Vehicle Refueling Appliance

Installation Instructions

This VRA Shall Only be Installed by Trained and Certified Personnel and Shall Only be Operated by a Trained Vehicle Owner or Operator

FuelMaker Corporation
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SAFETY GUIDELINES

These instructions contain information that is important to know and understand. This information is provided for **SAFETY** and to **PREVENT EQUIPMENT PROBLEMS.** To help recognize this information, observe the following symbols.

! WARNING Indicates a hazardous situation that, if not avoided, MAY result in death or serious injury.

! CAUTION Indicates a potentially hazardous situation that, if not avoided, MAY result in or moderate or minor injury.

! NOTICE Indicates important information that, if not followed, MAY cause damage to the equipment.

The information contained within this manual is subject to change without notice

SAFETY PRECAUTIONS

Read and understand these instructions as well as the operating instructions before installing Phill. Failure to follow these instructions may result in serious injury, death or property damage.

1. NO SERVICEABLE COMPONENTS

The internal components of *Phill* are not user serviceable. If *Phill* requires service, it shall only be carried out by FuelMaker authorized service personnel.

! NOTICE ***Do not attempt to dismantle Phill or tamper with any components. To do so will void all warranties.***

2. PHILL INSTALLATION

! NOTICE ***Installation of Phill shall be carried out by qualified persons only.***

In the interest of safety, *Phill* installation requirements are designed to take into account *Phill's* performance as well as that of the vehicle being fueled and therefore may differ from the requirements of local codes and regulations. The requirements of these instructions take precedence over local codes and regulations unless those codes or regulations are more stringent than the recommendations. Particular attention should be paid to Codes and Standards dealing with natural gas vehicle refueling.

If you experience any difficulties or are unsure about any feature of *Phill*, contact FuelMaker's Technical Support Group at :

North America: 1-866-MY-PHILL (1-866-697-4455)
International: +1-416-674-3034 (extention 290)

3. INTENDED FOR REFUELING NATURAL GAS VEHICLES ONLY

Phill is for use with Natural Gas only. *Phill* shall be used to fill cylinders with either a minimum working pressure of 20.7 MPa (3000 psig) for model *HRA-P30*, or a minimum working pressure of 24.8 MPa (3600 psig) for model *HRA-P36* .

! WARNING ***Attempts to use Phill for any purpose other than its intended use may result in serious injury or death.***

4. INDOOR REFUELING

For refueling of vehicles indoors:

1) The natural gas fuel system in the vehicle shall be installed by the Original Equipment Manufacturer or by an OEM authorized company, AND;
2) The natural gas fuel system in the vehicle must have 2 check valves, or an equivalent degree of redundancy.

After-market converted vehicles DO NOT meet this criteria and therefore shall only be refueled outdoors.

5. LOCATION OF PHILL

Phill may be installed indoors in a unoccupied location (i.e. garage) or outdoors. It shall be installed in non-hazardous locations as defined by the NFPA 70 National Electrical Code (USA) and the C22.1 Canadian Electrical Code(Canada).

6. VENTILATION

When installed indoors, *Phill's* ventilation system exhausts approximately 140 cfm of air to the outdoors during operation. Ensure that the area in which *Phill* has been installed has adequate air infiltration to replace the exhausted air. A minimum vent opening of 5" (127 mm) in diameter or equivalent area of 20 square inches shall be provided.

7. REFUELING HOSE

The refueling hose assembly must be protected from physical damage, abrasion, and from being driven over. The nozzle shall be stored in its cradle when not in use.

Inspect the hose regularly. If signs of wear, deterioration, or other damage are apparent, it shall be replaced immediately.

8. P30 / P36 NOZZLE INCOMPATIBILITY

There are two types of nozzles used in natural gas refueling. The P30 nozzle is used for 20.7 MPa (3000 psig) systems and the P36 nozzle is used for 24.8 MPa (3600 psig) systems. In order to prevent over pressurization of the vehicle cylinder, a P36 nozzle cannot be connected to a P30 receptacle.

9. REFUELING PRECAUTIONS

The vehicle being filled and *Phill* shall be positioned such that they are both exposed to the same ambient temperature during refueling (i.e. both are indoors or both are outdoors).

! WARNING ***Do not run the vehicle engine while refueling and ensure all ignition sources are OFF (including pilot lights in recreational vehicles). Do not smoke or bring an open flame within 1.5 m (5') of the refueling point.***

10. IF YOU SMELL GAS

- Turn off *Phill's* inlet gas valve.
- Extinguish open flames and turn off all sources of ignition.
- If it is safe to do so, close the manually-operated tank valve of the vehicle being refueled.
- Ventilate the area.
- Contact your gas supplier or authorized service representative.
- DO NOT interrupt power to *Phill.*

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1 INTRODUCTION

FuelMaker model *HRA-P30* and *HRA-P36 Vehicle Refueling Appliances* are self-contained appliances designed to refuel natural gas vehicles. They operate on a 120 or 230VAC electrical supply and a low pressure natural gas supply.

Phill is designed to fill 20.7 MPa (3000 psig) fuel systems at a nominal flow rate of 1.44 m^3/hr (0.85 scfm) and 24.8 MPa (3600 psig) fuel systems at nominal flow rate of 1.37 m^3/hr (0.8 scfm).

Phill contains ambient temperature sensors that allow it to determine the maximum pressure to be delivered to the vehicle tank in order to prevent over-pressurization should the tank warm after being filled.

Phill's software monitors pressure rise in the vehicle tank during refueling as a function of the hose leak detection diagnostics. The total maximum tank capacity that can be monitored is 150 liters (approximately 40 US gallons) water capacity.

Phill incorporates a self-regenerating natural gas dryer to remove moisture that may be present in the gas supply. During the fill cycle, the gas dryer will automatically purge the accumulated moisture.

Phill is equipped with an internal gas sensor. An external gas sensor can be connected to *Phill* where required by local Codes. When natural gas is detected at 20% of the Lower Explosive Limit an alarm will sound, the "Error" LED will illuminated and *Phill's* compressor will shutdown while the ventilation fan continues to operate.

Phill is air-cooled and is rated for an operating ambient temperature range of -40ºC to +46°C (-40°F to +115°F). Cooling air is drawn into *Phill* through a louver on the bottom of the housing and is vented outdoors through an opening on the top or rear of the *Phill* housing.

A User Panel, located on the front of the housing, incorporates the Start and Stop buttons, a *Phill* meter and 4 status indicator LEDs.

Phill is designed to be maintenance free and requires no regular servicing. There are no user serviceable parts inside.

2 TECHNICAL SPECIFICATIONS

GAS		
Maximum Discharge Pressure:	Model: HRA-P30	20.7 MPa @ 21°C (3000 psig @ 70°F)
	Model: HRA-P36	24.8 MPa @ 21°C (3600 psig @ 70°F)
Minimum Inlet Pressure:		1.7 kPa (7" water column) at rated flow
Maximum Inlet Pressure:		3.4 kPa (14" water column) at rated flow
Nominal Flow Rate (60 Hz)	Model: HRA-P30	1.44 m^3/hr @ 21°C and 1.7 kPa inlet (0.85 scfm @ 70°F and 7" w.c. inlet)
	Model: HRA-P36	1.37 m^3/hr @ 21°C and 1.7 kPa inlet (0.80 scfm @ 70°F and 7" w.c. inlet)
ELECTRICAL		
Electrical Supply:		120 VAC 60 Hz / 230 VAC 50 Hz, Single Phase
Circuit Ampacity:		15 Amps
Full Load Amperage:		10 / 4 Amps
Average Power Consumption:		800 Watts
MECHANICAL		
Dimensions (H x W x D):		762 mm x 356 mm x 330 mm (30" x 14" x 13")
Unit Weight / Shipping Weight:		43.2 kg (95 lbs) / 50 kg (110 lbs)
Noise Level:		45 dBA @ 5 m (16.5') open field (full sphere)
Ambient Temperature Rating:		-40°C to +46°C (-40°F to +115°F)

Table 1 Technical Specifications

3 INSTALLATION

3.1 GENERAL

Before proceeding with the installation, inspect *Phill* for damage due to shipping and report any such damage to the carrier as soon as possible.

Please do not return product to the manufacturer without prior authorization. Keep all original packaging in the event that Phill must shipped in the future.

Applicable Codes and Standards

Verify that the nameplate ratings of *Phill* are compatible with the gas and electrical supplies available. *Phill* shall be installed in accordance with all applicable codes, standards and ordinances.

In the United States, *Phill* shall be installed in accordance with the NFPA 54 National Fuel Gas Code, NFPA 52 CNG Vehicular Fuel Systems Code, NFPA 70 National Electrical Code, and with the requirements of the authorities having jurisdiction. In Canada, *Phill* shall be installed in accordance with the CSA B149.1 Natural Gas and Propane Installations Code and Canadian Electrical Code C22.1, Part 1 and with the requirements of the authorities having jurisdiction.

! WARNING ***Installation of Phill shall be carried out by qualified persons only. Particular attention shall be paid to Codes and Standards dealing with natural gas vehicle refueling.***

Structural Requirements

Phill weighs approximately 43 kg (95 lbs) and shall be mounted to a wall or structure capable of supporting this weight. *Phill's* support assembly is designed to reduce transmission of sound and vibration to the structure it is mounted to. *Phill* may be mounted between the studs of an unfinished wall, or surface-mounted onto a finished wall or flat surface. *Phill* may be installed freestanding on two well anchored posts.

