## 5.7 Loose burner materials

Loose burner materials, such as rock wool or glowing embers, when provided shall not adversely affect the performance of the appliance during conduct of the following Method of Test.

### Method of Test

The loose burner material, when provided, shall be applied to the burner and/or flame areas according to manufacturer's instructions. Under this condition, the appliance must comply with all performance tests.

## 5.8 Proved igniter systems

### 5.8.1

Clause 5.8 is applicable to a proved igniter system that provides for ignition of the main burner gas.

### 5.8.2

Proved igniter systems shall comply with the applicable performance provisions of the Standard for *Automatic Gas Ignition Systems and Components*, ANSI Z21.20.

### 5.8.3

The proved igniter system shall effect ignition of the gas at the main burner(s) when tested in accordance with the Method of Test specified in Clause 5.8.4.

### 5.8.4

Under the conditions of voltage variation specified in the following Method of Test, the proved igniter system shall ignite main burner gas within 4 seconds after gas reaches the main burner port(s).

### Method of Test

The following voltages shall be used during conduct of this test.

**Undervoltage**

The voltage to the appliance shall be adjusted to 85 percent of the appliance rating plate voltage.

**Overvoltage**

The voltage to the appliance shall be adjusted to 110 percent of the appliance rating plate voltage.

Under the conditions specified in undervoltage and overvoltage above, ignition cycles shall be repeated 25 times. In each case, the proved igniter system shall ignite main burner gas within 4 seconds after gas reaches the main burner port(s).

### 5.8.5

The proved igniter system shall effect ignition of the gas at the main burner(s) under the following conditions:

a) the test shall be conducted at normal inlet test pressure and with the appliance both hot and cold; and
b) the proved igniter system shall be placed in operation with the igniter-proving characteristic reduced to the minimum value specified by the control manufacturer. Under these conditions, the proved igniter system shall effect ignition of the gas within 4 seconds after gas reaches the main

  

burner port(s) without damage to the appliance or excessive flame flashout. While maintaining these conditions, the ignition cycle shall be repeated a total of 25 times.

### 5.8.6

For proved igniter systems, which incorporate an interrupted ignition source together with main burner flame proving, the time required for the system to shut off the main burner gas supply following loss of the supervised main burner flame shall not exceed the flame failure response time and valve closing time specified in Table 8, Maximum safety control timings.

For purposes of the following Method of Test, the control manufacturer's specified maximum flame failure response time for the proved igniter system shall be used.

### Method of Test

The appliance shall be operated for a period of 30 minutes at normal inlet pressure. All gas shall then be turned off and the gas flow immediately reestablished, but not ignited. The time for the main burner gas to be shut off shall be recorded and shall not exceed that specified in Table 8, Maximum safety control timings.

**Table 8**
**Maximum safety control timings[a]**
(See Clauses 5.8.6 and 5.8.8.)

| | Timing in seconds |
|---|---|
| Continuous ignition | |
| Pilot flame-establishing period | 120 |
| Flame failure response time | 180 |
| Flame failure re-ignition time | 0.8 |
| Valve closing time | b) |
| Intermittent ignition | |
| Pilot flame-establishing period | 90c) |
| Flame failure response time | 180 |
| Flame failure re-ignition time | 0.8 |
| Valve closing time | b) |
| Interrupted ignition | |
| Ignition means flame-establishing period | 90 |
| Trial for ignition period | 90c) |
| Flame failure response time d) | 180 |
| Flame failure re-ignition time e) | 0.8 |
| Valve closing time | b) |

*(Continued)*

  

**Table 8 (Concluded)**

| | Timing in seconds |
|---|---|
| Direct ignition | |
| Valve sequence period | 60 |
| Flame failure response time | 90 |
| Flame failure re-ignition time | 0.8 |
| Valve closing time | b) |
| Proved igniter | |
| Igniter failure response time | 90 |
| Pilot flame failure response time | 90f) |
| Flame failure re-ignition time | 0.8f) |
| Valve closing time | b) |

a) Or for sectional type appliances where there is any interconnection between sections below the draft hood.
b) Included in flame failure response time.
c) Includes main gas valve opening time from initiation of gas flow.
d) Applicable to both pilot and main burner flame failure.
e) Applicable to pilot flame failure re-ignition only.
f) The values apply when the ignition system utilizes an intermittent ignition source (see Clauses 5.8.6 and 5.8.7).

