UL 295

STANDARD FOR SAFETY

Commercial-Industrial Gas Burners

UL Standard for Safety for Commercial-Industrial Gas Burners, UL 295

Second Edition, Dated February 8, 2017

Summary of Topics

This revision of ANSI/UL 295 dated July 20, 2022 includes the addition of a conduit standard reference; 12.2.2.

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The revised requirements are substantially in accordance with Proposal(s) on this subject dated April 15, 2022 and June 17, 2022.

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FEBRUARY 8, 2017
(Title Page Reprinted: July 20, 2022)

ANSI/UL 295-2022

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Standard for Commercial-Industrial Gas Burners

First Edition – December, 2007

Second Edition

February 8, 2017

This ANSI/UL Standard for Safety consists of the Second Edition including revisions through July 20, 2022.

The most recent designation of ANSI/UL 295 as an American National Standard (ANSI) occurred on July 20, 2022. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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INTRODUCTION

1 Scope

1.1 These requirements cover commercial-industrial gas burners with input ratings over 400,000 Btu per hour (117.23 kW) intended for installation in heating equipment such as, but not limited to, appliances, furnaces, heaters, ovens, water heaters, and incinerators. These gas burners are required to be equipped with integral automatic primary safety controls to restrict the abnormal flow of gaseous fuel in case of ignition failure and/or flame failure.

1.2 Additional installation and operation requirements are available for commercial-industrial gas burners, as defined by the National Fuel Gas Code, NFPA 54 and by the Liquefied Petroleum Gas Code, NFPA 58, as applicable.

2 Components

2.1 Except as indicated in 2.2, a component of a product covered by this standard shall comply with the requirements for that component. See the individual sections of this Standard for component requirements.

2.2 A component is not required to comply with a specific requirement that:

a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or

b) Is superseded by a requirement in this standard.

2.3 A component shall be used in accordance with its rating established for the intended conditions of use.

2.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

3 Units of Measurement

3.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

4 Undated References

4.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

5 Glossary

5.1 For the purpose of this standard, the following definitions apply.

5.2 AIR SHUTTER – An adjustable device for varying the size of the air inlet or inlets regulating primary or secondary air.

5.3 AIR SHUTTER, AUTOMATICALLY OPERATED – An air shutter operated by an automatic control.

5.4 ALUMINUM-COATED STEEL – An aluminum coated steel in which the bond between the steel and the aluminum is an iron-aluminum alloy.

5.5 BURNER, GAS – A device for the final conveyance of the gas, or a mixture of gas and air, to the combustion zone.

5.6 BURNER, AUTOMATICALLY LIGHTED – One where fuel to the main burner is normally turned on and ignited automatically.

5.7 BURNER, MANUALLY LIGHTED – One where fuel to the main burner is turned on only by hand and ignited under supervision.

5.8 BURNER, MECHANICAL-DRAFT – A burner that includes a power-driven fan, blower, or other mechanism as the principal means for supplying air for combustion.

5.9 BURNER, NATURAL-DRAFT – A burner that depends principally upon the natural draft created in the flue to induce into the burner the air required for combustion.

5.10 BURNER HEAD – That portion of a burner beyond the outlet end of the mixer tube which contains the ports.

5.11 COMBUSTIBLE AND NON-COMBUSTIBLE – Refer to the Standard Glossary of Terms Relating to Chimneys, Vents, and Heat-Producing Appliances, ANSI/NFPA 97.

5.12 COMBUSTIBLE MATERIAL – Combustible material as pertaining to materials adjacent to or in contact with heat-producing appliances, chimney connectors and vent connectors, steam and hot water pipes, refers to material made of or surfaced with wood, compressed paper, plant fibers, or other material that will ignite and burn. Such material shall be considered as combustible even through flameproofed, fire-retardant treated, or plastered.

5.13 COMBUSTION – As used herein, the rapid oxidation of fuel accompanied by the production of heat, or heat and light. Complete combustion of a fuel is possible only in the presence of an adequate supply of oxygen.

5.14 COMBUSTION CHAMBER – The portion of an appliance within which combustion occurs.

5.15 COMBUSTION DETECTOR – That part of a primary safety control which is responsive directly to flame properties.

5.16 COMBUSTION PRODUCTS – Constituents resulting from the combustion of a fuel with the oxygen of the air, including the inerts, but excluding excess air.

5.17 CONDENSATE – The liquid which separates from a gas, including flue gases, due to a reduction in temperature.

5.18 CONTROL – A device designed to regulate the fuel, air, water, or electrical supply to the controlled equipment. It may be automatic, semiautomatic, or manual.

5.19 CONTROL, LIMIT – An automatic safety control, responsive to changes in liquid level, pressure, or temperature, for limiting the operation of the controlled equipment.

5.20 CONTROL, OPERATING – A control other than a safety control or interlock, to start or regulate burner firing according to load demand and to stop or regulate fire on satisfaction of demand or upon

reaching normal temperature or pressure in the device being fired. Operating controls may also actuate auxiliary equipment.

5.21 CONTROL, PRIMARY SAFETY – An automatic control that monitors the operation of a gas-fired or an oil-fired burner. It normally consists of the following sections that may be integrated into a common unit or may be separate units, interconnected by wiring:

a) A device that programs the burner through start-up and shutdown operations in response to signals from regulating, limiting, and monitoring devices. It also provides the necessary timings, in proper sequence, for purging, pilot flame ignition, main flame ignition, and in case of ignition or flame failure, for safety shutdown (lockout).

b) A device that is responsive to flame properties. It monitors the flame at the point of flame supervision and transmits a signal to the programming unit, indicating absence or presence of flame.

5.22 CONTROL, SAFETY – Automatic controls, including relays, switches, and other auxiliary equipment used in conjunction therewith to form a safety control system, that is intended to reduce the risk of fire, electric shock, or injury to persons during operation of the controlled equipment.

5.23 DAMPER – A valve or plate for regulating draft or flow of flue gases. A damper is generally considered as being located on the downstream side of the combustion chamber, usually in a flue passage of the appliance or in the chimney connector.

5.24 DAMPER, AUTOMATICALLY OPERATED – A damper operated by an automatic control.

5.25 ELECTRICAL CIRCUITS:

a) High-Voltage Circuit – A circuit involving a potential of not more than 600 volts and having circuit characteristics in excess of those of a low-voltage circuit.

b) Low-Voltage Circuit – A circuit involving a potential of not more than 30 volts alternating-current (42.4 volts peak) or direct current and supplied by:

1) A Class 2 transformer, or by a battery, by a battery and fixed impedance, or by a transformer and fixed impedance each of which, as a unit is in compliance with what is required for a Class 2 transformer; or

2) Is limited to a maximum of 100 volt-amperes. A circuit derived from a source of supply classified as a high-voltage circuit, by connecting resistance in series with the supply circuit as a means of limiting the voltage and current, is not considered to be a low-voltage circuit.

c) Safety Control Circuit – A circuit involving one or more safety controls.

5.26 EXCESS AIR – Air which passes through the combustion area and the appliance flues in excess of that which is theoretically required for complete combustion.

5.27 FLAME FAILURE REACTION TIME – The interval between the occurrence of flame extinguishment and de-energizing the safety shutoff means.

5.28 HEATING SURFACES – All surfaces which transmit heat directly from flame or flue gases to the medium to be heated.

5.29 IGNITION, CONTINUOUS – Ignition by an energy source which is continuously maintained throughout the time the burner is in service, whether the main burner is firing or not.

5.30 IGNITION, DIRECT – An automatic ignition that uses an electrically energized device to ignite fuel at a main burner.

5.31 IGNITION, DIRECT SPARK – An automatic ignition system that uses an electric spark to ignite fuel at a main burner.

5.32 IGNITION, DIRECT WITH GAS ASSIST – An ignition system with an ancillary burner located at the main burner intended to assist in the safe and smooth ignition of the main burner flame in a direct ignition system and provided with a separate fuel piping arrangement downstream of the main safety shutoff valves of the gas-fired burner assembly.

5.33 IGNITION, HOT SURFACE – An automatic ignition system that uses a hot surface igniter to ignite fuel at a main burner.

5.34 IGNITION, INTERMITTENT – Ignition by an energy source which is continuously maintained throughout the time the burner is firing.

5.35 IGNITION, INTERRUPTED – Ignition by an energy source which is automatically energized each time the main burner is fired and subsequently is automatically shut off during the firing cycle.

5.36 IGNITION, MANUAL – Ignition by an energy source that is manually energized and where the fuel to the pilot is lighted automatically when the ignition system is energized.

5.37 IGNITION, PILOTED – An automatic ignition system that uses a small burner, referred to as a pilot, to ignite the main burner and provided with a separate fuel piping arrangement upstream of the main safety shutoff valves of the gas-fired burner assembly. The pilot may be ignited from a direct spark or hot surface ignition system.

5.38 INTERLOCK – A control to prove the physical state of a required condition, and to furnish that proof to the primary safety control circuit.

5.39 LIQUEFIED-PETROLEUM GAS – Fuel gases, including commercial propane, predominantly propane or propylene or commercial butane, predominantly butane, isobutane, and/or butylene.

5.40 LOW-FIRE HOLD INTERLOCK – A control other than an operating or safety control or interlock, responsive to changes in temperature, to retain the burner at low fire until such time as the heating appliance has obtained the normal minimum operating temperature .

5.41 LP-GAS AIR MIXTURE – Liquefied-petroleum gases distributed at relatively low pressures and normal atmospheric temperatures which have been diluted with air to produce desired heating value and utilization characteristics.

5.42 MAIN BURNER FLAME-ESTABLISHING PERIOD – The interval of time the main burner fuel safety shutoff valves are permitted to be open before the primary safety control is required to supervise the main burner flame.

5.43 MANIFOLD – The conduit of a device which supplies gas to the individual burner.

5.44 MIXER, GAS – The combination of mixer head, mixer throat, and mixer tube.

a) That portion of an injection type burner, usually enlarged, into which primary air flows to mix with the gas stream.

b) That portion of the mixer which has the smallest cross-sectional area and which lies between the mixer head and the mixer tube.

c) That portion of the mixer which lies between the throat and the burner head.

5.45 MIXER FACE, GAS – The air inlet end of the mixer head.

5.46 NORMAL CARE – The periodic tasks usually performed to operate and maintain an appliance, such as air, fuel, pressure, and temperature regulation, cleaning, lubrication, resetting of controls.

5.47 PILOT FLAME-ESTABLISHING PERIOD – The interval of time fuel is permitted to be delivered to a proved pilot before the primary safety control is required to detect pilot flame.

5.48 PILOT, INTERMITTENT – A pilot which is automatically lighted each time there is a call for heat and which burns during the entire period that the main burner is firing.

5.49 PILOT, INTERRUPTED – A pilot which is automatically lighted each time there is a call for heat. The pilot fuel is cut off automatically at the end of the main burner flame-establishing period.

5.50 PILOT, PROVED – A pilot flame supervised by a primary safety control which senses the presence of the pilot flame prior to permitting the main burner fuel to be delivered for combustion.

5.51 PORT – Any opening in a burner head through which fuel or an air-fuel mixture is discharged for ignition.

5.52 PRIMARY AIR – The air introduced into a burner which mixes with the fuel before it reaches the ignition zone.

5.53 PROOF OF CLOSURE SWITCH – A non-field adjustable switch installed in a safety shutoff valve by its manufacturer that activates only after the valve is fully closed.

5.54 PURGE – To introduce air into the combustion chamber and the device flue passages in such volume and manner as to completely replace the air or gas-air mixture contained therein.

5.55 PURGE PERIOD – The period of time during the burner start-up in which air is introduced into the combustion chamber and the associated flue passages in such volume and manner as to completely replace the air or fuel-air mixture contained therein prior to initiating ignition.

5.56 READILY ACCESSIBLE – Capable of being reached easily and quickly for operation, adjustment, and inspection.

5.57 REGULATOR, GAS-PRESSURE – A device for controlling and maintaining a uniform outlet gas pressure.

5.58 SAFETY SHUTDOWN (LOCKOUT) – The action of shutting off of all fuel and ignition energy to the device by means of a safety control or controls such that restart cannot be accomplished without a manual reset.

5.59 SECONDARY AIR – The air externally supplied to the flame at or beyond the point of ignition.

5.60 SERVICING – The periodic tasks usually performed to operate and maintain an appliance, such as air, fuel, pressure, and temperature regulation, cleaning, lubrication, and resetting of controls. Repair and

replacement of parts other than those expected to be renewed periodically is not considered to be servicing. Some examples of servicing are:

a) Cleaning or replacing nozzles, atomizers, and pilots.

b) Setting ignition electrodes.

c) Cleaning strainers or replacing strainer or filter element.

d) Resetting safety control.

e) Replacing igniter cable.

5.61 SPECIAL TOOLS – Those tools that are not available on the open retail market.

5.62 TRANSFORMER, HIGH VOLTAGE – A transformer directly supplying a high voltage circuit, as defined by this Standard, see 5.25(a).

5.63 TRANSFORMER, LOW VOLTAGE – A transformer directly supplying a low voltage circuit, as defined by this Standard, see 5.25(b).

5.64 TRIAL-FOR-IGNITION PERIOD – That period of time the main burner fuel is permitted to be delivered into the ignition zone before the main flame-sensing device is required to detect main flame.

5.65 VALVE, MANUAL GAS SHUTOFF – A manually operated valve in a gas line for the purpose of completely turning on or shutting off the gas supply.

5.66 VALVE, SAFETY SHUTOFF – A valve that is automatically closed by the safety control system or by an emergency device. Such valve may be of the automatic or manually opened type.

CONSTRUCTION

6 General

6.1 Fuel confining parts, or operating parts if failure of the part will allow unsafe leakage of fuel, or unsafe operation, or prevent a safety device from functioning, shall be of sufficient strength, durability, and resistance to fire to insure safe and reliable service of the parts and the assembly. Such parts shall be made of material having a melting point (solidus temperature) of not less than 950°F (510°C) and a tensile strength of not less than 10,000 psi at 400°F (204°C). Such parts shall not sag, distort, melt, oxidize, or show leakage of fuel during any of the tests specified herein.

