

3.1 SITE SELECTION

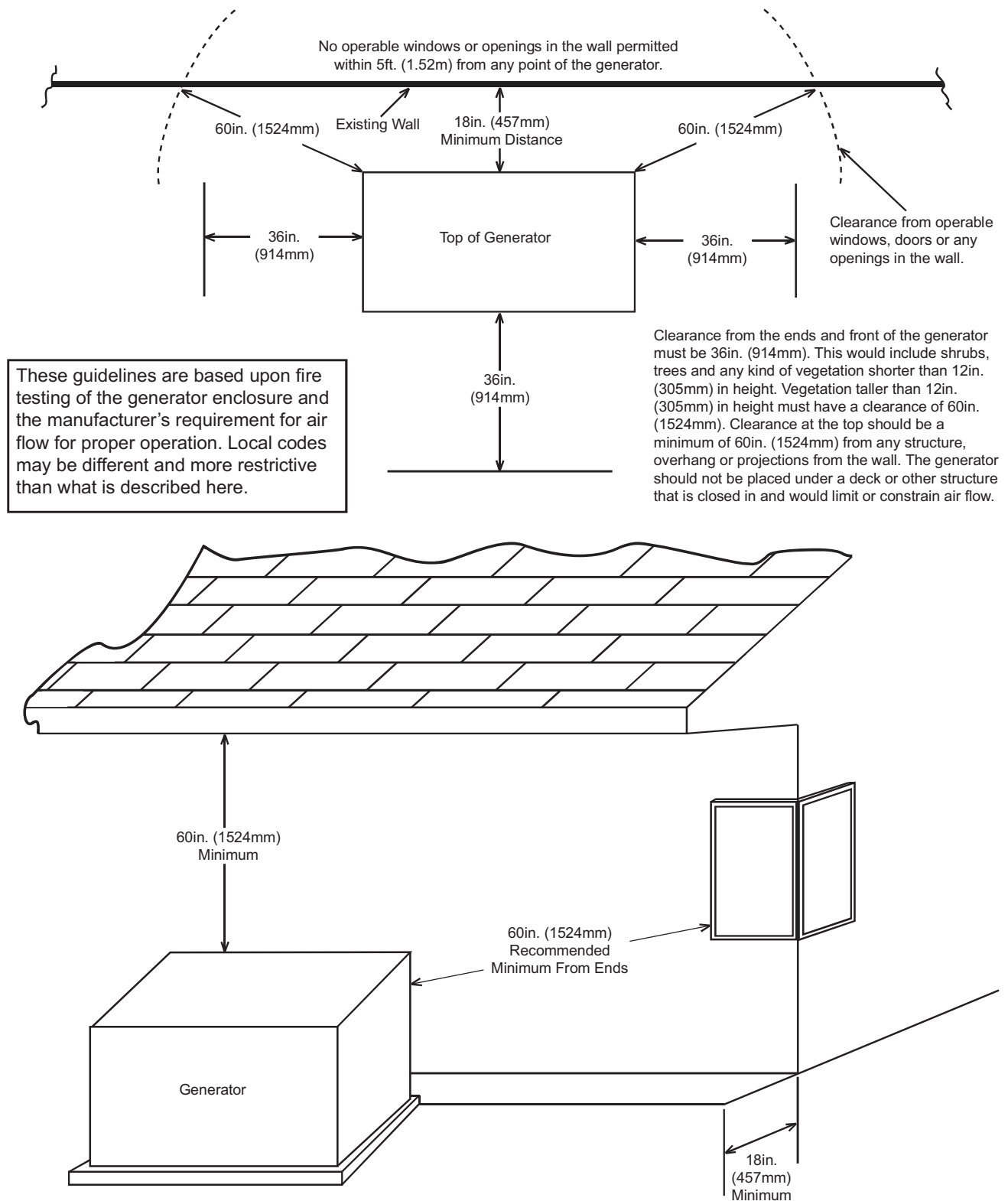


Figure 3.1 – Installation Guidelines

Install the generator set, in its protective enclosure, **outdoors**, where adequate cooling and ventilating air is always available (Figure 1.9). Consider these factors:

- The installation of the generator **must comply strictly with NFPA 37, NFPA 54, NFPA 58 and NFPA 70 standards.**
- Install the unit where air inlet and outlet openings will not become obstructed by leaves, grass, snow, etc. If prevailing winds will cause blowing or drifting, consider using a windbreak to protect the unit.
- Install the generator on high ground where water levels will not rise and endanger it. It should not operate in or be subjected to standing water.
- Allow sufficient room on all sides of the generator for maintenance and servicing. This unit must be installed in accordance with current applicable NFPA 37 and NFPA 70 standards, as well as any other federal, state and local codes for minimum distances from other structures. **DO NOT** install under wooden decks or structures unless there is at least 5ft. (1.52m) of clearance above the generator, 3ft. (.91m) of clearance on sides and front, and a minimum of 18in. (457mm) of clearance at the back of the unit.
- Install the unit where rain gutter down spouts, roof run-off, landscape irrigation, water sprinklers or sump pump discharge does not flood the unit or spray the enclosure, including any air inlet or outlet openings.
- Install the unit where services will not be affected or obstructed, including concealed, underground or covered services such as electrical, fuel, phone, air conditioning or irrigation. This could affect Warranty Coverage.
- Where strong prevailing winds blow from one direction, face the generator air inlet openings to the prevailing winds.
- Install the generator as close as possible to the fuel supply to reduce the length of piping. **REMEMBER THAT LAWS OR CODES MAY REGULATE THE DISTANCE AND LOCATION.**
- Install the generator as close as possible to the transfer switch. **REMEMBER THAT LAWS OR CODES MAY REGULATE THE DISTANCE AND LOCATION.**
- The generator must be installed on a level surface. The generator must be level within a .5in (13mm) all around.
- The generator is typically placed on pea gravel, crushed stone or a concrete pad. Check local codes to see what type is required. If a concrete pad is required, all federal, state and local codes should be followed.

3.1.1 INSTALLATION GUIDELINES FOR STATIONARY AIR-COOLED 8, 11, 13, 14, 15, 16, 17 AND 20 KW GENERATORS

The National Fire Protection Association has a standard for the installation and use of stationary combustion engines. That standard is NFPA 37, its requirements limit the spacing of an enclosed generator set from a structure or wall (Figure 1.10).