Sound Level

Phill emits a sound pressure level of 45dBA (open field) at a distance of 5 m (16.5') during operation. Local codes may restrict the sound pressure level at the property line. *Phill* should not be installed outdoors in a location where direct or reflected noise is directed at neighboring windows or other building openings. Additionally, avoid installing *Phill* near a sound reflecting surface or between buildings that are close together.

Tools Required

- ✓Measuring tape
- ✓Open end wrench set or adjustable wrenches
- ✓Pipe wrenches
- ✓Philips screwdrivers
- ✓Flat screwdriver
- ✓Level
- ✓Power drill and bits
- ✓Safety glasses
- ✓Gloves
- ✓Pencil
- ✓Wire strippers
- ✓Wire cutters
- ✓Digital Voltmeter

Materials Required

- ✓Natural gas piping including drip leg and transition fittings. i.e. unions, nipples etc.
- ✓Natural gas approved flexible hose (to connect *Phill's* gas inlet to the gas supply.
- ✓1/4 turn gas supply shut-off valve
- ✓Reducing Tee (optional gas supply test port)
- ✓Pipe joint sealant
- ✓Piping/tubing and fittings for Pressure Relief Vent (3/8" - 1/2" NPT) line - shall be stainless steel, black iron or copper.
- ✓5" 90 degree elbow duct (if cooling exhaust is to be top vented)
- ✓Exhaust hood with 5" duct (if cooling exhaust is to be rear/ direct vented)
- ✓Ducting (5" diameter, length determined by need)
- ✓Flexible metal ducting (5" diameter, length determined by need)
- ✓Duct clamps
- ✓High temperature foil duct tape
- ✓Self tapping screws
- ✓GFCI receptacle/breaker
- ✓Wire connectors
- ✓Electrical junction box
- ✓Junction box connectors
- ✓Excess Flow Valve (as required)

3 INSTALLATION (continued)

3.2 PHILL LOCATION CONSIDERATIONS

Determine a suitable location for *Phill* taking into consideration the following:

- ✓ The mounting surface or structure shall support a minimum of 45kg (100 lbs).
- ✓ For outdoor installations, avoid areas where damage from excessive ice build up may occur such as building overhangs or where vegetation, snow or debris may block the inlet or exhaust air vents. Do not install *Phill* beneath overhangs which may shed snow or rain directly onto the unit.
- ✓ Select a location where *Phill* and gas supply piping are not subject to damage from impact or falling objects.
- ✓ For indoor installations a minimum interior volume of 40 m^3 (1,400 ft^3) is required.
- ✓ For garages larger than 2 cars or indoor installations where the there is a potential for gas accumulation (e.g. peaked roofs, partially finished or dropped ceilings) a vent opening shall be provided, in highest point as practical, in the area of potential gas accumulation.
- ✓ Proximity to gas and electrical supplies.
- ✓ Routing of the cooling air exhaust and PRV vent lines.
- ✓ Minimum service clearances from adjacent construction (*see Figure 1*).
- ✓ Location of the vehicle receptacle relative to *Phill* during vehicle refueling. Ideally, it shall be on the same side of the vehicle as *Phill*.
- ✓ Ensure unimpeded operation of the refueling hose breakaway assembly in the event of a vehicle drive away while still connected to *Phill*.
- ✓ Sound level at property lines.
- ✓ Ensure there is sufficient lighting in the refueling area to see the *Phill* User Panel and refueling hose assembly.

Vehicle Refueling Point

Phill contains sensors that allow it to determine the maximum pressure *Phill* will deliver to the vehicle cylinder. This prevents over-pressurization of the vehicle tank should it warm, due to a higher ambient temperature, after being filled. *Phill* shall be installed in an area with the same ambient temperature as the vehicle being refueled.

Electrical Supply

Phill shall be installed in accordance with the applicable local codes or, in the absence of local codes, CSA Standard C22.1 Canadian Electrical Code Part 1 in Canada or the National Electrical Code ANSI/NFPA 70 in the U.S. (*see section 3.5)*

If the electrical power supply is not provided or does not meet the specifications listed, contact a licensed electrician to perform the necessary work.

Gas Supply

Installation of *Phill's* gas supply piping shall conform to local Codes or, in the absence of local Codes, CSA standard CSA B149.1 in Canada or the NFPA 54 National Fuel Gas Code in the U.S. (*see section 3.6)*

Where required by local ordinances a seismic gas shut-off device shall be installed downstream of the gas utility meter.

If the gas supply is not provided or does not meet the specifications listed, contact a licensed plumber to perform the necessary work.

Impact Protection and Service Clearances

Phill shall be mounted to protect it from vehicle and human impact. If *Phill* must be installed lower than the recommended height of 1.5 m (5'), other impact protection provisions shall be made. (*see section 3.3*)

Ensure that the service clearances stated on the nameplate are maintained. (*see Figure 1)* Ensure there are no obstructions or objects (e.g. shelves) within these distances.

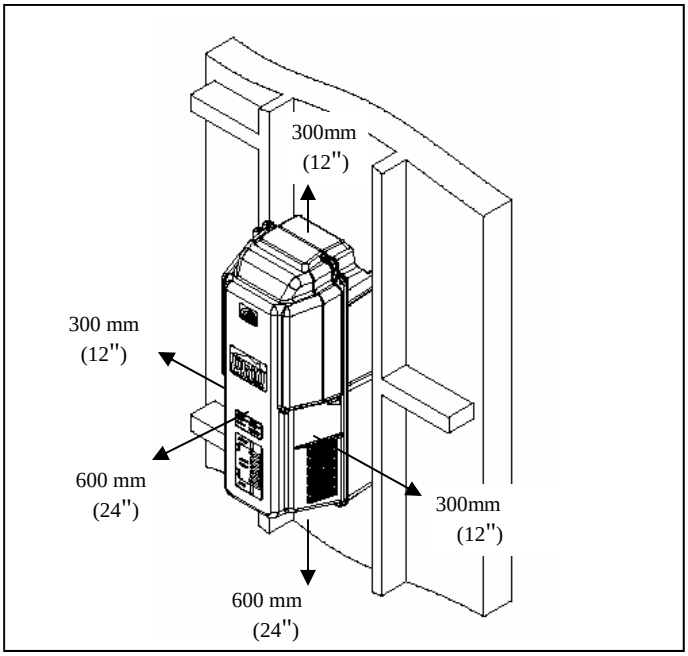


Figure 1 Service Clearances

Venting

Phill has two vents that shall be directed to outdoors. *Phill's* cooling air exhaust (*see section 3.8*) and the **P**ressure **R**elief **V**alve (*see section 3.7*). Careful consideration must be given to the routing and installation of these vent lines. Adherence to Codes relating to the PRV, especially regarding the point of termination, shall be followed.

3 INSTALLATION (continued)

3.3 IMPACT PROTECTION

Gas Supply Piping Protection

The gas supply piping shall be routed such that it is protected from vehicle impact. Shield the gas line from impact, if routing does not provide adequate protection from vehicle impact. e.g. route gas supply piping as high as practical.

An **E**xcess **F**low **V**alve shall be installed, in accordance with the manufactures instructions, in the gas supply piping where there is risk of vehicle impact to the gas supply line. The EFV shall be located no less than 3 m (10') and no more than 8 m (25') from *Phill*.

Phill Impact Protection

Phill shall be installed so that it is protected from vehicle or human impact. (*See Figure 3)*

If *Phill* is to be installed lower than the recommended height of 1.5 m (5') from the ground, provisions shall be made to protect *Phill* from human or vehicle impact if no natural or inherent barriers exist.

Typically, 2 m (7') long, 100 mm (4") diameter concrete filled steel posts spaced no more than 0.6 m (2') apart are sunk 1 m (3.5') into the ground between *Phill* and the flow of traffic to act as a barrier against impact. Heavy squared timbers may also be used.

The local gas utility may be consulted to determined what practice is locally accepted by the authorities having jurisdiction.

Breakaway Operation

In order to ensure reliable separation of the breakaway, installation location relative to the refueling receptacle location must be considered when determining *Phill's* mounting location. Avoid installing in the areas shown in *Figure 2*, as the hose may get caught on the corners edge if the vehicle is driven away with the nozzle still attached.

