

UNDERWRITERS'
LABORATORIES
OF CANADA

ULC-S545-02

STANDARD
FOR
RESIDENTIAL FIRE
WARNING SYSTEM
CONTROL UNITS



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CONTROL UNITS**

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STANDARD FOR RESIDENTIAL FIRE WARNING SYSTEM CONTROL UNITS

PREFACE

This is the Second Edition of the Standard for Residential Fire Warning System Control Units, ULC-S545-02.

This Edition of the Standard has been formally approved by the ULC Committee on Fire Alarm Equipment and Systems.

A product which complies with these requirements will not necessarily be acceptable if, when examined and tested, it is found to have features not covered by the Standard which may impair the result contemplated by these requirements.

A product employing materials or having forms of construction differing from those detailed in these requirements may be examined and tested according to the intent of the requirements, and if found to be substantially equivalent, may be given recognition.

Only SI units of measurement are used in this Standard.

1. SCOPE

1.1 These requirements cover residential fire warning system control units and accessories intended to be installed in accordance with the Standard for the Installation of Residential Fire Warning Systems, CAN/ULC-S540.

1.2 A residential fire warning system control unit consists of a unit assembly of electrical parts having provision for connection of power source and *initiating device circuits*. Provision for connection of an *indicating device circuit* is also required unless an alarm-sounding device is integral with the control unit. Additional terminals may be provided for the connection of supplementary devices such as *annunciators*, remote switches and the like. A secondary supply, such as a battery, may be provided as integral with the control unit or provision may be provided for its connection to the control unit.

1.3 Provision for the connection to the control unit of at least one smoke detector is required unless reference is made on the installation diagram for the use of a self-contained smoke detector such as a single or multiple-station smoke alarm.

1.4 These requirements also apply to the use of *combination systems*, such as a combination fire-burglar alarm system control unit, which employs circuit wiring common to both systems. When common wiring is employed for *combination systems*, it shall be connected in such a manner that internal *fault* conditions (shorts, opens, grounds) in the non-fire alarm (burglary) system circuit wiring, or *faults* between the fire and non-fire alarm system circuits, will not interfere with the supervision of the *fire alarm system* or prevent normal *alarm signal* transmission.

1.5 These requirements do not cover single or multiple-station smoke alarms, automatic fire detectors, or alarm indicating appliances, such as bells, horns, and the like. They do cover accessories, which are external to the control unit and are dependent upon the control unit to function, such as end-of-line devices, *annunciators*, and remote switches.

2. GLOSSARY

NOTE: Terms used in this Standard that are in *italic* print are defined as follows:

ALARM SIGNAL – A control unit accessory to visually indicate required signals received from a *fire alarm system* (fire warning system).

ANNUNCIATOR - A device to visually indicate a signal received from the fire warning system.

COMBINATION SYSTEM - A combined system, incorporating burglar and *fire alarm system*.

DISTINCTIVE SIGNALS - Signals obtained from different sounding appliances, such as bells, horns, sirens, speakers and buzzers, or from a single appliance, such as an electronic horn, where a continuous signal is obtained under one condition and a pulsing signal under another.

DWELLING UNIT - A suite operated as a housekeeping unit, used or intended to be used as a domicile by one or more persons and usually containing cooking, eating, living, sleeping and sanitary facilities.

END-OF-LINE RESISTOR - A resistor installed at the end of an *initiating or indicating device circuit* to limit the amount of supervisory current.

FAULT - An open or ground condition on any extended circuit or a short on a signalling circuit extending from a control unit.

FIRE ALARM SYSTEM - A combination of devices designed to warn the building occupants of an emergency condition

INDICATING DEVICE - Any audible signal appliance employed to indicate a fire, supervisory, or trouble condition. Examples of audible signal appliances are bells, horns, sirens, speakers, electronic horns, buzzers, and chimes.

INDICATING DEVICE CIRCUIT - Circuit to which indicating devices are connected.

INITIATING DEVICE - A manually or automatically operated device whose operation results in a fire alarm indication from the control unit. Examples of *alarm signal initiating devices* are heat detectors, manual pull stations, and smoke detectors.

INITIATING DEVICE CIRCUIT - Circuit to which automatic or manual *initiating devices* are connected.

