CPSC Staff's Statement on Southwest Research Institute's (SwRI's) Report,
"Test Report – Gas Ranges"
February 2016

The following contractor report titled, "Test Report – Gas Ranges," presents the results of research and testing conducted by SwRI, under CPSC contract CPSC-F-15-0092. SwRI performed this research to assist in determining probable causes for gas range ovens turning on by themselves, overheating electronic components, and/or loss of temperature control.

Under the contract, SwRI performed testing and analysis on three exemplar freestanding ranges. The three test scenarios were the bake, broil, and the self-clean cycle. SwRI recorded:

(1) temperatures at various locations on the gas range, when it is operated at higher temperature range functions;
(2) the electronic oven control panel voltage signals and any electromagnetic disturbances;
(3) the associated performance of components exposed to higher temperatures and higher voltages, such as electronic oven control panel assembly components and some internal and external oven surfaces; and
(4) the functional performance of the range if error codes or failures occur with the electronic control assembly.

This information will assist CPSC staff as they continue to work with standards developers, the Association of Home Appliance Manufacturers (AHAM), and other interested parties to develop proposals for requirements for reducing the likelihood of overheating electronic components, ovens turning on by themselves, and/or loss of temperature control.

TEST REPORT

GAS RANGES

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0 RELEASE CONTROL RECORD

Below is a table documenting the various changes recorded in this report. Each issuance of the report is clearly marked with the revision number and date of issue.

Table 0-1 Revision Table

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
1	Draft Release	June 14, 2016
2	Final Release	July 28, 2016

TEST REPORT

GAS RANGES

1 EXECUTIVE SUMMARY

At the request of the Consumer Product Safety Commission (CPSC), Southwest Research Institute (SwRI) investigated whether electrical noise associated with the ignition of the gas range surface burners while performing oven bake, broil, and self-clean functions can initiate unexpected behavior of the oven control. The CPSC supplied three gas ranges Brand A, Brand B and Brand C for testing.

Each gas range was subjected to several surface burner ignition pulses while set for the highest temperature attainable for both bake and broil functions, and several surface burner ignition pulses while set for the longest duration self-clean function. To add heat load during these bake, broil, and self-clean functions, a pot of water was placed on each of the two rear lit burners with the gas control for these set to medium-high.

The temperature at various CPSC-defined locations was recorded throughout testing. The voltage at various inputs to the oven control circuit board was also recorded during the surface burner ignition pulses.

None of the gas ranges displayed error codes or unexpected behavior at any time during the tests defined in this report.

The Brand A oven control touch panel warped during high temperature exposure, but returned to its original condition following removal of heat. No other visible changes were observed during or after testing for any of the gas ranges.

On the Brand A gas range the maximum recorded temperature near the oven control circuit board exceeded the manufacturer's datasheet-expressed upper temperature rating for an XRY MPX/MKP Y2 capacitor located on the board. The temperature ratings were not exceeded for any other observed components on the Brand A oven control circuit board nor for the observed components on the Brand B and Brand C oven control circuit boards.

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5 PURPOSE

SwRI investigated if electrical noise associated with the ignition of the gas range surface burners while performing oven bake, broil, and self-clean functions can initiate unexpected behavior of the oven control. The Consumer Product Safety Commission (CPSC) supplied gas ranges of three different models for testing.

This report contains the temperature and electrical noise data that was collected during various oven operations. The test setup and methods are explained and the results are given within this report.

6 TEST FACILITY

6.1 LOCATION FOR ALL TESTS

Southwest Research Institute

6220 Culebra Road

San Antonio, Texas 78238

6.2 TEST EQUIPMENT

Test equipment used to perform the tests and acquire data during this qualification program is listed in Table 6-1 below.

Table 6-1 Test Equipment Used

Description	Model	Asset Number	Calibration Due Date
Data Acquisition Chassis	NI cDAQ-9174	S/N 15EDFA2	N/A
Thermocouple Input Module	NI 9214	S/N 1A51D36	3/3/2017
Analog Input Module	NI 9242	022657	11/5/2016
Analog Input Module	NI 9239	022903	2/8/2017
Multifunction Process Calibrator	Fluke 725	020818	5/12/2016
Laptop Computer	DELL Vostro 3700	Service Tag 6S0SWM1	N/A
Software	NI SignalExpress 2013	Version 7.0.0	N/A
Software	Measurement NI MAX	Version 15.0.0F0	N/A
Software	NI-DAQmx	Version 15.1.0	N/A

6.3 CALIBRATION

Instrumentation calibration was performed in accordance with the SwRI Operating Procedure SwRI Structural Engineering SOP-715-01, "Control of Monitoring and Measuring Resources," Rev. 8, 17 February 2016.

7 TEST ITEM INFORMATION

7.1 TEST ITEM IDENTIFICATION

The gas range test samples selected and supplied by the CPSC are as follows:

Table 7-1 Hourly BTU Ratings at 4" Water Column Natural Gas

Make	Cooktop Burners					Single Oven Burners	
	Right Front	Left Front	Right Rear	Left Rear	Center	Bake	Broil
Brand A	14,200	9,500	5,000	9,500	--	18,000	13,500
Brand B	15,000	15,000	5,000	9,500	--	16,500	10,000
Brand C	9,500	18,000	12,000	5,000	10,000	16,000	13,500

All test samples were purchased and shipped to SwRI by the CPSC in their original packaging. Figure 7-1 through Figure 7-3 are photographs of the test samples installed and prior to testing.

Figure 7-1 Brand A Test Sample

Figure 7-2 Brand B Test Sample

Figure 7-3 Brand C Test Sample

7.2 TEST DATES

Laboratory testing was performed from February 29 through April 12, 2016.

7.3 FUNCTIONAL CHECK & FAILURE CRITERIA

Unless otherwise stated, a gas range was considered to have failed a test if an error code was displayed by the oven control and/or if unexpected operation occurred.

8 TEMPERATURE RECORDING

The first condition investigated was high heat operation which may create issues that affect proper operation of the electronic oven control. For each bake, broil, and self-clean high temperature test, the gas range was instrumented to record temperature data at 10 times per minute with an accuracy of ±2.5°F throughout the expected temperature range of measurement.

The type of thermocouple used that most closely matched the temperature range and accuracy requirements was "K-type." The Omega XCIB-K-4-5-10 K-type thermocouple was selected for the interior of the oven (oven cavity) and the Omega SA1XL-K-120 K-type thermocouple was selected for all other locations. The interior oven temperature measurement required the use of a thermocouple assembly that could withstand the higher temperature associated with that location. The thermocouple assembly used for the other locations included a self-adhesive tab for use with surface temperature measurements.

A National Instrument (NI) chassis and module were used to meet the temperature data acquisition requirement. The module was an NI 9214 16-channel Isothermal Thermocouple Input Module with up to ±0.8°F measurement accuracy and up to 0.036°F measurement sensitivity (24-bit analog to digital converter). It supports a variety of applicable thermocouple types, including the "K-type." The module can perform an interval scan of the temperature measurement channels within microseconds.

The eight (8) CPSC-specified locations for which temperature data was taken are given in Table 8-1, and Figure 8-1 through Figure 8-7. Note that the location for item number 2 on the Brand A test sample is diametrically opposite of the location for item number 2 on the Brand B and Brand C test samples. This change was due to the necessity of available space for thermocouple wire routing.

Table 8-1 Thermocouple Locations

Item No.	CPSC-defined Location	Description on Data Plots	Air or Surface?
0	ambient temperature of test cell	Ambient	Air
1	within the central oven cavity	Oven Cavity	Air
2A	between the external oven cavity and near the upper insulation barrier	Oven Insulation (Brand A and Brand C)	Air
2B		Oven Insulation (Brand B)	Air
3	on the external upper and rear surface of the range	Cooktop Surface	Surface
4	within the oven exhaust air vent	Oven Exhaust	Air
5	on the external lower front surface of the electronic control panel touch pad and near the bottom of the circuit board	Control Panel Surface	Surface
6	within the electronic oven control panel and near the printed circuit board	Main Circuit Board	Air
7		Secondary Circuit Board (Brand B)	Air

These locations were recorded during each bake, broil, and self-clean task. The data was placed into a Microsoft Excel file with a worksheet for each location. A plot providing each location's temperature during the performance of each task was produced using a MATLAB script and these are presented in the appendices.