### 5.8.7

A proved igniter system, which incorporates an interrupted ignition source together with main burner flame proving, shall not cause excessive flame flashout damage to the appliance.

For purposes of the following Method of Test, the control manufacturer's specified maximum flame failure response time in combination with the control manufacturer's specified minimum recycle time for the proved igniter system shall be used.

### Method of Test

The appliance shall be instrumented with a sampling tube(s) to measure the gas-air ratio at various points in the appliance. This sampling tube(s) shall be connected to a gas-air analyzer coupled to a chart-type single-point recording potentiometer in order to produce a constant trace of the gas-air ratio at the sample point for sufficient time to allow a complete evaluation of the system. The gas-air ratio trace shall be developed with the appliance both hot and cold and with all Test Gases for which the appliance is tested. Supplemental natural gas test with Test Gas G need not be conducted.

Unburned gas shall be allowed to flow into the appliance for the control manufacturer's maximum specified flame failure response time plus the valve closing time. Immediately following shutoff of the gas supply, an ignition cycle shall be initiated at normal rated voltage and continued until the igniter would be energized, as determined by the control manufacturer's specified minimum recycle time.

If the gas-air ratio at the time at which the igniter would be energized is below the lower explosive limit, the appliance shall be considered as complying with this Clause. If this ratio is above the lower explosive

  

limit, sufficient ignition tests shall be conducted between the time of energization of the proved igniter and when the atmosphere within the appliance returns to below the lower explosive limit, to determine that the igniter does not cause excessive flame flashout or damage to the appliance.

An appliance with a control system providing a purge period of 5 minutes or longer shall be considered as complying with this Clause.

### 5.8.8

For a proved igniter system that incorporates an intermittent ignition source, the time required for the gas supply to the main burner to be shut off following failure of the supervised proved igniter shall not exceed that specified in Table 8, Maximum safety control timings, when tested as specified in the following Method of Test.

### Method of Test

The appliance shall be operated for a period of 30 minutes at normal inlet pressure. The proved igniter shall then be disabled. The time required for the proved igniter system to shut off the main burner gas supply shall not exceed the igniter failure response time and valve closing time specified in Table 8.

For purposes of this test, the control manufacturer's specified maximum igniter failure response time shall be used.

## 5.9 Automatic gas ignition systems

### 5.9.1

If a piezo-electric spark device is used for pilot burner ignition, it shall comply with the Standard for *Manually Operated Piezo-Electric Spark Gas Ignition Systems and Components*, ANSI Z21.77 • CSA 6.23.

### 5.9.2

The pilot shall effect ignition of the gas at the main burner(s) or pan burner media surface under the following conditions. For purposes of this test, the control manufacturer's specified maximum flame failure response time for the automatic gas ignition system shall be used.

A pilot that becomes extinguished after having completed main burner ignition is considered as complying with this provision.

The following tests shall be conducted at normal inlet test pressure.

**Single-flame pilot burners (pilot burners that produce a single flame with substantially uniform contour under turndown conditions)**

The pilot shall effect ignition of the gas within 4 seconds from the time gas is admitted to the main burner(s) when the pilot gas supply is reduced to an amount just sufficient to keep the valve of the safety shutoff device open, or just above the point of flame extinction, whichever represents the higher pilot gas rate.

A flame can be considered as being equivalent to a substantially uniform contour flame if its deviation from uniform contour is occasioned by a flame baffle(s) or channel(s).

  

**Multi-flame pilot burners (pilot burners that produce a flame(s) with substantial variation in contour under turndown conditions)**

The pilot shall effect ignition of the gas within 4 seconds from the time gas is admitted to the main burner(s) ports, or pan burner media surface when all the pilot flame ports except those for heating the thermal element are blocked, and the pilot gas supply is reduced to an amount just sufficient to keep the valve of the safety shutoff device open, or just above the point of flame extinction, whichever represents the higher pilot gas rate.

The above test shall also be conducted under sufficient conditions of increased pilot input rating to determine that main burner ignition will take place within 4 seconds from the time gas is admitted to the main burner(s) ports, or pan burner surface with the pilot input at any level from the turndown condition described above, up to and including that providing normal flow through the unblocked port(s) based on the manufacturer's specified normal input rating for the pilot.