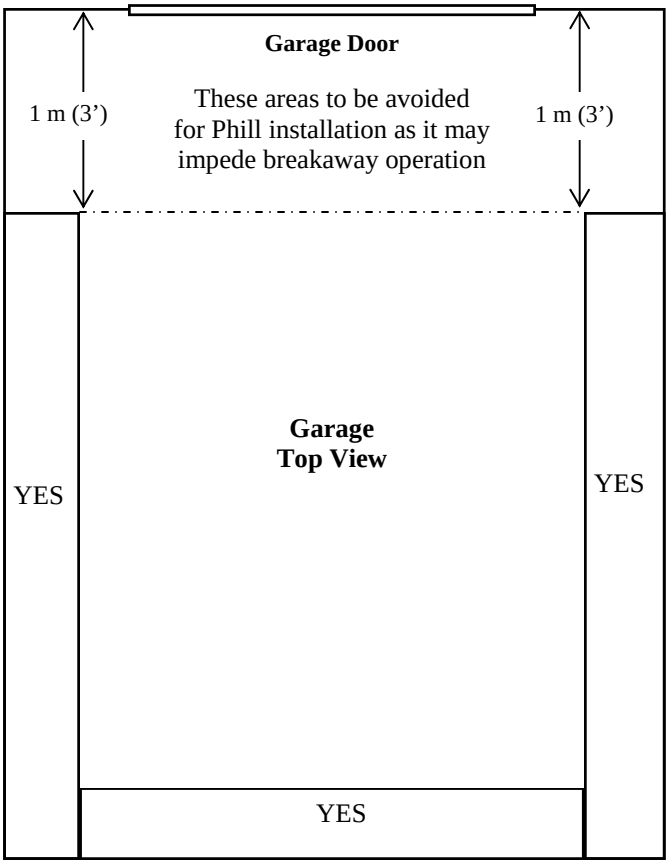


Figure 2 Acceptable Phill Installation Locations

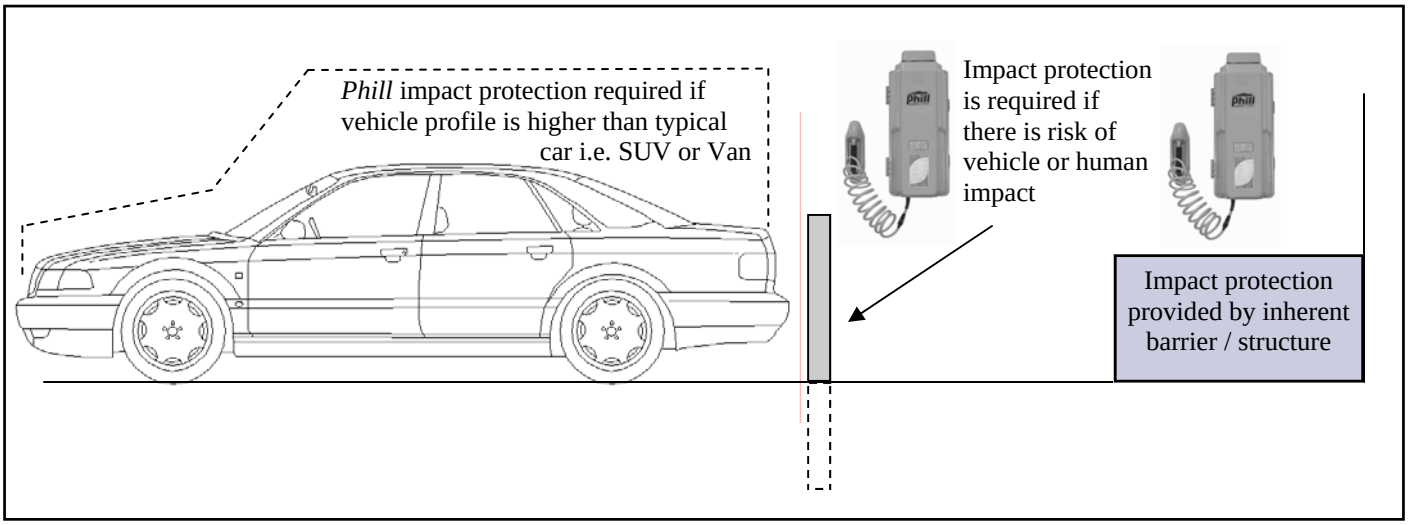


Figure 3 Impact Protection

3 INSTALLATION (continued)

3.4 PHILL SUPPORT ASSEMBLY

Having selected a suitable location for *Phill* based on the recommendations made in this manual (see *section 3.2)*, prepare the site for installation of the support assembly.

Phill's mounting frame is factory installed on the rear of the housing. The mounting frame mates with the wall brackets that are fastened to the wall or support structure. (*see Figure 4*)

Support Assembly Components

The support assembly consists of the following components;

2 Back Wall Brackets
1 Back Wall Bracket Lock
4 Angle Slide Brackets (used for mounting between studs)
4 Flat Slide Brackets (used for flat surface mounting)
4 ¼" 20 UNC x ½" screws

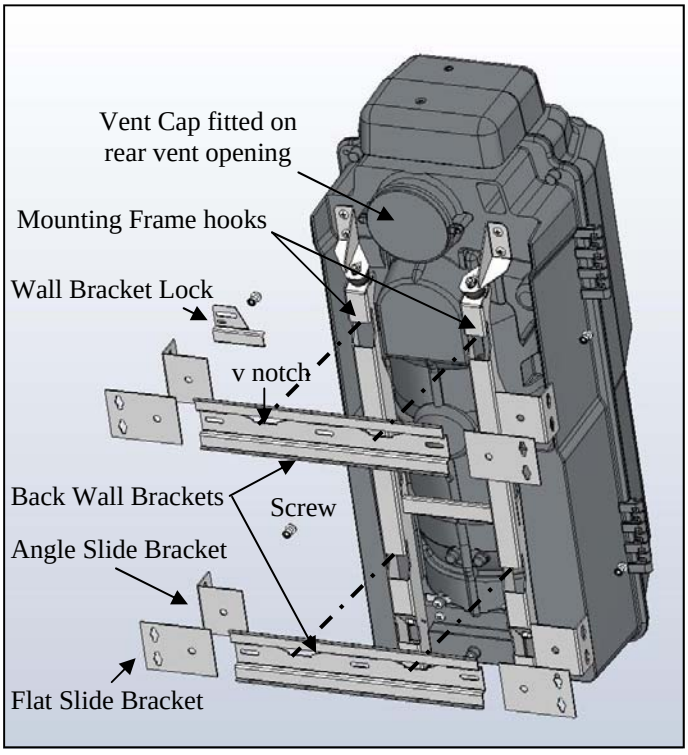


Figure 4 Support Assembly components

3 INSTALLATION (continued)

Installing Support Assembly

! CAUTION ***Be sure to anchor Phill's support assembly directly to the frame of the building, to a brick or concrete wall, or to a firmly anchored post. Drywall, plaster, stucco or similar construction wall surfaces are not suitable to support the weight of Phill.***

Phill can be installed recessed in an unfinished wall between studs with 16" centers or can be mounted on a flat surface. If the studs are further apart than 17" additional bracing shall be required. A section of a finished wall (e.g. drywall, paneling etc.) can be cut out to accommodate *Phill. (see Figure 7 & 8)*

1. Use the template provided, or refer to the measurements found on the template, to establish and mark the correct mounting hole position of the, flat or angle, slide brackets. Ensure that the distance from grade indicated on the template is adhered to. If *Phill* is to be installed on the inside surface of an outside wall and rear vented, use the template provided to correctly position the 170 mm (6 ¾") cooling air vent hole.
2. Remove template and drill slide bracket mounting holes. If rear venting, cut the cooling air venting hole. Use appropriate fasteners and washers to fasten the slide brackets to the mounting structure. Use the angle slide brackets for installation recessed between studs (*see Figure 10*) and the flat slide brackets for flat surface mounting (*see figure 9*). **Be sure the brackets are installed square and level.** When installing *Phill* on a flat surface be sure the brackets are fastened to studs or firmly anchored to the building.
3. Fasten the top and bottom wall brackets to the installed angle or flat slide brackets using the ¼" 20 UNC x ½" screws provided. Be sure to attach the wall bracket lock to the bottom wall bracket. Do not fully tighten the screws for the wall brackets until *Phill* has been mounted onto the wall brackets.
4. *Phill* is attached to the wall brackets by a self-centering mounting frame attached to the back of the *Phill* housing. With help, lift *Phill* onto the wall brackets and lower it so the mounting frame hooks on *Phill* mate with the v-notches in the wall brackets. Ensure *Phill* is level when mounted on the wall brackets.
5. Slide the wall bracket lock to the left and tighten the screw to secure *Phill* to the support assembly.

! NOTICE ***Ensure the wall bracket lock secures Phill to the support assembly.***

6. Open *Phill's* front housing by removing the 5 screws and loosen the 3 restraining bolts. (*see Figure 5)*
7. Close the front housing and replace the five housing screws.

! NOTICE ***Failure to loosen the restraining bolts will cause severe damage to Phill.***

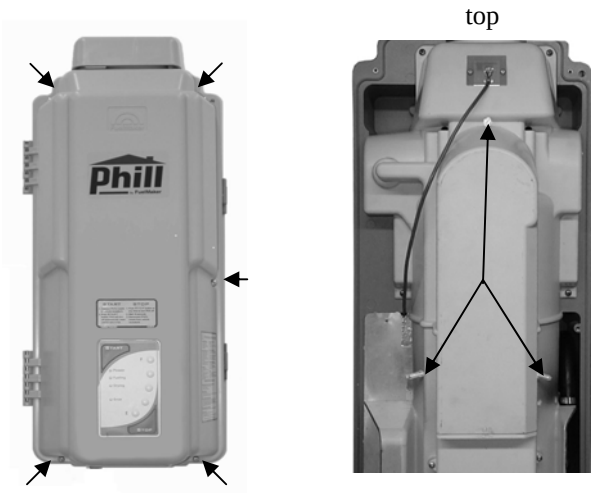


Figure 5 Restraining Bolts

Installing Nozzle Cradle

1. Choose a suitable location for the fueling nozzle cradle. Ensure that the cradle is mounted, or a back plate is fitted, so that the back of the cradle is closed off so that water or debris cannot enter the nozzle.
2. Use the template provided to establish and mark correct position of nozzle cradle mounting screw holes. Remove the template and drill the holes. Fasten the nozzle cradle to mounting surface using appropriate hardware (*see Figure 6*). Fit the nozzle into cradle assembly. If required use padlock or pin to hold nozzle securely in cradle.

