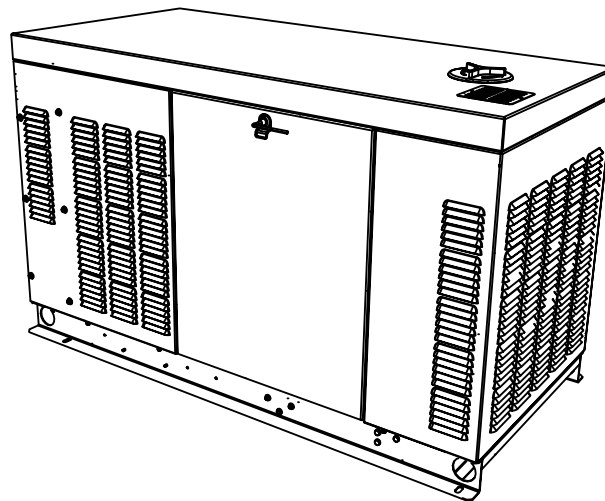


Installation Guidelines *Spark-Ignited Stationary Generators*

Protector Series 22 kW to 60 kW



WARNING

Loss of life. This product is not intended to be used in a critical life support application. Failure to adhere to this warning could result in death or serious injury.

(000209b)

Register your Generac product at:
WWW.GENERAC.COM
1-888-GENERAC
(888-436-3722)

Para español , visita: <http://www.generac.com/service-support/product-support-lookup>

Pour le français, visiter : <http://www.generac.com/service-support/product-support-lookup>P

SAVE THIS MANUAL FOR FUTURE REFERENCE

Use this page to record important information about your generator set.

Model:	
Serial:	
Prod Date Week:	
Volts:	
LPV Amps:	
NG Amps:	
Hz:	
Phase:	
Controller P/N:	

Record the information found on your unit data label on this page. For the location of the unit data label, see your Owner's Manual. The unit has a label plate affixed to the inside partition, to the left of the control panel console.

When contacting an Independent Authorized Service Dealer about parts and service, always supply the complete model number and serial number of the unit.

Operation and Maintenance: Proper maintenance and care of the generator ensures a minimum number of problems and keeps operating expenses at a minimum. It is the operator's responsibility to perform all safety checks, to make sure all maintenance for safe operation is performed promptly, and to have the equipment checked periodically by an Independent Authorized Service Dealer. Normal maintenance, service and replacement of parts are the responsibility of the owner/operator and, as such, are not considered defects in materials or workmanship within the terms of the warranty. Individual operating habits and usage may contribute to the need for additional maintenance or service.

When the generator requires servicing or repairs, Generac recommends contacting an Independent Authorized Service Dealer for assistance. Authorized service technicians are factory-trained and are capable of handling all service needs. To locate the nearest Independent Authorized Service Dealer, please visit the dealer locator at:

www.generac.com/Service/DealerLocator/.



WARNING

CANCER AND REPRODUCTIVE HARM

www.P65Warnings.ca.gov.

(000393a)

Table of Contents

Section 1: Safety Rules & General Information

Introduction	1
Read This Manual Thoroughly	1
How to Obtain Service	1
Safety Rules	2
General Hazards	2
Exhaust Hazards	3
Electrical Hazards	3
Fire Hazards	3
Explosion Hazards	4
General Rules	4
Before You Begin	5
Standards Index	5

Section 2: Installation Planning

Unit Drawings	7
Wiring Diagrams	7
Receiving	7
Receiving and Unpacking	7
Inspection	8
Storage Before Installation	8
Long Term Storage	8
Short Term Storage	8
Lifting	8
Generator Location	8
General Location Guidelines	8
Weather Considerations	9
Accessories	10

Section 3: Site Selection and Preparation

Site Selection	11
Installation Guidelines for Stationary Liquid-Cooled Generators	12
Site Preparation	12
Generator Foundation	12
Concrete Pad	12
Dimensions	12
Stub-Up Area	13
Mounting	13
Fixed Foundation	13
Connections	13
Placement on Roofs, Platforms, and other Supporting Structures	13

Section 4: Gaseous Fuel Systems

Fuel Requirements and Recommendations ...	15
General	15
Fuel System Conversion	15
Gaseous Fuel Properties	15
Natural Gas	15
Propane Vapor (LPV)	16
Definitions	16
Gaseous Fuel Systems	17
Natural Gas System	17
Flexible Fuel Line	17
Primary Regulator Outlet	17
LP-Vapor Withdrawal System	18
Sediment Trap	18
Fuel Pressure Regulators	19
General	19
Best Practices	19
Operating Fuel Pressure	19
Engine Fuel Consumption	19
Fuel Pressure Regulator Sizing	20
Recommended Fuel Pressure Regulators	20
Primary Fuel Pressure Regulator	20
Pipe Sizing Considerations	21
General	21
Sizing LP Tanks for Vapor Withdrawal	22
Final Operating Test	25
Shutoff Valve	25
Gas Pressure Test Port Location	25
Final Test Procedure	26

Section 5: Electrical System

General Information	27
Connecting Generator Feeder Conductors	27
Connecting Control Circuit Wires	27
Remove Rear Panel and Stub Up Cover	28
Typical Load leads and Control Wiring in Stub Up	28
Customer Load Wiring	28
Control Wiring Connections	30
RTS Series Transfer Switch With T1 Fuse/Connection	30
Two-Wire Start	31
Optional Accessory Power	32
Install Stub Up Cover and Rear Panel	32
Transfer Switch Location	32
Battery	32
General Safety Precautions	32
Battery Requirements	33
Battery Installation	33

Section 6: Control Panel/Start-Up/Testing

Control Panel Interface	35
Using the AUTO/MANUAL/OFF Buttons	35
Generator Set-up	35
Setting The Exercise Timer	35
Before Initial Start-Up	36
Installation Wizard	36
Interconnect System Self Test Feature	36
Before starting, complete the following:	36
Check Manual Transfer Switch Operation	36
Activate Unit	38
Operational Checks	38
Self Test	38
Check Manual Transfer Switch Operation	39
Electrical Checks	39
Test Generator Under Load	39
Check Automatic Operation	40
Installation Summary	40

Section 7: Installation Checklists

Safety Checklist	41
Installation Planning Checklist	41
Foundations and Mounting Checklist	41
Ventilation System Checklist	42
Exhaust System Checklist	42
Gaseous Fuel System Checklist	42
Electrical System Checklist	43
Oil Maintainer System Checklist	43

Section 8: Lube Oil Maintainer System

Lube Oil Maintainer System	45
Description	45
Fill Oil Supply Tank	46
Test Functionality	46
Shutoff Valve	46

Section 9: Troubleshooting / Quick Reference Guide

Troubleshooting	49
Quick Reference Guide	50

Section 10: Accessories

Section 11: Installation Drawings

0K8420-C 25/30 kW (1.5 L) Page 1 of 2	55
0K8420-C 25/30 kW (1.5 L) Page 2 of 2	56
0K8624-D 22/27 kW (2.4 L) Page 1 of 2	57
0K8624-D 22/27 kW (2.4 L) Page 2 of 2	58
0K8636-C 36/45 kW (2.4 L) Page 1 of 2	59
0K8636-C 36/45 kW (2.4 L) Page 2 of 2	60
0K9268-E 32/38 kW (2.4 L) Page 1 of 2	61
0K9268-E 32/38 kW (2.4 L) Page 2 of 2	62
0L2090-C 60 kW (2.4 L) Page 1 of 2	63
0L2090-C 60 kW (2.4 L) Page 2 of 2	64
0K9243-C 48 kW (5.4 L) Page 1 of 2	65
0K9243-C 48 kW (5.4 L) Page 2 of 2	66
AC Connections—1/3 Phase, 6/12 Lead	67
Alternator Wiring Diagram	69

Section 1: Safety Rules & General Information

Introduction

Thank you for purchasing this compact, high performance, liquid-cooled, engine-driven generator. It is designed to automatically supply electrical power to operate critical loads during a utility power failure.

This unit is factory installed in an all-weather enclosure intended exclusively for outdoor installation. This generator will operate using either vapor withdrawn liquid propane (LPV) or natural gas (NG).

NOTE: When sized properly, this generator is suitable for supplying typical residential and commercial loads such as induction motors (sump pumps, refrigerators, air conditioners, furnaces, etc.), electronic components (computer, monitor, TV, etc.), lighting loads and microwaves.

The information in this manual is accurate based on products produced at the time of publication. The manufacturer reserves the right to make technical updates, corrections, and product revisions at any time without notice.

Read This Manual Thoroughly



Consult Manual. Read and understand manual completely before using product. Failure to completely understand manual and product could result in death or serious injury. (000100a)

If any portion of this manual is not understood, contact the nearest Independent Authorized Service Dealer for starting, operating and servicing procedures.

This manual must be used in conjunction with the appropriate Owner's Manual.

SAVE THESE INSTRUCTIONS: The manufacturer suggests this manual and the rules for safe operation be copied and posted near the unit installation site. Safety should be stressed to all operators and potential operators of this equipment.

Throughout this publication and on tags and decals affixed to the generator, DANGER, WARNING, and CAUTION blocks are used to alert personnel to special instructions about a particular operation that may be hazardous if performed incorrectly or carelessly. Observe them carefully. Their definitions are as follows:

DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

(000001)

WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

(000002)

CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

(000003)

NOTE: Notes provide additional information important to a procedure or component.

These safety alerts cannot eliminate the hazards they indicate. Observing safety precautions and strict compliance with the special instructions while performing the action or service are essential to preventing accidents.

The operator is responsible for proper and safe use of the equipment. The manufacturer strongly recommends, if the operator is also the owner, to read the Owner's Manual and thoroughly understand all instructions before using this equipment. The manufacturer also strongly recommends instructing other users to properly start and operate the unit. This prepares them if they need to operate the equipment in an emergency.

How to Obtain Service

When the generator requires servicing or repairs, contact an Independent Authorized Service Dealer for assistance. Service technicians are factory-trained and are capable of handling all service needs. For assistance locating a dealer, go to www.generac.com/Service/DealerLocator/.

When contacting an Independent Authorized Service Dealer about parts and service, always supply the complete model number and serial number of the unit as given on its data decal, which is located on the generator. Refer to Owner's Manual for decal location. Record the model number and serial numbers in the spaces provided on the inside front cover of this manual.

Safety Rules

Study these SAFETY RULES carefully before installing, operating or servicing this equipment. Become familiar with this Owner's Manual and with the unit. The generator can operate safely, efficiently and reliably only if it is properly installed, operated and maintained. Many accidents are caused by failing to follow simple and fundamental rules or precautions.

The manufacturer cannot anticipate every possible circumstance that might involve a hazard. The warnings in this manual and on tags and decals affixed to the unit are, therefore, not all-inclusive. If using a procedure, work method, or operating technique the manufacturer does not specifically recommend, verify it is safe for others. Also, make sure the procedure, work method or operating technique utilized does not render the generator unsafe.

