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TESTING OF *STOVETOP FIRESTOP® PLUS LC (STFS+LC)* WITH SENSOR BOARD, IN GENERAL ACCORDANCE WITH UL SUBJECT 300A, *OUTLINE OF INVESTIGATION FOR EXTINGUISHING SYSTEM UNITS FOR RESIDENTIAL RANGE TOP COOKING SURFACES (ISSUE NO. 3, NOVEMBER 21, 2006)*

FINAL REPORT
Consisting of 20 Pages

SwRI® Project No.: 01.22385.01.101b
Test Date: July 11, 2017
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Prepared for:

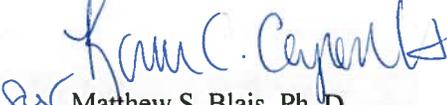
WilliamsRDM, Inc.
200 Greenleaf Street
Fort Worth, TX 76107

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1.0 INTRODUCTION

The objective of the test program was to evaluate the functionality of the StoveTop FireStop® Plus LC with Sensor Board automatic fire suppression units in typical residential indoor cooktop fire situations. Testing was conducted in general accordance with UL Subject 300A, *Outline of Investigation for Extinguishing System Units for Residential Range Top Cooking Surfaces (Issue No. 3, November 21, 2006)*, at the Client's test facility, located in Fort Worth, Texas. The testing was conducted in general accordance, since not all the tests described in UL 300A were performed. However, the test setup and extinguishment tests were very similar to Test No. 8, described in Table 4.1 of UL 300A. Jason Huczek, representing Southwest Research Institute, was present to witness testing. This report documents the testing performed and the results obtained.

The test methods described in this report are intended to measure and describe the properties of materials or products in response to heat and flame under controlled laboratory conditions. The results should not be used alone to describe or appraise the fire hazard or the fire risk of materials, products, or assemblies under actual fire conditions. However, results of this test may be used as elements of a complete fire hazard for fire risk assessment, which takes into account all the factors that are pertinent to an assessment of the fire hazard or risk of a particular end-use.

The results presented in this report apply specifically to the specimens tested, in the manner tested, and not to the entire production of these or similar materials, nor to the performance when used in combination with other materials.

2.0 FIRE SUPPRESSION SYSTEM DESCRIPTION

The Client identified the system under test as, *Automatic Fire Suppression System for Grease Fires on Indoor Residential Cooktops (Class K)*. The specific product tested was the StoveTop FireStop® Plus LC with Sensor Board device. A product data sheet for this device can be referenced in Appendix A. Figure 1 shows a photograph of the devices in their bulk and individual packaging. Figure 2 provides a close-up photograph of two angles of the device out of the packaging. Figure 3 shows two angles of the devices installed prior to a fire test.



Figure 1. Stovetop Firestop® Plus LC with Sensor Board Bulk and Individual Packaging.



Figure 2. Stovetop Firestop® Plus LC with Sensor Board Close-up View.



Figure 3. Stovetop Firestop® Plus LC with Sensor Board Installed Prior to a Fire Test.

3.0 TEST CONFIGURATION AND PROCEDURE

The testing was conducted in the WilliamsRDM fire test facility which was constructed to replicate a typical kitchen environment. The facility is climate controlled and contains a residential electric stove manufactured by Hotpoint (model number RB526D H1WW). A residential microwave (LG Model Number: LMV1683ST /00) was positioned above the stove and the mounting height is adjustable to allow the distance from the stove to the microwave to be varied as desired. Metal partitions are mounted to both sides of the microwave to simulate cabinets.

Two mounting heights were tested, 15 in. and 27 in., as measured from the burner surface to the bottom of the microwave surface. These mounting heights represent the lower and upper range of typical kitchen arrangements, based on a survey conducted by WilliamsRDM.

A total of four different skillets were used during testing: two cast iron (10 in. diameter, 3.5 in. high and 13 in. diameter, 2.5 in. high) and two aluminum (10 in. diameter, 2.25 in. high and 12 in. diameter, 2.5 in. high) in construction. These diameters are at the upper and lower ranges of the majority of skillets used for residential cooking, based on a survey conducted by WilliamsRDM.

Two oil depths were used for testing: 3/4 in. and 1 in. Vegetable oil was selected for use during all testing because it is the most common oil used for residential pan cooking, based on a survey conducted by WilliamsRDM. Figure 4 shows a photograph of the oil used during testing.



Figure 4. Vegetable Oil Used for Fire Tests.

