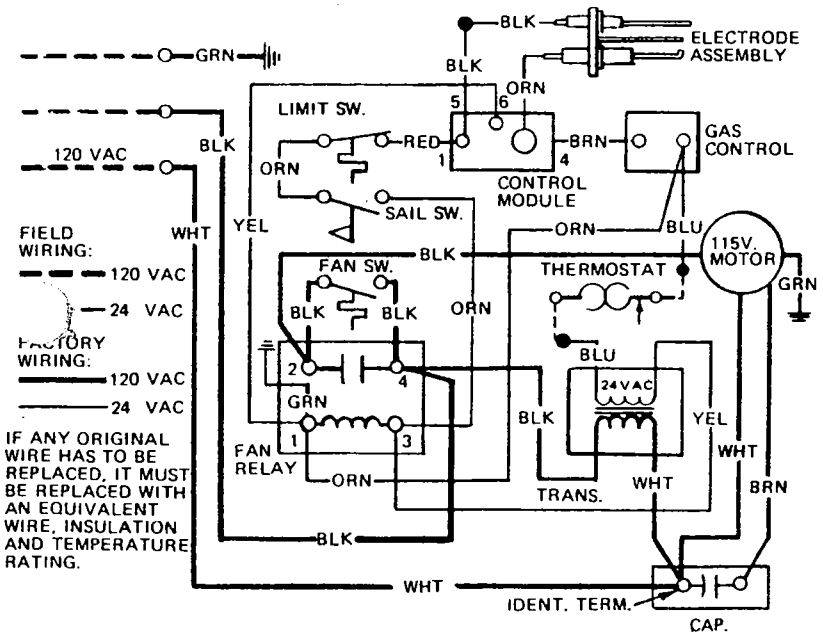
DUO-THERM OWNERS MANUAL

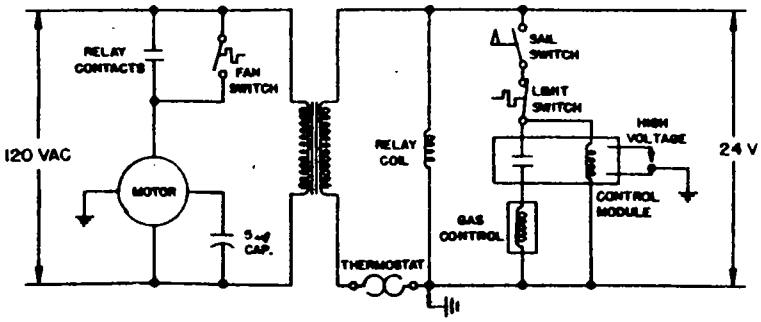
65941-001 Series

DIRECT SPARK IGNITION
120 VAC ONLY

GAS DIRECT-VENT FORCED AIR FURNACES

WIRING DIAGRAM AND SCHEMATIC





- IMPORTANT INSTRUCTIONS - MUST STAY WITH UNIT OWNER - READ CAREFULLY

FOR YOUR SAFETY:

If you smell gas:

1. Open Windows.
2. Don't touch electrical switches.
3. Extinguish any open flame.
4. Immediately call your gas supplier.

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this appliance.

Children and adults should be alerted to the hazards of high surface temperatures and should stay away to avoid burns or clothing ignition.

Young children should be carefully supervised when they are in the same room as the appliance.

Clothing or other flammable material should not be placed on or near the appliance.

UL® UNDERWRITERS LABORATORIES INC.® LISTED

APPROVED

LISTED BY U.L. FOR RESIDENTIAL, MOBILE HOME AND RECREATIONAL VEHICLE INSTALLATIONS.

CERTIFIED BY C.G.A. FOR USE IN MOBILE HOMES AND RECREATIONAL VEHICLE INSTALLATIONS.

CAUTION

This unit must be serviced only by an authorized service man. Modification of the appliance can be extremely hazardous and could lead to serious injury or death.

