GE Consumer Service Training

TECHNICIAN'S MANUAL

GE, HOTPOINT, RCA COOKING PRODUCTS

GAS SYSTEMS

CONTENTS

<u>1. IMPORTANT SAFETY INFORMATION</u>

1. **<u>USE COMMON SENSE</u>**.....DON'T SMOKE AROUND GAS. DON'T GET INTO A HURRY AND GET CARELESS. DON'T MODIFY THE RANGE BY BY-PASSING SAFETY DEVICES OR MODIFYING PARTS.

2. **<u>TURN OFF THE GAS</u>**.....ALWAYS TURN OFF THE GAS TO THE RANGE WHEN SERVICING UNLESS IT IS ABSOLUTELY NECESSARY TO HAVE THE GAS ON FOR TESTING.

3. **<u>CHECK FOR GAS LEAKS</u>**..ALWAYS CHECK YOUR WORK WHEN COMPLETED TO BE SURE THERE ARE NO GAS LEAKS. USE A SOAP AND WATER SOLUTION TO CHECK FOR LEAKS. WORK THE SOAP AND WATER INTO A LATHER AND OBSERVE FOR FORMATION OF LARGE BUBBLES INDICATING A GAS LEAK. CORRECT LEAKS BY TIGHTENING FITTINGS,SCREWS,CONNECTIONS,APPLYING APPROVED COMPOUND OR BY INSTALLING NEW PARTS. **<u>NEVER USE A FLAME TO TEST FOR LEAKS</u>**, ESPECIALLY WITH LP GAS. LP WILL SEEK LOW LYING AREAS AND FORM "PUDDLES". YOU MAY NOT SMELL IT BUT A FLAME WILL QUICKLY FIND THE PUDDLE.

4. **<u>LARGE GAS LEAKS</u>**......IF LARGE GAS LEAKS ARE PRESENT IN THE HOME, CALL THE GAS COMPANY. DO NOT TURN ANY ELECTRICAL SWITCHES ON OR OFF. DO NOT OPEN ANY WINDOWS. USE ONLY A FLASHLIGHT. GET OUT OF THE HOUSE AND LET THE GAS COMPANY LOCATE THE SOURCE OF THE LEAK.

5. **<u>CHECK THE RANGE WHEN YOU HAVE COMPLETED THE JOB</u>**......BEFORE TURNING THE RANGE OVER TO THE CUSTOMER, DOUBLE CHECK YOUR WORK TO BE SURE ALL PILOT LIGHTS ARE LIT AND ALL ELECTRICAL CONNECTIONS HAVE BEEN MADE. BE SURE THE RANGE OPERATES PROPERLY. ADVISE CUSTOMER OF THE CONDITION OF THE RANGE BEFORE LEAVING.

2. WHAT IS GAS ?

There are two categories of gas available for domestic use in North America. The two categories are natural gas and liquified petroleum (LP) gas.

In their natural state both natural and LP gasses are non toxic and odorless. Neither gas will burn unless it is mixed with the proper ratio of air.

NATURAL GAS	LP GAS
950 TO 1080 BTU PER CUBIC FOOT	2400 TO 2600 BTU PER CUBIC FOOT

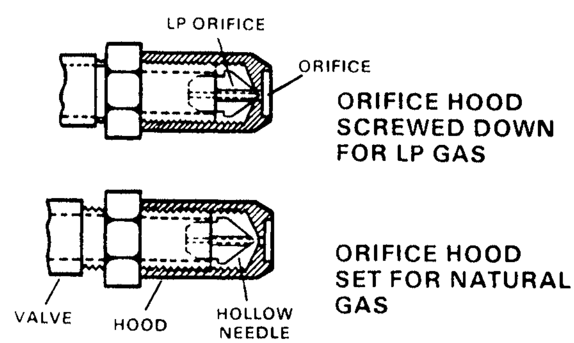
Most gas appliances will operate on either natural gas or LP as long as the appliance is adjusted for the proper fuel. These adjustments are necessary due to the different BTU ratings of the two gasses and the different pressures at which the gasses are supplied.

The BTU rating of the gas is a measurement of the amount of heat the gas is capable of producing. Gas is rated in BTU's per cubic foot. One BTU (British thermal unit) is the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit.

Burners are also rated in BTU's to indicate the amount of heat the burner can produce safely. The BTU rating of a gas burner can be compared to the Wattage rating of an electrical heating element. BTU ratings for each burner are printed on the model and serial tag attached to the range.

On average, natural gas has a rating of 950 to 1080 BTU per cubic foot.
LP gas (propane) has a much higher rating of 2400 to 2600 BTU per cubic foot.

Since it has a much higher BTU rating than natural gas, it takes less LP than natural gas to power a burner at the same BTU rate. When a burner is converted from natural gas to lp, the opening in the gas metering orifice is reduced to allow less lp gas to flow into the burner.



The sizes of the openings in the gas metering orifices are determined by two factors: the BTU rating of the gas and the pressure at which the gas is supplied.

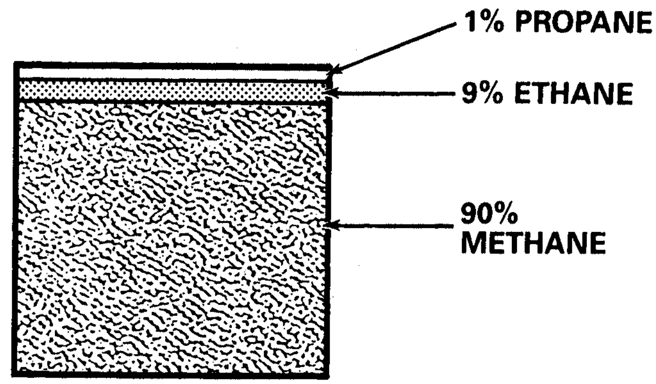
2. WHAT IS GAS ?

The supply pressure can be regulated by the appliance pressure regulator, however the BTU rating of the gas is determined by the content of the gas.

Within the same category (natural gas or lp gas) gas will differ slightly in content and BTU rating from one city to the next or from one season to the next.

These differences usually go unnoticed, but in extreme instances can be a source of consumer complaints resulting in service calls.

<u>NATURAL GAS</u> Natural gas is made up of approximately 90% methane, 9% ethane with the remaining 1% mostly propane. This is the composition of the gas that is purchased by the utility from the gas transmission companies. The utility adds an odorant to the otherwise odorless gas as a method for leak detection.



ONE CUBIC FOOT OF NATURAL GAS - AVERAGE RATING OF 950 TO 1080 BTU

The utility companies purchase natural gas from the transmission companies as much as two years in advance. Gas is usually purchased in weekly allowances, that is, gas used the first week of January, 1990 was purchased around the first week of January, 1988.

The amount of gas purchased for a given time period is based on records showing the amount needed for the same period in previous years plus other factors such as new customers and so on.

A problem develops when gas usage is higher than expected and the gas supply runs short.

The utilities have several methods of supplementing their supply of natural gas. Some store natural gas in underground caverns, abandoned mines or other suitable locations and use this stored gas when supplies run low. Other utilities supplement the natural gas with mixtures of lp gas and air. Mixing the lp gas and air results in a diluted lp mixture with a BTU rating closer to natural gas. This mixture is called 1400 lp/air because of its BTU rating of 1400 and it is an air/gas mix.

2. WHAT IS GAS ?

Other less used methods of supplementing short supplies include the use of liquified natural gas, manufactured gas and in some areas, natural gas from small nearby gas wells.

The American Gas Association (AGA) tests all ranges submitted for approval to ensure they will operate safely on reasonable amounts of the various supplemental mixtures.

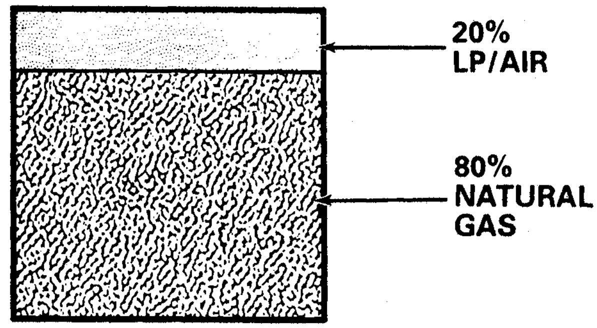
Problems can occur when excessive amounts of supplemental gas are introduced into the system. The most apparent symptoms will be yellow tipping of the burner flames and slower than usual ignition times of the top burners. **DO NOT BLAME THE GAS FOR EVERY CALL FOR THESE SYMPTOMS**. Usually if the gas is the problem, an abnormal amount of calls will be received for the same problem.

LP GAS (LIQUIFIED PETROLEUM) LP gas as used in the home is made up of 95% propane and 5% butane. Its molecular structure makes it heavier than air. In the event of a gas leak, lp gas will seek low lying areas and form puddles of gas. This makes lp more dangerous when compared to natural gas which is lighter than air and will mix with the air and dissipate.

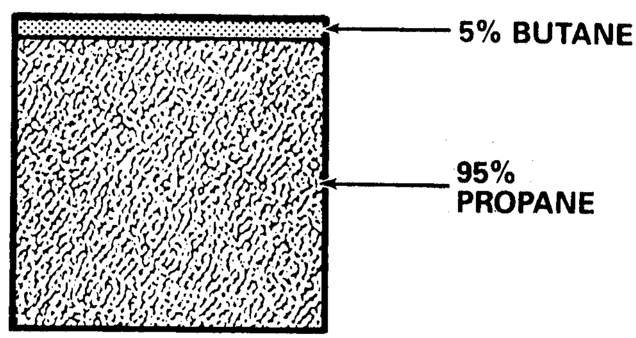
On a national average, only about 10% of all gas ranges use lp, however, more than 35% of total service calls on all gas ranges are to correct problems related to lp gas adjustments.

The reason for such a high percentage of calls on lp gas installations is due to a variety of factors. First of all, most ranges must be converted for use with lp gas. The conversion is usually done by someone with little or no experience in making the conversion. This results in improper burner adjustments and, quite often, damaged orifice needles.

In some cases, the lp gas itself can be the cause of service problems.



ONE CUBIC FOOT NATURAL GAS, LP GAS AND AIR. BTU RATING INCREASED



ONE CUBIC FOOT OF LP GAS - AVERAGE RATING OF 2400 TO 2600 BTU

2. WHAT IS GAS ?

As stated earlier, lp gas contains roughly 5% butane. Butane has an average BTU rating of 3200 BTU per cubic foot. This is much higher than the BTU rating of propane which is between 2400 and 2600 BTU per cubic foot. In small amounts, butane presents no problem. The problem develops as the percentage of butane in the lp gas increases to the point where the burners develop yellow tips due to the increased BTU rating of the lp mixture.

The increase in the amount of butane in the lp occurs due to the different "boiling" temperatures of propane and butane. The boiling temperature is the temperature where the liquid turns into a gas.

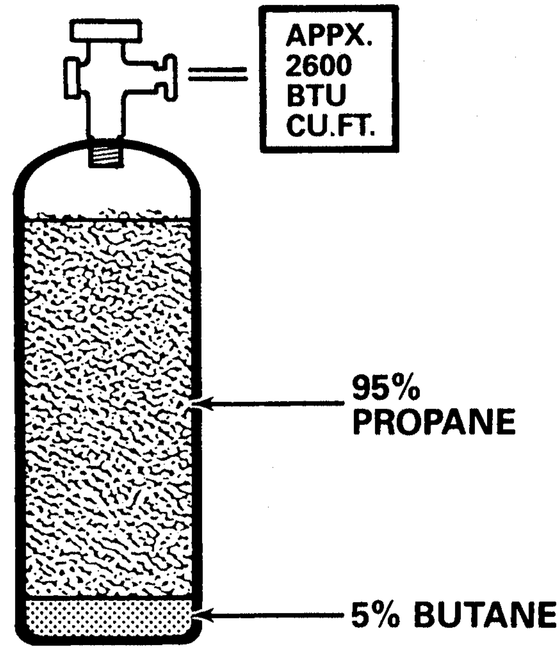
For propane, the liquid will continue to boil into a gas at temperatures as low as 40 below zero (F). Butane will stop boiling and remain a liquid at temperatures as warm as 32 above zero (F). This is where the problem begins.

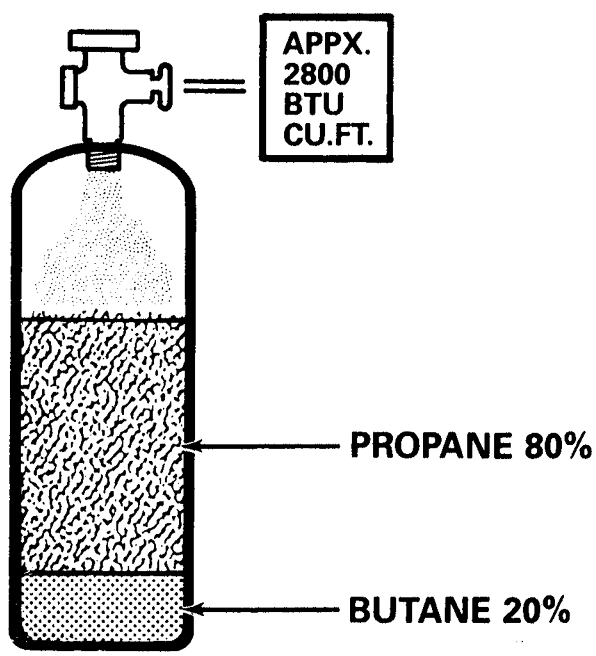
In most areas, the temperature will fall below freezing for some amount of time during the winter months. When the temperature remains cold for long periods of time, the butane remains in the lp tank as a liquid while the propane boils into a gas and is used.

As the weather warms and the butane again boils into a gas, it now represents a larger percentage of the gas mix in the lp tank. The exact percentage of butane depends on how much of the propane was used from the tank during the period when the butane remained a liquid.

Depending on how long the Winter is and how many times the lp tank is filled, the percentage of butane in the tank can grow very high by the time warm weather arrives.

This could explain a sudden increase in complaints of yellow tipping burners from lp users on a warm day or in early Spring.





PERCENT OF BUTANE INCREASES AS THE PROPANE BOILS INTO GAS AND IS USED.

It also will explain why the burner flames look good in the morning when it is cold outside and begin yellow tipping in the afternoon and evening after the lp tank has been warmed by the sun.

If the level of the lp tank is below half full, having the tank filled should reduce the problem.

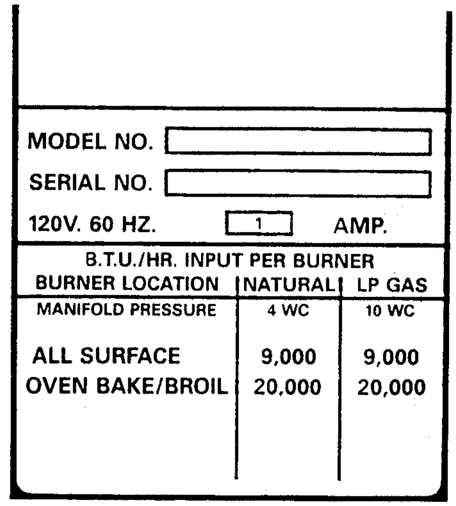
Once again, **DO NOT BLAME THE GAS FOR EVERY CALL FOR YELLOW TIPPING BURNERS**.

3. BURNERS, HOW THEY OPERATE

Regardless of the type, the principals of operation are basically the same for all burners used on gas ranges.

Burners are rated in BTUs. The BTU rating of a burner corresponds to the amount of heat or flame the burner is capable of producing. This can be compared to the Wattage rating of an electrical heating element.

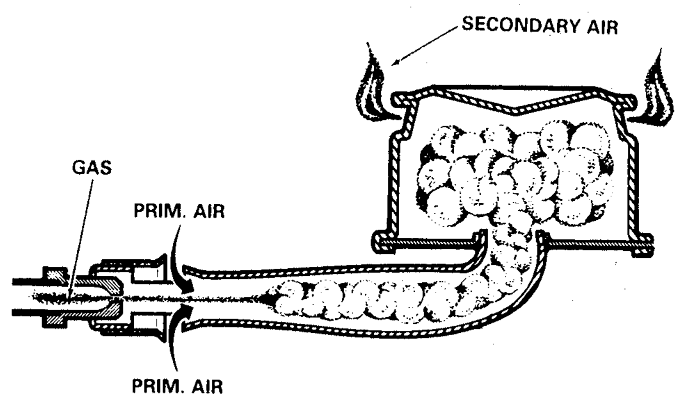
Most surface burners used on GE gas ranges have been rated at 9,000 BTU. Oven burners have ranged from 14,000 to 20,000 BTU's. The BTU rating for each burner is listed on the model and serial label attached to the appliance.