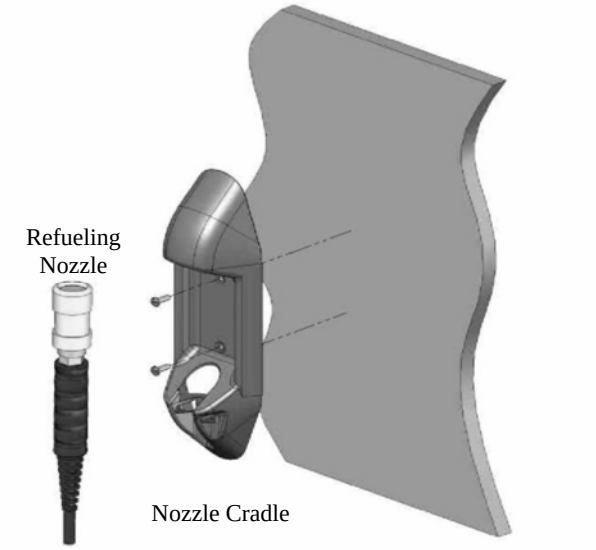


Figure 6 Nozzle Cradle

3 INSTALLATION (continued)

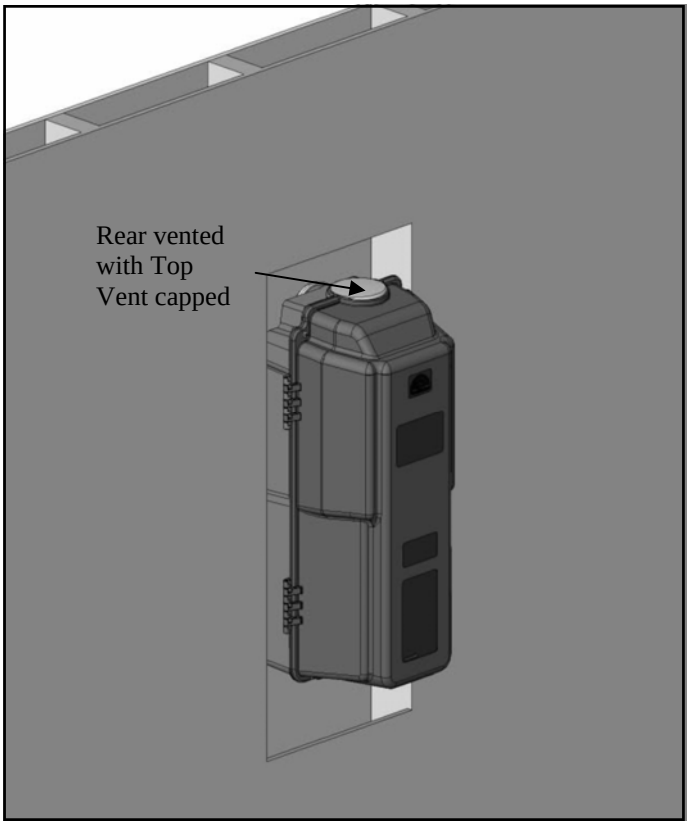


Figure 7 Phill installed in cut out

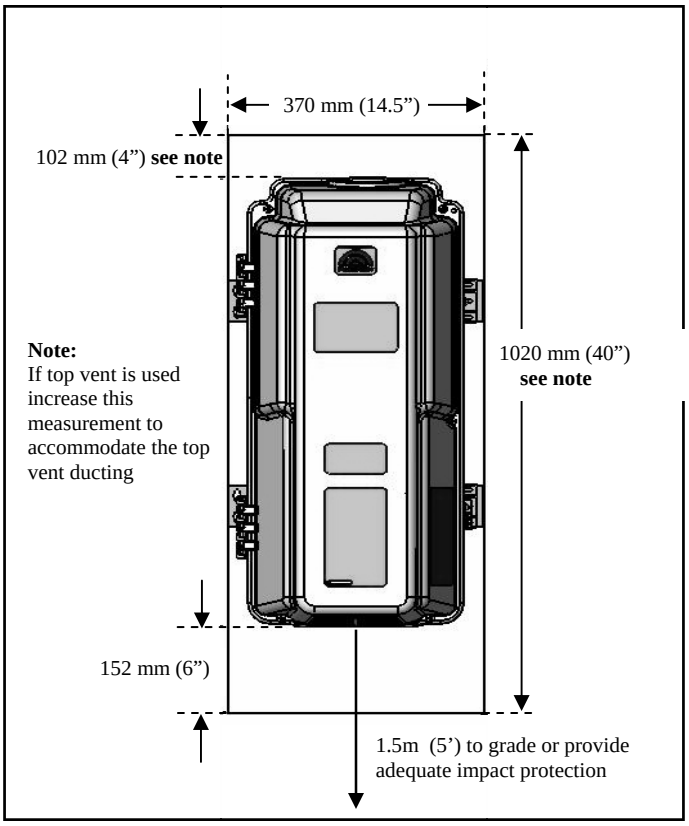


Figure 8 Cut out dimensions

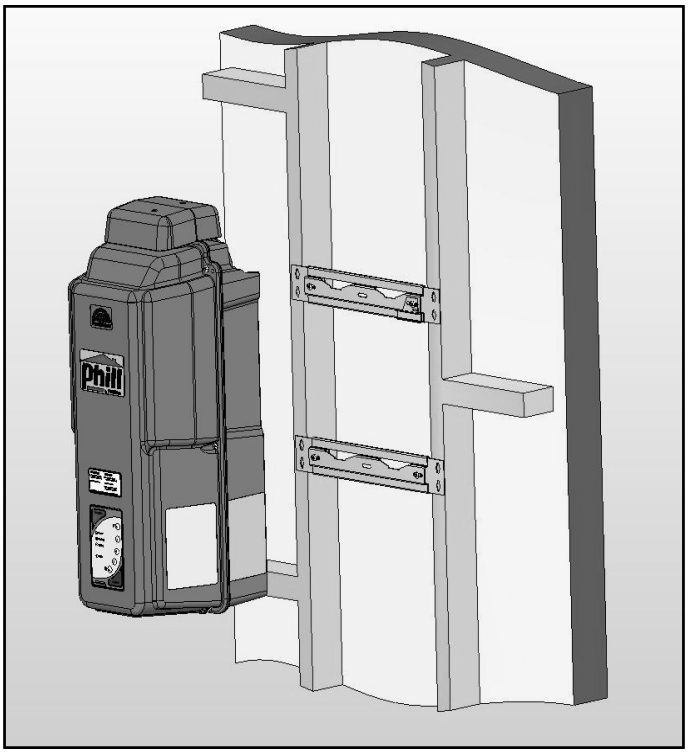


Figure 9 Surface Mounting

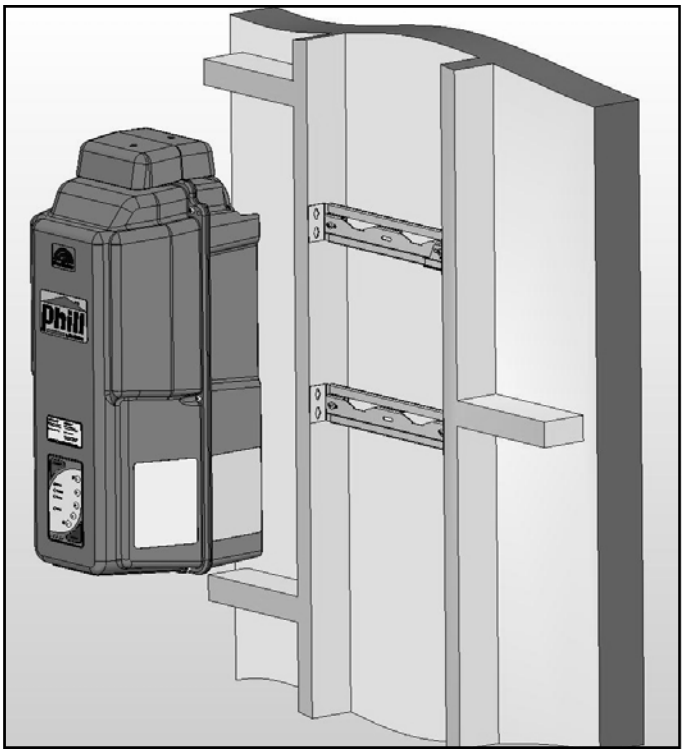


Figure 10 Recessed Mounting

3 INSTALLATION (continued)

3.5 ELECTRICAL SUPPLY CONNECTION

Phill requires a branch circuit run directly from the electrical service panel (not split off to other devices or receptacles) to the *Phill*. No other appliances or equipment shall be powered from the same circuit when *Phill* is in use.

Receptacle Connection (120 VAC)

- The grounded receptacle shall be located at least 1.5 m (60”), but no more than 2 m (84”) from *Phill.*
- The dedicated circuit shall be protected by a 15 amp circuit breaker or time delay fuse.
- A GFCI receptacle shall be used where required by local codes.

! CAUTION ***Do not use an extension cord or an adaptor plug with Phill. Do not cut or remove the grounding prong from Phill’s plug.***

Hardwired Connection (230 VAC)

- The circuit shall be protected by a 15 amp circuit breaker or time delay fuse.
- A emergency electrical disconnect shall be installed at least 1.5 m (60”) from, and in view of, *Phill*. If allowed by local Authorities the service panel circuit breaker will suffice.
- Connect *Phills* ground, neutral and hot leads to the appropriate connections of the electrical supply.

