LOG OF MEETING

CPSA 6 (b)(1) Cleared
No Mfrs/PrvtLblrs or Products Identified
Excepted by
Firms Notified,
Comments Processed.
11/13/98

SUBJECT: Meeting of Working Group on Rangetop Cooking Fires

DATE: October 5, 1998 **PLACE:** CPSC Headquarters
4330 East-West Highway
Bethesda, MD

DATE OF LOG ENTRY: November 9, 1998

SOURCE OF LOG ENTRY: Andrew Trotta, ESEE

CPSC PARTICIPANTS:
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Han Lim, LS
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Linda Smith, Epidemiology and Health Sciences Directorate
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NON-CPSC PARTICIPANTS:
Dean Bolt, Travelers Insurance -Loss Prevention
Tim Brooks, Whirlpool
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Sharon Franke, Good Housekeeping
Gordon Gillerman, Underwriters Laboratories
Ed Godziszewski, Figaro
Beth McConnell, Product Safety Letter
Wayne Morris, Association of Home Appliance Manufacturers
John Ottoson, U.S. Fire Administration
Issac Sargunam, Maytag
Rick Seib, Whirlpool
Jack Thomas, Amana

SUMMARY:
Representatives from United States Consumer Product Safety Commission (CPSC) staff, Association of Home Appliance Manufacturers (AHAM), range industry engineers/product safety and invited guests met for the second time as a working group to discuss issues related to reducing rangetop cooking fires. CPSC staff presented the status of testing on an experimental thermocouple-based pre-ignition detection electric burner control system, which was developed at the CPSC Laboratory (attachment 1). CPSC staff stated that additional tests of extreme normal cooking conditions would be performed. The Good Housekeeping Institute representative extended an offer to perform an independent evaluation of the impact of the control system on normal cooking (pending Good Housekeeping management approval). Industry representatives stressed that CPSC should provide a list of acceptance criteria to assist in determining the success of a candidate rangetop pre-ignition detection and control system, and AHAM presented a proposed list (attachment 2). Industry representatives indicated that they are still unwilling to commit additional resources to independent tasks but would continue to participate in the working group. The group will meet again at Underwriters Laboratories in Northbrook, Illinois in November 1998.

U.S. CONSUMER PRODUCT SAFETY COMMISSION

RANGE FIRE PROJECT
PHASE IV - CONTROL SYSTEM DEMONSTRATION

October 5, 1998

Han Lim

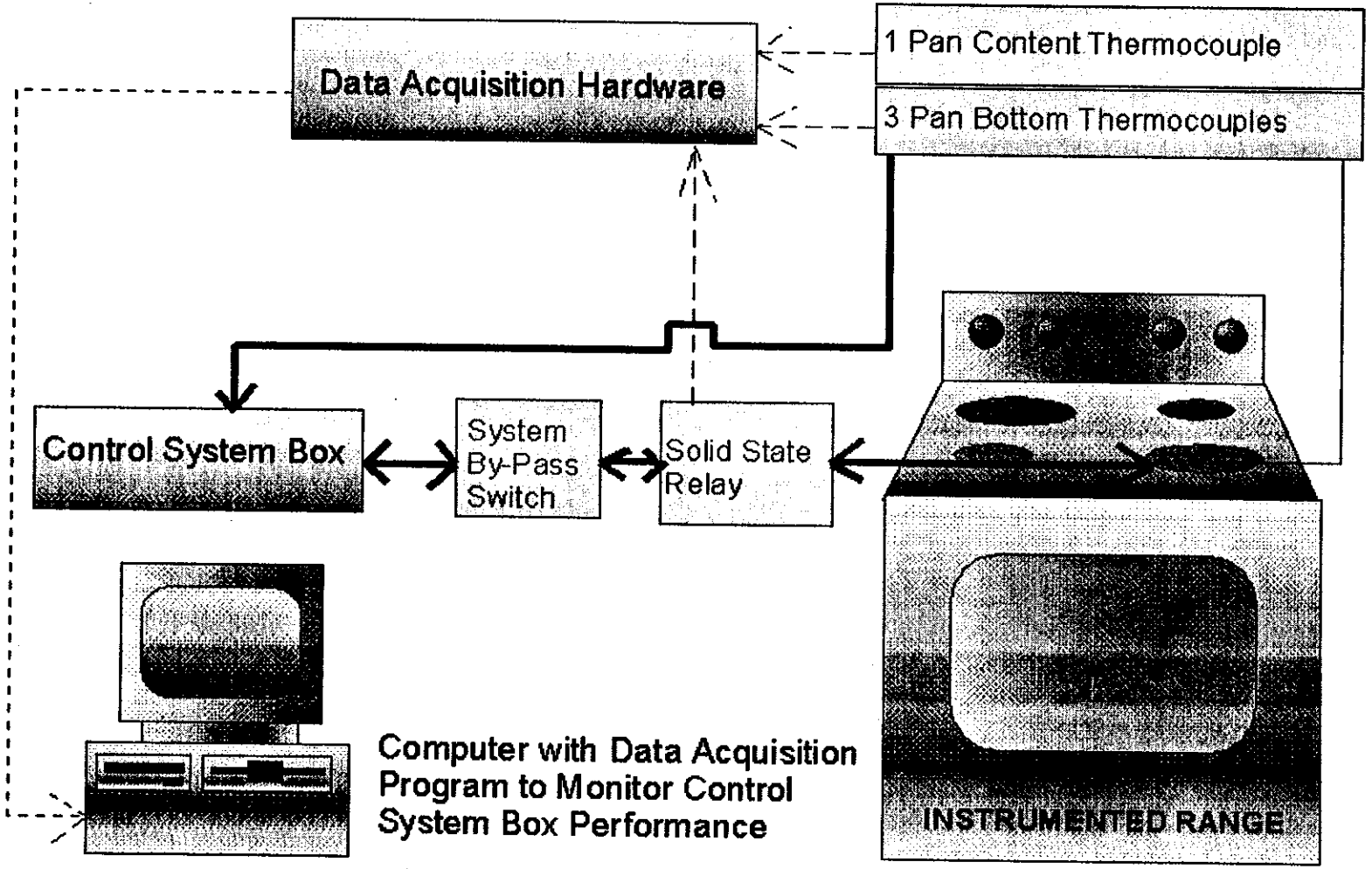
PURPOSE OF THE PHASE IV STUDY:

DEMONSTRATE THE FEASIBILITY OF A TEMPERATURE SENSING PROTOTYPE CONTROL SYSTEM THAT:

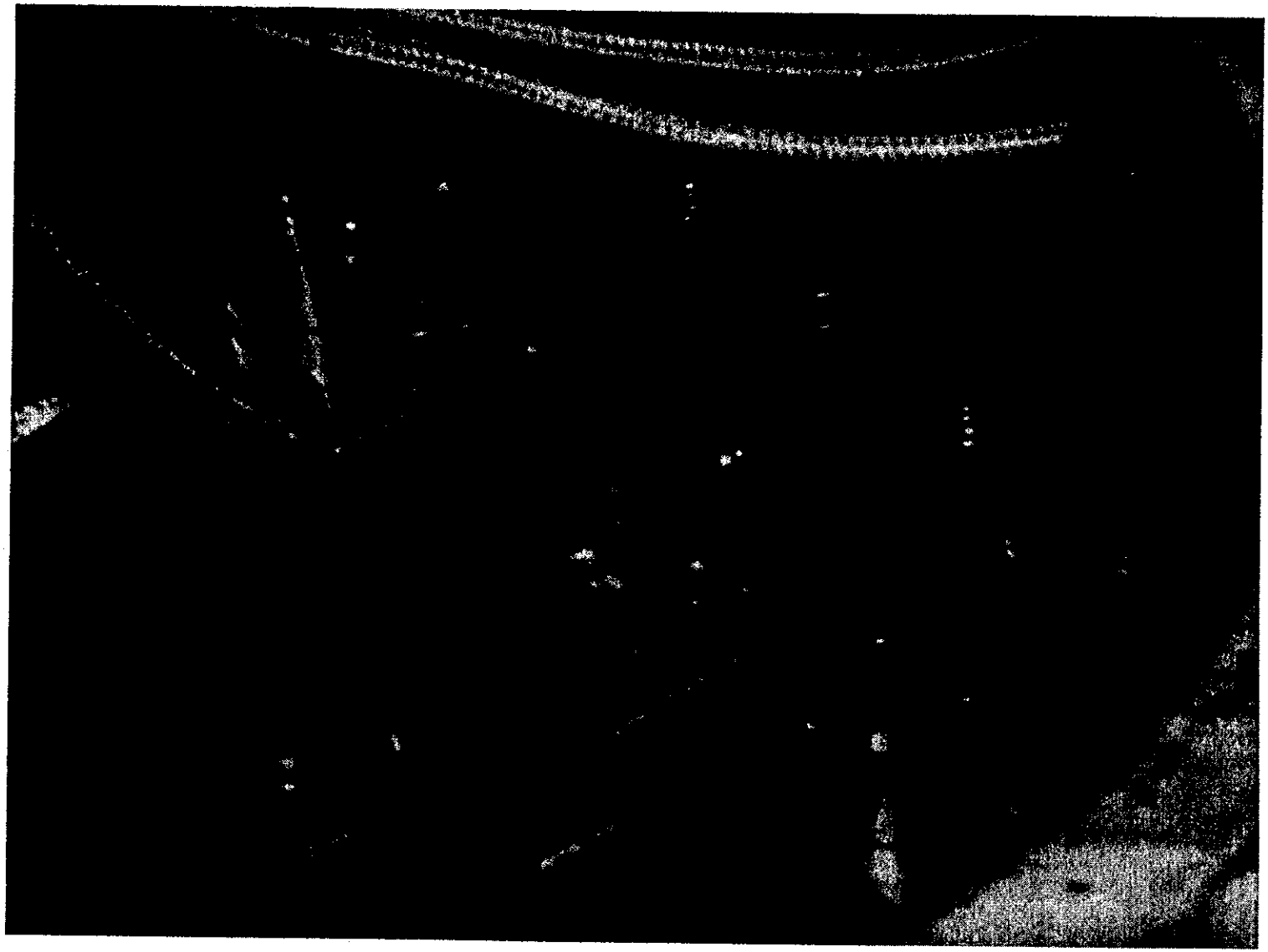
1) DETECTS PRE-IGNITION CONDITIONS AND

2) REDUCES THE RISK OF COOKING FIRES

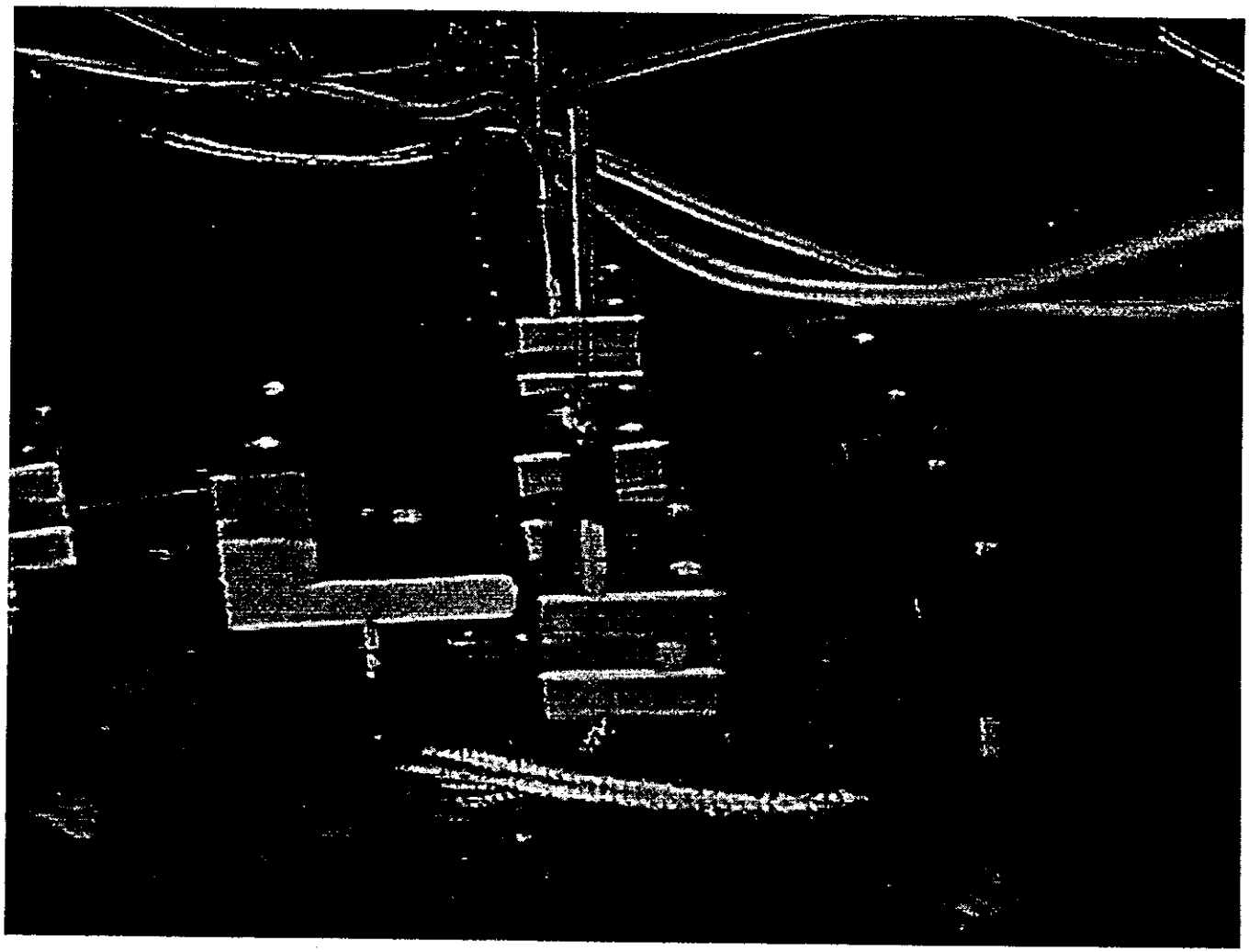
BASIC BLOCK DIAGRAM OF RANGE CONTROL SYSTEM



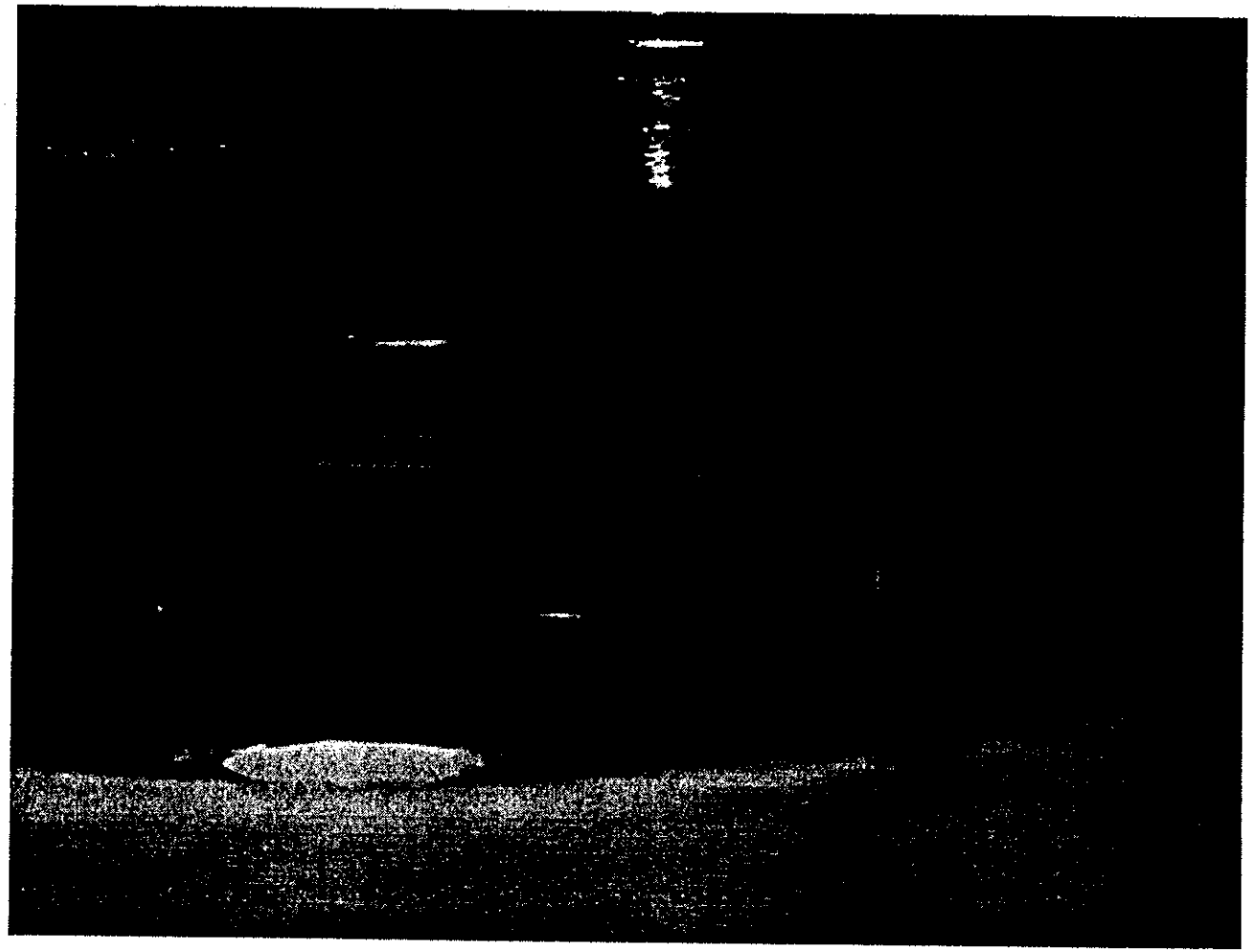
PHOTOGRAPH OF THERMOCOUPLE MOUNTING SYSTEM



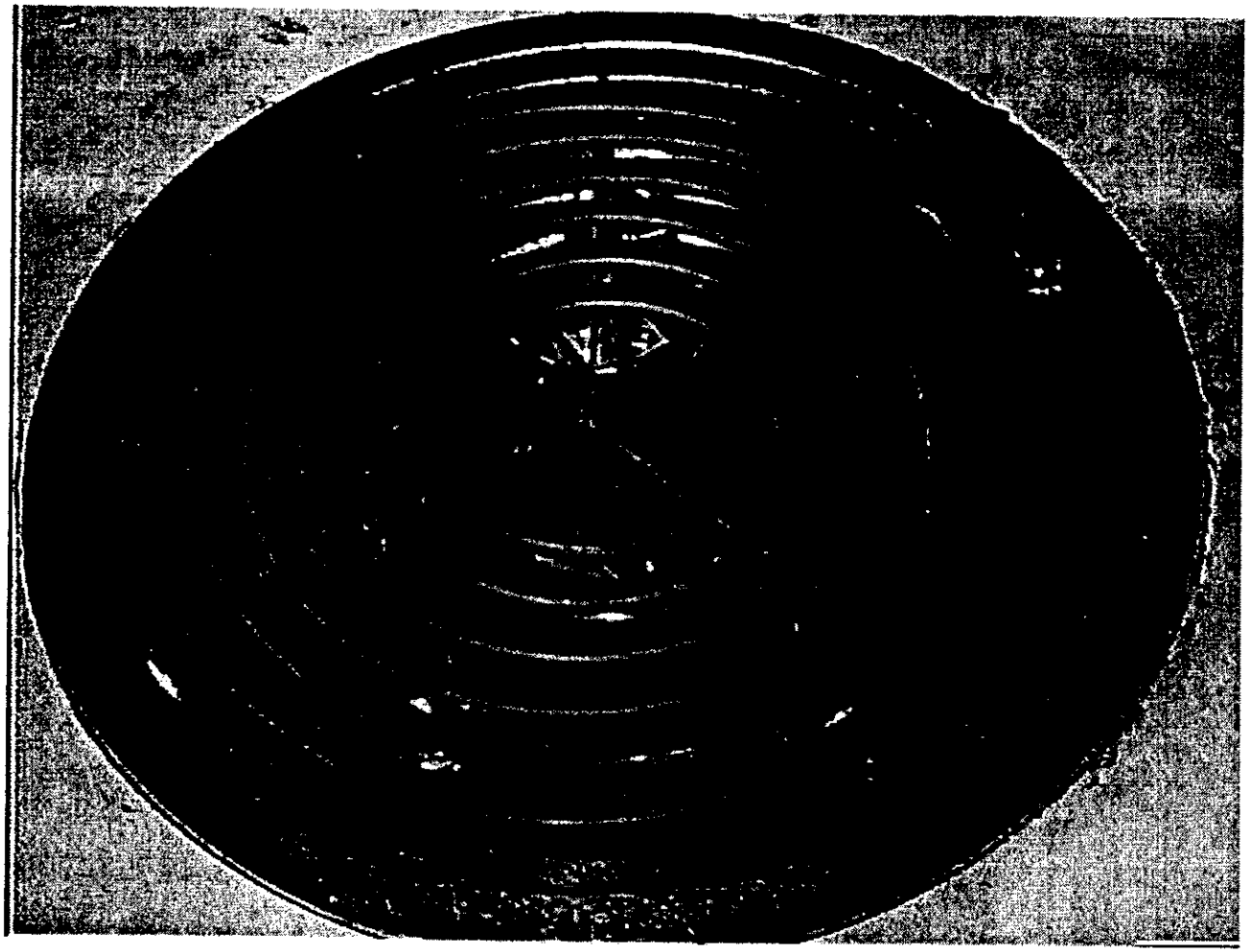
SIDE VIEW OF THERMOCOUPLE MOUNTING SYSTEM



SIDE VIEW OF THERMOCOUPLE MOUNTING SYSTEM