Form No. 19-1218 4/15/81

DUO-THERM Division
LaGrange, Indiana 46761

TO CONVERT FROM LP GAS TO NATURAL GAS

This unit is shipped from the factory equipped to burn LP Gas. It also is listed for use with Natural Gas. To operate this unit on Natural Gas, the following conversion instructions must be followed carefully: (This conversion should be performed by a qualified service person). For conversion refer to **FIGS. 1, 2 and 3.**

1. Be sure all gas and electricity to the appliance are off.
2. Remove the vent terminals (2) from the outside of the vehicle.
3. Disconnect the gas line and electrical wires from the furnace.
4. Remove the mounting screws and slide the inner casing out of the fixed casing.
5. Remove the cover panel.
6. Remove the burner assembly from the heat exchanger, being careful not to damage the burner mounting gasket.
7. Remove the burners from the burner assembly, keeping track of the order of the burners in the assembly.
8. Remove the LP gas orifices (Marked "63") and replace them with the Natural Gas orifice (Marked "53"). (Orifices are stored in bag attached to burner manifold).
9. Using a screwdriver, rotate the indicator on top of the gas valve to point toward "NAT".
10. Reassembly the burners to the burner box, in the same order as they were removed.
11. Reinstall the burner box on the heat chamber, being careful to seat the leading end of the burner into the "pockets" on the inside of the heat exchanger and taking care not to damage the burner box gasket.
12. Reinstall the cover panel.
13. Slide the inner casing assembly into the permanent casing and attach it using the screws previously removed.
14. Reinstall the vent terminals removed in Step 2.
15. Connect the gas line and electrical wires.
16. **CHECK ALL CONNECTIONS FOR GAS LEAKS USING A SOAP SOLUTION.**
17. **NEVER CHECK FOR LEAKS USING AN OPEN FLAME**
18. Follow normal lighting instructions.