TROUBLE SIGNAL - A visual and audible indication of equipment failure, circuit failure, *fault* condition or operational malfunction.

3. GENERAL

3.1 GENERAL

3.1.1 The term "product" as used in this standard refers to all items of equipment covered by the Scope.

3.1.2 Unless otherwise indicated, all voltage and current values mentioned in this Standard are rms.

3.1.3 The requirements of this standard apply uniformly to all equipment regardless of whether used as a component of a control unit or separately enclosed and referred to as a control unit accessory.

4. INSTRUCTIONS AND INSTALLATION DRAWINGS

4.1 INSTALLATION DRAWINGS

4.1.1 An installation drawing shall be provided with each residential control unit illustrating the field connections to be made. The drawing may be attached to the unit or, if separate, shall be referenced in the marking attached to the unit. Where wireless equipment is to be used, the appropriate instructions shall be supplied.

4.1.2 The drawing shall show a pictorial view of the installation terminals or leads to which field connections are to be made, as they would appear when viewed from the front. The terminal designations on the control unit shall agree with the designations on the drawing. An unattached drawing shall be marked with the name or trademark of the manufacturer, drawing number and issue number and/or date.

4.1.3 The instructions and drawings shall include such directions and information adequate for attaining proper and safe installation, maintenance, and operation of the control unit.

4.1.4 The following information shall appear on the installation wiring diagram for the applicable circuits to which field connections are made:

- A MAIN SUPPLY CIRCUIT - The voltage, frequency and maximum current or watts input;
- B ALARM INDICATING CIRCUITS - The manufacturer, model number, method of connection, and maximum number of indicating devices that can be connected;
- C *INITIATING DEVICE CIRCUIT* - The maximum voltage, current and frequency and reference to the type and maximum number of devices to be employed, such as heat detectors, smoke detectors, etc., shall be indicated in addition to their intended connection. The maximum line impedance shall be noted unless the control unit can operate with 100 Ω impedance in each circuit;
- D BATTERY CIRCUIT - The voltage "DC" and the maximum current input. For a battery intended to be charged by the control unit, the maximum charging currents, trickle and fast charge, shall be indicated as well as the battery capacity in ampere-hours; and
- E SUPPLEMENTARY SIGNALLING CIRCUITS - The specific devices, which are intended to be connected or the maximum electrical rating in amperes or watts, volts, and frequency.

4.1.5 The product and instruction documents shall be marked as to their intended wiring methods in keeping with the requirements of CSA C22.1, Canadian Electrical Code, Part I, Safety Standard for Electrical Installations.

4.2 INSTRUCTIONS

4.2.1 Each residential control unit shall be provided with the following operating, installation, and maintenance instructions:

- A Typical installation layout for the residential fire warning system indicating recommended locations of the control unit, detectors, bells, etc;
- B Description of the operation, testing, and proper maintenance procedures of the system. This shall include an indication of the following conditions, where applicable:
 - (i) Normal standby;
 - (ii) Alarm;
 - (iii) Alarm test;
 - (iv) Alarm silence;

- (v) Trouble;
- (vi) Trouble silence;
- (vii) Off-normal position of switches;
- (viii) Functions of lights, switches, etc;
- (ix) Lamp and fuse replacement;
- (x) Battery maintenance and replacement;
- (xi) Name and address of service people to contact in event of trouble;
- (xii) Maintenance recommendations;
- (xiii) Loss of AC power; and
- (xiv) Low battery.

- C Information on establishing a residential emergency evacuation plan in the event of a fire.

4.2.2 The instructions shall be referenced in the Control Unit Marking.

5. CONSTRUCTION

5.1 GENERAL

5.1.1 A control unit shall be so constructed that it will be practical, reliable, and sufficiently durable for its intended installation and use. It shall be suitable for use with acceptable signal initiating and indicating devices, and other equipment normally connected to it to form a residential fire warning system of the type indicated by the installation diagram.

5.1.2 An acceptable initiating or *indicating device* is considered to be one which has been found by investigation to be suitable for use with the control unit.

5.1.3 A component of a control unit shall comply with the requirements for that component, except that such requirements may be modified if appropriate for the particular application.

5.1.4 Except where indicated otherwise, the construction requirements specified for control units shall apply also for control unit accessories.