3.6 GAS SUPPLY CONNECTION

Phill has been designed to operate with an inlet pressure in the range of 1.7kPa - 3.4 kPa (7" to 14" water column). *Phill* will shut down due to low, or excessive, inlet pressure.

The utility regulator should be set for the maximum gas load the system will experience. Failure to do so may cause *Phill* to shut down due to low inlet pressure when other gas loads on the users system draw from the gas supply system. Run *Phill* while simultaneously operating all major gas appliances on the user system in order to verify regulator setting.

! WARNING ***A trained and qualified gas appliance installer shall make the gas supply connection to Phill. Installation must conform to ALL applicable Standards, Codes and Ordinances. Leak testing of the appliance shall be conducted by the installer upon completion of the installation. Never check for leaks with a flame.***

Before connecting *Phill* to the gas piping system ensure that flexible hoses and all fittings that will be used to connect *Phill* to the main gas supply are free of metal shavings, rust, dirt, liquids (oil or water) or other debris. Read and follow any instructions supplied with hoses or fittings.

- Install a ¼ turn manual shut-off valve, in an accessible location, in the gas supply line to *Phill*.
- Install Excess Flow Valve, if required (*see section 3.3*), in accordance with manufacturers instructions .
- Install a drip leg in accordance with applicable standard or code.
- Install a reducing tee with plug at *Phill’s* gas inlet fitting. This provides at test port for measuring inlet pressure.
- Connect the gas supply line to *Phill’s* 1/2” NPT female gas inlet connection (*see Figure 11*) using approved pipe, tubing or flexible hose and appropriate adaptors and fittings.

! WARNING ***Check all gas connections for leaks using a gas sensor or non-corrosive leak detection fluid.***

3 INSTALLATION (continued)

3.7 PRESSURE RELIEF VENT CONNECTION

The **P**ressure **R**elief **V**ent discharges any gas released by the PRV in the event of over-pressurization of *Phill*. Escaping gas must be routed outdoors and then upwards to a safe point of discharge. The PRV shall not terminate near building openings, mechanical air intakes, directly under potential gas accumulating overhangs or near hot air exhausts.

Use piping or tubing appropriate for natural gas, i.e. copper, stainless steel or black iron. If *Phill* is installed outdoors no connection to PRV is required unless the discharge must be routed away from building openings to a safe place of discharge. If the PRV line will be over 4.5 m (15') in length, the tubing shall be a minimum of 1/2" inside diameter .

1. Cut a hole of appropriate size through the wall to the outside for the vent line. The hole should be big enough to accommodate a protective sleeve (e.g. PVC pipe) around the vent line as it passes through the wall.
2. Use appropriate fittings to connect the vent line to the male 3/8" NPT male connection of *Phill*. (*See Figure 11)*
3. Route the vent line through the hole in the wall to the outdoors. Install a protective sleeve around the section of the vent line that passes through the wall.
4. Secure the vent line to the wall to prevent damage from impact or vibration.
5. The vent line shall be installed in such a way that water and debris cannot enter. It should terminate in a gooseneck configuration with the end of the tube facing downward.
6. Transfer the bug screen from the PRV fitting of *Phill* to the end of the PRV line.