MODEL NO.
SERIAL NO.
120V. 60 HZ. 1 AMP.

B.T.U./HR. INPUT PER BURNER		
BURNER LOCATION	NATURAL	LP GAS
MANIFOLD PRESSURE	4 WC	10 WC
ALL SURFACE	9,000	9,000
OVEN BAKE/BROIL	20,000	20,000

For proper operation, a burner needs the correct amount of gas mixed with the correct amount of air resulting in a flame that is stable without yellow tips.

In order to understand how a burner operates you need to be familiar with the terminology used to describe the process:



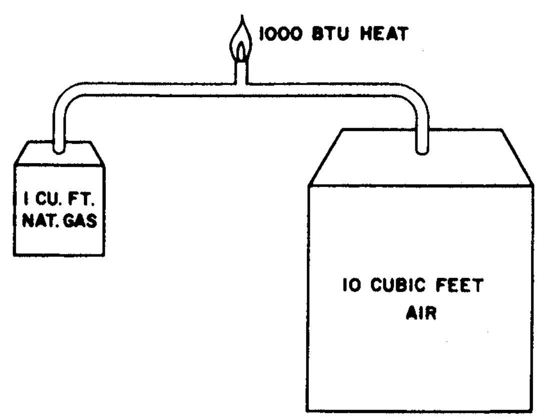
1. Gas--This is the fuel used by the burner, either natural gas or LP gas.

2. Primary Air--This is the air mixed with the gas in order to make the gas combustible.

3. Secondary Air--This is supplemental air or ambient air surrounding the flame.

4. Air/Gas Ratio--for complete combustion, it takes ten cubic feet of air to burn one cubic foot of natural gas (10 to 1 ratio) and twenty four cubic feet of air to burn one cubic foot of LP gas (24 to 1 ratio).

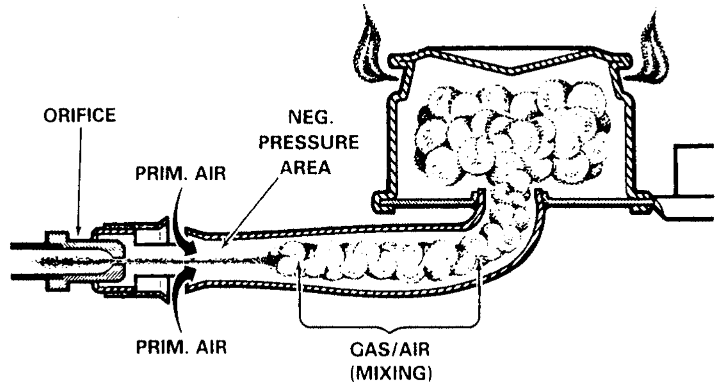
   When broken down into primary and secondary air, 70 to 80 percent of the total air required is mixed with the gas as primary air. The remaining 20 to 30 percent is pulled into the flame as secondary air.



3. BURNERS, HOW THEY OPERATE

Mixing of Gas and Primary Air

As shown in the illustrations, gas flow passes through a gas metering orifice before entering the burner. The diameter of the hole in the orifice regulates the amount of gas entering the burner. The size of the hole is calculated based on the BTU rating of the gas, the regulated delivery pressure of the gas and the BTU rating of the burner itself.

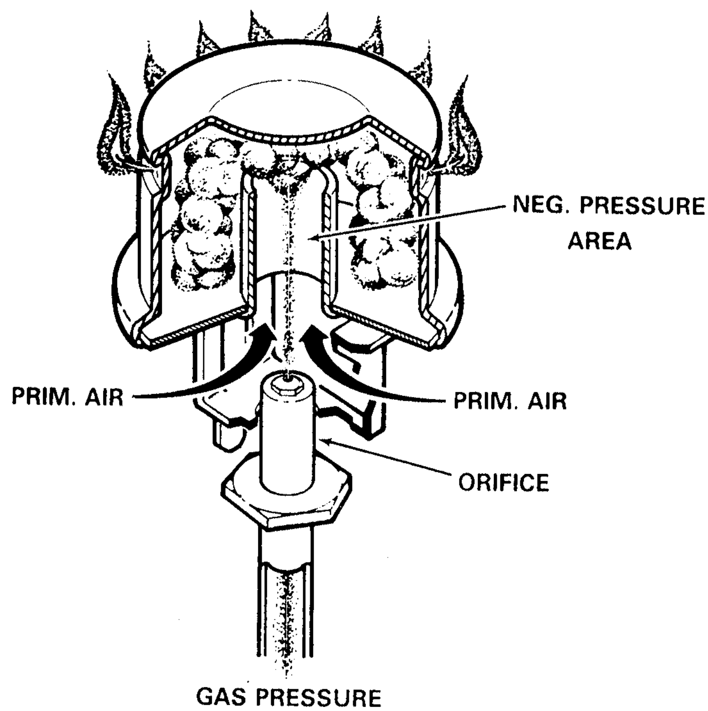


BURNER WITH EXTERNAL MIXING TUBE (VENTURI)

As the pressurized gas stream flows out of the orifice and into the base of the burner, a vacuum (called aspiration) is created around the gas flow.
Primary air is pulled in by this vacuum and mixes with the gas in the mixing zone.

The amount of primary air pulled in is determined by the size of the air shutter opening (burners with air shutters) or by the distance between the orifice and the base of the burner (burners without air shutters).

Gas must be injected straight into the burner in order to pull the right amount of air into the mixing zone. If the gas is injected at an angle, the vacuum surrounding the gas flow will be reduced. The loss of this vacuum will result in too little primary air being mixed with the gas. Yellow tipping of the burner flames will result. The same problem will occur if the orifice is partially blocked with debris from a spill over or by a burr in the orifice opening (or by the orifice pin being distorted due to the over tightening of the orifice hood when converting to LP gas).



BURNER WITH INTERNAL MIXING TUBE (VENTURI)

When the air and gas are properly adjusted, the flame will burn clean, without yellow tips and deliver the proper amount of BTU's for the burner.

The flame burns properly because the gas/air mixture is supplied to the burner at the correct SPEED and VOLUME.

3. BURNERS, HOW THEY OPERATE

At the burner, natural gas burns back towards the source of the gas/air mixture at a speed of about 130 feet per minute. For a proper burning flame, the air/gas mixture must be supplied to the burner at the same rate as the burning speed.

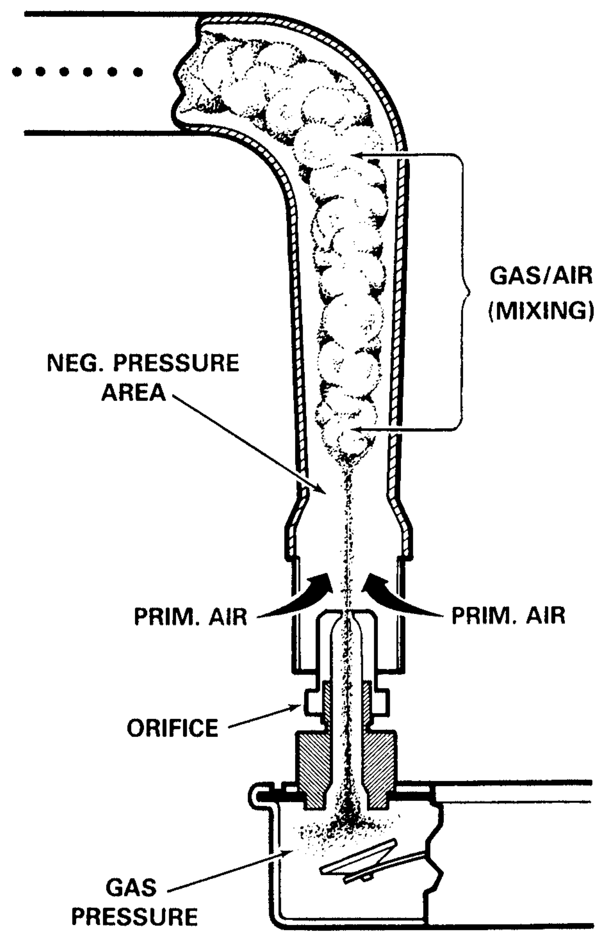
The speed at which the air/gas mixture burns can be altered by varying the amount of primary air in the air/gas mix.

Increasing the primary air results in an increase in burning speed. Too large of an increase results in the flame blowing off of the burner.

Reducing the primary air slows the burning speed. Too little primary air will result in yellow tips forming on the end or the burner flames.

Starvation of primary air will result in a flame without the normal definition or cone structure as seen on properly burning flames. This flame will burn off of the burner with occasional upward leaps. The lazy flame without structure is a sure sign of incomplete combustion.

OVEN BURNER



COMBUSTION, COMPLETE AND INCOMPLETE

A gas range is not vented to the outdoors as a gas water heater or a furnace must be. All by-products of combustion from a gas range are vented directly into the kitchen.

When complete combustion occurs, the by-products of combustion are harmless and consist mainly of water vapor and carbon dioxide.

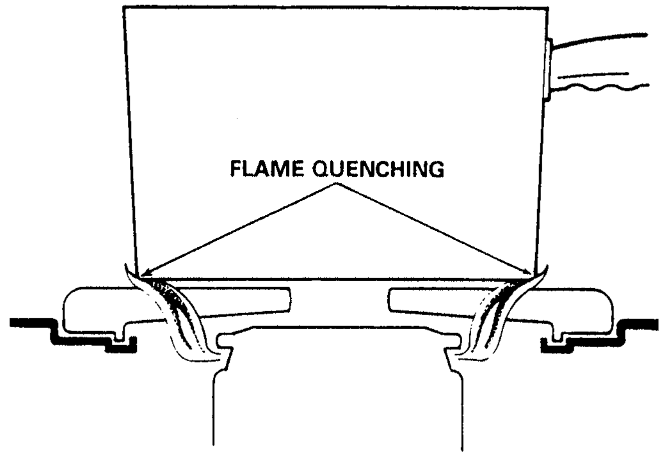
When incomplete combustion occurs, the by-products can include carbon monoxide and sometimes aldehydes.

Obvious signs of incomplete combustion are yellow flames, soot and sometimes a strong chemical odor from the aldehydes.

3. BURNERS, HOW THEY OPERATE

Incomplete combustion can usually be traced to one of three common causes:

1. Quenching of the Flame--Flame quenching occurs when the flame is cooled before complete combustion can occur.
   As an example, a surface burner has been bent upward to the point the flame contacts the bottom of the pot. The flame is cooled as it touches the pot. The cooling effect interrupts the combustion process before complete combustion can occur.



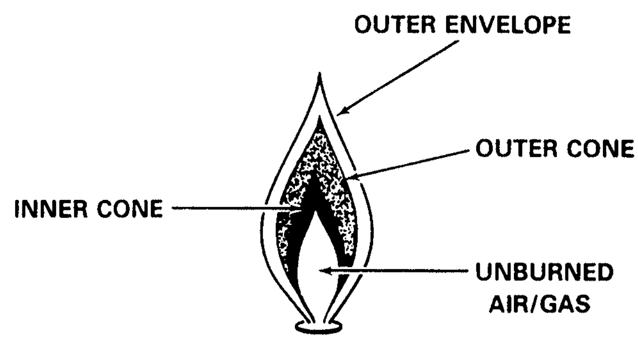
2. Improper Air/Gas Mixture--This is the most common cause of incomplete combustion.

3. Over Powering The Burner--This occurs when the volume of gas supplied to the burner is too large resulting in an "over fired" burner. The flame size exceeds the BTU rating of the burner.

THE COMBUSTION PROCESS

Proper Burning Flame

As shown in the illustration, a proper burning flame has an inner cone, outer cone and an outer envelope.



PROPER BURNING FLAME

The inner cone is the point where the air/gas mixture ignites and the combustion process begins. High levels of carbon monoxide and aldehydes are produced in this cone.

The outer cone surrounds the inner cone. The outer cone is the hottest part of the flame. Secondary air is drawn into the flame at this point and accelerates combustion. As the by-products from the inner cone move into the outer cone, they are burned and transformed into harmless water vapor and carbon dioxide.

The envelope surrounds the outer cone. The combustion process has been completed by the time the air/gas mixture reaches this point. The glow of the envelope is the result of the hot carbon dioxide and water vapor exiting the outer cone.

3. BURNERS, HOW THEY OPERATE

Too Much Primary Air

The illustration shows what happens as the primary air is increased too much.

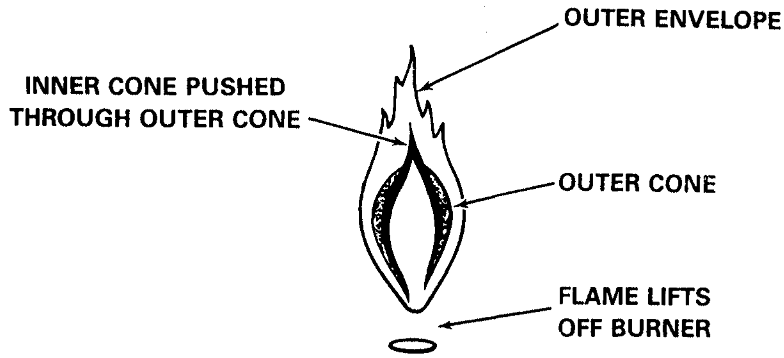
The air/gas mixture burns at a faster speed with the additional primary air (like fanning a flame).

The additional primary air results in a greater volume of air/gas flow through the burner ports. The additional volume also increases the pressure at the ports.

With increased delivery pressure and a faster burning flame, the result is a flame that blows straight out of the burner and burns with a sound similar to that of a blow torch.

The flames lift off the burners and the cone structure of the flame is disrupted.

NOTE: It is a normal for the burners without mixing tubes to have blowing flames during the first minute or so of operation. When the burner is cold, primary air injection is increased. Once the burner heats, the injection of primary air is reduced and the flames settle.



TOO MUCH PRIMARY AIR

Too Little Primary Air

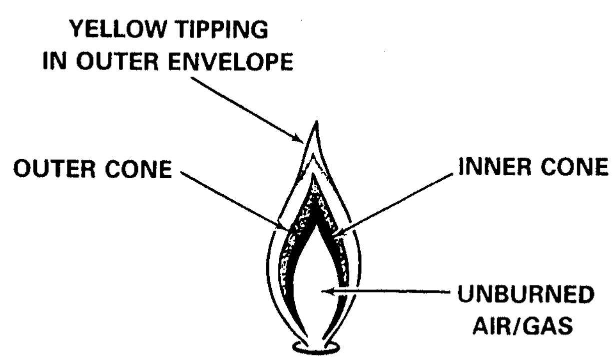
The illustration shows what happens as primary air is reduced to the point where yellow tips appear on the end of the flame.

The reduction of primary air slows the burning process and results in the inner cone rising higher in the flame.

Less burning takes place in the inner cone. A larger amount of the by-products that would normally be consumed in the inner cone pass into the outer cone.

The size of the outer cone is also reduced by the lack of primary air.

The outer cone cannot consume the volume of by-products flowing from the inner cone. A percentage of these by-products flow into the outer envelope where the carbon content of the by products is burned. This shows up as yellow tips.



TOO LITTLE PRIMARY AIR

3. BURNERS, HOW THEY OPERATE

Over Gassed Burner

Over gassing of the burner can be caused by excessive gas pressure, high BTU rating of the gas or an oversized orifice.

It is difficult to distinguish between an over gassed burner and too much primary air.

In both cases, the burner flame length extends too far off the burner.

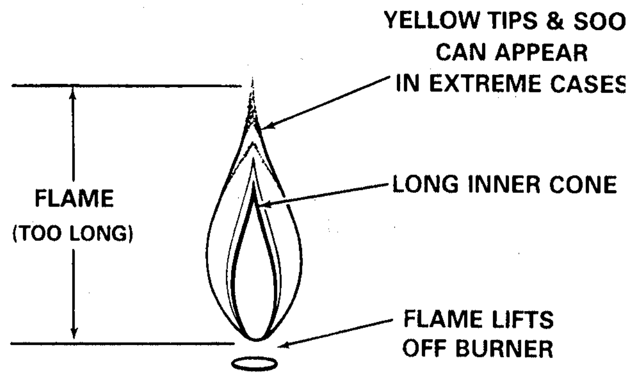
The over gassed burner has more of a normal flame structure and less of a blowing noise than a burner with too much primary air.

The easiest way to determine whether the burner is overgassed is to vary the air shutter opening. If the flame can be reduced to the correct length and structure by adjusting the air shutter then obviously the problem is not a over gassed burner.