NFPA 37, Section 4.1.4, Engines Located Outdoors: Engines, and their weatherproof housings if provided, that are installed outdoors shall be located at least 5ft. (1.52m) from openings in walls and at least 5ft. (1.52m) from structures having combustible walls. A minimum separation shall not be required where either of the following conditions exist:

1. The adjacent wall of the structure has a fire resistance rating of at least 1 hour.
2. The weatherproof enclosure is constructed of noncombustible materials and it has been demonstrated that a fire within the enclosure will not ignite combustible materials outside the enclosure.

Annex A — Explanatory Material

A4.1.4 (2) Means of demonstrating compliance are by means of full scale fire test or by calculation procedures.

Because of the limited spaces that are frequently available for installation, it has become apparent that exception (2) would be beneficial for many residential and commercial installations. With that in mind, the manufacturer contracted with an independent testing laboratory to run full scale fire tests to assure that the enclosure will not ignite combustible materials outside the enclosure.

NOTE: Southwest Research Institute testing approves 18in. (457mm) installation minimum from structure. Southwest Research is a nationally recognized third party testing and listing agency.

The criteria was to determine the worst case fire scenario within the generator and to determine the ignitability of items outside the engine enclosure at various distances. The enclosure is constructed of non-combustible materials, and the results and conclusions from the independent testing lab indicated that any fire within the generator enclosure would not pose any ignition risk to nearby combustibles or structures, with or without fire service personnel response.

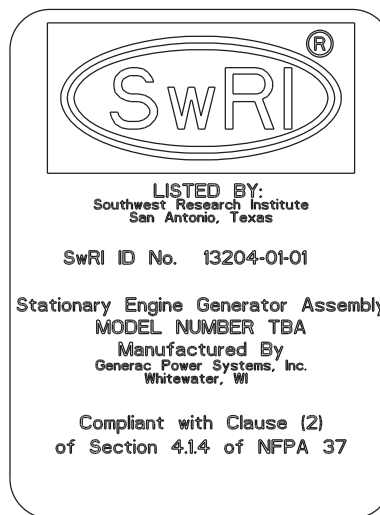


Figure 3.2 — Southwest Research Institute Decal (located inside the generator, next to the generator’s data decal)
<http://www.swri.org/4org/d01/fire/listlab/listprod/director.htm>

Based on this testing and the requirements of NFPA 37, Sec 4.1.4, the guidelines for installation of the generators listed above are changed to 18in. (457mm) from the back side of the generator to a stationary wall or building. For adequate maintenance and airflow clearance, the area above the generator should be at least 5ft. (1.52m) with a minimum of 3ft. (.91m) at the front and ends of the enclosure. This would include trees, shrubs and vegetation shorter than 12in. (305mm) in height. Vegetation taller than 12in. (305mm) in height must have a clearance of 60in. (1524mm). Vegetation not in compliance with these clearance parameters could obstruct air flow. In addition, exhaust fumes from the generator could inhibit plant growth. See Figure 3.1 and the installation drawing within the owner’s manual for details.

Generator exhaust contains DEADLY carbon monoxide gas. This dangerous gas can cause unconsciousness or death. Do not place the unit near windows, doors, fresh air intakes (furnaces, etc.) or any openings in the building or structure, including windows and doors of an attached garage.

⚠ WARNING!

⚠ If the generator is not set to the OFF mode, it can crank and start as soon as the battery cables are connected. If the utility power supply is not turned off, sparking can occur at the battery posts and cause an explosion.

3.2 SITE PREPARATION

- Locate the mounting area as close as possible to the transfer switch and fuel supply.
- Leave adequate room around the area for service access (check local code), and place high enough to keep rising water from reaching the generator.
- Choose an open space that will provide adequate and unobstructed airflow.
- Place the unit so air vents won’t become clogged with leaves, grass, snow or debris. Make sure exhaust fumes will not enter the building through eaves, windows, ventilation fans or other air intakes (see the “Site Selection” section).
- Select the type of base, gravel or concrete, as desired or as required by local laws or codes. Verify your local requirements before selecting.

3.2.1 CRUSHED STONE OR GRAVEL

- Dig a rectangular area approximately 5in. (127mm) deep and about 6in. (152mm) longer and wider than the footprint of the generator. Cover with polyurethane film, if desired, and fill with pea gravel or crushed stone. Compact and level the stone. A concrete pad can be poured if desired or required. The pad should be 4-5in. (102-127mm) thick and extend 6in. (152mm) beyond the outside of the generator in all directions.

NOTE: If a concrete pad is required, follow all applicable Federal, State or local codes.

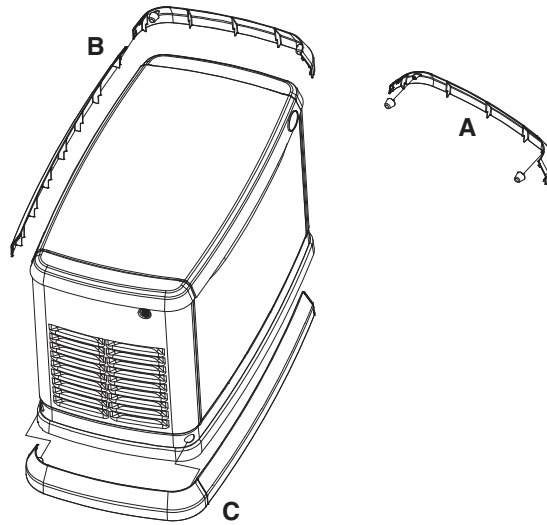


Figure 3.5 — Fascia Installation

***After completing GENERATOR PLACEMENT, proceed to
Step 4:
SECTION 5 — FUEL CONVERSION / GAS REQUIREMENTS /
CONNECTIONS***

***Section 5 Fuel Conversion / Gas Requirements /
Connections***

5.1 FUEL CONVERSION

The generator was configured for natural gas operation at the factory. Switching over to LP Vapor is a simple procedure.

NOTE: The orange fuel conversion knob is located on the top of the fuel mixer on the V-twin engine and under the fuel mixer on the single cylinder engine.

Turn the valve towards the marked fuel source arrow until it stops. If needed, use pliers to break free in correct direction of arrow. Fuel knob will rotate 180° and slide into the mixer body when converting to LP.

