



INVESTIGATION GUIDELINE

Revised September 22, 1994

RANGE AND OVEN FIRES

(Excludes Counter-top Units and Solid-Fuel Fired Products)

Complete Attachment A for all fires. If fire resulted from cooking-related activity, also fill out Attachment B. Attach to CPSC Form 182, Epidemiologic Investigation Report, along with copy of Fire Incident Report.

I. INTRODUCTION

A. Background Information

Based on data from the National Fire Incident Reporting System (NFIRS) and the National Fire Protection Association, ranges/ovens were involved in the following estimated residential fire losses in 1991:

93,100 fires
240 deaths
4,780 injuries
\$394.6 million in property loss

Available data indicate that unattended cooking fires are a major cause of range/oven fires. Other causes include failure of a variety of component parts or features related to installation. It is believed that existing technology is capable of reducing the fire hazard related to cooking activities.

The purpose of these investigations is to provide details of the incidents to help focus technical changes to these products to reduce the number of fires, deaths and injuries.



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B. Product Description

Definitions and General Description

- Products include any free-standing range (that is, a combination range/oven), or a built-in and/or wall oven, or an installed cooking surface, except wood/coal-fired. Plug-in and portable counter-top units are not included; e.g., ovens, toaster ovens, microwaves, and hot plates. Fires in exhaust hoods are included only if an integral part of the range.
- Note product information and illustrations in Attachment C.

C. Specific Items of Interest

If the incident involved cooking activities, we are particularly interested in learning the details, e.g., what was being cooked, over what time period, and heat setting. (Fill out Data Record Sheet, Attachment B in addition to Attachment A.)

If the incident involved apparent arcing, gas leak, or other failure of a component, provide photographs and a description of the failure point. Contact consumer immediately to request that any failed components not be discarded, e.g., gas valve, igniter, pilot burner, main burner, flexible connector, and heating element control.

Describe any previous problems with range; e.g., repairs, perceived malfunctions, or difficulties with use.

Include diagrams of controls and settings if available.

Please note that this is a guideline, not a check list. Any relevant information discovered in the course of the investigation should be included regardless of whether it has been anticipated here.



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D. Headquarters Contacts

Linda Smith, Project Manager, EPHA -- (301) 504-0470, Extension 1275
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II. INSTRUCTIONS FOR COLLECTING SPECIFIC INFORMATION (Data Record Sheets are attachments.)

A. Synopsis

Describe the sequence of events that led to the incident. Describe the incident including component failure or multiple failures (if known), subsequent events, including contributing factors as appropriate, and details of injuries.

For data retrieval from the computer, please make sure the following key words are used in the synopsis as appropriate:
Cooking fire, surface element (halogen, radiant, solid, conventional coil), bake elements, broil elements, plug, thermostat, receptacle, electric, gas, gas lead, pilot light, igniter, valve, gas control, flexible connector, pressure regulator, gas regulator, explosion, LP-gas or natural gas.

B. Description of Incident Environment

Pre-Incident: Include in this portion of the narrative a description of the unit as installed, subsequent modifications (e.g., converted from LP-gas to natural gas), and specific circumstances leading to the incident as follows:

- Describe product location, indicating cleanliness or neatness of use area, and specifying items on adjacent counter-tops. Describe any items that were stored on or in the appliance.



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- Determine if and where aluminum foil was used to catch spills; e.g., in oven floor, under heating elements (electric)/surface burners (gas).
- Measure clearance between surface heating units and combustible items above and to the sides. Indicate if wood cabinets.
- Describe details of range connection to power or fuel supply.
- Specify if the unit was wired directly into the circuit with conduit or flexible armored cable or a cord and plug-in connection.
- List the size, type, and manufacturer of the overcurrent protection device (fuse or circuit breaker) and determine whether device functioned to shut off current during the incident.

Incident: Describe in the narrative how the fire and any explosion happened. State relevant facts and the source of any technical evaluations. If the incident involved apparent arcing, gas leak or other component or installation-related failure, describe and photograph in detail.

- Determine if there was an explosion or fire involving a gas leak and try to specify the exact place where gas was escaping. Photograph relevant component parts, if possible, paying particular attention to the area between the tank or gas line entrance, the flexible connector or rigid gas pipe, and the appliance. If LP gas, determine when tank was last filled, and any intervening usage or sequence of events related to the incident. Determine if the regulator was frozen due to exposure to sleet or freezing rain, over pressure on line, any problems with gas supply, e.g., turning on burners. Also make initial contact with the respondent as soon as possible to request that the gas valve, igniter, pilot burner, and main burner not be discarded. **Information of particular importance is: a) date of manufacture, b) year of purchase, c) location of gas leak, d) description of part failure, e) identification of connector and coating materials, f) role of movement of the connector, and g) presence of an ammonia atmosphere.**
- Determine how product was being used at the time of the fire (e.g., for cooking activities, for heating home, or left on inadvertently). If product was being used for cooking, provide details of cooking activity as requested on Attachment B along with any other relevant information.



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- If the fire started from cooking related activities, specify if the user left the appliance unattended and for how long; the condition of the appliance (e.g., soiled from food spillage, clean surface, etc.); temperature setting (e.g., high, medium); who discovered the fire and at what time; what was being cooked and amount (e.g., four pieces of chicken in eight ounces of corn oil); how it was being cooked and time period; and the size, type, material and condition of pan (e.g., old and encrusted from food spillage, clean pan, etc.); whether or not a family member was present just prior to the fire and whether a power outage was involved.
- If the fire appeared to involve the range or oven connections to the branch circuit, provide as many details of the wiring and connection involved as possible. Provide voltage, wire gauge, material of conductor and sheathing (copy any markings available), and details of connection method including grounding. Problems related to the use of aluminum conductors or damage to power supply cords are of particular interest. Photograph connections as appropriate to show failure point (e.g., terminal block or pigtail plug and socket).
- Describe any attempts to put out the fire (e.g., cover pan, use extinguisher, etc.)

Post-incident:

- Describe conditions that may have contributed to fire ignition or spread (e.g., crowded or cluttered room, children playing, etc.).
- Specify if the unit was repaired or replaced after the incident. Talk to the repairman and gas company to determine cause of any component failure.
- Specify estimated property damage, if any, including fire spread and dollar loss.
- Indicate if a detector (smoke, heat, or CO) was in dwelling, its location, and whether it operated. If powered, but it did not operate even though fire was big enough that it should have operated, indicate whether it was battery operated or permanently wired, manufacturer, and model number.