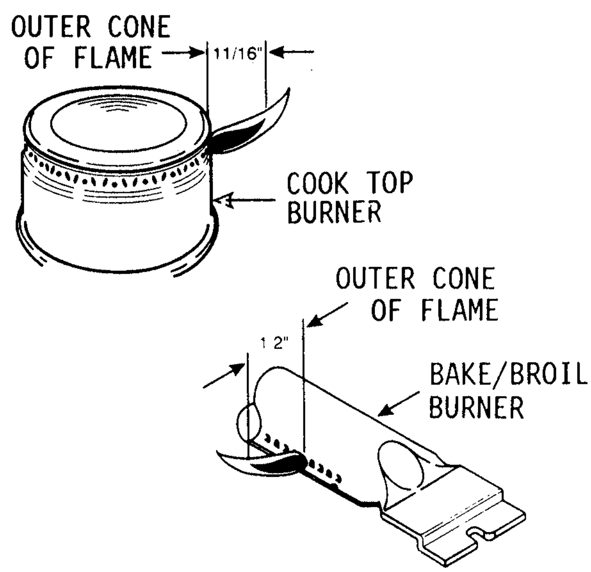
If air shutter adjustments will not correct the problem, turn the orifice hood in the LP direction (natural gas installations) while observing the change in flame length and structure.

Top burners should have a cone length of approximately 3/4 inch. Oven burners should have a cone length of approximately 1/2 inch with the flame spreader removed.

For LP installations and models without adjustable (convertible) orifices, the orifice must be replaced with an orifice one size smaller.



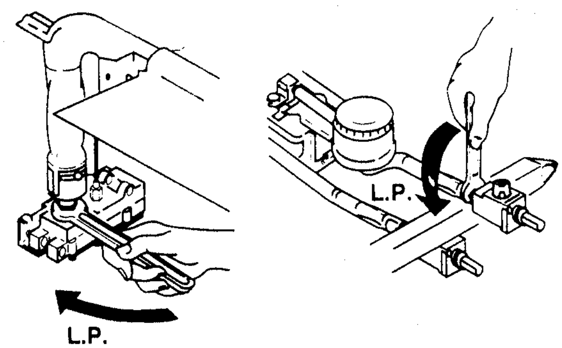
OVER GASED BURNER



Flame Quenching

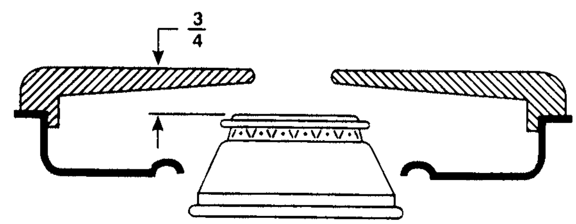
As discussed earlier in this section, flame quenching occurs when the flame is cooled before complete combustion occurs.

Placing an object such as an oven flame spreader into the flame will cool or quench the flame resulting in incomplete combustion. The object interrupts the combustion process and releases the un burned by-products from the inner or outer cone of the flame.



3. BURNERS, HOW THEY OPERATE

The height of the surface burners in relation to the burner grates should always be closely examined and measured. If the burner is too close to the grate or too close to the main top, quenching can result (not to mention damage to the top or grate).

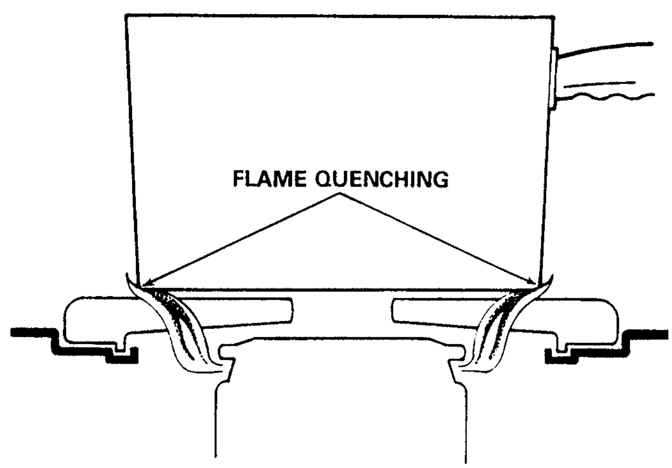


SURFACE BURNER HEIGHT

Top burners can be bent out of adjustment easily by an installer who leans on the burner when installing the gas line or by a variety of other circumstances.

The dimension from the highest point of the burner to the top of the grate must be as shown in the illustration.

In the case of an over gassed burner, the excessive length of the flames can result in quenching at the oven flame spreader or top burner grate even though the flame spreader and grate are in the proper position.



When quenching occurs, the customer may complain of a chemical odor. This odor results from the aldehydes being released from the flame as one of the by product of incomplete combustion. Some customers may associate this odor with a gas smell although the two odors are quite different.

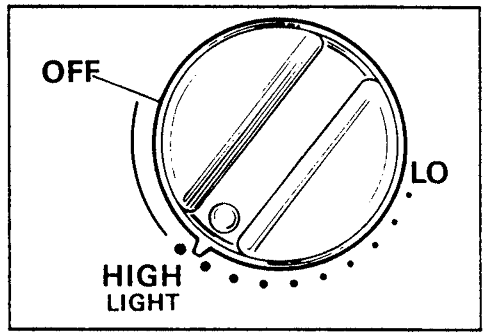
By examining the flame length and looking for an out of place component, the cause of the quenching can be located.

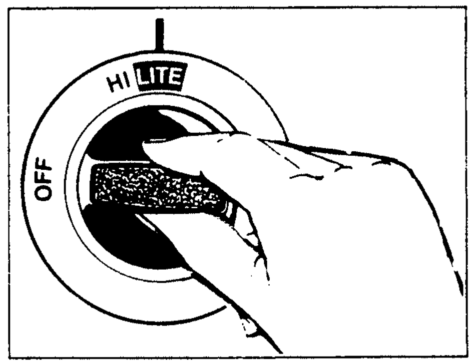
4. TOP BURNER CONTROL VALVES

Top burner control valves have been supplied by numerous different suppliers.

Although they differ in shape and size, they all work basically the same.

Valves can be categorized by their degree of knob rotation beginning with the 90 degree rotation valve used on standard models up to the 325 degree rotation valve used on some deluxe models.





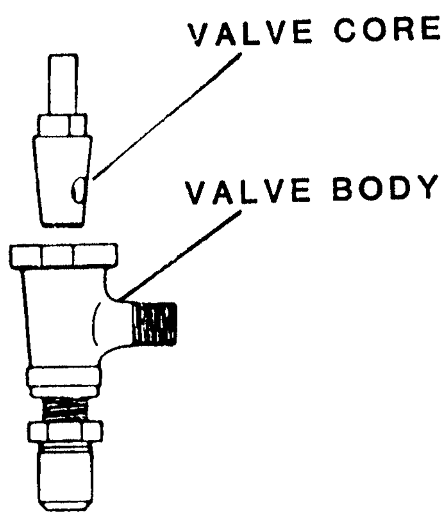
VALVE CONSTRUCTION

The two main components of the valve are the valve body and the valve core.

The valve body is mounted to the gas manifold. An inlet in the valve body permits gas to flow from the gas manifold into the valve.

The valve core is tapered to fit perfectly nside the valve body.

The core is hollow through the center with a large port or a series of different size ports drilled into the side of the core. These ports lead to the hollow center of the core. The center of the core opens to the outlet from the valve body.



When the valve is turned from off, a port or series of ports in the valve core are aligned with the inlet from the manifold. Gas will flow from the manifold, through port(s) in the valve core, through the center of the core and exit from the valve outlet.

Depending on the type of burners used on the range, the burner orifice will be mounted directly on the valve outlet or at the end of the supply tubing leading to the base of the burner.

4. TOP BURNER CONTROL VALVES

FLAME CONTROL

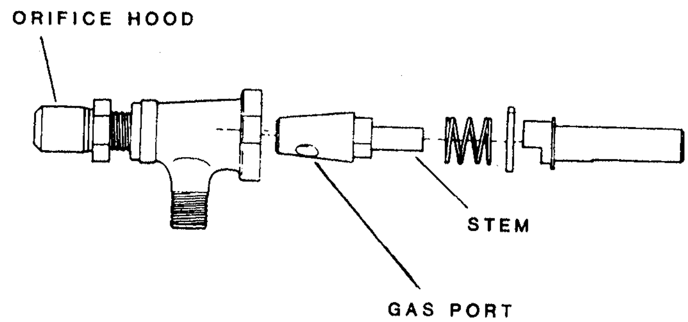
The size of the burner flame depends on the amount of gas flowing through the valve.

Gas flow through the valve is regulated by the diameter of the port in the valve core and the amount of this diameter that is aligned with opening from the manifold.

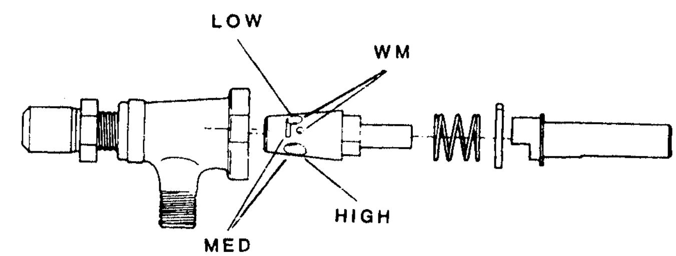
With the 90 degree valve, one large port is drilled in the valve core. Flame control available with this valve is determined by the amount of the total diameter of the port that is lined up with the inlet from the manifold. Different phases of port exposure permit different amounts of gas flow to enter the valve.

Valves with higher degrees of rotation (170, 225, 325) use a series of ports with different diameters to regulate gas flow through the valve.

The different diameter ports are aligned with the valve inlet to permit gas flow through the full diameter of the port, a phase of the diameter of the port like the 90 degree valve, or through combinations of phases from two different size ports.



90° VALVE



225° VALVE

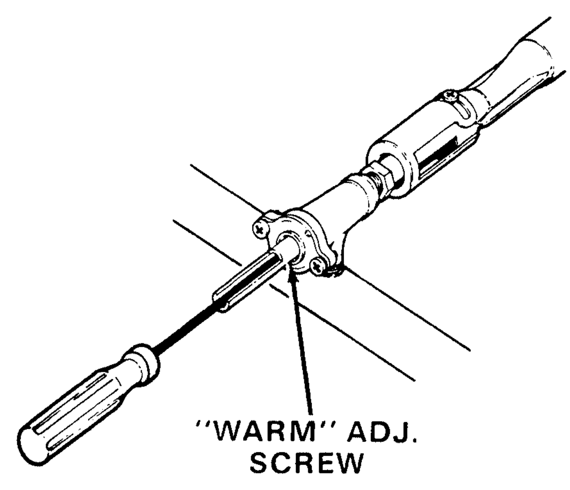
TEMPERATURE SETTINGS

With the exception of the 90 degree valve, most valves have adjustable stop settings or "click positions" to denote the LOW and sometimes the MEDIUM and HI settings.

The location of the "click position" can be moved to better correspond with the actual LO flame setting.

To adjust the location of the setting, light the burner and turn the knob to the LO click position. Remove the knob and locate the adjustment screw in the center of the valve stem.

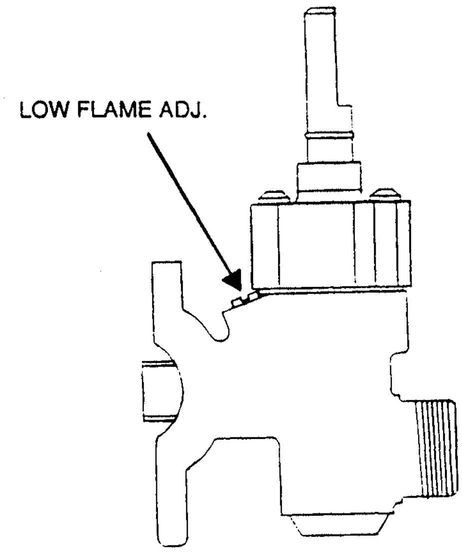
Turn the screw until the burner flame size decreases to the desired LO flame size. Place the knob back on the shaft and turn the burner rather quickly from HI to LO several times. If the burner flame goes out when turned from HI to LO, the low flame setting is too low and needs to be adjusted higher then tested again.



4. TOP BURNER CONTROL VALVES

NOTE: Valves used on models with "SPILL PROOF" burners have low flame adjustment screws located on the valve body near the valve stem.

To adjust the low setting on these models, at least two other burners must be operating on a medium setting and remain on when testing by turning from HI to LO.



TOP BURNER VALVE PROBLEMS

Most problems associated with top burner valves are the result of the valve being over heated. Over heating can occur if the door is left open during broil or if the door seals poorly and allows heat to escape into the valve area.

Excessive heat effects the lubricant between the valve body and the valve core. The lubricant or grease will liquefy and flow to the lowest point in the valve.

The movement of the grease makes the valve hard to turn and may result in blockage of one or more of the ports in the valve core. The absence of grease can result in a gas leak developing around the top of the core at the base of the valve stem.

The valve manufacturers discourage re-greasing of the valves.

The recommended repair is to correct the cause of the overheating of the valves then replace the valves.

5. SURFACE BURNER IGNITION SYSTEMS

A. Standing Pilot System

Two constant burning standing pilot flames (pilots) are used to light the top burners. One pilot ignites the two left burners, the other ignites the two right burners.

The ignition process begins when any burner control valve is turned from the "OFF" position.

Gas flows through the valve to the burner. At the base of the burner there are charge ports or charge holes that direct gas flow from the base of the burner into a flash tube leading to the pilot.

The pilot flame ignites the gas in the flash tube. The ignited gas flashes back through the flash tube to the charge ports.

Once the flame reaches the charge ports, it climbs the side of the burner by way of the climber ports which are small holes in the side of the burner. The climber ports carry the flame to the top of the burner where burner ignition occurs.

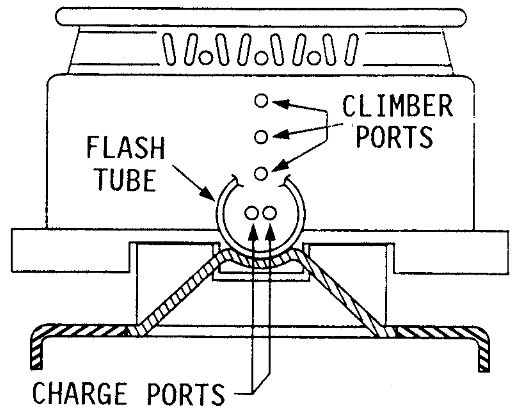
The main disadvantage of the pilot system is the fact there are two pilot flames beneath the main top which burn constantly (plus an additional constant burning pilot in the oven).

The energy used by these pilots is one concern, but another serious concern is the formation of rust that results when the by products given off by the pilots attack the surrounding metal.

The effects of these disadvantages can be reduced by maintaining the height of the pilot flame to around 5/16". A pilot height adjustment screw is located near the main manifold.

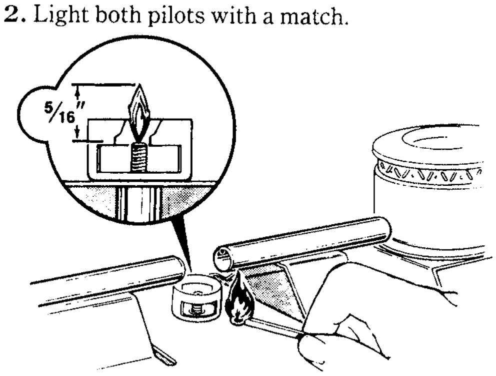
A single adjustment screw is used to adjust the height of both pilots. When properly adjusted, the pilots flames produce about 75 BTU's each.

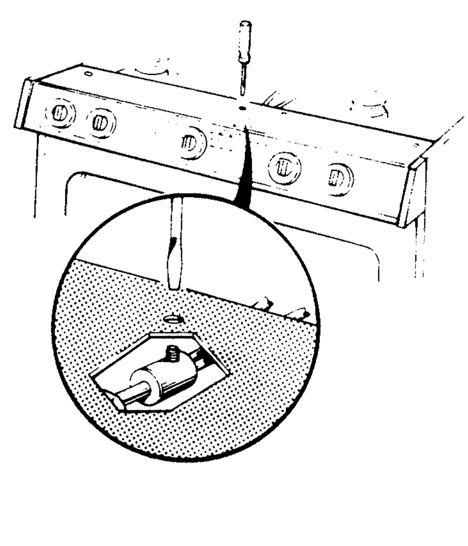
TOP BURNER VIEWED THRU FLASHTUBE



LIGHT THE SURFACE BURNER PILOTS

1. Raise the cooktop.
2. Light both pilots with a match.





5. SURFACE BURNER IGNITION SYSTEMS

B. Manually Controlled Spark System

The system is classified as manually controlled because the burner control valves must be manually turned to or from the "LITE" position to activate or de activate the spark circuits.