FUEL KNOB LOCATIONS SHOWN FROM GENERATOR AIR BOX SIDE VIEW

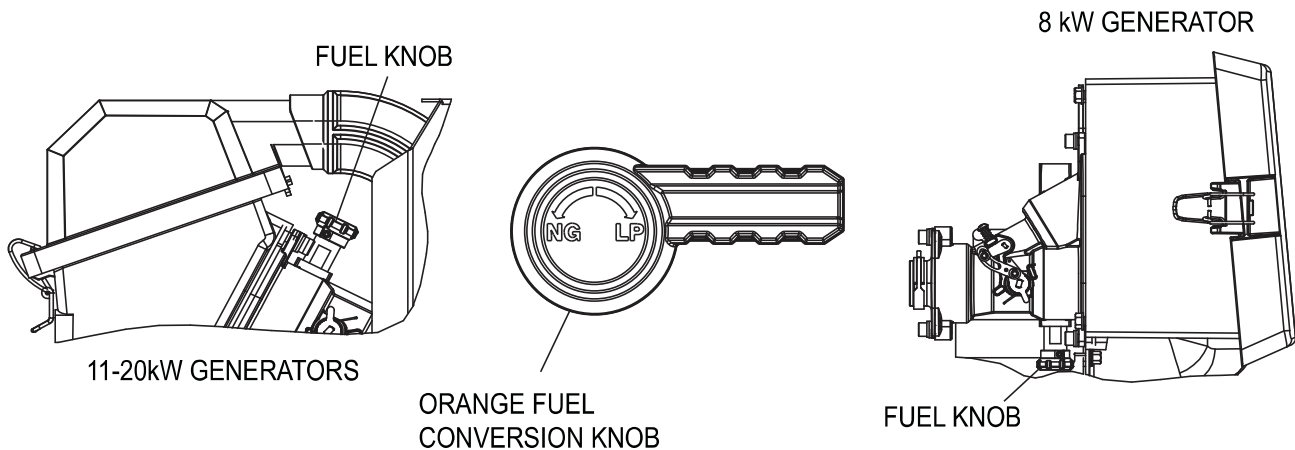


Figure 5.1 — Fuel Conversion Knob Location for Single and Twin Cylinder Generators

5.2 FUEL REQUIREMENTS AND RECOMMENDATIONS

With LP gas, use only the vapor withdrawal system. This type of system uses the vapors formed above the liquid fuel in the storage tank.

The engine has been fitted with a fuel carburetion system that meets the specifications of the 1997 California Air Resources Board for tamper-proof dual fuel systems. The unit will run on natural gas or LP gas, but it has been factory set to run on natural gas. Should the primary fuel need to be changed to LP gas, the fuel system needs to be reconfigured. See the Fuel Conversion section for instructions on converting the fuel system.

Recommended fuels should have a Btu content of at least 1,000 Btus per cubic foot (37.26 megajoules per cubic meter) for natural gas; or at least 2,500 Btus per cubic foot (93.15 megajoules per cubic meter) for LP gas. Ask the fuel supplier for the Btu content of the fuel.

Required fuel pressure for natural gas is 3.5-7" water column (7-13mm mercury). Required fuel pressure for liquid propane vapor is 10-12" water column (19-22mm mercury). The primary regulator for the propane supply is NOT INCLUDED with the generator.

NOTE: All pipe sizing, construction and layout must comply with NFPA 54 for natural gas applications and NFPA 58 for liquid propane applications. Once the generator is installed, verify that the fuel pressure NEVER drops below it's required fuel pressure rating. For further information regarding NFPA requirements refer to their website at www.nfpa.org.

Prior to installation of the generator, the installer should consult local fuel suppliers or the fire marshal to check codes and regulations for proper installation. Local codes will mandate correct routing of gaseous fuel line piping around gardens, shrubs and other landscaping to prevent any damage.

Special considerations should be given when installing the unit where local conditions include flooding, tornados, hurricanes, earthquakes and unstable ground for the flexibility and strength of piping and their connections.

Use an approved pipe sealant or joint compound on all threaded fittings.

All installed gaseous fuel piping must be purged and leak tested prior to initial start-up in accordance with local codes, standards and regulations.

5.3 FUEL CONSUMPTION

NOTE: Required fuel pressure for natural gas is 3.5-7" water column (7-13mm mercury). The required fuel pressure for LP Vapor is 10-12" water column (19-22mm mercury).

These are approximate values, use the appropriate spec sheet or owner's manual for specific values.

Unit	Nat. Gas		LP Vapor	
	1/2 Load	Full Load	1/2 Load	Full Load
7 / 8 kW	78 / 2.21	121 / 3.43	0.87 / 3.29	1.42 / 5.37
10 / 11 kW	124 / 3.51	195 / 5.52	1.18 / 4.45	1.92 / 7.28
13 / 13 kW	157 / 4.45	255 / 7.22	1.64 / 6.2	2.95 / 11.15
14 / 14 kW	177 / 5.01	279 / 7.9	1.85 / 6.99	3.07 / 11.61
15 / 15 kW	185 / 5.24	296 / 8.38	1.83 / 6.91	2.86 / 10.82
16 / 16 kW	193 / 5.47	312 / 8.83	1.9 / 7.2	3.19 / 12.07
16 / 17 kW	193 / 5.47	312 / 8.83	1.99 / 7.53	3.57 / 13.53
18 / 20 kW	205 / 5.8	308 / 8.72	2.08 / 7.87	3.85 / 14.57
* Natural gas is in cubic feet per hour / cubic meters per hour. ** LP is in gallons per hour / liters per hour. *** Values given are approximate.				

Verify that gas meter is capable of providing enough fuel flow to include household appliances and all other loads.

⚠ DANGER!

 Gaseous fuels such as natural gas and liquid propane (LP) gas are highly explosive. Even the slightest spark can ignite such fuels and cause an explosion. No leakage of fuel is permitted. Natural gas, which is lighter than air, tends to collect in high areas. LP gas is heavier than air and tends to settle in low areas.

NOTE: A minimum of one approved full flow manual shut-off valve must be installed in the gaseous fuel supply line. The valve must be easily accessible. Local codes determine the proper location.