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C. Description of Injured Person(s) and Product Interaction (Victim/Product Environment Interface)

- Describe accident scenario including all injuries and/or deaths sustained; indicate if hospitalized, for how long, treatment, and prognosis.
- Indicate user's age, sex, any competence reducing factors (e.g., impaired vision, physical handicaps, medication, narcotics, alcohol), perception of hazard, user attitude, inability to read instructions, and how victim was clothed if relevant, etc. Indicate any competence related factors related to those injured and any other factors relevant to injury occurrence.
- Specify activity and location of user (responsible for cooking) at the time of the incident, and general activities of the household that day which might affect use of the product. If cooking had been left unattended, describe user's activities during that period.
- Specify user's experience with or knowledge of product, common usage. Use diagrams to illustrate the use of the range/oven during the incident. Indicate who was closest to the unit at the time of the fire and distance from the unit.

D. Description of Product

- List manufacturer's name, brand name, and model/serial numbers. Photograph all information from rating plate.
- Specify age of product, date of purchase, condition at time of purchase (new, used, etc.).
- Specify size of product: height, width, and depth.
- Specify who installed the range/oven, e.g., professional, maintenance man, homeowner, etc.



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- Indicate product history: previous problems including electric shocks, gas supply and other repairs, modifications or alterations, etc. If repaired, specify date, type, and who did the repairs (factory authorized repair service; maintenance or handy man, homeowner, other). Describe routine maintenance.
- Indicate whether the unit has an exhaust fan or hood, and if it is an integral part of unit or separate item, and whether ducted. Advise if fan or hood was filtered and free of grease or other materials, and whether turned on at time of fire.
- If oven-related fire, indicate whether the oven has a continuous-clean or self-clean feature. Specify oven type, conventional or convection, microwave, etc. and any other features.
- Show arrangement of surface heating units and all controls (both surface and oven). Specify labeling on all controls. Photographs or diagrams are extremely important.
- Specify type of controls, e.g., push and turn, push button, etc.
- Specify wattage rating and dimensions of surface heating elements (burners)--usually stamped in area where element plugs in.
- Specify surface burner element types (e.i., halogen, radiant, solid, conventional coil, gas burner module, etc.).
- Describe type of gas used, LP-gas or natural gas, and type of ignition system.
- Determine if gas burner needed flame adjustment; i.e., a good flame is clear/ blue and hardly visible in a well-lighted room, but a yellow-orange flame indicates need for cleaning or adjustment.
- Describe any previous or current problems with gas supply, e.g., turning on burners, over pressure, etc.
- Describe condition of product before the fire.



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E. Product Safety Standards

CPSC does not have mandatory standards on electric or gas free-standing ranges, or separately installed ovens or counter-top surfaces. Voluntary standards for these appliances include the following:

- Electric: UL 858 Standard for Household Electric Ranges
- Gas: ANSI/A.G.A Z21.1 Standard for Household Cooking Gas Appliances

III. INSTRUCTIONS FOR PHOTOGRAPHING AND/OR DIAGRAMMING FACTORS RELATED TO THE INVESTIGATION

Photograph whole product and its environment. Also, photograph and label location of fire ignition (e.g., control, connector, element) and the rating plate. Diagram and label surface elements and all control placements and settings of the surface cooking or oven that are relevant to the incident. If accessible, photograph date tag on the flexible connector, if relevant.

Try to photograph product with utensils and appliances in their positions at the time of the incident.

IV. INSTRUCTIONS FOR OBTAINING SAMPLES AND DOCUMENTS RELATED TO THE INVESTIGATION

Stipulate whether the fire department was summoned and obtain a copy of the incident report. Obtain copies of any insurance, utility, or repair reports, installation instructions, maintenance records, and a summary of medical records, if applicable.

If the fire resulted from component failure and component is available, contact Mai Ngo, ESEE, (Electric), Ronald Jordan, ESEE, (Gas), or Linda Smith, EPHA, to discuss sample collection for the Directorate for Epidemiology. Before collecting component samples for the Office of Compliance and Enforcement, contact CECA.



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Attachment A

DATA RECORDING SHEET FOR RANGE/OVEN FIRES

Complete for all fires. To be attached to CPSC Form 182, Epidemiologic Investigation Report, along with a copy of the Fire Incident Report. Also complete Attachment B if the fire was cooking-related, either attended or unattended.

Task Number _____ Incident Date _____

A. PRODUCT IDENTIFICATION

Copy and photograph all information on rating plate or tags: _____

1. Fuel: Electric Gas Other

If gas, indicate type of gas being used: _____

2. Product involved in fire:

____ Range (combination cooking surface and oven)

____ Installed oven (separate)

____ Installed cooking surface

3. Manufacturer: _____

4. Model No.: _____

5. Rating:

a) Gas input rating (BTU's/hr): _____

b) Electrical rating: Volts _____ Watts _____ Amps _____

6. Date manufactured (from rating plate): _____

7. Serial No.: _____

How long has consumer had range/oven? _____

8. Voluntary Standards Certification: _____



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9. Surface Cooking Features/Controls:

a. Location: Front Back Side Other (specify)

b. Type: Push button Turn only Push & Turn Touch

c. Is there an indicator light for the surface heating units?

Yes No

If yes, are there individual lights for each heating unit?

Yes No

Did the indicator light work for the heating unit involved?

Yes No

d. Do any surface heating elements or burners have an automatic temperature sensor? If yes, specify which:

e. If gas-fueled, specify ignition type (electric, non-electric): _____

10. Surface Heating Elements or Burners:

Surface Heating Element Types: Coiled, plug-in Coiled, hard-wired

Solid disk Radiant Quartz-halogen lamp Induction cook-top

For surface heating unit that was involved in the fire, indicate:

a. Location of surface heating unit involved in the fire (e.g., right rear): _____

b. Diameter/size of involved element: _____

c. Power rating (stamped near connection): _____

d. How heating element was connected to range:

Screw terminations (specify number on involved unit)

Plug-in tabs and receptacle

If tabs, describe shape (e.g., loop, flat blade): _____

Quick connect terminals



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11. Oven Features (if oven was involved in fire):

- Self-cleaning control Continuous-cleaning control
 Clock control Timer control
 Broil element Bake element Rotisserie Other
- Is there an indicator light for the oven? Yes No

B. INCIDENT

12. Type:

- Cooking Fire, either attended or unattended (Complete Attachment B also)
- Gas leak (explain, for example: leak in flexible connector or gas control valve, gas line/pipe rupture, loose gas fitting, malfunctioning pilot light, gas control valve, etc.)

