ORIFICE SELECTION AND CHANGING INSTRUCTIONS OPTION 278

Recognize this symbol as an indication of Important Safety Information!

⚠WARNING

THESE INSTRUCTIONS ARE INTENDED AS AN AID TO QUALIFIED, LICENSED SERVICE PERSONNEL FOR PROPER INSTALLATION, ADJUSTMENT AND OPERATION OF THIS UNIT. READ THESE INSTRUCTIONS THOROUGHLY BEFORE ATTEMPTING ANY MAINTENANCE OR OPERATION. FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN IMPROPER INSTALLATION, ADJUSTMENT, SERVICE OR MAINTENANCE RESULTING IN FIRE, ELECTRICAL SHOCK, CARBON MONOXIDE POISONING, EXPLOSION, PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

FOR CANADIAN INSTALLATIONS, THE CONVERSION SHALL BE CARRIED OUT BY A MANUFACTURER'S AUTHORIZED REPRESENTATIVE, IN ACCORDANCE WITH REQUIREMENTS OF THE MANUFACTURER, PROVINCIAL OR TERRITORIAL AUTHORITIES HAVING JURISDICTION AND IN ACCORDANCE WITH THE REQUIREMENTS OF THE CAN/CGA-B149.1 OR CAN/CGA-B149.2 INSTALLATION CODES.

⚠WARNING

"THIS CONVERSION KIT SHALL BE INSTALLED BY A QUALIFIED SERVICE AGENCY IN ACCORDANCE WITH THE FURNACE MANUFACTURER'S INSTRUCTIONS AND ALL APPLICABLE CODES AND REQUIREMENTS OF THE AUTHORITY HAVING JURISDICTION. IF THE INFORMATION IN THESE INSTRUCTIONS IS NOT FOLLOWED EXACTLY, A FIRE, AN EXPLOSION OR PRODUCTION OF CARBON MONOXIDE MAY RESULT CAUSING PROPERTY DAMAGE, PERSONAL INJURY OR LOSS OF LIFE. THE QUALIFIED SERVICE AGENCY IS RESPONSIBLE FOR THE PROPER INSTALLATION OF THE KIT. THE INSTALLATION IS NOT PROPER AND COMPLETE UNTIL THE OPERATION OF THE CONVERTED FURNACE IS CHECKED AS SPECIFIED IN THE FURNACE MANUFACTURER'S INSTRUCTIONS SUPPLIED WITH THE KIT."

RECOMMENDED TOOLS:

Slotted & Phillips screwdrivers
1/4″ Nut driver
Needle-nosed pliers
Pipe wrenches (2)
7/16″ Socket or wrench

NOTICE: THIS FURNACE HAS ORIFICES INSTALLED FOR A 20% REDUCTION IN HEATING OUTPUT BASED ON A 1075 BTU/FT³ NATURAL GAS HEATING VALUE (MEETS CANADIAN HIGH ALTITUDE REQUIREMENTS). LOCAL HEATING VALUES (BTU/FT³) AND ELEVATION MAY REQUIRE AN ORIFICE CHANGE. ORIFICE SIZE ADJUSTMENTS NEED TO BE CALCULATED AND APPROPRIATE ORIFICES INSTALLED BASED ON THE ACTUAL HEATING VALUE AND ALTITUDE USING GUIDELINES SET FORTH BY THE *NATIONAL FUEL GAS CODE* and (for Canada) *NATURAL GAS AND PROPANE INSTALLATION CODE* and *GAS FIRED APPLIANCES FOR USE AT HIGH ALTITUDES* (CGA 2.17-M91).

AT CERTAIN COMBINATIONS OF ELEVATION AND GAS HEATING VALUE, THE ORIFICES MUST BE CHANGED. FOLLOWING IS A PROCEDURE FOR DETERMINING AT WHAT ELEVATION THE ORIFICES WILL NEED TO BE CHANGED AND WHAT DRILL SIZE THEY MUST HAVE. THE INSTRUCTIONS ARE BASED ON ALTITUDE AND GAS HEATING VALUE. THE INSTALLER WILL NEED TO DETERMINE BOTH THE ELEVATION AND THE HEATING VALUE (BTU/FT³) OF THE GAS AT SEA LEVEL BEFORE MAKING THE CALCULATIONS.