Manually controlled systems can be broken down into two different types:

1. 2+1 SYSTEM This system has two spark electrodes to ignite the top burners plus one electrode to ignite the oven burner.

2. 2+0 SYSTEM This system has only the two electrodes for top burner ignition.

Regardless of the system, 2+1 or 2+0, the top burner ignition circuits are identical in operation.

The system consists of a spark module, two spark electrodes and four spark switches.

The four spark switches are mounted on the four top burner control valves.

When a valve is turned to the "LITE" position, the spark switch on that valve closes, completing a 120 Volt circuit to the primary of the spark module.

The spark module transforms the 120 Volt input voltage into a 15,000 Volt DC output and releases this output in pulses at the rate of two pulses per second.

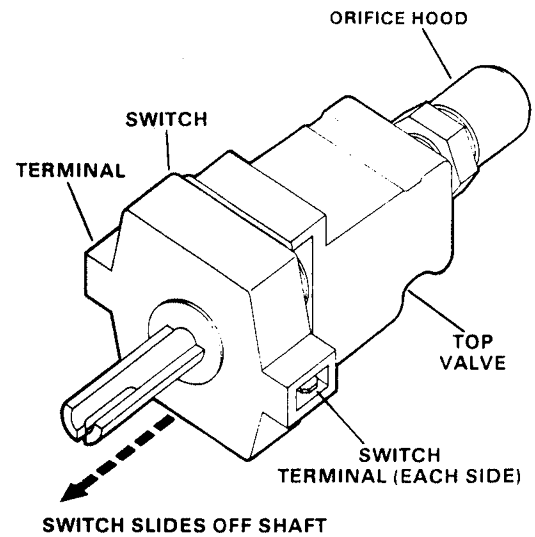
The 15,000 Volt pulses travel through high voltage wires to the spark electrodes.

Located above each electrode is a metal bracket. Through its mounting screws, the bracket is grounded to the chassis of the appliance.

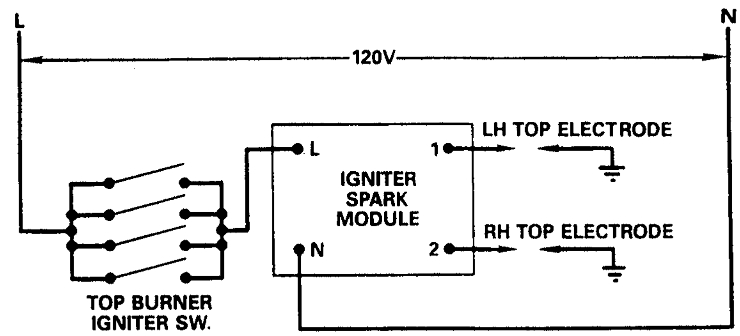
A tab from the grounded bracket is bent downward toward the tip of the electrode.

A dimension of 1/10" is maintained between the bracket tab and the tip of the spark electrode.

As each 15,000 Volt pulse is released, a spark jumps across the gap between the electrode tip and the grounded bracket.

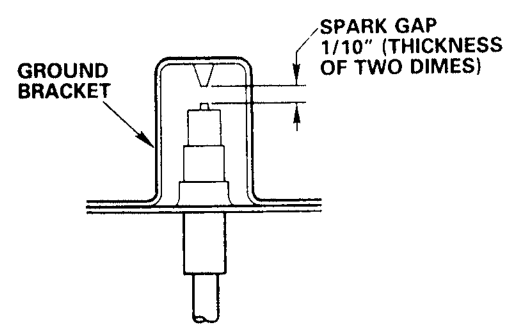


TYPICAL SWITCH



TOP BURNER SPARK IGNITION CIRCUIT

SPARK ELECTRODE



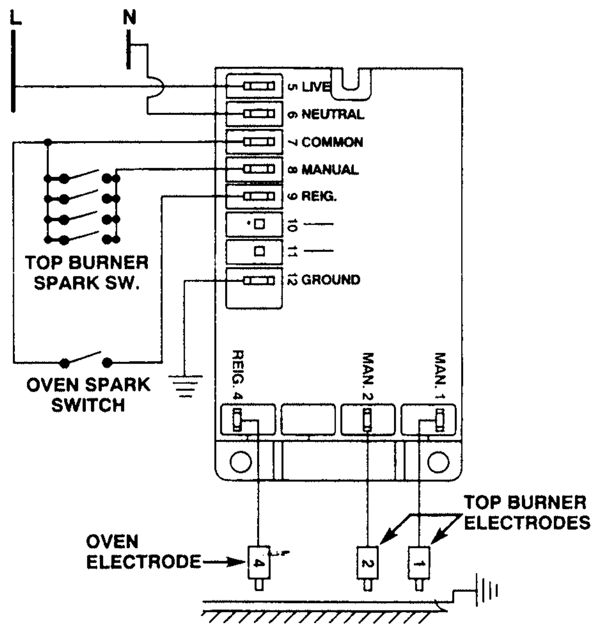
5. SURFACE BURNER IGNITION SYSTEMS

Sparking will occur at both electrodes regardless of which burner valve is turned to "LITE".

Gas is channeled to the spark electrodes through the flash tubes. The sparks from the electrode ignite the gas. The rest of the burner ignition process is exactly as described under Standing Pilot System.

The main disadvantage of the manually controlled spark ignition system is in the event of the burner flame going out, the burner control valve must be manually turned to the "LITE" position to relight the burner.

2 + 1 SYSTEM CIRCUITS



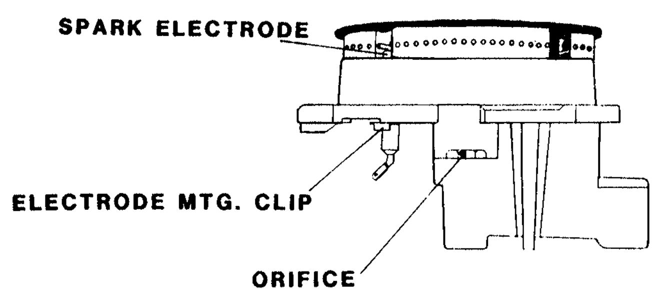
C. FLAME SENSING SPARK IGNITION

This system has recently been introduced and is used only on selected models with "SPILL PROOF" top burner systems at present.

The system consists of a spark module, four spark switches and <u>four spark electrodes</u>. (Cooktop models with five burners use five switches and five electrodes.)

Each burner has its own spark electrode mounted directly to the base of the burner. The need for a flash tube to channel the gas from the burner to the electrode is eliminated.

SPILL-PROOF BURNER



When any burner valve is turned from the "OFF" position, the spark switch on that valve closes and remains closed until the valve is turned back to "OFF".

Closing the spark switch places 120 Volts across the primary of the spark module.

The module releases the 15,000 Volt pulses to the electrodes to induce the sparks and ignite the burners (same as the manual spark system).

5. SURFACE BURNER IGNITION SYSTEMS

Sparking will occur at all four (or five) electrodes regardless of which burner is being ignited.

Once the burner ignites, the presence of the flame is sensed by the flame recognition circuit within the spark module and the sparking stops.

If the burner should go out with the burner valve in any position except "OFF", the system will automatically begin sparking to re-light the extinguished burner.

The ability of the spark module to recognize the presence of the flame is based on the fact a flame is a good conductor of electrical current. Current will pass through the flame but it will be rectified by the flame into DC.

When the burner ignites, a circuit which passes through the burner flame is placed in parallel with the primary of the spark module. This circuit is through the electrode lead, **across the flame** to ground.

This circuit has the same effect as placing a diode in the circuit from the primary of the spark module to ground.

The voltage available to the module is now reduced and converted to pulsating DC.

As long as the burner is lit the affects of the circuit through the burner flame prevent the module from operating .

If the flame should go out, the parallel circuit opens. Full power is then available to the primary of the module and sparking will occur until the burner flame reignites and the parallel circuit returns.

In order for the flame sensing circuitry to work, each burner ignitor and its circuitry must be kept separate from the other burner ignitor circuitry.

5. SURFACE BURNER IGNITION SYSTEMS

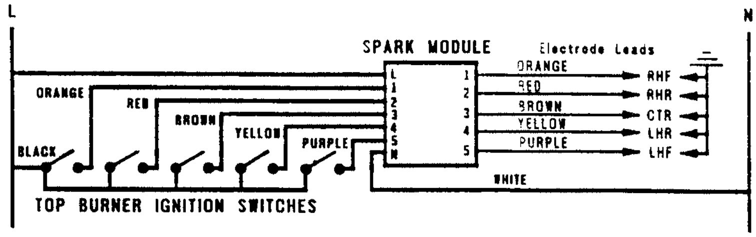
In other words, the right front spark switch must be connected to the right front input terminals of the spark module and the right front electrode must be connected to the right front output terminal of the spark module.

Cross wiring, for example, the left front electrode lead on the right front output terminal of the spark module will result in the constant sparking of the electrode even though the burner is lit. The flame sensing circuit will be monitoring the wrong burner.

There are other causes of constant or random sparking of the electrode after the burner is lit. Some of the known causes are:

1. An improperly grounded range or wall receptacle.
2. The low (simmer) flame setting too low. The flame sensing circuits cannot detect an extremely low flame.
3. Drafts blowing the flame away from the spark electrode.
4. A crack in the electrode insulator.
5. A shorted electrode lead.
6. The spark gap between the electrode and the burner base too large or too small. Gap should be the thickness of a nickle or slightly less.
7. Electrode sparking up to the burner cap. Electrode must spark downward to the burner base.
8. Gas pressure available to appliance too low.

SCHEMATIC DIAGRAM



6. OVEN BURNER IGNITION SYSTEMS

A. Standing Pilot System

SYSTEM IDENTIFICATION Two different suppliers of standing pilot systems have supplied components used on GE, Hotpoint, and RCA brand ranges. The two suppliers are the ROBERTSHAW and HARPER WYMAN companies.

Although the operations of the two systems are basically the same, there are several differences that need to be pointed out

1. FLAME MODULATION Flame modulation refers to the increase and decrease of the burner flame size as directed by the thermostat to regulate oven temperature. When set to a baking temperature above 400 degrees, the Robertshaw control will reduce the oven burner flame size rather than cycle the burner off at the selected temperature. At bake temperatures below 400 degrees, the burner will be cycled off.

   The Harper Wyman control does not modulate the burner flame at any BAKE temperature and will always cycle the burner off.

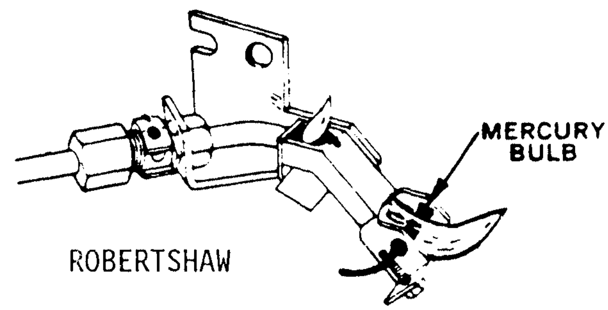
   Both controls will modulate the burner flame during BROIL.

   BOTH CONTROLS WILL MODULATE THE FLAME SIZE IN THE EVENT OF A COMPONENT FAILURE SUCH AS A STUCK OVEN VALVE WHICH WOULD OTHERWISE RESULT IN A "RUN AWAY" CONDITION. Under these conditions, the oven temperature will be regulated by flame modulation to approximately 70 degrees above the selected temperature. This is a safety feature of the thermostats.

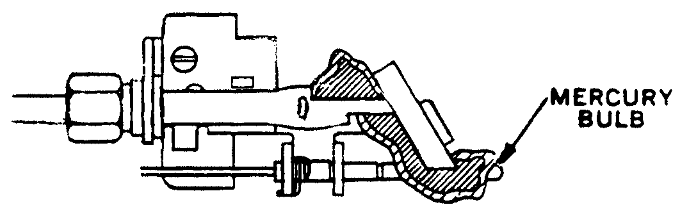
2. OVEN PILOT ASSEMBLY CONFIGURATION The control brand can be identified by examining the oven pilot assembly on the burner.

   The mercury filled bulb from the oven gas valve is positioned side ways in the Robertshaw pilot assembly and is mounted parallel to the pilot assembly on the Harper Wyman control.

OVEN PILOT ASSEMBLY CONFIGURATIONS



ROBERTSHAW

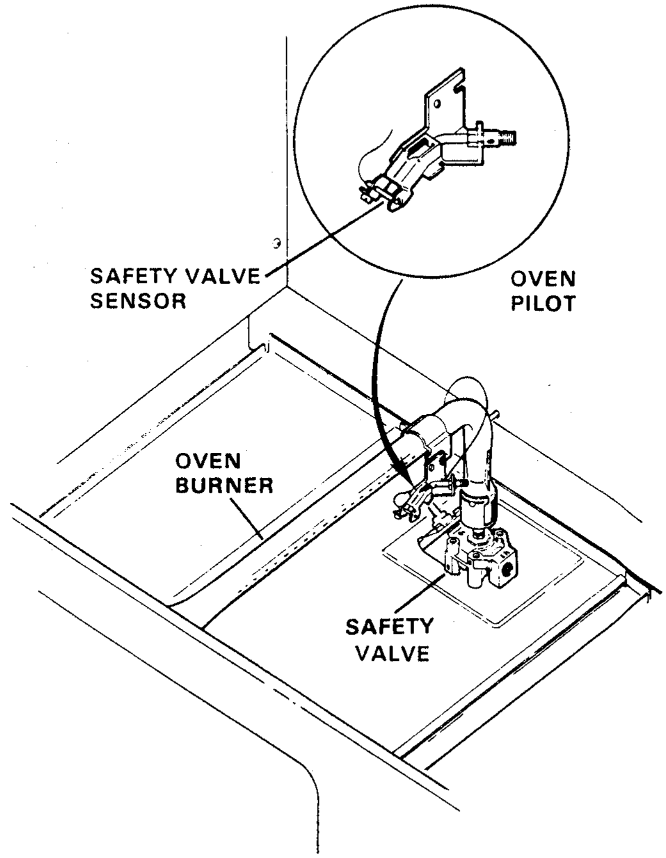


HARPER WYMAN

6. OVEN BURNER IGNITION SYSTEMS

The Harper Wyman system is currently being used on all new models with standing pilot oven ignition.

Components cannot be interchanged between control system brands.



SYSTEM OPERATION

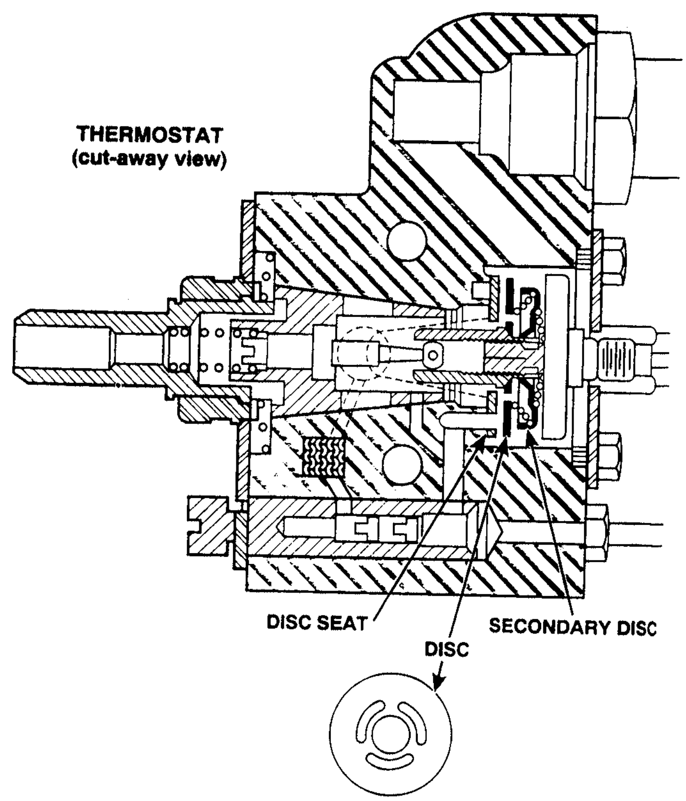
The oven control system consists of:
1. Thermostat
2. Pilot assembly
3. Oven gas valve (also called safety valve)

The cut-away view of the thermostat shows the internal temperature regulating components of the control.

The illustrations used in the following sequences are of the Harper Wyman control system.

The primary function of the standing pilot thermostat is to regulate the size of the oven pilot flame. The height of the pilot flame determines whether the oven gas valve is open or closed.

As a secondary function, the thermostat acts as a shut-off valve by shutting off the gas supply to the oven gas valve when the thermostat is in the OFF position.



6. OVEN BURNER IGNITION SYSTEMS

The main components of the thermostat are:

1. The DISC - The disc acts as a stopper to block the flow of extra gas to the oven pilot. There are slotted openings in the disc that allow gas to flow through the disc to the oven gas valve regardless of the position of the disc.

2. The DISC SEAT - The disc seat is a machined surface of the thermostat body with a passage hole leading to the oven pilot gas outlet.

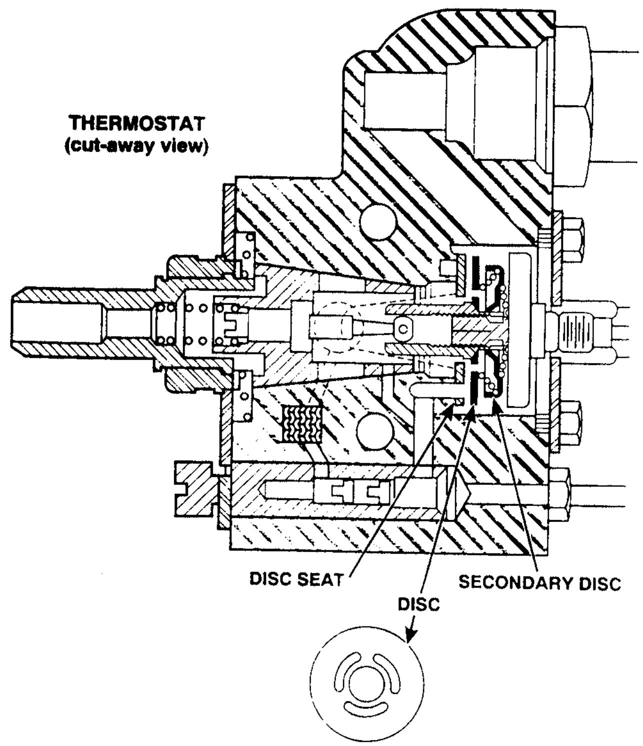
   As the disc comes in contact with the disc seat, the passage to the pilot outlet is closed off, reducing the flow of gas to the pilot.

3. The SECONDARY DISC - The secondary disc is used only during broil on the Harper Wyman system and for broil and high temperature baking (above 400 degrees) on the Robertshaw system.

   The secondary disc is used to control a "run away" condition on both brands.

   As the secondary disc moves toward the main disc, it reduces the amount of gas flowing through the openings in the main disc to the oven gas valve.

   This reduction in gas flow results in a smaller flame at the oven burner. The burner flame height will modulate up and down in proportion to the movement of the secondary disc.



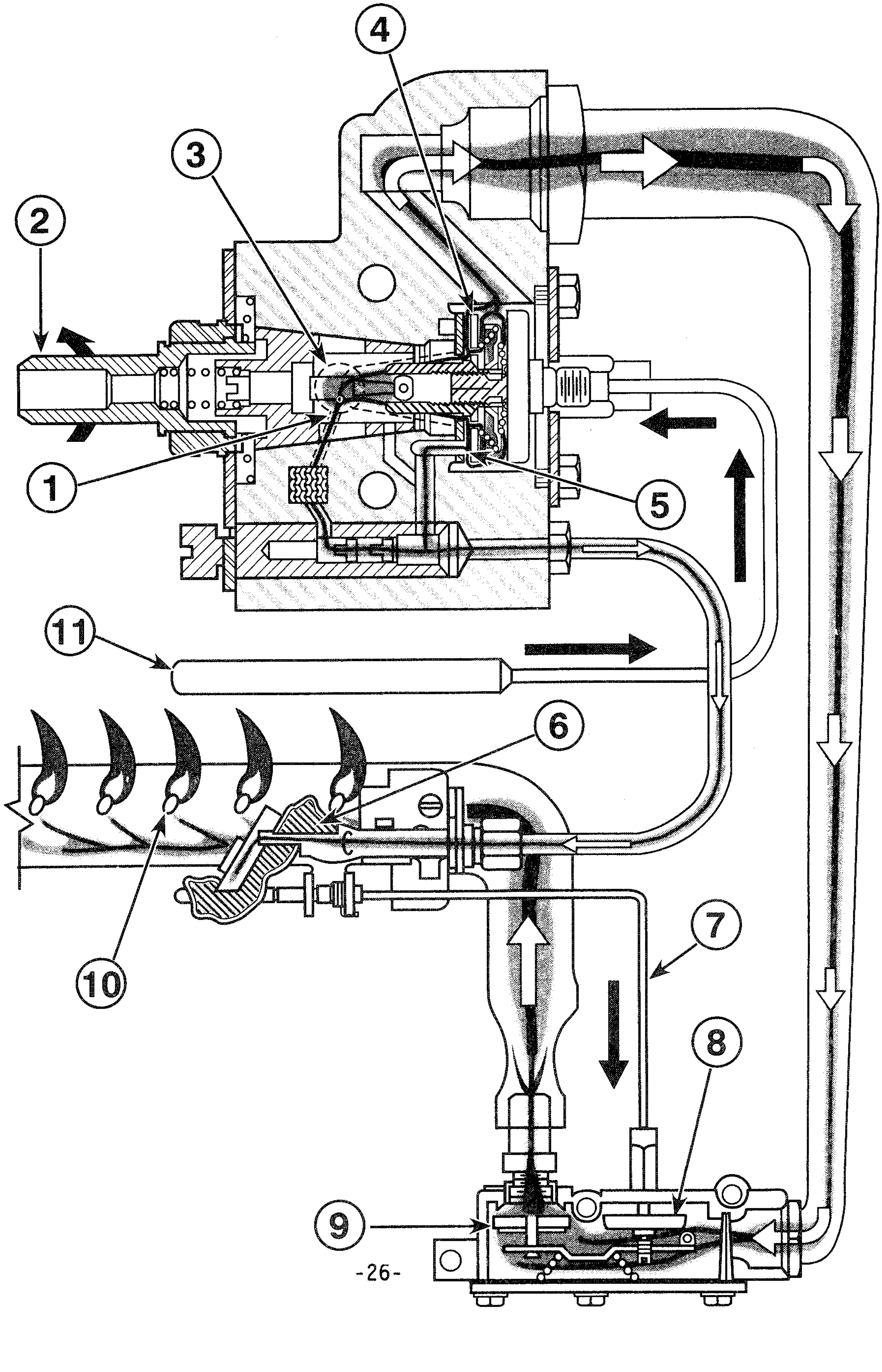
6. OVEN BURNER IGNITION SYSTEMS

350 DEGREE BAKE OPERATION; BELOW SELECTED TEMPERATURE

1. STANDING PILOT GAS FLOWS FROM THE MANIFOLD THROUGH THE THERMOSTAT AT ALL TIMES.
2. THE THERMOSTAT KNOB IS TURNED TO A SELECTED BAKE TEMPERATURE. TURNING THE KNOB ROTATES THE SHAFT AND UNSCREWS THE THERMOSTAT DISC FROM THE DISC SEAT.
3. GAS FLOWS INTO THE THERMOSTAT BODY FROM THE MANIFOLD. THIS OPENING REMAINS OPEN EXCEPT WHEN THE THERMOSTAT IS IN THE OFF POSITION.
4. GAS FLOWS PAST AND THROUGH THE DISC TO THE OVEN GAS VALVE.
5. ADDITIONAL GAS IS SUPPLIED TO THE PILOT THROUGH A PASSAGE BENEATH THE UNSEATED DISC.
6. THE SIZE OF THE PILOT FLAME INCREASES DUE TO THE ADDITIONAL GAS FLOW. THE INCREASED PILOT FLAME IS CALLED THE HEATER PILOT.
7. THE HEATER PILOT FLAME HEATS A MERCURY FILLED BULB FROM THE OVEN GAS VALVE.
8. THE DIAPHRAGM INSIDE THE OVEN GAS VALVE IS PUSHED DOWNWARD BY THE PRESSURE OF THE EXPANDING MERCURY WITHIN THE BULB.
9. PRESSURE FROM THE DIAPHRAGM DEPRESSES THE VALVE LEVER WHICH OPENS THE VALVE. GAS FLOWS FROM THE VALVE, THROUGH THE ORIFICE AND INTO THE BURNER.
10. GAS FLOWING FROM THE BURNER IS IGNITED BY THE PILOT FLAME.
11. THE INCREASING OVEN TEMPERATURE IS MONITORED BY ANOTHER MERCURY FILLED BULB FROM THE THERMOSTAT. AS THE MERCURY EXPANDS WITHIN THE BULB, PRESSURE IS PLACED ON THE THERMOSTAT DISC.

6. OVEN BURNER IGNITION SYSTEMS

350 DEGREE BAKE OPERATION; BELOW SELECTED TEMPERATURE



6. OVEN BURNER IGNITION SYSTEMS

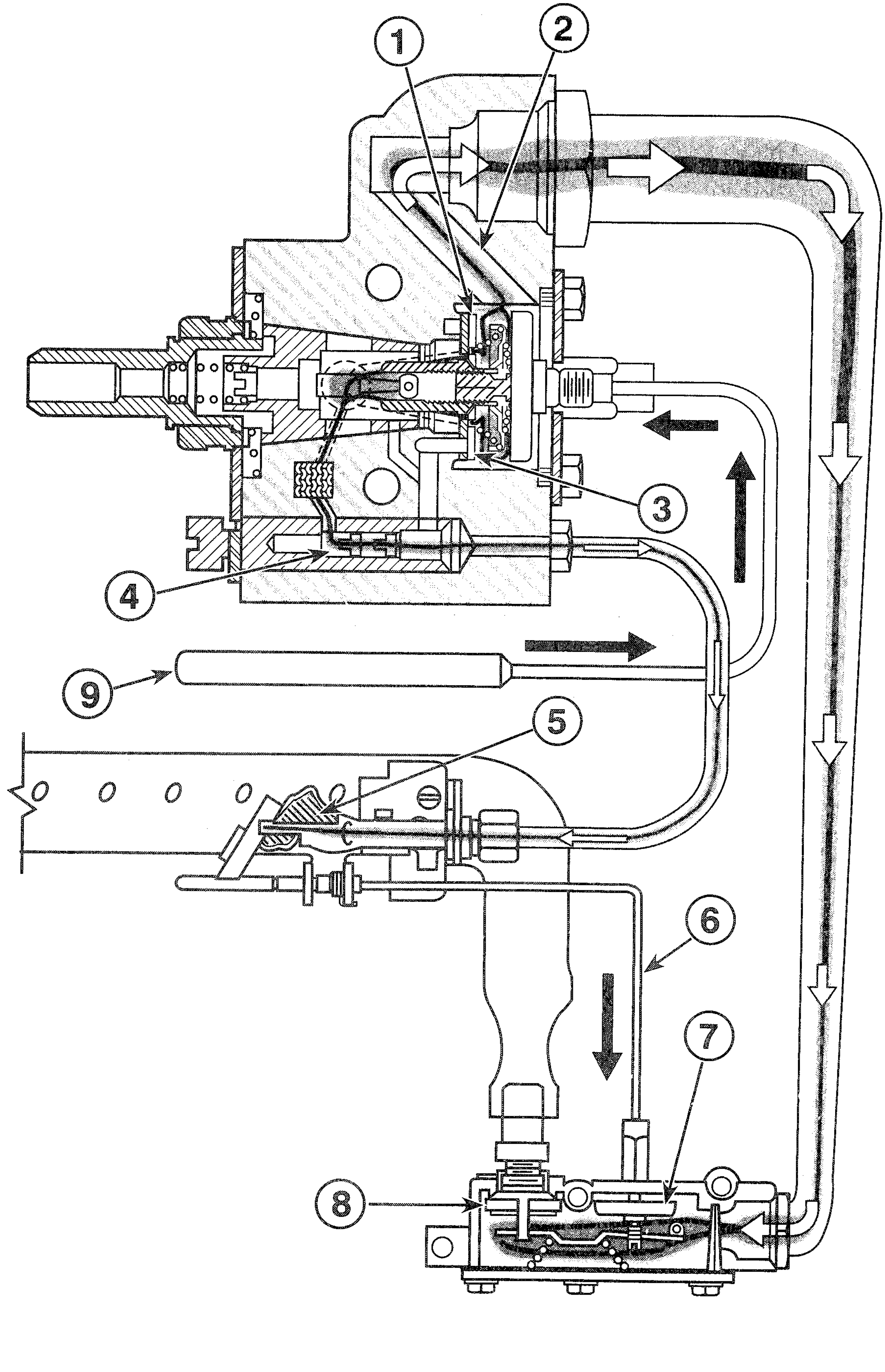
BAKE; PRE-HEATED AND CYCLED OFF

1. THE PRESSURE OF THE EXPANDING MERCURY HAS FORCED THE THERMOSTAT DISC AGAINST THE DISC SEAT.
2. GAS CONTINUES TO FLOW TO THE OVEN GAS VALVE THROUGH THE OPENINGS IN THE DISC.
3. HEATER PILOT GAS FLOW HAS BEEN SHUT OFF BY THE SEATING OF THE DISC.
4. STANDING PILOT GAS CONTINUES TO FLOW THROUGH THE THERMOSTAT.
5. THE PILOT SIZE RETURNS TO NORMAL OR STANDBY SIZE.
6. THE MERCURY FILLED BULB FROM THE OVEN GAS VALVE IS NO LONGER HEATED BY THE HEATER PILOT AND HAS COOLED.
7. PRESSURE AGAINST THE DIAPHRAGM IN THE OVEN GAS VALVE IS REDUCED AS THE MERCURY IN THE BULB COOLS.
8. THE OVEN GAS VALVE CLOSES AND SHUTS OFF THE GAS TO THE OVEN BURNER.
9. THE MERCURY FILLED BULB FROM THE THERMOSTAT BEGINS TO COOL TO RELIEVE THE PRESSURE AGAINST THE DISC. ONCE THE PRESSURE IS REDUCED ENOUGH, THE DISC WILL MOVE AWAY FROM THE DISC SEAT TO BEGIN THE NEXT HEATING CYCLE.

Note: At baking temperatures above 400 degrees, the Robertshaw control will reduce the size of the burner flame instead of cycling the burner off. The next sequence (BROIL) explains this operation called FLAME MODULATION.

6. OVEN BURNER IGNITION SYSTEMS

BAKE; PRE-HEATED AND CYCLED OFF



6. OVEN BURNER IGNITION SYSTEMS

BROIL; ABOVE 550 DEGREES

1. THE THERMOSTAT IS TURNED TO BROIL.

2. GAS FLOWS INTO THE THERMOSTAT FROM THE MANIFOLD.

3. HEATER PILOT GAS FLOWS THROUGH AN ALTERNATE PASSAGE WITHIN THE THERMOSTAT. THIS PASSAGE IS USED FOR BROIL ONLY.

4. THE THERMOSTAT DISC HAS BEEN PUSHED TO THE SEATED POSITION BY THE EXPANSION OF THE MERCURY IN THE THERMOSTAT MERCURY BULB. THE NORMAL PASSAGE FOR GAS FLOW TO THE HEATER PILOT HAS BEEN CLOSED BY THE SEATING OF THE DISC.
   GAS CONTINUES TO FLOW TO THE OVEN GAS VALVE THROUGH THE OPENINGS IN THE DISC.

5. GAS FLOW THROUGH THE OPENINGS IN THE DISC IS REGULATED BY THE SECONDARY DISC. THE SECONDARY DISC IS PUSHED CLOSER TO THE MAIN DISC BY THE INCREASING PRESSURE IN THE MERCURY FILLED THERMOSTAT BULB.