NOTE: THE GAS SUPPLY AND PIPE MUST BE SIZED AT 100% LOAD BTU / MEGAJOULE RATING.

5.4 FUEL LINE SIZING

- First, determine what size pipe is required. Refer to NFPA 54 for NG or NFPA 58 for LP for further information.
- Always refer to the owner's manual for the proper BTU / megajoule and required gas pressures. To calculate BTU or Megajoules:
 - Natural Gas: $\text{BTU} = \text{Cubic feet / hour} \times 1000$
 $\text{Megajoules} = \text{Cubic meters / hour} \times 37.26$
 - Liquid Propane Vapor: $\text{BTU} = \text{Cubic feet / hour} \times 2500$
 $\text{Megajoules} = \text{Cubic meters / hour} \times 93.15$
- Start by measuring the distance from the generator to the gas source. The generator should be plumbed directly from the source, not off the end of an existing system.
- When measuring the pipe length, add 2.5ft. (.76m) for every angle or bend in the pipe and add that to the overall pipe distance.

5.4.1 NATURAL GAS PIPE SIZING

To properly use this chart, find the kW rating of the generator in the left column, and trace to the right. The number to the right is the maximum length (measured in feet / meters) allowed for the pipe sizes on top. The pipe sizes are measured by inside diameter (ID) to include any fittings, valves (must be full flow), elbows, tees or angles. Add 2.5ft. (.76m) per any bend, tee or angle in the pipe to the overall distance.

kW	Pipe Size (in. / mm)				
	.75 / 19	1 / 25	1.25 / 32	1.5 / 38	2 / 51
7-8	55 / 16.76	200 / 60.96	820 / 249.94		
11	20 / 6.1	85 / 25.91	370 / 112.78	800 / 243.84	
13-14	10 / 3.05	50 / 15.24	245 / 74.68	545 / 166.12	
16-17		40 / 12.19	190 / 57.91	425 / 129.54	
20		20 / 6.1	130 / 39.62	305 / 92.96	945 / 288.04
For 5-7" of water column (9-13mm mercury)					

kW	Pipe Size (in. / mm)			
	.75 / 19	1 / 25	1.25 / 32	1.5 / 38
7-8	20 / 6.1	60 / 18.29	175 / 53.34	
11		30 / 9.14	125 / 38.1	200 / 60.96
13-14		20 / 6.1	80 / 24.38	175 / 53.34
16-20		10 / 3.05	60 / 18.29	125 / 38.1
For pressures below 5" of water column (9mm mercury) down to 3.5" of water column (7mm mercury)				

5.4.2 LP VAPOR PIPE SIZING

To properly use this chart, find the kW rating of the generator in the left column, and trace to the right. The number to the right is the maximum length (measured in feet / meters) allowed for the pipe sizes on top. The pipe sizes are measured by inside diameter (ID) to include any fittings, valves (must be full flow), elbows, tees or angles. Add 2.5ft. (.76m) per any bend, tee or angle in the pipe to the overall distance.

NOTE: Pipe sizes are using a second stage regulator.

NOTE: The minimum LP tank size is 250 gallons (946 L), unless unit calculations dictate use of a larger tank. Vertical tanks, which are measured in pounds (or kilograms), will not usually meet the minimum tank size requirement. A 1050 lb (476 kg) vertical tank size minimum is required.

kW	Pipe Size (in. / mm)		
	.75 / 19	1 / 25	1.25 / 32
7-8	165 / 50.29	570 / 173.74	
11	70 / 21.33	255 / 77.72	1000 / 304.8
13-14	45 / 13.72	170 / 51.82	690 / 210.31
16-17	25 / 7.62	130 / 39.62	540 / 164.59
20	15 / 4.57	115 / 35.05	480 / 146.3

5.4.3 GAS INSTALLATION SUMMARY

GAS PIPE SIZING IS ONE OF THE MOST COMMONLY MADE MISTAKES. A PROPERLY SIZED GAS PIPE IS CRITICAL TO THE PROPER OPERATION OF THE GENERATOR. THE GENERATOR INLET SIZE HAS NO BEARING ON THE PROPER GAS PIPE SIZE.

NOTE: THE GAS SUPPLY AND PIPE MUST BE SIZED AT 100% LOAD BTU / MEGAJOULE RATING.

5.5 INSTALLING & CONNECTING GAS LINES

- Both natural gas and LP Vapor are highly volatile substances, so strict adherence to all safety procedures, codes, standards and regulations is essential.
Gas line connections should be made by a certified plumber familiar with local codes. Always use AGA-approved gas pipe and a quality pipe sealant or joint compound.
Verify the capacity of the natural gas meter or the LP tank in regards to providing sufficient fuel for both the generator and other operating appliances.
 - Fuel Regulator installed per laws or regulator manufacturer's specifications
 - AGA approved gas pipe
 - Flexible fuel line
 - Do not bend!!!
 - Do not attach directly to generator
 - Check all connections for leaks
 - Sediment trap near generator (if applicable or required by code)
 - Full flow rated shut-off near generator per local jurisdiction or code

2. Most applications will require an external manual full flow shutoff valve on the fuel line.



Figure 5.2 — Full Flow Shutoff Valve

3. When connecting the gas line to the generator, use the provided section of UL Listed or AGA-approved flexible fuel line in accordance with local regulations. The purpose of the flexible fuel line is to ensure that vibration from the generator does not cause a gas leak at one of the connection points, so it's important that the line be installed with as few bends as possible. Configure the sediment trap (if applicable or required by code) as illustrated.



Figure 5.3 — Sediment Trap



Figure 5.4 — Incorrect Routing of Flexible Hose

4. Never bend the flexible fuel line to avoid using an elbow. Bending the flexible line decreases its ability to absorb vibrations and defeats its purpose, as well as constricts the actual fuel flow. See Figure 5.5.
5. Check for leaks by spraying all connection points with a soap solution made of dishwashing soap and water. You should not see the solution be “blown away” or form “bubbles”. Next, check the gas pressure at the regulator in the generator by following these steps.
 - Close gas supply valve.
 - Remove the top gas pressure test port from the regulator (see Figure 5.6) and install the gas pressure tester (manometer).
 - Open the gas supply valve and ensure that the pressure is within the specified values.

NOTE: See owner’s manual or spec sheet for proper fuel pressure specifications. If the gas pressure is not within specifications, contact the local gas supplier.