General Hazards

DANGER

Loss of life. Property damage. Installation must always comply with applicable codes, standards, laws and regulations. Failure to do so will result in death or serious injury. (000190)

DANGER

Automatic start-up. Disconnect utility power and render unit inoperable before working on unit. Failure to do so will result in death or serious injury. (000191)



WARNING

Loss of life. This product is not intended to be used in a critical life support application. Failure to adhere to this warning could result in death or serious injury. (000209b)

WARNING

Equipment damage. This unit is not intended for use as a prime power source. It is intended for use as an intermediate power supply in the event of temporary power outage only. Doing so could result in death, serious injury, and equipment damage. (000247a)



WARNING

Electrocution. Potentially lethal voltages are generated by this equipment. Render the equipment safe before attempting repairs or maintenance. Failure to do so could result in death or serious injury. (000187)

WARNING

Accidental Start-up. Disconnect the negative battery cable, then the positive battery cable when working on unit. Failure to do so could result in death or serious injury. (000130)

WARNING

Equipment damage. Only qualified service personnel may install, operate, and maintain this equipment. Failure to follow proper installation requirements could result in death, serious injury, and equipment or property damage. (000182a)

WARNING

Electric shock. Only a trained and licensed electrician should perform wiring and connections to unit. Failure to follow proper installation requirements could result in death, serious injury, and equipment or property damage. (000155a)



WARNING

Moving Parts. Do not wear jewelry when starting or operating this product. Wearing jewelry while starting or operating this product could result in death or serious injury. (000115)



WARNING

Moving Parts. Keep clothing, hair, and appendages away from moving parts. Failure to do so could result in death or serious injury. (000111)



WARNING

Hot Surfaces. When operating machine, do not touch hot surfaces. Keep machine away from combustibles during use. Hot surfaces could result in severe burns or fire. (000108)

WARNING

Equipment and property damage. Do not alter construction of, installation, or block ventilation for generator. Failure to do so could result in unsafe operation or damage to the generator. (000146)

WARNING

Risk of injury. Do not operate or service this machine if not fully alert. Fatigue can impair the ability to service this equipment and could result in death or serious injury. (000215)

⚠ WARNING

Injury and equipment damage. Do not use generator as a step. Doing so could result in falling, damaged parts, unsafe equipment operation, and could result in death or serious injury.

(000216)

Inspect the generator regularly, and contact the nearest Independent Authorized Service Dealer for parts needing repair or replacement.

Exhaust Hazards**⚠ DANGER**

Asphyxiation. Running engines produce carbon monoxide, a colorless, odorless, poisonous gas. Carbon monoxide, if not avoided, will result in death or serious injury.

(000103)

**⚠ WARNING**

Asphyxiation. Always use a battery operated carbon monoxide alarm indoors and installed according to the manufacturer's instructions. Failure to do so could result in death or serious injury.

(000178a)

**⚠ WARNING**

Fire hazard. Do not obstruct cooling and ventilating airflow around the generator. Inadequate ventilation could result in fire hazard, possible equipment damage, death or serious injury.

(000217)

Electrical Hazards**⚠ DANGER**

Electrocution. Contact with bare wires, terminals, and connections while generator is running will result in death or serious injury.

(000144)

**⚠ DANGER**

Electrocution. Never connect this unit to the electrical system of any building unless a licensed electrician has installed an approved transfer switch. Failure to do so will result in death or serious injury.

(000150)

⚠ DANGER

Electrical backfeed. Use only approved switchgear to isolate generator from the normal power source. Failure to do so will result in death, serious injury, and equipment damage.

(000237)

**⚠ DANGER**

Electrocution. Verify electrical system is properly grounded before applying power. Failure to do so will result in death or serious injury.

(000152)

**⚠ DANGER**

Electrocution. Do not wear jewelry while working on this equipment. Doing so will result in death or serious injury.

(000188)

**⚠ DANGER**

Electrocution. Water contact with a power source, if not avoided, will result in death or serious injury.

(000104)

**⚠ DANGER**

Electrocution. In the event of electrical accident, immediately shut power OFF. Use non-conductive implements to free victim from live conductor. Apply first aid and get medical help. Failure to do so will result in death or serious injury.

(000145)

Fire Hazards**⚠ WARNING**

Fire hazard. Do not obstruct cooling and ventilating airflow around the generator. Inadequate ventilation could result in fire hazard, possible equipment damage, death or serious injury.

(000217)

**⚠ WARNING**

Fire and explosion. Installation must comply with all local, state, and national electrical building codes. Noncompliance could result in unsafe operation, equipment damage, death or serious injury.

(000218)

**⚠ WARNING**

Fire hazard. Use only fully-charged fire extinguishers rated "ABC" by the NFPA. Discharged or improperly rated fire extinguishers will not extinguish electrical fires in automatic standby generators.

(000219)



⚠ WARNING

Consult Manual. Read and understand manual completely before using product. Failure to completely understand manual and product could result in death or serious injury. (000100a)



⚠ DANGER

Risk of fire. Allow fuel spills to completely dry before starting engine. Failure to do so will result in death or serious injury. (000174)



⚠ WARNING

Electrocution. Refer to local codes and standards for safety equipment required when working with a live electrical system. Failure to use required safety equipment could result in death or serious injury. (000257)



⚠ WARNING

Risk of Fire. Hot surfaces could ignite combustibles, resulting in fire. Fire could result in death or serious injury. (000110)



⚠ WARNING

Risk of Fire. Unit must be positioned in a manner that prevents combustible material accumulation underneath. Failure to do so could result in death or serious injury. (000147)

General Rules

⚠ DANGER

Loss of life. Property damage. Installation must always comply with applicable codes, standards, laws and regulations. Failure to do so will result in death or serious injury. (000190)

⚠ DANGER

Electrical backfeed. Use only approved switchgear to isolate generator from the normal power source. Failure to do so will result in death, serious injury, and equipment damage. (000237)

Comply with regulations the Occupational Safety and Health Administration (OSHA) has established. Also, verify the generator is installed in accordance with the manufacturer's instructions and recommendations. Following proper installation, do nothing that might alter a safe installation and render the unit in noncompliance with the aforementioned codes, standards, laws and regulations.

Explosion Hazards



⚠ DANGER

Explosion and fire. Fuel and vapors are extremely flammable and explosive. No leakage of fuel is permitted. Keep fire and spark away. Failure to do so will result in death or serious injury. (000192)

⚠ WARNING

Equipment damage. Only qualified service personnel may install, operate, and maintain this equipment. Failure to follow proper installation requirements could result in death, serious injury, and equipment or property damage. (000182a)

⚠ DANGER

Explosion and fire. Connection of fuel source must be completed by a qualified professional technician or contractor. Incorrect installation of this unit will result in death, serious injury, and property and equipment damage. (000151a)



⚠ WARNING

Electrocution. Refer to local codes and standards for safety equipment required when working with a live electrical system. Failure to use required safety equipment could result in death or serious injury. (000257)

⚠ WARNING

Environmental Hazard. Always recycle batteries at an official recycling center in accordance with all local laws and regulations. Failure to do so could result in environmental damage, death or serious injury. (000228)

- Follow all safety precautions in the Owner's Manual, Installation Guidelines manual and other documents included with your equipment.

- Refer to NFPA 70E for safety equipment required when working with a live system.
- Never energize a new system without opening all disconnects and breakers.
- Always consult your local code for additional requirements for the area in which the unit is being installed.

Improper installation can result in personal injury and damage to the generator. It may also result in the warranty being suspended or voided. All the instructions listed below must be followed including location clearances and pipe sizes.

Before You Begin

- Contact the local inspector or City Hall to be aware of all federal, state and local codes that could impact the installation. Secure all required permits before starting the job.
- Carefully read and follow all of the procedures and safety precautions detailed in the installation guide. If any portion of the installation manual, technical manual or other factory-supplied documents is not completely understood, contact an Independent Authorized Service Dealer for assistance.
- Fully comply with all relevant NEC, NFPA and OSHA standards as well as all federal, state and local building and electric codes. As with any generator, this unit must be installed in accordance with current NFPA 37 and NFPA 70 standards as well as any other federal, state, and local codes for minimum distances from other structures.
- Verify the capacity of the natural gas meter or the LP tank in regards to providing sufficient fuel for both the generator and other household and operating appliances.

Standards Index



⚠ WARNING

Loss of life. This product is not intended to be used in a critical life support application. Failure to adhere to this warning could result in death or serious injury. (000209b)

Strictly comply with all applicable national, state and local laws, as well as codes or regulations pertaining to the installation of this engine-generator power system. Use the most current version of applicable codes or standards relevant to the local jurisdiction, generator used, and installation site.

NOTE: Not all codes apply to all products and this list is not all-inclusive. In the absence of pertinent local laws and standards, the following publications may be used as a guide (these apply to localities which recognize NFPA and IBC).

1. National Fire Protection Association (NFPA) 70: The NATIONAL ELECTRIC CODE (NEC) *
2. NFPA 10: Standard for Portable Fire Extinguishers *
3. NFPA 30: Flammable and Combustible Liquids Code *
4. NFPA 37: Standard for Stationary Combustion Engines and Gas Turbines *
5. NFPA 54: National Fuel Gas Code *
6. NFPA 58: Standard for Storage and Handling Of Liquefied Petroleum Gases *
7. NFPA 68: Standard On Explosion Protection By Deflagration Venting *
8. NFPA 70E: Standard For Electrical Safety In The Workplace *
9. NFPA 211: Standard for Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances *
10. NFPA 220: Standard on Types of Building Construction *
11. NFPA 5000: Building Code *
12. ICC IFGC: International Fuel Gas Code
13. International Building Code **
14. Agricultural Wiring Handbook ***
15. Article X, NATIONAL BUILDING CODE
16. ASAE EP-364.2 Installation and Maintenance of Farm Standby Electric Power ****

This list is not all-inclusive. Check with the Authority Having Local Jurisdiction (AHJ) for any local codes or standards which may be applicable to your jurisdiction. The above listed standards are available from the following internet sources:

* www.nfpa.org

** www.iccsafe.org

*** www.nerc.org Rural Electricity Resource Council P.O. Box 309 Wilmington, OH 45177-0309

**** www.asabe.org American Society of Agricultural & Biological Engineers 2950 Niles Road, St. Joseph, MI 49085

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Section 2: Installation Planning

⚠ DANGER

Electrical backfeed. Use only approved switchgear to isolate generator from the normal power source. Failure to do so will result in death, serious injury, and equipment damage.

(000237)

Connecting this generator to an electrical system normally supplied by an electric utility shall be by means of a transfer switch, so as to isolate the electric system from the utility distribution system when the generator is operating. Failure to isolate the electric system by these means will result in

damage to the generator and may also result in injury or death to utility workers due to backfeed of electrical energy.

NOTE: Only Independent Authorized Service Dealers or qualified, competent installation contractors or electricians thoroughly familiar with applicable codes, standards and regulations should install this standby electric power system. The installation must comply strictly with all codes, standards and regulations pertaining to the installation.

Unit Drawings

Installation Drawings

Installation drawings show weights, dimensions, clearances, exhaust details, connection locations, wiring stub-ups, lifting locations, and other information. Use the

unit specific installation drawings when designing a site installation plan. Thoroughly read the NOTES section of each drawing for important details.

