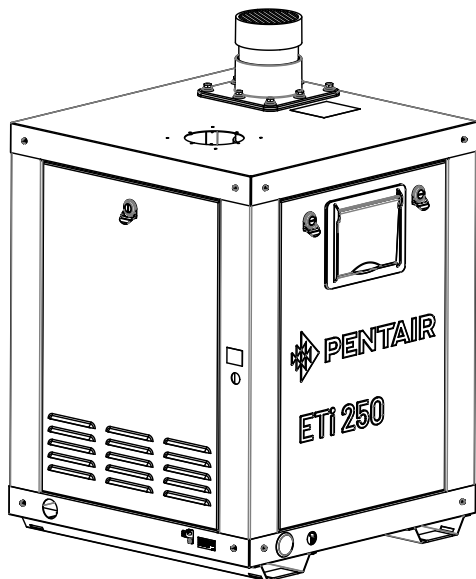




# ETi<sup>®</sup> 250

NATURAL GAS ORIFICE KIT (P/N 476369z)



## INSTALLATION GUIDE

### **IMPORTANT!**

**WARNING! FOR YOUR SAFETY: THIS PRODUCT  
MUST BE INSTALLED AND SERVICED BY  
AUTHORIZED SERVICE PERSONNEL  
QUALIFIED IN POOL/SPA INSTALLATION**

## CUSTOMER SERVICE / TECHNICAL SUPPORT

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**Hours:** 9:00AM to 7:00PM EST (6:00AM - 4:00PM PST)

**Call:** (800) 831-7133

**Visit:** [www.pentair.com](http://www.pentair.com)

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## TABLE OF CONTENTS

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<b>IMPORTANT WARNING AND SAFETY INSTRUCTIONS.....</b>	<b>3-5</b>
Install Altitude Limit.....	6
Required Tools.....	6
Gas Connection .....	7
Kit Installation Instructions .....	8-10
Gas Supply Pressure Verification Instructions .....	11
Sequence of Operation .....	12
Heater Specifications .....	12
Parts List.....	12

## IMPORTANT WARNING AND SAFETY INSTRUCTIONS



**SERIOUS BODILY INJURY OR DEATH CAN RESULT IF THIS PRODUCT IS NOT INSTALLED AND USED CORRECTLY.**



**INSTALLERS, POOL OPERATORS AND POOL OWNERS MUST READ THESE WARNINGS AND ALL INSTRUCTIONS BEFORE USING THE HEATER.**



Most states and local codes regulate the construction, installation, and operation of public pools and spas, and the construction of residential pools and spas. It is important to comply with these codes, many of which directly regulate the installation and use of this product. Consult your local building and health codes for more information.



**IMPORTANT NOTICE - Attention Installer:** This Installation Guide (“Guide”) contains important information about the installation, operation and safe use of this product. This Guide should be given to the owner and/or operator of this heater.



Before installing this product, read and follow all warning notices and instructions in this Guide. Failure to follow warnings and instructions can result in severe injury, death, or property damage. Call (800) 831-7133 for additional free copies of these instructions. Please refer to [www.pentair.com](http://www.pentair.com) for more information related to this products.

**IN CANADA: THE CONVERSION SHALL BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE PROVINCIAL AUTHORITIES HAVING JURISDICTION AND IN ACCORDANCE WITH THE REQUIREMENTS OF THE NATURAL GAS AND PROPANE INSTALLATION CODE CSA B149.1.**



Failure to follow instructions could result in fire or explosion with serious injury or property damage. This conversion kit shall be installed by a qualified service agency in accordance with the manufacturer’s instructions and all applicable codes and requirements of the authority having jurisdiction. The information in these instructions must be followed to minimize the risk of fire or explosion or to prevent property damage, personal injury, or death. The qualified service agency is responsible for the proper installation of this kit. The installation is not proper and complete until the operation of the converted appliance is checked as specified in the manufacturer’s instructions supplied with the kit.



**Risk of fire or explosion from incorrect fuel use or faulty fuel conversion.** Do not try to run a heater set up for natural gas on propane gas or vice versa. Only qualified service technicians should attempt to convert heater from one fuel to the other. Serious malfunction of the burner can occur which may result in loss of life. Any additions, changes, or conversions required in order for the appliance to satisfactorily meet the application needs must be made by a Pentair dealer or other qualified agency using factory specified and approved parts.