- 4) Close gas valve when completed.

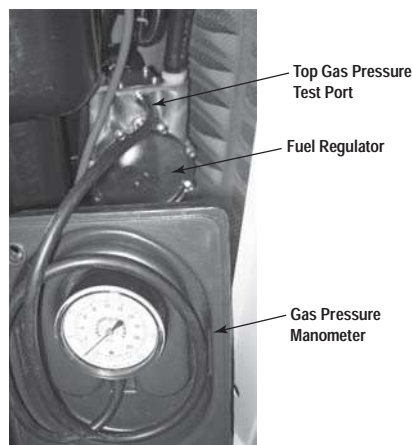
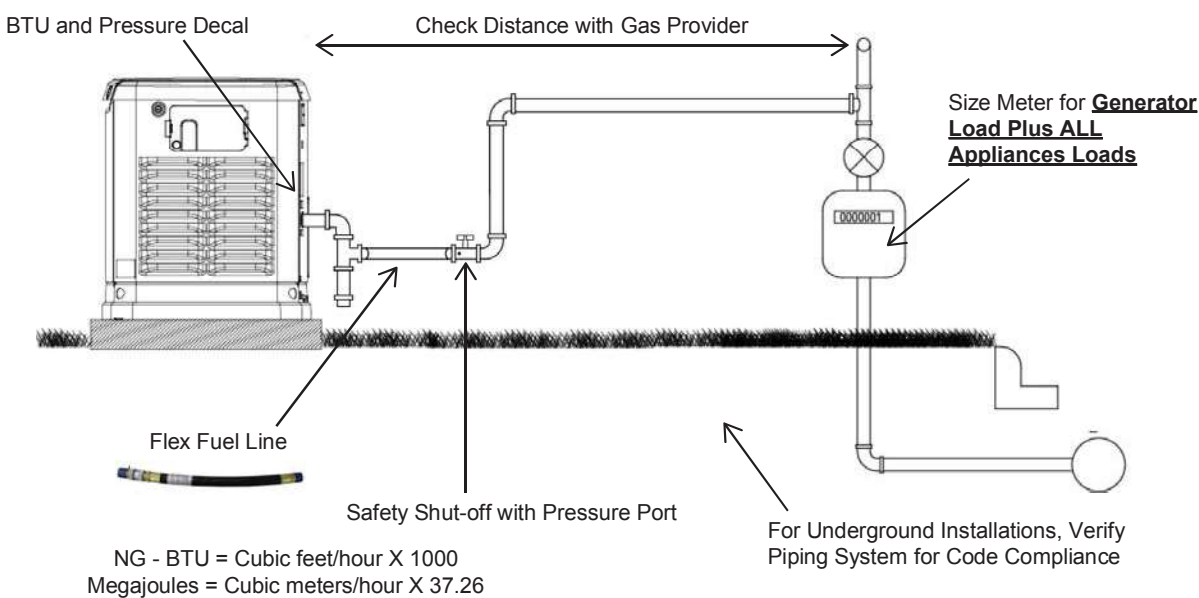
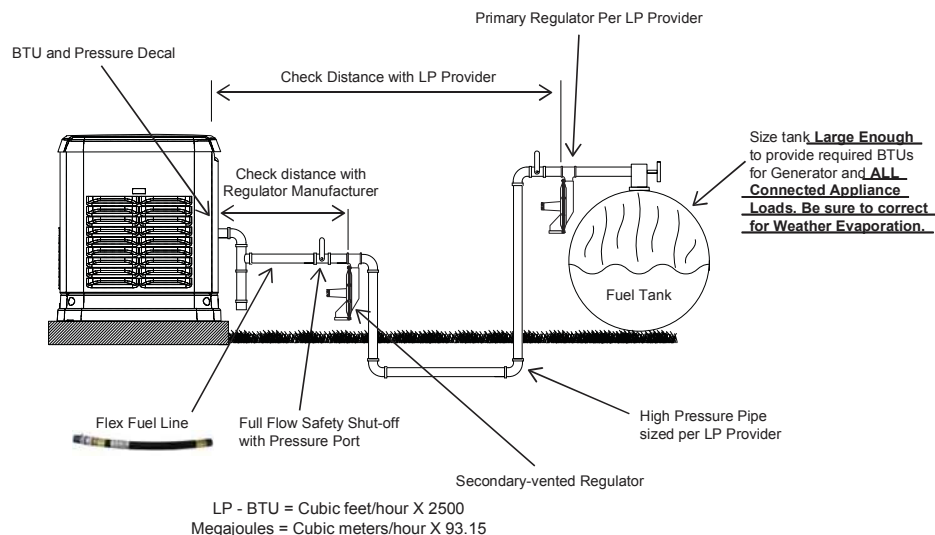


Figure 5.5 — Checking Pressure with Manometer



Size gas pipe with Pipe Sizing Guide or to local codes.

Figure 5.6 — Typical Natural Gas Vapor Installation



Size gas pipe from secondary regulator with Pipe Sizing Guide or to local codes.

Figure 5.7 — Typical LP Vapor Installation

NOTE: When sizing a secondary regulator for LP or high pressure natural gas applications be sure to note the maximum individual load capabilities which will be lower than total capacity. This could impact generator starting performance if sized too small.

NOTE: It is not recommended to reduce the fuel pipe size exiting the secondary regulator unless necessary to accommodate the ½" or ¾" flexible fuel line that is shipped with the generator. This may potentially cause starting or performance issues.

After completing GAS REQUIREMENTS / CONNECTIONS / FUEL CONVERSION, it's time for Step 5: SECTION 6 — ELECTRICAL CONNECTIONS

Section 6 Electrical Connections

6.1 GENERATOR CONNECTIONS

NOTE: Control wiring may be already wired on pre-wired generators. If so, tighten the 5' whip conduit inside of the enclosure. If not, wiring must be in accordance with local jurisdiction and codes.

1. Remove the appropriate Main AC/Control Wiring Knock-out Plug from the back of the generator.
2. Install the conduit and Main AC and Control Wires between the generator and the transfer switch. See Figure 2.6 for knockout locations (verify specific transfer switch wiring/connections per model).

NOTE: These wiring connections may be present on pre-wired models.