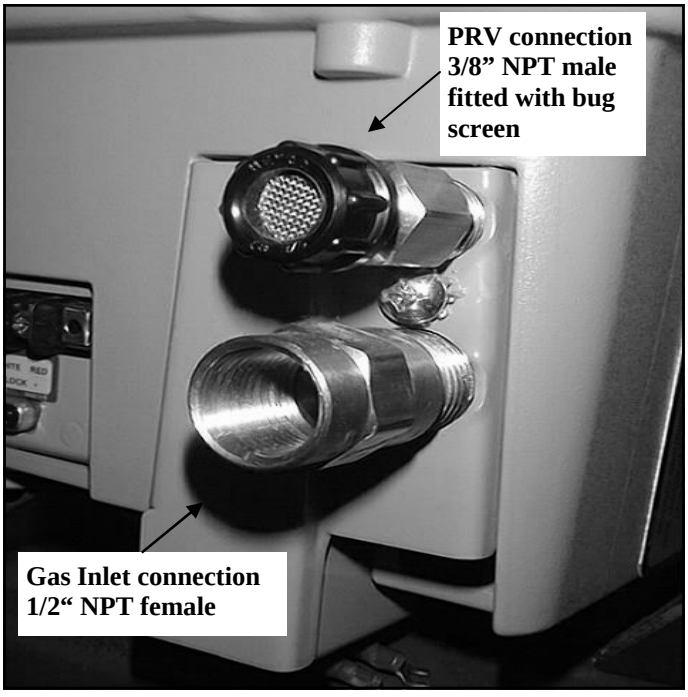


Figure 11 Gas Inlet and PRV Connections

3 INSTALLATION (continued)

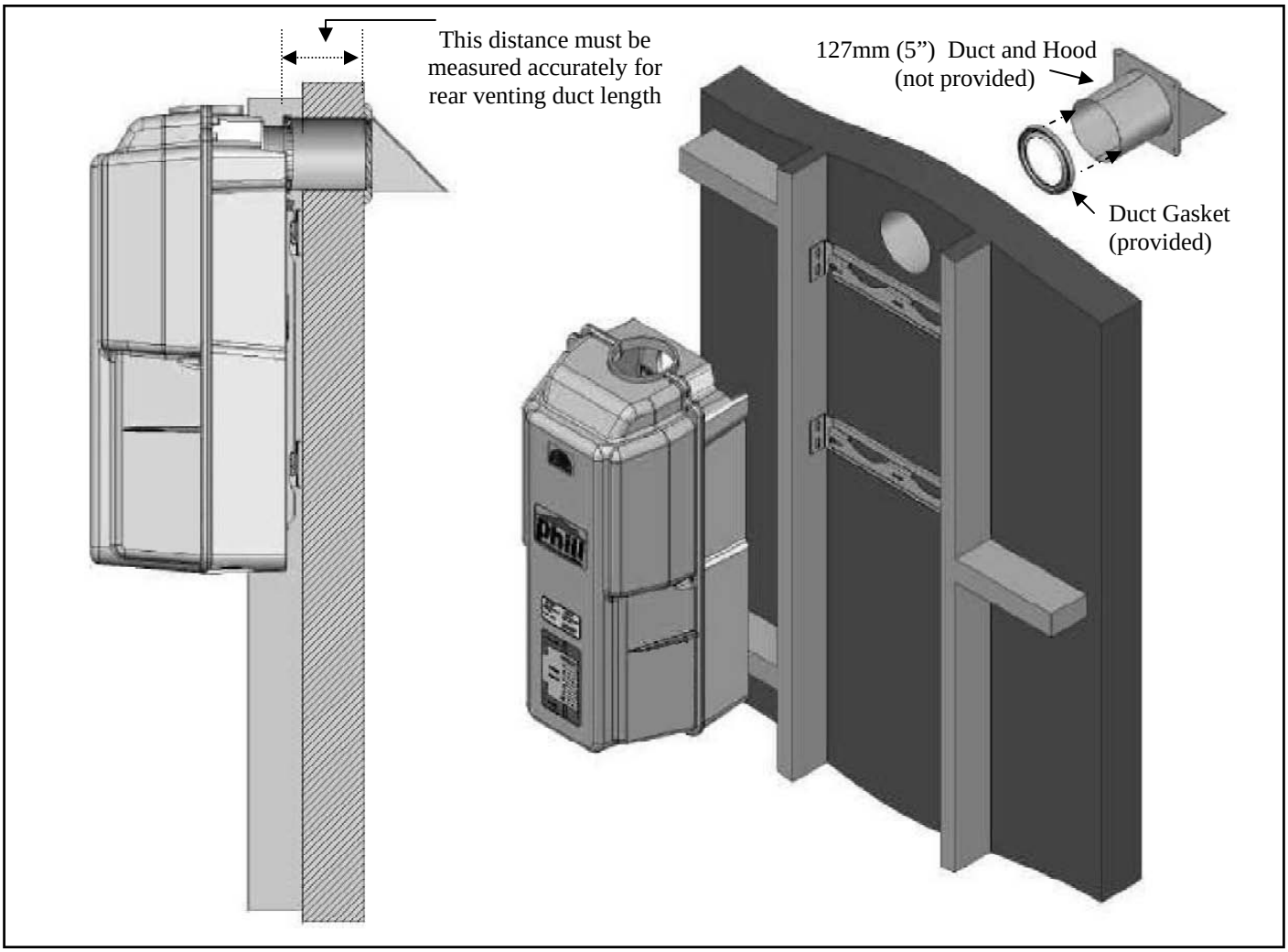


Figure 12 Rear venting

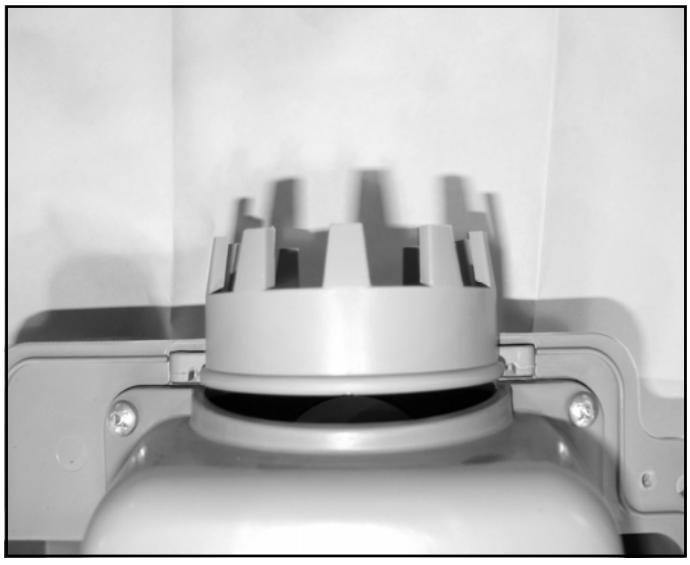


Figure 13 Coupler

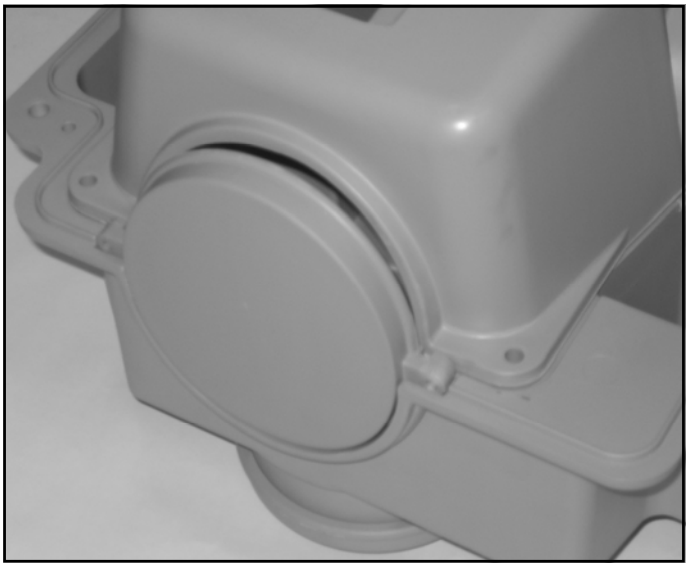


Figure 14 Vent Cover fitted in Top Vent opening

3 INSTALLATION (continued)

3.8 COOLING AIR EXHAUST VENT

The cooling air exhaust can be vented from the top or rear openings of *Phill's* housing. Use the rear opening, for direct venting if *Phill* is mounted indoors onto an outside wall. A hole must be cut through the wall prior to the installation of *Phill* if rear venting is used. (*see section 3.4*) If the unit is mounted on a wall that is shared by the interior of the dwelling then the exhaust air shall be routed through the garage directly to outdoors. The terminating vent hood shall be directed downward and have a fine mesh screen.

Top Venting

Ensure that the factory installed vent cover is fitted to seal the rear vent opening. (*see Figure 4*)

1. With *Phill* mounted securely on its support assembly, loosen the 5 housing screws and swing the front of the housing open. Attach the coupler to the rear housing (*see Figure 13*) with screws provided.
2. Swing housing closed and replace 5 housing screws.
3. Use 3 self tapping screws to fasten 127 mm (5") 90^{o}elbow to coupler. Use a minimum of 300 mm (12") of metallic flexible ducting between the elbow and rigid ducting to reduce transmission of vibration. (*see Figure 17*) Use rigid ducting to route the exhaust to outdoors.
4. Seal all venting connections with foil tape
5. Terminate the exhaust ducting to outside with a downward firing exhaust hood fitted with a screen.

Rear Venting

When mounting *Phill* indoors onto an outside wall, the rear vent opening is used to directly vent the exhaust to the outdoors. An exhaust hood and short section of 127 mm (5") diameter ducting attached shall be used to terminate the vent. A hole must be cut prior to mounting *Phill* on its support brackets. *(see section 3.4*)

1. Ensure the vent cover is fitted to seal the top vent opening. (*see Figure 14)*
2. Measure the length of the exhaust duct required so that it overlaps the flange on the back of *Phill* and the duct hood sits flush against the outside wall. (*see Figure 12)* Trim duct to the measured length. Place the duct gasket provided around the end of the 127 mm (5") duct.
3. Apply sealant to rear surface of exhaust hood. From the outside, push the 127 mm (5") duct through the hole in the wall so it mates with the *Phill's* rear vent opening. Secure the exhaust hood to the outside wall.

Outdoor Venting

1. Attach top muffler to the top of the housing using the screws provided. (*see figure 17*)

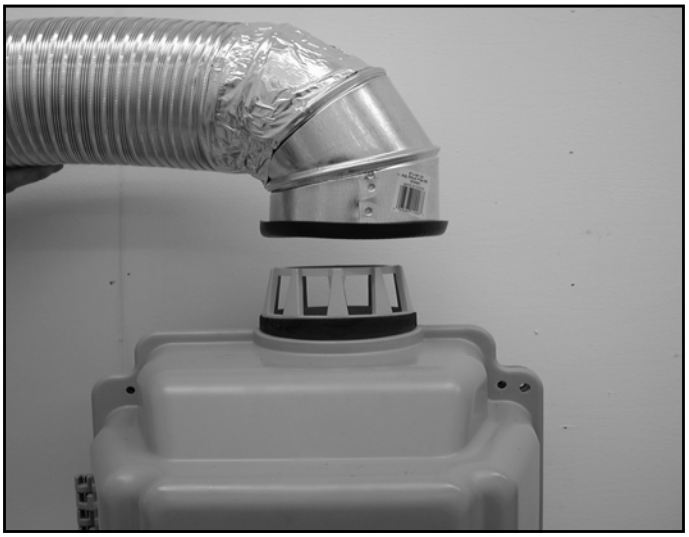


Figure 15 Top Vent Coupler

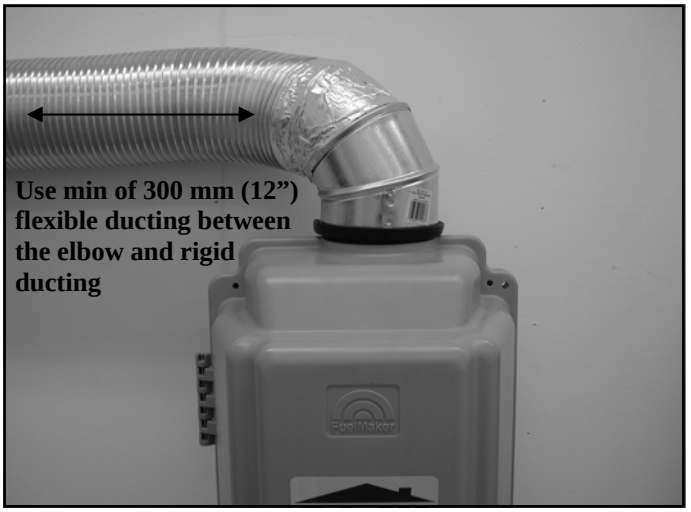


Figure 16 Mating duct to Top Vent Coupler

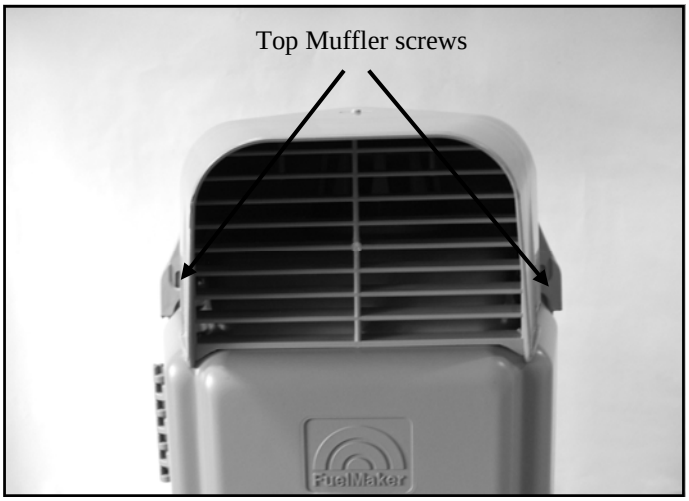


Figure 17 Top Muffler

3 INSTALLATION (continued)

3.9 REMOTE GAS SENSOR INSTALLATION

Phill is equipped with an internal gas sensor. However, if required, a remote gas sensor is available. The remote gas sensor is factory wired and stowed in a cavity in *Phill's* rear housing. (s*ee Figure 18)* for shipping. It shall be removed and installed as required.

Figure 18 Remote Gas Sensor stowage location

Remote Gas Sensor Connection

Install the remote gas sensor in a suitable location as per local code requirements. Typically, the remote gas sensor should be located within 6" of the highest point in the room. Extend the pre-wired remote gas sensor cable so that the sensor is mounted as far away from *Phill* as the 9 m (30') cable allows.

Ensure the power (RED), negative (BLACK) and interlock (WHITE) connections are secured on the appropriate terminals of the terminal strip located on the bottom of *Phill*.

Figure 19 Remote Gas Sensor connections

4 COMMISSIONING

4.1 GENERAL

! CAUTION ***Phill shall be commissioned by qualified persons only. Local codes and regulations may require that Phill be inspected prior to use. Contact the authority having jurisdiction or your local gas supplier.***

To commission *Phill* a FuelMaker Test Kit is required. The Test Kit is comprised of; a test cylinder, a hand-operated vent valve, a calibrated pressure gauge, and a pressure relief device. The Test Kit is also equipped with a refueling receptacle that mates with the fill nozzle.