6. THE HEATER PILOT SIZE REMAINS CONSTANT AS LONG AS THE THERMOSTAT IS IN THE BROIL POSITION.

7. THE MERCURY FILLED BULB FROM THE OVEN VALVE IS HEATED CONSTANTLY DURING BROIL.

8. THE OVEN VALVE DIAPHRAGM REMAINS FLEXED DUE TO THE PRESSURE OF THE HEATED MERCURY.

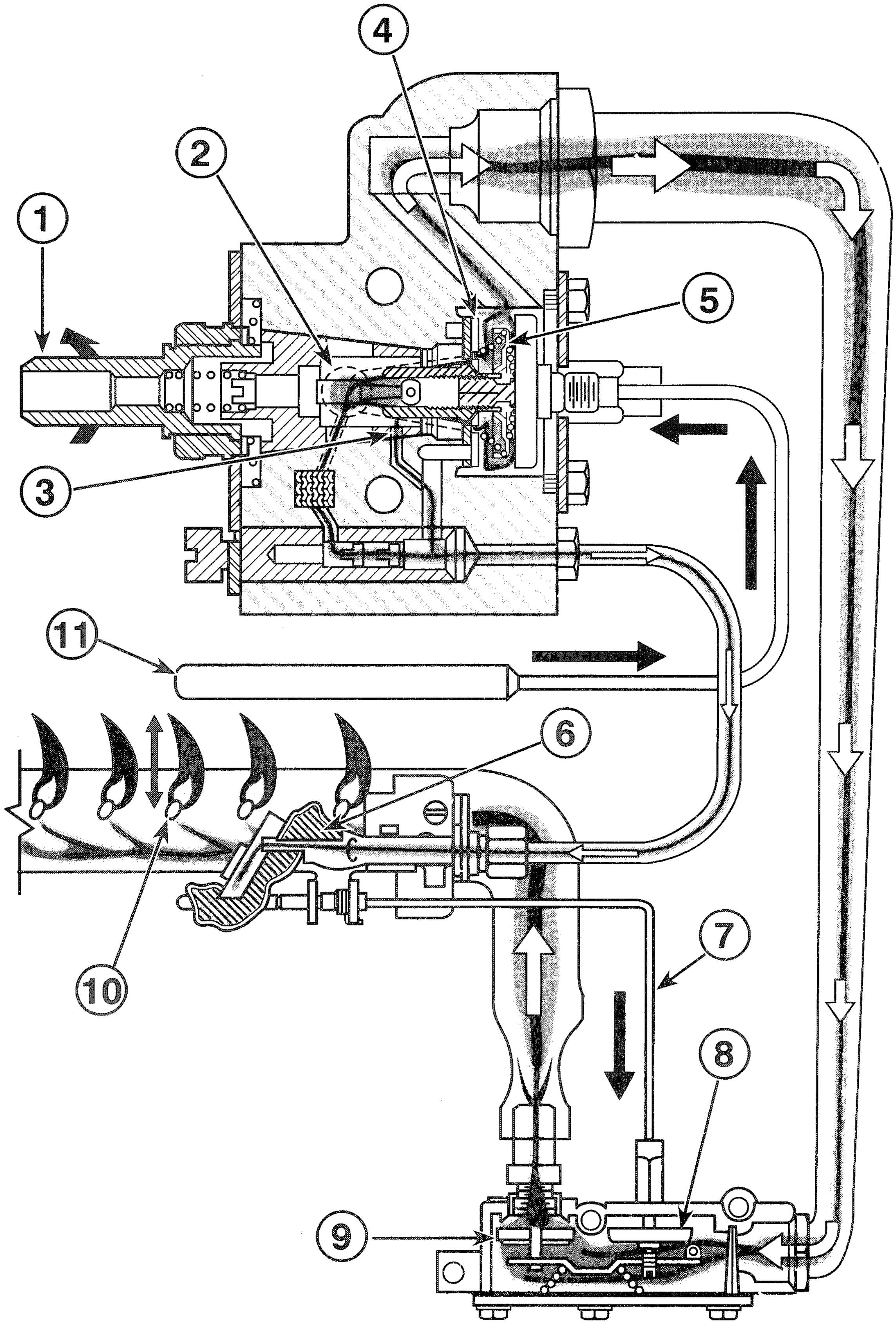
9. THE VALVE SEAT REMAINS OPEN ALLOWING GAS TO FLOW TO THE BURNER.

10. THE BURNER FLAME HEIGHT WILL INCREASE AND DECREASE IN PROPORTION TO THE MOVEMENT OF THE SECONDARY DISC TOWARD THE MAIN DISC.

11. THE MERCURY INSIDE THE OVEN THERMOSTAT BULB EXPANDS AND CONTRACTS WITH OVEN TEMPERATURE CHANGE. THE MODULATION OF THE BURNER FLAME WILL KEEP THE OVEN AT AN AVERAGE BROIL TEMPERATURE OF 575 TO 600 DEGREES.

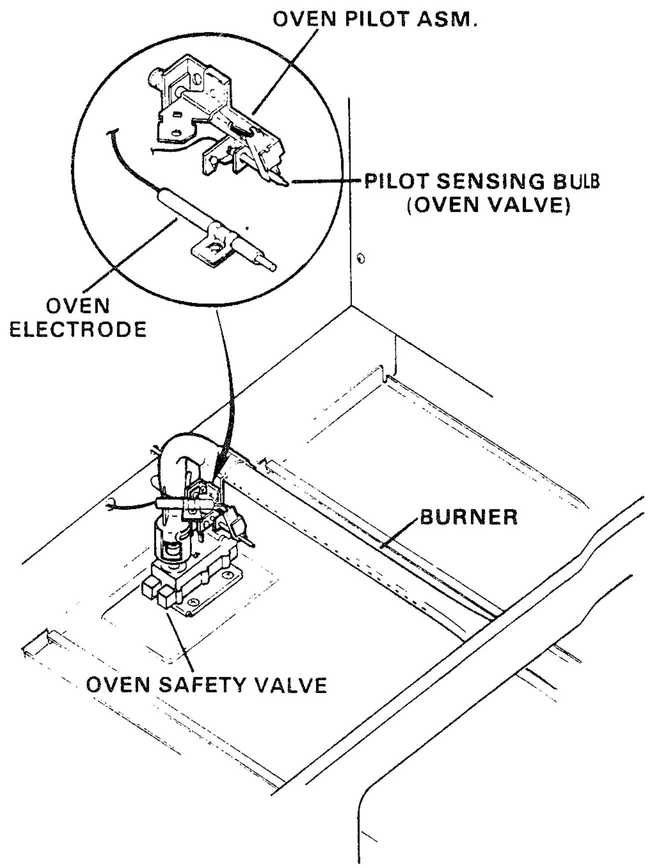
6. OVEN BURNER IGNITION SYSTEMS

BROIL; ABOVE 550 DEGREES



6. OVEN BURNER IGNITION SYSTEMS

B. Spark Pilot System



SYSTEM IDENTIFICATION
As with the standing pilot systems, the same two suppliers, ROBERTSHAW and HARPER WYMAN have supplied spark pilot systems used on GE, Hotpoint and RCA brand ranges. The HARPER WYMAN control is currently used on all models in production with a spark pilot system.

Within the same brand, the standing pilot and spark pilot thermostats are identical in appearance when held side by side.

It is not uncommon for a technician to install what he thinks is the correct replacement thermostat only to find he installed a spark thermostat on a range with a standing pilot or vice versa.

The best way to identify the type of control is to look at the control shaft. HARPER WYMAN color codes the standing pilot thermostat with green paint on the tip of the shaft.(spark pilot has no color code).

ROBERTSHAW includes the spark switch with their spark pilot thermostat.

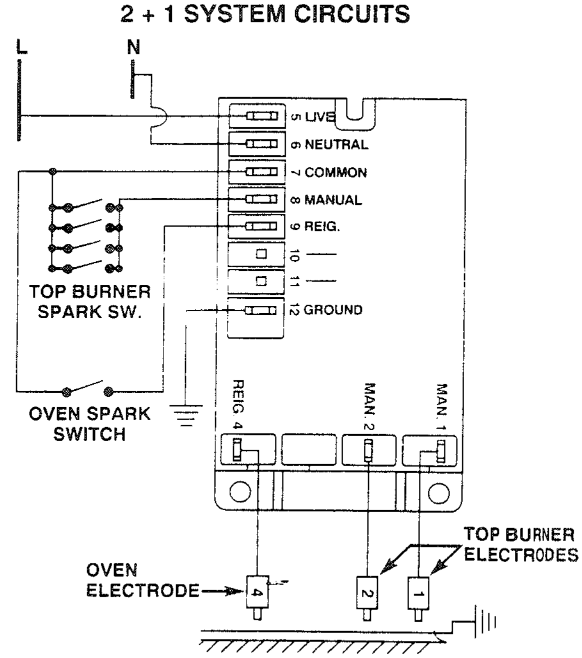
SYSTEM OPERATION
The spark pilot system works identical to the standing pilot system with one exception. The standing pilot is lit only when the oven is in use and will go out when the thermostat is turned to the OFF position.

Ranges with spark lit oven pilots will also have spark lit top burners.

A common spark module is used to generate the sparks for ignition of the oven burner and the top burners. This spark system is called a "2+1" ignition system as the system has two top burner spark electrodes plus one oven spark electrode.

The oven electrode circuit has flame sensing, re-ignition capabilities. The operation of this feature is explained further in this section.

2 + 1 SYSTEM CIRCUITS



6. OVEN BURNER IGNITION SYSTEMS

Moving the thermostat from the OFF position results in three events:

1. Opens a passage inside the thermostat to allow gas to flow to the oven pilot. (this passage is open at all times on the standing pilot system).
2. Opens the gas valve within the thermostat allowing gas to flow down to the oven gas valve.
3. Closes the contacts in the spark switch which is mounted on the thermostat shaft.

Closing the contacts of the spark switch completes a circuit to the primary of the spark module. The module releases a DC voltage of approximately 15,000 volts in pulses at the rate of about two pulses per second.

At the oven pilot, the high voltage pulses are used to generate sparks across a 1/10 inch gap from the tip of the spark electrode to a grounded bracket.

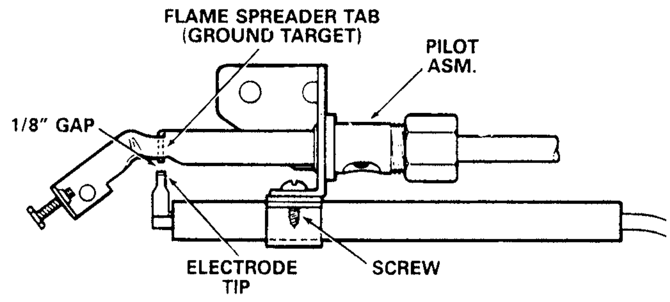
As soon as the sparks ignite the oven pilot, the flame recognition circuits within the spark module sense the presence of the flame and automatically stop the sparking process.

Just as described under FLAME SENSING SPARK IGNITION in the SURFACE BURNER IGNITION SYSTEMS section of this manual, the ability of the spark module to sense the presence or the pilot flame is based on the fact a flame is a good conductor of electrical current. Current will pass through the flame but it will be rectified by the flame into DC.

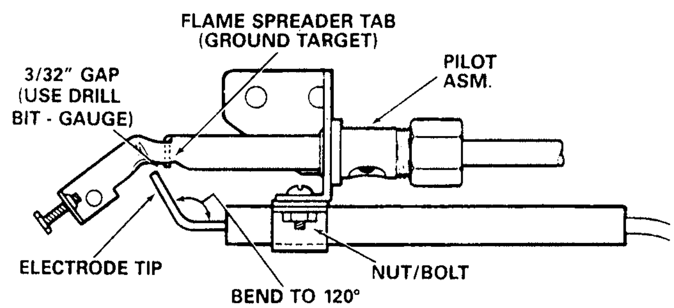
When the pilot flame ignites, a circuit through the pilot flame is placed in parallel with the primary of the spark module. This circuit is through the electrode lead, the pilot flame to ground.

This circuit has the same effect as placing a diode in the circuit from the primary of the spark module to ground. The voltage available to the spark module is reduced and converted into pulsating DC.

ROBERTSHAW PILOT ASSEMBLIES

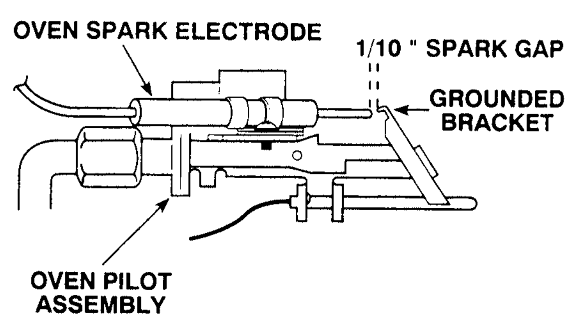


ORIGINAL TYPE IGNITER



REPLACEMENT - NEW TYPE IGNITER

HARPER WYMAN PILOT ASSEMBLY



6. OVEN BURNER IGNITION SYSTEMS

As long as the pilot flame stays lit, the affects of the parallel circuit will prevent the spark module from operating.

*If the pilot should go out, the parallel circuit opens and full power is available to the spark module. Sparking occurs immediately and continues until the pilot ignites.

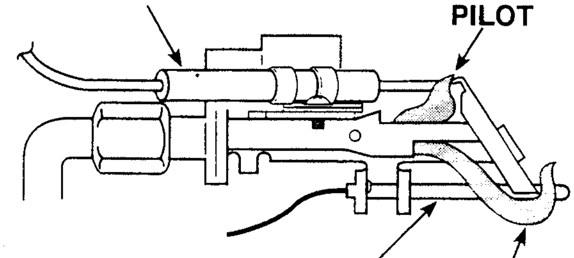
Once the pilot is lit it immediately begins to heat the mercury filled bulb from the oven gas valve.

Burner ignition will occur within 30 to 60 seconds.

The system will operate exactly like the standing pilot system once the spark-lit pilot is lighted.

When the oven thermostat is turned to OFF, gas flow to the oven pilot is shut off and the contacts of the spark switch are opened.

The system remains in this condition until the thermostat is turned for the next cook cycle.



*In order for the flame recognition circuit to sense the presence of the flame, the pilot flame must complete the circuit from the tip of the electrode to the grounded bracket.

Conditions such as low flame height, too wide of a spark gap, fluctuations of the flame due to a draft, etc. can interrupt the circuit resulting in sparking after the pilot is lit.

6. OVEN BURNER IGNITION SYSTEMS

C. GLOW BAR IGNITION SYSTEM

SYSTEM IDENTIFICATION

Here again, two different suppliers of glow bar ignitors have supplied components used on GE, Hotpoint and RCA brand appliances. The two suppliers are the CARBORUNDUM and NORTON companies.

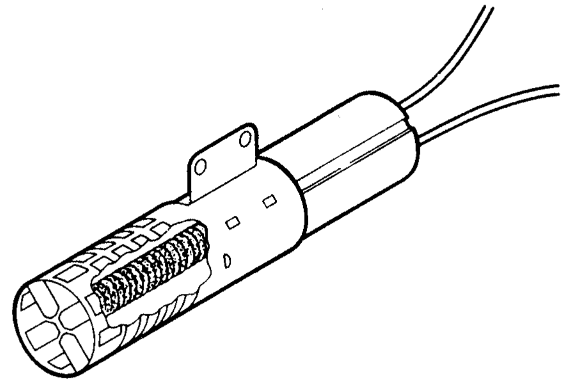
There are two major differences between the ignitor brands that must be pointed out.

1. SHAPE
   The CARBORUNDUM ignitor is cylindrical (commonly called round)

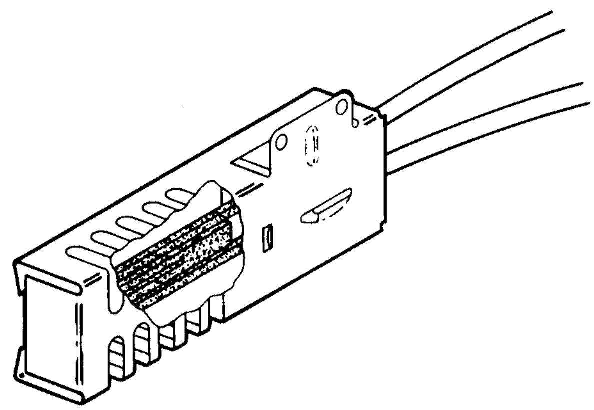
   The NORTON ignitor is rectangular (commonly called square).

2. OPERATING CURRENT
   The CARBORUNDUM ignitor limits the operating current flow in the circuit to 2.5 to 3.0 Amps.

   The NORTON ignitor limits the operating current flow in the circuit to 3.2 to 3.7 amps.



CARBORUNDUM GLOWBAR



NORTON GLOWBAR

SYSTEM OPERATION

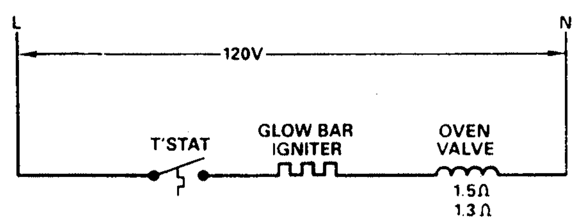
The glow-bar ignition system consists of three main components:

1. The thermostat (or electronic range control).
2. The glow-bar ignitor.
3. The oven gas valve (also called the safety valve).

Other accessories such as a fuse, timer contacts, door switches, etc. may be inserted in the circuit, but the basic operation of the three main components remains the same.

The thermostat, ignitor and gas valve are wired in series.

The thermostat knob is turned to a selected setting closing a set of electrical contacts in the thermostat to apply power to the series circuit.