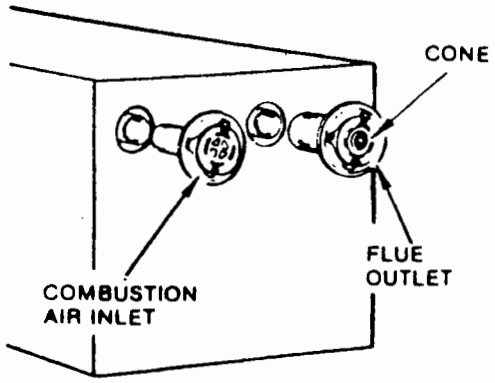


FIG. 1

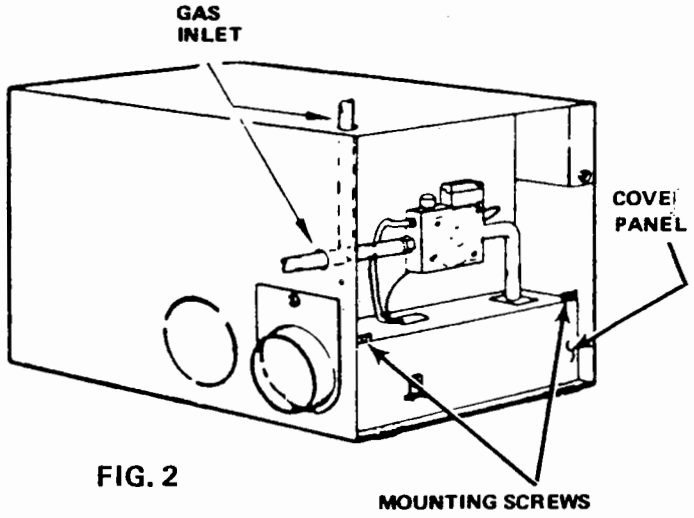


FIG. 2

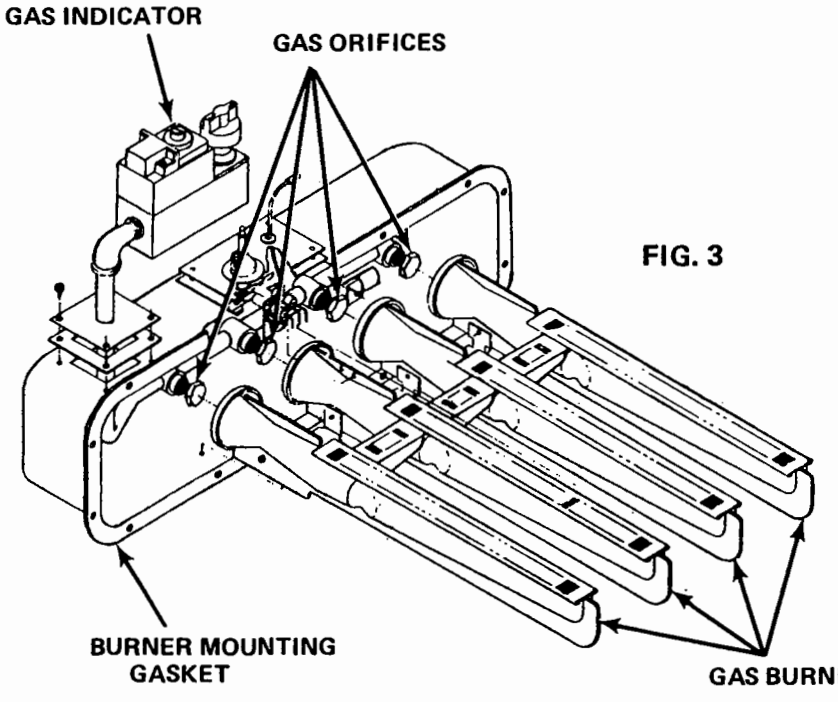
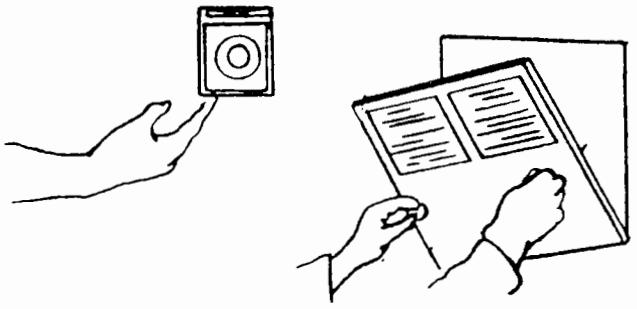


FIG. 3

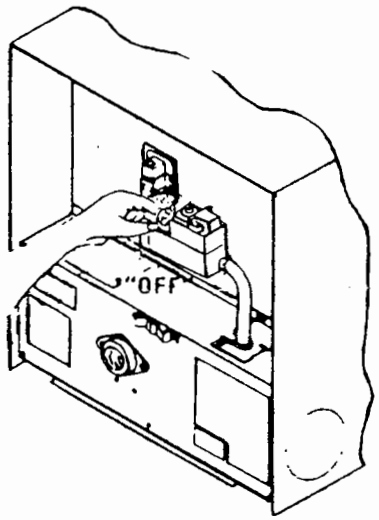
BEFORE PROCEDING CHECK ALL CONNECTIONS WITH A SOAP SOLUTION TO DETECT LEAKS. THIS ALSO SHOULD INCLUDE A CHECK OF THE FURNACE CONTROLS AND PIPING. NEVER CHECK FOR LEAKS WITH A LIGHTED MATCH.

IMPORTANT: FAILURE TO FOLLOW THESE LIGHTING INSTRUCTIONS EXACTLY MAY RESULT IN DAMAGE TO THE UNIT.

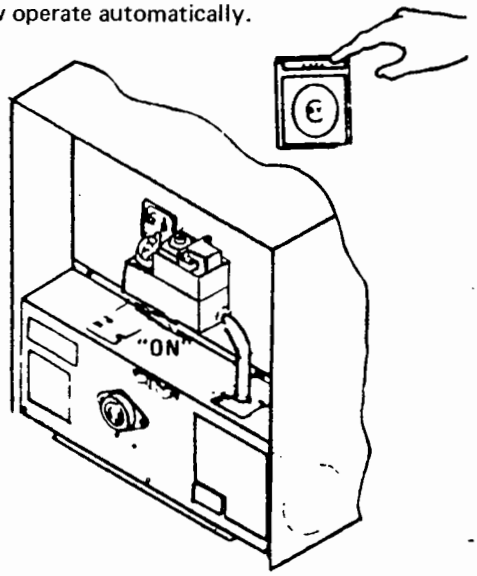
1 Set thermostat to "OFF" position.
Remove front panel.



2 Turn gas valve knob to "OFF" position.
Wait 5 minutes.

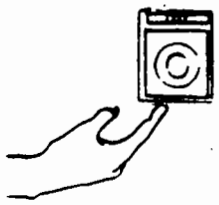


3 Turn gas valve knob to full "ON" position. Correct operation of the unit depends on this valve being in the full "ON" position. Never attempt to operate the unit with valve partially closed.
Set thermostat to "ON" position.
Set thermostat at desired temperature.
Furnace will now operate automatically.