**READ AND FOLLOW ALL INSTRUCTIONS IN THIS MANUAL**

## IMPORTANT WARNING AND SAFETY INSTRUCTIONS



### **WARNING Risk of explosion if a unit converted to propane gas is installed in a pit or other low spot.**

Propane is heavier than air. Do not install the heater using propane in pits or other locations where gas might collect. Consult your local building code officials to determine installation requirements of heater relative to propane storage tanks and filling equipment. In Canada, Installation must meet the requirements of the Standard for the Storage and Handling of Liquid Petroleum Gases, CAN/CSA B149.1 (latest edition). In the U.S. installation must meet the requirements of the Standard for the Storage and Handling of Liquefied Petroleum Gases, ANSI/NFPA 58 (latest edition). Consult local codes and fire protection authorities about specific installation restrictions.

Liquid Propane Gas (LPG) fired heaters must not be installed in garages in Massachusetts, by order of the Massachusetts State Fire Marshall. For more information, call the Fire Marshall's office.



### **DANGER CARBON MONOXIDE GAS IS DEADLY! READ OWNERS MANUAL COMPLETELY BEFORE OPERATING**

This product must be installed and serviced by a professional service technician, qualified in pool heater installation. Some jurisdictions require that installers be licensed. Check with your local building authority about contractor licensing requirements. Improper installation and/or operation could create carbon monoxide gas and flue gases which could cause serious injury or death. Improper installation and/or operation will void the warranty.

Exhaust from this pool heater contains toxic levels of carbon monoxide, a dangerous, poisonous gas you cannot see or smell. Symptoms of carbon monoxide exposure or poisoning include dizziness, headache, nausea, weakness, sleepiness, muscular twitching, vomiting and inability to think clearly. IF YOU EXPERIENCE ANY OF THE ABOVE SYMPTOMS, IMMEDIATELY TURN OFF THE POOL HEATER, LEAVE THE VICINITY OF THE POOL OR SPA AND GET INTO FRESH AIR IMMEDIATELY. THE POOL HEATER MUST BE THOROUGHLY TESTED BY A GAS PROFESSIONAL BEFORE RESUMING OPERATION.

EXCESSIVE CARBON MONOXIDE EXPOSURE CAN CAUSE BRAIN DAMAGE OR DEATH.

- NEVER use this pool heater indoors without specified ventilation system (and properly installed vent pipe).
- NEVER use this pool heater in the home or in partly enclosed areas (such as garages), unless the specified ventilation system is used. If used outdoors, install far from open windows, doors, vents and other openings.
- Pentair strongly recommends that all vents, pipes and exhaust systems be initially and periodically tested for proper operation. This testing can be accomplished by using a hand-held carbon monoxide meter and/or by consulting with a gas professional.
- Pool heaters must be used in conjunction with carbon monoxide detectors installed near the pool heater. The carbon monoxide detectors must be periodically inspected for proper operation so as to insure continued safety. Broken or malfunctioning carbon monoxide detectors must be replaced immediately.

## IMPORTANT WARNING AND SAFETY INSTRUCTIONS

### CONSUMER INFORMATION AND SAFETY

**⚠ WARNING** The U.S. Consumer Product Safety Commission warns that carbon monoxide is an “invisible killer”. Carbon monoxide is a colorless and odorless gas.

1. Carbon monoxide is produced by burning fuel, including natural gas and propane.
2. Proper installation, operation and maintenance of fuel-burning appliances in the home is the most important factor in reducing carbon monoxide poisoning.
3. Be sure that fuel burning appliances such as heaters are installed by professionals according to manufacturer’s instructions and codes.
4. Always follow the manufacturer’s directions for safe operation.
5. Have the heating system (including vents) inspected and serviced annually by a trained service technician.
6. Examine vents regularly for improper connections, visible cracks, rust or stains.
7. Install battery-operated carbon monoxide alarms. The alarms should be certified to the requirements of the most recent UL, IAS, CSA and IAPMO standard for carbon monoxide alarms. Test carbon monoxide alarms regularly and replace dead batteries.