**Pilot burner and thermal element assemblies that supply electrical energy for an automatic control system**

When the thermal element is the only source of electric power for operation of the automatic valve, the tests under single-flame pilot burners and multi-flame pilot burners shall be conducted with the pilot adjusted to the minimum size (pull-in millivoltage) required to open the automatic valve. This test condition shall be based on the performance of the system when only the thermal element and automatic valve are present. Under these conditions, the pilot shall effect ignition of the gas within 4 seconds from the time gas is admitted to the main burner(s).

Any system components that may be changed or added shall be excluded during this test.

When a multi-flame pilot is provided, the tests outlined under multi-flame pilot burners at increased pilot input ratings shall also be conducted.

### 5.9.3

The pilot of a safety shutoff device shall meet the provision set forth herein for pilots.

### 5.9.4

The time from initiation of pilot gas flow to proof of the ignition source shall not exceed 5 minutes, except that for a system that operates every time the main burner(s) with which it is used is turned on and off, the time shall not exceed 1.5 minutes.

In the case of a system requiring a manual operation to assume the "on" position, the time required for application of the manual operation shall not exceed 1.5 minutes and this time plus the time from initiation of pilot gas flow to proof of the ignition sources shall not exceed 5 minutes.

For purposes of the following Method of Test, the control manufacturer's specified maximum flame-establishing period for the automatic gas ignition system shall be used.

### Method of Test

This test shall be conducted at normal inlet test pressure. With the appliance at room temperature, the pilot shall be ignited and the time required for the ignition system to turn on the main gas supply noted.

  

### 5.9.5
When an interrupted ignition source is provided, the time required for the main burner flame to be proved from the initiation of main gas flow shall not exceed 90 seconds when the appliance is operated at normal inlet test pressure.

### 5.9.6
The time required for the automatic gas ignition system to shut off the gas supply following loss of the supervised flame shall not exceed 3 minutes.

For purposes of the following Method of Test, the control manufacturer's specified maximum flame failure response time for the automatic gas ignition system shall be used.

#### Method of Test
The appliance shall be operated for 15 minutes at normal inlet test pressure. All gas shall then be turned off and the gas flow to a continuous or intermittent pilot immediately reestablished but not ignited. The combined flame failure response time and valve closing time shall not exceed 3 minutes. An interrupted pilot having a separate sensing device from that for the main burner flame shall also be tested by turning off all gas after the pilot has been proved, but before the main burner gas is ignited. The gas flow to the interrupted pilot shall be immediately reestablished but not ignited. The combined flame failure response time and valve closing time shall not exceed 3 minutes.

### 5.9.7
If the time of operation for safety shutoff devices can be varied by means of an adjustment, this adjustment shall be the same throughout tests for compliance with Clauses 5.9.4 and 5.9.6.

### 5.9.8
When the pilot acts both as the actuating medium of the safety shutoff device and as the means for igniting the gas at the main burner(s), the construction shall be such that in case the pilot flashes back and burns at the orifice, the device shall operate either to shut off the main gas supply in accordance with the test specified in Clause 5.9.6, or provide effective ignition of the gas at the main burner(s). A pilot that cannot be made to flash back under any condition of test shall be considered as complying with this provision.

### 5.9.9
A standing pilot equipped with an automatic relight pilot system shall not cause excessive flame flashout or damage to the appliance.

For purposes of the following Method of Test, the control manufacturer's specified maximum flame failure response time or minimum recycle time for the automatic gas ignition system shall be used.

#### Method of Test
The pilot igniter shall be rendered inoperative.

The appliance shall be instrumented with a sampling tube(s) to measure the gas-air ratio at various points in the appliance. This sampling tube(s) shall be connected to a gas-air analyzer coupled to a chart-type single-point recording potentiometer in order to produce a constant trace of the gas-air ratio at the sample point for sufficient time to allow a complete evaluation of the system. The gas-air ratio trace shall be developed with the appliance both hot and cold and with all Test Gases for which the appliance is tested. Supplemental natural gas tests with Test Gas G need not be conducted.

  

Unburned gas shall be allowed to flow into the appliance for a time equivalent to the control manufacturer's specified maximum flame failure response time. Immediately following shutoff of the gas supply, an ignition cycle shall be initiated and the time at which the pilot igniter would normally be energized noted.

If the gas-air ratio at the time at which the pilot igniter would normally be energized does not exceed the lower explosive limit, the appliance shall be considered as complying with this provision. If this ratio is above the lower explosive limit, sufficient ignition tests shall be conducted between the time of energization of the ignition means and when the atmosphere of the appliance returns to below the lower explosive limit, to determine that the automatic relight pilot system does not cause excessive flame flashout or damage to the appliance.