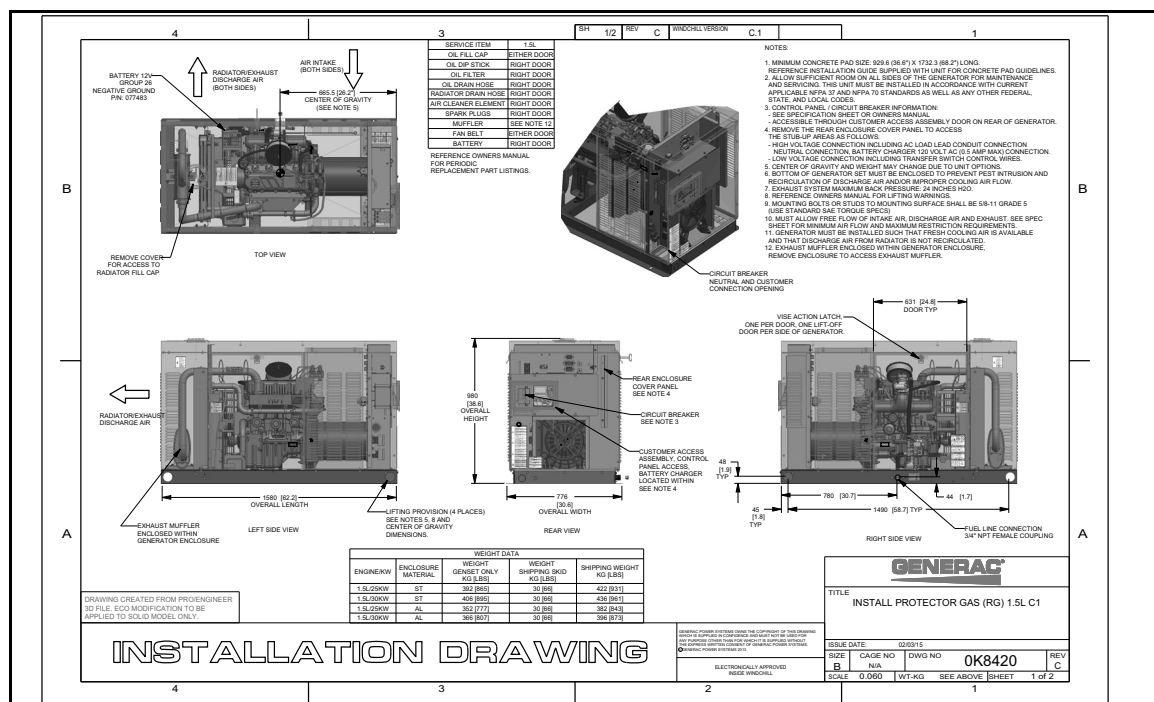


Figure 2-1. Typical Installation Drawing

Wiring Diagrams

Wiring and schematic diagrams show the connection points for control wiring, load wiring, and any service power supply required for battery chargers, block heaters, etc. Always use the unit specific wiring diagrams during planning and installation.

Receiving

Receiving and Unpacking

When applicable, handle shipping cartons and crates with care to avoid damage. Store and unpack cartons with the correct side up, as noted by the label on the shipping carton.

Inspection

Carefully inspect the generator set and all contents of cartons for any damage that may have occurred during shipment. See the shipping documentation for any provisions or guidance when damage is incurred. Correct all damage or deficiencies before installation of the generator set.

Storage Before Installation

Long Term Storage

If the unit is to be stored (or installed and not started) for six months or more, preserve in accordance with the manufacturer's instructions. Contact the local Independent Authorized Service Dealer to obtain the Long Term Preservation and Storage Manual (Part No. 0G4018) and the Preservation Checklist (Part No. 0G4018A).

Short Term Storage

If the unit is to be stored (or installed and not started-up) for less than six months, proceed as follows:

- All units are provided with an enclosure.
- Place the unit on a smooth flat surface. Do not leave unit on the shipping pallet, as it leaves the bottom open for entry of dirt, debris, insects, rodents, etc.
- If applicable, cover any exhaust system openings.
- Leave plastic plugs in fuel connection points.
- Use anti-rodent plugs and other enclosure features to prevent entry of birds, small animals, and foreign objects.

Lifting



⚠ DANGER

Risk of electrocution. Avoid touching overhead power lines when lifting or hoisting generator. Failure to do so will result in death or serious injury.

(000245)

⚠ WARNING

Personal injury. Excessive weight. Use only appropriate lifting eyes and lifting equipment to lift unit. Improper lifting techniques could result in equipment damage, death or serious injury. (000224)

Generators weighing more than 900 pounds (408 kg) require proper tools, equipment, and qualified personnel to be used in all phases of handling and unpacking.

To ensure personal safety and prevent damage to the unit, use only properly sized equipment intended for safe rigging, lifting and moving of heavy machinery.

Use a spreader bar to prevent damage to the unit.

Failure to use a spreader bar will result in scratches and damage to painted surfaces.

Installation drawings show the lifting points for rigging and lifting purposes. Always attach lifting and rigging devices at the designated points only. Do not use the lifting points of the engine or alternator to move the generator set. See [Figure 2-2](#).

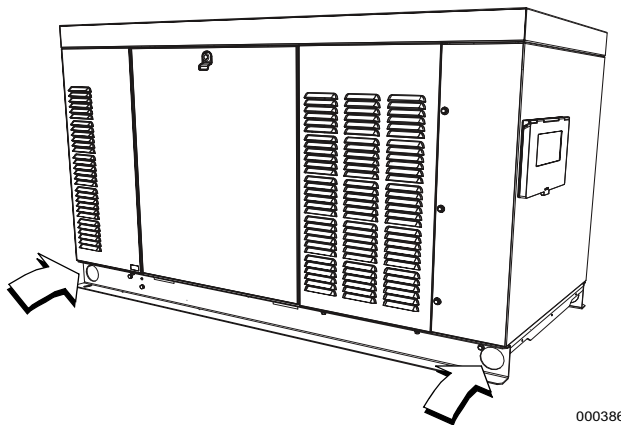


Figure 2-2. Lifting Points (Four Places)

Generator Location

Locate the generator set so it is readily accessible for maintenance, repair, and firefighting purposes. Comply with code requirements for minimum distance from combustible walls and building openings.

General Location Guidelines

Consider the following:

- The generator set, in its protective enclosure, must be installed **outdoors**.
- The supporting structure must be adequate for the generator set and its accessories.
- Be sure the site is clean, dry, not subject to flooding, and provided with adequate drainage in the event of heavy rains.
- Be sure the location permits noise and vibration to be effectively isolated.
- Verify the site provides easy, ready access to the generator set for maintenance, repair, and emergency response purposes.
- Refer to [Figure 3-1](#). Keep a minimum clear working space around each side of the generator set to facilitate service or maintenance. See NEC Article 110.26 for clarification.

- Verify the location permits engine exhaust gases to be safely evacuated from inhabited or occupied areas. Consider the direction of prevailing winds to prevent exhaust gases from being carried back to the engine area or to the fresh air intake vents of nearby buildings.
- The site must allow for the provision of an adequate fuel supply.
- Verify the location permits sufficient air flow for cooling and ventilation. Consider the proximity of any walls, fences, or other noise abatement or security barriers. Do NOT face the radiator discharge end of the enclosure into the prevailing wind.
- Consider cold weather kit options and accessories for the generator in cold weather locations.
- Verify the unit is securely fastened to the mounting pad to prevent movement caused by vibration.

- Verify all electrical connections have flexible sections to isolate vibration.
- Verify the fuel pressure and pipe is sized correctly and it has the appropriate flex hose.

NOTE: Failure to comply with the location guidelines can result in damage to the generator or surrounding area and may cause the warranty to be suspended or voided. Extra repair labor or equipment may not be covered under the warranty if service access is difficult or restricted.

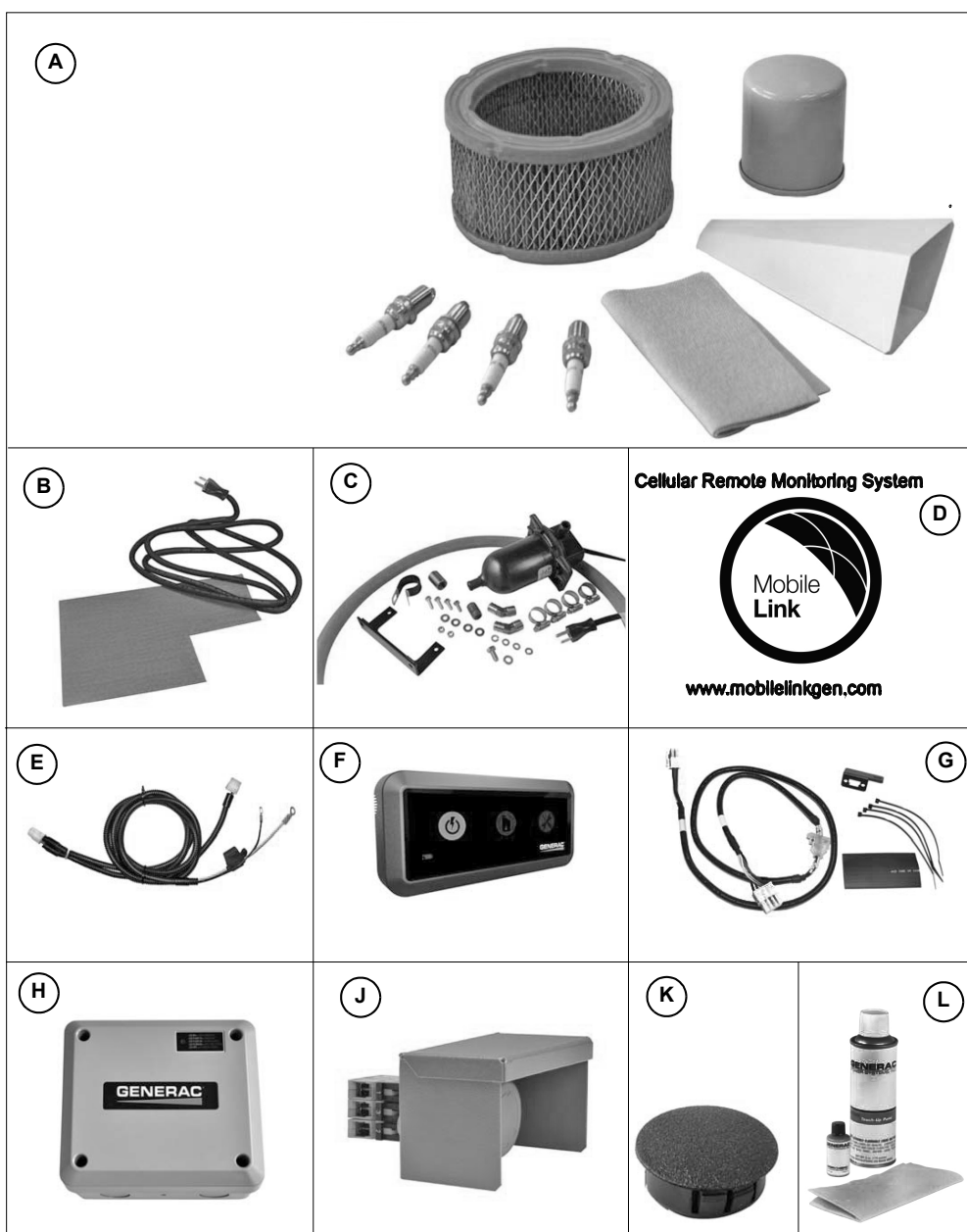
Weather Considerations

Consider local weather conditions during installation. There are various accessories available to ensure fast, reliable starting and operation regardless of local climatic conditions. Optional cold weather kits make starting of the engine more dependable and reliable.