TOP VIEW OF THERMOCOUPLE MOUNTING SYSTEM



REVIEW OF PHASE IV PRELIMINARY TESTS COMPLETED THROUGH 6/98:

- **THERMAL INERTIA TESTS IN STAINLESS STEEL AND CERAMIC PANS:**
  - **SOYBEAN OIL: 50, 75, 100, AND 300 ml**
  - **EXTRA VIRGIN OLIVE OIL: 75 ml**

- **IGNITION TESTS**
  - **SOYBEAN OIL: 100 AND 500 ml**
  - **EXTRA VIRGIN OLIVE OIL: 500 ml**
  - **FULL BODIED OLIVE OIL: 500 ml**

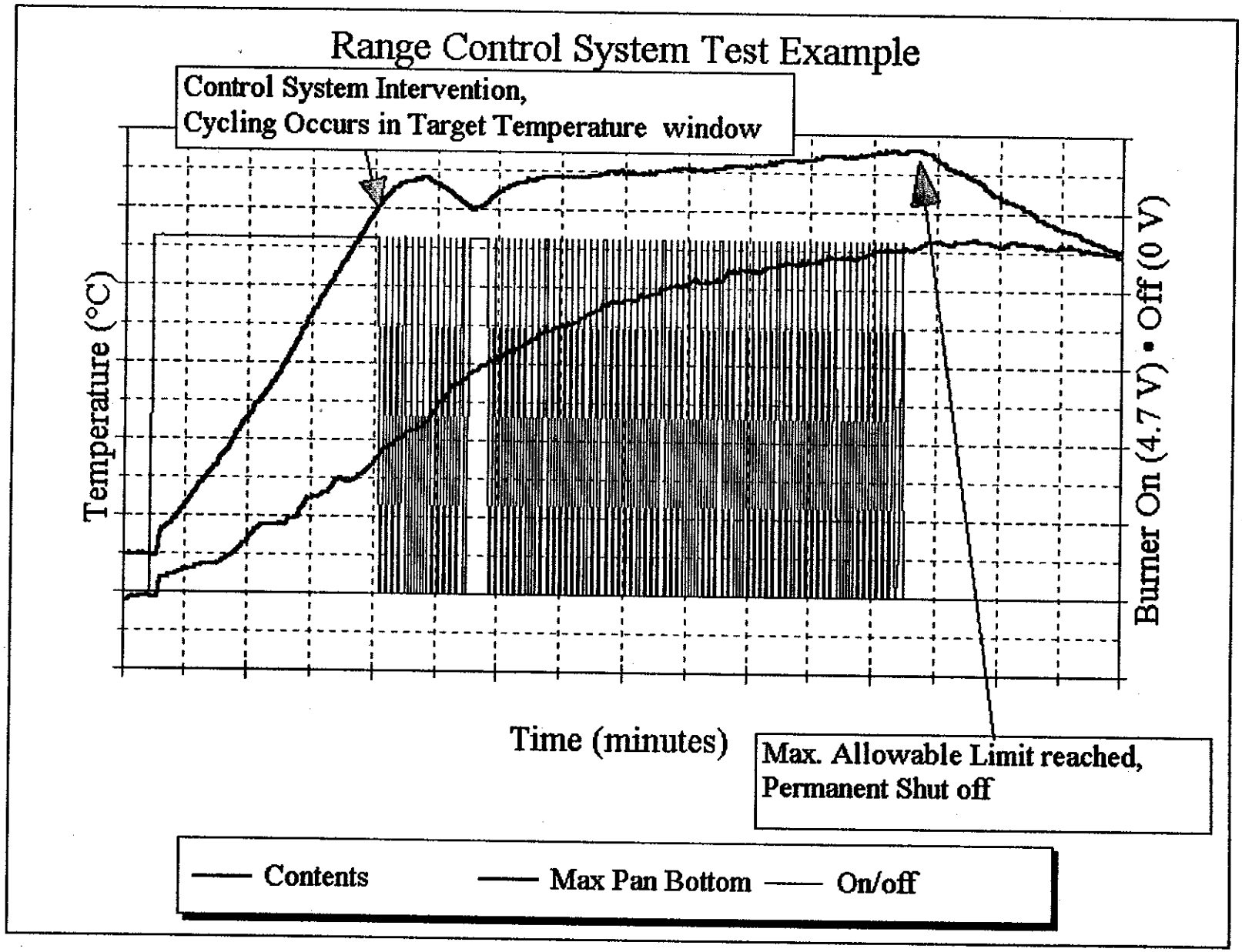
RESULTS OF THE PRELIMINARY TESTS:

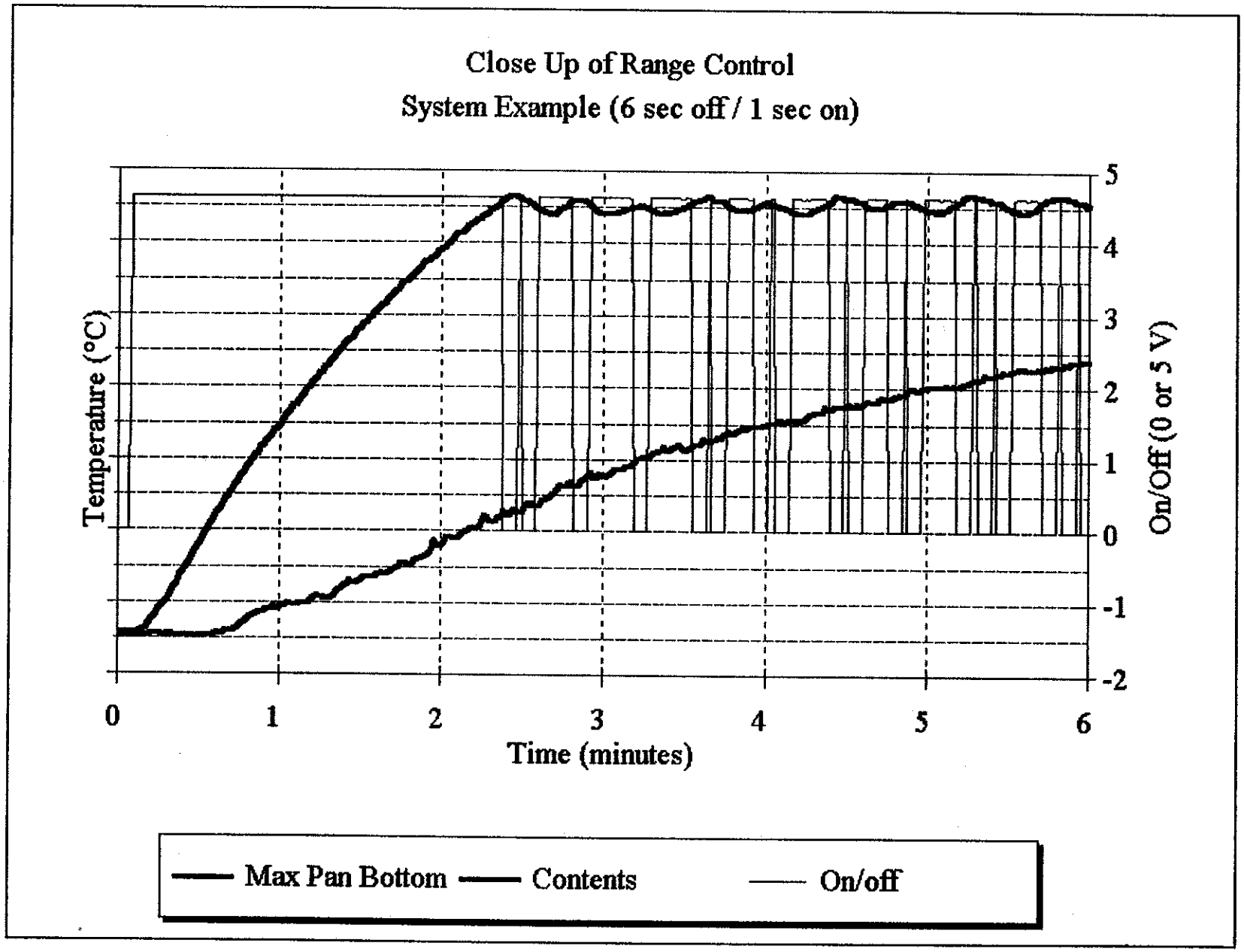
- THE LARGEST OIL TEMPERATURE RISE OCCURS WITH 100 ml OF OIL

- BOTH EXTRA VIRGIN AND FULL BODIED OLIVE OILS IGNITE AT THE SAME OIL TEMPERATURE AS SOYBEAN OIL, APPROXIMATELY 390°C

OPTIMIZED PARAMETERS TO THE CONTROL SYSTEM:

- BURNER CYCLES 1 SECOND ON, 6 SECONDS OFF WHEN PAN BOTTOM TEMPERATURE IS BETWEEN 330°C TO 360°C
- VARIOUS EXPERIMENTS THROUGH SEVERAL ITERATIONS ASSISTED IN DETERMINING THE ABOVE PROGRAMMING PARAMETERS
- INTERNET SEARCHES FROM CANOLA AND CRISCO SITES FURTHER SUPPORTED THE PARAMETERS


Range Control System Test Example
Control System Intervention,
Cycling Occurs in Target Temperature window
Temperature (°C)
Burner On (4.7 V) • Off (0 V)
Time (minutes)
Max. Allowable Limit reached,
Permanent Shut off
Contents
Max Pan Bottom
On/off


Close Up of Range Control
System Example (6 sec off / 1 sec on)
Temperature (°C)
On/Off (0 or 5 V)
5
4
3
2
1
0
-1
-2
0
1
2
3
4
5
6
Time (minutes)
Max Pan Bottom
Contents
On/off

TEST SCENARIOS PERFORMED WITH THE CONTROL SYSTEM:

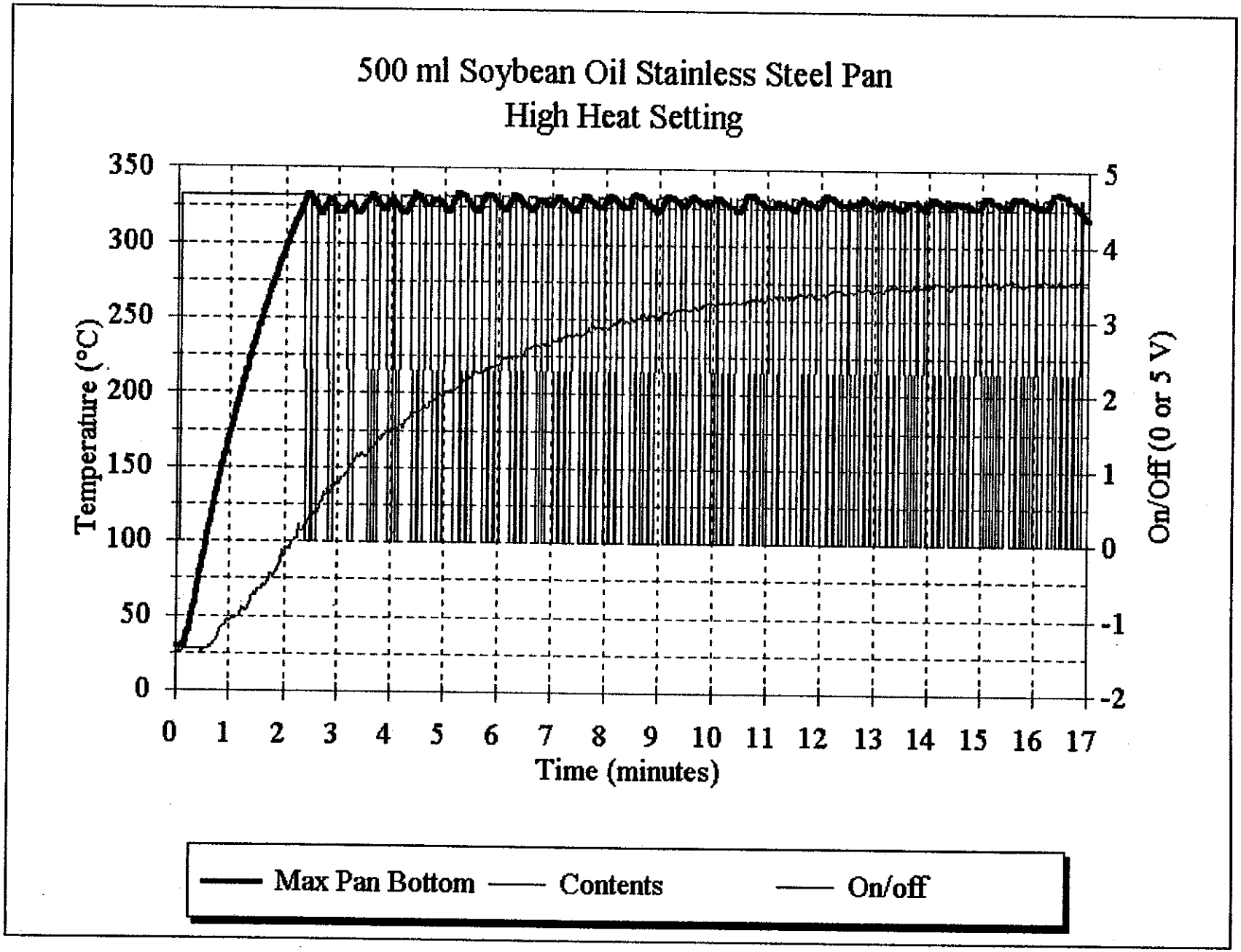
- EMPTY, BOIL DRY AND NO PAN CONDITIONS
- STAINLESS STEEL, ALUMINUM, AND CERAMIC PANS
- COOKING SCENARIOS:
  - BACON
  - CHICKEN AND OIL
  - REUSED OIL WITH FRENCH FRIES
- VARIABLE HEAT SETTINGS
- VARIABLE DIAMETER PANS

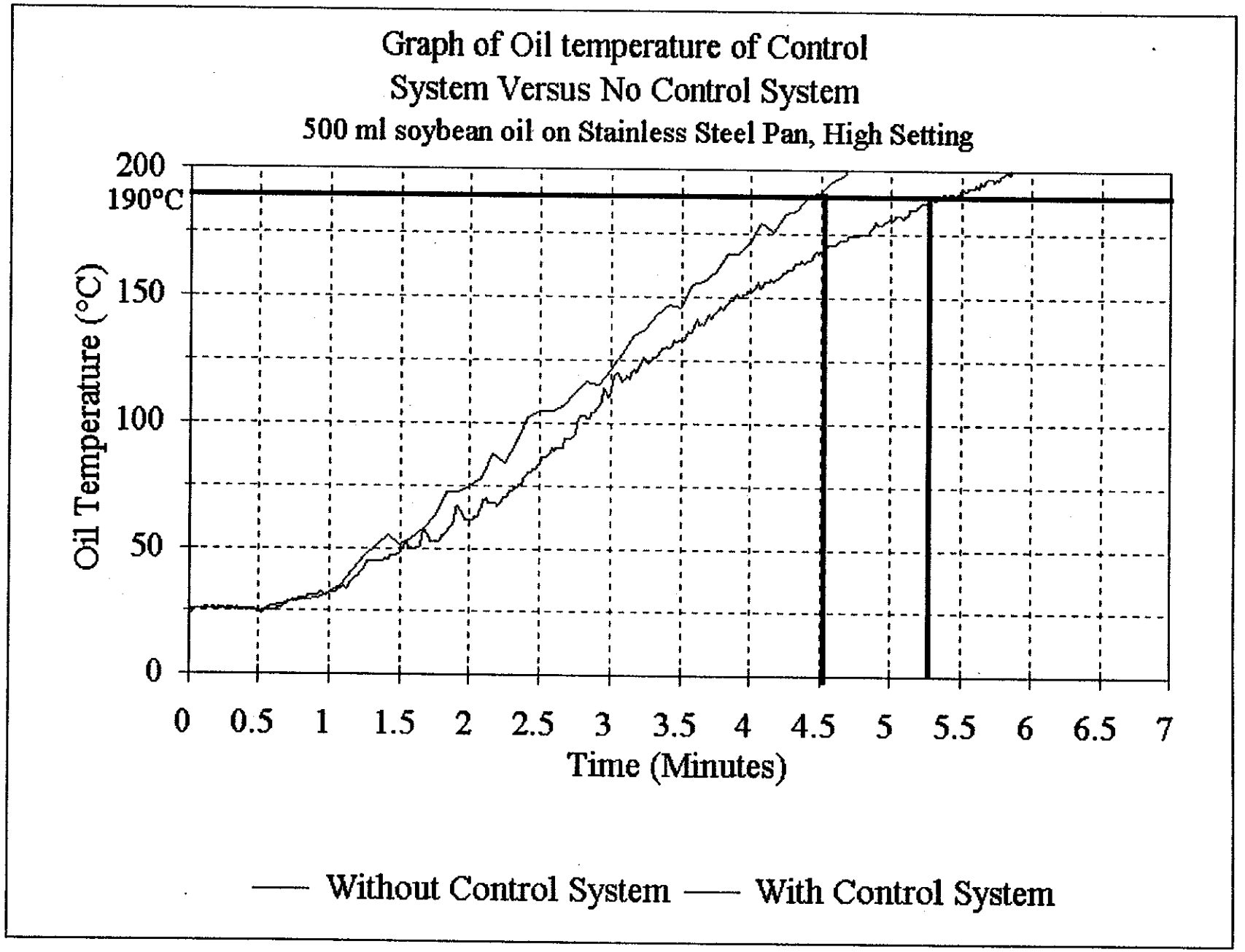
TEST RESULTS:

- BURNER CYCLES CONTINUOUSLY FOR EMPTY STAINLESS STEEL AND CERAMIC PANS, BOIL DRY AND NO PAN CONDITIONS; SHUTS OFF ONLY ON EMPTY ALUMINUM PANS

- OIL TEMPERATURE REACHES STEADY STATE OF >>250°C FOR ALL CASES; >270°C ON THE HIGH HEAT SETTING

- COOKING TEMPERATURES (APPROX. 190°C = 375°F) LESS THAN 1 MINUTE FOR 500 ml OF SOYBEAN OIL WITH THE CONTROL SYSTEM THAN WITHOUT