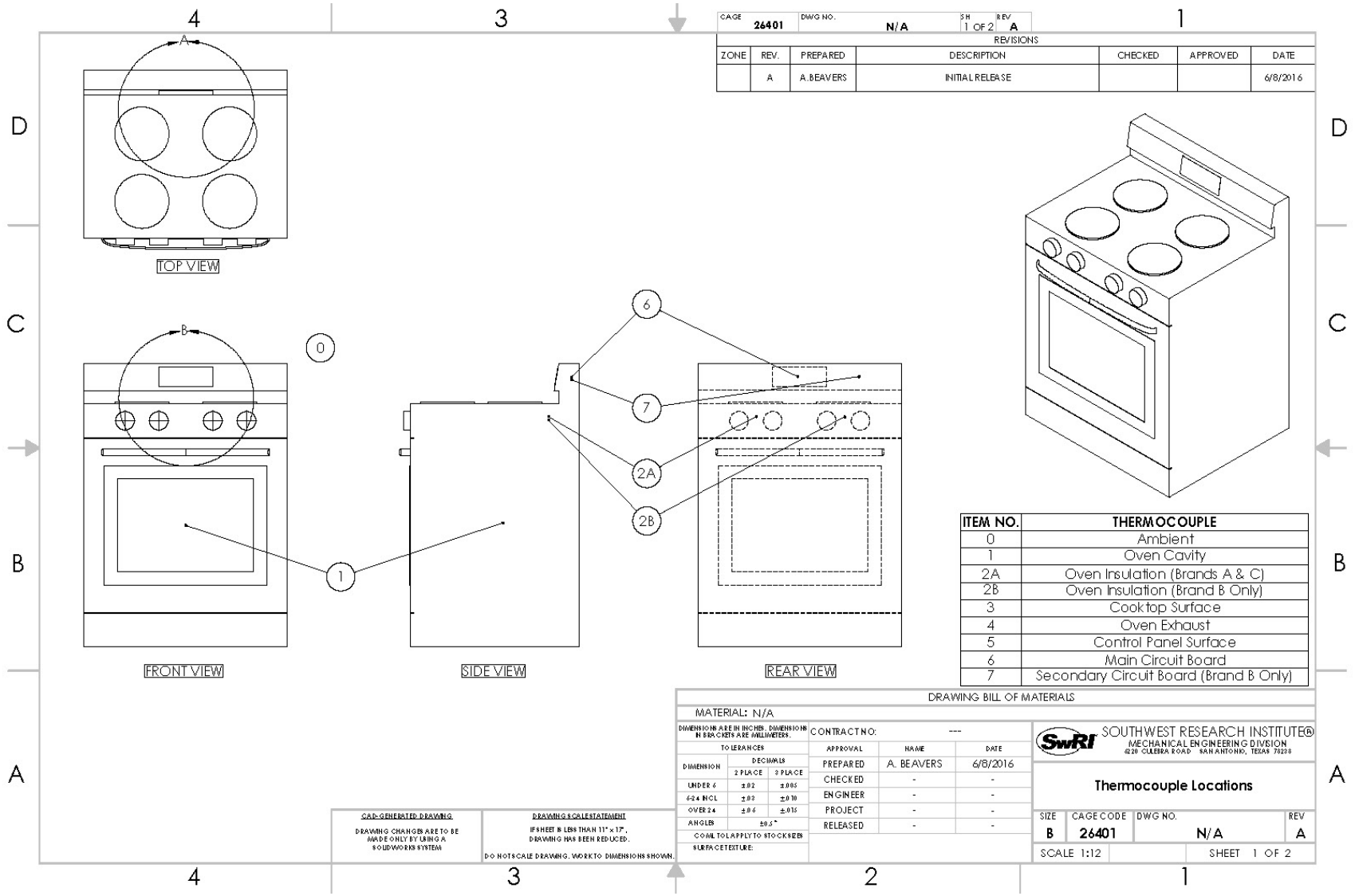

Figure 8-1 Thermocouple Locations, Sheet 1

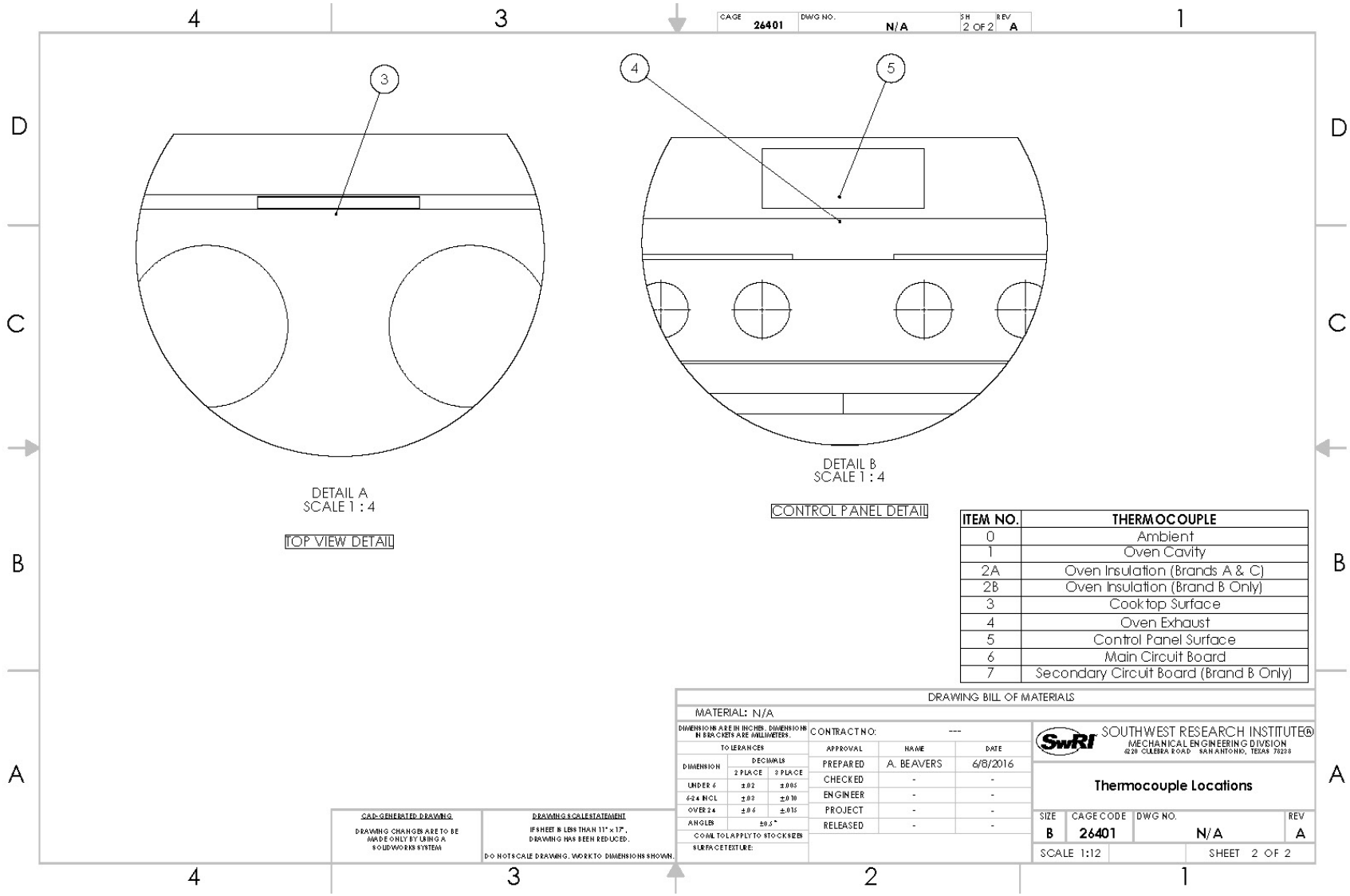

Figure 8-2 Thermocouple Locations, Sheet 2

Figure 8-3 Example of Thermocouple Oven Cavity Location/Brand B Test Sample

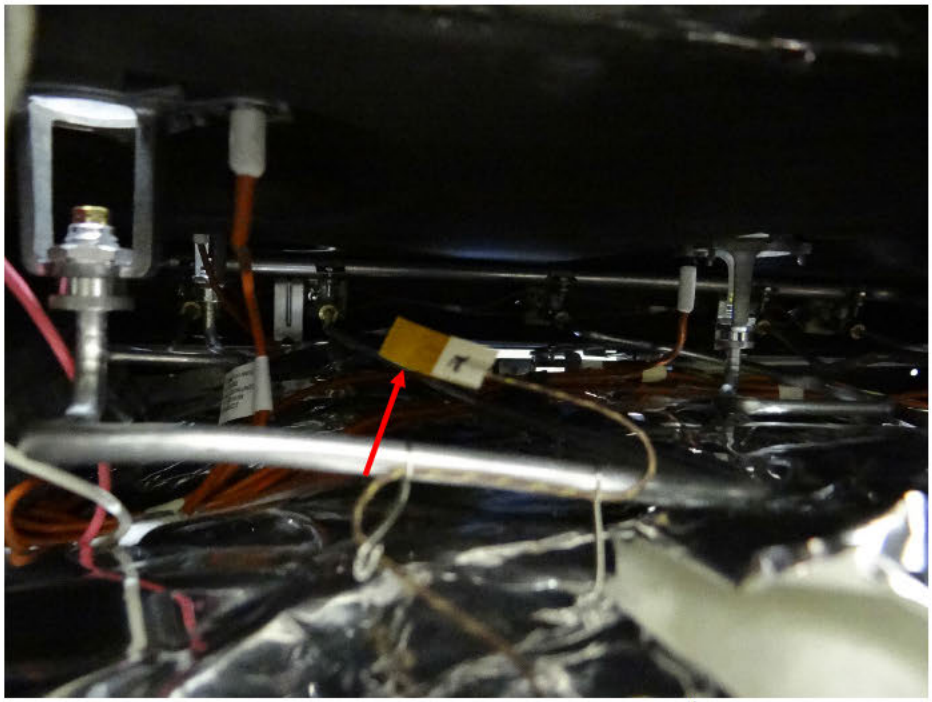

Figure 8-4 Example of Thermocouple Oven Insulation Location/Brand C Test Sample

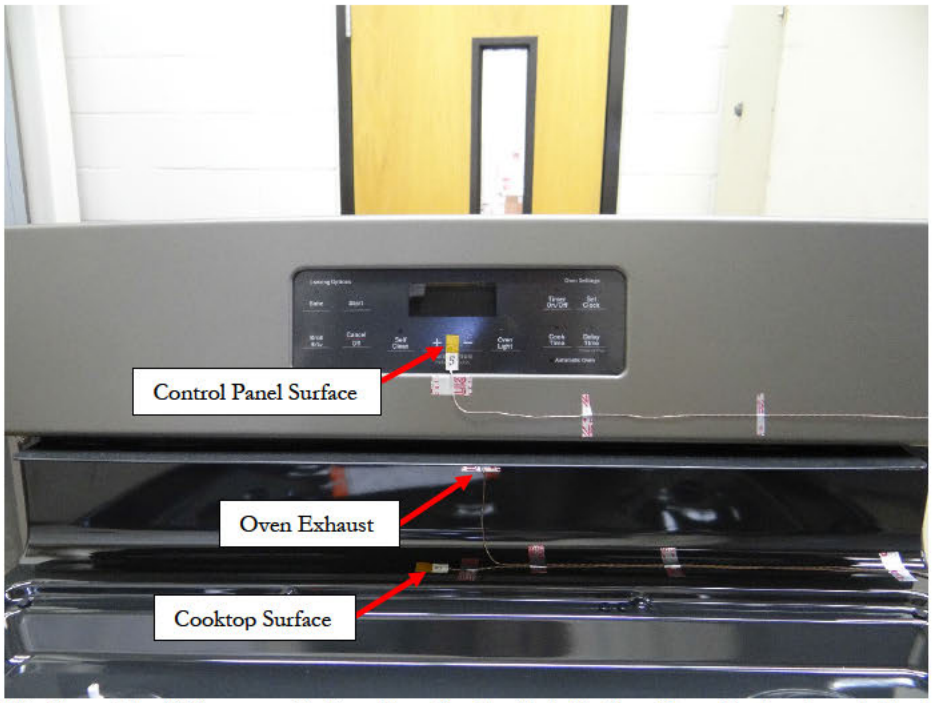

Figure 8-5 Example of Thermocouple Locations for Cooktop Surface, Oven Exhaust, and Control Panel Surface/Brand C Test Sample