Accessories

The following product accessories are available. Contact an IASD for additional information.

A	Scheduled Maintenance Kit G005656-0 (22/27 kW), G006176-0 (25/30 kW), G005984-0 (32/38 kW), G006172-0 (36/45 kW), G006205-0 (48 kW), G006170-0 (60 kW) (kit contents may vary)	G	Wireless Remote Extension Harness Kit (G006665-0)
B	Cold Weather Kit G006175-0 (25/30 kW), G005630-1 (36/45/60 kW)	H	Smart Management Module (G006873-0)
C	Extreme Cold Weather Kit G006170-0 (25/30 kW), G005616-0 (36/45/60 kW)	J	Emergency Stop Switch (G006510-0)
D	Mobile Link (G006463-4)	K	Base Plug Kit (G005651-0)
E	Mobile Link Harness Adapter Kit (G006478-0) (Required for liquid-cooled applications)	L	Touch-Up Paint Kit G005703-0 (Bisque), G005704-0 (Gray)
F	Wireless Local Monitor (G006664-0)	—	—



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Section 3: Site Selection and Preparation

Site Selection

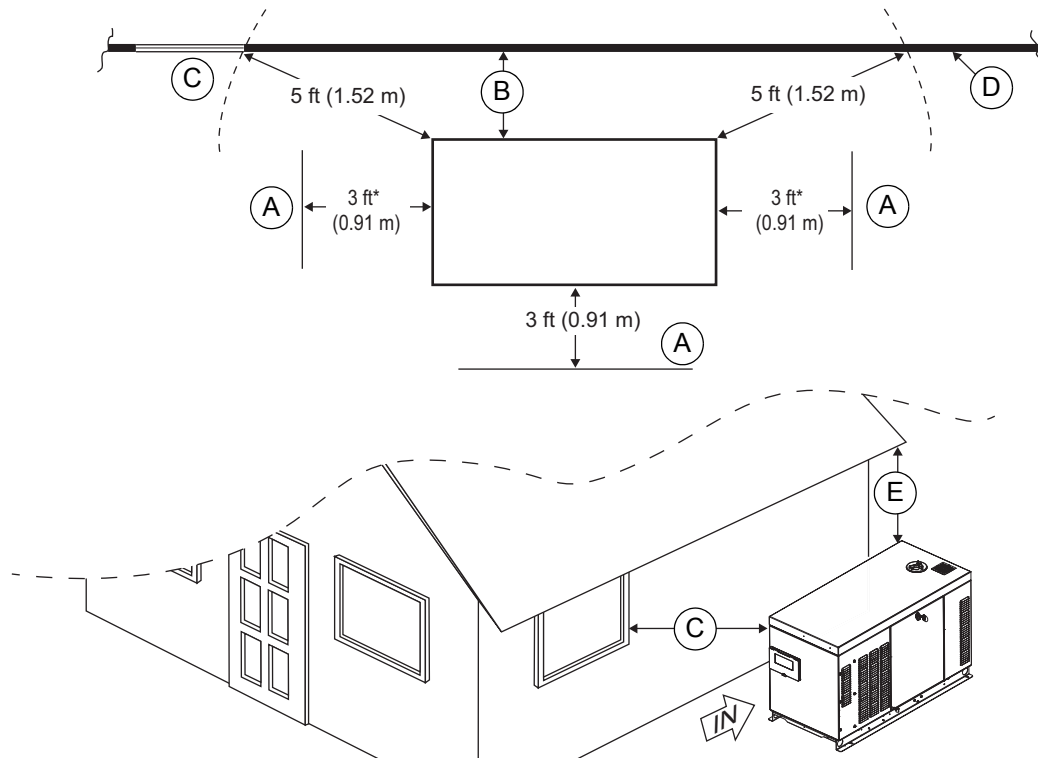
The generator must be installed **outdoors** in a location allowing sufficient clearance around all sides for reasons of safety, maintenance, and servicing.

The National Fire Protection Association (NFPA) publishes a standard, NFPA 37, that limits the distance between an enclosed generator set and adjacent structures or walls.

The guidelines provided in this section are based on NFPA 37 and the manufacturer's requirement for air flow for proper operation.

NOTE: Local codes may be different and more restrictive than what is described here. Prior to beginning any installation, consult the local AHJ to determine which standards and codes apply in your area.

The diagrams and comments below illustrate the manufacturer's recommended clearances for this unit.



001752

Figure 3-1. Installation Clearances

ID	Description	Comments
A	Surround Clearance	- Minimum clear distances cannot include shrubs, bushes, removable fence panels, or trees. - Removable fence panels for servicing cannot be placed less than 3 ft (0.91 m) in front of the generator (if one hour fire rated); no less than 5 ft (1.52 m) in front of the generator if the fence is not fire rated.
B	Side Clearance	For products NOT showing SWRI on the data plate: 5 ft (1.52 m) minimum distance if the wall is not fire rated 3 ft (0.91 m) minimum distance if the wall is one hour fire rated. If the data plate indicates the product is SWRI rated: 18 in. (47.7 cm) minimum distance from a combustable wall
C	Windows and Openings	No operable windows, doors, or openings in the wall are permitted within 5 ft (1.52 m) from any point of the generator.
D	Existing Wall	—
E	Overhead Clearance (including wooden decks)	5 ft (1.52 m) minimum distance from any structure, overhang, or projections from the wall. DO NOT install under wooden decks or structures unless this distance is maintained.
IN	Air intake	Air intake end of unit. Opposite end is discharge.


⚠ DANGER

Asphyxiation. Running engines produce carbon monoxide, a colorless, odorless, poisonous gas. Carbon monoxide, if not avoided, will result in death or serious injury. (000103)

Install the generator set, in its protective enclosure, outdoors, where adequate cooling and ventilating air is always available (**Figure 3-1**). Consider these factors:

- The installation of the generator must comply strictly with NFPA 37, NFPA 54, NFPA 58, ICC, IFGC, 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 any codes in place in your country or local jurisdiction for minimum distances from other structures.
- 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.** In the absence of local codes regarding placement or clearance, we recommend following the guidelines in this section.
- 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 0.5 in (13 mm) all around.
- The generator is typically placed on a concrete pad. All applicable codes should be followed.

Installation Guidelines for Stationary Liquid-Cooled 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 3-1**).

⚠ DANGER

Automatic start-up. Disconnect utility power and render unit inoperable before working on unit. Failure to do so will result in death or serious injury. (000191)

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.

Site Preparation

Generator Foundation

Install the generator set on a concrete pad or base slab able to support its weight and accessories. A proper foundation is needed to resist dynamic loading and reduce transmitted noise and vibration. The exact composition of the mounting pad must follow standard engineering practices for the required loading and application. **Securely fasten the generator set to the foundation using suitable grade, size and style fasteners.** Holes are provided in the base frame for this purpose.

Concrete Pad

Follow all federal, state, and local codes when designing a concrete pad or base slab.

Seat the concrete pad on a prepared solid subsurface and use appropriate reinforcing bar or expanded wire mesh. A common specification calls for 2500 psi (17.24 MPa) concrete reinforced with 8 gauge wire mesh.

Dimensions

Extend the concrete pad beyond the frame of the unit at least three (3) inches (7.62 cm). To provide a mounting surface for fuel line support, and space for maintenance and repair, a concrete pad extending six (6) inches (15.2 cm) beyond the frame of the unit is suggested.

The base pad must be:

- Capable of supporting 125% of the unit wet weight for single unit applications.
- Flat and level to within 1/2 inch (13 mm).
- Capable of withstanding severe torque reactions.

To calculate the depth of the concrete pad, the following formula may be used:

$$\text{Depth of Base} = \frac{W}{\text{Density} \times B \times L}$$

W = Total wet weight of generator set in pounds (kg)

Density = Density of the concrete:

- 150 pounds per cubic foot
- 2400 kilograms per cubic foot

B = Foundation width in feet (meters)

L = Foundation length in feet (meters)

Suggested mixture of concrete (by volume) is 1:2:3 of cement, sand, and aggregate with a maximum four inch (100 mm) slump with a 28 day compression strength of 3000 psi (20.7 MPa).

Stub-Up Area

For load conduit, auxiliary power conduit (high voltage), and control wiring conduit (low voltage), see the unit installation drawings for the location and dimensions of the stub-up area. **Figure 3-2** (A) illustrates a typical stub opening.

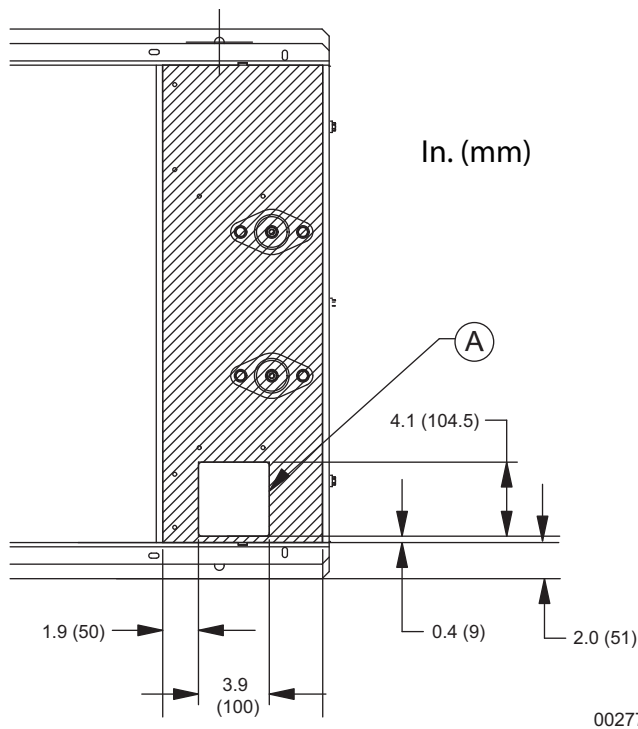


Figure 3-2. Installation Drawing Stub-Up Detail (Typical)

Mounting

Fixed Foundation

Use mounting holes in the base frame to fasten the unit to the foundation. Always use hardware of a suitable grade, size and style.

Connections

All electrical connections must have flexible sections to isolate vibration if they connect to the unit base rails. Properly support and secure all piping before installing the flexible connection.

Placement on Roofs, Platforms, and other Supporting Structures

An oil containment system consisting of a curb or dike having a capacity at least equal to the total capacity of the lubricating oil system or the liquid fuel system, whichever is greater, shall be provided. This system shall also comply with applicable requirements of NFPA 37, Chapter 6.

The surface beneath the engine and beyond the engine and the oil containment dike shall be noncombustible to a minimum distance of 12 in. (300 mm).

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Section 4: Gaseous Fuel Systems

Fuel Requirements and Recommendations



⚠ DANGER

Explosion and fire. Fuel and vapors are extremely flammable and explosive. No leakage of fuel is permitted. Keep fire and spark away. Failure to do so will result in death or serious injury. (000192)

NOTE: Natural gas is lighter than air and will collect in high areas. LP gas is heavier than air and will settle in low areas.