Instrumentation for the testing included a thermocouple (Omega Engineering, Type K, part number – TJ36-CAXL-14G-18) to measure the oil temperature, a data logger (Extech Instruments, 3 Channel Data logging Thermometer – Model SD200) to record the oil temperature and a video system to document each test and record observations.



Figure 5. Oil Temperature Measurement (Left: Thermocouple Probe, Right: Data Logger).



Figure 6. Photograph of Video Test Screen.

4.0 TEST PROCEDURE

For each test, the skillet is to be placed on the largest burner at the front of the stove. The largest burner produces the most heat input to the skillet. The burner was set at the highest setting for all tests. The general test procedure used for all testing was as follows:

1. Place fire suppression units under a microwave per published mounting instructions
2. Place skillet on largest front burner
3. Pour oil into skillet (vegetable oil to specified depth)
4. Position thermocouple in oil (tip to be approx. 1/8 in below the surface)
5. Record unit mounting height
6. Record skillet size and material (cast iron 10 in. diameter or 13 in. diameter and aluminum 10 in. diameter or 12 in diameter)
7. Record oil type (vegetable)
8. Record oil depth and volume
9. Start video recording
10. Turn on microwave fan
11. Turn on burner to the highest setting
12. Heat oil to auto-ignition point
13. Allow fire to grow
14. Observe actuation of unit and suppression of the fire
15. Turn burner off after unit actuation
16. Observe skillet oil temp until it falls below 650°F (below auto-ignition temp)
17. Observe stove surface for oil splash and record observations
 - a. Splash, y/n
 - b. If yes, where did the grease land and was it burning?
18. Playback video and record data
 - a. Time to oil auto-ignition
 - b. Oil temperature at auto-ignition time
 - c. Time to unit actuation from auto-ignition time
 - d. Oil temperature at unit actuation
 - e. Time to fire extinguishment from unit actuation
 - f. Time from unit actuation to oil temperature decrease to 650°F, or to re-ignition
19. Clean all surfaces and cool the test pan to ambient temperature before next test.

5.0 RESULTS

Testing was conducted in general accordance with UL 300A, and per the procedure outlined above, at the Client's test facility, located in Fort Worth, Texas. Jason Huczek, representing Southwest Research Institute, was present to witness testing. Table 1 provides a summary of the observations and results for each test. The *Stovetop Firestop® Plus LC with Sensor Board Device* successfully extinguished all the test fires without re-ignition. Figure 7–14 provide selected photographs from each test.

Table 1. Summary of Test Results for Stovetop Firestop® Plus LC with Sensor Board Device.

Test Date	Test No.	Skillet Diameter (inches)	Oil Depth (inches)	Amount of Oil (cups)	Skillet Material	Mounting Height (inches)	Time to Oil Auto-Ignition (min:s)	Oil Temp at Ignition (°F)	Time to Actuation from Ignition (s)	Oil Temp at Actuation (°F)	Time to Ext. from Actuation (s)	Oil Splash on Stovetop (Yes/No)	Number of Splash Drops over Dime Size
7/10/17	1	10	3/4	3	Cast Iron	15	15:28	724.1	3	726.8	1	No	0
7/10/17	2	10	3/4	3	Aluminum	15	15:31	702.8	6	704.8	1	No	0
7/10/17	3	13	1	7	Cast Iron	15	36:28	700.3	12	702.3	1	No	0
7/10/17	4	12	1	6	Aluminum	15	39:10	681.4	3	681.4	1	No	0
7/11/17	5	10	3/4	3	Cast Iron	27	16:08	717.2	5	721.4	1	No	0
7/11/17	6	10	3/4	3	Aluminum	27	17:11	691.8	13	694.0	1	No	0
7/11/17	7	13	1	7	Cast Iron	27	34:50	698.5	4	699.2	1	No	0
7/11/17	8	12	1	6	Aluminum	27	39:28	678.7	15	680.0	1	No	0



Figure 7. Selected Photographs from Test 1.



Figure 8. Selected Photographs from Test 2.



Figure 9. Selected Photographs from Test 3.



Figure 10. Selected Photographs from Test 4.



Figure 11. Selected Photographs from Test 5.



Figure 12. Selected Photographs from Test 6.



Figure 13. Selected Photographs from Test 7.



Figure 14. Selected Photographs from Test 8.