TYPICAL GLOWBAR IGNITION CIRCUIT

6. OVEN BURNER IGNITION SYSTEMS

With power applied, the ignitor begins to heat. The electrical resistance of the ignitor will <u>decrease</u> as the surface temperature of the ignitor <u>increases</u>.

The current flowing in the series circuit increases in proportion to the drop in ignitor resistance.

As the current flows through the oven gas valve, it passes through a series of heater wires.

The heater wires are wrapped around a bi-metal arm which will flex and open the valve as the arm is heated to the flexing temperature.

The increasing current flow in the circuit raises the amount of heat produced by the heater wires. The bi-metal arm will reach flexing temperature and open the valve when the current flow approaches its peak which is 2.5 to 3 Amps with the Carborundum ignitor or 3.2 to 3.7 Amps with the Norton ignitor.

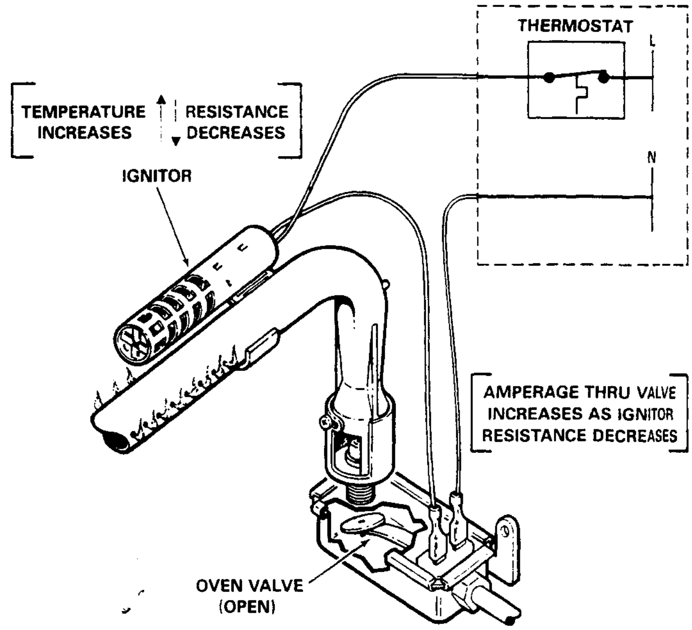
By the time the current has risen high enough to open the valve, the surface temperature of the ignitor is between 1800 to 2500 degrees F.

The gas flows out of the valve and into the burner. As the gas exits the burner, a portion of the gas flows across the hot ignitor and ignition occurs.

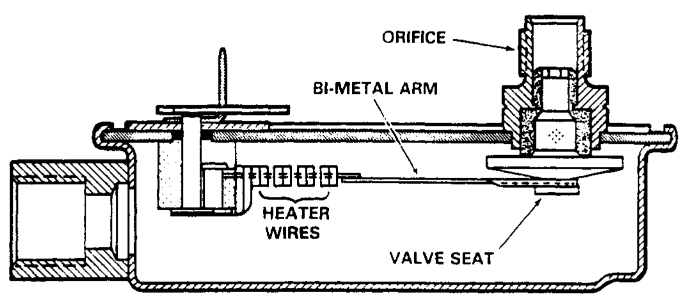
The ignitor side of the burner is lit first. The flame then travels to the other side of the burner by way of a cross-over slot to ignite that side of the burner.

The ignitor will remain energized at all times when the burner is lit. Once the oven reaches the selected temperature, the thermostat contacts will open and remove power from the ignitor/valve circuit. The valve will then close after a few seconds and the burner flame will go out.

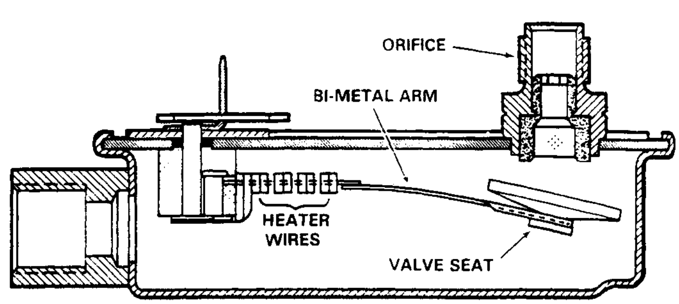
SERIES IGNITOR/VALVE CIRCUIT



CLOSED



OPEN



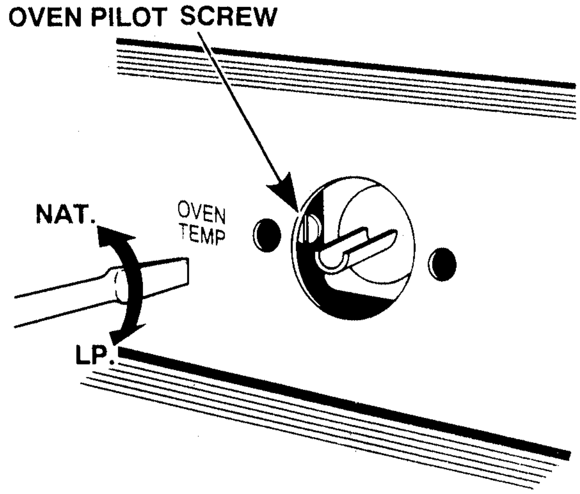
6. OVEN BURNER IGNITION SYSTEMS

OVEN BURNER PROBLEM SOLVING

1. STANDING AND SPARK PILOT SYSTEMS

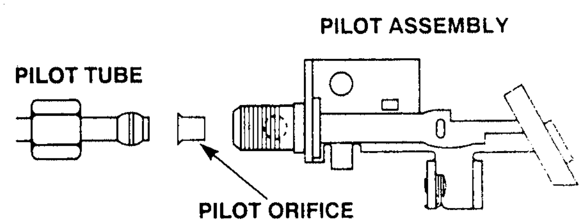
A. NO PILOT OR PILOT TOO SMALL :

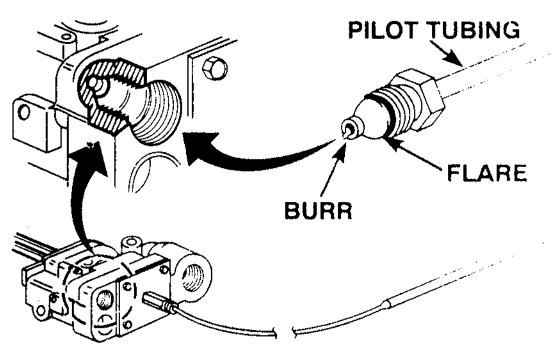
1. No gas available to range.
2. Pilot nat/lp selector in wrong position.
3. Blocked or partially blocked orifice at pilot assembly.
4. Burr on thermostat end of pilot tube.
5. Blockage in pilot tubing.
6. Kink in pilot tubing.
7. Blocked pilot passage in thermostat.
8. Low gas pressure.



B. BURNER FLAME SIZE INCREASES AND DECREASES BUT WON'T CYCLE OFF

1. Normal condition at bake temperatures above 400 degrees on models using the ROBERTSHAW thermostat
2. Normal condition during broil with either brand thermostat.
3. * Standing pilot too large.
4. * Heater pilot too small.
5. Mercury filled bulb from oven valve improperly positioned in pilot flame or bent away from flame
6. Kink in pilot tubing restricting gas flow.
7. Debris on thermostat seat preventing disc from seating (results in a constant heater pilot).





* Be sure oven pilot selector is set for the correct type of gas (natural or lp).

6. OVEN BURNER IGNITION SYSTEMS

2. GLOW BAR IGNITION PROBLEM SOLVING

A. IGNITOR DOESN'T GLOW

1. Remove ignitor and measure ignitor resistance. Resistance should be between 50 and 150 Ohms. (The value of the resistance is not important as long as the ignitor is not open or shorted.)

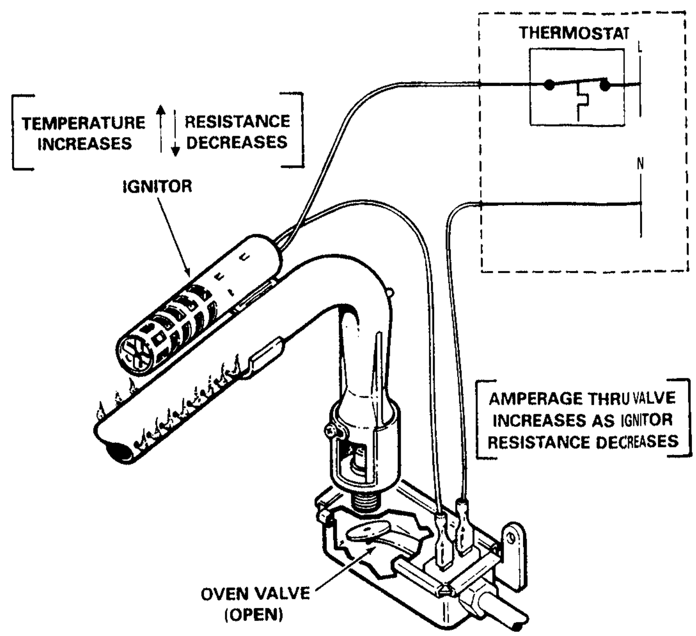
2. With at least one ignitor lead disconnected, measure the voltage applied to the ignitor. Measure from lead to lead and each lead to ground.

   If line voltage is measured from lead to lead, the ignitor is bad and needs to be replaced.

   If line voltage is measured from one ignitor lead to ground, look for an open circuit in the gas valve.

   If line voltage cannot be measured on either lead to ground, refer to the wiring diagram and mini-manual and continuity test the components "up stream" from the ignitor such as the thermostat, clock contacts, fuse (some models), door switch, etc.

SERIES IGNITOR/VALVE CIRCUIT

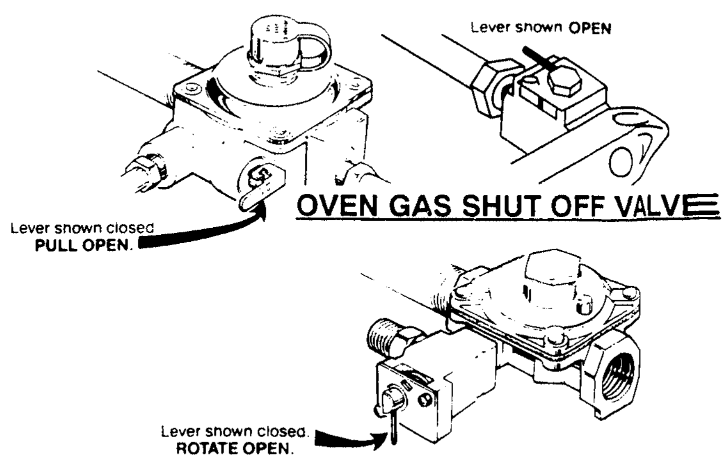


B. IGNITOR GLOWS BUT VALVE WON'T OPEN

1. Oven shut-off valve in closed position.

2. Ignitor has aged or is cracked and will no longer allow enough current flow for the valve to open.

NOTE: When measuring the current flow through the ignitor circuit, shut the gas off to the oven at either the main shut-off for the range or at the oven (only) shut-off located on the manifold or at the pressure regulator.

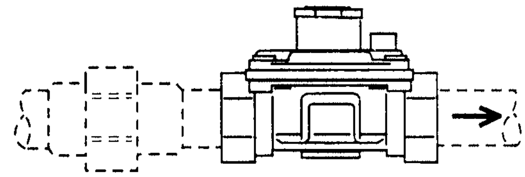


7. GAS PRESSURE AND PRESSURE REGULATORS

For any burner to burn properly, it must be suppled with the correct amount of gas.

Gas flow to the burner is determined by:

1. The pressure at which the gas is supplied.
2. The size of the opening in the gas metering orifice.

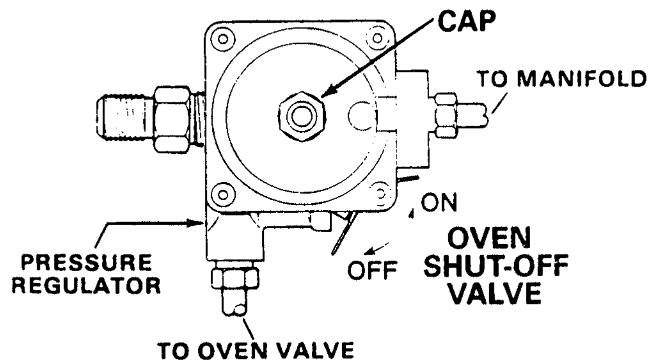


PRESSURE REGULATOR

One of the most overlooked sources of problems on a gas range is improper gas pressure.

Too little pressure will result in small burner flames. Models with standing pilot or spark-lit oven burners will be affected the most by low pressure as the non-adjustable oven pilots will be too small to heat the mercury filled bulb from the safety valve. This will result in a "no oven" complaint.

Too much gas pressure will result in excessive flame length and yellow tipping of the burner flames. (This would be excessive yellow tipping that cannot be eliminated by air shutter adjustments on models with shutters.)



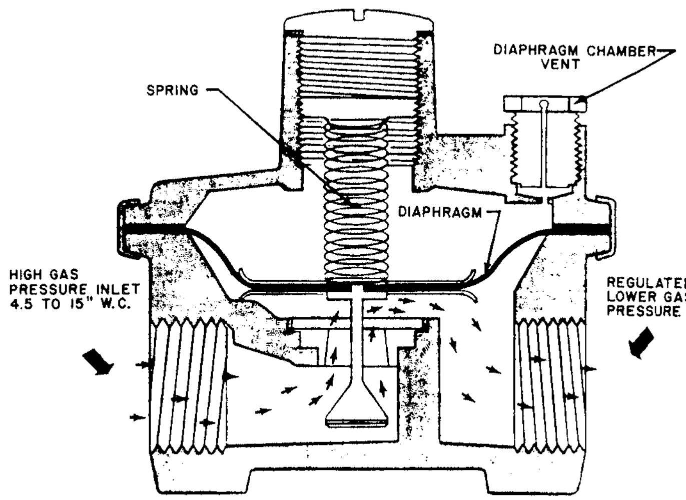
To maintain the gas at a constant pressure, a pressure regulator is used. All gas ranges manufactured since 1973 are equipped with a gas pressure regulator. The regulator maintains the gas supplied to the burners at a constant pressure. The regulator can only reduce pressure and can do nothing to correct a problem resulting from low pressure coming into the home.

Pressure regulators differ in size, shape and location on the appliance. In spite of these differences, all appliance pressure regulators operate basically the same way.

7. GAS PRESSURE AND PRESSURE REGULATORS

The cut-away view of the regulator shows the internal working components.

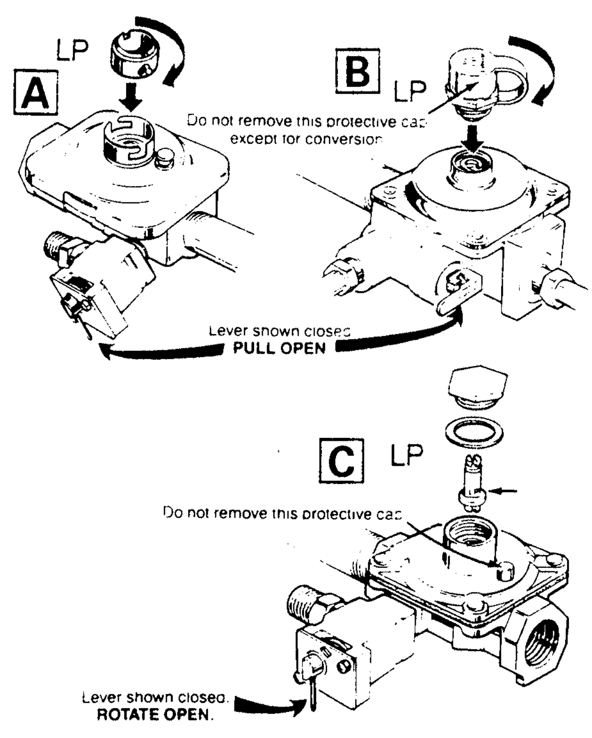
In the illustration, gas enters the left side of the regulator. (All appliance regulators use an arrow on regulator body to indicate the direction of gas flow.)



The pressure of the incoming gas pushes against a spring-loaded diaphragm forcing the diaphragm upward. The diaphragm spring works against the gas pressure and places downward pressure on the diaphragm. A tapered plug is suspended from the diaphragm. As the diaphragm moves up and down, the tapered plug is moved in and out of the gas passage way to restrict or increase gas flow and pressure.