An appliance with a control system providing a purge period of 5 minutes or longer shall be considered as complying with this Clause.

### 5.9.10

When tested in accordance with the following Method of Test, the temperatures developed on an automatic gas ignition system component shall not exceed those for which the component is designed.

### Method of Test

Thermocouples shall be peened into or brazed to the following points, which are applicable to the device provided:

a) pilot burner tip;
b) pilot burner orifice fitting;
c) electric igniter;
d) flame sensor;
e) surfaces of the hot and cold junction of thermoelectric types;
f) valve body;
g) electric switch;
h) contact mechanism; and
i) magnetic assembly.

The pilot(s) and main burner(s) shall be operated at normal inlet test pressure until equilibrium pilot temperatures have been attained, at which time the temperatures at the points listed above shall be recorded.

## 5.10 Direct ignition systems

### 5.10.1

A direct ignition system shall provide a lockout timing of not more than 60 seconds. For test purposes, the control manufacturer's specified maximum lockout time for the automatic gas ignition system(s) shall be used.

If the ignition means is reactivated, the control manufacturer's specified maximum flame failure re-ignition time or minimum recycle time for the automatic gas ignition system shall be used.

### 5.10.2

For systems that incorporate an ignition activation period (see Clause 3, Definitions), the period of time between deactivation of the ignition means and the maximum lockout time shall not exceed 4 seconds.

  

### 5.10.3

When tested in accordance with the following Method of Test, the ignition system shall effect ignition of the gas at the main burner(s) immediately after gas reaches the main burner port(s), or pan burner media surface, when operated at the appliance rating plate voltage (see Clause 7.3.1).

### Method of Test

While maintaining the rated voltage to the appliance, the ignition system shall be placed in operation and ignition observed.

The procedure described above shall be repeated 25 times, and in each instance ignition shall occur immediately after gas reaches the main burner port(s) and/or pan burner media surface.

### 5.10.4

During conduct of the following Method of Test, the ignition system shall effectively ignite the main burner gas within 4 seconds after gas reaches the main burner port(s), and/or pan burner media surface, when the system is operated at 85 percent of appliance rating plate voltage. When the ignition circuit is operated at 70 percent of the appliance rating plate voltage, and all other electrical components are operated at 85 percent of the appliance rating plate voltage, the ignition system shall effectively ignite the main burner gas within 4 seconds after gas reaches the main burner port(s), or pan burner media surface, or shall lock out within the manufacturer's specified maximum lockout time.

### Method of Test

While maintaining 85 percent of the appliance rating plate voltage to the appliance and all other electrical components, the appliance shall be placed in operation and ignition observed.

The procedure described above shall be repeated 25 times, and in each instance ignition shall occur within 4 seconds after gas reaches the main burner port(s), and/or pan burner media surface.

With the voltage to the ignition circuit only reduced to 70 percent of the appliance rating plate voltage and with all other electrical components, including the gas valve(s), maintained at 85 percent of the appliance rating plate voltage, the appliance shall be placed in operation.

The procedure described above shall be repeated 25 times, and in each instance ignition shall occur within 4 seconds after gas reaches the main burner port(s), or pan media surface, or the system shall lock out within the manufacturer's specified maximum lockout time.

### 5.10.5

With the appliance at equilibrium temperature while operating at normal inlet test pressure, the time required for the main burner gas supply to be shut off in the event of flame outage during an operating cycle shall not exceed 90 seconds.

If the ignition system incorporates flame failure re-ignition, it shall be capable of reestablishing ignition in not more than 0.8 second following flame outage, and it shall re-ignite the main burner gas without flame flashout or damage to the appliance. For purposes of this test, the control manufacturer's specified maximum flame failure response time shall be used.

If the ignition means is reactivated, the control manufacturer's specified maximum flame failure re-ignition time or minimum recycle time for the automatic gas ignition system shall be used.

  

### 5.10.6

The construction of the appliance and the arrangement of the ignition system shall be such that in the event of a delay in ignition of the main burner gas, such as might be caused by foreign debris or electrical shorting of the ignition means, the appliance will vent itself without excessive flame flashout or damage.

For purposes of the following Method of Test, the control manufacturer's specified maximum lockout time for the automatic gas ignition system shall be used. For systems that deactivate the ignition means prior to the end of the lockout time, the test shall be conducted using the control manufacturer's specified maximum ignition activation period timing.