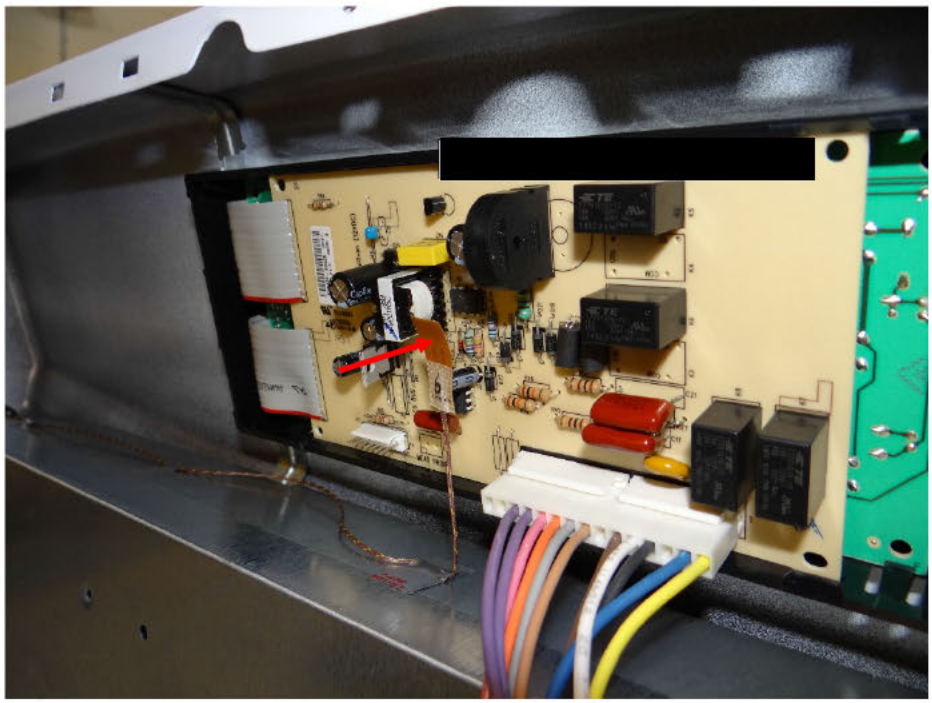

Figure 8-6 Example of Thermocouple Main Circuit Board Location/Brand A Test Sample

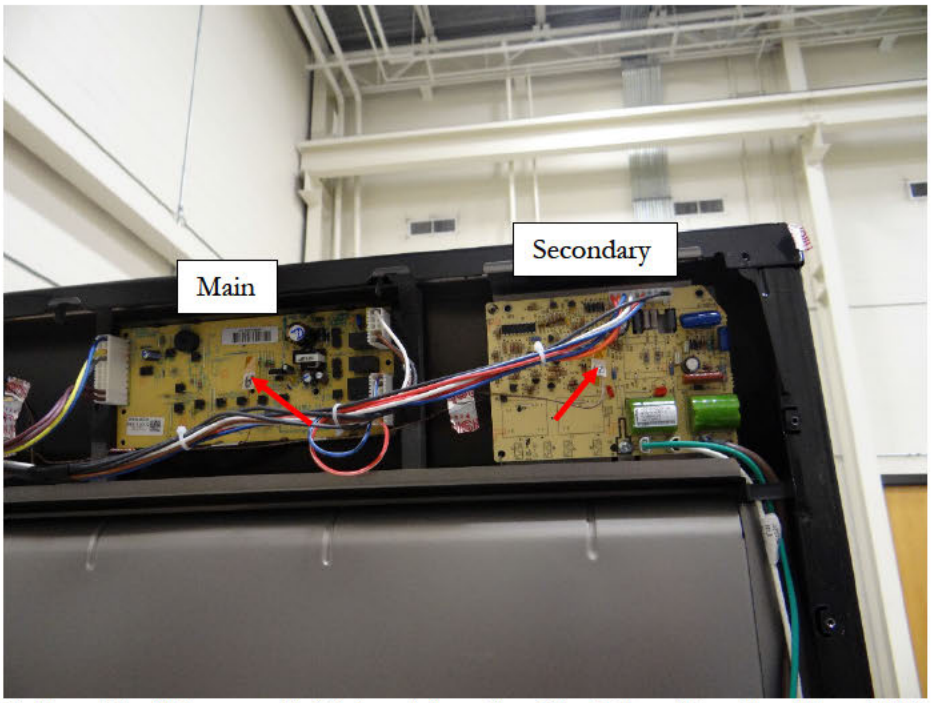

Figure 8-7 Example of Thermocouple Main and Secondary Circuit Board Locations/Brand B Test Sample

9 VOLTAGE SIGNAL (NOISE) RECORDING

The second condition investigated was electrical noise or pulses that may create undesirable logic signals in the electronic oven control panel. These electrical disturbances may be caused by either thermal effects on the control panel circuitry or from coupling of high-voltage pulses created by the electrode ignitor spark at the top surface burners. Some pre-testing (prior to task execution) was conducted to characterize the noise pulses produced by the electrode ignitor spark so that the data acquisition system range parameters could be set appropriately to record the pulses. The pre-testing also determined the electrical inputs that might carry the electrical noise or pulses into the electronic oven control module to be as follows:

- AC line to neutral
- AC neutral to ground
- Gas valve for bake burner
- Gas valve for broil burner
- Resistance temperature detector (RTD)
- Oven door switch

The voltage on these lines was monitored and recorded during the bake, broil and self-clean tasks. The tap locations for the signals were as close as physically feasible to the oven control board so that any noise transferred to the interconnect wire would be captured in the data recordings.

A National Instrument (N.I.) chassis was used to host NI 9242 and NI 9239 modules selected to monitor and record the electrical noise pulses produced by the range's ignitors on the oven controller board electrical inputs.

The NI 9242 module has the following features:

- 250Vrms line-to-neutral;
- 400Vrms line-to-line;
- simultaneous analog input;
- 24-bit resolution; and
- capable of 50,000 samples per second per channel simultaneous sample rate.

The NI 9239 module has the following features:

- +/- 10V;
- simultaneous analog input;
- analog input;
- 24-bit resolution; and

- capable of 50,000 samples per second per channel simultaneous sample rate

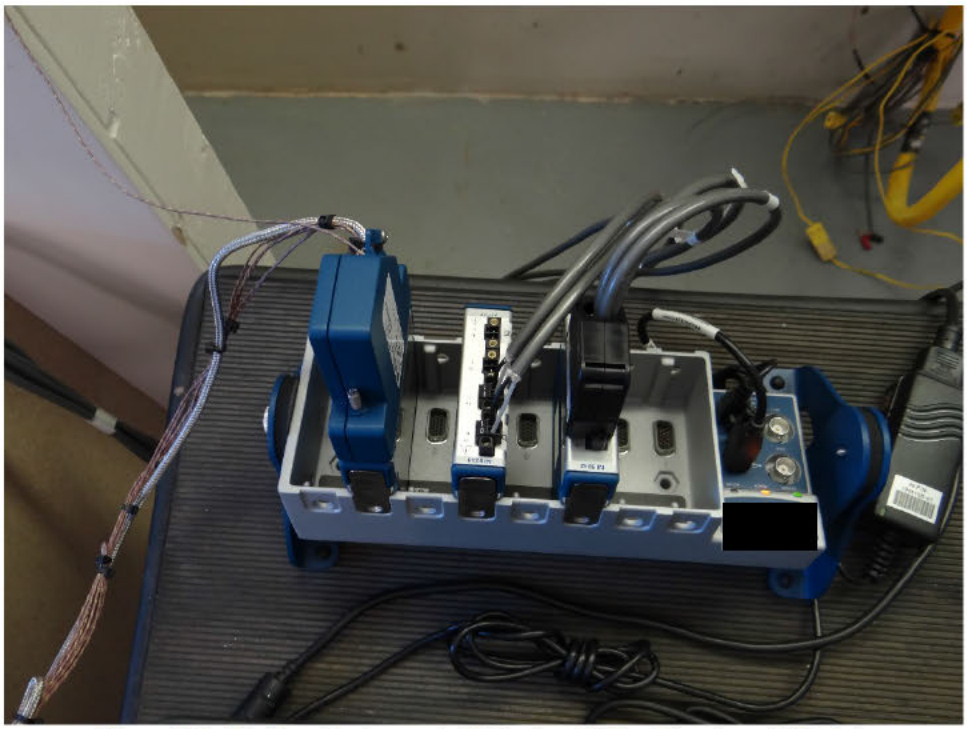

Figure 9-1 National Instruments Data Acquisition Chassis and Modules

10 TEST SETUP

Three models of gas ranges were supplied by the CPSC for testing. These ranges were connected, one at a time, to gas and electrical utilities in accordance with local codes. The gas ranges were installed against a wall constructed to simulate a typical consumer installation location (see Figure 10-1 and Figure 10-2) including a base cabinet installed on either side of the gas range. Dimensional drawings of the test set up including the location of the gas delivery are given in Figure 10-3 and Figure 10-4. The drawings also include the location and materials used adjacent to the range to replicate typical cabinet and wall installation in consumers' homes. The sample ranges were installed in accordance with the owner's manual instructions. The location of the gas supply and electrical outlet are given in Figure 10-5.

The general natural gas pipe supply pressure was 6-14" W.C. The gas pipe to the appliance used a Canadian Standards Association (CSA) certified flexible metal appliance connector (see Figure 10-6). Each range was equipped with its own CSA-rated connector. The gas supply line was equipped with three shutoffs; one outside the test cell exterior wall, another accessible inside the test cell and to the left of the wall assembly, and the last at the wall stub-through.

The electrical power was routed from a dedicated circuit breaker (see Figure 10-7) to the electrical wall outlet behind the appliance. The AC supply in the test cell was a nominal $123V_{RMS}$ at 60Hz.

Blue flame appearance was confirmed for each gas range sample for all observable burners prior to testing. No adjustments were necessary.