APPENDIX A
CLIENT-SUPPLIED PRODUCT DATA SHEET
(CONSISTING OF 4 PAGES)

STOVETOP FIRESTOP PLUS SENSOR LG USER MANUAL



AUTOMATIC FIRE SUPPRESSION FOR GREASE FIRES
ON INDOOR RESIDENTIAL STOVE TOPS
(CLASS K)

www.STFS.com

Read this user manual carefully prior to installation

⚠ WARNING

- Not intended for cooking with more than 1" oil depth before food is added.
- Not recommended for gas stoves; powder may extinguish burner flame on a gas stove top
- If safe, turn burner OFF immediately after activation.
- Reignition is possible.
- When suppressing powder comes in contact with fire, it may briefly flare and/or cause grease to splash. This is a normal and temporary reaction.
- This product may not suppress all stove top fires.

FIRE SAFETY

- Unattended cooking is the leading cause of fires in the kitchen. Many injuries occur when occupants attempt to fight the fire themselves.
- Never leave anything cooking on the stove top unattended! If you have to leave the kitchen—even for a short time—turn off the stove.
- Never leave home or fall asleep while you are cooking.
- Never pick up a flaming pan. You may be burned, or if the pan is dropped, flames may quickly spread to other flammable areas.
- Never use water to fight a grease fire! A violent explosion may result. Wet dishcloths or towels are also dangerous.
- Always follow National Fire Protection Association (NFPA) guidelines for proper cooking safety. Visit www.nfpa.org.

⚠ CAUTION

- Keep away from children.
- Avoid exposure to suppressing powder if you wear contacts, or have a respiratory illness or skin allergies.
- Contents may be harmful if swallowed.
- Suppressing powder is non-toxic but could cause skin irritation. In case of contact with powder, flush from affected area with water.
- If irritation persists, contact a physician immediately.
- Discard product after activation.
- Discard product if dropped or damaged.
- Do not clean unit.

MANUFACTURERS INFO

Designed & Manufactured
by WilliamsRDM in Texas, USA

**Designed solely for suppressing
stove top grease fires in
indoor residential kitchens using no more
than 1" of oil before food is added.**

Contents: Potassium Bicarbonate

For storage and disposal information,
or to learn more about StoveTop FireStop,
please visit our website at www.STFS.com,
or call 1-888-616-7976.

NOTICE

- **Failure to remove or replace by the "remove or replace before" date, as shown on the product label, could diminish the effectiveness of the product.**
- Primary activation method is through electronic sensors.
- At time of activation, a loud "POP" will occur, followed by 3 long, repeating tones. This is normal and meant to alert occupants, if present.
- Device is equipped with a fuse that works as a secondary activation method in case of dead batteries.
- Replace batteries as required to ensure optimum performance. Do not mix old and new batteries. It is recommended that you not mix brands.

FCC NOTICE

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

LIMITED WARRANTY

WilliamsRDM, Inc. ("WRDM") warrants this StoveTop FireStop® product against defects in material or workmanship for the time periods and under the terms set forth below. Pursuant to this Limited Warranty, WRDM will, at its option, (i) repair the product using new or refurbished parts or (ii) replace the product with a new or refurbished product. For purposes of this Limited Warranty, "refurbished" means a product or part that has been returned to its original specifications. **In the event of a defect, these are your exclusive remedies.**

WRDM warrants to the original retail purchaser all WRDM products for a period of one (1) year against defective material and faulty workmanship. Any unit found to be defective during the warranty period will be repaired if possible, or replaced free of charge upon the buyer's prepaid return of the defective unit—only after receipt of an official Return Material Authorization (RMA) number. Proof of retail purchase is required. This warranty gives the buyer specific legal rights which may vary by state (or country).

THE FORGOING WARRANTY IS MADE IN LIEU OF ALL OTHER WARRANTIES WITH RESPECT TO THIS PRODUCT, INCLUDING

ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE—WHICH ARE HEREBY DISCLAIMED. THERE ARE NO IMPLIED WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. NO PERSON IS AUTHORIZED TO GIVE ANY OTHER WARRANTY, OR TO ASSUME FOR WRDM ANY OTHER LIABILITY IN CONNECTION WITH THE SALE OR INSTALLATION OF ITS PRODUCTS. REPLACEMENT OF THE PRODUCT WILL BE THE SOLE REMEDY WITH RESPECT TO ANY LOSS OR DAMAGE TO PROPERTY. BUYER IS NOT RELYING ON SELLER'S JUDGMENT REGARDING BUYER'S PARTICULAR REQUIREMENTS AND BUYER HAS HAD AN OPPORTUNITY TO INSPECT THE PRODUCT TO BUYER'S SATISFACTION. UNAUTHORIZED SERVICE OF ANY KIND INVALIDATES ALL WARRANTY PROVISIONS.