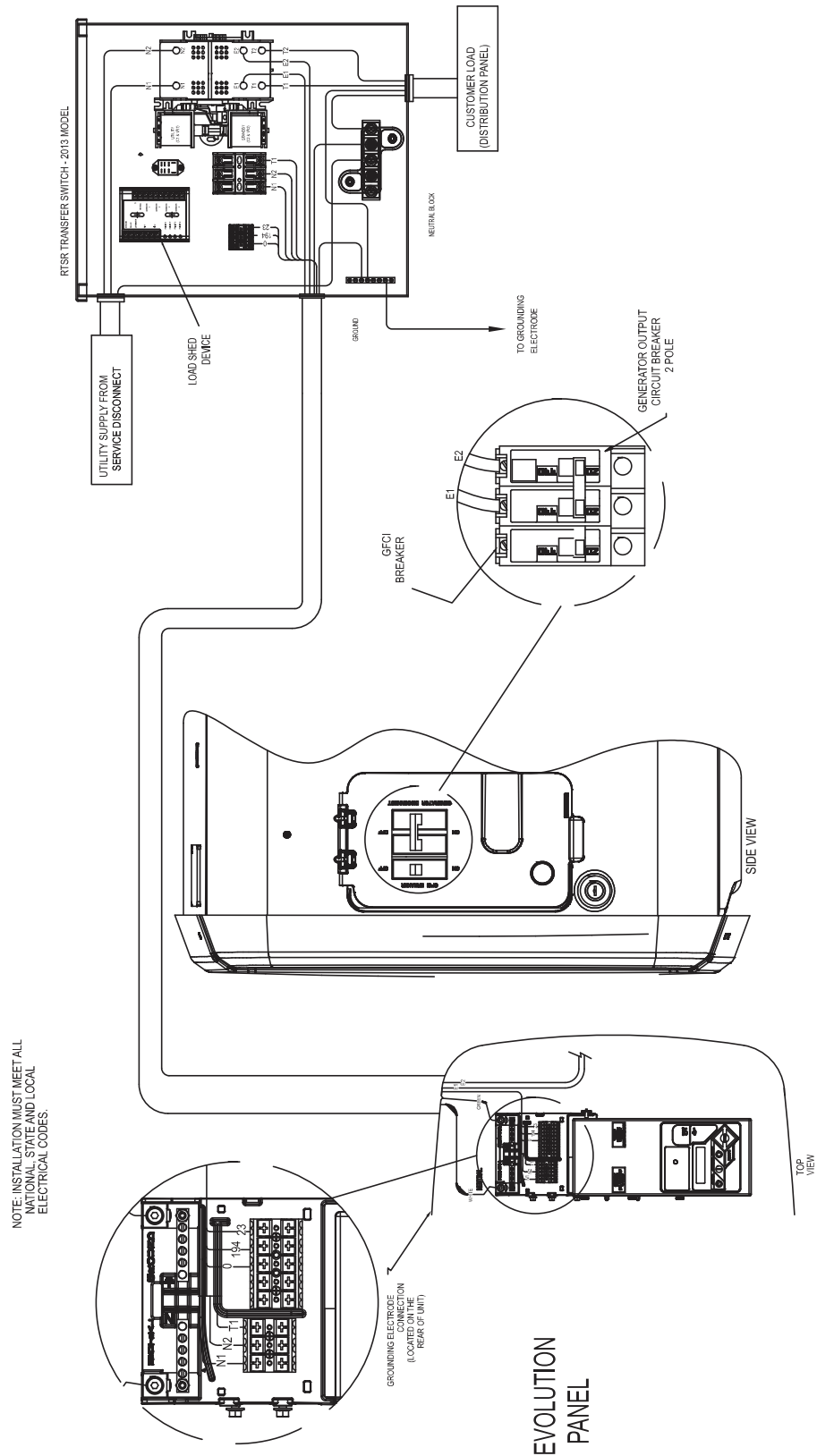
NOTE: This wiring can be run in the same conduit if the appropriate insulation rated wire is used.

3. Seal the conduit at the generator and in compliance with any codes.
4. Strip the insulation from the ends of the wires. Do not remove excessive insulation.
5. To connect the control wires, push down on the spring loaded connection point with a flat head screwdriver, insert wire and release.

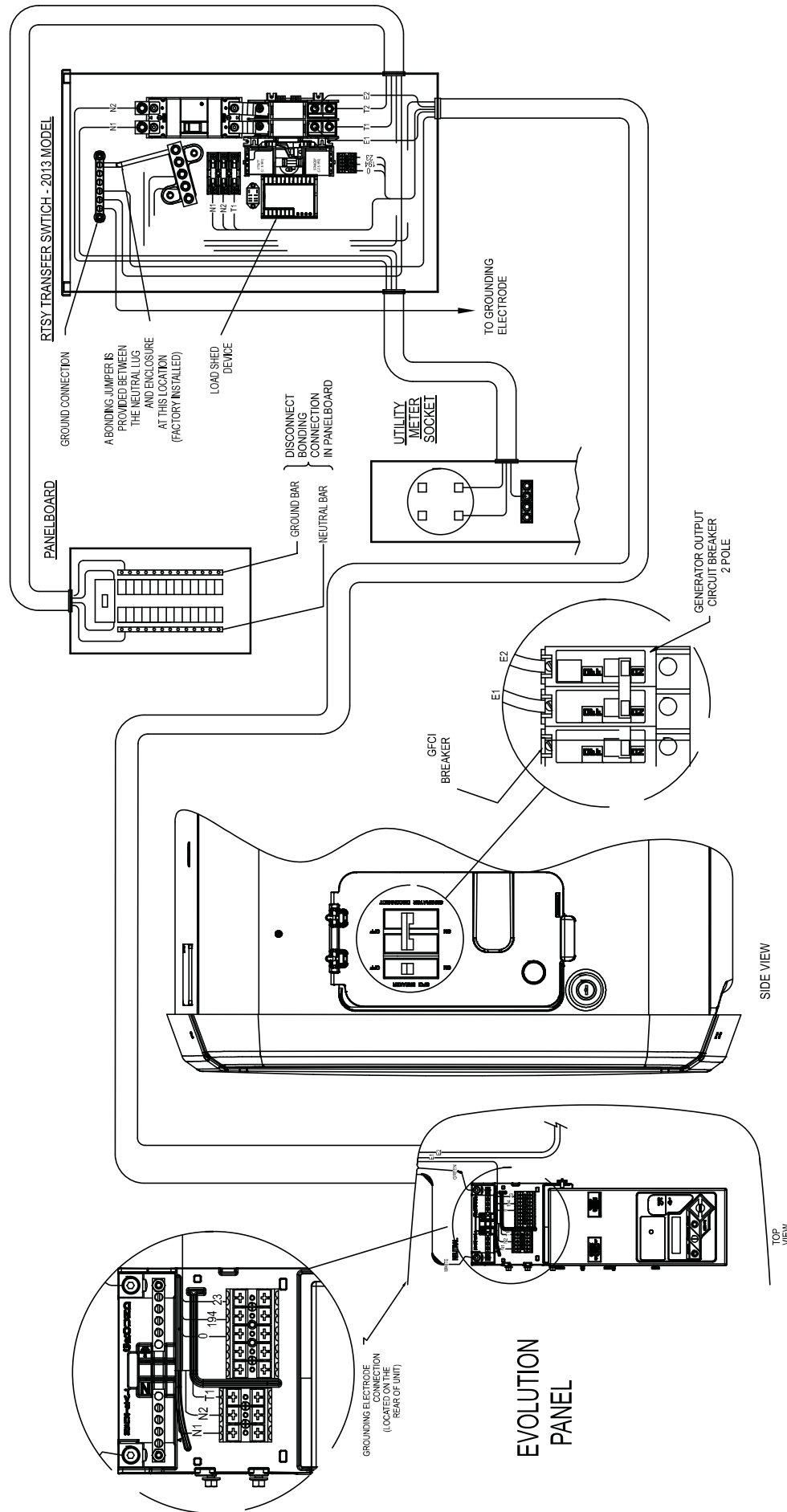
NOTE: No wire insulation should be in the connection point, only bare wire.