4 Allow 5 to 8 seconds for burners to ignite.

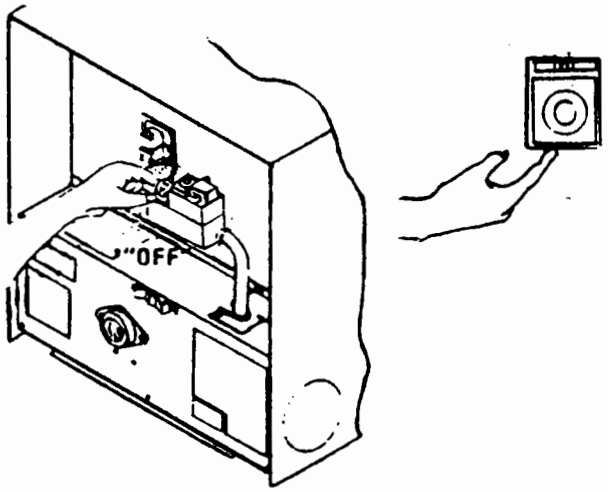
5 If burners do not light, set thermostat on "OFF" position. Wait 5 seconds, then re-set thermostat to "ON" position.



6 If ignition is not obtained after three tries, go to complete shut down and determine cause.

7 Replace furnace front panel when ignition is obtained.

8 **FOR COMPLETE SHUT-DOWN, TURN GAS VALVE KNOB TO "OFF". SET THERMOSTAT TO "OFF" SETTING.**



9 SEQUENCE OF NORMAL OPERATION

1. When the thermostat calls for heat, the fan relay closes immediately, and the blower motor is energized.
2. As the blower motor reaches approximately 75 percent of the normal r.p.m. (within 1 to 2 seconds) the combustion air switch, in response to the air flow that provides a supply of air for combustion, will engage allowing current flow to the automatic ignition device.
3. The automatic ignition device then simultaneously opens the main burner valve and provides the ignition spark. As soon as the flame is established, the spark ceases. Should the flame not be established within a period of 5 to 8 seconds, the system provides safety shut-down.
4. If within a period of approximately 1 minute after the main burner is lit, the thermostat is turned back, both the blower motor and gas valve are de-energized. However, if the furnace continues to run longer than 1 minute, which it normally should, a slight snap can be heard from within the casing. The snap is caused by the fan switch as it changes its position. After this occurs, if the thermostat is satisfied or turned back, the gas valve will close, the flame on the main burner will go out, but the blower will continue to run for a short period of time and will then shut-off. The purpose of this is to remove most of the remaining gases and heat from the heat exchanger.

10 COMPONENT PARTS FUNCTION

1. BLOWER ASSEMBLY

One motor is used to drive both the combustion air and the circulating air blower wheels. Although one motor drives both wheels, the blowers are separate. The combustion air blower is sealed so as to allow no passage of air between it and the circulating room air blower. The combustion air blower draws air from the outside atmosphere, discharges it into the combustion chamber, and forces the combustion products out the exhaust tube. The circulating room air blower pulls return air in and forces it across the heat chamber, discharging it to the area to be heated.