! NOTICE ***Please read the Test Kit instructions carefully prior to commissioning Phill.***

Purging

1. Attach the Test Kit ground strap to suitable ground (e.g. gas pipe).
2. Attach *Phill's* refueling hose to the receptacle of the Test Kit and open the vent valve on the Test Kit.
3. Push the "START" button on *Phill's* User Panel.
4. Purge the air in *Phill* by running it for 5 seconds.
5. Push the "STOP" button on *Phill's* User Panel .
6. Close the valve on the Test Kit

Flow Rate and Fill Pressure Test

1. Ensure the Test Kit vent valve is closed. Push "START" on *Phill's* User Panel to fill the Test Kit cylinder until *Phill* shuts off and the *Phill* Meter indicates full. The Test Kit cylinder should fill within the allowable pressure limits for the ambient temperature as indicated in *Table 2.* Model HRA-P30 will take approximately 20 minutes to fill the Test Kit cylinder, model HRA-P36

Flow Rate and Fill Pressure Test (continued)

will take approximately 23 minutes to fill the Test Kit cylinder. If *Phill* fails to shutdown, or if the shutdown pressure is out of specification push the "STOP" button and contact FuelMaker.

2. Disconnect *Phill's* nozzle from the Test Kit and stow in the nozzle cradle.
3. Vent Test Kit contents in a safe location.

Leak Test

Following the installation of *Phill*, all pipe and fittings shall be leak-tested using a suitable gas detector or non-corrosive leak detection fluid. The high pressure connections shall be checked for leaks while *Phill* is filling the Test Kit cylinder in the range of 19.3 - 20.7 MPa (2,800 - 3,000 psig) for HRA-P30 and 23.8 - 24.8 MPa (3,400 - 3,600 psig) for HRA-P36.

Cooling Air Exhaust Vent Test

- ✓ Visually inspect all venting and ensure there are no obstructions.
- ✓ Attach the refueling hose nozzle to the Test Kit receptacle and push START.
- ✓ Verify that all venting connections are free of leaks.
- ✓ Seal any leaks found.

Electrical Supply Inspection

- ✓ Visually inspect the wiring
- ✓ Ensure that the supply wiring is code
- ✓ Attach a clamp-on voltmeter to test Phill while it is running
- ✓ Make sure that the voltage and amperage are within specifications according to the spec plate

HRA-P30	HRA-P36
20.5 MPa - 20.7 MPa / 2970 - 3000 psig @ 21°C / 70°F and >	24.6 MPa - 24.8MPa / 3565 - 3600 @ 21°C / 70°F and >
19.0 MPa / 2760 psig* @ 10°C / 50°F	22.8 MPa / 3315 psig* @ 10°C / 50°F
17.6 MPa / 2555 psig* @ 0°C / 32°F	21.1 MPa / 3065 psig* @ 0°C / 32°F
16.2 MPa / 2345 psig* @ -10°C / 14°F	19.4 MPa / 2815 psig* @ -10°C / 14°F
14.7 MPa / 2140 psig* @ -20°C / -4°F	17.7 MPa / 2570 psig* @ -20°C / -4°F
13.3 MPa / 1930 psig* @ -30°C / -22°F	16.0 MPa / 2320 psig* @ -30°C / -22°F
11.9 MPa / 1725 psig* @ -40°C / -40°F	14.3 MPa / 2075 psig* @ -40°C / -40°F
*Note: Pressure readout may vary ± 0.20 MPa / 30 psig	*Note: Pressure readout may vary ± 0.25 MPa / 35 psig

Table 2 Shutdown Pressure vs. Ambient Temperature

4 COMMISSIONING (continued)

4.2 USER TRAINING

Before leaving the site, the Installer shall instruct the user in the proper operation of Phill. The Installer shall leave the Phill Operating and Installation Instructions with the user.

The user shall be trained in the proper use of *Phill* including:

- ✓ Refueling procedure
- ✓ Drive away recovery / Breakaway reconnection
- ✓ Inspection of exhaust air venting
- ✓ Blowback handling
- ✓ Gas leak procedures.

Safety precautions require that the internal components of Phill be inaccessible to the User and other unauthorized persons. Ensure that all panels and fasteners are installed before leaving the site.

5 TROUBLESHOOTING

5.1 USER PANEL ERROR DISPLAY

Phill has diagnostic capabilities that continuously monitor operation and display error conditions using the User Panel *Phill* Meter. If *Phill* detects an Error, the red Error LED will illuminate.

To display the error code, push and hold the "STOP" button. Refer to the table below for the type of error and corrective action. Do not attempt repairs to the unit, contact a qualified service representative for assistance.

✷ **indicates flashing LED** ● **indicates steady lit LED**

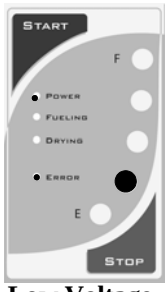
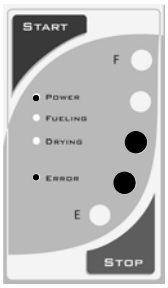
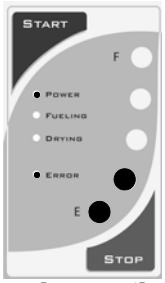
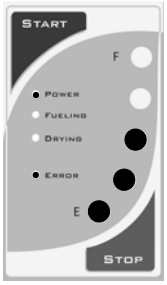
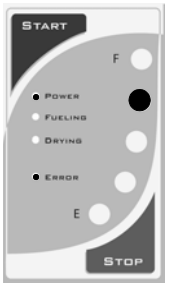
Error Display	Corrective Action	Error Display	Corrective Action
 **Low Inlet Pressure (00001)**	✓ Confirm gas inlet pressure at *Phill* is within specification. Inlet pressure must be 1.7 – 3.5 kPa (0.25 – 0.50 psig). ✓ Ensure that the 1/4 turn shut-off valve is fully open. ✓ Check if gas pipe size is sufficient for pressure / flow. ✓ Check if gas regulator is correct type and size for pressure / flow.	 **Motor Over Current (00101)**	✓ Confirm supply voltage to *Phill* is within specification. ✓ 120 VAC supply voltage must be 108 - 126 VAC. ✓ 240 VAC supply voltage must be 216 - 252 VAC. ✓ Check voltage at receptacle. ✓ Check voltage at service panel.
 **Low Voltage (00010)**	✓ Confirm supply voltage to *Phill* is within specification. ✓ 120 VAC supply voltage must be 108 - 126 VAC. ✓ 240 VAC supply voltage must be 216 - 252 VAC. ✓ Check voltage at receptacle. ✓ Check voltage at service panel.	 **Internal Gas Alarm (00110)**	✓ Check the following for the source of a gas leak: - Nozzle - Breakaway Assembly - Refueling Hose - Inlet Piping - Vehicle - Other combustibles stored in refueling area. ✓ Repair as required.
 **Blowdown Failure (00011)**	✓ Check breakaway assembly for obstructions. ✓ Check nozzle for obstructions. ✓ Check vehicle refueling receptacle for obstructions or binding. ✓ Clean / replace vehicle receptacle as required.	 **No Pressure Rise (00111)**	✓ Check the following for the source of a gas leak: - Nozzle - Breakaway Assembly - Refueling Hose - Vehicle ✓ Repair as required. **This error may occur if the vehicle tank pressure is too low i.e. tank nearly empty. Use public refueling station.**
 **Motor Overheated (00100)**	✓ Confirm supply voltage to *Phill* is within specification. ✓ Check cooling exhaust vent for obstructions. ✓ Check cooling air inlet louvers for obstructions. ✓ Check exhaust duct size and length. - Minimum 5" diameter ducting. - Maximum 45 feet run length and no more than 3 changes in direction.	 **Sudden Pressure Drop (01000)**	✓ Check the following for the source of a gas leak: - Nozzle - Breakaway Assembly - Refueling Hose - Vehicle fuel system ✓ Repair as required.