### Method of Test

This test shall be conducted at normal inlet test pressure with the appliance at room temperature. The appliance shall be placed in operation with the ignition means temporarily circumvented for varying intervals of time up to the control manufacturer's specified maximum lockout time or specified maximum ignition activation period, whichever is shorter. The resulting ignition in each trial shall be observed for excessive flame flashout or damage to the appliance.

### 5.10.7

Temperatures of automatic gas ignition system components shall not exceed those for which the components are designed when tested as specified in Clause 5.9.10.

## 5.11 Appliance main gas valves

Temperatures of appliance main gas valve bodies shall not exceed those for which the valves are designed when tested as specified in the following Method of Test.

### Method of Test

Thermocouples shall be peened into or brazed to the valve body and the maximum temperature determined as specified in Clause 5.15, Handle temperatures.

## 5.12 Gas appliance pressure regulators

### 5.12.1

The manufacturer's specified hourly Btu rating of the appliance shall be within the range of regulation capacity (see Clause 3, Definitions) of the regulator as determined under Clause 4.11.2. Gas appliance pressure regulators shall have a maximum regulation capacity (see Clause 3, Definitions), as determined under this Standard, at least equal to the manufacturer's total hourly Btu input rating for the appliance.

### 5.12.2

The temperature of a regulator body shall not exceed the temperature for which the regulator is designed under conditions of the following Method of Test.

### Method of Test

Thermocouples shall be peened into or brazed to the regulator body, and the maximum temperature determined as specified in Clause 5.15, Handle temperatures.

  

## 5.13 Automatic valves

The temperature of an automatic or combination gas valve body shall not exceed the temperature for which the valve is designed.

### Method of Test

This test shall be conducted concurrently with the test specified in Clause 5.15, Handle temperatures.

## 5.14 Manifold and control assembly capacity

When tested in accordance with the following Method of Test, the manifold and control pressure assembly shall have sufficient flow capacity to provide the manufacturer's normal hourly Btu input rating and manifold pressure when supplied with the gas pressure designated by the manufacturer as the minimum permissible for the purpose of input adjustment.

### Method of Test

The appliance shall be equipped with the manifold and gas control assembly having the lowest flow capacity for the applicable gas. The unit shall be adjusted and operated as specified in Clause 5.3.4. The inlet test pressure shall then be reduced so as to maintain the minimum gas supply pressure for the purpose of input adjustment immediately upstream from the inlet connection. With no additional change other than adjustment of the gas pressure regulator outlet pressure, the manufacturer's normal hourly Btu input rating and manifold pressure shall be maintained. The manifold pressure shall be measured at the downstream tapping specified in Clause 4.8.12.

## 5.15 Handle temperatures

The maximum temperatures on handles of main burner valves and valve access doors shall not exceed room temperature by more than 40°F (22 °C) for metallic handles and 60°F (33.5 °C) for nonmetallic handles as specified in the following Method of Test.

### Method of Test

Temperatures on handles of main burner valves and valve access doors shall be measured by means of 24 AWG (0.20 $mm^2$) iron-constantan thermocouples in firm contact (such as by cementing or taping) with the handle surfaces. Temperatures shall be taken on all portions of handles that are grasped during normal use.

The appliance shall be operated at the maximum input rate obtainable in the range of normal through increased inlet test pressures for a period of 1 hour. At the end of this time, the maximum surface temperature of the main burner valve handle(s) and access door handle(s) shall not exceed room temperature by more than 40°F (22 °C) for metallic handles and 60°F (33.5 °C) for nonmetallic handles.

## 5.16 Marking material adhesion and legibility

The adhesive quality of Class IIA-3, IIA-4, IIIA-1, and IIIA-2 marking materials and the legibility of all Class II, IIIA, and IIIB marking materials (see Clause 4.14.1) shall not be adversely affected when the marking materials are exposed to heat and moisture as specified in the following Method of Test.

### Method of Test

a) Adhesive type marking materials shall be applied to the particular type of finish used on the appliance in production. A sample metal panel of this finish shall be cleaned with a solvent and dried. Half of the panel shall be wiped with a clean cloth lightly oiled with SAE-30 medium machine oil. Two samples of marking material shall be applied to the panel, one on the dry area and one on the oiled area. Test samples shall be applied with firm pressure, unless the manufacturer's

  