12.1 COMPLETED WIRING INTERCONNECTION DRAWINGS

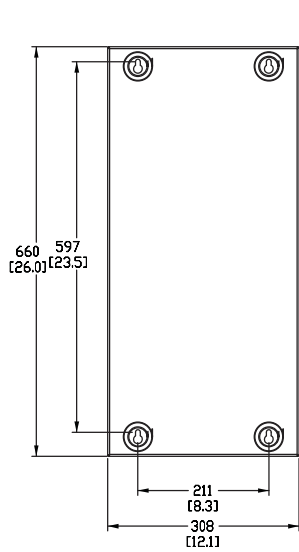
The completed wiring is shown, depending on the configuration of the transfer switch location (Drawing 0K2516-B).



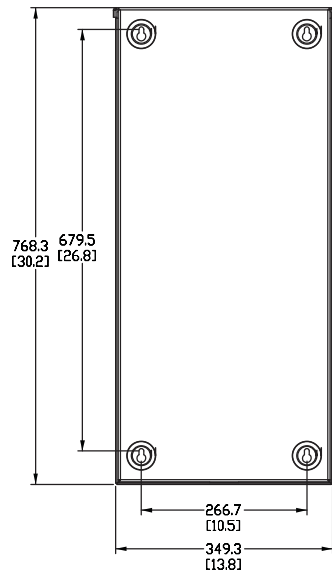
NOTE: INSTALLATION MUST MEET ALL NATIONAL, STATE AND LOCAL ELECTRICAL CODES.



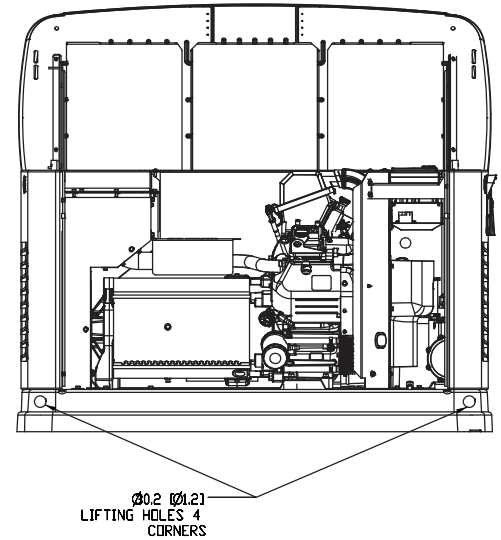
13.1 INSTALLATION DRAWING 0J9945-B



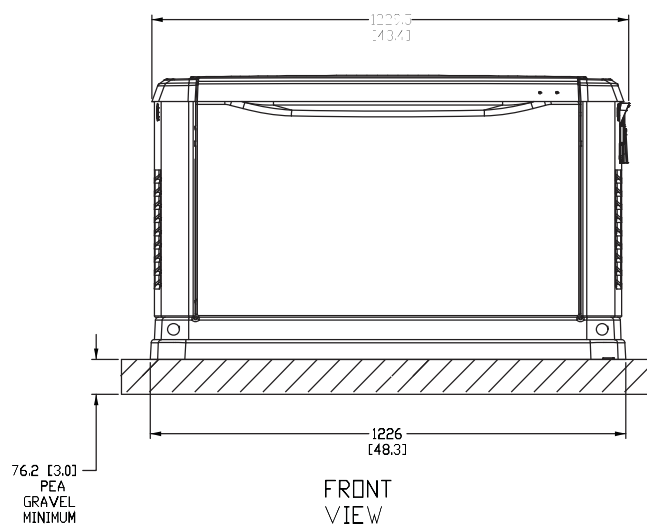
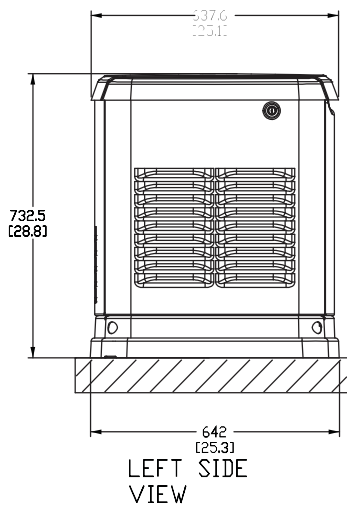
TRANSFER
SWITCH
8KW - 17KW
(IF SUPPLIED)