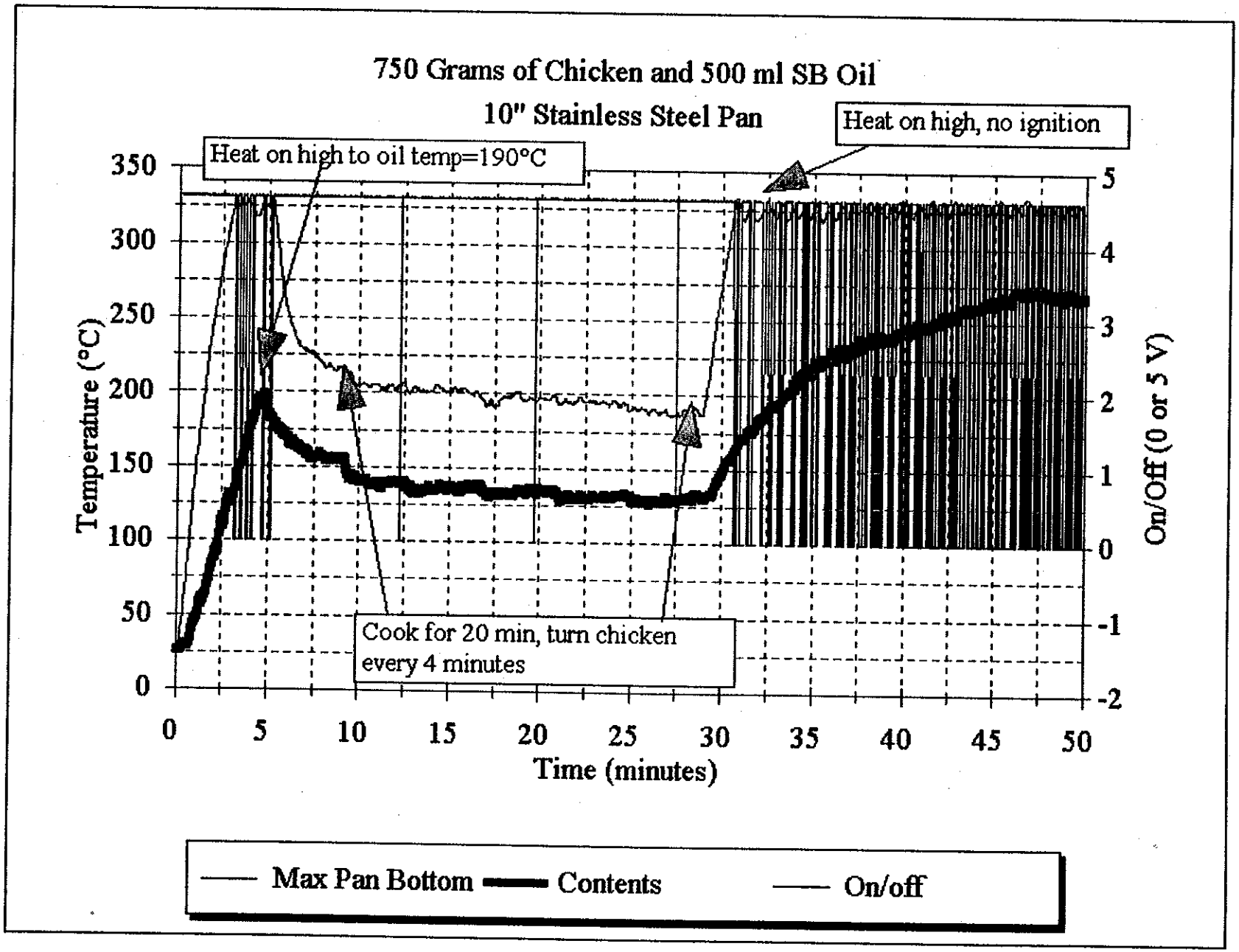

500 ml Soybean Oil Stainless Steel Pan
High Heat Setting
Temperature (°C)
350
300
250
200
150
100
50
0
On/Off (0 or 5 V)
5
4
3
2
1
0
-1
-2
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
Time (minutes)
Max Pan Bottom
Contents
On/off

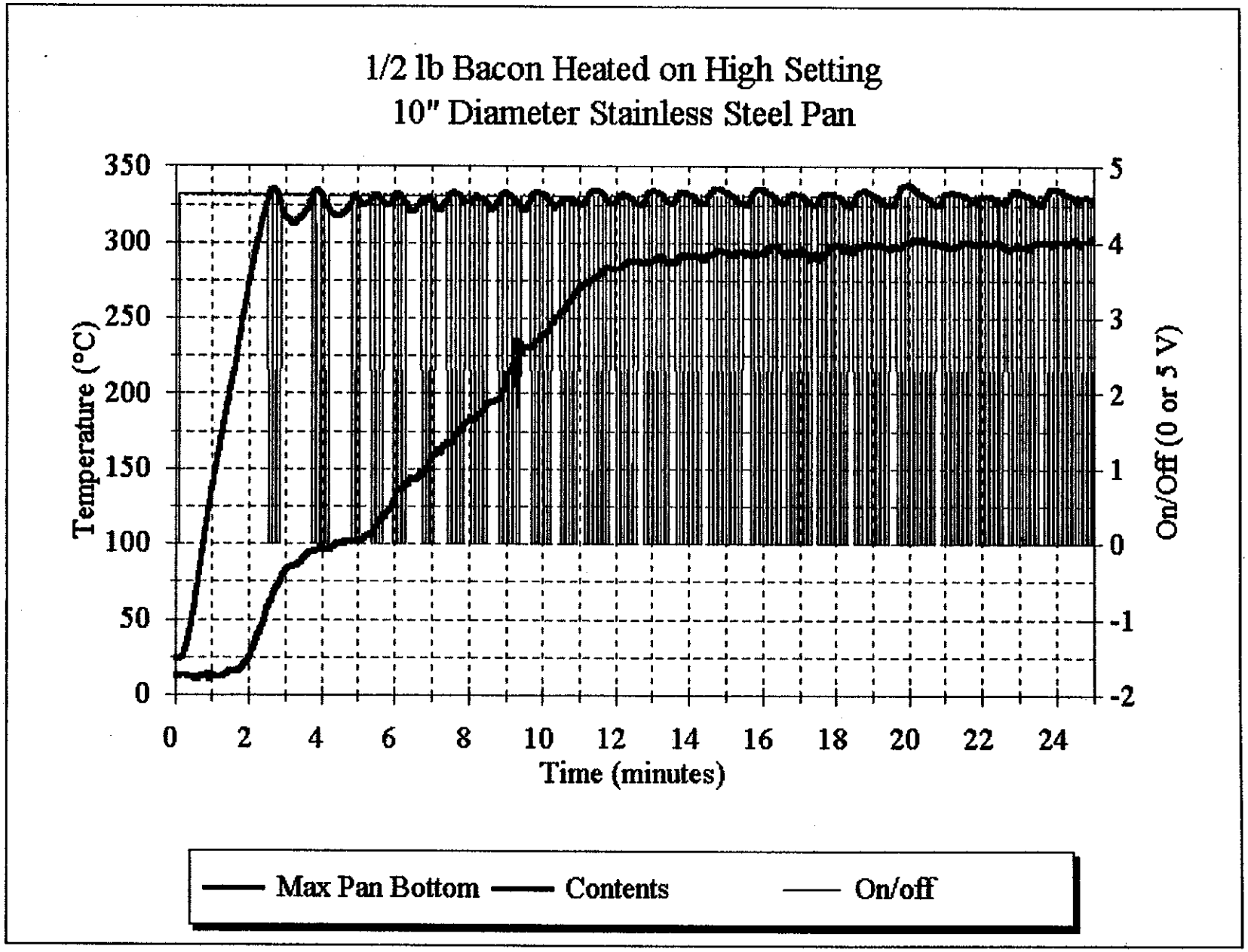

Graph of Oil temperature of Control System Versus No Control System
500 ml soybean oil on Stainless Steel Pan, High Setting
200
190°C
150
100
50
0
Oil Temperature (°C)
0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7
Time (Minutes)
Without Control System
With Control System

