.102BDV.1.3.

17.16.102BDV.1.3 The endurance test as described in 17.8 shall be conducted on the control for 30,000 cycles of operation at a maximum rate of 1 cycle per minute or as declared by the manufacturer. Only one pole of a multistage device is to be loaded, unless loading of the other poles contributes to timing differences. Additional overload and endurance tests are to be conducted on separate samples for additional ratings, or the like. These samples need not be calibrated, unless such ratings contribute to timing differences.

17.16.102BDV.1.4 Immediately after the test of clause 17.16.102BDV.1.3, the sample shall be subjected to the tests of clauses 15.5.6BDV and 15.5.6CDV, followed by an Electric Strength test per clause 13.2.

17.16.102CDV D2 *Addition of the following to Clause 17.16:*

17.16.102CDV.1 Self-Heating Thermal Protectors (SHTP)

17.16.102CDV.1.1 A sample of the self-heating thermal protector (SHTP) shall be subjected to an overload test as described in clause 17.7, consisting of making and breaking the rated load for 50 cycles of operation at a rate of six cycles per min. For a tungsten-filament lamp load, the test cycle is to be minimum 1 second on and minimum 55 seconds off. For a protector with a ballast or high-intensity-discharge rating, the test current is to be 150 percent of the rated current, or 4.5 amperes, whichever is greater. The voltage is to be the rated voltage.

17.16.102CDV.1.2 If a wattage-rated device has wattage ratings with more than one voltage, a test at the highest voltage is considered to be representative of tests at the lower voltages. However, if the device has a higher wattage rating at the lower voltage than at the higher voltage, tests are to be conducted at the highest and lowest voltages.

17.16.102CDV.1.3 The thermal protector subjected to the overload test, 17.16.102CDV.1.1 and 17.16.102CDV.1.2 is also subjected to the endurance test of 17.8. A protector with a tungsten rating is to make and break a tungsten-filament lamp load of rated current at rated voltage for 10,000 cycles of operation. The cycling rate is to be one cycle per minute with a minimum on period of 1 second and a minimum off period of 55 seconds. For a protector with a ballast or high-intensity-discharge rating, the protector shall make and break a load of twice the rated current having a 40-50 percent power factor at rated voltagfe for 10,000 cycles of operation. The cycling rate shall be in accordance with note a or b of Table CC2.

17.16.102CDV.1.4 Immediately after the test of clause 17.16.102CDV.1.3, the sample shall be subjected to the tests of clauses 15.5.6EDV.1.4 to 15.5.6EDV.1.7, followed by an Electric Strength test per clause 13.2.

27.101DV D2 *Addition of the following clauses:*

27.101DV.1 Overvoltage

27.101DV.1.1 The following is applicable to controls classified under 6.7.103BDV.

27.101DV.1.2 Three SHTPs are to be subjected to an overvoltage test. Each SHTP is to be connected to a supply circuit that has been adjusted to 10 percent above the rated nominal voltage of the device. The SHTP is to be operated for 7-1/2 hours and is to be caused to cycle (by an external heat source if necessary) 5 times during the 7-1/2 hours. During each cycle, the SHTP is to be de-energized no more than 5 minutes.

27.101DV.1.3 After the conclusion of the test, the resistance of the heater shall be within 5 percent of its value before the test, and the cutout temperature of the device shall not rise above the initial cutout temperature by more than 5°C (9°F), or more than 5 percent of the rated Fahrenheit cutout temperature, whichever is greater.

27.102DV D2 *Addition of the following clauses:*

27.102DV.1 Thermal Cycling

27.102DV.1.1 The following is applicable to controls classified under 6.7.103BDV.

27.102DV.1.2 Three SHTPs are to be subjected to a thermal cycling test. Each SHTP is to be connected to a source of supply adjusted to rated voltage and connected to a rated load. The supply is to be cycled on and off such that the device is energized for one hour and then de-energized for the next hour and repeated for a total of 1000 hours.

27.102DV.1.3 At the conclusion of the test, the resistance of the internal heater shall be within 5 percent of its value before the test; and the cutout time of the device shall be within 5 minutes of the initial cutout time as determined by subjecting the SHTP tested to the initial time calibration-verification, 15.5.6EDV.1.5 to 15.5.6EDV.1.7.

27.103DV D2 *Addition of the following clauses:*

27.103DV.1 Short Circuit

27.103DV.1.1 The following is applicable to controls classified under 6.7.103BDV.

27.103DV.1.2 Three thermal protective devices are to be subjected to a short circuit test. Each device is to be connected to a branch circuit supply with a power factor of 0.9 - 1.0, available current as specified in Table 27.103DV.1, and adjusted to the maximum rated voltage for the device. A nonrenewable fuse that is rated for the maximum intended branch circuit amperes, 10,000 amperes fault current, and voltage rating equal to or greater than the maximum rated voltage of the thermal protective is to be connected in series between the supply and the thermal protective device. The fuse shall be such that it will not open in less than 12 seconds while carrying twice its rated current. The conductor between each side of the branch circuit supply and the thermal protective device are to be 8 AWG (3.3 mm) and are to be 4 feet (1.2 m) long. That part of a device that could protrude into the

concealed space of a building and any openings in the device are to be wrapped with a layer of surgical cotton. The device is to be operated with the output of the device connected to the grounded supply conductor, until the fuse opens or some part of the thermal protective device is permanently open-circuited. The test setup is illustrated in Figure 27.103DV.1.

Table 27.103DV.1
Short-circuit currents

Branch circuit capacity at which device is intended to be used (amperes)	Circuit capacity (amperes)
20	200
30	1000
40	3500
50	5000