During performance of the bake, broil, and self-clean tasks, each range was additionally heat-loaded with two 5-quart capacity (~8 inches in diameter) aluminum pots filled with tap water up to the handle lower rivet line. The pots filled with water are shown in Figure 10-8. Prior to the initiation of a bake, broil, or self-clean task, the two rear burners were started and adjusted to medium-high setting on the respective cooktop burner gas control knob, and allowed to pre-heat the water for a period of time prior to continuing with the task. The burners were left on for the duration of each task, and the water in each pot was replenished as needed to keep the water within about an inch of the handle rivet line.

Figure 10-1 Wall/Cabinet Setup in Test Cell

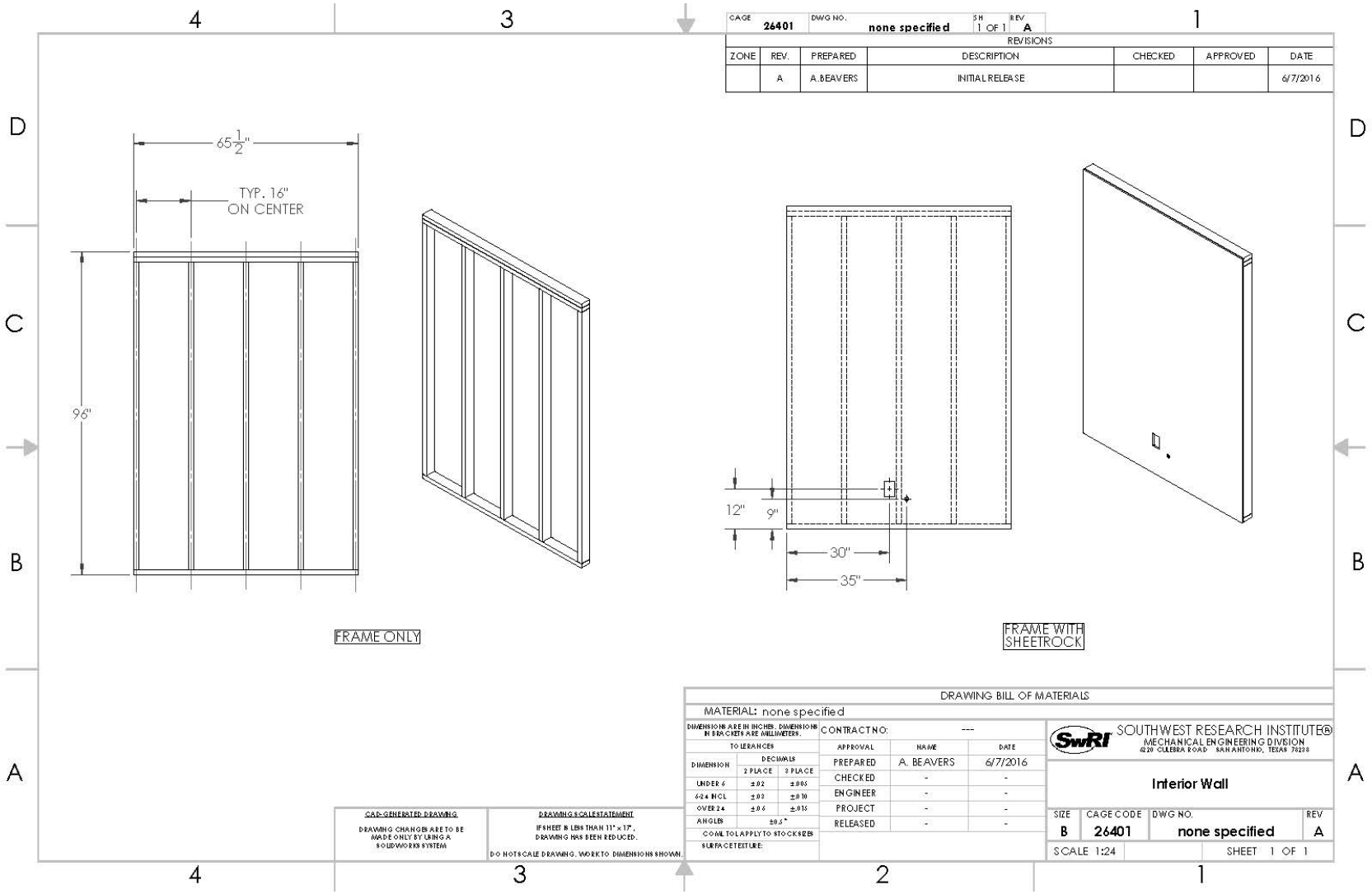

Figure 10-2 Dimensional Drawing of Residential Wall

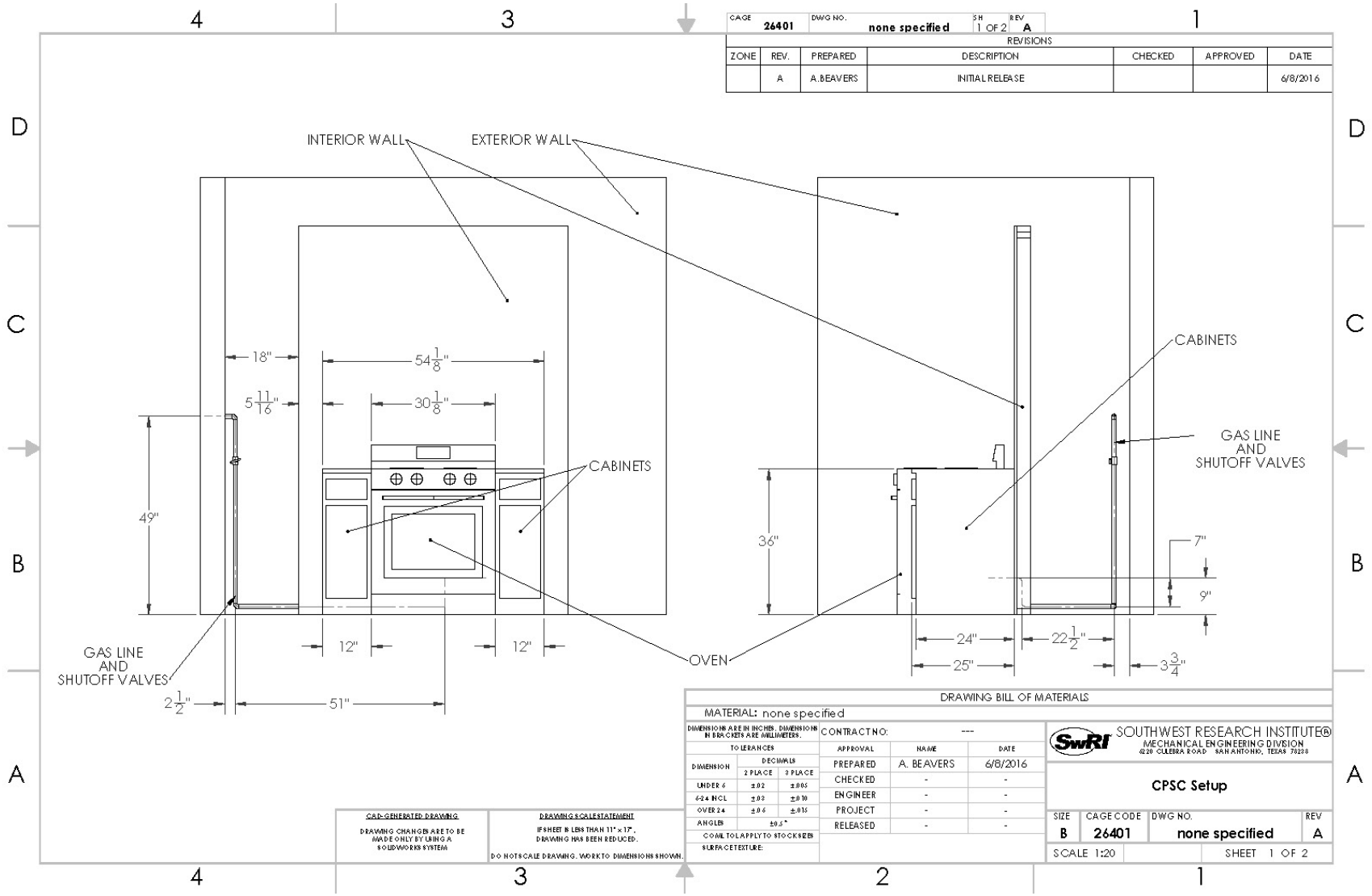

Figure 10-3 Dimensional Drawing of Test Setup, Sheet 1

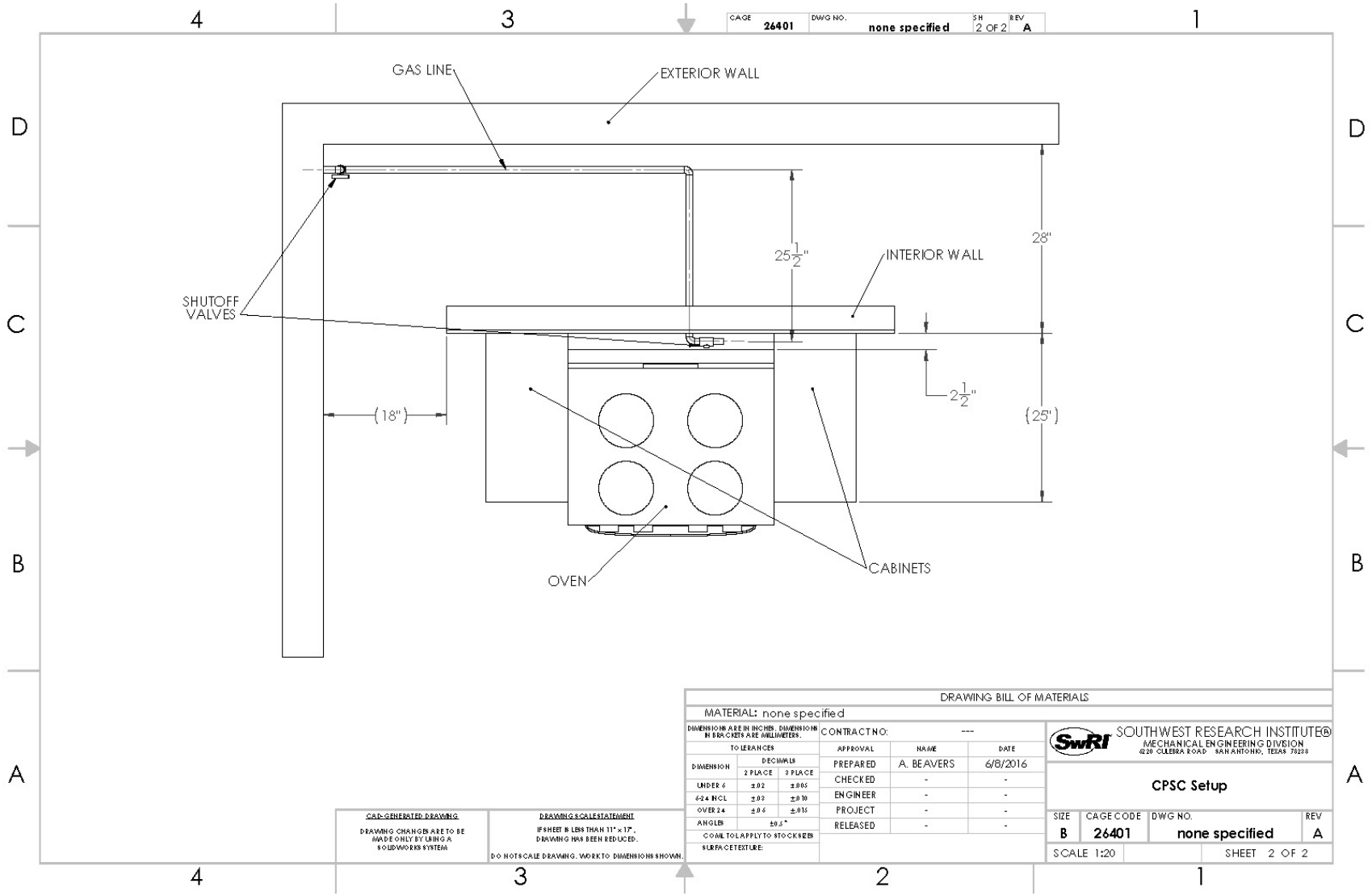

Figure 10-4 Dimensional Drawing of Test Setup, Sheet 2

Figure 10-5 Gas Supply and Electrical Outlet Location for Gas Range Test Samples

Figure 10-6 CSA-rated Gas Connector

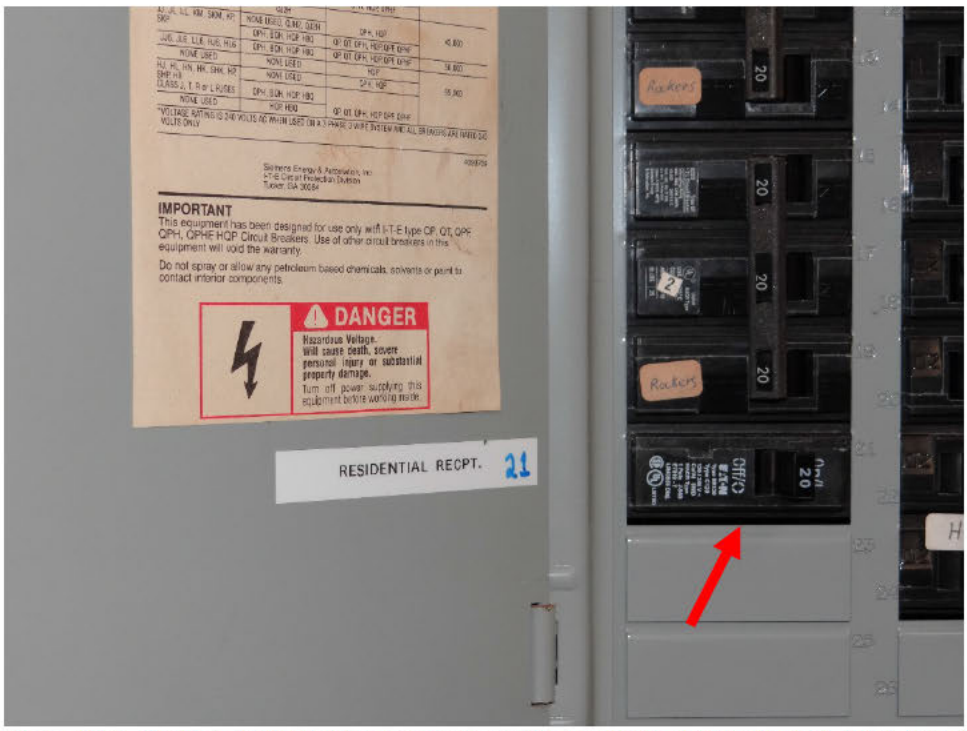

Figure 10-7 Dedicated Circuit Breaker Connected to Residential Outlet for Electrical Supply

Figure 10-8 5-Quart Aluminum Pots filled with Water

11 METHOD FOR PERFORMING WORK

The tasks defined in this section were applied to each instrumented gas range to investigate whether an error code or unexpected operation occurred. Each range was tested in sequence as depicted in the following overview.

Test Order Overview

The instrumented Brand A range was setup in the test cell and exposed to bake, broil, and self-clean tasks. The three tasks were repeated and, upon completion, the data from the second run was compared to the first run. After the data was deemed to be sufficiently consistent, the Brand A range was removed from the test cell and was replaced in the test setup by the instrumented Brand B range. This range was then subjected to the same tasks as the Brand A range. For the Brand B gas range, a third set of Task B (broil) data was collected to further verify consistency. The Brand B range was then removed and replaced by the Brand C range, and two sets of data for broil, bake, and self-clean tasks were collected and compared and found to be consistent.

Detailed Task Test Procedure

Prior to all tasks, the general condition of the gas range under test was observed; this includes the condition and functionality of the oven control panel, wiring, and other assembly components that are visible with the back covers removed.

Task A (Bake)

3-hours at highest temperature [550°F for Brand A, 525°F for Brand B, 550°F for Brand C] bake test with cooktop surface burner ignition actions.

For the duration of the Task A bake test, an uncovered 5-quart aluminum sauce pan filled with water was placed on each of the two rear burners that was heated to the medium/high setting (as indicated on the associated cooktop burner knob). These pans were allowed to heat for 5 minutes prior to the start of the bake test and the burners were left on at least until thermocouple data recording had ceased two minutes after test end. During the Task A bake test, thermocouple data was collected every 6 seconds. The continuous data collection period for the thermocouples was 2 minutes prior to test start until 2 minutes after test end. Test start was defined as initiating the bake function and test end was defined as 3 hours after the oven controller indicated that it had reached the set bake temperature. During the period where the oven bake test had started, the following cooktop burner actions/data acquisition were performed several times using the following sequence:

- Start 50Ks/S electrical data acquisition, turn left rear burner knob to "lite" position for at least 10 ignition events; stop electrical data acquisition and save time-stamped data.

- Start 50Ks/S electrical data acquisition, turn left front burner knob to "lite" position to record at least 10 ignition events; stop electrical data acquisition and save time-stamped data.