5.2 FRAME AND ENCLOSURE

5.2.1 General

5.2.1.1 A control unit shall be so formed and assembled that it has the strength and rigidity necessary to resist the abuses to which it is likely to be subjected in service without adversely affecting its performance and without introducing fire, shock, or accident hazard due to total or partial collapse with resulting reduction of spacings, loosening or displacement of parts or other serious defects.

5.2.1.2 All electrical parts of a control unit shall be enclosed to provide protection against contact with uninsulated live parts.

5.2.1.3 There shall be adequate space within a terminal or wiring compartment for completing all wire connections as specified by the installation wiring diagram.

5.2.1.4 An enclosure shall have suitable means for mounting, which shall be accessible without disassembling any operating part of the unit. Removal of a completely assembled panel or printed wiring board to mount the enclosure is not considered to be disassembly of an operating part.

5.2.1.5 A compartment enclosing electrical parts shall not be open to the floor or other support on which a unit rests.

5.2.2 Cast Metal Enclosures

5.2.2.1 The thickness of cast metal for an enclosure shall be as indicated in Table 1, except that cast metal having a thickness 0.8 mm less than that indicated in the Table may be employed if the surface under consideration is curved, ribbed, or otherwise reinforced, or if the shape and/or size of the surface is such that equivalent mechanical strength is provided.

5.2.2.2 If threads for the connection of conduit are tapped all the way through a hole in an enclosure wall, or if an equivalent construction is employed there shall be not less than 3-½ nor more than 5 threads in the metal, and the construction shall be such that a standard conduit bushing can be properly attached.

5.2.2.3 If threads for the connection of conduit are tapped only part of the way through a hole in an enclosure wall, there shall be not less than five full threads in the metal, and there shall be a smooth, well-rounded inlet hole for the conductors which shall afford protection to the conductors equivalent to that provided by a standard conduit bushing.

5.2.3 Sheet Metal Enclosures

5.2.3.1 The thickness of sheet metal employed for the enclosure of a control unit shall be not less than that indicated in Table 2, except that sheet metal of two gauge sizes lesser thickness may be employed if the surface under consideration is curved, ribbed, or otherwise reinforced, or if the shape and/or size of the surface is such that equivalent mechanical strength is provided.

5.2.3.2 At any point where conduit or metal-clad cable is to be attached, sheet metal shall be of such thickness or shall be so formed or reinforced that it will have stiffness at least equivalent to that of uncoated flat sheet steel having a minimum thickness of 1.35 mm.

5.2.3.3 A plate or plug for an unused conduit opening or other hole in the enclosure shall have a thickness of not less than: 0.36 mm for steel or 0.48 mm for nonferrous metal for a hole having a 6.4 mm maximum dimension; and 0.69 mm steel or 0.8 mm nonferrous metal for a hole having a 35 mm maximum dimension.

5.2.3.4 A closure for a larger hole shall have a thickness equal to that required for the enclosure of the device or a standard knockout seal shall be used. Such plates or plugs shall be securely mounted.

5.2.3.5 A knockout in a sheet-metal enclosure shall be reliably secured but shall be capable of being removed without undue deformation of the enclosure.

5.2.3.6 A knockout shall be provided with a flat surrounding surface adequate for proper seating of a conduit bushing, and shall be so located that installation of a bushing at any knockout likely to be used during installation will not result in spacings between uninsulated live parts and the bushing of less than the requirements in this Standard.

5.2.4 Nonmetallic Enclosures

5.2.4.1 A nonmetallic enclosure or enclosure part shall have mechanical strength and durability and be so formed that operating parts will be protected against damage, and shall resist the abuses likely to be encountered during installation and normal use and service, but in any case, the mechanical strength shall be at least equivalent to a sheet-metal enclosure of the minimum thickness specified in Table 2. The enclosure or enclosure part shall protect persons from shock hazard.

5.2.4.2 Among the factors taken into consideration when judging the acceptability of a nonmetallic enclosure with respect to aging are: the mechanical strength; resistance to impact; moisture-absorptive properties; combustibility and resistance to ignition from electrical sources; dielectric strength, insulation resistance, and resistance to arc tracking; and resistance to distortion and creeping at temperatures to which the material may be subjected under conditions of normal and abnormal usage.