LP gas should only use a vapor withdrawal system. This type of system uses the vapors formed above the liquid fuel in the storage tank. The unit will run on natural gas or LP gas, but has been configured at the factory to run on natural gas.

NOTE: Should the primary fuel need to be changed to LP gas, the fuel system needs to be reconfigured. See the [General](#) section for instructions on converting the fuel system.

Recommended fuels should have a BTU content of at least 1,000 BTU/ft³ (37.26 MJ/m³) for natural gas; or at least 2,500 BTU/ft³ (93.15 MJ/m³) for LP gas.

NOTE: BTU fuel content information is available from the fuel supplier.

Required fuel pressure for natural gas and liquid propane vapor is 5–14 inches water column (9–26 mm mercury). Always validate the fuel pressure using the appropriate specification sheet for the generator.

NOTE: The primary regulator for the propane supply is NOT INCLUDED with the generator.

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

Always 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.

Piping strength and connections should be given special consideration when installation takes place in areas at risk for; flooding, tornadoes, hurricanes, earthquakes, and unstable ground.

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

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

General

Fuel System Conversion

Commercial units come from the factory configured and EPA certified with the fuel system ordered. Units in the 22 to 48 kW range come from the factory configured for natural gas, with an additional jet for LPV that can be reconfigured in the field. 60 kW units come from the factory as ordered, and are not reconfigurable in the field.

Any one of the following gaseous fuel systems may be installed:

- Natural Gas (NG)
- LP-Vapor Withdrawal

To convert to a different fuel (for example, from NG to LP-Gas Vapor), see the Owner's Manual or an Independent Authorized Service Dealer.

Gaseous Fuel Properties

Natural Gas

Natural gas is lighter than air. It is found in the gaseous state at normal ambient temperatures and pressures. It is highly explosive and can be ignited by the slightest spark. For this reason, fuel lines must be free of leaks and adequate ventilation is absolutely essential. Local fuel/gas codes dictate the maximum pressure under which natural gas can be delivered to a site or structure. The supply pressure from the utility meter/regulator is usually not the same as that required by the generator set, so a separate primary regulator providing the correct pressure and volume of fuel to the generator set is required. If the local utility source pressure is **less** than that required by the generator, it is up to the local utility to provide the volume of gas at the required pressure.

Propane Vapor (LPV)

Liquefied Petroleum gas is heavier than air. The gas vapors are explosive and can be ignited by the slightest spark. LP Vapor is supplied by liquid propane stored in tanks. Propane exists in its liquid form at or below its boiling point (-44° F [-42°C]) as well as when it is stored under pressure. LP tank pressure is dependent on the

ambient temperature and the liquid volume in the tank, and can be over 200 psi (1379 kPa). A first-stage regulator at the tank reduces the gas pressure to a lower line pressure value. This line pressure is then reduced to the correct operating pressure and volume for the generator set through the use of a second-stage regulator included with the unit.

Definitions

The following definitions are provided for use in this manual:

Term	Description
Allowable Pressure Drop	The design pressure loss in the system under maximum probable flow conditions, from the point of delivery to the inlet connection of the generator set, shall be such that the supply pressure at the generator is greater than or equal to the minimum pressure required by the generator at its full load capacity.
Authority Having Jurisdiction (AHJ) (NFPA-54)	An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.
Cubic Foot (ft ³) of Gas (NFPA-54)	The amount of gas that would occupy 1 ft ³ when at a temperature of 600° F saturated with water vapor and under a pressure equivalent to 30 in. w.c.
Generator Connection Point	The connection point for the fuel supply system to the generator set is the end of the manufacturer supplied flexible hose fitting which connects to the fitting on the base frame of the generator. An elbow and short nipple can be incorporated to allow the flexible hose to be positioned parallel to the unit base frame. The size of the connection point on the base frame is shown in each unit's installation drawing; the size of the flexible hose (and any elbow and nipple) must be equal to or larger than this connection point. The flexible hose must be installed straight without bending, twisting or kinking.
psi & psig	Measure of pressure in pounds per square inch and pounds per square inch gauge.
Inches of Water Column (in.w.c.)	Measure of pressure in inches of water column (in. w.c.). 14 in. w.c. = approximately 0.5 psi.
Primary Regulator	A pressure regulator installed between the service regulator (NG) or first-stage regulator (LP-Gas vapor) sized to provide the pressure and volume required by the generator at its full rated load capacity.
Regulator (for LP-Gas vapor)	
First-Stage Regulator	A pressure regulator for LP-Gas vapor service designed to reduce pressure from a container to 10.0 psig or less.
High-Pressure Regulator	A pressure regulator for LP-Gas liquid or vapor service designed to reduce pressure from the container to a lower pressure in excess of 1.0 psig.
Second-Stage Regulator	A pressure regulator for LP-Gas vapor service designed to reduce first-stage regulator outlet pressure to 14 in. w.c. or less. For generator set purposes, this is also referred to as the Primary Regulator.
Regulator (for NG fuel)	
Pressure Regulator	Device placed in a gas line for reducing, controlling, and maintaining pressure in downstream piping
Service Regulator	A pressure regulator installed by the servicing gas supplier to reduce and limit the service line gas pressure to delivery pressure.

Gaseous Fuel Systems

Natural Gas System

The utility gas provider will provide the gas meter. Consult the utility gas provider to verify they offer a gas meter that will deliver a sufficient fuel supply. The local utility is also responsible for providing gas at sufficient volume and pressure to operate the primary regulator. The primary regulator can then provide the correct volume of gas at the required pressure to the generator.

The piping system between the primary pressure regulator and the generator must be properly sized to provide the fuel volume required at 100% load while also staying within the pressure range noted on the unit specification sheet.

Follow the regulator manufacturer's recommendation for placement and mounting of the regulator.

Flexible Fuel Line

The purpose of flexible fuel line is to isolate vibration from the generator to reduce possibility of a gas leak at one of the connection points.

From the primary regulator, gas flows to the generator connection point, which is the end of the manufacturer supplied flexible fuel line. The flexible fuel line can be connected directly to the generator connection point (perpendicular to the frame rail), or by an elbow and short nipple to the frame rail itself (to run parallel to the frame rail). The nipple and elbow used must be the same pipe size as the flexible fuel line and generator connection point.

When connecting the gas line to the generator, use a listed nonmetallic assembly meeting the requirements of ANSI Z21.75/ CSA 6.27—Connectors for Outdoor Gas Appliances and Manufactured Homes or AGA-approved flexible fuel line in accordance with local regulations.

The flexible fuel line shall not be connected directly to the generator fuel inlet. Always connect the flexible fuel line to an approved gas fitting.

Follow all installation instructions and warnings provided with the flexible fuel line. Do not remove any labels or tags. Installation must always comply with applicable codes, standards, laws and regulations.

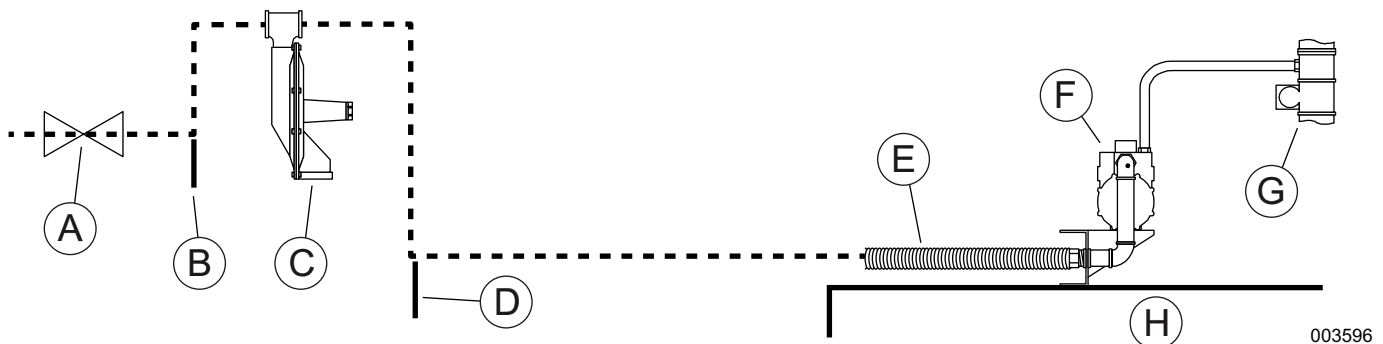
Additional flex fuel line options can be ordered. Consult an Independent Authorized Service Dealer for more information on sizes and availability.

Primary Regulator Outlet

The primary regulator outlet and the generator connection point must be sized correctly to provide the generator with the required volume and pressure when it is operating at 100% of its rated load.

On the generator, the unit-mounted regulator (it may be either a demand regulator or a pressure regulator) and its associated shutoff valves control the flow and pressure to the unit for proper operation. The fuel pressure required for the generator to operate is always measured at the inlet of the unit mounted regulator. For the location of the pressure test connection, see [Shutoff Valve](#). The supply pressure and volume must meet the requirements described in the unit specification sheet. If specifications are not met, the generator will not operate properly and will probably display symptoms such as hard starting, rough running, inability to carry load, and erratic operation.

Gas pressure from the primary regulator (supplied by the installing contractor) to the generator's fuel shutoff valve should be between 5–14 inches (12.7–35.6 cm) W.C. Always validate the fuel pressure using the appropriate specification sheet for the generator.



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A	Manual Shutoff Valve	D	Sediment Trap	G	Actuator
B	Sediment Trap	E	Flexible Fuel Line	H	Generator Base
C	Primary Regulator	F	Unit Mounted Regulator	—	—

Figure 4-1. Typical NG Fuel System

LP-Vapor Withdrawal System

This type of system uses the vapors formed above the liquid fuel in the supply tank. The maximum tank fill capacity is 80% and a minimum of approximately 20% of the tank capacity is needed for fuel expansion from the liquid to vapor state. Gas pressure and volume requirements for an LP-Gas vapor system at the connection point of the generator are listed on the unit specification sheet.