6.2 Fuel-confining parts not conforming to 6.1 may be employed if a fusible-link valve or the equivalent is included in the assembly of the burner so as to shut off the fuel supply in the event of excessive temperature or fire in the vicinity of such parts.

6.3 Soft solder shall not be used on any fuel-handling parts if melting of the solder may allow leakage of fuel. Soft-soldered joints, where permitted, shall be made mechanically secure before soldering.

6.4 The burner shall function so as to reduce to a minimum the generation of unburned vapors, and shall not include chambers or pockets in which unburned vapors may accumulate.

6.5 Electrical equipment and wiring shall be arranged so that oil or water will not drip or run on them during normal usage or from a connection required to be uncoupled for servicing the device also to avoid contact with water from humidifiers.

6.6 Attachment plugs or separable connectors shall not be used in circuits when the breaking or making of the circuit by such devices may result in operation of the equipment in a manner that involves a risk of fire, electric shock, or injury to persons.

6.7 The gas burner shall be constructed such that supervised firing with operation as specified in 46.3, as appropriate, may be accomplished without further adjustment.

7 Corrosion Protection

7.1 Iron and steel parts shall be protected against corrosion by painting, galvanizing, plating or other equivalent means if the malfunction of such unprotected part would be likely to result in a hazardous condition.

Exception: Cast-iron parts, cast-aluminum parts and ASME coded pressure vessels are not required to be protected against corrosion.

8 Protection of Users and Service Personnel

8.1 An uninsulated high-voltage live part and a moving part that may involve a risk of injury to persons shall be located, guarded, or enclosed so as to reduce the likelihood of unintentional contact by personnel performing service functions that may have to be performed with the equipment energized.

Exception: A moving part is not required to comply with 8.1 if the part is unlikely to be contacted through the opening because of fixed components, including baffles.

8.2 Service functions which may have to be performed with the equipment energized include:

a) Adjusting the setting of temperature controls with or without marked dial settings;

b) Resetting control trip mechanism;

c) Operating manual switches; or

d) Adjusting air-flow dampers.

A factory set and sealed control is not considered to be adjustable.

8.3 The requirements of 8.1 are not applicable to mechanical service functions which are not normally performed with the equipment energized.

8.4 Adjustable or resettable electrical control or manual switching devices may be located or oriented with respect to uninsulated live parts, so that manipulation of the mechanism for adjustment, resetting, or operation can be accomplished in the normal direction of access if uninsulated live parts or moving parts that may involve a risk of injury to persons are:

a) Not located in front, in the direction of access, of the mechanism; and

b) Are not located within 6 inches (152 mm) on any side or behind the mechanism, unless guarded.

8.5 An electrical control component that may require examination, adjustment, servicing, or maintenance while energized, not including voltage measurements, shall be located and mounted with respect to other components and grounded metal parts so that it is accessible for electrical service functions without subjecting the serviceman to a risk of electric shock from adjacent uninsulated live parts or to unintentional contact from adjacent moving parts that may involve a risk of injury to persons.

8.6 Accessibility and protection from a risk of fire, electric shock, or injury to persons may be obtained by mounting the control components in an assembly so that unimpeded access is provided to each component through the access cover or panel in the outer cabinet and the cover of the control assembly enclosure with the following arrangement:

a) The components are located with respect to the access opening in the cabinet so that the farthest component in the control assembly is not more than 14 inches (356 mm) from the plane of the access opening.

b) Uninsulated live parts outside the control assembly projected clear space (except for live parts within a control panel) or unguarded moving parts that may involve a risk of injury to persons are located not closer than 6 inches (152 mm) from any side of the access area. The projected clear space is considered to be bounded on the sides by the projection of the smallest rectangular perimeter surrounding the outside edge of the components or control enclosure when provided. The access area is considered to be bounded on the sides by the projection of the perimeter of the access opening in the outer cabinet to the closest rectangular perimeter surrounding the outside edge of the component or control enclosure.

c) The volume generated by the projected clear space of the control assembly to the access opening in the outer cabinet (within the access area) is completely free of obstructions, including wiring.

d) Access to the components in the control assembly is not impeded in the direction of access by other components or by wiring in this assembly.

e) Extractor-type fuseholders and snap switches mounted through the control assembly enclosure are to be located so that:

1) There is unimpeded access to these components through the access opening in the outer cabinet; and

2) They are not immediately adjacent to uninsulated live parts outside the control assembly enclosure, unless guarded.

Also see Figure 8.1.