As the gas pressure against the diaphragm drops, the tension from the spring pushes the diaphragm downward. The downward movement of the diaphragm moves the tapered plug out of the gas passage way. Additional gas and pressure now flow through the passage way pushing the diaphragm back up. This upward movement pulls the tapered plug into the passage way reducing the pressure. Once again, the tension from the spring pushes the diaphragm downward and the cycle repeats itself.

The pressure is maintained at a constant level by the movement of the diaphragm.



The amount of spring tension applied to the diaphragm determines the output pressure of the regulator. When converting a pressure regulator from natural gas to LP gas, additional tension is applied to the diaphragm spring to increase the output pressure. As shown in the illustration, spring tension is increased by using some type of device, either a reversible plunger or a reversible spring access cap to place the additional pressure on the spring.

As a safety feature, the regulator will "lock up" and stop all gas flow to the appliance in the event of any condition that would place extreme pressure in the incoming gas supply line. The regulator can be unlocked by removing the spring access cap and pushing down on the diaphragm with a blunt object such the eraser end of a pencil.

7. GAS PRESSURE AND PRESSURE REGULATORS

MEASURING GAS PRESSURE

Gas pressure for home use is rated in inches of water column pressure (WCP). It takes 28 inches of water column pressure to equal 1 pound per square inch (PSI).

In most locations, natural gas entering the home is regulated between *6 and 7 inches WCP. Liquified petroleum (LP) gas is regulated to 11 inches WCP. The appliance pressure regulator reduces the incoming pressure to the required amount which is usually 4 inches WCP for natural gas installations (there are two GE models that require 6 inches WCP natural gas) and 10 to 10 1/2 inches for LP installations.

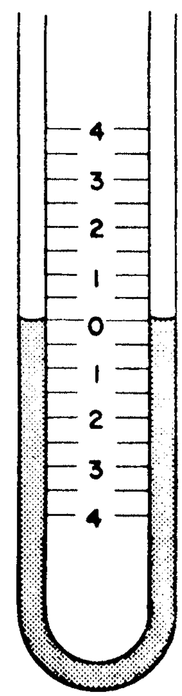
A manometer is used to measure gas pressures in inches of water column. A manometer is a clear tube shaped like the letter "U". Markings on each leg of the tubing divide the tubing into increments of inches. Usually the mid point of each leg is the zero inches point and the one inch increments extend above and below this point.

To use the manometer pour enough water into the tube to bring the water level of both legs to the zero point. Using a little food coloring in the water will make reading the gauge easier.

* There are areas, especially in older sections of most major cities, where the supply pressure will drop as low as 2 to 3 inches wcp.

In these areas, appliances requiring 4 inches of pressure may operate reasonably well. However, models which operate on 6 inches wcp will most likely operate poorly, resulting in a service call. There is nothing the technician can do to make the appliance operate correctly when the pressure is too low. The best way to handle the situation is to show the customer what the gas pressure is, explain the pressure requirements of appliance (the required pressure is printed on the rating label) and encourage the customer to contact the gas company.

MANOMETER



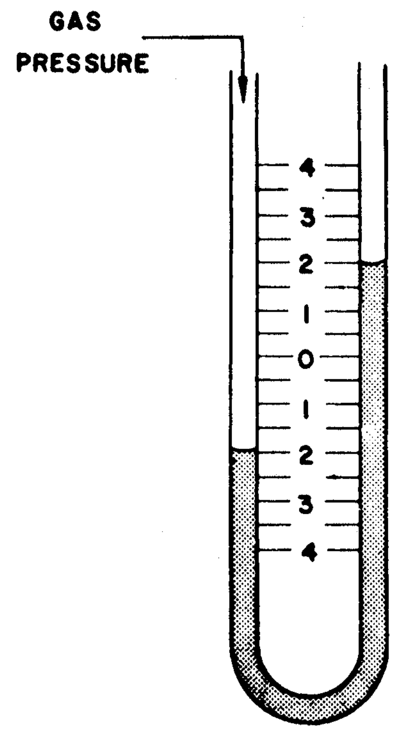
0" W.C.

NOTE: THIS MONOMETER COULD NOT BE USED TO MEASURE LP GAS PRESSURES.

7. GAS PRESSURE AND PRESSURE REGULATORS

Connect the tubing supplied with the manometer over one end of the manometer. Remove a burner from the appliance and place the other end of the tubing over the burner orifice. Turn on the gas to the orifice in test and light at least one other burner to serve as a load.

Observe the movement of the water in the manometer. The gas pressure is read by adding the inches of water movement in both legs of the gauge.



4" W.C.

EXAMPLE: As shown in the illustration, the manometer shows a water level of 2" below the zero point in the left leg. The right leg is 2" above the zero point. By adding the movement of water in both legs, the manometer reads 4" WCP.

APPLIANCE REGULATOR TEST

When measuring the gas pressure, examine the appliance rating plate and find the pressure required.

Connect a manometer to one of the burner orifices and turn another burner on.

The gas pressure must not fall below 1/2 inch of the required operating pressure regardless of the number of burners in use.

If the gas pressure is too low with only one burner in operation or with no burners in operation, test the supply pressure.

SUPPLY PRESSURE TEST

The house supply pressure can be measured at the range by temporarily bypassing the appliance regulator.

With a manometer connected over one of the appliance orifices, remove the spring access cap from the regulator

Manually depress the regulator diaphragm using your finger. With the diaphragm depressed, the regulator is blocked open.

The pressure shown on the manometer is the house supply pressure.
DO NOT TURN ON ANY BURNERS WHILE HOLDING THE REGULATOR OPEN.

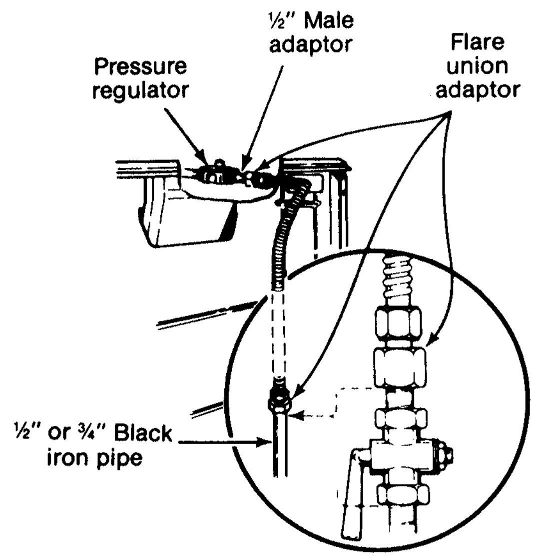
7. GAS PRESSURE AND PRESSURE REGULATORS

HOW TO MEASURE GAS VOLUME

Occasionally, it is necessary to measure the volume of gas supplied to the appliance. Usually a volume problem is indicated by the height of the burners dropping as additional burners are turned on.

The appliance regulator can be the source but most often gas supply lines are the cause of volume problems. Supply line problems include use of insufficient diameter supply line, a kink in the line, rust in the line or water in the line. The diameter of the supply line is governed by local codes, however for use with a gas range, the supply line must be at least 1/2 inch in diameter.

As the volume of gas is reduced, the gas pressure will decrease. This can be observed by connecting a manometer to the range and turning the burners on one at a time. With no burners on, the pressure will usually read normal. Observe the pressure drop as each burner valve is turned on and left on as additional burners are turned on. A pressure drop of 1/4 to 1/2 inch is not unusual. Large drops of 1" or more indicate a volume problem.



8. CONVERSION TO LP GAS

Because of the large difference in BTU ratings of the two gasses, conversion of the range is required when switching from natural gas to lp gas.

Liquified petroleum (LP) gas has a BTU rating nearly 2 1/2 times that of natural gas. Much less lp gas than natural gas is needed to power a burner at the same BTU output.

Although less of the hotter burning gas is required, about the same amount of primary air is needed with both fuels for complete combustion.

By increasing the pressure at which the gas is injected into the burner, the vacuum surrounding the gas stream in the negative pressure zone of the burner is increased. The increased vacuum pulls in a larger amount of primary air to mix with the reduced amount of fuel.

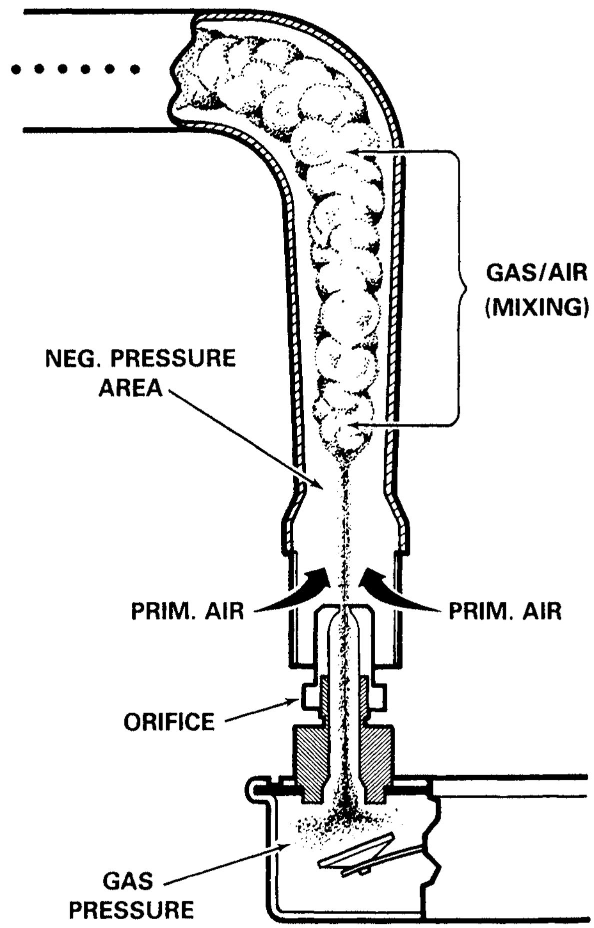
When converting the range for use with lp gas, the pressure regulator must be set to regulate at a higher pressure. This is accomplished by removing the diaphragm spring cover from the center of the regulator and using a device to increase the spring tension against the diaphragm. Increasing the spring tension results in an increase in the regulator output pressure.

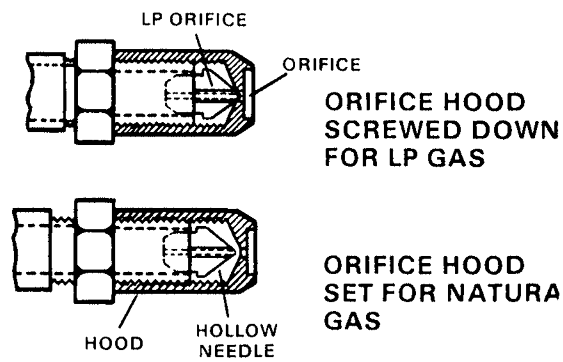
The next step is to reduce the diameter of the opening in the gas metering orifices. For most models, this is accomplished by tightening the natural gas orifice hoods down onto the lp sized orifice needles beneath the hoods.

Many of the new models will be shipped with two separate sets of orifices for the top burners. The range will be shipped with the natural gas orifices in place. When converting these models to lp, the natural gas orifices are removed and replaced with orifices sized for lp use.

Models with "SPILL-PROOF" burners require an optional kit containing lp orifices and various other necessary components to make the conversion.

OVEN BURNER



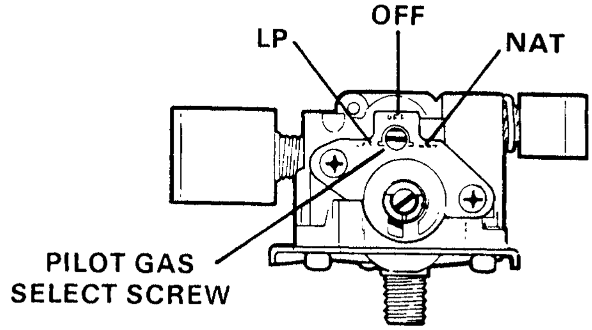


8. CONVERSION TO LP GAS

On models with standing pilot or spark pilot oven ignition, the NAT/LP selector screw on the thermostat body must be moved to the LP position. Moving the selector changes the size of an orifice within the thermostat to reduce gas flow to the oven pilot.

IMPORTANT The NAT/LP selector must be turned completely to the stop position in either the NAT or LP position. Maximum rotation of the selector screw is 1/2 turn. Failure to turn the selector to LP when converting to lp gas will result in an oven burner that does not cycle off during bake. The increased size of the pilot flame will keep the oven valve open at all times.

Air shutter adjustments may be needed after the conversion has been completed and the burners have been lit and observed.



FRONT VIEW
OVEN THERMOSTAT

LP CONVERSION PROBLEMS

Most conversions to lp gas are performed by an installer or home owner with little or no experience in making the conversion.

The most common error is over tightening of the convertible orifice hood resulting in damage to the fragile orifice needle beneath the hood.

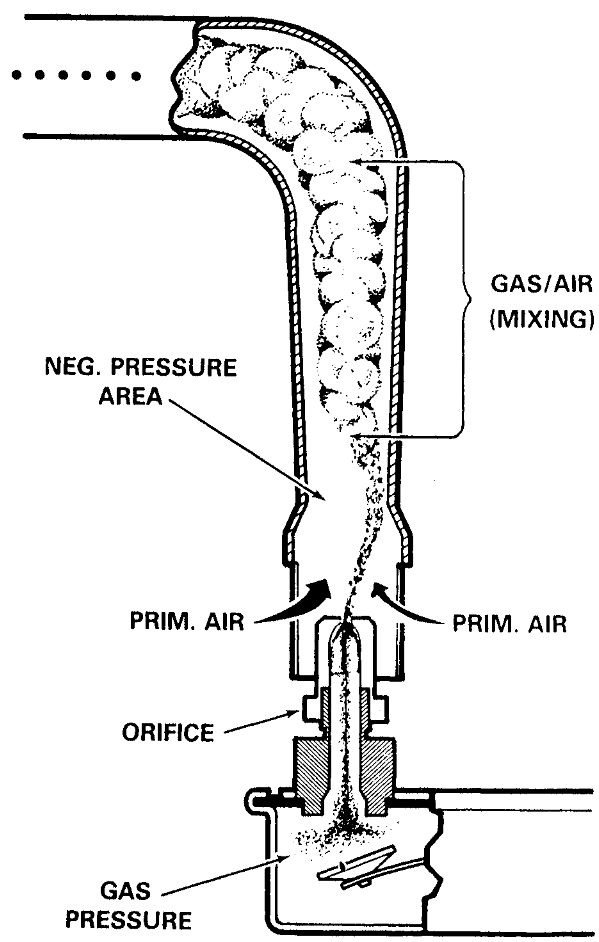
Over tightening results in the shape of the orifice needle opening being distorted from round to, at best, oval shaped.

The angle at which the gas is injected into the burner will be distorted, resulting in too little primary air being drawn into the burner mixing zone. Yellow tipping of the burner flames will result, indicating incomplete combustion is taking place.

The recommended correction for this condition is to remove the distorted orifice pin and replace the orifice hood with a hood sized for lp gas use.

Before installing the lp hoods, the damaged lp needles should be removed. This can be extremely difficult due to their tight fit in the valve or tubing.

OVEN BURNER

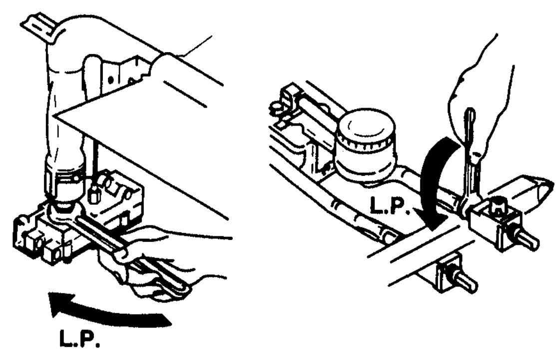


8. CONVERSION TO LP GAS

An alternate method is to cut the needles as close to the valve or tube as possible. Install the replacement hood onto the valve or tube only a few turns, keeping the maximum amount of distance possible between the old needle and the new hood. This prevents the remaining part of the needle from interfering with the flow pattern and amount of gas flowing through the new lp orifice hood.

With the replacement hood installed, a slight amount of flame adjustment can be made by turning the hood to increase or decrease tne distance from the orifice opening and the base of the burner.

Note: Some state and local codes prohibit the replacement of the orifice by itself by the service technician. In these areas, replacement of the entire valve or tubing assembly is required to replace damaged orifices. This is the main reason the orifice is usually not listed as a separate item in the repair parts manual.



After replacing the valve or tubing assembly, convert the part by using a flashlight to look into the orifice opening so you can see when the orifice needle and orifice hood make contact.

You may or may not feel an increase in the torque when turning the orifice hood and contact is made with the needle. Usually about 2 to 2 1/2 turns of the hood is all that is needed.