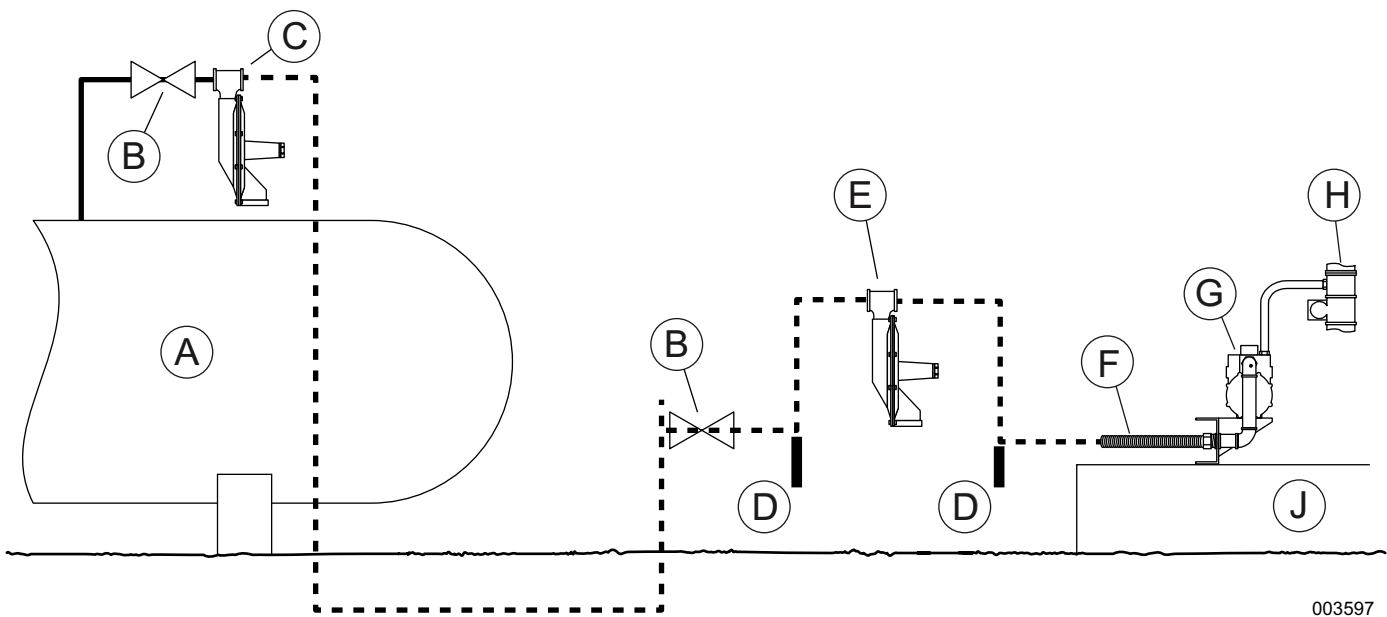
Pressure regulation for vapor withdrawal systems is typically a two-step process. First, by reducing the high tank pressure to a lower line pressure with a first-stage regulator, then reducing the line pressure to the pressure required by the unit with a second-stage regulator. Both regulators and the associated system piping and valves need to be sized correctly to provide the generator with the required volume and pressure of fuel at the generator connection point.

Gas pressure from the primary regulator (supplied by the installing contractor) to the generator's fuel shutoff valve should be between 11–14 inches (12.7–35.6 cm) W.C. Always validate the fuel pressure using the appropriate specification sheet for the generator.

The piping system connecting the outlet of the first stage regulator to the connection point on the second stage regulator must be properly sized to provide the fuel volume required by the unit at 100% load.

The piping system between the outlet of the second stage regulator and the generator connection point must be sized to provide the fuel volume required by the generator at 100% load while also staying within the pressure range noted on the unit specification sheet.

Follow the regulator manufacturer's recommendation for placement and mounting of the regulator.



A	Fuel Tank	D	Sediment Trap	G	Unit Mounted Regulator
B	Manual Shutoff Valve	E	Second Stage Regulator	H	Mixer
C	First Stage Regulator with Relief Valve and Pressure Tap	F	Flexible Fuel Line	J	Generator Base

Figure 4-2. Typical LP-Vapor Withdrawal Fuel System

Sediment Trap

A sediment trap shall be installed downstream of the generator shut off valve and as close as practical to the inlet of the generator. The sediment trap shall be either a tee fitting having a capped nipple installed vertically in the lowest opening of the tee fitting, or a device approved for use as an effective sediment trap.

Fuel Pressure Regulators

General

One of the most common causes of a generator set not operating properly is improper sizing and installation of the gaseous fuel supply system between the meter (utility source) and the generator connection. The fuel supply system consists of a primary regulator to regulate the flow and volume from the source (utility supply) to the generator, and all of the associated piping, fittings, and shutoff valves, both upstream (feeding the main meter/regulator) and downstream (between the meter and primary regulator), which connect the fuel source to the connection point on the generator. The fuel supply system must be capable of supplying the correct volume of fuel within the correct pressure range to the connection point on the generator. The volume of fuel and operating pressure required are listed in the technical specifications for the applicable generator. Fuel pressure at the unit must remain within the specified operating range and not drop below the minimum pressure specified.

Best Practices

These are the manufacturer recommended best practices for configuring and sizing fuel supply piping to generators. These best practices have been developed specifically for the manufacturer's product and may not represent conventional gaseous fuel system sizing methods, particularly those used frequently with low volume appliance installations. Compliance with these best practices will help to ensure the generator set engine will operate properly under dynamic conditions.

- The minimum distance from the primary pressure regulator outlet to the generator connection point is covered in the regulator manufacturer's installation instructions. Do not connect the pressure regulator directly to the flexible fuel line on the generator. The piping between the primary pressure regulator and the connection point on the generator acts as a reservoir (accumulator) which stores gas and, therefore, can minimize or maximize the changes in delivery pressure that the generator sees during cranking and load changes.
- The required fuel pressure to the unit is measured before the fuel shutoff solenoids at the inlet to the unit mounted regulator. A 1/8 inch pipe port in the pressure regulator body, or in the piping just before

the pressure regulator, is provided for this purpose. See [Shutoff Valve](#).

- Seasonal supply pressure changes to the primary pressure regulator can affect the proper operation of the generator. The fuel supply pressure to the unit must remain within the specified operating parameters as stated in the unit specification sheet. Contact the local utility to find out what can be done to correct seasonal changes.
- Use sediment traps.
- The generator set must have its own dedicated fuel supply. Do not connect any other loads to the outlet of the primary pressure regulator.

For LP-Vapor systems, due to the nature of the conversion process from LP liquid to LP vapor, consider the following:

- The vaporization rate of a given LP tank is dependent on the liquid level in the tank (wetted surface area), the ambient temperature around the tank, and relative humidity.
- When ambient temperatures are below 40° F (4° C), engine fuel consumption is high, and sufficient humidity is present, condensation can occur resulting in frosting of the tank at the liquid level. This condition can lead to a reduced rate of vaporization. See the LP tank sizing section for more information.

Operating Fuel Pressure

The unit specification sheet lists the operating fuel pressure range, as well as the 100% load fuel consumption rate. The pressure range is the minimum and maximum acceptable pressures for proper operation of the unit under all operating conditions. The maximum fuel system pressure drop at each condition, that is, static, cranking, running at no load, and running at full load, is 1-2 in. (25-50 mm) w.c. as measured at the primary fuel pressure regulator. For definitions of each condition, see [Final Test Procedure](#).

Engine Fuel Consumption

The volume of gaseous fuel consumed at various loads is listed in the unit specification sheet. Both Natural Gas and LP-Vapor values are provided in Cubic Feet per Hour (CFH). International units of measure are also provided.

Use the following formulas if it becomes necessary to convert CFH to BTUs per Hour:

• Natural Gas: CFH x 1000 = BTU per hour	• LP-Vapor: CFH x 2500 = BTU per hour
• Natural Gas: CMH x 37.26 = MJ per hour	• LP-Vapor: CMH x 93.15 = MJ per hour
NG Operating Range: 5–14 in. (12.7–35.6 cm) WC	LP Operating Range: 10–14 in. (25.4–35.6 cm) WC

Fuel Pressure Regulator Sizing

Fuel pressure regulators are designed to automatically adjust flow to meet downstream demand at a required pressure. The typical regulator installed as the primary regulator for a generator set is of the direct acting, internally registered design. "Direct acting" means the pressure sensing element acts directly to open the valve and control the flow to the load while maintaining the desired pressure. The pressure sensing element is typically a diaphragm which is opposed by a combination of spring pressure and atmospheric pressure. The valve is the restricting element and consists of some type of variable restriction (cone, poppet, disc) which closes against a fixed seat. Internal registration means the pressure used for sensing comes from within the valve body, usually through a passage from the secondary side (outlet) to the sensing diaphragm.

The primary regulator must be sized to provide the required flow at the rated pressure to the generator at its full load capacity. The generator fuel consumption values and required operating pressures are listed in the unit specification sheet.

The manufacturer recommends the primary pressure regulator be sized for at least 110% of the generator's required fuel consumption at 100% load, and the regulator provide no more than a 1-2 inch (25–50 mm) w.c. pressure drop at each operating condition, that is, static, cranking, running at no load, and running at full load.

Various regulator manufacturers provide sizing tables, flow capacity, pressure drop tables, and distributors who will help size a regulator correctly to a system.

Recommended Fuel Pressure Regulators

Use only direct acting fuel pressure regulators, such as those made by **Fisher®** or **Maxitrol®** or any other listed regulator manufacturer.

Primary Fuel Pressure Regulator

The following are the manufacturer's recommendations for specifying, sizing, and installing the primary fuel pressure regulator.

1. Verify the regulator:
 - Is sized to have a fuel flow delivery rating equal to the fuel consumption requirements of the generator.

NOTE: The recommended selection for orifice diameters is to use the smallest orifice that will still provide a CFH fuel flow rate at least 1.1 times greater than the required full load CFH rating of the generator set.

- Is approved for a mechanized engine application.
- Has an accuracy rating of 1% or less and/or have a maximum allowable pressure droop rate of 1-2 inches (25–50 mm) w.c.

NOTE: "Droop" is the reduction of outlet pressure experienced by pressure-reducing regulators as the flow rate increases. It is stated as a percent, in inches of water column, or in pounds per square inch, and indicates the difference between the outlet pressure at low flow rates and the outlet pressure at the published maximum flow rate. Droop is also called offset or proportional band. For proper generator operation, a maximum of 1-2 in. (25–50 mm) w.c. droop is required at each operating condition, that is, static, cranking, running at no load, and running at full load.

- Has a spring rating within the range of the fuel pressure listed in the generator specification sheet.
2. Be sure the generator has a dedicated fuel supply which is not shared with any other appliances (furnace, water heaters, ranges, etc.).
 3. Check the inlet pressure measured at the regulator body inlet connection when the regulator appears unable to pass the published flow rate. Supply piping up to the regulator can cause significant flowing pressure losses.
 4. Be sure the regulator is flowing at least five percent of the normal operating flow when adjusting the pressure set point.
 5. Expect approximately a one degree drop in gas temperature for every 15 psid (differential) across the regulator due to the natural refrigeration effect.

NOTE: Freezing is often a problem when the ambient temperature is between 30° and 45° F (-1° and 7° C), particularly with LP-V systems.

6. Point vents down to help avoid the accumulation of water condensation or other materials in the spring case.
7. Keep vents open. Do not use long, small diameter vent lines. Follow the rule-of-thumb: use the next nominal pipe size for every ten feet of vent line, and use three feet of vent line for every elbow in the line.
8. The connection point on the generator is the end of the manufacturer supplied flex hose. The flex hose is the same size as the connection point on the generator frame rail (see installation drawings). It is permissible to install one elbow (90°) and a short nipple between the flex hose and frame rail connection point to allow the flex hose to parallel the frame rail for installation purposes.

Pipe Sizing Considerations

General

Consult a local gas distributor or licensed installer when sizing and installing the piping for any gaseous fuel supply system. When using a local gas distributor or installer, be sure they have the proper documentation to support their recommendations. The fuel system requirements and best practices conveyed in this manual must be provided to the representative responsible for sizing the fuel system. The final test of the system is measuring the fuel pressure as described in **Shutoff Valve**. If the pressure requirements are not met, then the fuel supply system is not correct.

