

## **GENERAL**

The information in this document was developed by the UL 858 Standards Technical Panel (STP) cooktop fire working group. The cooktop fire working group was formed in August 2001 as a result of discussions at the STP meeting held on May 15, 2001. In February 2002, a survey was sent to STP members asking for guidance on the direction of the Working Group. The results of the survey indicated that the STP felt that it was premature to develop proposed new requirements for UL 858. However, the STP did request that efforts continue toward the development of test protocols and common acceptance criteria for future devices intended to mitigate range fires. As a result of the survey, the Cooktop Fire Working Group developed the aforementioned test protocols and common acceptance criteria, hereafter referred to as the Technical Feasibility Performance Goals.

The Technical Feasibility Performance Goals were discussed in detail over several teleconference meetings of the Cooktop Fire Working Group. As a result of these discussions, the group has developed a document that is intended to provide guidance to engineers, inventors, entrepreneurs or others that may be involved with the design of a device intended to reduce cooktop fires by sensing an over temperature condition. The Technical Feasibility Performance Goals are not meant to be final requirements.

The Feasibility Goals focus on devices that could be incorporated into a cooktop surface element/burner and that would interface with a cooking vessel (Pan) to sense the over temperature condition. It is anticipated that all tests for performance and reliability would be conducted on the following applicable cooktop designs: coil element, smooth top ceramic/glass (with halogen and radiant elements), open and sealed element gas ranges, and induction ranges.

It is understood that other devices/appliances may additionally be developed that could also accomplish a reduction in cooktop fires. Examples of these devices include, but are not limited to: Fire Suppressions Devices (Fire extinguishers), Timers, Gas/Vapor Sensors, Visual Fire Sensors, etc. In the event that a person is interested in developing a device outside the scope of these Feasibility Goals, additional guidelines would need to be developed to accommodate those products.

## **TECHNICAL FEASIBILITY PERFORMANCE GOALS**

### **CONSTRUCTION:**

General - Previous attempts at developing cooktop element controls have involved a thermocouple temperature control that contacts the bottom of the pan. This thermocouple temperature control may need to be factory-wired to the range or to a computer within the range. The following are some general construction requirements for such a control.

1.1 If wires or probes extend through the surface of a burner bowl, the bowl must contain spills and liquids to the same level as a burner bowl not containing such protrusions.

1.2 Where electronic controls are used, they shall comply with all applicable requirements of UL 858, UL 858A and ANSI Z21.1 for temperature extremes and abnormal operations. When software is used, it shall comply with the applicable requirements in UL 1998.

1.3 Any safety device shall be added to the range in such a way as to make defeat, tampering, or bypassing by a consumer unlikely under normal use and abuse conditions. Any attempt to by-pass the system should result in the inoperability of the range.

1.4 Any components applied to a gas range shall show no degradation of safety or performance when shutdown of the range element or the range is applied. Any shutdown of a gas valve shall allow safe re-start without attention by service personnel.

### **TEST APPLIANCES:**

General - Cooktop appliances are available in a variety of fuel types, burners, and wattage or BTU energy ranges. In order to evaluate sensor devices, depending on the results obtained, it may or may not be necessary to test every configuration, but the following minimum elements/burners are recommended:

- 2.1 All tests for performance and reliability shall be performed on the following burners with energy ranges:
- a) Gas burners: 5,000 to 17,000 BTU; and
  - b) Coil elements electric: 1200 W to 2600 W.

### **TEST COOKWARE:**

General - One of the important characteristics of a contact sensing device is its ability to sense different types of cookware, both new and used. The following are suggested minimum types of cookware that must be evaluated:

3.1 Cooking performance and reliability tests shall be conducted with new and used cast iron, ceramic, glass, stainless steel, stainless steel-copper clad, and aluminum cookware.

The following sizes: 9 inch diameter skillet, 12 inch diameter skillet; 1 quart, 2 quart and 4 quart sauce pans; 8 quart water boiling pot; and 12 by 12 aluminum griddle with non-stick coating; 18 inch diameter wok. Saucepans should be of lightweight, approximately 20-22 gauge and 12-14 medium gauge. Used pans shall have no less than ¼ inch inward and outward bottom curvature.

3.2 "Used" cookware is defined as cookware that has been filled with 8 ounces of the food mixture specified in AHAM ER-1-1992 Section 8.6, boiled to dry, allowed to cool, and then cleaned. This process is repeated until a total of 5 heating and cooling cycles are completed.

### **FOOD MIXTURE(S):**

General - It is recognized that food material burned onto the bottom surface of a pan may interfere with the temperature sensing ability of a contact device. The following describes the food material to be used as a "Standard" burned on mixture representing reasonable use.

4.1 The burned on food mixture shall be that shown in AHAM ER-1-1992 Section 8.6. The food mixture should be applied with a brush to the top of any surface burner element and especially to any sensor mechanism. The burner should be operated through ten cycles to burn the food mixture onto the surface. The sensor shall detect all required safety parameters without change in operation.

### **DETERGENT MIXTURE:**

General - Any pan contact device that may be exposed to the cooking surface needs to be evaluated to show that routine cleaning will not interfere with the operation of the device.

5.1 For the cleaning tests, the dishwashing detergent shall:

- a) Have the following formula by mass:
  - Sodium carbonate 40%
  - Sodium tripolyphosphate 25%
  - Sodium sulfate 15%
  - Water 10%
  - Sodium silicate solids 8%
  - Nonionic surfactant (low-foaming alcohol alkoxyate) 1%
  - Sodium dichloroisocyanurate 1%, or
- b) Be a powdered dishwashing detergent as specified in ANSI/AHAM DW-1, or any other powdered dishwashing detergent having similar properties.

### **ACCEPTANCE CRITERIA:**

General - The following criteria need to be met for each test, as applicable, for the type of device under consideration:

6.1 Perform as designed for twice the designed life of the range or be provided with a means to cease functioning, disables the controlled element(s) and alerts the user of this condition until it is either returned to a normal operation (Such as by replacing a battery) or requires servicing by a qualified person.

6.2 Depending on the use of safety components, it is recommended that all devices have a minimum of 100,000 cycles of operation. The results are acceptable if the device disables the appliance or continues to function with no change in the sensing function. Audio or visual alerting the user to the failure of the device or any single component may be an acceptable alternative however; the acceptability will be determined once the alerting means has been developed.

6.3 As a result of the 2,000-cycle dishwasher-cleaning test, components that are acceptable to be washed in a dishwasher shall function without change in operation. Components that are marked "Not Suitable for Dishwasher Cleaning" shall operate as described in item 6.2.

#### **ENDURANCE:**

General - Ranges are appliances that are designed to have long lifespans in homes. Sensors attached to the range must be suitable and evaluated for equivalent life, movement, removal, and cleaning as the original appliance. The following are requirements for evaluation:

7.1 Removable control components shall be removed and reinstalled 2,000 times without need for re-calibration. This is based on one disassembly operation for cleaning per week for 20 years with a double lifetime safety factor.

7.2 Burners that can be physically contacted by cleaning chemicals are to be cleaned thoroughly at a rate equivalent to once per day with normal cleaning cloths, sponges, scrubbing pads, dishrags, and standard household cleaners. The performance of the device shall not change after 15,000 cycles of cleaning. This equates to a cleaning sequence of once per day, for 20 years with a double lifetime safety factor.

7.3 Control components shall perform as designed after dragging a 12-inch diameter, cast iron pan, with a heavy pattern or ribbed surface across it. The pan is to be drawn across the burner with a horizontal motion of 4-6 inches a minimum of 50,000 times. This is based on 2-3 times per day, for 20 years with a double lifetime safety factor. At the end of this cycling the device shall continue to function without change in operation.

7.4 In the case of a sensor attached to the heating element, where disassembly is allowed for cleaning, 2,000 removal and re-assembly operations are to be conducted. The heating element should be re-seated using a 12-inch, cast iron skillet placed on the burner in the off position. A downward (not impact) force of 25 lbs (111N) is to be applied at the opposite end from the connection.

7.5 If sensor devices are integral with a burner bowl and able to be removed for cleaning, they should be disassembled and cleaned using a normal household dishwasher for 2,000 cycles consisting of both a wash and heated dry cycle.

## **TESTS:**

General - Any components used to control pan temperatures must also not interfere with cooking activities, must operate in polluted environments, and must be able to be cleaned by ordinary persons using common tools, if necessary. The following detail the requirements for operation tests.

8.1 Using the pans specified in "TEST COOKWARE", conduct the following cooking tests.

- blackening meat and fish fillet in the skillets described "TEST COOKWARE", above,
- stir frying vegetables and meat in 1 tbs. oil in the wok described in "TEST COOKWARE", above,
- heating 1, 2, and 4 quarts of water in appropriately sized pans described in "TEST COOKWARE", above, from 75 deg F to 190 deg F,
- heating and simmering commercially available tomato based pasta sauce in 1 and 2 quart pans described in "TEST COOKWARE", above.
- a heat recovery test, such as frying three consecutive batches of french fries in the skillets described in "TEST COOKWARE", above.
- boiling 8 quarts of water in the pot described in "TEST COOKWARE", above and maintaining a boil for 4-6 hours.

As a result of these tests, the amount of time to heat 1, 2 and 4 quarts of water in appropriately sized pans from 75 deg. F to 190 deg F shall not be greater than 15% of the time required on an uncontrolled burner. The acceptability of all other cooking times will be based on the quality of the cooking activity and consumer acceptance, which will be determined at a later date.

8.2 Depending on the type of sensor technology chosen, performance and reliability tests shall be performed in the following environmental conditions: with a hood fan on high settings approximately 160 and 900 CFM, in 85% humidity, 20% humidity, and altitudes of 3000 feet.

8.3 All tests for performance and reliability shall be performed on used burners and components (described in 3.2) after cleaning with water and common household cleaners (e.g., 409, Fantastic) applied with a washcloth or as specified in the manufacturer's cleaning instructions.

8.4 The element/sensor is to be subjected to the impact produced by dropping a steel sphere, 2 inches (50.8 mm) in diameter and weighing 1.18 pounds (535 g), through a distance of 20 ¼ inches (514 mm). The test is to be conducted with the element at room temperature. Following the test described above, the element/sensor is to be subjected to ten impacts produced by dropping a 3.96-pound (1.8-kg) weight through a distance of 6

inches (152 mm). The weight is to be shaped as a cooking utensil, is to have a flat bottom of copper or aluminum, and is to have a diameter of 4-¼ to 5-1/8 inches (108-130 mm) with a corner radius of 3/8 inches (9.5 mm). The element/sensor is to be subjected to ten impacts. The weight is to be dropped so that it strikes the element/sensor as flatly as possible. The test is to be conducted with the element/sensor at room temperature.

**FIRE MANAGEMENT SYSTEMS USED IN CONJUNCTION WITH ELEMENT/BURNER SENSORS:**

General - In the event that a Fire Management System is used with and connects to the element/burner-sensing device, the following requirements are to be applied, as appropriate:

9.1 For any fire Event Management System that is mounted above the range, the device shall comply with UL923 (Microwave Oven) Fire Isolation Test (UL923, Sec. 49). The flame management or extinguishing device acceptance criteria is:

- a. The surface temperature of any point of the top building cabinet cannot exceed 300C (572F) and
- b. A fuse rated 3A connected between exposed dead-metal parts of the cooking appliance and ground cannot open.

9.2 A flame extinguishing system shall comply with SU 300A.