This Limited Warranty covers only the hardware components packaged with this product. It does not cover technical assistance for hardware. Any parts or product replaced under this Limited Warranty will become the property of WRDM.

LIMITATION ON DAMAGES: WRDM SHALL NOT BE LIABLE FOR

ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO ANY SUCH DAMAGES FOR ANY BREACH OF ANY EXPRESS OR IMPLIED WARRANTY ON THIS PRODUCT.

Instructions: To obtain warranty service, you must deliver the product, freight prepaid, in either its original packaging, or packaging affording an equal degree of protection, to WRDM's specified manufacturing facility.

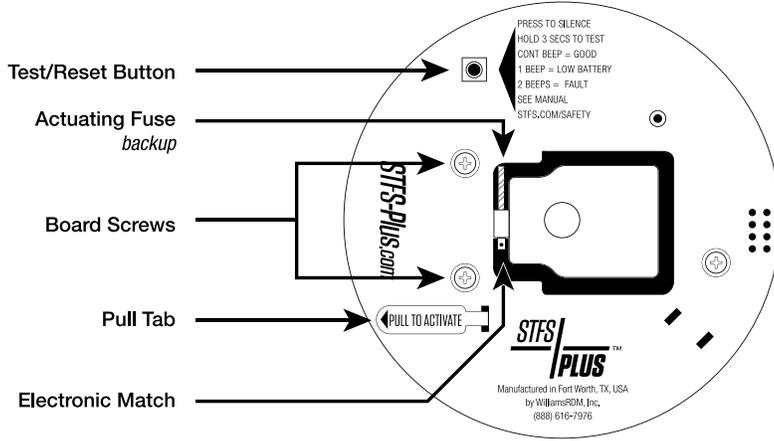
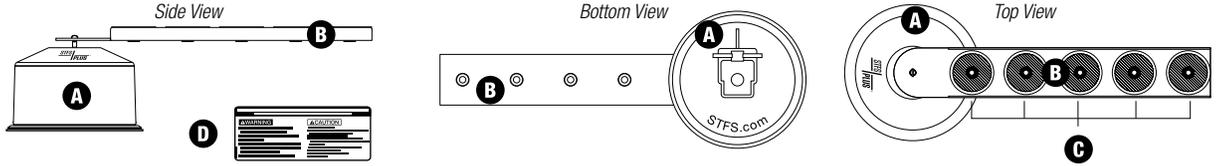
This Limited Warranty only covers product issues caused by defects in material or workmanship during ordinary consumer use; it does not cover product issues caused by any other reason, including but not limited to product issues due to commercial use, acts of God, misuse, limitations of technology, or modification of or to any part of the WRDM product. This Limited Warranty is invalid if either the factory-applied work order number or date code has been altered or removed from the product. This Limited Warranty is valid only in the United States.

**For StoveTop FireStop customer service:
go to www.STFS.com or call 1-888-616-7976.**

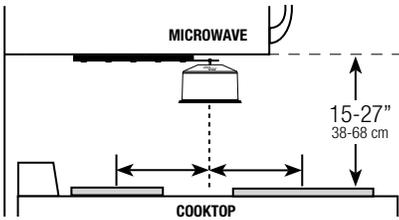
IN THE BOX

ONE ASSEMBLED PAIR
FOR EACH 4-BURNERS

- [A] Canister, x2
- [B] ClickBar™, x2
- [C] Magnets
- [D] Decal, 1 per pair



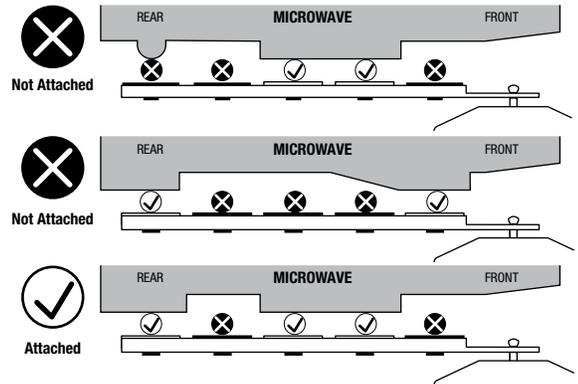
REQUIREMENT - HEIGHT/ALIGNMENT



Each canister must be able to mount independently to the underside of the microwave at the midpoint between center of the front and back burners on each side (left and right) at a distance of 15-27" (38-68 cm) above the surface of the stove.