There are several pipe sizing programs available for use on the Internet and from various manufacturers. If used it is highly recommended that the minimum pressure drop value always be used (0.5 inches [13 mm] w.c or less). This will ensure the piping system is sized correctly to handle the generator set volume at full load, and during cranking and load transients, while also remaining above the minimum operating pressure.

The following general rules apply to piping of gaseous fuel systems:

- Use black iron piping or other approved gas line. Pipe must be rigidly mounted and protected against vibration.

- Install the supplied or recommended length of flexible hose between the generator connection point and the rigid supply piping. Do not install the flexible hose underground or in contact with the ground.

IMPORTANT NOTE: Some manufacturers offer flexible hose specifically designed to permit bends. Do not allow any bends, twists, or kinks in the installation unless you are certain the flexible hose is approved for that purpose. Contact the hose manufacturer for specifications.

- Install a sediment trap. (Consult local AHJ for requirements)
- Correctly size the piping to maintain the required supply pressure and volume under varying load conditions.
- Properly purge and leak test installed piping.
- Use an approved pipe sealant or joint compound on all threaded fittings to reduce the possibility of leakage.
- Make provision for a fuel shutoff valve near the unit. Verify the fuel shutoff valve is installed correctly and works properly.
- Using suitable methods, check entire pipe run for leaks,

Table 4-1. Fuel Pipe Sizing for Natural Gas (NG)

Natural Gas 5–14 in. (12.7–35.6 cm) of Water Column							
Table values are maximum pipe run in feet (meters)							
kW	0.75 in (1.9 cm)	1 in (2.5 cm)	1.25 in (3.2 cm)	1.5 in (3.8 cm)	2 in (5.1 cm)	2.5 in (6.4 cm)	3 in (7.7 cm)
RG 22	10 (2.5)	30 (7.6)	115 (29.2)	250 (63.5)	—	—	—
25 and 30	10 (2.5)	50 (12.7)	200 (50.8)	450 (114.3)	—	—	—
27	—	20 (5.1)	80 (20.3)	175 (44.4)	550 (139.7)	—	—
32	—	20 (5.1)	90 (22.9)	175 (44.4)	600 (152.4)	—	—
36	—	10 (2.5)	35 (10.7)	80 (20.3)	250 (63.5)	—	—
38	—	10 (2.5)	70 (21.4)	150 (38.1)	500 (152.4)	—	—
45	—	—	20 (5.1)	50 (12.7)	175 (44.4)	400 (121.9)	—
48	—	10 (2.5)	30 (7.6)	75 (22.9)	250 (63.5)	600 (182.9)	—
60	—	—	10 (2.5)	30 (7.6)	100 (30.45)	200 (60.9)	700 (213.4)
Note: Size the fuel pipe to the sizing charts or to local codes. When installing other than Sch. 40 black pipe, please refer to the manufacturer's sizing charts. The liquid-cooled generator is not a constant flow appliance. The fuel pipe was sized large enough to supply at least 100% of the generator BTU/hr rating.							
Natural Gas • 1 cubic foot (28.31 L) = 1,000 BTU (1.055 MJ) • 1 therm = 100,000 BTU (105.5 MJ) • Gas consumption = 13,000–16,000 BTU per kW/hr Pressure 1 inch mercury = 13.61 inches water column 1 inch Water Column = 0.036 psi 11–14 inches water column = 0.396 psi to 0.50 psi				Note: • Pipe sizing is based on 0.5 inch (1.27 cm) H₂O pressure drop. • Sizing includes a nominal number of elbows and tees. • Please verify adequate service and meter sizing. • Tables based on black pipe.			

Table 4-2. Fuel Pipe Sizing for Liquid Propane

LP Vapor (LPV) 11–14 in. (27.9–35.6 cm) of Water Column							
Table values are maximum pipe run in feet (meters)							
kW	0.75 in (1.9 cm)	1 in (2.5 cm)	1.25 in (3.2 cm)	1.5 in (3.8 cm)	2 in (5.1 cm)	2.5 in (6.4 cm)	3 in (7.7 cm)
RG 22	20 (5.1)	100 (30.45)	400 (121.9)	—	—	—	—
25 and 30	50 (12.7)	200 (50.8)	800 (243.8)	—	—	—	—
27	15 (4.6)	70 (21.4)	300 (91.4)	625 (190.5)	—	—	—
32	10 (2.5)	60 (18.3)	280 (85.3)	550 (167.6)	—	—	—
36	—	20 (5.1)	150 (45.7)	325 (99.1)	950 (289.6)	—	—
38	10 (2.5)	35 (10.7)	200 (60.9)	450 (137.2)	—	—	—
45	—	10 (2.5)	80 (24.4)	200 (60.9)	600 (182.9)	—	—
48	—	10 (2.5)	80 (24.4)	200 (60.9)	600 (182.9)	—	—
60	—	10 (2.5)	40 (12.2)	100 (30.5)	350 (106.7)	—	—
Note: Size the fuel pipe to the sizing charts or to local codes. When installing other than Sch. 40 black pipe, please refer to the manufacturer's sizing charts. The liquid-cooled generator is not a constant flow appliance. The fuel pipe was sized large enough to supply at least 100% of the generator BTU/hr rating.							
LPG 8.55 ft³/lb. (548.02 L/kg) 4.24 lbs./gal. (0.51 kg/L) 2500 BTU/ft³ (93.2 kJ/L) 36.3 ft³ = 1 gal. (0.272 m³/L) Pressure 1 inch mercury = 13.61 inches water column 1 inch Water Column = 0.036 psi 11–14 inches water column = 0.396 psi to 0.50 psi				Note: - Pipe sizing is based on 0.5 inch (1.27 cm) H₂O pressure drop. - Sizing includes a nominal number of elbows and tees. - Please verify adequate service and meter sizing. - Tables based on black pipe.			

Sizing LP Tanks for Vapor Withdrawal

The manufacturer recommends the installer consult with a reputable LP supplier when sizing LP storage tanks and their associated pressure regulators and piping systems. Many factors come into play when working with LP in either its vapor or liquid form.

The operation of an LP-Vapor system depends on the vaporization of the liquid stored in the tanks. As the vapor above the liquid level is withdrawn the pressure in the tank decreases. This change in pressure causes the liquid to “boil” in order to restore the pressure equilibrium. The liquid in the tank uses the temperature difference between its boiling point (-44° F [-42°C] for Propane) and the outside temperature to extract enough heat to enable vaporization (boiling). Only the liquid in contact with the tank wall absorbs heat from the outside. The area of the tank where the liquid is in contact with the tank wall is referred to as the “wetted surface area”. Cold weather results in a reduced tank vaporization capacity because there is less heat energy available to boil off the liquid into vapor. The wetted surface area of the tank must be large enough to sustain the vaporization rate required by the generator. Depending on the relative humidity and

the ambient temperature, frosting can occur on the outside of the tank when it is in use. This condition further inhibits the heat transfer required to sustain vaporization. Several factors affect the rate of vaporization for LP tanks:

- The size of the tank (wetted surface area). As the wetted surface area decreases the rate of vaporization decreases.
- The lowest liquid level the tank will be allowed to reach (relates directly to the wetted surface area). The typical maximum fill level for LP tanks is 80%, and the lowest recommended operating level is 20%. This provides a volume equivalent to 60% of the tank capacity to be used to calculate run time. Most tank sizing tables provide the vaporization rate of the tank at the lowest allowable level (20%); any tank level above this point will have a higher vaporization rate.
- The lowest normal temperature expected. Typical tank tables provide vaporization rates at 40° F, 20° F, and 0° F (4°C, -7°C, and -18°C). For temperatures below 0° F (-18°C) consult a reputable LP dealer for options.
- The mean relative humidity.

To size an LP tank for a desired run time the following information is required:

- The maximum vapor consumption of the generator (in BTU/hr) at 100% load. The specification sheet for the generator will list the fuel consumption rate, usually in cubic feet per hour. To convert CFH to BTU/hr, multiply by 2520.
- The fuel consumption rate in gallons per hour with the generator at 100% load. To convert CFH (propane vapor) to GPH, divide by 36.38. To convert BTU/hr to GPH, divide by 91502.
- The desired run time.
- The minimum operating temperature expected.

The most important thing to consider when sizing LP tanks for vapor withdrawal is the vaporization rate of the tank at the minimum temperature expected, and at the minimum fuel level the tank will be allowed to reach. The vaporization rates shown in Table 4-3. are based on the tank at 20% of its fill capacity.

1. Multiply the gallons per hour fuel consumption rate of the generator at 100% load by the longest run time expected/desired.
2. Determine the fuel consumption in BTU/hr with the generator at 100% load.
3. Determine the lowest expected operating temperature.
4. See **Table 4-3: Vaporization Rates** Using both the Minimum Operating Temperature and the Tank Vaporization Capacity columns, find the BTU/hr vaporization rate of the generator at 100% load corresponding to the lowest expected operating temperature.
5. Look back at column 2, and note the Available Tank Capacity. If it is greater than the total run time fuel consumption refer back to column 1- this is the correct size tank required. If it is less than the total run time fuel consumption, then go to the next larger tank size. Recheck the lowest operating temperature and the tank vaporization capacity.

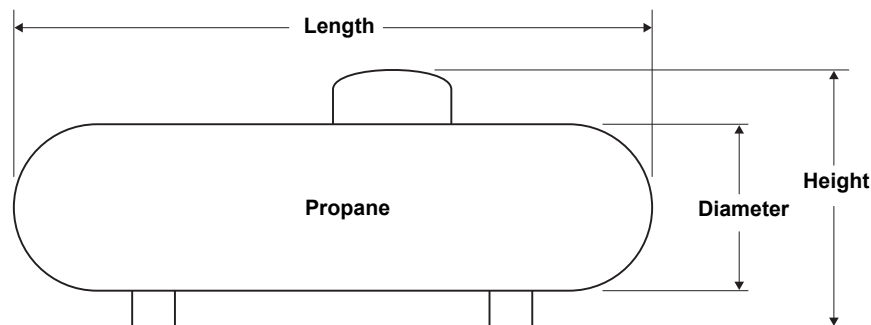
Table 4-3. Vaporization Rates

Tank Capacity Total (gal [L]) See Note 1	Available Tank Capacity (gal [L]) See Note 2	Minimum Operating Temperature (° F [°C])	Tank Vaporization Capacity (BTU/hr [MJ/hr]) See Note 3	Length (in. [cm])	Diameter (in. [cm])
250 [946.4]	150 [567.8]	40 [4.4] 20 [-6.6] 0 [-17.8]	507,600 [535.5] 338,400 [357] 169,200 [178.5]	94 [238.8]	30 [76.2]
325 [1230.3]	195 [768.2]	40 [4.4] 20 [-6.6] 0 [-17.8]	642,600 [683.3] 428,400 [452] 214,200 [226]	119 [302.3]	30 [76.2]
500 [1892.7]	300 [1135.6]	40 [4.4] 20 [-6.6] 0 [-17.8]	792,540 [836.2] 528,360 [557.4] 264,180 [278.7]	119 [302.3]	37 [94]
850 [3217.6]	510 [1930.6]	40 [4.4] 20 [-6.6] 0 [-17.8]	1,217,700 [1284.7] 811,800 [856.5] 405,900 [428.2]	165 [419.1]	41 [104.1]
1000 [3785.4]	600 [2271.2]	40 [4.4] 20 [-6.6] 0 [-17.8]	1,416,960 [1495] 944,640 [996.6] 472,620 [498.6]	192 [487.7]	41 [104.1]

Note 1: The minimum tank size should be sized large enough to provide the proper fuel capacity to the generator at full load. Consult with the LP provider for proper tank sizing.