- Other Component Malfunction (Specify) _____
- Connection Failure (specify) _____
- Used for heating room
- Left on following power outage
- Left on inadvertently (nothing on range)
- Other (specify; e.g., potholder, clothing ignition): _____

13. If gas-fueled, was burner flame abnormal? Yes No

14. If yes, describe color and height of flame: _____

C. VICTIM(S)

15. Number deceased: _____

16. Number injured: _____



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D. OTHER

17. Is there a detector (smoke, CO, heat) present in the dwelling?

Yes No Unknown

18. If yes, specify type: _____

19. Detector went off (alarmed)? Yes No Unknown

20. If no, do you know any reason why not; e.g., not powered, fire too small, etc?

21. Before the fire, indicate whether the odor of gas was detected: _____

E. SOCIOECONOMIC DATA:

22. Education level of head of household:

Less than high school Completed high school Some College

23. Total household income:

LT \$15,000 \$15,000 - \$34,999 \$35,000 +

24. Approximate home market value: _____

Rent Own

General Description: Provide general description, including all other relevant factors and information on the investigation form, CPSC Form 182.



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Attachment B

DATA RECORDING SHEET FOR COOKING-RELATED FIRES

(To be attached to CPSC Form 182, Epidemiologic Investigation Report, along with Attachment A and copy of Fire Incident Report)

1. Size of pan involved in fire (bottom diameter in inches/capacity in quarts): _____
2. Comparison of pan diameter to heating unit diameter, (if appropriate):
_____ pan smaller
_____ pan larger
_____ pan same size
3. Pan type, material (e.g., aluminum saucepan), and condition: _____

4. Burner/element control or oven temperature setting at time of ignition:

5. Describe food that was being cooked: _____
6. Describe cooking process (sauteing, boiling): _____
7. Type and amount of cooking oil at time of fire: _____
8. Was the pan covered? _____
9. What was burning when fire was discovered? _____

10. List all items that burned, or general extent of flame damage: _____

11. Length of time that food cooked prior to fire: _____



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12. Who was doing the cooking? _____

_____ Age

13. User's experience (indicate general history of use of appliance):

Several times a week Once a week or less Once a month or less

Other (Specify) _____

14. Time of day fire started: _____

15. Was anyone in the kitchen when ignition occurred? _____

Who? _____

Indicate where the nearest occupants were at the time of fire: _____

16. Was there an exhaust fan in operation? _____ Yes _____ No

17. Was a reflector pan (drip pan) located under the surface heating element at the time of the fire?

_____ Yes _____ No

18. Was the reflector pan covered with anything (to keep it clean)?

_____ Yes _____ No

If yes, what? _____

19. In the past, had the consumer turned the wrong heating element on or off? _____

20. Had the consumer experienced previous flare-ups (gas)? _____

General Description: Provide general description, including all other relevant factors and information on the investigation form, CPSC Form 182.



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Attachment C

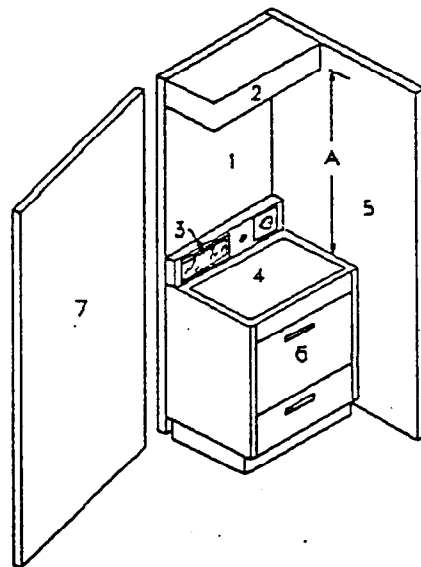
BACKGROUND TECHNICAL INFORMATION

I. Electric Section:

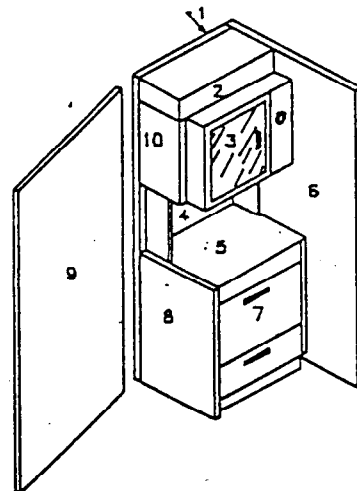
Electric Ranges - General Information¹

Counter level ranges (left) consist of a cook-top with multiple surface elements located at counter level and an enclosed oven located beneath the cook-top. The clearance "A" is the distance between the clearance between the top of the cook-top's cooking surface and the bottom of an upper building cabinet.

Some ranges (right) have a second oven located above the cook-top at eye-level and are commonly referred to as eye-level ranges.



1. Building back wall
2. Upper building cabinet
3. Oven and top control panel
4. Range backguard
5. Cooking surface
6. Building side wall
7. Oven or bottom building cabinet



1. Building back wall
2. Upper building cabinet
3. Control panel
4. Cooking surface
5. Building side wall
6. Oven
7. Building side wall
8. Base building cabinet
9. Building side wall
10. Upper end building cabinet

¹Provided by Underwriters Laboratories, Inc.



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1. Cook-top Section

There are several types of electric range cook-tops. The most popular configuration employs four coiled sheathed elements arranged in a rectangular pattern. These elements are relatively inexpensive, have relatively higher power and shorter heat up times than other types and have been on the market for many years. Most models have removable, plug-in heating elements that can be replaced by the user. Power ratings generally range from less than 1200 Watts to 2600 Watts. Most elements are designed to be connected to either 240 or 208 Volts. Most coiled element cook-tops are hinged at the back and can be lifted for cleaning. Coiled heating element generally include a drip bowl located immediately beneath the heating element to help catch spilled food. These drip bowls are removable for cleaning.