5.2.4.3 The continuity of the grounding system shall not rely on the dimensional integrity of the nonmetallic material.

5.3 ELECTRIC SHOCK

5.3.1 Any part that is exposed only during operator servicing shall not present the risk of electric shock. See Electric Shock Current Test, Subsection 7.14.

5.3.2 Each terminal provided for the connection of an external antenna shall be conductively connected to the supply circuit grounded conductor. The conductive connection shall have a maximum resistance of 5.2 MΩ, a minimum wattage rating of ½ W, and shall be effective with the power switch in either the on or off position.

5.3.3 The conductive connection need not be provided if such a connection is established in the event of electrical breakdown of the antenna isolating means, the breakdown does not result in a risk of electric shock, and in a construction employing an isolating power transformer, the resistance of the conductive connection between the supply circuit and chassis does not exceed 5.2 MΩ.

5.3.4 The maximum value of 5.2 MΩ specified in Clauses 5.3.2 and 5.3.3 is to include the maximum tolerance of the resistor value used; that is, a resistor rated 4.2 MΩ with 20% tolerance or a resistor rated 4.7 MΩ with a 10% tolerance is acceptable. A component comprised of a capacitor with a built-in shunt resistor that complies with the requirements for antenna isolating capacitors may be rated a minimum of ¼ W.

5.3.5 The insertion in any socket of any component used in the product shall not result in a risk of electric shock.

5.4 VENTILATING OPENINGS

5.4.1 Ventilating openings in an enclosure, including perforated holes, louvres, and openings protected by means of wire screening, expanded metal, or perforated covers, shall be of such size or shape that no opening will permit passage of a rod having a diameter of 3.6 mm. An enclosure for fuses or other overload-protective devices and provided with ventilating openings shall afford adequate protection against the emission of flame or molten metal.

5.4.2 Except as noted in Clause 5.4.3, perforated sheet metal and sheet metal employed for expanded-metal mesh shall be not less than 1.07 mm in average thickness, 1.17 mm if zinc coated.

5.4.3 If the indentation of a guard or enclosure will not alter the clearance between uninsulated, movable, live parts and grounded metal so as to affect performance adversely or reduce spacings below the minimum values given under Spacings, Subsection 5.19, 0.53 mm expanded-metal mesh (0.61 mm if zinc coated) may be employed, provided that the exposed mesh on any one side or surface of the device so protected has an area of not more than 465 cm² and has no dimension greater than 300 mm, or that the width of an opening so protected is not greater than 90 mm.

5.4.4 The wires of a screen shall be not smaller than No. 16 AWG and the screen openings shall be not greater than 3.2 mm by 3.2 mm.

5.5 METAL COVERS AND DOORS

5.5.1 An enclosure cover shall be hinged, sliding, pivoted or similarly attached if it provides ready access to fuses or any other over current-protective device the normal functioning of which requires renewal, or if it is necessary to open the cover in connection with the normal operation and maintenance of the unit.

5.5.2 With reference to the requirement of the Clause 5.5.1, normal operation is considered to be operation of a switch for testing or for silencing an audible signal appliance or operation of any other component of a unit, which requires such action in connection with its intended performance.

5.5.3 A hinged cover is not required where the only fuse(s) enclosed is intended to provide protection to portions of internal circuits such as may be employed on a separate printed wiring board or circuit subassembly, to prevent excessive circuit damage resulting from a *fault*. The use of such a fuse(s) is acceptable if the following or equivalent marking is indicated on the cover: "CIRCUIT FUSE(S) INSIDE - Disconnect Power Prior To Servicing."

5.5.4 A hinged cover shall be provided with a latch, screw, or catch to hold it closed. An unhinged cover shall be securely held in place by screws or the equivalent.

5.6 GLASS PANELS

5.6.1 Glass covering an observation opening shall be held securely in place so that it cannot be readily displaced in service and shall provide adequate mechanical protection for the enclosed parts. The thickness of a glass cover shall be not less than that indicated in Table 3.

5.6.2 A glass panel for an opening having an area of more than 930 cm², or having any dimension greater than 300 mm, shall be supported by a continuous groove not less than 5 mm deep along all four edges of the panel.

5.6.3 A transparent material other than glass employed as a cover over an opening in an enclosure shall have equivalent mechanical strength to that of glass, not become a fire hazard, distort, nor become less transparent at the temperature to which it may be subjected under normal or abnormal service conditions.