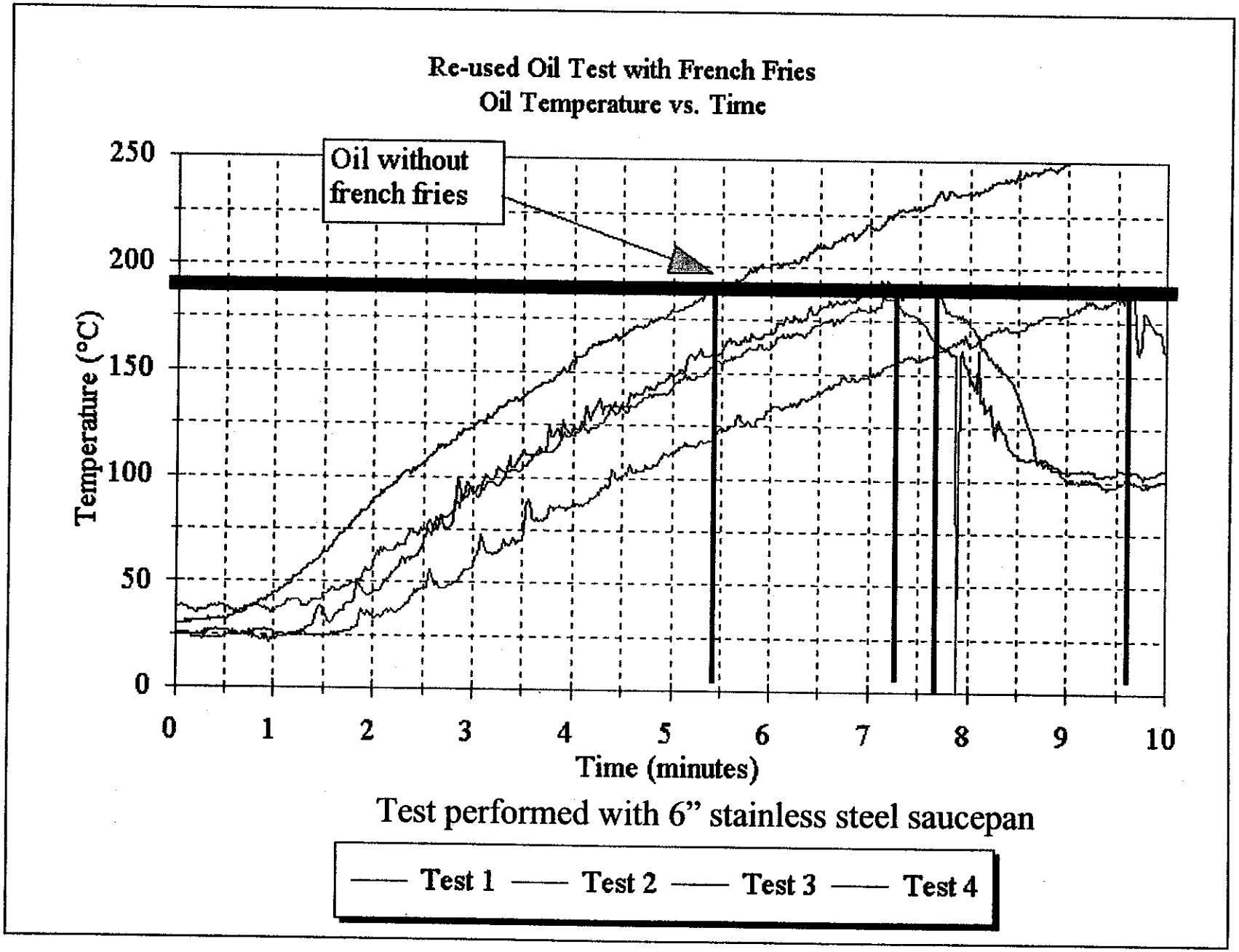
TEST RESULTS (CONTINUED):

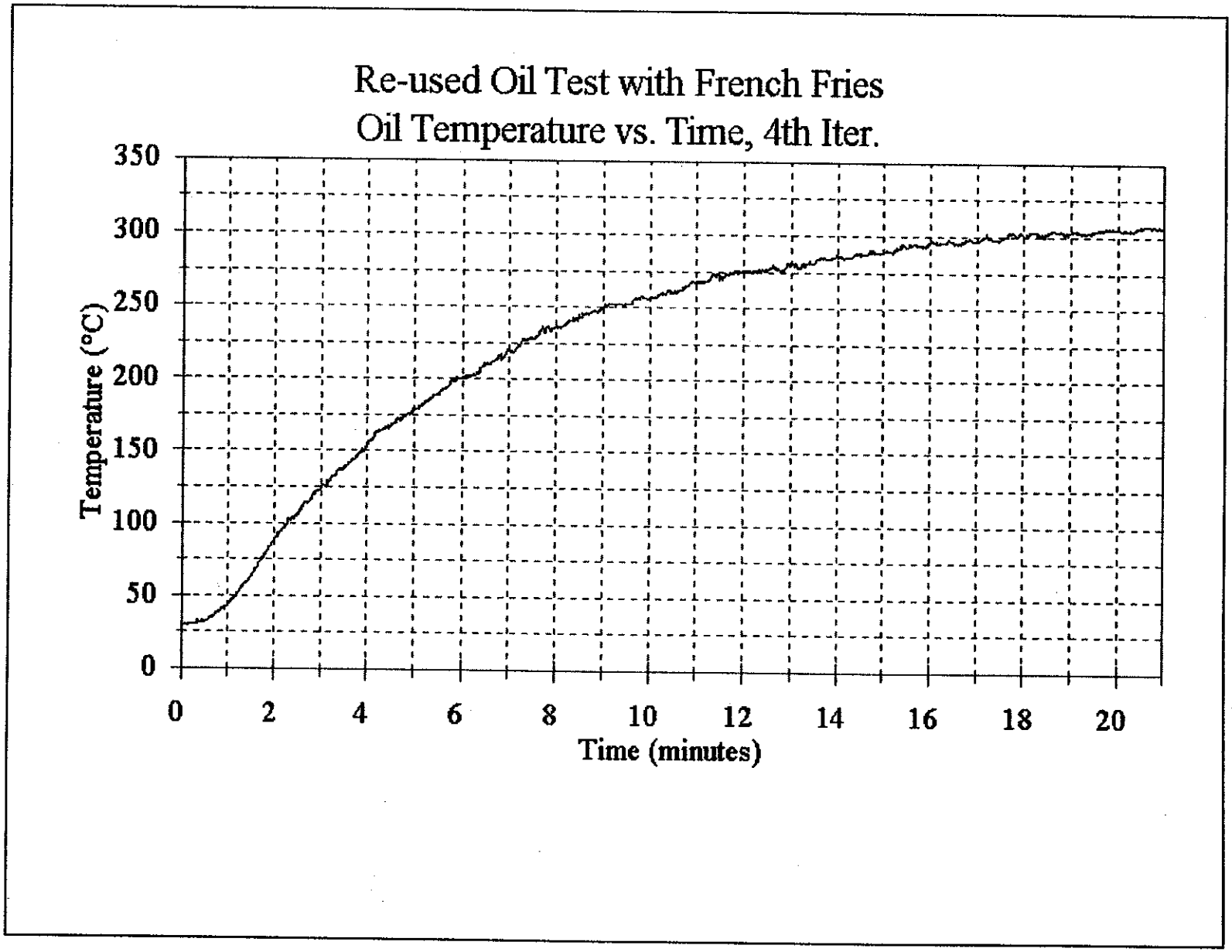
- BACON AND CHICKEN TURN CRISP BLACK, BUT DO NOT IGNITE, BOTH REACH STEADY STATE TEMPERATURE OF APPROX. 300°C IN THE CONTENTS

- REUSED OIL TESTS SHOWED IT TOOK LESS TIME TO ACHIEVE AN OIL TEMPERATURE OF 190°C AFTER EACH ITERATION


750 Grams of Chicken and 500 ml SB Oil
10" Stainless Steel Pan
Heat on high to oil temp=190°C
Heat on high, no ignition
Cook for 20 min, turn chicken every 4 minutes
Temperature (°C)
On/Off (0 or 5 V)
Time (minutes)
0
50
100
150
200
250
300
350
-2
-1
0
1
2
3
4
5
0
5
10
15
20
25
30
35
40
45
50
Max Pan Bottom
Contents
On/off


1/2 lb Bacon Heated on High Setting
10" Diameter Stainless Steel Pan
Temperature (°C)
350
300
250
200
150
100
50
0
On/Off (0 or 5 V)
5
4
3
2
1
0
-1
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
Time (minutes)
Max Pan Bottom
Contents
On/off