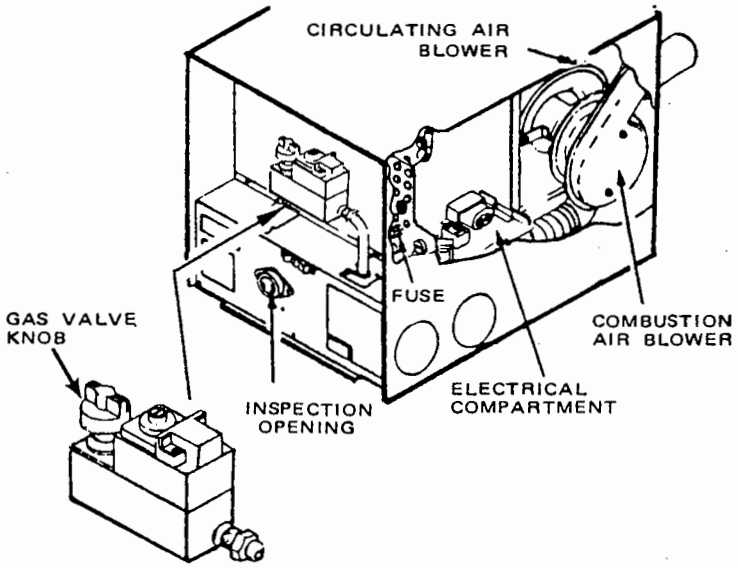
2. FAN SWITCH

The fan switch is to control the sequence of the blower operation. When the bimetal disc of the fan is heated to the operating temperature, the switch closes. This completes a circuit through the motor. The blower will continue to run as long as the chamber is hot even though the thermostat is satisfied and the main burner is off. When the chamber cools, the fan switch changes back to its original position and shuts the blower off.

3. AIR SWITCH

The combustion air switch has two purposes:

A. It is an "air prover". It operates in response to the current of air generated by the blower. Hence, if for any reason the air from the blower is not sufficient, the switch will not operate. This may be caused by a slow motor due to low voltage, restricted return air, or lint accumulation on the blower wheel.



B. The switch allows time for the blower to pull in sufficient air to support combustion before it engages. Once it engages, the gas valve opens, gas flows to the main burner, and ignition occurs.

4. LIMIT SWITCH

The purpose of the limit control is to turn off power to the ignition board and the gas control if the furnace becomes overheated. If the circulating air is blocked, even partially, the limit control will function and cause the main burner to short cycle. If short cycling exists, the furnace blower and the circulating air system should be thoroughly cleaned.

If the limit control is found to be defective, it can not be repaired. It must be replaced with a new one.

CAUTION: NEVER SHORT ACROSS OR BYPASS THE LIMIT CONTROL EVEN FOR ONLY TEMPORARY OPERATION.

11 MAINTENANCE AND CLEANING

NOTE: For continued satisfactory performance of this unit it is necessary that the control compartment be kept clean. Routine inspection, maintenance and cleaning is recommended at least on a yearly basis.

If for any reason the main burner has been allowed to operate with a high yellow flame, a soot formation is sometimes deposited inside the combustion chamber. The carbon deposit may be of such quantity that cleaning will be necessary. In the combustion chamber a vacuum cleaner is ideal to clean out any carbon deposit.

The blower motor should be oiled once each heating season with a few drops of SAE 20 motor oil. Inner casing assembly must be removed from outer casing shell to gain access to motor. **DO NOT USE LIGHT HOUSEHOLD OILS. DO NOT OVER OIL.**

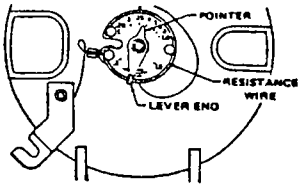
12 THERMOSTAT ADJUSTMENT

This unit is equipped with an adjustable thermostat. Improper setting of the heat anticipator can cause either abnormally short or long heating cycles resulting in discomfort.

For correct heating anticipator adjustment, proceed as follows:

Cycle system to determine if cycling rate is satisfactory. If adjustment is necessary, move pointer to a higher setting for longer "ON" cycle and to a lower setting for shorter "ON" cycle.

Suggested normal settings: **65900 Series (120VAC Models) .4**



13 SERVICE HINTS, DIAGNOSIS AND CORRECTIVE MEASURES

PROBLEM – NO HEAT

A. Check electrical supply to make sure that 120 volt A.C. is present at the power supply connection.

B. THERMOSTAT OFF: Check to be sure thermostat is calling for heat. Wire to thermostat could be off terminal.

C. MALFUNCTIONING COMBUSTION AIR SWITCH: Be sure the combustion air switch blade is moving far enough to close its contacts. If the switch is not closing, clean any dust or dirt from the actuator pin. Other reasons for switch not operating are:

1. Insufficient air speed (slow motor due to low line voltage, faulty motor, or lint and dust accumulation on the blower wheels, or restriction of return air to furnace).
2. Faulty combustion air switch—Replace switch if valve does not open when switch is engaged.

NOTE: TO SERVICE SWITCH, INNER FURNACE ASSEMBLY MUST BE REMOVED FROM OUTER CASING TO VISUALLY AND MANUALLY CHECK THE SWITCH.

D. GAS CONTROL VALVE: With test light check valve terminals. If current is present, but valve is not opening (when combustion air switch engages), replace control valve.