**⚠ DANGER** **CARBON MONOXIDE GAS IS DEADLY!**

Exhaust from this pool heater contains toxic levels of carbon monoxide, a dangerous, poisonous gas you cannot see or smell.

**⚠ WARNING** **Risk of fire, carbon monoxide poisoning, or asphyxiation if exhaust venting system leaks.** Only qualified service technicians should attempt to service the heater, as leakage of exhaust products or flammable gas may result from incorrect servicing.

**⚠ WARNING** **Risk of asphyxiation if exhaust is not correctly vented.** Follow venting instructions exactly when installing heater. Do not use a draft hood with this heater, as the exhaust is under pressure from the burner blower and a draft hood will allow exhaust fumes to blow into the room housing the heater. The heater is supplied with an integral venting system for indoor installation. Canada: In Canada, this pool heater can only be installed outdoors or in an enclosure that is not normally occupied and has no openings directly into occupied areas.

## Install Altitude Limit

THIS KIT IS ONLY INTENDED FOR HEATERS INSTALLED **BELOW 2,000 FT (610 M)** ELEVATION.

HEATERS INSTALLED ABOVE THE 2,000 FT (610 M) LIMIT SHOULD NEVER BE CONVERTED TO PROPANE GAS.

**⚠ DANGER** **DO NOT INSTALL** propane fueled heaters above 2,000 ft. (610 m). Improper installation can cause damage to the heater, property damage and personal injury (including brain damage), or death. The release of carbon monoxide is colorless and odorless and potentially fatal if received in high doses.

INSTALL ALTITUDE	FUEL TYPE	
	PROPANE	NATURAL GAS
0 – 2,000 ft. [0 – 610 m]	P/N 476370 Propane Conversion Kit	P/N 476369z Natural Gas Orifice Kit
2,000 – 10,000 ft. [610 – 3,048 m]	DO NOT INSTALL	P/N 462057 High Altitude Conversion Kit
> 10,000 ft. [ > 3,048 m]	DO NOT INSTALL	

## Required Tools

- Air orifice (P/N 476353)
- Gas orifice and O-ring (“KN” stamped on the orifice).
- 5/16-inch socket wrench or nut driver
- Channel lock pliers
- Adjustable wrench, 2-1/2 inch capacity
- Adjustable wrench, 1-1/2 inch capacity
- Flat Blade Screwdriver
- 3/16-inch Hex key (Allen wrench)
- Pipe Sealant approved for use with natural gas
- Pressure gauge or manometer with range to 14” WC (High Pressure Gauge)
- Differential pressure gauge or slope gauge (inclined manometer) capable of reading to a resolution of 0.05” WC (Low Pressure Gauge)
- Flue-gas analyzer reading CO<sub>2</sub> (optional)

**Note:** Do not attempt the heater conversion without all the listed tools shown above.

## Gas Connection

The heater requires a gas supply pressure between 4" (10.2 cm) WC and 12" (35.6 cm) WC. Gas supply pressures outside of this range may result in improper operation. A minimum flowing or dynamic inlet pressure (while the heater is running) of 4" (10.2 cm) WC is required to maintain input rating with no more than 2" WC pressure drop between static and dynamic. The gas supply must be installed in accordance with standard CSA B149.1 or ANSI/NFPA 58 (as applicable), and all applicable local codes. Install a manual shut-off valve, sediment trap and union outside the heater. Do not use a restrictive gas cock. Recommended gas pipe sizes are listed below.

**NOTE: DO NOT use a corrugated flexible gas line to supply the heater. It will not deliver enough gas (at nominal diameter) to supply heater.**

### Gas Pipe Sizing - STAGE TWO LOW PRESSURE GAS PIPE SIZING

Maximum Equivalent Pipe Length (ft)											
Natural Gas 1000 BTU/FT <sup>3</sup> 0.60 Specific Gravity at 0.5 in. WC Pressure Drop											
Propane Gas 2500 BTU/FT <sup>3</sup> 1.50 Specific Gravity at 0.5 in. WC Pressure Drop											
	Input	1/2"		3/4"		1"		1-1/4"		1-1/2"	
Model	(KBTU)	N	P	N	P	N	P	N	P	N	P
ETi 250	250	*	10	20	50	60	200	200	550	600	*

**Note (\*): 3/4-inch (1.9 cm) gas line can be used for up to 2 ft. (61 cm) maximum length from the gas valve in addition to the sediment trap.**



#### **INSTRUCTIONS FOR CHECKING THE GAS PRESSURE THROUGH THE COMBINATION GAS CONTROL VALVE.**

Risk of fire and explosion. Improper installation, adjustment, alteration, service, or maintenance of the Combination Gas Control Valve can lead to fire or explosion, causing loss of life, personal injury, or property damage.