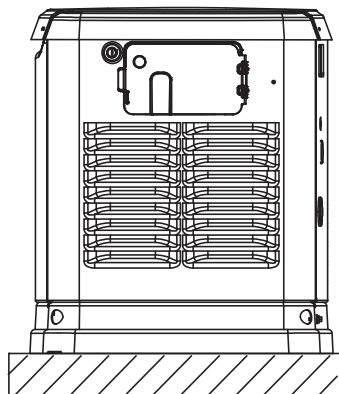
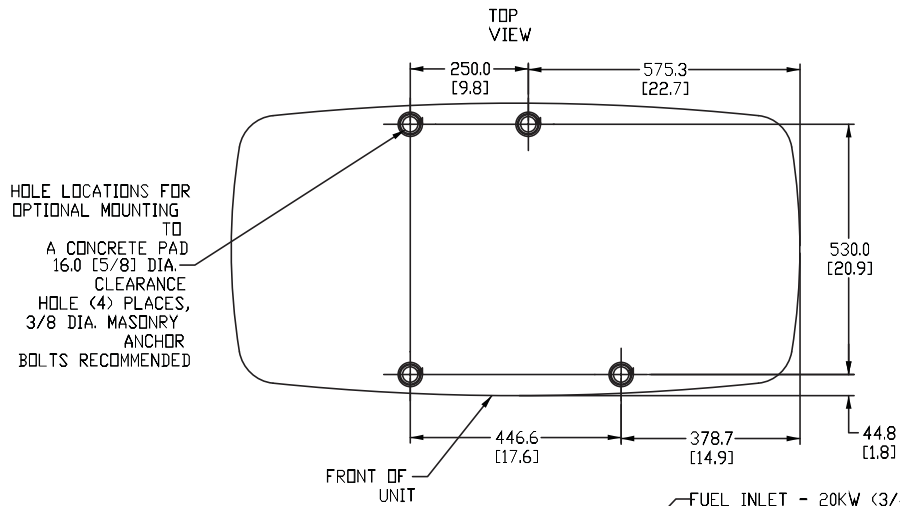
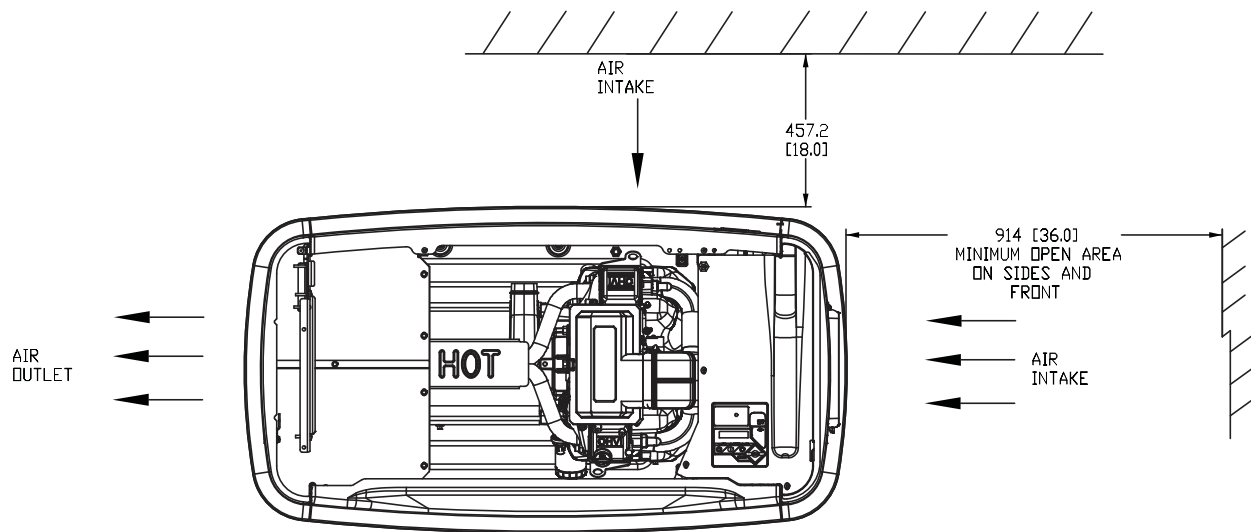


SERVICE
ENTRANCE
TRANSFER SWITCH
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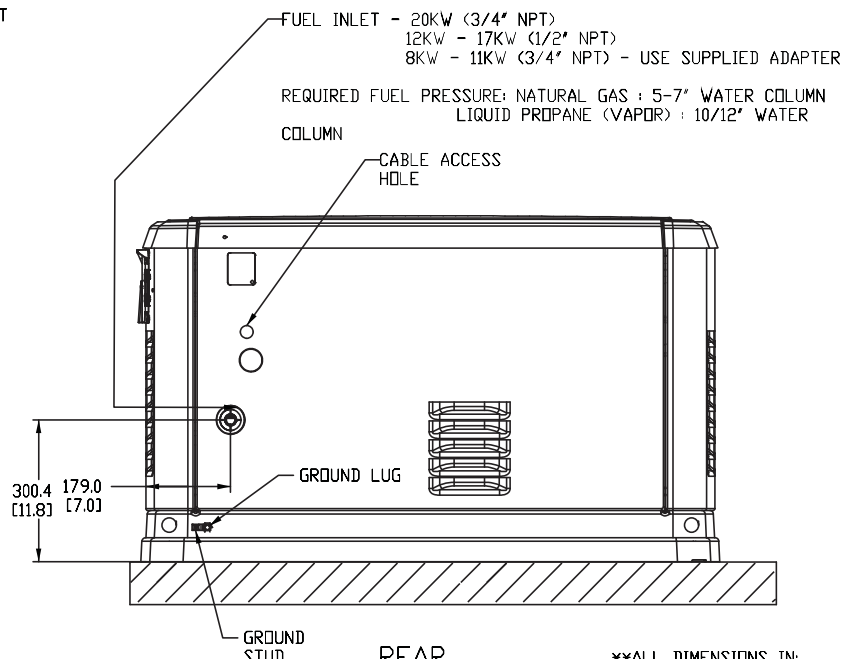


"DO NOT LIFT BY
ROOF"





RIGHT SIDE
VIEW



REAR
VIEW

××ALL DIMENSIONS IN:
MILLIMETERS
[INCHES]