- Start 50Ks/S electrical data acquisition, turn right rear burner knob to "lite" position to record at least 10 ignition events; stop electrical data acquisition and save time-stamped data.

- Start 50Ks/S electrical data acquisition, turn right front burner knob to "lite" position to record at least 10 ignition events; stop electrical data acquisition and save time-stamped data.

- If a fifth surface burner exists, start 50Ks/S electrical data acquisition, turn fifth surface burner knob to "lite" position to record at least 10 ignition events; stop electrical data acquisition and save time-stamped data.

Task B (Broil)

1-hour at highest temperature broil ["hi" setting for Brand A, 525°F for Brand B, "hi" setting for Brand C] test with cooktop surface burner ignition actions.

For the duration of the Task B broil test, an uncovered 5-quart aluminum sauce pan filled with water was placed on each of the two rear burners that was heated to the medium/high setting (as indicated on the associated cooktop burner knob). These pans were allowed to heat for 5 minutes prior to the start of the broil test, and the burners were left on at least until thermocouple data recording had ceased two minutes after test end. During the Task B broil test, thermocouple data was collected every 6 seconds. The continuous collection period for the thermocouples was 2 minutes prior to test start until 2 minutes after test end. Test start was defined as initiating the broil function, and test end was defined as 1 hour after the oven controller indicates that it has reached the set broil temperature. During the period where the oven broil test had started, the following cooktop burner actions/data acquisition were performed several times using the following sequence:

- Start 50Ks/S electrical data acquisition, turn left rear burner knob to "lite" position for at least 10 ignition events; stop electrical data acquisition and save time-stamped data.

- Start 50Ks/S electrical data acquisition, turn left front burner knob to "lite" position to record at least 10 ignition events; stop electrical data acquisition and save time-stamped data.

- Start 50Ks/S electrical data acquisition, turn right rear burner knob to "lite" position to record at least 10 ignition events; stop electrical data acquisition and save time-stamped data.

- Start 50Ks/S electrical data acquisition, turn right front burner knob to "lite" position to record at least 10 ignition events; stop electrical data acquisition and save time-stamped data.

- If a fifth surface burner exists, start 50Ks/S electrical data acquisition, turn fifth surface burner knob to "lite" position to record at least 10 ignition events; stop electrical data acquisition and save time-stamped data.

Task C (Self-Clean)

Maximum-time [4-hr Brand A, 4-hr 30-min Brand B, 5-hr Brand C] self-clean test with cooktop burner ignition actions. The cooktop burner ignitor actions were performed within the last 15 minutes of self-clean time.

For the duration of the Task C self-clean test, an uncovered 5-quart aluminum sauce pan filled with water was placed on each of the two rear burners that was heated to the medium/high setting (as indicated on the associated cooktop burner knob). These pans were allowed to heat for 5 minutes prior to the start of the self-clean test, and the burners were left on at least until thermocouple data recording had ceased two minutes after test end. During the self-clean test, thermocouple data was collected every 6 seconds. The continuous data collection period for the thermocouples was 2 minutes prior to test start until 2 minutes after test end. Test start was defined as initiating the self-clean function, and test end was defined by the oven control display. During the period where the self-clean test had started, the following cooktop burner actions/data acquisition were performed several times using the following sequence:

- Start 50Ks/S electrical data acquisition, turn left rear burner knob to "lite" position for at least 10 ignition events; stop electrical data acquisition and save time-stamped data.