*These instructions are for the use of qualified service technicians only!*

*Do not attempt this procedure unless you have been trained and certified in the care and repair of gas-fired appliances!*

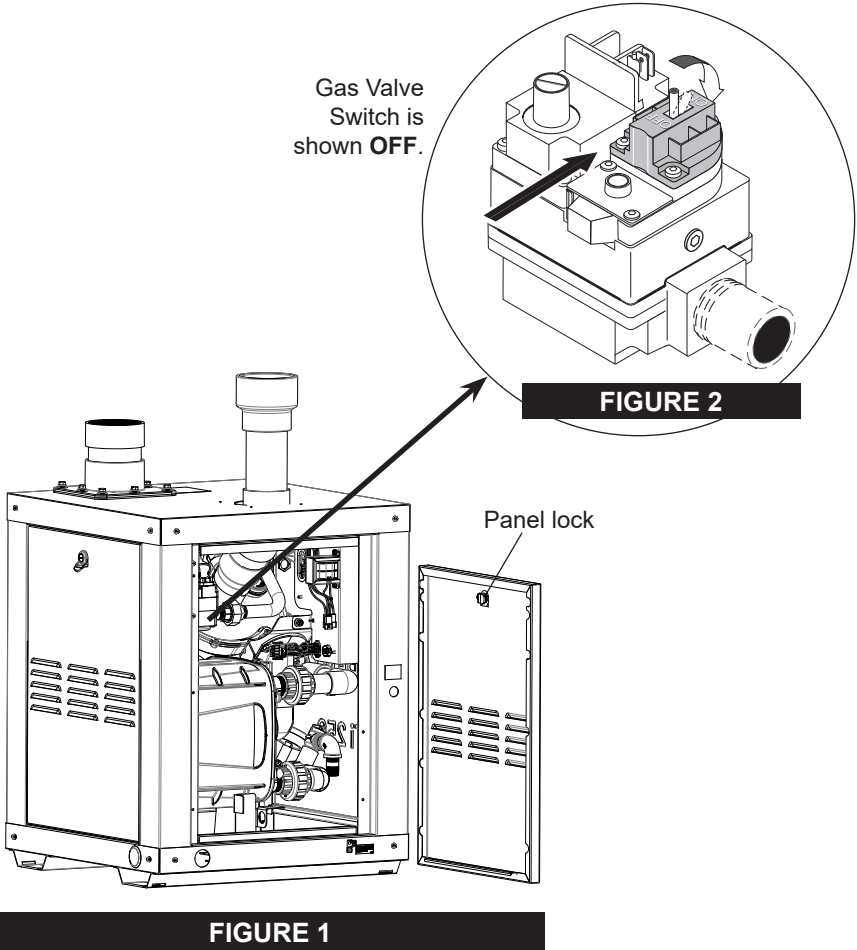
*Do not attempt this procedure if you are not confident about following instructions!*

This appliance is equipped with an unconventional gas control valve that is factory set with a manifold pressure of +1.4" WC (POSITIVE not negative). Installation or service must be performed by a qualified service technician or the gas supplier. If this control valve is replaced, it must be replaced with an identical control.

**NOTICE:** Before converting the heater, make the necessary gas connections to the new gas supply, following the instructions in the Heater Installation and User's Guide. Verify the maximum and minimum regulated gas pressures from the gas supply. These pressures must be within the range listed on the conversion label.