Another common cook-top element type is the solid disk or cast iron element. These elements have become widely available in North America only within the last 10 years, but have been popular in Europe for quite a long time. Solid disk elements are constructed with the active portion of the heating element imbedded in a heavy cast iron plate or disk. This results in more stable cooking temperatures, longer heat up times and somewhat higher initial cost than the more traditional coiled elements. In order to have efficient heat transfer from the element to the cooking utensil, these elements must be used with pots and pans that have nearly perfectly flat bottoms, without dents or other deformations. Most solid disk elements contain a "limiter" thermostat imbedded in the iron disk that can sense high disk temperatures caused by operating the element with a pot that has boiled dry, and can automatically turn off the element or reduce the power level. Nearly all solid disk element cook-tops are sealed to prevent spillage from accumulating beneath the cook-top. These elements have electrical ratings similar to coiled elements.

Glass or ceramic, smooth top units have been available for many years and have recently gained additional popularity. These cook-tops use radiant heating elements located beneath a clear or opaque glass cooking surface, using infrared radiation to heat the glass and the cooking utensil. Some of these radiant heating elements include one or more quartz-halogen lamps. These quartz halogen lamps heat very rapidly and sharply reduce the time needed to heat the cooking surface. As with solid disk elements, nearly all glass cook-top elements include a limiter thermostat to cut power to an individual heating element if the glass cooking surface begins to overheat. Glass cook-tops are sealed for ease of cleaning and to protect internal parts and wiring from spillage.

Induction cook-tops are similar to glass-ceramic cook-tops in that they use a sealed glass or ceramic cooking surface. However, induction cook-tops heat the pot or pan using a magnetic field rather



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than a heating element. As a result, the cooking surface remains relatively cool. They rely heavily on electronics to control the cooking temperature and are rather expensive. Induction cook-tops provide the user with the most control of cooking temperatures and are the most energy-efficient cook-top design available. Induction cook-tops generally have lower power ratings than other types of cook-tops and must be used with iron or steel pots and pans to cook effectively. Induction cook-tops can usually be distinguished from glass-ceramic cook-tops by the use of the word "Induction" in product marking and user instructions or by the use of electronic controls vs. the predominant use of conventional "knob"-type controls with glass-ceramic units.

A few range cook-tops include a grill or griddle. These units are designed to heat food directly rather than using a pot or pan.

Some range cook-tops are modular units that can be removed and replaced with a different type of heating element. For example, a range may be provided with one module consisting of two solid disk elements and a second module consisting of a grill. The modules are provided with a plug and receptacle arrangement that allows the user to remove the grill module and replace it with a griddle, coiled element module or glass cook-top module—all without disturbing the appliance wiring.

2. Cook-top Controls

Most electric range cook-top elements are controlled by cycling-type switches with continuous heat settings, from Low to High, and are commonly called infinite switches. This type of device does not sense or detect the temperature of the heating element or cooking utensil. Instead, the heating element power is controlled by switching the heating element from full power, to zero power, and back again - repeating the cycle over and over every few seconds until the user turns the control to the "off" position. The control setting determines the amount of On time and Off time during each cycle.

A few coiled and solid disk cook-top elements are controlled by a thermostat-type switch. A copper or brass capillary tube, containing a small amount of fluid, is attached to a small sensing disk located in the center of the heating element. As the temperature of the pot and the thermostat disk increases, the fluid inside the capillary tube expands to send a hydraulic signal to the control. The control setting determines the temperature at which the heating element cycles on and off.

Range cook-top controls are generally located either in the front of the cook-top (just above the oven door), on a backguard located behind the cook-top elements, or arranged in a line to the left or right side of the cook-top.



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All range cook-top controls need two distinct operations to energize a cook-top element. Conventional "knob"-type controls require that the knob be pushed-in prior to turning; electronic cook-top controls necessitate the actuation of two separate buttons or touch pads.

3. Oven Section

The oven of an electric range consists primarily of an insulated steel box, a door, racks for holding food, two or more sheathed heating elements and a thermostat. A standard oven includes a baking heating element located beneath the oven racks and a broiling heating element located above the oven racks.

In the bake mode, heat in the form of infrared radiation from the bake (and sometimes the broil) element causes the temperature of the oven walls to increase. The oven walls, in turn, heat the air and food inside the oven by conduction.

In the broil mode, food is cooked by infrared radiation from the broil element rather than by hot air.

Oven bake elements are generally rated between 2,000 Watts and 2,600 Watts. Most broil elements are rated in the 3,000 to 3,600 Watt range.

Some ovens are provided with a convection cooking feature in which hot air is circulated within the oven cavity by a fan or blower. This allows food to be cooked faster and at slightly lower oven temperatures compared to conventional baking.

Many ovens feature a pyrolytic or self-cleaning cycle in which the temperature inside the oven is raised to approximately 1,000 degrees Fahrenheit for 2 - 3 hours, reducing any food residue left inside the oven to water vapor, carbon dioxide and a small amount of ash. During the self-cleaning cycle the oven door is locked to prevent a fire or burn hazard.

A few ovens include a continuous cleaning feature. An inert catalytic coating on the surfaces of the oven cavity causes food particles on the surfaces to break down as the oven is operated at higher baking temperatures, usually 400 degrees Fahrenheit or higher.

Some oven designs include microwave cooking capability, either in a separate oven located at eye-level or in a common oven cavity. They can usually be identified by the words "Microwave" or "micro" in product markings located on or near the oven controls.

Many oven doors are provided with a window and oven lamp to allow the user to view food inside the oven without having to open the oven door.



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II. Gas Section

A. Gas Ranges-General Information²

Modern gas ranges incorporate automatic controls, such as thermostats, automatic pilots, gas pressure regulators and automatic gas valves. In addition, today's gas range may incorporate specialized controls for programmed cooking, self-cleaning oven controls or meat probes.

All of these ranges must be equipped with automatic ignition of all burners in order to comply with current American National Standards Institute (ANSI) standards for domestic gas ranges. This requirement is accomplished by manufacturers in different ways, and further differs in various sections of the range.

For example, automatic ignition of the top burner of a gas range is usually accomplished by flash tube ignition. In this system, a small metal tube called a flash tube conducts a fast burning mixture of air and gas from the burner cap to a standing pilot. (Note: the standing pilot is manually lit). The standing pilot ignites this mixture which then burns ("flashes back") through the flash tube to ignite the air-gas mixture issuing from the flash tube injector port. This flame is carried upward by carryover ports or slots to ignite the air-gas mixture at the main burner ports.

Spark ignition may be used to light the gas issuing from the burner directly, thus eliminating the need for a standing pilot. The energy for the spark is developed in an electronic circuit which is usually located at the rear of the range. The high voltage energy for providing the spark(s) is distributed throughout the range by high tension leads.