- Start 50Ks/S electrical data acquisition, turn left front burner knob to "lite" position to record at least 10 ignition events; stop electrical data acquisition and save time-stamped data.

- Start 50Ks/S electrical data acquisition, turn right rear burner knob to "lite" position to record at least 10 ignition events; stop electrical data acquisition and save time-stamped data.

- Start 50Ks/S electrical data acquisition, turn right front burner knob to "lite" position to record at least 10 ignition events; stop electrical data acquisition and save time-stamped data.

- If a fifth surface burner exists, start 50Ks/S electrical data acquisition, turn fifth surface burner knob to "lite" position to record at least 10 ignition events; stop electrical data acquisition and save time-stamped data.

After all Tasks were performed for the gas range test sample, the general condition of the gas range under test was observed and compared to the condition prior to test start; this includes the condition and functionality of the oven control panel, wiring, and other assembly components that are visible with the back covers removed.

12 RESULTS

None of the gas ranges described in Section 7.1 displayed an error code or produced unexpected operations during any part of this test program.

The Brand A gas range exhibited some warping of the touch panel membrane during Task A, B, and C testing, but the warping was no longer observed after the heat was removed (see Figure 12-1 and Figure 12-2). No other observations were made regarding changes to the condition and functionality of any oven control panel, circuit board, wiring, or other assembly components that are visible with the back covers removed.

The maximum temperatures recorded during each test run for each thermocouple location are given in Table 12-1. A survey of the temperature-stamped discrete components (which were all capacitors) used in the oven control circuit boards indicated a temperature rating of 221°F, and this was generally common across all three brands. One XRY MPX/MKP Y2 capacitor located on the Brand A oven control circuit board has a manufacturer's datasheet-expressed upper temperature limit of 212°F. The maximum recorded temperature for the oven control circuit board thermocouple location for the Brand A gas range was 218.8°F. The maximum recorded temperature for the oven control circuit board thermocouple location for the Brand B gas range was 184.4°F and for the Brand C gas range was 175.0°F, and were below the 221°F temperature rating for the observed components in those models.

Temperature and Electrical Data Results

Several appendix sections containing temperature and electrical data plots are associated with this report. Appendix A contains data for the Brand A test sample. Appendix B covers the Brand B test sample, and Appendix C covers the Brand C test sample. Appendix x-1 is data collected for the bake (Task A) function, Appendix x-2 covers broil (Task B), and Appendix x-3 covers self-clean (Task C).

For the Brand B test sample, when there is no call for bake or boil burners to be on, the activation of the cooktop gas ignitors is reflected in the bake and broil voltage versus time plots as electrical noise. A representative example of this observation is shown in Figure 12-3.

Figure 12-4 through Figure 12-6 give examples of temperature data taken during the test program and Figure 12-7 through Figure 12-12 give examples of voltage data taken. Appendices A, B, and C contain complete sets of temperature and voltage data taken throughout the test program.

Clarification Labels and Numbers used in the Plot Headers

1. Baseline: This refers to a data acquisition system check after rear cooktop burners were turned on, but prior to the 3-5 minute warm-up period required by the test procedure. This data was always obtained while the ignition system was being activated with the knob for the left-rear cooktop burner.
2. BR#, BK#, SC#: These prefixes refer to the readings that were obtained at the moment when or immediately after the bake, broil, and self-clean cycles (respectively) were

initiated with the press of the 'Start' button. This value was always obtained while the ignition system was being activated with the knob for the left-rear cooktop burner or with no ignition system being activated.

   a. The numbering following these prefixes refers to the reading number in the sequential order in which they were obtained.

3. LR-, LF-, RR-, RF-, and Cburner#: These prefixes refer to the cooktop burner control knob that was used to activate the surface burner ignition system, and are followed by a number that indicates the sequential number for the reading that was obtained at each ignition switch location (i.e. which knob). LR, LF, RR, RF, and C indicate the cooktop burner knob for the left-rear, left-front, right-rear, right-front, and center surface burners, respectively.
   a. All reading numbers labeled *burner1 indicate data that was obtained while the rear-surface burners were on and set to a mid-high temperature setting. This was following the required 3-5 minute wait period to allow temperatures to stabilize and before the start of oven setting described by the task name (i.e. bake, broil, and self-clean). Note that the rear-surface burners remained on for all subsequent electrical data samples.
   b. Reading numbers labeled *burner2 indicate data that was obtained after the appropriate task was initiated and following the time required to allow oven cavity temperatures to reach a pre-heated status. Pre-heating was indicated as complete by the pre-heat feature for ovens and tasks that had this feature. For ovens and tasks that did not have or use a pre-heat indicator, this was determined to be the moment that either the bake or broil burners were allowed to switch to the off state for the first time following the initiation of the task.
   c. The last reading for each task was obtained just prior to the end of the prescribed task run-time while still at operating temperatures. The last reading number ranged from 3 to 5, but will always be the last in the sequence.
   d. All readings that were obtained between *burner2 and the final data set were obtained as the oven was at operating temperature for the required task.

Note that all plots in the appendices are auto-scaled in the x- and y-axes unless otherwise noted.

Figure 12-1 Warping of Touch Panel Membrane for Brand A Gas Range during Testing

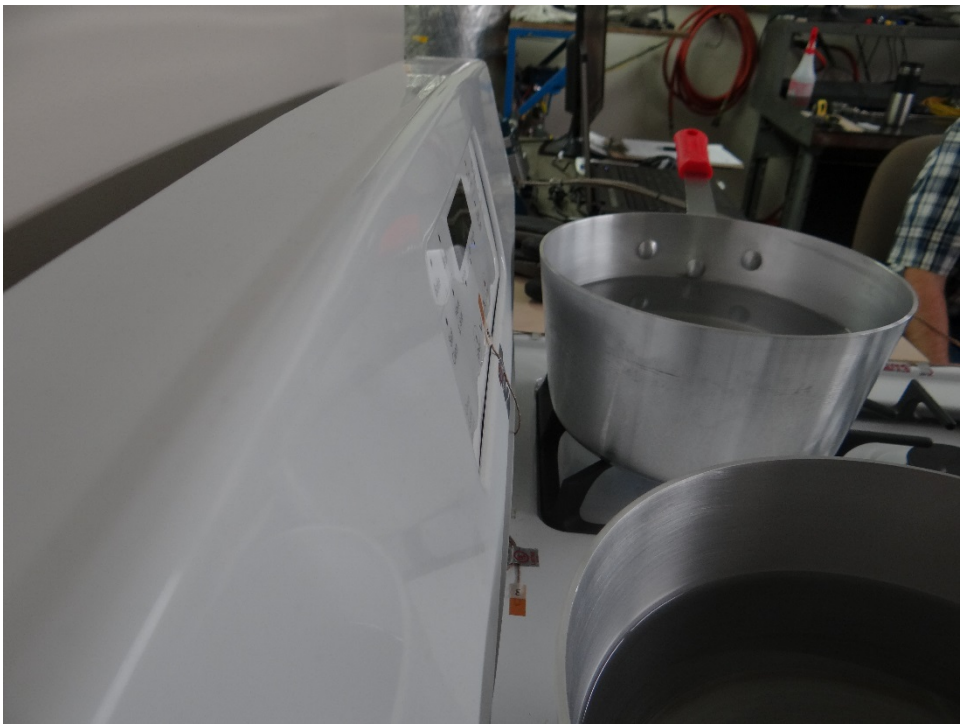

Figure 12-2 Touch Panel Membrane for Brand A Gas Range after Testing

Table 12-1 Maximum Temperatures Recorded

Brand	Test Name	Maximum Temperatures (°F)							
		Ambient	Cavity	Insulation	Rear Surface	Exhaust	Control Panel	Circuit Board	Secondary Board
Brand A	Bake 1	76.1	553.4	189.9	243.0	267.2	211.0	174.9	-
	Bake 2	74.1	554.6	187.6	241.0	256.3	204.4	169.3	-
	Broil 1	73.1	502.2	240.1	334.6	367.4	226.6	196.4	-
	Broil 2	74.1	506.6	234.9	328.4	352.1	233.1	200.9	-
	Self-Clean 1	74.8	848.4	270.3	315.9	355.0	211.7	213.0	-
	Self-Clean 2	77.6	847.0	273.8	314.5	358.3	213.5	218.8	-
Brand B	Bake 1	75.7	524.7	200.8	249.0	464.3	198.5	154.6	90.8
	Bake 2	75.9	526.3	200.8	246.2	452.0	203.0	158.1	92.8
	Broil 1	75.9	448.6	201.4	282.6	582.9	218.0	170.7	98.5
	Broil 2	76.2	450.2	204.9	282.1	580.3	219.5	171.0	89.0
	Broil 3	76.2	453.1	208.1	281.7	587.1	220.0	173.4	89.3
	Self-Clean 1	77.2	811.4	259.8	315.7	624.1	214.9	183.9	105.9
	Self-Clean 2	77.7	809.7	259.1	313.1	635.3	214.7	184.4	94.6
Brand C	Bake 1	77.2	558.5	196.1	194.8	460.9	142.7	138.0	-
	Bake 2	76.4	558.2	193.8	193.8	486.0	147.4	138.5	-
	Broil 1	77.3	388.0	207.3	206.8	557.4	150.1	145.4	-
	Broil 2	76.4	392.6	206.2	204.3	549.0	147.5	146.1	-
	Self-Clean 1	76.8	813.2	247.8	246.3	659.1	161.7	172.3	-
	Self-Clean 2	76.9	813.8	248.9	246.0	670.8	173.6	175.0	-

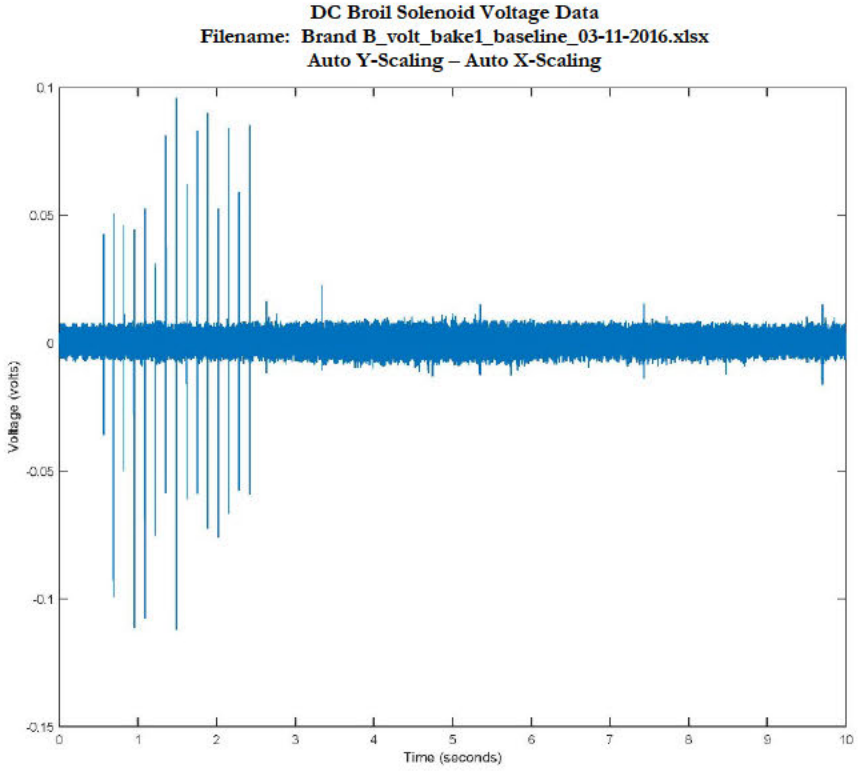

Figure 12-3 Example of Electrical Noise Generated by the Gas Ignitors

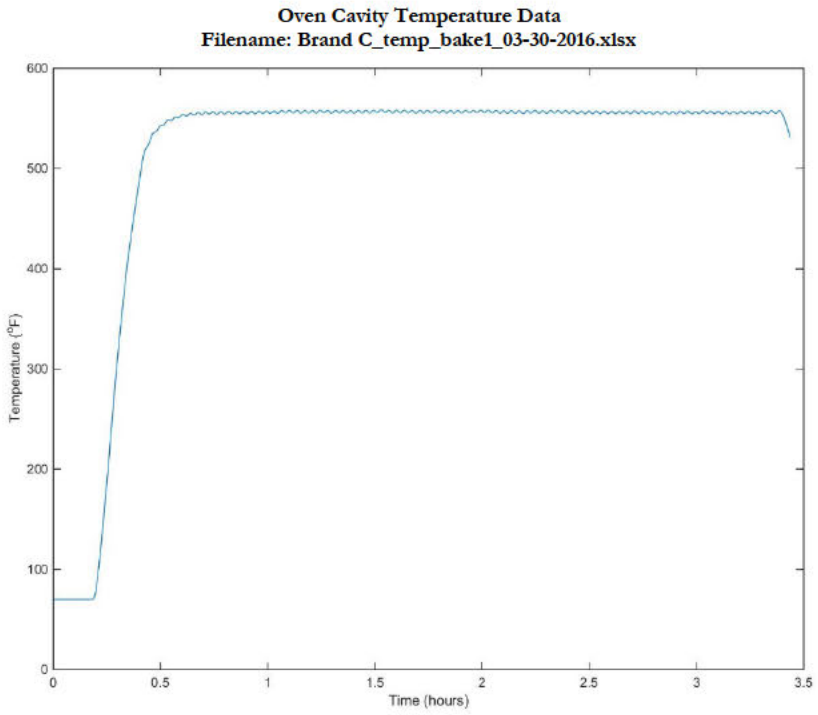

Figure 12-4 Example of Oven Cavity Temperature during Bake Task

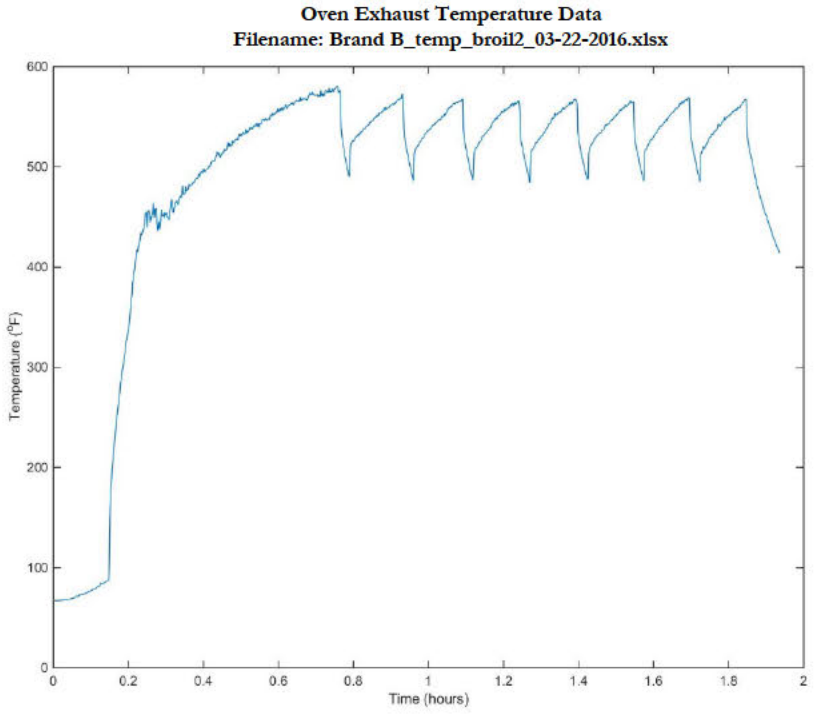

Figure 12-5 Example of Oven Exhaust Temperature during Broil Task

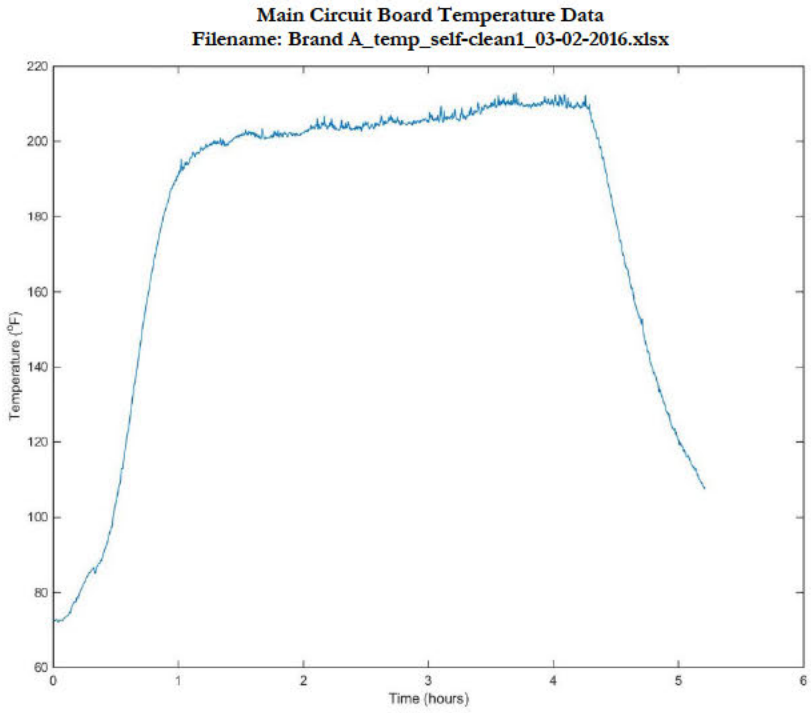

Figure 12-6 Example of Main Circuit Board Temperature during Self-Clean Task

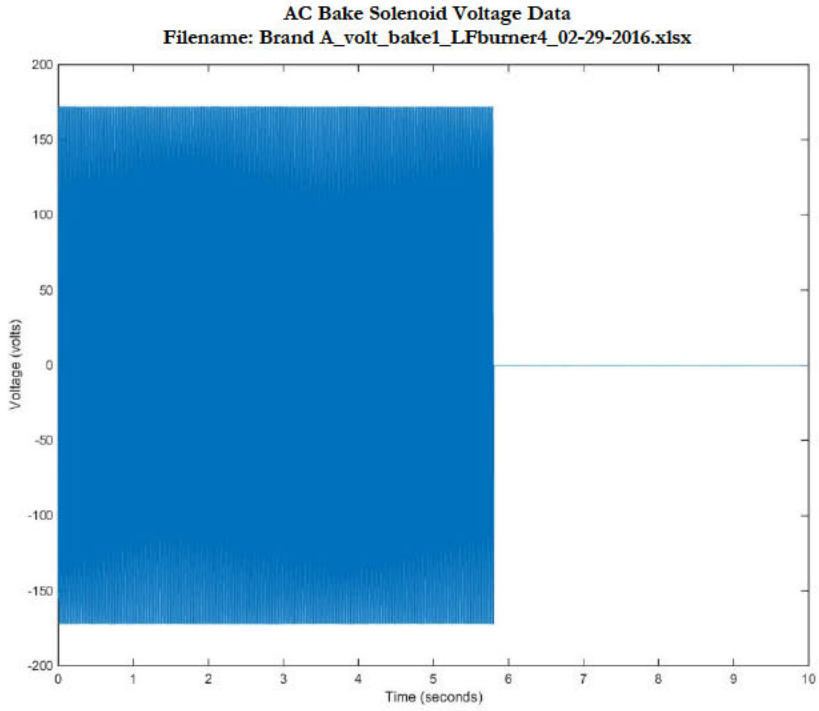

Figure 12-7 Example of AC Bake Solenoid Voltage Data during Bake Task