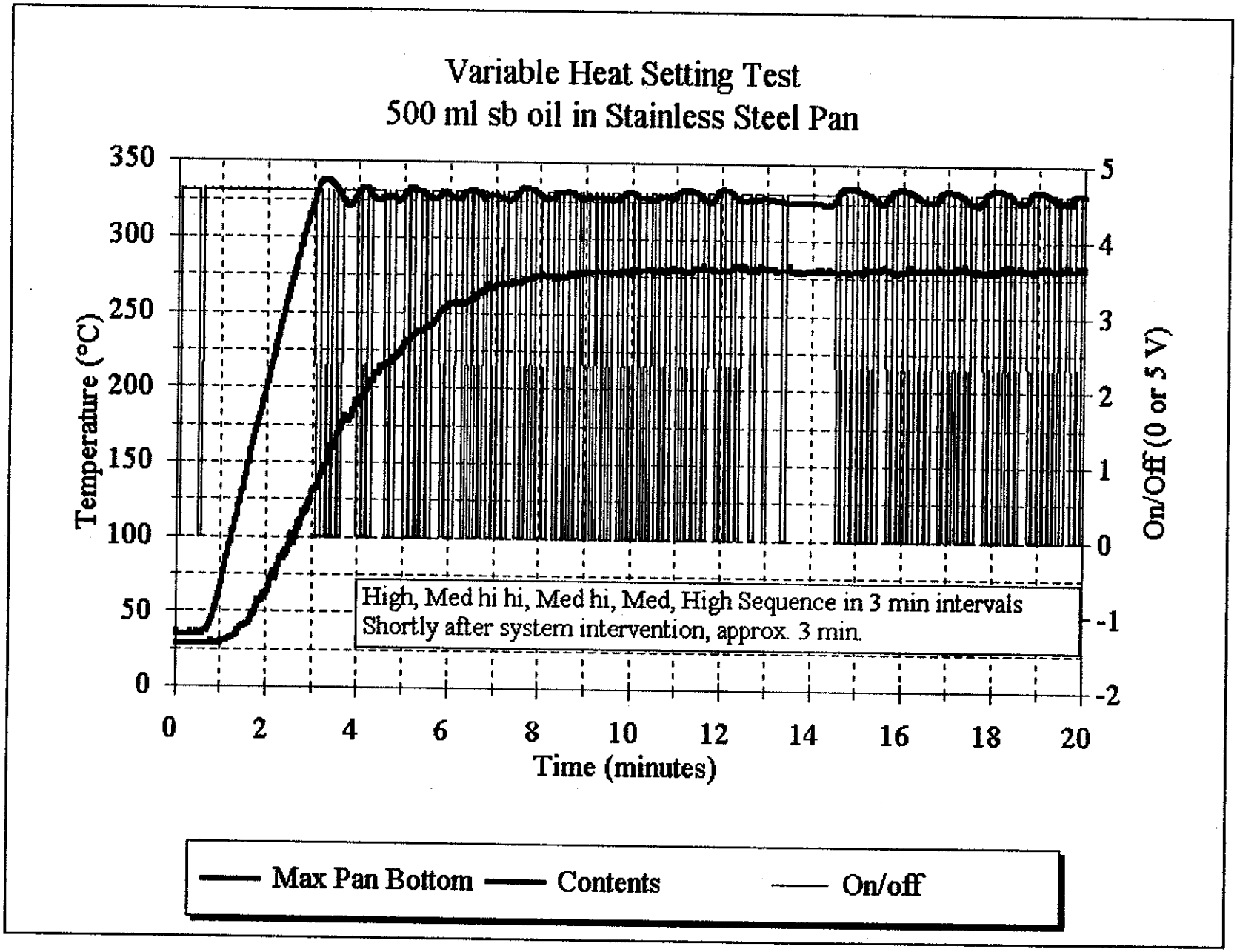

Re-used Oil Test with French Fries
Oil Temperature vs. Time
Oil without french fries
250
200
150
100
50
0
Temperature (°C)
0
1
2
3
4
5
6
7
8
9
10
Time (minutes)
Test performed with 6" stainless steel saucepan
Test 1
Test 2
Test 3
Test 4


Re-used Oil Test with French Fries
Oil Temperature vs. Time, 4th Iter.
Temperature (°C)
350
300
250
200
150
100
50
0
0
2
4
6
8
10
12
14
16
18
20
Time (minutes)

TEST RESULTS (CONTINUED):

- VARIABLE HEAT SETTING TESTS: CONTROL SYSTEM CAN ADJUST HEAT OUTPUT PROPORTIONAL TO POSITION OF THE HEAT CONTROL KNOB

- 10" DIAMETER FRYING PANS AND 6" DIAMETER SAUCEPANS (FOR REUSED OIL SCENARIO) WERE USED FOR TESTING; SYSTEM CAN HANDLE BOTH SIZES


Variable Heat Setting Test
500 ml sb oil in Stainless Steel Pan
Temperature (°C)
350
300
250
200
150
100
50
0
On/Off (0 or 5 V)
5
4
3
2
1
0
-1
-2
0
2
4
6
8
10
12
14
16
18
20
Time (minutes)
High, Med hi hi, Med hi, Med, High Sequence in 3 min intervals
Shortly after system intervention, approx. 3 min.
Max Pan Bottom
Contents
On/off

PHASE IV STATUS

- PROTOTYPE CONTROL SYSTEM APPEARS TO REDUCE THE RISK OF UNATTENDED COOKING FIRES ON OPEN COIL ELECTRIC RANGE

- APPLICABILITY OF PROTOTYPE CONTROL SYSTEM TO OTHER RANGE TYPES HAS YET TO BE DEMONSTRATED

- EXAMINING VARIOUS OPTIONS FOR OUTSIDE EVALUATION OF THE CONTROL SYSTEM

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Kitchen Range-Fire Safety Device
Possible List of Design Acceptance Criteria

October 5, 1998

This list is designed as a set of general acceptance criteria topics. The actual performance criteria for each will need to be determined.

The criteria presupposes a product design for electric ranges that is based on the concept seen by the manufacturers at the May 30, 1998 meeting. This includes a thermocouple based design that is coupled to a computer controller which cycles the burner temperature when it reaches a set point lower than the ignition temperature of cooking oil.

The device shall demonstrate that it will…

1. not interfere with normal cooking behavior or recipes. The time for frying foods will not be extended. The time for boiling water of various quantities will not be extended beyond the current times for a coil element electric range.

2. work with various size pans (diameter and thickness), woks, including smaller pans used for melting butter, etc. In addition, the device should work within acceptable limits with pans of various composition, including ceramic, glass, stainless steel, aluminum, copper clad, etc. The device will work within acceptable limits with pans of various quality and degrees of flatness (concave and convex).

3. work when subjected to a normal life test for all components on ranges and shall have a failure incidence rate of less than or equal to other electronic components on the range.

4. be able to be cleaned thoroughly at a rate equivalent to once per day with normal cleaning cloths, scrubbing pads, dishrags, and standard household cleaners. The cleaning action shall not disturb the thermocouples nor change the tolerance of the pre-set limits more than 1 to 2% over the expected life of the product..

5. allow the heating element to be removed for cleaning of the burner bowls under the element and for removal of the burner bowl for cleaning. The burner bowls should be water tight to collect any spills. In addition, the burner assembly should be replaceable by the consumer or service technician without need for factory calibration.

6. function when subjected to normal cooking utensil and pot/pan interface. A test scheme should be developed to determine that the thermocouple contacts do not change position if forseeably aggressive cleaning occurs. This is should not become a high service call item.

7. function properly while cooking with used oil, used bacon grease, or other oil materials and will not allow a flame to occur within the temperature ranges pre-set.

8. work within the UL 923 and manufacturer's abnormal operation tests for temperature extremes in the vicinity of the electronic controls. Typically, the coil elements raise the temperature in the area of controls.

9. will function and alarm when confronted with several different grease and food fire conditions.

10. not limit the cooking functionality i.e. blackening of foods, use of woks, etc.

11. not vary in performance when subjected to field testing conducted by a culinary school or independent food laboratory (i.e. Good Housekeeping).

12. show acceptable results when used on different cooking designs, i.e. coil element, solid cast iron element, smooth top ceramic/glass, open and sealed element gas ranges, if mandated.

13. function properly with various wattage coil elements.

14. not change its operation characteristics when subjected to soil build-up, oxidation, water or other liquid spills, baked on or burnt-on food materials.

15. function properly in various environmental conditions, such as: with hoods on, ceiling fans on, windows open, in high humidity, low humidity, and high altitudes.

16. operate over reasonably anticipated assembly locations or tolerances without requiring unit specific calibrations.

17. maintain set-point calibration throughout design life to maintain effective function.