Another means of automatic ignition employed in gas ranges is the electric glow coil. This system usually is used to light gas pilots for oven or broiler burners. The system employs a small electric resistance coil (glow coil) which gives off sufficient heat to ignite the pilot gas when energized. The gas to the pilot is usually turned on at the same time the electrical circuit is activated. Some electric glow coils remain hot for a few seconds after the pilot gas is ignited and then are shut off usually by a flame switch. Others may remain energized while the circuit is activated.

Another type of ignition system often found in the oven section of the range is the two stage gas pilot.

Automatic pilots incorporated in gas range ovens are usually of the mercury vaporization type. The bulb sensor is rigidly mounted, since its position with relation to the pilot flame must be maintained.

²Material on the operation of gas ranges has been used by permission of the copyright holder, American Gas Association (A.G.A.) Catalog No. XH1275, Printed in U.S.A., 5M3.84-2.5-2.0-577.



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Also, the complete pilot assembly (pilot burner and sensor) must be maintained in a fixed relationship to the burner it is designed to light. For this reason most range oven and broiler burner pilots are mounted directly on the burner.

Top burner range controls are simply manually operated gas valves which have virtually an infinite range of flame settings. In addition to these basic top burner controls, automatic top burner temperature controls are available. There are two basic types of top burner automatic temperature controls. They are the tower and the bypass type. Both of these sense temperature by a liquid filled bulb positioned in the center of the burner so that the bulb makes direct contact with the bottom of the vessel being heated. As the pan bottom gets hot so does the sensor, and the liquid in it expands. This expanding liquid exerts pressure in the gas valve to control gas flow to the burner.

In a bypass type of automatic top burner temperature control, as the cooking load (pan) heats up the sensor bulb also heats. The expanding fluid in the sensor bulb exerts an increasing pressure in the gas control valve, acting to gradually reduce gas flow to the burner. The minimum gas rate which is used is referred to as the bypass rate. In turn, the minimum cooking temperature which can be attained is limited by how small a bypass rate can be used with stable flames. The smaller the bypass rate that can be used, the lower will be the minimum temperature indicated on the thermostat control dial. With the bypass system there is always a flame present at the main burner ports in normal cooking operations.

The tower burner system uses a small tower burner near the main burner. During normal cooking operations there is always a flame on the tower burner as long as the main burner gas valve is in the on position. The temperature sensor in this case acts to cycle the main burner flames on and off to maintain the set temperature in the cooking load. The minimum load temperature which can be maintained with this system depends on the gas input rate of the tower burner. The tower burner also serves to reignite the gas at the main burner ports each time the main burner is cycled on.

The primary advantage of the bypass system lies in its simplicity. The primary advantage of the tower system is that it permits control at a lower temperature.

1. Gas Oven Controls

Control of oven temperature by automatic means has been accomplished in various ways through the years. But in all cases an automatic oven has (1) a temperature sensor that responds to temperature in the oven, and (2) an automatic valve that responds to the sensor and controls the flow of fuel to the oven burner. These two devices can be combined into one unit called an oven thermostat



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valve. The sensors used in most gas ovens today are the liquid or gas filled bulbs with capillary tubes. Control of the flow of fuel can be accomplished either by modulation or cycling of the oven burner.

a. Modulating Oven Control Systems

Early gas control systems resorted to modulating the flow of fuel to obtain the desired temperature, between the limits set by maximum gas rate used and minimum stable flame on the oven burner. This system ordinarily would provide, when used with proper burner and oven construction, temperatures as low as 250 F. The minimum gas rate providing stable flames is called the bypass rate.

The chief advantage of modulating controls is that they provide a uniform temperature in the oven corresponding to the control setting. Their chief disadvantage is their inability to maintain oven temperatures below 250 F.

b. Cycling Oven Control Systems

Several systems have been developed that use the method of cycling the main burner on and off to maintain oven temperature. One system incorporates the two stage pilot valve which has been previously discussed. This all-gas two-stage pilot system has the advantage of not being affected by electrical supply problems.

In another cycling system, a liquid filled thermostat bulb opens and closes an electrical switch which controls an electrically operated solenoid gas valve. Also, in series with the thermostat switches is a pilot flame switch. This switch opens the electric circuit to the oven burner solenoid valve if the source of ignition for the oven burner becomes extinguished.

A combination of the modulating and cycling systems can be incorporated to maintain very low oven temperature below 250 F. In this case, the thermostat valve modulates down to a low bypass rate and is then cycled on and off to maintain oven temperatures as low as 140 F.

2. Controls for Self-Cleaning Gas Ovens

There are two different systems used in today's modern gas self-cleaning ranges: The pyrolytic system and the continuous clean system, (sometimes referred to as a catalytic cleaner). The continuous clean system simply employs special catalytic oven liners which are continually self-cleaning during the normal oven operation.

The pyrolytic system involves heating the oven cavity to approximately 800 F to 1,000 F to burn off any cooking soil or spillovers. Special controls are necessary to complete this function safely and satisfactorily. For example, a special door lock mechanism must be incorporated to prevent opening of the oven door when the temperature inside the oven cavity is greater than 675 F. Smoke must be eliminated from the oven flue products and they must be cooled before they are vented to the kitchen.



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The oven must be capable of being cycled in the 800 - 1,000 F range which is quite different than the temperature range used in normal oven operations.

A typical sequence of operation for a pyrolytic self-cleaning gas oven would proceed as follows: First, the oven selector switch is turned to the "clean" position. At the same time the oven door is closed and locked into position by an electric solenoid lock. The clock timer is then set for the desired length of cleaning time (usually between 1-1/2 and 2 hours), and the cleaning process is started. The waist-high broiler burner comes on first. After a few minutes, the oven burner is automatically supplied with gas. When the oven cavity reaches a temperature of 675 F, a bimetal switch opens, preventing any current flow to the electric solenoid lock. As a result, the oven door lock handle cannot be moved to the unlocked position. At the end of the cleaning cycle, the clock timer acts to shut off gas flow to the waist-high broiler burner and oven burner and the oven cools down. The electric solenoid lock prevents opening of the oven door until temperature in the oven has dropped to below 675 F.

3. Broiler Burner Controls

There are two basic types of broilers found in domestic gas ranges; the "low broiler" and the "waist-high broiler." The low broiler is located in the bottom of the range below the oven/broiler burner. Several rack positions are provided for the broiler pan. The pan has small openings to permit cooking fats to drain into the bottom of the pan.