Table 2 User Panel Error Display

5 TROUBLESHOOTING

5.1 USER PANEL ERROR DISPLAY

✹ **indicates flashing LED** ● **indicates steady lit LED**

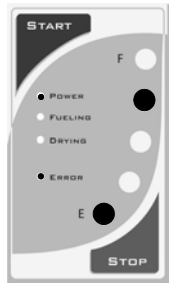
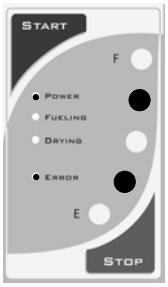
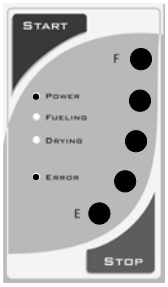
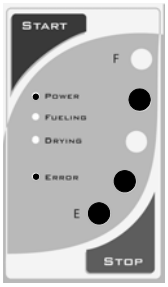
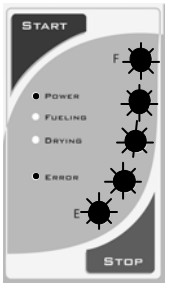
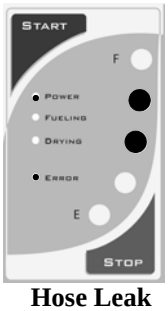
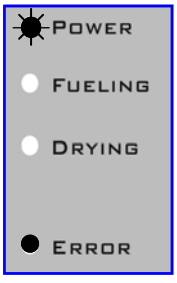
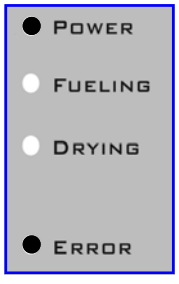
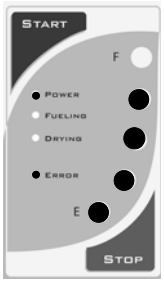
Error Display	Corrective Action	Error Display	Corrective Action
 **Low Cooling Air Flow (01001)**	✓ Check cooling exhaust vent and ducting for obstructions. ✓ Check cooling air inlet louver for obstructions. ✓ Check exhaust duct size and length. - Minimum 5" diameter ducting. - Maximum 45 feet run length and no more than 3 changes in direction. ✓ Ensure there is sufficient replacement air into the refueling area	 **Remote Gas Alarm (01101)**	✓ Check for the following for the source of a gas leak: - Nozzle - Breakaway Assembly - Refueling Hose - Inlet Piping - Vehicle - Other combustibles stored in refueling area. ✓ Repair as required.
 **Maximum Run Time Exceeded (01010)**	✓ Check the following for leaks. - Nozzle - Breakaway - Refueling Hose - Vehicle fuel system ✓ Restart *Phill*.	 **Non Serviceable Error (11111)**	✓ Unplug *Phill* for 1 minute and plug back in to reset. Call your installer or FuelMaker for assistance.
 **Excessive Inlet Pressure (01011)**	✓ Confirm gas inlet pressure at *Phill* is within specification. Inlet pressure must be 1.7 – 3.5 kPa (0.25 – 0.50 psig). ✓ Check gas regulator is correct type and size for pressure /flow.	 **Blowback**	Refer to section **4.2 ERROR CONDITIONS Blowback** of these instructions on how to correct this condition. ✓ Inspect vehicle receptacle and repair as required. **Do not use vehicle until cause of blowback has been determined.**
 **Hose Leak (01100)**	✓ Check breakaway assembly for obstructions or damage. ✓ Inspect hose assembly for damage or leaks. ✓ Inspect nozzle assembly for damage or debris. ✓ Inspect vehicle refueling receptacle for debris or damage. ✓ Clean / replace as required.	 **Calibration Error**	 **Software Error** Unplug *Phill* for 1 minute and plug back in to reset.

Table 2 User Panel Error Display

✹ **indicates flashing LED** ● **indicates steady lit LED**

Error Display	Corrective Action	Error Display	Corrective Action
 **Start Button Failure (10001)**	✓ Check the following by substitution: - User Panel - Header PCB - Ribbon cable ✓ Replace Front cover is problem persists	 **Air Flow Switch (01111)**	✓ Check the air flow switch for the following: - Obstructions or debris. - Proper movement of air flow switch ✓ Confirm level installation of *Phill*. ✓ Check air flow switch voltages.
 **Stop Button Failure (10010)**	✓ Check the following by substitution: - User Panel - Header PCB - Ribbon cable ✓ Replace Front cover is problem persists		
 **Internal Gas Sensor Failure (10011)**	✓ Check and clean gas sensor. ✓ Check internal gas sensor voltages.		
 **Gas Sensor Reference Voltage Failure (10100)**	✓ Check internal gas sensor voltages.		

6 REMOVAL AND DISPOSAL

6.1 REMOVING PHILL

! CAUTION ***If for any reason Phill must be removed, it shall be done by authorized service representatives only.***

1. Turn off the gas supply to *Phill.*
2. Unplug *Phill's* power supply cord from the electrical receptacle.
3. Disconnect *Phill's* gas inlet from the gas supply connection.
4. Disconnect the Pressure Relief Valve vent piping from the connection at *Phill.*
5. If installed remove the remote gas sensor and stow it in the appropriate cavity in the back of the housing. *(see Figure 18)* Neatly coil the cable and fasten the detector shell to the Velcro strip on housing.
6. Depressurize *Phill* by pushing down on the stem inside the nozzle using a blunt instrument (see *Figure 19*). Make sure the nozzle is pointing away from anyone when depressurizing. Do Not use a tool that could mark the nozzle or break apart within the nozzle.
7. Open the front housing of Phill and finger-tighten the 3 restraining bolts (see *Figure 5*).
8. Separate the refueling hose at the breakaway assembly.
9. Remove the cooling exhaust ducting from *Phill.*
10. Loosen and lock plate and slide it to the right to disengage *Phill* from the support assembly.
11. With help, lift *Phill* straight upwards to disengage it from the support assembly.
12. Cover *Phill's* gas inlet and Pressure Relief Vent openings before packing and transporting *Phill* to prevent contamination of internal components.
13. Lay *Phill* on its back and, using a slot screwdriver, firmly tighten the 3 restraining bolts to secure the internal mechanism for shipping. Replace the front housing screws.
14. Place *Phill* in the original packaging, laying on its back, for transportation or shipping.

! NOTICE ***Phill must be shipped in the original packaging. Ensure that the refueling nozzle/ hose assembly is properly stowed in the accessories box for transportation or shipping.***

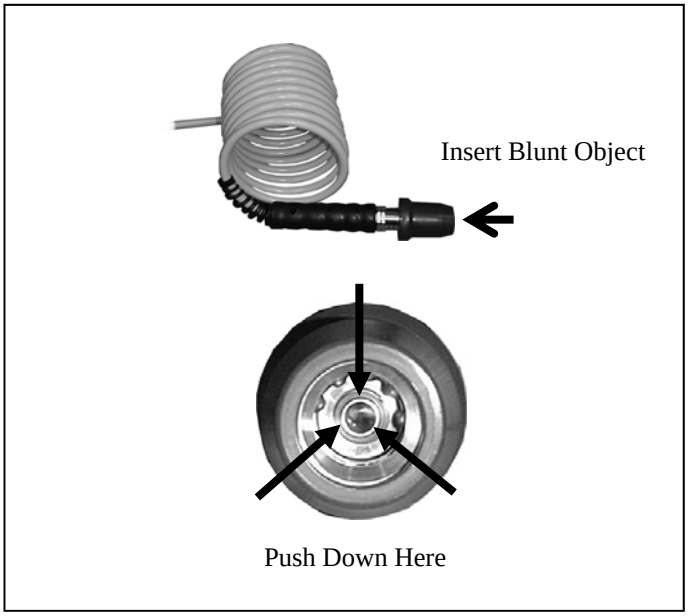


Figure 19 Depressurizing Phill

6 REMOVAL AND DISPOSAL

6.2 DISPOSAL

At the end of *Phill*'s life cycle, it is important to plan a careful disposal of the unit. *Phill* contains a drying desiccant that absorbs mercaptan from the natural gas during the refueling process which is considered as hazardous waste.

DO NOT DISPOSE OF PHILL WITH YOUR HOUSEHOLD WASTE.

There is no danger of exposure but the disposal must be performed according to Federal and State environmental protection guidelines.

In order to adhere to these guidelines, owners must call their local / county health or household hazardous waste management agencies to schedule a pick-up or drop-off.

These authorities have collection facilities available for the appropriate disposal of hazardous waste such as Mercaptan. These facilities usually have specific schedules for the collection of hazardous waste, so please contact them to find their applicable pick up schedule in your area.

The *Phill* unit to be disposed of must be carefully packed and labeled. In California, a special label has been designed to mark such as hazardous waste and is available at your local environmental protection/health agencies.
Please find an example of such a label below:


HAZARDOUS WASTE

STATE AND FEDERAL LAW PROHIBIT IMPROPER DISPOSAL.
IF FOUND, CONTACT THE NEAREST POLICE OR PUBLIC SAFETY AUTHORITY, THE U.S. ENVIRONMENTAL PROTECTION AGENCY OR THE CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL.

GENERATOR INFORMATION:
NAME UNIVERSITY OF CALIFORNIA, BERKELEY
ADDRESS UNIVERSITY HALL 2ND FLOOR PHONE 510-642-3073
CITY BERKELEY STATE CA ZIP 94720-1150
EPA ID NO. / MANIFEST DOCUMENT NO. /
EPA WASTE NO. D008 CA WASTE NO. 181 ACCUMULATION START DATE
CONTENTS, COMPOSITION: LEAD BACKMOUNT CHIPS
SHIPPING START DATE: 11-01-01
PHYSICAL STATE: ☒ SOLID ☐ LIQUID
HAZARDOUS PROPERTIES: ☐ FLAMMABLE ☒ TOXIC ☐ CORROSIVE ☐ REACTIVITY ☐ OTHER
D.O.T. PROPER SHIPPING NAME AND UN OR NA NO. WITH PREFIX

HANDLE WITH CARE!

STYLE CFWXCAR

LABELMASTER® (800) 621-5808 www.labelmaster.com

Steps to be taken for the disposal of Phill:

- Call your local hazardous waste management / environmental protection / health agency to inquire about specific procedures applicable to your area, including obtaining appropriate labeling for disposal.
- Have a qualified installer remove Phill as per the instructions in the Installation Manual. (*see section 6.1*)
- Pack the product carefully for shipment.
- Label the product according to the applicable labeling requirements.
- Call your local authority to schedule a pick-up or to locate the hazardous waste collection facility for a drop-off.

For additional information on Household Hazardous Waste disposal agencies and contacts, please call FuelMaker at 1 866 MY PHILL.

PRODUCT / INSTALLATION INFORMATION

Unit Serial number: _____

Unit Model Number: _____

Date of Installation: _____

Installing Contractor: _____

Installing Contractor Telephone Number: _____

External Gas Sensor Installed: **YES** / **NO**

Excess Flow Valve Installed: **YES** / **NO**

NOTES: