

**ULC
STANDARD**

ULC-S636-08

STANDARD FOR TYPE BH GAS VENTING SYSTEMS



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For further information on ULC services, please contact:

CORPORATE HEADQUARTERS

Underwriters' Laboratories of Canada
7 Underwriters Road
Toronto, Ontario M1R 3B4
Telephone: (416) 757-3611
Fax: (416) 757-9540
Toll-free telephone: 1-866-9373-ULC

EASTERN OFFICE

6505 Trans-Canada Hwy., Suite 330
St. Laurent, Québec H4T 1S3
Telephone: (514) 363-5941
Fax: (514) 363-7014
Toll-free telephone: 1-866-9373-ULC

PACIFIC OFFICE

No. 130 – 13775 Commerce Parkway
Richmond, British Columbia V6V 2V4
Telephone: (604) 214-9555
Fax: (604) 214-9550
Toll-free telephone: 1-866-9373-ULC

For further information on ULC standards, please contact:

STANDARDS DEPARTMENT AND GOVERNMENT RELATIONS OFFICE

200-440 Laurier Avenue West
Ottawa, Ontario
K1R 7X6
Telephone: (613) 755-2729
Fax: (613) 231-5977

E-mail: customerservice@ulc.ca

Web site: www.ulc.ca

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REFERENCE PUBLICATIONS

The documents shown below are referenced in the text of this Standard. Unless otherwise stated elsewhere in this Standard such reference shall be considered to indicate the edition and/or revisions of the document available at the date on which the Committee approved this ULC Standard.

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- ASTM A653M-07, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.
- ASTM D638M-96, Standard Test Method for Tensile Properties of Plastics [Metric].
- ASTM D1784-06a, Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- ASTM D1822M-93, Standard Test Method for Tensile-Impact Energy to Break Plastics and Electrical Insulating Materials [Metric].
- ASTM D2412-02, Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
- ASTM D2661-06, Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.
- ASTM D3163-01, Standard Test Method for Determining Strength of Adhesively Bonded Rigid Plastic Lap-Shear Joints in Shear by Tension Loading.
- ASTM D5048-03, Standard Test Method for Measuring the Comparative Burning Characteristics and Resistance to Burn-Through of Solid Plastics Using a 125 mm Flame.
- ASTM F628-06, Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core.

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- CSA 2.3-06/ANSI Z21.47-06, Gas-Fired Central Furnaces (harmonized Standard)
- CSA 4.1-04/ANSI Z21.10.1-04 Incl. Addenda A - 02/06 & Addenda B - 04/06, Gas Water Heaters Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less (harmonized Standard)
- CSA 4.3-04/ANSI Z21.10.3-04, Gas Water Heaters; Volume III - Storage Water Heaters with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous (harmonized Standard)

- ANSI Z21.13a-05/CSA 4.9a-05, Incl. Addenda A – 04/05, Standard for Gas-Fired Low Pressure Steam and Hot Water Boilers (harmonized Standard)
- CAN/CSA-B149.1-05 Incl. Supplement No. 1, Natural Gas and Propane Installation Code.
- CAN/CSA-B149.2-05 Incl. Supplement No. 1, Propane Storage and Handling Code.

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TYPE BH GAS VENTING SYSTEMS

PREFACE

This is the Third Edition of the Standard for Type BH Gas Venting Systems, ULC-S636.

This Edition of the Standard has been formally approved by the ULC Committee on Factory-Built Fireplaces, Chimneys and Vents.

Only metric SI units of measurement are used in this Standard. If a value for measurement is followed by a value in other units in parentheses, the second value may be approximate. The first stated value is the requirement.

Appendix A, identified as normative, forms a mandatory part of this standard.

Attention is drawn to the possibility that some of the elements of this Canadian standard may be the subject of patents rights. Underwriters' Laboratories of Canada shall not be held responsible for identifying any or all such patents rights.

Requests for interpretation of this Standard should be sent to the Standards Department of Underwriters' Laboratories of Canada. The requests should be worded in such a manner as to permit a "yes" or "no" answer based on the literal text of the requirement concerned.

This Standard is intended to be used for conformity assessment.

1. SCOPE

1.1 These requirements cover the design, construction, and performance of gas venting systems intended for negative or positive pressure venting of gas-fired appliances producing flue gases having temperatures as specified in Clauses 1.2 and 1.3.

1.2 Class I venting systems are suitable for gas-fired appliances producing flue gas temperatures of more than 135°C but not more than 245°C.

1.3 Class II venting systems are suitable for gas-fired appliances producing flue gas temperatures of 135°C or less.

1.4 Class II venting systems are further classified into four temperature ratings as follows:

- A Up to and including 65°C;
- B Up to and including 90°C;
- C Up to and including 110°C; and
- D Up to and including 135°C.

Note: Compliance of a venting system with this standard does not imply that the venting system is acceptable for use on a gas appliance without supplemental tests in the applicable gas appliance standard resulting in the listing of the appliance for use with the specific type(s) of venting system covered by this standard.

2. CONSTRUCTION

2.1 DEFINITIONS

2.1.1 The definitions contained in the Natural Gas and Propane Installation Code, CAN/CSA-B149.1, shall apply throughout this Standard.

2.1.2 Appliance adapter - A fitting which connects a vent system to a fuel-burning appliance outlet.

2.2 MATERIALS

2.2.1 A part normally in contact with flue gases shall be made of corrosion-resistant materials or have a corrosion-resistant finish to resist corrosion by flue-gas condensate. Metals shall not be used in combinations such as to cause detrimental galvanic action, which will adversely affect any part of the assembly.

2.2.2 Materials shall incorporate appropriate strength, rigidity, corrosion-resistance, thermal properties and gas tightness.

2.2.3 The thickness of sheet metal employed for a venting system component or sub assembly shall be not less than that indicated below, except that sheet metal of lesser thickness may be employed if, upon investigation (consideration being given to the shape, size and function of the component or sub assembly), it is found to have adequate mechanical strength and to be otherwise suitable for the purpose.

Aluminum Alloys.....	0.40 mm
Zinc-Coated Steel (Refer to Clause 2.2.7).....	0.46 mm
Aluminum-Coated Steel (122 g/m ² and where the bond between the steel and the aluminum is an iron-aluminum alloy).....	0.46 mm
Stainless Steel	0.30 mm

2.2.4 Aluminum alloys containing more than 1.0% magnesium are not to be used if the reflectivity of the material is utilized to reduce a fire hazard.

2.2.5 Ceramic materials and porcelain-enamelled steel shall conform to the requirements of the applicable tests described for the material.

2.2.6 An outer casing or other structural part (exclusive of the flue-gas conveying conduit) of a Class I venting system intended for interior installation only, whose failure would cause the gas vent to collapse or fail, or which adjoins fire stopping, shall be made of material having durability and resistance to physical damage, corrosion and fire. Plain galvanized steel (refer to Clause 2.2.7), or Type 1100 aluminum ordinarily meets the requirements of the foregoing.

2.2.7 A coating of zinc conforming to the specifications of ASTM A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process coating designation Z275, will satisfy the coating requirement for galvanized steel.

2.2.8 The outer casing of venting systems designed for exterior installation or the section or sections of any system extending exterior to the building shall conform to the requirements contained in Test No. 9 - Condensing Sulphur Dioxide (Metallic Vents), as described in Subsection 3.10.

2.2.9 Metal flue-gas conveying conduits of all venting systems shall be resistant to the corrosive effects of combustion products and shall conform to the requirements of Test No. 9 - Condensing Sulphur Dioxide (Metallic Vents).

2.2.10 Metal flue-gas conveying conduits of all venting systems shall meet the requirements of Test No. 16 - Resistance to Condensate (Metallic Vents).

2.2.11 A cap shall conform to the requirements of Clauses 2.2.9 and 2.2.10 as applicable.

2.2.12 Flexible venting materials shall not crack or be subject to reduction in cross sectional area when bent to a degree simulating field conditions in accordance with Test No. 17 - Bending (Flexible Metallic Vents).

2.2.13 Materials used for jointing shall not show signs of loosening, deterioration or loss of effectiveness after extended use when tested in accordance with Subsections 3.4.2 and 3.4.3.

2.2.14 Thermal insulation material shall be of a metal or mineral base.

2.2.15 Thermal insulation as employed shall comply with the following conditions when the venting system is tested in accordance with these requirements:

- A The products resulting from the combustion or volatilization of any combustible binder shall be discharged to the venting system terminus outside of the building;
- B The insulating material shall retain sufficient physical strength to remain in its intended position;
- C The thermal conductivity of the insulating material shall not be increased; and
- D Thermal insulation shall not show evidence of softening, melting, change in physical structure, or other evidence of failure.

2.2.16 Thermal insulation shall be adequately protected against contact with products of combustion.

2.2.17 Thermal insulation, which is not adequately self-supporting, shall be securely applied to solid surfaces in a manner to prevent sagging. Cement for attaching such material shall retain its adhesive qualities at any temperature the cement may attain when tested in accordance with these requirements and at -40°C.

2.2.18 A water-absorbing insulating material shall not become wetted by condensate or rain when installed as intended if such wetting will depreciate its durability or insulating value.

2.2.19 Plastic venting materials shall meet the requirements of Subsections 2.2.19.1 through 2.2.19.3.

2.2.19.1 Combustibility

Plastic venting materials shall not support combustion when tested in accordance with Test No. 13 - Combustibility (Nonmetallic Vents).

2.2.19.2 Thermal Properties

Plastic venting materials shall not weaken or become brittle when exposed to changes in temperature when tested in accordance with Test No. 14 - Thermal Properties (Nonmetallic Vents).

2.2.19.3 Aging

Plastic venting materials shall not show signs of aging after extended use when tested in accordance with Test No. 15 - Aging (Nonmetallic Vents).

2.3 ASSEMBLY

2.3.1 A venting system shall consist of all the essential parts necessary for the proper installation of a complete system. Each part or assembly shall be designed for ready attachment of one to the other without requiring alteration, cutting, threading, or similar task by the installer; except that a special assembly or part designed to be cut to length or to fit by the installer may be provided if means are furnished for readily joining any altered part to a companion part or assembly.

2.3.2 Two or more parts or subassemblies, which must bear a definite relationship to each other for proper and safe use, shall be arranged and constructed to permit them to be incorporated into the complete assembly without need for alteration or alignment, only in the correct relationship with each other; or such parts or subassemblies shall be assembled and shipped from the factory as one element.

2.3.3 Each part (such as a vent section or length, a cap, fire stop spacer, or support element, etc.) shall be completely assembled by the manufacturer at the factory.

2.3.4 A venting system shall be capable of ready attachment to appliance flue outlets having diameters as specified in ANSI Z21.47/ CSA 2.3, Gas-Fired Central Furnaces, ANSI Z21.10.1/ CSA 4.1, Gas Water Heaters Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less, ANSI Z21.10.3/ CSA 4.3, Gas Water Heaters; Volume III - Storage Water Heaters with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous and, ANSI Z21.13/ CSA 4.9, Standard for Gas Fired Low Pressure Steam and Hot Water Boilers.

2.3.5 A venting system, when installed in accordance with the manufacturer's instructions, shall be positioned securely, resistant to damage from external forces, and stable.

2.3.6 The design of a system part shall not void the firestopping required between spaces of a building when the part is installed in accordance with the instructions furnished by the manufacturer.

2.3.7 Where the performance of a multiple-wall vent pipe depends upon an air gap between its walls, the gap shall not be less than 6 mm in width.

2.3.8 Thimbles and firestops for nonmetallic venting systems shall be provided and designed to permit unrestricted longitudinal thermal expansion movement that occurs during pipe heating. Other types of supports and hangers shall be specified and shall accommodate both longitudinal and lateral vent movement. Instructions for the maximum length of pipe shall be specified in the manufacturer's installation instructions.

2.4 JOINTS

2.4.1 Venting systems shall comply with Test No. 12 - Gas Leakage.

2.4.2 Parts of systems shall be joined and secured in a manner to prevent unintentional disengagement.

2.4.3 If screws are employed to field-join assemblies, screw locating holes shall be provided. If cement is employed for this purpose, it shall be a quick-drying type. Cement shall be specified; screws and instructions shall be furnished.

2.4.4 Joining compounds or tape used for sealing vent joints shall have a temperature rating not less than the maximum temperature obtained on the vent walls when tested in accordance with Test No. 1 - Temperature, for the class of venting system.

2.4.5 A joint shall not reduce the cross sectional area of the vent conduit by more than 5%.

2.4.6 A joint shall not permit condensate to flow from the interior to the exterior of the flue-gas conveying conduit.

2.4.7 In addition to complying with the requirements of Clause 2.2.1, screws that extend into a flue-gas passage shall be of material compatible with the flue-gas liner and shall be supplied by the manufacturer.

2.4.8 The joints of gas vents intended for exterior installation shall be designed to be resistant to the entry of rain.

2.5 SPACERS

2.5.1 Venting systems for installation, with other than zero clearance, shall include spacers, which will maintain the minimum required clearance between the pipe and combustible surfaces.

2.5.2 A spacer designed to locate a vent penetrating a floor or ceiling shall constitute a complete fire stop. Spacers shall have sufficient strength and bearing surface to maintain the required clearances from vent sections to the inner surface of joists, ceiling and floor material, and the inner surface of walls.

2.5.3 A spacer is to provide for substantially continuous interference with construction for a height of not less than 12 mm. A joint between factory-made parts, which provide for fire stopping shall not have a through opening greater than 3 mm wide. (See Figure 6.)

2.6 SUPPORTS

2.6.1 Gas venting assemblies shall be provided with support assemblies sufficient to maintain the intended position of the assembly.

2.6.2 Gas venting assemblies designed for exterior installation shall be provided with support assemblies sufficient to resist wind forces.

2.6.3 A support assembly shall be designed to sustain, without failure, a load equivalent to four times the force imposed upon it by the weight of all vent parts it is intended to support.

2.6.4 A support assembly intended to be secured by nails or screws shall be arranged so that such holding means will be in shear.

2.6.5 A lateral support assembly shall be designed so that a supported vent is able to resist a horizontal force of 1.44 kN/m^2 applied in any direction without separation, sagging, or other displacement or damage, and without distortion or dislodgement of the supports.

2.7 RADIATION SHIELDS

2.7.1 A radiation shield, if provided to obtain safe temperatures on floor or ceiling structures, shall be an integral part of a firestop spacer or support assembly and shall provide a continuous barrier for a vertical distance referenced to the ceiling or floor level of not less than 250 mm. The assembly shall fit into a framed joist area dimensioned not larger than 12 mm greater than the outside diameter of the vent plus twice the dimension to be specified for clearance between vent sections and combustible enclosures. For Class I and Class IIC and IID venting systems, a radiation shield intended to penetrate an attic area shall fully enclose the vent section for a depth of not less than 250 mm above the top of the joist. (See Figure 7.)

2.7.2 Parts of a firestop spacer or support assembly which provide incidental shielding from radiation to combustible construction are not considered to be radiation shields.

2.7.3 A radiation shield shall not be provided to obtain safe temperatures on roof structures if employed in a roof or other terminating assembly intended to be altered in the field and if such alteration would require the shifting or relocation of the shield.

2.8 CAPS

2.8.1 A cap shall be designed so that snow, leaves and debris falling or blown onto it are not likely to be retained so as to obstruct flue-gas or cooling-air passages.

2.8.2 A cap for venting systems intended for vertical terminal installation shall be designed so as to direct the flue gases above a horizontal plane coincident with the top of the upper terminal section.

2.9 TERMINATION ASSEMBLIES

2.9.1 A termination assembly shall be capable of resisting, without damage or giving way, a wind load equivalent to 1.44 kN/m^2 of exposed area applied to any surface extending from the building in accordance with the test method described herein.

2.9.2 A termination assembly shall be resistant to weather and condensate. A termination assembly when installed as specified by the manufacturer shall prevent the

entrance of water and debris into the building where the vent passes through the exterior structure of the building.

2.9.3 A termination assembly shall be designed so that debris is not likely to accumulate therein when such accumulation may obstruct flue-gas or cooling-air passages or remain in contact with vent parts having temperatures exceeding the requirements for zero clearance.

2.9.4 A termination assembly, if not intended for positive pressure venting, shall be designed for installation above the roof line.

2.9.5 A termination assembly shall be provided for venting systems intended for wall exit of flue gases and shall be designed to direct flue gases away from the building.

2.10 APPLIANCE CONNECTIONS

2.10.1 Appliance adapters shall be provided as part of a type BH gas venting system and shall have an identified means for connection to the appliance flue outlet. The appliance adapter shall not be more than 300 mm, or less than 50 mm in length and shall be provided with identification of its intended uses.

Exception: Appliance adapters are not required to be provided for appliances provided with integral adapters supplied by appliance manufacturers.

2.10.2 Identification of intended uses noted in Clause 2.10.1 shall include appliance identification, construction, or any other means, which identifies the intended appliance flue outlet construction on which the appliance adapter is to be used.

2.10.3 Metal used in an appliance adapter, which is subject to contact by flue gases or flue-gas air mixtures shall comply with the requirements of Subsection 3.17, Resistance to Condensate (Metallic Vents).

Exception: Appliance adapters intended to be connected to an appliance that does not employ an internal condensate drain system are not required to comply with this requirement. See Clause 2.10.4.

2.10.4 Appliance adapters intended to be connected to an appliance which does not employ an internal condensate drain system are required to comply with the following:

- A Metals in contact with flue gases or flue-gas air mixtures shall consist of a material having durability and resistance to corrosion and heat equivalent to type 1100 aluminum or series 300 or types 430 and 446 stainless steel;
- B The installation instructions shall specify a field-installed condensate drain as close as possible to, and downstream of the appliance adapter; and
- C Each appliance adapter shall be marked in accordance with Clause 5.7.

2.10.5 When attached to an appliance flue outlet, the appliance adapter/appliance flue outlet joint shall be subjected to testing by the testing agency determining compliance with the requirements described in International Approval Services Interim Requirement IR65, Test for Connection between BH Venting and Appliance Vent Outlet (see Appendix A for an excerpt of IR65).

2.10.6 Metals shall not be used in combination that may cause galvanic action at any location within the connection.

3. PERFORMANCE

3.1 GENERAL

3.1.1 Venting systems shall comply with the following conditions when tested in accordance with these requirements:

- A Safe temperatures to combustible construction shall be maintained;
- B No part shall attain a temperature in excess of its material temperature rating;
- C Required corrosion protection shall not be damaged;
- D No part shall sustain distortion, cracking, or loosening of joints such as to impair the intended function of the system; and
- E Resistance to damage by wind, rain and handling shall be demonstrated.

3.2 TEST NO. 1 - TEMPERATURE, STRUCTURE

3.2.1 Test Installation

3.2.1.1 Venting systems are to be tested on the following basis:

- A Size and form (round, oval, etc.);
- B Configuration and length;
- C Temperature rating;
- D Minimum clearance to combustible construction;
- E Methods of enclosure;
- F Single storey or multistorey buildings.

3.2.1.2 The test structures are to simulate the methods of installation recommended by the manufacturer of the system and are to provide for various sizes and designs following the details provided in the manufacturer's printed instructions.

3.2.1.3 The test structure is to be erected within a room, which is reasonably free of drafts, and the venting system is to exhaust into the same space or into a space freely communicating with that from which the air for heating or combustion is taken. The room is to be such that during any one test the room temperature does not increase more than 11°C above the room temperature at the beginning of the test.

3.2.1.4 If the system is designed for taking air from an occupied space and exhausting such air to the outside of a building to cool the system, all the openings in the parts as assembled, intended to provide such air flow and which would be within an occupied space of the building, are to be closed during the tests.

3.2.1.5 If the system is designed for taking air from the outside of a building to cool the vent, the test arrangement is to provide means for maintaining the temperature of such air at $\pm 5^{\circ}\text{C}$.

3.2.1.6 The test system is to consist of an assembly composed of all the required parts erected according to the manufacturer's installation instructions. The outlet of the test system is to be provided with a termination assembly if always provided as a functional part of the system. When the manufacturer's instructions provide for a variety of installation options, tests shall be conducted in those configurations judged to present the greatest potential hazards.

3.2.1.7 A hot air or flue-gas generator such as illustrated in Figures 8 and 9 is to be used to supply simulated flue gases to the system being tested. The generator is to be capable of producing gases at the test temperatures and pressures specified herein.

3.2.1.8 The hot air or flue-gas generator outlet is to be connected to the inlet of the test vent by means of a pipe having a diameter equivalent to that of the vent inlet. This connection is to be made using a section of pipe, together with other pipe fittings arranged as shown in Figures 1, 2, 3 and 4. The pipe and fittings are to be uninsulated.

3.2.1.9 Gaps or joints between firestops and combustible construction are to be sealed with tape¹. Joints between two or more factory-made parts, which in combination provide a firestop, are to be similarly taped. Gaps or joints between vent sections and firestops are not to be taped with the exception of an attic floor or exterior wall penetration.

3.2.1.10 A part used as a support, spacer, radiation barrier, or firestop intended to be in contact with construction is to be placed in contact with the structure in a normal manner.

3.2.1.11 Plywood used for the test enclosure for a vent is to be 9.5 mm thick. All joints and openings between spacers or supports and the test enclosure, and all joints and openings in the test enclosure walls, are to be sealed with tape².

3.2.1.12 Tests are to be conducted as described by the following on a venting assembly of each kind. If more than one size of system is to be investigated, tests are to be conducted on as many sizes as may be deemed necessary to determine conformance with these requirements.

3.2.1.13 One or more venting assemblies based on the configuration and length limitations specified by the manufacturer and its design may be selected for test. Tests are usually

¹ No. 6302 adhesive backed 75 mm wide aluminum-foil tape manufactured by Anchor Continental Canada, Cornwall, Ontario, has been found suitable for this purpose.

² No. 655 50 mm wide black cloth tape manufactured by Anchor Continental Canada, Cornwall, Ontario, has been found suitable for this purpose.

conducted with the vent installed in a single storey test structure, but tests may be conducted also with the vent installed in a multistorey test structure if the vent is intended for installation in multistoried buildings. The height and arrangement of the structure for various designs is illustrated in Figure 2.

3.2.1.14 Tests are to be conducted in a test structure arranged typically as shown in Figure 1. Vent pipe is to be tested on the basis of clearance to the enclosure. Such clearance is designated by the dimension "X" in Figure 1. The enclosing casing is to be of a square cross section for round and square pipe and of rectangular cross section for oval and rectangular pipe. The four sides of the enclosing casing are to be 9.5 mm plywood.

3.2.1.15 When a test in a multistorey test structure is to be conducted, the height of the test system is to be increased as shown in Figure 2 for each storey, and each additional increment is to be encased by a joist and floor area and an enclosure duplicating that shown in Figure 1 and with thermocouples similarly placed. Each such additional enclosure is to be placed directly above the one below. Otherwise, the arrangement and method of test are to be as described for the single storey test structure. The enclosing casing is to be closed at each level by the installation of a manufacturer's fire stop or fire stop spacer assembly.

3.2.1.16 Where tests are to be conducted for through the wall applications, a test wall section constructed in accordance with common accepted building practices and similar to that shown in Figure 3 shall be used.

3.2.2 Temperature Measurement

3.2.2.1 The inlet hot air or flue-gas temperature is to be determined by a 5-thermocouple grid located within the insulated outlet of the hot air or flue-gas generator. (See Figures 8 and 9.) The thermocouples are to be Type K (chromel-alumel) of 0.51 mm diameter size with an untwisted welded bare bead junction of minimum size (not over 1.27 mm) enclosed in a suitable sealed tube of inside diameter of approximately 1.5 mm.

3.2.2.2 Temperatures other than flue-gas temperatures are to be measured by iron-constantan thermocouples not larger than 0.20 mm diameter size. For structural elements in contact with venting system parts, junctions of thermocouples are to be placed on the vent part surfaces, except that where a point or line contact of a spacer not over 3 mm diameter or width is made, thermocouples are to be placed on the test structure at points 12 mm from the centre line of such point or line contact. Thermocouples are to be attached to structural elements having a surface adjacent to the vent parts and onto ceilings or roof areas adjacent to the vent, so as to have 12 mm of wire exposed and be secured by staples over the insulated portions of the wires. The junctions are to be depressed flush with the surface and held in thermal contact with the surface by black fabric tape or equivalent.

Note: Temperatures on surrounding combustibles need not be measured for Class IIA and Class IIB venting systems.

3.2.2.3 At least four thermocouples are to be placed at each location of suspected high temperatures on the interior face of the enclosure, at points of minimum clearance. Additional thermocouples are to be placed on joists, floor edges, and other locations as deemed necessary.

3.2.2.4 The temperatures attained by parts of the system are to be obtained by means of thermocouples applied to assure good thermal contact with the parts. Thermocouples to be attached to surfaces of metal parts are to have junctions, silver-soldered to the surface.

Thermocouples to be attached to surfaces of nonmetallic parts are to have the junction and at least the initial 25 mm of the lead wires embedded flush with the surface of the material. Furnace cement or other material compatible with the surface is to be smoothed over such indentations to assure thermal contact. Such thermocouples are to be located at points likely to attain maximum temperatures. Additional thermocouples may be placed at other locations as deemed necessary.

3.2.2.5 The hot air or flue-gas temperature rise is to be based on the room temperature at the level of the hot air or flue-gas generator. The temperature rise on surfaces of the test enclosure within a given storey of the test structure is to be the observed temperature on the surface minus the room temperature in that storey of the test structure.

3.2.2.6 The room or ambient temperature is to be obtained by a shielded thermocouple located centrally within a 150 mm length of aluminum-painted 50 mm nominal diameter steel tube having a wall thickness of 0.3 mm and open at both ends. The shielded thermocouple is to be located so as to place the shield in a manner to avoid direct radiation to the thermocouple.

3.2.2.7 The room or ambient temperature is to be determined by a shielded thermocouple located at the elevation of the horizontal axis of the hot air or flue-gas generator and also at an elevation of 1200 mm above any additional floor level, each to be on a vertical line located 600 mm horizontally from the vent connector or from the vertical test enclosure.

3.2.2.8 For systems designed for taking air from the outside of a building to cool the system, the ambient temperature of the space into which the system exhausts is to be measured by a thermocouple located on a horizontal plane with the opening provided for the admission of outside air and 900 mm distant from such opening. This temperature is to be maintained at $27 \pm 5^{\circ}\text{C}$ during all tests for temperature.

3.2.3 Test Procedure

3.2.3.1 After being tested in accordance with these requirements, a venting system shall be safe for further use.

3.2.3.2 Results indicating conformance with Clause 3.2.3.1 include the following:

- A No part has become damaged or permanently distorted to an extent that it or the vent will not continue to function as intended;
- B The effectiveness of any required protective coating or finish on metal parts has not been impaired;
- C A ceramic material does not show evidence of cracking, disintegration, nor spalling to an extent that impairs the serviceability of the part of an assembly;
- D Cracks are not observable in porcelain enamel used as a required protective coating when the surface is examined under a microscope of 60 magnification;
- E The reflectivity of a surface has not been impaired when the reflectivity of such surface is utilized to reduce fire hazard;
- F Burning or scaling of metal parts is not evident by visual observation.

- G The effectiveness of insulating material has not been reduced to an unsafe degree; and
- H Joints between venting system components have not loosened, separated or opened up.

3.2.3.3 The test is to be started with the venting system and test structure at room temperature. The hot air or flue-gas generator is to be operated at the inputs and temperatures specified in Table 1. The temperatures shall be measured at the temperature measurement location shown in Figure 8 or Figure 9, as applicable, and a restriction shall be applied to produce a pressure within the venting system of 100 Pa.

3.2.3.4 The test is then to be continued until equilibrium temperatures are attained on surfaces of the test-system parts and the test structure.

3.2.3.5 The system, when tested as described in the foregoing, is to comply with the requirements of Clauses 3.2.3.6 and 3.2.3.7.

3.2.3.6 The maximum temperature attained on surfaces of the test structure (ceilings, enclosures, floors, joists, wall sections, etc.) and on surfaces of vent system parts at points of zero clearance to the test structure, shall be not more than 65°C above room temperature when the hot air or flue-gas temperature is maintained as described in Clause 3.2.3.3, nor after the hot air or flue-gas generator is shut off.

3.2.3.7 The maximum temperature attained on surfaces of a termination assembly shall not exceed the temperature specified in Table 2 when the hot air or flue-gas temperature is maintained as described in Clause 3.2.3.3, nor after the hot air or flue-gas generator is shut off. Where temperatures exceed the values specified in Table 2, the installation instructions shall include details on the location or guarding of termination assemblies to prevent possible contact.

3.3 TEST NO. 2 - WIND LOAD

3.3.1 An external termination assembly of any system and the entire assembly of systems designed for exterior installation shall resist, without damage or giving way, a load equivalent to 1.44 kN/m² of exposed area applied to any surface exterior to the building when tested as described in Clauses 3.3.2 and 3.3.3.

3.3.2 For external termination assemblies the test is to be made on the tallest assembly representative of each style furnished by the manufacturer. The assembly is to be installed as described in the manufacturer's installation instructions. The projected area of the largest surface of the assembly exposed to wind is to be computed in square metres. The projected area is defined as the product of the diameter or the widest average dimension of the external assembly (whichever is greater) multiplied by the greatest length measured from the terminal of the system. A load equivalent to the product of the projected area multiplied by 1.44, and expressed in kilonewtons per square metre, is to be applied in a horizontal direction to the surface assumed to be exposed to wind. If a uniform surface load cannot be applied, the load is to be applied at the middle of the length used to calculate the load in a manner such as to evenly distribute the load over as much of the surface as practical. (See Figure 10.) The load is to be sustained for a period of 1 h as a static load.