REQUIREMENT - MOUNTING

Below are just some of the possible scenarios. Microwave detail is not drawn to scale.

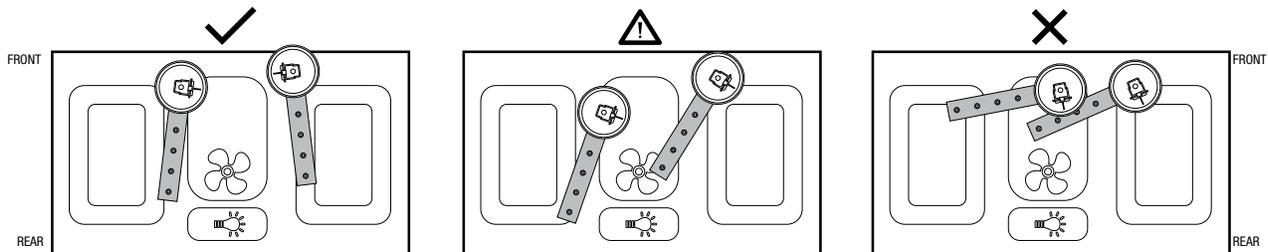


To accommodate many different microwave configurations, each ClickBar™ contains five (5) magnets. At least three (3) of the five (5) magnets must make full, strong contact with a flat surface on the underside of the microwave.

NOTE: Magnets making contact with ridges, support ribs, valleys, non-magnetic parts, and rounded or angled sections should not be counted on.

REQUIREMENT - PRECHECK MICROWAVE

MICROWAVE Underside View



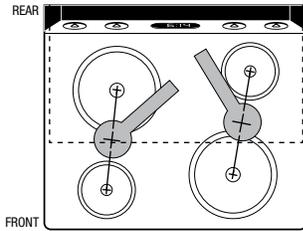
VENTS: Canisters should not be mounted over any vents, if possible. The ClickBar and magnets may do so, but only if it permits the device to meet the three (3) magnet minimum requirement. Some metallic parts under the microwave may not hold a magnet.

LIGHTS: Neither glass nor plastic light covers will hold a magnet. Canisters or ClickBars may obstruct the light, provided that the three (3) magnet requirement has been met, and the unit is secure.

INSTALLATION INSTRUCTIONS

STEP 1

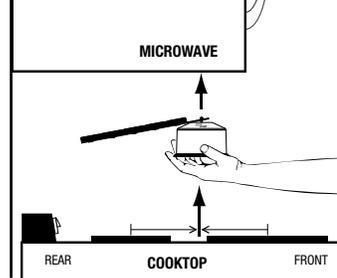
COOKTOP
Overhead
View



Position the canisters on the stove where the canisters sit at the midpoint between the center of the front and back burners on each side. The ClickBar need only be able to be raised without obstructions.

STEP 2

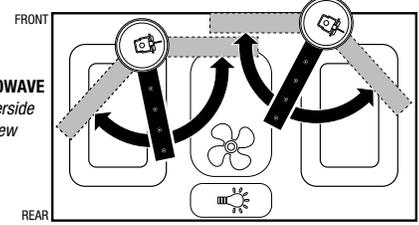
COOKING AREA
Side
View



Raise canisters from underneath to the spot directly above under microwave without attaching the ClickBar.

STEP 3

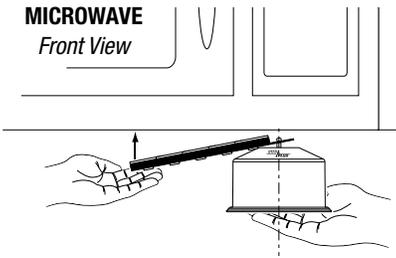
MICROWAVE
Underside
View



Use one hand to hold the canister in its final position, while using the other hand to swivel the ClickBar to the optimal mounting position (see precheck section).

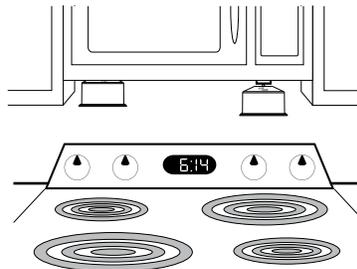
STEP 4

MICROWAVE
Front
View



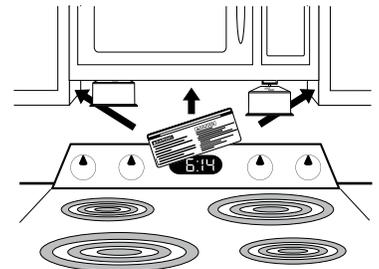
Once you have found an acceptable location, lift the ClickBar upwards. Confirm that three (3) of the five (5) magnets are securely fastened.