## Kit Installation Instructions

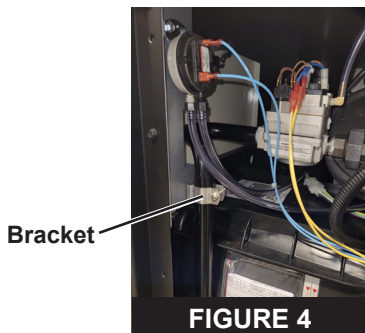
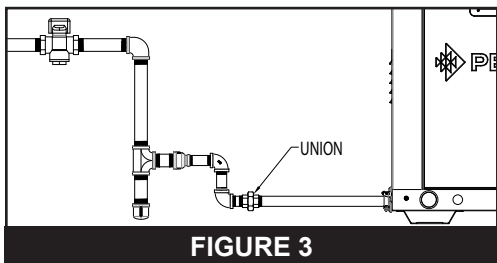
1. **IMPORTANT! Disconnect all power to the heater, filter pump, and any automatic controls at the circuit breaker.**
2. Using a flat-blade screwdriver, unlock the Panel Lock and remove the panel from the heater. See **FIGURE 1**.
3. Close the gas supply SHUT OFF valve to the heater.
4. Turn the heater Gas Valve Switch to the off position. See **FIGURE 2**.
5. Remove the water manifold and side service panel from the heater.





## Kit Installation Instructions (Continued)

6. Loosen the External Union outside of the heater (**FIGURE 3**) and the Bracket that retains the lower gas train inside the heater (**FIGURE 4**).

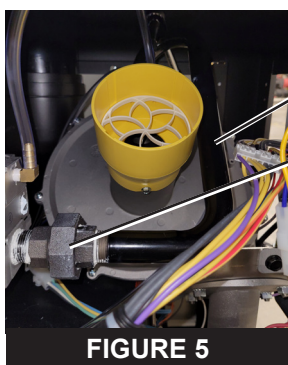


7. Using channel lock pliers, loosen Gas Valve Union (**FIGURE 5**) and remove the old gas orifice from the gas valve.
8. Ensuring the engraved marking “KN” is facing outwards, install the new Gas Orifice into the gas valve. See **FIGURE 6**.

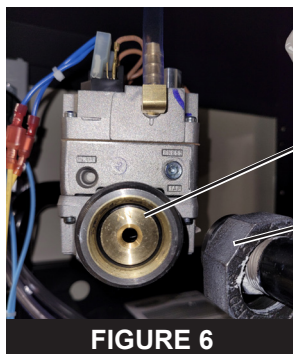
**NOTE:** Ensure the orifice O-ring is installed around the edge of the gas orifice, and the gas orifice is seated flush inside gas valve.

9. Tighten the Gas Valve Union (**FIGURE 5**) using channel lock pliers.

**WARNING** FAILURE TO USE THE CORRECT GAS ORIFICE CAN RESULT IN CARBON MONOXIDE POISONING AND CAUSE BRAIN DAMAGE OR DEATH.



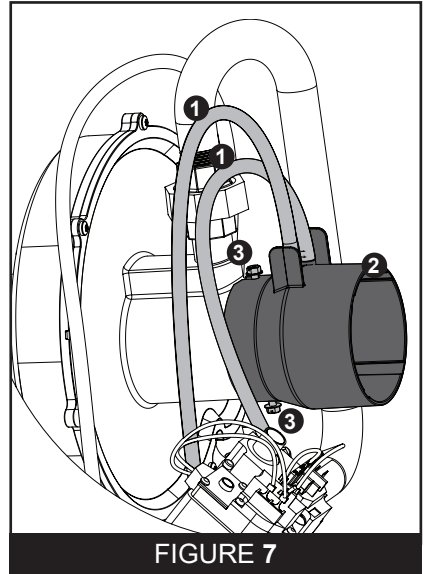
Upper Gas Train  
Gas Valve Union



Gas Orifice  
Ensure the letters “KN” are facing outward.  
Gas Valve Union

## Kit Installation Instructions (Continued)

10. Disconnect all *Tubing (1)* from the *Air Orifice (2)*. See **FIGURE 7**.
11. Using a 5/16-inch wrench, remove the two *Air Orifice Screws (3)* from and discard the air orifice. See **FIGURE 7**.
12. Secure the lower gas train to the gas pipe located on the exterior of the heater.
13. Tighten the union outside the heater with channel lock pliers and tighten screw to secure lower gas train.
14. Using a 5/16-inch wrench, reinstall the two *Air Orifice Screws (3)* and secure the new *Air Orifice (2)*.