For **ALL** furnace models, an orifice change may be necessary depending on the elevation and gas heating value. *Elevations above 2000 ft. require the furnace to be de-rated 4% per thousand feet. This means that for every thousand feet of elevation, the furnace loses 4% of its heating capacity. Burner orifices must be adjusted in order to achieve the reduced rates.*

$$\text{Input BTU/HR} = \frac{\text{Heating Value of Gas (BTU/Ft}^3\text{) x 3600 x correction factor}}{\text{Time in Seconds (for 1 cu.ft.) of Gas}}$$

NOTE: For high altitude models, orifices are installed based on a 20% reduction in heating output and a 1075 BTU/ft³ natural gas heating value (meets Canadian high altitude requirements). These orifices may need to be exchanged when different elevations and/or heating values are used. Consult the appropriate section of this document to determine if a change will be necessary and what the new drill size will be for the orifice.

ORIFICE SELECTION FOR HIGH ALTITUDE APPLICATIONS

⚠CAUTION

The National Fuel Gas Code (NFGC) and (for Canada) *The Natural Gas and Propane Installation Code* and *Gas Fired Appliances for Use at High Altitudes* (CGA 2.17-M91) guidelines should be followed when converting these furnaces for high altitude operation.

TABLE 1
NATURAL GAS ORIFICE DRILL SIZE FOR 80+ FURNACES (4% PER 1000 FT. DE-RATE) BURNER INPUT (PER BURNER) 25,000 BTU @ SEA LEVEL

Annual Avg. Heat Value (btu per ft³)	Sea level to 1999 ft.	2000 to 2999 ft.	3000 to 3999 ft.	4000 to 4999 ft.	5000 to 5999 ft.	6000 to 6999 ft.	7000 to 7999 ft.	8000 to 8999 ft.
850	38	39	40	41	41	42	42	43
900	40	41	42	42	42	43	43	44
975	41	42	42	42	43	43	44	44
1075	42	42	43	43	43	44	44	45
1170	43	44	44	44	45	45	46	47

⚠ WARNING

In addition to the high altitude furnace model and orifice sizing, an alternate method is available for Canadian installations of standard furnace models whereby the manifold gas pressure can be adjusted to get the 10% reduction in furnace output. This method does not apply to the models of furnaces with which these instructions are shipped since the furnace is already equipped with orifices sized for a 20% reduction. **Do not adjust the manifold pressure of the furnace shipped with these instructions as this 10% reduction will be in addition to the reduction already in place with the smaller orifices that come equipped on the furnace.** For more information on the manifold gas pressure adjustment methods, see the Installation and Operation instructions for the furnace.

FOR 80+ FURNACE INSTALLATIONS
(Natural Gas Only)

Examples of orifice sizing using the National Fuel Gas Code Appendix F:

In addition to any necessary pressure switch changes, installations at elevations above 2000 ft. require the furnace to be derated 4% per thousand feet. *Note that for high altitude options, #43 factory installed* orifices are based on a 20% reduction in heating output and a 1075 BTU/ft³ natural gas heating value (meets Canadian high altitude requirements). *Regional reduced heating values may nullify the need to change orifices except at extreme altitudes.* Table 1 shows some quick conversions based on elevation and gas heating value. This table is combined and simplified from Tables F1 and F4 of the NFGC. **IMPORTANT:** TO CALCULATE THE NEW ORIFICE SIZE, THE EQUIVALENT HEATING VALUE OF THE GAS AT SEA LEVEL MUST BE KNOWN. THE VALUE MUST BE THAT OF SEA LEVEL BEFORE ANY CALCULATIONS ARE PERFORMED. THIS INFORMATION CAN BE OBTAINED FROM THE LOCAL GAS SUPPLIER.