The gas controls used with the low broiler are the same as the oven controls since the same burner is used for both broiling and baking operations. There is one exception: the oven thermostat has one additional position marked "broil." In this position, the oven/broiler burner will remain lit or it may cycle on and off or modulate.

The waist-high broiler is located at the top of the oven cavity. With this arrangement additional space is freed in the bottom of the range for storage. If the range is a self-cleaning type then any broiler spattering of the oven walls can be automatically self-cleaned.

A separate broiler burner and pilot are necessary in the waist-high broiler, along with a special diverter-type pilot valve. This valve is necessary to prevent operation of both the oven and broiler valve simultaneously. At a cold start this valve is open to the oven burner and closed to the waist-high broiler burner.

The sequence for broiler operation is as follows: The combination oven/broiler thermostat is turned to the broil position. This permits gas to flow to the broiler pilot where it can be ignited by a glow coil. When the broiler pilot sensor is heated it causes the diverter valve to switch from the



INVESTIGATION GUIDELINE

normally open oven position to a closed oven position and to an open broiler position. Thus gas flows to the broiler burner where it is ignited by the broiler pilot.

When the thermostat is turned to an oven position the broiler pilot gas is shut off and the oven pilot gas is permitted to flow. As a result, the broiler pilot sensor is not heated, so that the diverter valve assumes its normally open oven position while the two-stage oven pilot is heating up its sensor.

If an electric solenoid valve system is used, a simple electric thermostat switch can be used to switch on the oven or broiler burners. Usually in this type of system a standing type oven pilot with a flame switch sensor is used to detect pilot flame and ignite the oven burner. The broiler pilot also incorporates a flame switch, but because of infrequent use has its pilot ignited by glow coil each time the broiler is put into operation.

4. Gas Pressure Regulators

The gas range, like other gas appliances is designed to operate within certain gas pressure limits and will perform safely and most efficiently within this range. Therefore, for purpose operation a gas pressure regulator is installed in the gas range manifold to supply a constant gas pressure to all of the burner orifices.

On ranges, the regulator is usually located just under the top section and toward the front near the top burner valves. In this position it is easily reached for any adjustment needed. Correct direction of the gas flow through the regulator is essential for its proper operation. All design certified regulators must have the direction of gas flow clearly marked on them so that they can be installed properly.

The mounting position (upright, on its side, up-side down, etc.) of some regulators is critical.

	Btu per hour	Btu per hour
Two top burners at	9,000 each	18,000
Two top burners at	12,000 each	24,000
Griddle burner	10,000	10,000
Low oven burner	25,000	25,000
Elevated oven burner	13,000	13,000
Total		90,000



INVESTIGATION GUIDELINE

Capacity is another factor that must be considered when selecting a regulator for a range. For example, a range may consist of the following burners that could all be operated at the same time:

The total input rating for this range is 90,000 Btu/hr. Therefore, a regulator with a maximum regulation capacity of at least 90,000 Btu/hr. must be selected.

The operating pressure range of the regulator also must be considered. Some regulators are designed to operate in the pounds-to-pounds range, while others regulate in the inches-to-inches range. Domestic gas ranges ordinarily are equipped with the inches-to-inches type supplying an outlet pressure of about 4 to 6 inches water column. Range regulators should be marked P which indicates they are designed to handle pilot gas flow.

5. Manual Valves

a. Shut-Off Valves

A manual shut-off valve should be used with a gas range to provide a means of complete positive shutoff of the range gas supply for servicing and replacement purposes. Shutoff would be necessary if a burner valve had become defective and has to be replaced without disturbing other gas appliances on the same supply line. On a range, the shut-off valve is located ahead of all controls.

b. Top Burner Valves

Most range top burner valves are manual valves. The exception would be thermostatically controlled top valves. The manual valves are usually of the plug and barrel type.

6. Timers and Clock Controls

One useful accessory found on most gas ranges is the timer and clock control. The clock may be digital or have sweeping hands and can be used to: (1) indicate time; (2) control the oven during programmed cooking such as start and stop cooking and cook and keep warm; (3) start and stop the self-cleaning sequence; (4) provide a timed convenience outlet; and (5) provide a minute minder usually having settings from one to sixty minutes. At the end of the timed period, an audible sound is supplied by a buzzer.



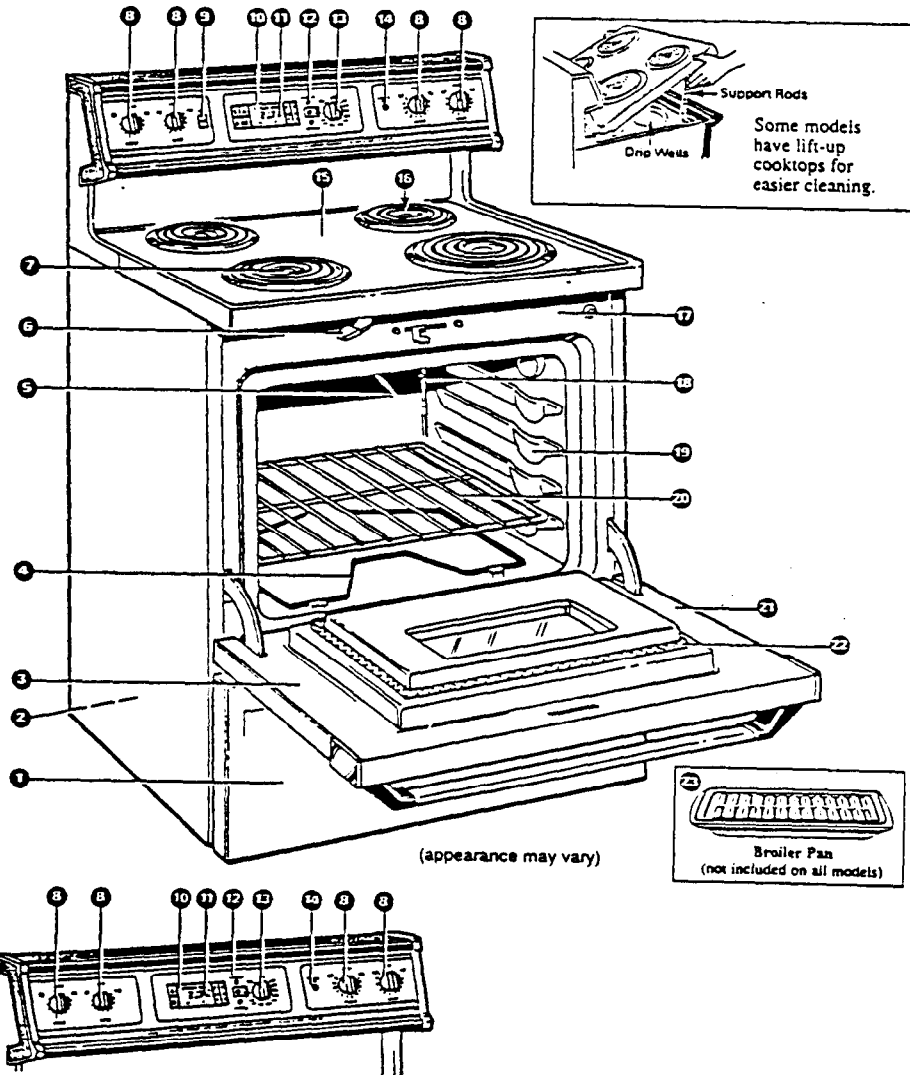
INVESTIGATION GUIDELINE

ELECTRIC



FEATURES OF YOUR RANGE

Not all features are on all models.





INVESTIGATION GUIDELINE

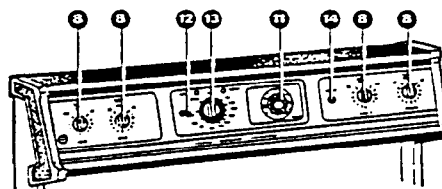
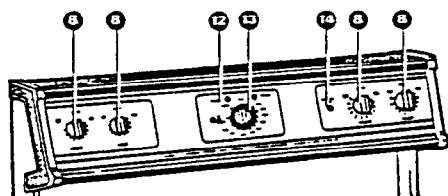
B. Flexible Connector

Flexible connectors, generally used with free-standing ranges, have exhibited gas leakage which may result in fires and/or explosions. Some incidents have been traced to failure of soldered or brazed end-fittings and stress corrosion of the brass tubes of the connectors. Prior to 1973, some end fittings were brazed or soldered to connector bodies with either butted or lapped surfaces. Particularly with the butted surfaces, but to a lesser extent with the lapped surfaces, corrosion occurred in the joint, and leaks developed. Also, connectors can be over-stressed during installation or movement, resulting in stress corrosion in the presence of ammonia vapors from such products as floor waxes, floor and window cleaners, and oven cleaners.



INVESTIGATION GUIDELINE

ELECTRIC



Feature Index Not all models have all features.

- 1 Storage Drawer (on some models)
- 2 Anti-Tip Device
See the Installation Instructions.
- 3 Anti-Tip Label
- 4 Bake Unit May be lifted gently for wiping oven floor.
- 5 Broil Unit
- 6 Oven Door Latch
Use for Self-Clean only.
- 7 Surface Units, Drip Pans
- 8 Surface Unit Controls
- 9 Oven Light Switch
(for models with oven window)
- 10 Automatic Oven Light
- 11 Clock and Timer (on some models)
- 12 Oven On Light
- Latch Door Light
Preheated Light
Automatic Oven Light
(on some models)
- 13 Oven Temperature Knob

Feature Index Not all models have all features.

- 14 Surface Unit On Light
- 15 Cooktop/Lift-Up Cooktop
(on some models)
- 16 Oven Vent
Located under right rear surface unit.
- 17 Model and Serial Number Location
Located behind the range door or behind the storage drawer.
- 18 Oven Interior Light
(on some models) Comes on automatically when door is opened.
- 19 Oven Shelf Supports
Shelf positions for cooking are suggested in the Baking, Roasting and Broiling sections.
- 20 Oven Shelf with Stop-locks
(number may vary)
- 21 Removable Oven Door with Broil Stop Position
Easily removed for cleaning.
- 22 Oven Door Gasket
- 23 Broiler Pan and Rack
(on some models)
Do not clean in the Self-Clean oven.

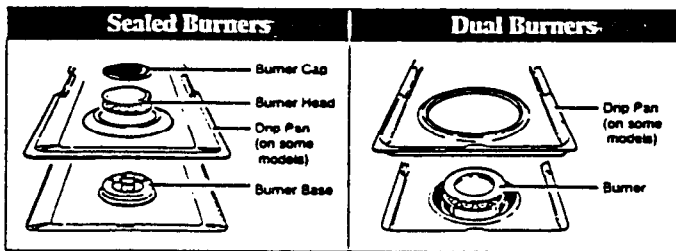
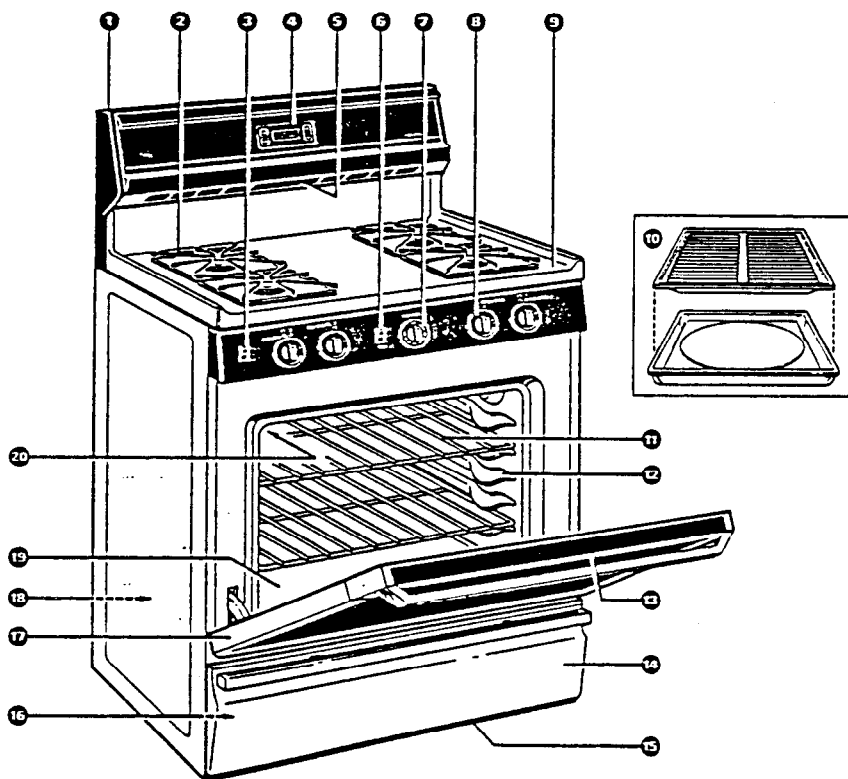
Features of Your Range



INVESTIGATION GUIDELINE

GAS

Features of Your Range



Your range is equipped with one of the two types of surface burners shown above.