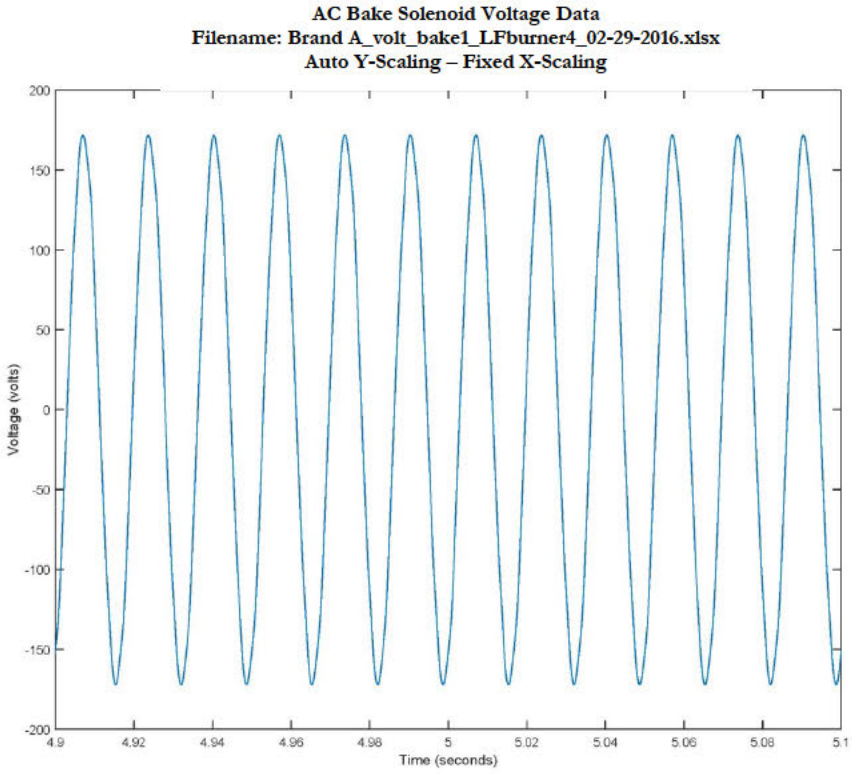

Figure 12-8 Expanded View of AC Bake Solenoid Voltage Data during Bake Task

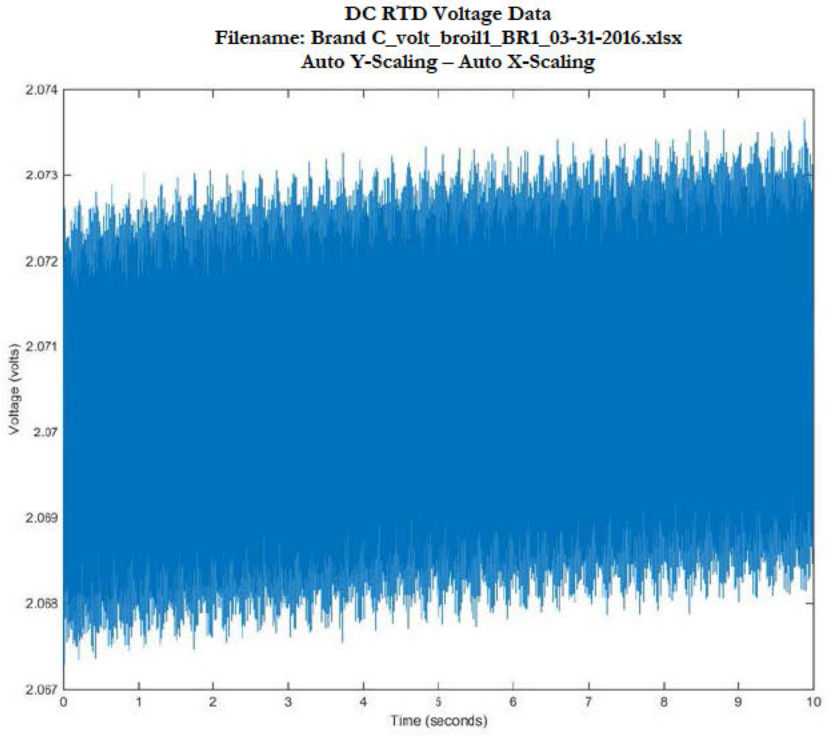

Figure 12-9 Example of RTD Voltage Data during Broil Task

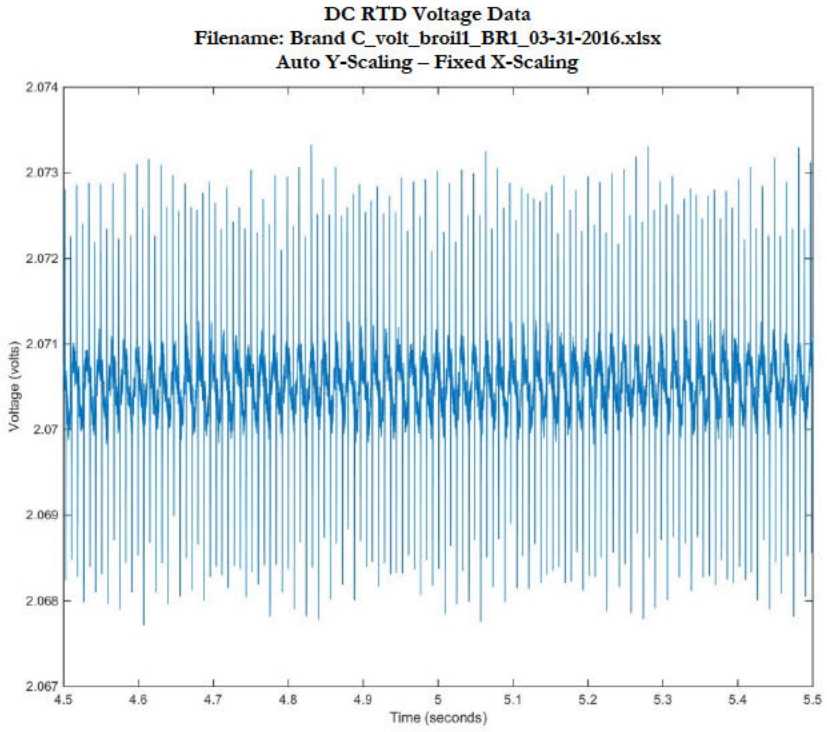

Figure 12-10 Expanded View of RTD Voltage Data during Broil Task

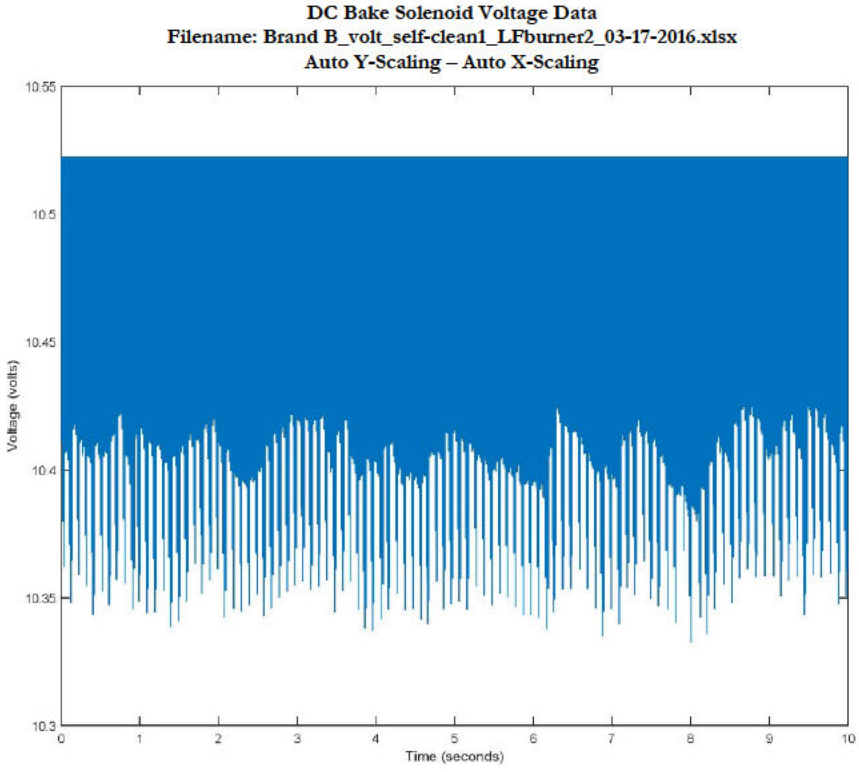

Figure 12-11 Example of DC Bake Solenoid Voltage Data during Self-Clean Task

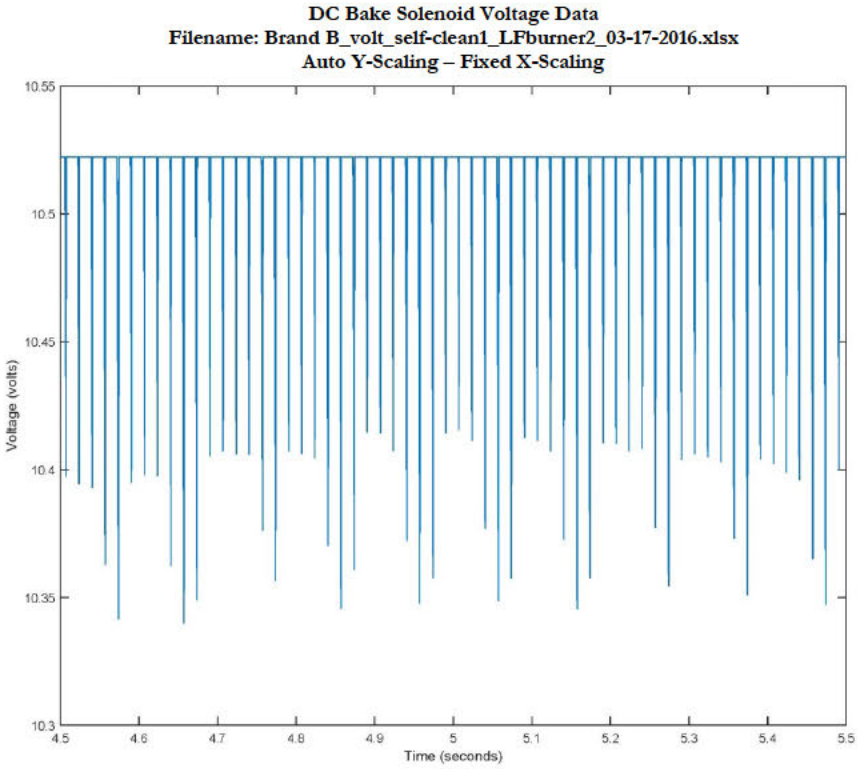

Figure 12-12 Expanded View of DC Bake Solenoid Voltage Data during Self-Clean Task