STEP 5



Due to variances in stove design and element layout, the canisters may not perfectly align with each other under the microwave.

STEP 6

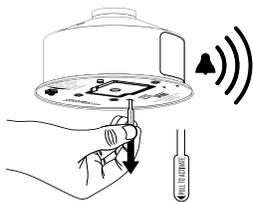


Place the enclosed decal under or near the microwave where it can be seen.

ACTIVATION INSTRUCTIONS

ACTIVATE

(1)



1) Pull out the red tab to activate the product. The product should emit three (3) short tones, one time.

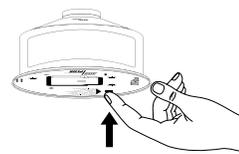
(2)



2) If no sound is heard, proceed to TESTING section and/or BATTERY REPLACEMENT sections.

TEST

(1)



1) To test the device, hold Test button for more than 3 seconds until a tone is heard.

(2)



2) When the button is released, the tone will stop.

See chart on the next page for explanation of additional alerts.

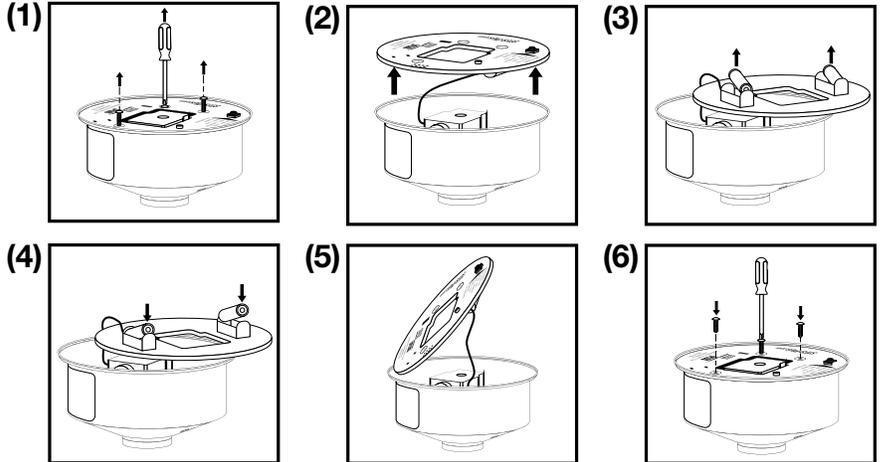
TROUBLESHOOTING

	SOUND	MEANING	CONDITION	CYCLE	ACTION
ALERTS	— — — 3 long tones	Device has detected a fire and deployed suppression powder	Alarm	Repeats every 1.5 seconds until batteries run out or are removed	Leave dwelling immediately, then call 911
	• • 1 short tone	Low Battery	Low Battery	Repeats every 60 seconds until batteries run out or are replaced.	Replace old batteries with two (2) new, 1.5V alkaline, N-cell batteries
	•• •• 2 short tones	Device has detected an error within the sensor board	Fault	Repeats every 60 seconds until batteries run out	Go to STFS Plus Sensor Troubleshooting Section at www.STFS.com
TESTING	••• 3 short tones	Initial activation by pulling tab, or batteries have been replaced	Power On	Once when tab is pulled, and each time batteries are replaced.	Device is powered on and working properly
	———— 1 continuous tone	Hold down self-test button for more than 3 seconds	Self Test	Continuous until button release	Device has self-tested, and is working properly

BATTERY REPLACEMENT

- 1) Use #2 Phillips head screw driver to unscrew the three (3) small screws from the sensor board.
- 2) Remove the sensor board, taking care not to damage or disconnect the wires.
- 3) Properly dispose of the existing batteries.
- 4) Replace with two (2) new, 1.5V alkaline N-cell, batteries. Do not mix new and old batteries.
- 5) Fold the wires back into place, taking care not to damage the wires.
- 6) Reattach the sensor board with the three (3) small screws, and reinstall per installation instructions.

Do not tamper with any sensors, or any other parts of the product or you risk device malfunction and voiding manufacturer's warranty.



williamsrdm

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