Example 1: 80+ Furnace w/ 900 BTU/ft³ Regional Nat. Gas Heating Value

I / H = Q
25000 / 900 = 27.78 ft³

I = Sea Level input (per burner): 25000
H = Sea Level Heating Value: 900
Q = 27.78 ft³ Natural Gas per hour.

From Table F.1 of *National Fuel Gas Code Handbook, 2002* (3.5" w.c. column).
Orifice required at Sea Level: # 40
From Table F.4 of *National Fuel Gas Code Handbook, 2002*
Orifice required at 5000 ft. elevation (4% de-rate per thousand ft): # 42
Orifice required at 8000 ft. elevation (4% de-rate per thousand ft): # 44

Example 2: 80+ Furnace w/ 1050 BTU/ft³ Regional Nat. Gas Heating Value

I / H = Q
25000 / 1050 = 23.81 ft³

I = Sea Level input (per burner): 25000
H = Sea Level Heating Value: 1050
Q = 23.81 ft³ Natural Gas per hour.

From Table F.1 of *National Fuel Gas Code Handbook, 2002* (3.5" w.c. column).
Orifice required at Sea Level: # 43
From Table F.4 of *National Fuel Gas Code Handbook, 2002*
Orifice required at 5000 ft. elevation (4% de-rate per thousand ft): # 45
Orifice required at 8000 ft. elevation (4% de-rate per thousand ft): # 47

TABLE 2
NATURAL GAS ORIFICE DRILL SIZE FOR 90+ FURNACES (4% PER 1000 FT. DE-RATE) BURNER INPUT (PER BURNER) 15,000 BTU @ SEA LEVEL

Annual Avg. Heat Value (btu per ft³)	Sea level to 1999 ft.	2000 to 2999 ft.	3000 to 3999 ft.	4000 to 4999 ft.	5000 to 5999 ft.	6000 to 6999 ft.	7000 to 7999 ft.	8000 to 8999 ft.
850	47	48	48	49	49	49	50	50
900	48	49	49	49	50	50	50	51
975	49	50	50	50	51	51	51	52
1075	50	51	51	51	51	52	52	52
1170	51	51	52	52	52	53	53	53

FOR 90+ FURNACE INSTALLATIONS
(Natural Gas Only)

Examples of orifice sizing using the National Fuel Gas Code Appendix F:

In addition to any necessary pressure switch changes, installations at elevations above 2000 ft. require the furnace to be de-rated 4% per thousand feet. *Note that for high altitude options, #51 factory installed* orifices are based on a 20% reduction in heating output and a 1075 BTU/ft^3 natural gas heating value (meets Canadian high altitude requirements). *Regional reduced heating values may nullify the need to change orifices except at extreme altitudes.* Table 2 shows some quick conversions based on elevation and gas heating value. This table is combined and simplified from Tables F1 and F4 of the NFGC. **IMPORTANT:** TO CALCULATE THE NEW ORIFICE SIZE, THE EQUIVALENT HEATING VALUE OF THE GAS AT SEA LEVEL MUST BE KNOWN. THE VALUE MUST BE THAT OF SEA LEVEL BEFORE ANY CALCULATIONS ARE PERFORMED. THIS INFORMATION CAN BE OBTAINED FROM THE LOCAL GAS SUPPLIER.

Example 3: 90+ Furnace w/ 900 BTU/ft^3 Regional Nat. Gas Heating Value

I / H = Q
15000 / 900 = 16.68 ft^3/hr

I = Sea Level input (per burner): 15000
H = Sea Level Heating Value: 900
Q = 16.68 ft^3 Natural Gas per hour.

From Table F.1 of *National Fuel Gas Code Handbook, 2002* (3.5" w.c. column)
Orifice required at Sea Level: # 48
From Table F.4 of *National Fuel Gas Code Handbook, 2002*
Orifice required at 5000 ft. elevation (4% de-rate per thousand ft): # 50
Orifice required at 8000 ft. elevation (4% de-rate per thousand ft): # 51

Example 4: 90+ Furnace w/ 1050 BTU/ft^3 Regional Nat. Gas Heating Value

I / H = Q
15000 / 1050 = 14.63 ft^3/hr

I = Sea Level input (per burner): 15000
H = Sea Level Heating Value: 1050
Q = 14.28 ft^3 Natural Gas per hour.

From Table F.1 of *National Fuel Gas Code Handbook, 2002* (3.5" w.c. column)
Orifice required at Sea Level: # 50
From Table F.4 of *National Fuel Gas Code Handbook, 2002*
Orifice required at 5000 ft. elevation (4% de-rate per thousand ft): # 51
Orifice required at 8000 ft. elevation (4% de-rate per thousand ft): # 52

FOR LP GAS FURNACE INSTALLATIONS

LP Gas is a manufactured gas that has consistent heating value across most regions.

The National Fuel Gas Code guidelines are used with the following exception:

The recommended LP Gas high altitude orifice selections differ slightly in that the NFGC LP orifice chart, as they are not accurate for Rheem products. The National Fuel Gas Code LP orifices are based on an 11" of water column pressure at the orifice, which differs from Rheem products that use 10" of water column at the orifice. This difference requires a deviation from the NFGC orifice size recommendations. The Sea Level input should still be reduced by 4% per thousand ft. and the orifice size must be selected based on the reduced input selection chart shown in Tables 3 & 4.

For 80+ Furnace Installations with LP Gas

TABLE 3
LP GAS ORIFICE DRILL SIZE (4% PER 1000 FT DE-RATE).
BURNER INPUT = 25,000 BTU @ SEA LEVEL – 80+ FURNACES.

Altitude	Input (BTU per burner) 25000	Orifice Size
0 to 1999 ft	25000	#54
2000 to 2999	24000	#54
3000 to 3999	23000	#54
4000 to 4999	22000	#54
5000 to 5999	21000	#54
6000 to 6999	20000	#54
7000 to 7999	19000	#55
8000 to 8999	18000	#55
9000 to 10000	17000	#55

For 90+ Furnace Installations with LP Gas

TABLE 4
LP GAS ORIFICE DRILL SIZE (4% PER 1000 FT DE-RATE).
BURNER INPUT = 15,000 BTU @ SEA LEVEL – 90+ FURNACES.

Altitude	Input (BTU per burner) 25000	Orifice Size
0 to 2000 ft	15000	1.15 mm (factory)
2001 to 3000	13200	1.15 mm
3001 to 4000	12600	1.10 mm*
4001 to 5000	12000	#58*
5001 to 6000	11400	#59**
6001 to 7000	10800	#60**
7001 to 8000	10200	#62**
8001 to 9000	9600	#63**
9001 to 10000	9000	#64**

* : -GRL-07 and -GRL-10 models use 1.15mm
* : -GRM-07 and -GRM-10 models use 1.15mm
** : -GRL-07 uses 1.15mm, -GRL-10 uses 1.10mm
** : -GRM-07 uses 1.15mm, -GRM-10 uses 1.10mm

ORIFICE ORDERING INFORMATION

Orifices may be ordered from Rheem/Ruud Prostock parts departments by specifying the Rheem/Ruud part number. Orifice sizes are selected by adding the 2-digit drill size required in the orifice part number. Drill sizes available are 39 though 64; metric sizes available 1.10mm (-90) and 1.15mm (-91):

Orifice Part Number 62-22175-(drill size)

Example 1:
60 drill size orifice required
Part # 62-22175-60

Example 2:
1.15mm drill size orifice required
Part # 62-22175-91

TO REPLACE THE ORIFICES:

Once it has been determined (using the method above) that the orifices need to be changed, the following procedure should be followed to replace the orifices.

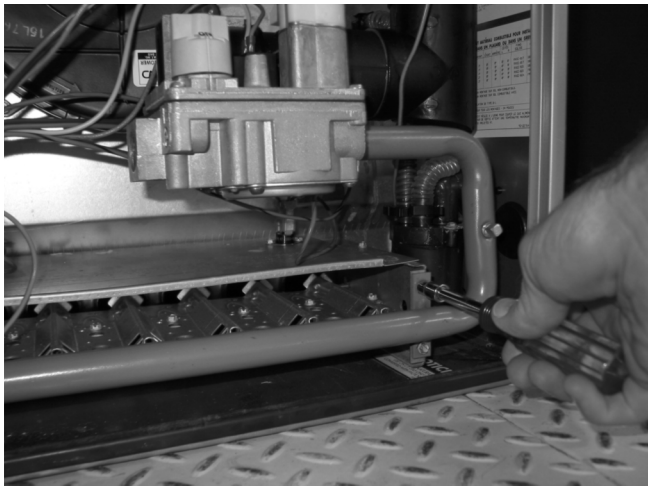
⚠ WARNING

1. **DISCONNECT THE MAIN ELECTRICAL POWER FROM THE UNIT BEFORE ATTEMPTING ANY MAINTENANCE. FAILURE TO DO SO CAN CAUSE ELECTRICAL SHOCK RESULTING IN SEVERE PERSONAL INJURY OR DEATH.**

⚠ WARNING

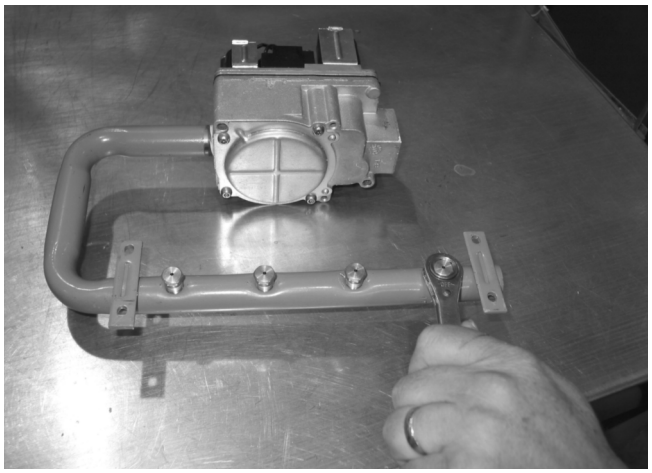
2. **SHUT OFF THE GAS SUPPLY AT A MANUAL VALVE IN THE SUPPLY PIPING TO THE UNIT BEFORE ATTEMPTING MAINTENANCE. FAILURE TO DO SO CAN CAUSE FIRE OR AN EXPLOSION RESULTING IN PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.**
3. Disconnect the gas supply line from the system at the union inside the furnace.
4. Remove all necessary wiring to permit removal of the manifold assembly.
5. Remove the four screws holding the gas manifold to the burner brackets and remove the manifold assembly. See Figure 1.

FIGURE 1
REMOVE THE MANIFOLD ASSEMBLY



6. Remove the existing orifices from the manifold using a 7/16” socket or wrench. See Figure 2.

FIGURE 2
ORIFICE REMOVAL



7. Replace the orifices with the proper high-altitude orifices. Screw them in hand tight and secure in place (with the wrench or socket) 1/4 turn from hand tight.
8. Replace the manifold assembly on the burner assembly with the four screws removed in step 5.
9. Replace all wiring removed in step 4.
10. Re-attach the gas line at the union. Tighten securely with a pipe wrench. **IMPORTANT:** When tightening gas pipe connections, use a back-up wrench to prevent any twisting of the control assembly and/or the gas valve.
11. Turn on the gas at the manual gas valve and check for any leaks using soap and water solution or other approved method.

⚠ WARNING

DO NOT USE AN OPEN FLAME TO CHECK FOR LEAKS. USE OF AN OPEN FLAME CAN CAUSE A FIRE OR EXPLOSION RESULTING IN PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

12. Turn on the electrical power to the unit. Set the thermostat at a temperature which causes the unit to operate in the heat mode. Let the furnace operate through several cycles to confirm proper operation.