5.7 CORROSION PROTECTION

5.7.1 Except as indicated in Clause 5.7.2, iron and steel parts, except bearings, and the like, where such protection is impracticable, shall be suitably protected against corrosion by enamelling, galvanizing, sherardizing, plating, or other equivalent means.

5.7.2 The requirement of Clause 5.7.1 applies to all enclosing cases whether of sheet steel or cast iron, and to all springs and other parts upon which proper mechanical operation may depend. It does not apply to minor parts such as washers, screws, bolts, and the like, if the failure of such unprotected parts would not be liable to result in a hazardous condition or adversely affect the operation of the unit. Parts made of stainless steel, properly polished or treated if necessary, do not require additional protection against corrosion. Bearing surfaces should be of such materials and design as to ensure against binding due to corrosion.

5.8 INSULATING MATERIAL

5.8.1 Insulating materials for the support or separation of live parts shall be of a non-flammable, moisture-resistant insulating material, such as porcelain, phenolic or cold-moulded composition, or other material which is recognized for the support of live parts.

5.8.2 A base mounted on a metal surface shall be provided with an insulating barrier between the mounting surface and all live parts on the underside of the base which are not staked, upset, sealed, or equivalently prevented from loosening so as to prevent such parts and the ends of replaceable terminal screws from coming in contact with the supporting surface.

5.8.3 Vulcanized fibre may be used for insulating bushings, washers, separators, and barriers, but not for the sole support of live parts.

5.8.4 The thickness of a flat sheet of acceptable insulating material, such as phenolic composition employed for panel-mounting parts, shall be not less than that indicated in Table 4.

5.8.5 A terminal block mounted on a metal surface which may be grounded shall be provided with an insulating barrier between the mounting surface and all live parts on the underside of the base which are not staked, upset, sealed or equivalently prevented from loosening so as to prevent such parts and the ends of replaceable terminal screws from coming in contact with the supporting surface.

5.8.6 A countersunk, sealed part shall be covered with a waterproof insulating compound which will not melt at a temperature 15°C higher than the maximum normal operating temperature of the assembly, and at not less than 65°C in any case. The depth or thickness of sealing compound shall be not less than 3.2 mm.

5.9 MOUNTING OF ELECTRICAL COMPONENTS

5.9.1 All parts of a residential control unit shall be securely mounted in position and prevented from loosening or turning if such motion may affect adversely the normal performance of the control unit, or may affect the risk of fire and accident hazard incident to the operation of the control unit.

5.9.2 A switch, lampholder, attachment-plug receptacle, or plug connector shall be mounted securely and, except as noted in Clauses 5.9.3 and 5.9.4, shall be prevented from turning.

5.9.3 The requirement that a switch be prevented from turning may be waived if all the following conditions are met:

- A The switch is of a push button or other type that does not tend to rotate when operated (a toggle switch is considered to be subject to forces that tend to turn the switch during normal operation of the switch);
- B The means of mounting the switch makes it unlikely that operation of the switch will loosen the switch; or
- C The spacings are not reduced below the minimum acceptable values if the switch does rotate.

5.9.4 A lampholder of a type in which the lamp cannot be replaced, such as a neon pilot or indicator light in which the lamp is sealed in by a nonremovable jewel, need not be prevented from turning if rotation cannot reduce spacings below the minimum acceptable values.

5.9.5 The means for preventing turning of a device is to consist of more than friction between surfaces; for example, a suitable lockwasher, properly applied, is acceptable as the means for preventing a small stem-mounted switch or other device having a single-hole mounting means from turning.

5.9.6 Uninsulated live parts, including terminals, shall be secured to their supporting surfaces by methods other than friction between surfaces, so that they will be prevented from turning or shifting in position if such motion may result in reduction of spacings to less than those required. The security of contact assemblies shall be such as to ensure the continued alignment of contacts.

5.10 OPERATING MECHANISMS

5.10.1 Operating parts, such as switches, relays, and similar devices, shall be adequately protected by individual protection on dust-tight cabinets, against fouling by dust or by other material which may affect adversely their normal operation.

5.10.2 A part shall be constructed of material that is acceptable for its intended application.