INVESTIGATION GUIDELINE

GAS

Feature Index (Not all models have all features. Appearance of features varies.)

1 Backguard (on some models)
2 Surface Burners, Drip Pans (on some models) and Grates
3 Oven Lamp On/Off Switch (on some models)
4 Clock and Timer (on some models)
5 Oven Vent (located on cooktop on some models)
6 BAKE/BROIL Switch (on some models)
7 Oven Control
8 Surface Burner Controls
9 Cooktop
10 Broiler Pan and Rack
11 Oven Shelves (number of shelves varies)
12 Oven Shelf Supports
13 Air Vent in Oven Door (located at top of Oven Door)
14 Broiler Drawer or Storage Drawer (depending on model)
15 Air Intake
16 Model and Serial Numbers (located on front frame of range, behind either Broiler Drawer or Storage Drawer)
17 Removable Oven Door
18 Anti-Tip Device (Located right rear at bottom. See Installation Instructions.)
19 Oven Bottom
20 Oven Interior Light (on some models)

Features of Your Range

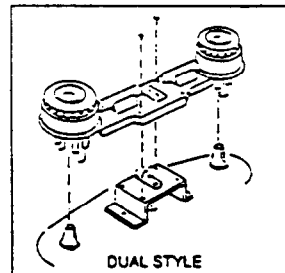
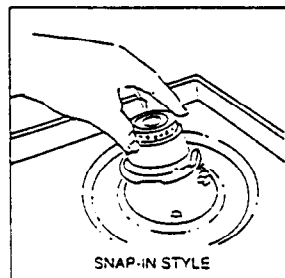
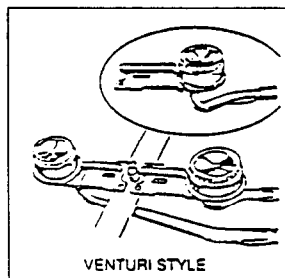


INVESTIGATION GUIDELINE

GAS

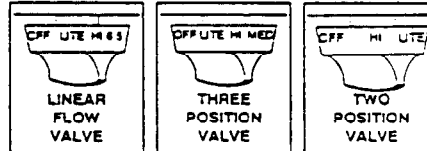
OPERATION OF SURFACE BURNERS

This range is equipped with one of the three burner types shown below.



6a. ELECTRIC IGNITION SURFACE BURNERS

Operation of electric igniters should be checked after range and supply line connectors have been carefully checked for leaks and range has been connected to electric power. To check for proper lighting, push in and turn a surface burner knob to the LITE position. You will hear the igniter sparking. The surface burner should light when gas is available to the top burner. Each burner should light within four (4) seconds in normal operation after air has been purged from supply lines. Visually check that burner has lit. Once the burner lights, knob should be rotated out of the LITE position. There are separate ignition devices for each burner. Try each knob separately until all burner valves have been checked.

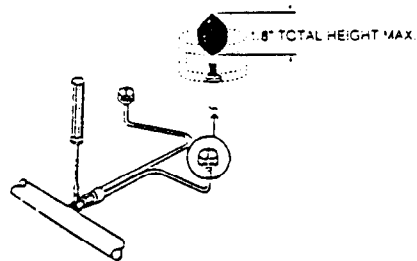


KNOB STYLES MAY VARY FROM THOSE PICTURED ABOVE.

6b. STANDING PILOT SURFACE BURNERS

After range and supply line connections have been carefully checked for leaks, purge air from the system. The standing pilots must be lit immediately, proceed as follows:

1. Lift main top, and locate top burner pilot adjustment.
2. Hold match over top pilot until lit. After one pilot is lit, light the other pilot.
3. When both pilots are lit, adjust the top pilot adjustment until the pilots are approximately 1/8" tall with a very slight yellow tip.



CHECK SURFACE BURNERS

To check for proper lighting, push in and turn a surface burner knob to the LITE position. Each burner should light within four (4) seconds in normal operation. Once the burner lights, knob should be rotated out of the LITE position. Try each knob separately until all burner valves have been checked.



INVESTIGATION GUIDELINE

GAS

OPERATION OF OVEN BURNERS AND OVEN ADJUSTMENTS

9a. ELECTRIC IGNITION BURNERS

Operation of electric igniters should be checked after range and supply line connectors have been carefully checked for leaks and range has been connected to electric power.

The oven burner is equipped with an electric control system as well as an electric oven burner igniter. If your model is equipped with a waist-high broil burner, it will also have an electric burner igniter. These control systems require no adjustment. When the oven is set to operate, current will flow to the igniter. It will "glow" similar to a light bulb. When the igniter has reached a temperature sufficient to ignite gas, the electrically controlled oven valve will open and flame will appear at the oven burner. There is a time lapse from 30 to 60 seconds after the thermostat is turned ON before the flame appears at the oven burner. When the oven reaches the dial setting, the glowing igniter will go off. The burner flame will go "out" in 20 to 30 seconds after the igniter goes "OFF". To maintain any given oven temperature this cycle will continue as long as the dial (or display) is set to operate.

After removing all packing materials and literature from the oven:

1. Set oven to **BAKE** at 300°, see OWNER'S GUIDE for operating instructions.
2. Within 60 seconds the oven burner should ignite. Check for proper flame, and allow the burner to cycle once. Reset controls to off.
3. If your model is equipped with a waist-high broiler, set oven to **BROIL**, see OWNER'S GUIDE for operating instructions.
4. Within 60 seconds the broil burner should ignite. Check for proper flame. Reset controls to off.

9b. STANDING PILOT OVEN BURNER

To light the oven pilot proceed as follows:

Turn the oven thermostat knob to "Off". Remove oven bottom, see step 10 for instructions on removing the oven bottom. Light the oven pilot with a match. The oven pilot should burn with a stable flame after a few seconds operation and should have a small flame visible only at the opening in the top of the pilot assembly.