**FIGURE 7**

15. Reconnect all *Tubing (1)* to the air orifice.
16. **BEFORE PROCEEDING** double check the installation. Ensure the gas valve union and the external union outside the heater are tight, and the air orifice is properly seated and secured.
17. Turn the heater Gas Valve Switch back to the ON position.
18. Open the gas supply SHUT OFF valve to the heater.
19. Turn on heater and verify smooth ignition and regular combustion.
20. Run heater for at least 10 minutes, then insert a combustion analyzer probe into the exhaust and measure CO<sub>2</sub>. **The recommended CO<sub>2</sub> range for Natural Gas combustion is 7.8% - 9.2%.**

Fuel	Recommended CO <sub>2</sub> (Dry Basis)
Natural Gas	7.8% – 9.2%

## Gas Supply Pressure Verification and Instructions

After completing the Kit Installation Instructions verify the gas supply pressure as follows:

1. Use a 3/16-inch hex key to remove the plug from the PRESSURE TAP port on the outlet side of the Combination Gas Control Valve.
2. Install a 1/8-inch NPT barbed fitting into the 'PRESSURE TAP' port on the outlet side of the gas valve. Use a flexible tube to connect it to the HIGH side of a differential pressure gauge or a slope gauge. This gauge will measure low (outlet) pressure, which requires a high degree of resolution.
3. Open the manual gas shutoff valve.
4. Before operating the heater, leak-test the heater and all its gas connections with soapy water.

**⚠ WARNING** Risk of fire or explosion. Never test for gas leaks with an open flame.

5. Restore electricity to heater and start the filter pump.
6. Turn on the heater.

**NOTE:** If you are using a slope gauge, close the shutoff valve of the gauge to avoid pulling the liquid out of the gauge when the blower starts.

7. After the burner lights, verify that the supply pressure is within the range 4" to 12" WC. If the supply pressure drops below this range when the burner ignites, the gas line capacity may be inadequate, and should be increased.
8. With the burner still on, disconnect the plastic hose between the gas valve and "VENT" tap and the blower mixer inlet. The pressure gauge should then read **+1.4" ±0.1" WC** (POSITIVE not negative). If the pressure is outside the range listed, call the factory at 1-800-831-7133. Do not try to adjust the pressure yourself.
9. Reinstall both heater Service Panels.

REPLACEMENT GAS ORIFICE SIZE		
P/N	ID Stamp	Diameter in [mm]
472630	KN	0.337 in [8.56 mm]

## Sequence of Operation

An electronic temperature sensing thermistor in the manifold adapter inlet controls heater operation. When incoming water temperature drops below programmed a set point, the control board supplies power to the combustion air blower through a series of safety interlocks. The heater interlocks are:

- **Water Pressure Switch (PS)** senses whether filter pump is running.
- **High Limit Switch (HLS)** opens if heat exchanger outlet temperature exceeds 135°F (57°C).
- **Air Flow Switch (AFS)** senses the pressure drop across the air metering orifices.
- **Thermal Fuse (TF)** opens if the heat exchanger exceeds 572°F (300°C).
- **Automatic Gas Shut-off Switch** opens if heat exchanger outlet temperature goes above 150°F (66°C).
- **Float Switch** opens if condensate overflows at the float switch due to blockage in the condensate drain hose or neutralizer cartridge.
- **Stack Flue Sensor (SF)** shuts down the heater if flue gas temperature reaches 170°F (77°C).

As soon as there is sufficient air flow, the AFS closes and completes the circuit to the Gas Ignition Control board. The gas ignition control then opens the gas valve and the fuel mixture is ignited by the Direct Spark Ignition (DSI). On a call for heat, the blower is energized the gas valve opens simultaneously as the direct spark igniter is energized and ignition occurs.

## Heater Specifications

<b>Inlet Pressure (Min. / Max.):</b>	4" / 12" WC
<b>Manifold Pressure:</b>	+1.4" WC (POSITIVE not negative)
<b>Required Gas Input:</b>	250,000 BTU/Hr

## Parts List

Description	Qty.	P/N
Air Orifice, Natural Gas	1	476353
Gas Orifice (KN)	1	472630
O-ring	1	U9-370
Installation Instructions	1	476574
Screw 10-16 X 0.5" Hex Washer	2	37336-4104
Grill Air Orifice	1	42001-0114

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