E. BLOWER NOT OPERATING: Check for burned-out motor or broken wire leads or connections.

F. DEFECTIVE TRANSFORMER: Check to see if 24VAC is present at BLUE and YELLOW leads of transformers. If not, replace transformer.

G. DEFECTIVE RELAY: If fan relay does not click when 24VAC is applied to terminals 1 and 3, replace relay. If relay does click but contacts 2 and 4 do not close, replace relay.

14 AUTOMATIC DIRECT SPARK IGNITION

1. PRINCIPLE OF OPERATION

To ignite the burner, it is necessary only to set the thermostat. The thermostat powers a relay which activates the blower motor which supplies the air necessary for combustion and to move the air switch to complete the circuit to simultaneously open the main burner valve and provide the ignition spark. As soon as the flame is established, the spark ceases. Should the flame not be established within a period of 5 to 8 seconds the system provides safety shut-down of the main valve and ignition spark.

Electronic flame sensing circuitry in the ignitor detects the presence or absence of main burner flame. If the flame is not established during the Flame Establishing Period, the system closes the gas valve and locks out. If the flame is extinguished during the duty cycle, the ignitor will provide one retry for ignition, before going into lockout. To reactivate, or retry for ignition, turn thermostat to "OFF" position, wait 5 seconds, then re-set thermostat to "ON" position.

2. DESCRIPTION

The direct spark ignition system consists of a solid state printed circuit control module, an electrode assembly and connecting high and low voltage wires.

3. REPAIRS

The solid state control module is not field repairable. Any modifications or repairs will invalidate the warranty and agency certifications.

WARNING: DO NOT APPLY POWER TO CONTROL MODULE UNLESS WIRING CONNECTIONS ARE COMPLETE AND ELECTRODE IS PROPERLY GROUNDED.

4. SYSTEM CHECKS

CAUTION: HIGH VOLTAGE IS PRESENT AT TERMINATION OF ORANGE WIRE ON IGNITOR MODULE BOARD.

A. POWER SUPPLY: Check voltage across secondard leads of transformer. If 24V AC is not present, with 110V AC applied to primary leads, replace transformer.

B. GROUNDING: It is essential to proper operation that the system be properly grounded. If a spark is present and the gas valve opens but the system shuts down after the trial for ignition period, check for proper ground. The following items should be checked:

1. Green wire to bottom of electrical box must be secure.
2. The burners and mounting brackets must be secure.

C. WIRING: Check all wiring for proper and secure connections. Be sure the wire connector is fully engaged in the control board. Check the high voltage wire for proper connection at both ends. Clean any corrosion that may interfere with good electrical contact.

D. HIGH VOLTAGE MALFUNCTION: If during the trial for ignition, the spark is intermittent and the valve may or may not open, the following should be checked:

1. Electrode spark gap – should be 1/8" ± 1/32".
2. Ceramic Housing – Check for cracks.
3. Electrode lead wires – Check for cracks or breaks.

E. VALVE MALFUNCTION: If there is power to the control module and a spark during the trial for ignition, but the valve will not open, check the valve for an open coil or other malfunction.

F. ERRATIC OPERATION: If the system operates properly for a period of time, but randomly shuts down during the duty cycle, or will not operate during cold starts, check the flame proving circuit (sensor wire) with a DC Microamp meter. The current should be 5 - 15 microamps. A low or marginal flame current may cause nuisance tripping. If this condition is experienced, the electrode location should be checked to make sure the sensor electrode is in the flame.

15 HIGH ALTITUDE OPERATION

When the unit is operated at altitudes higher than 4000 ft. above sea level, the gas input to the burners should be reduced 4% for each 1000 ft. above sea level.

Failure to derate the unit properly will cause inefficient operation of the burner, and could create carbon monoxide fumes. Re-entry of these fumes into the vehicle (due to improper installation, or through another opening in the coach) could endanger the life of anyone exposed to these fumes for a period of time.

ORIFICE GUIDE FOR ALTITUDE DERATING

Altitude In Feet	Rated Input In BTU/HR	
	60,000	
	Orifice Size	
	NAT	PROP
0-4500	53	63
5000	54	66
6000	55	66
7000	55	66
8000	55	67
9000	56	67
10,000	56	68
11,000	56	69
12,000	56	69