Note 2: The available tank capacity is approximately 60% of the total fill capacity. This is based on a maximum fill level of 80% and a minimum operating level of 20% (80%-20% = 60%).

Note 3: The vaporization capacity shown is based on a tank level of 20%. This represents the smallest allowable wetted surface area of the liquid in the tank. As the liquid level goes up, the wetted surface area and the vaporization rate increases.

**Figure 4-3. Typical Propane Tank Dimensions**

Propane conversion figures:

- 36.38 ft³ = 90,500 BTU = 1 gal
- 1 lb = 21,500 BTU = 8.56 ft³
- 2500 BTU = 1 ft³
- 0.001 m³ = 21 MJ = 1 L
- 1 kg = 10.3 MJ = 0.11 m³
- 1.13 MJ = 1 m³

Final Operating Test

A properly configured and sized fuel system provides the fuel volume and fuel pressure required for the generator set to operate correctly in all modes of operation. To confirm proper fuel system operation, a series of tests must be performed as described below.

Shutoff Valve

Most applications will require an external manual shut-off valve on the fuel line. The valve must be easily accessible. Local codes determine the proper location.

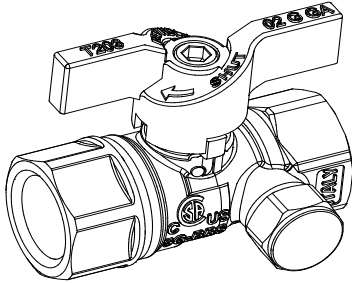


Figure 4-4. Accessory Valve with Manometer Port

NOTE: [Figure 4-4](#) illustrates a fuel shut-off valve with a manometer port for making fuel pressure checks. This accessory valve permits making pressure checks without going into the generator enclosure.

Valves available through Generac and Independent Authorized Service Dealers:

- 3/4" pressure rated ball valve, part number 0K8754
- 1" pressure rated ball valve; part number 0K8184
- 1-1/4" pressure rated ball valve; part number 0L2844
- 1-1/2" ball valve; part number 0L2856
- 2" ball valve; part number 0L2846

Gas Pressure Test Port Location

Using a suitable pressure gauge or water manometer, measure the gas pressure to the generator at a test port located before the fuel solenoid shutoff valve(s).

See A of [Figure 4-5](#). On units using demand type regulator(s), there may be a factory-installed 1/8 inch pipe port in a tee fitting connected to the low pressure switch.

See B of [Figure 4-5](#). If the unit has a low pressure switch without the tee, install a tee and plug between the low pressure switch and the test port on the regulator body using a suitable pipe dope. Use only the upper port on the regulator body, as it detects supply gas pressure even when the unit solenoid valve is closed. This allows static pressure to be measured, as well as pressure when cranking, while running at no load, and while running at full load.

See C of [Figure 4-5](#). Factory installed at the test point, some units may be provided with a special test port plug known as a "Pete's Plug." The plug allows fuel pressure test readings to be taken quickly without leaving costly gauges installed in the line.

Use the "Pete's Plug" as follows:

1. Clean and lubricate gauge adapter probe with a small amount of petroleum jelly or silicone grease.
2. Assemble gauge adapter.
3. Using the appropriate sealant, screw barbed fitting into gauge adapter.
4. Install fuel hose of the proper pressure gauge onto barbed fitting.
5. Slowly unscrew protective cap from the test port plug.

NOTE: Quickly tighten the cap if escaping gas or liquid is heard or felt. Replace the plug if defective.

6. Insert gauge adapter into test port plug and secure.
7. Once the fuel pressure reading is obtained, remove gauge adapter probe and screw protective cap onto fuel pressure test port plug.

NOTE: Take necessary readings as quickly as possible. Severe deformation of the valves may occur if gauge adapter probe is left in the test port plug for a period of hours or days.

NOTE: Below 45° F (7°C), the neoprene core of the plug does not recover its original shape as rapidly as it would at higher temperatures. Therefore, upon removal of the gauge adapter probe, the valves may not close fully and immediately, or they may remain slightly open until the operating temperature is above 45° F (7°C). Lower pressures and the length of time the gauge adapter probe is inserted also can affect the valve closing rate. The protective cap is provided to eliminate the small amount of leakage that might occur following removal of the gauge adapter probe.

8. Tighten protective cap to prevent tampering.

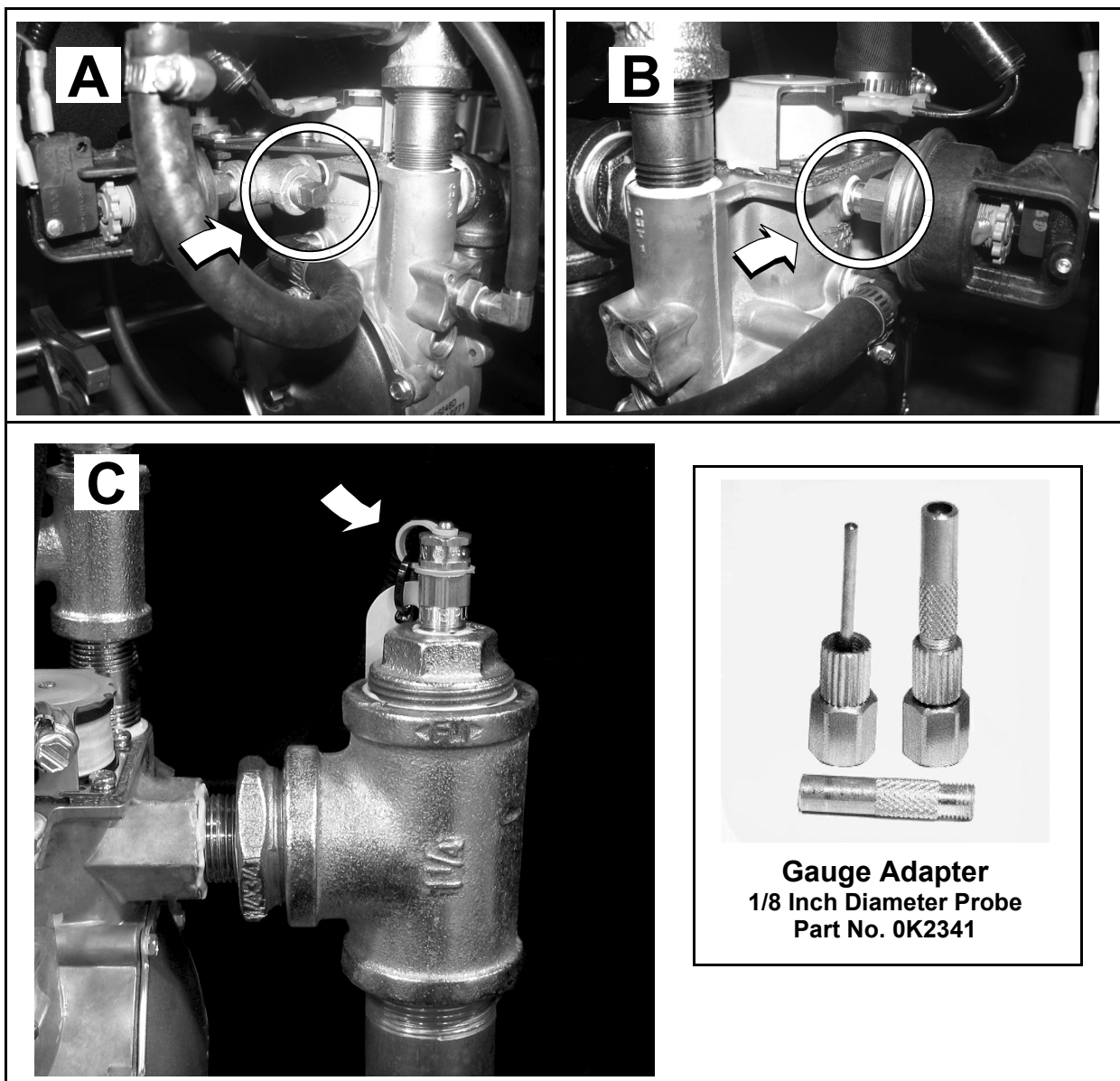


Figure 4-5. Fuel Pressure Test Points

Final Test Procedure

The following test must be performed at startup to document and validate fuel system operation. It requires a load bank connected to the unit, or a combination of load bank and system load, to bring the unit to its full rated kW load capacity.

Measure the fuel supply pressure under each of the following conditions:

1. **Static Pressure.** Pressure when the unit is not running. Must not exceed the maximum pressure listed in the unit specification sheet.
2. **Cranking Pressure.** Pressure when the unit is cranking. Must not drop more than 1 in. (25.4 mm) w.c. below *Static Pressure* or below the minimum pressure listed in the unit specification sheet. If it does, it may indicate fuel supply piping is not correctly sized, or primary regulator is improperly

sized or mounted too close to the generator connection point. The unit may experience hard starting, or will not perform as expected at full load or during load transients.

3. **Running- No Load Pressure.** Pressure when the unit is running at rated frequency and voltage with no load. Should be at or slightly below the maximum pressure as listed in the unit specification sheet.
4. **Running- Full Load Pressure.** Pressure when the unit is running with full rated load applied (kW). Pressure should not drop more than 1–2 in. (25.4–50.8 mm) w.c. from the *Running- No Load Pressure* and must NEVER drop below the minimum pressure listed in the unit specification sheet.

Section 5: Electrical System

General Information

All wiring must be properly sized, routed, supported, and connected. All wiring must comply with NEC and local codes.

The generator uses Customer Connection Interface (CCI) panels to separate the high voltage and customer control wiring connections. These two panels are clearly labeled. The wiring diagrams for each specific unit show the connection points in their corresponding sections. Terminal boards are clearly labeled and correspond to the same terminal connections shown in the wiring diagrams. Always use the unit specific wiring diagrams when making wiring connections.

IMPORTANT NOTE: Refer to **AC Connections—1/3 Phase, 6/12 Lead** in Section 11: Installation Drawings.

Connecting Generator Feeder Conductors



⚠ DANGER

Electrocution. Turn utility and emergency power supplies to OFF before connecting power source and load lines. Failure to do so will result in death or serious injury. (000116)

Installation and interconnection diagrams are provided at the back of this manual.

NOTE: All installations must comply with national, state, and local codes. It is the responsibility of the installer to perform an installation that will pass the final electrical inspection.

The generator supply connection is made at the generator disconnect circuit breaker terminals. Conductor sizes must be adequate to handle the maximum current to which they will be subjected, based on the 75°C column of tables, charts, etc. used to size conductors. The installation must comply fully with all applicable codes, standards and regulations.

All power cables can enter the enclosure through the knockouts provided.

NOTE: If aluminum conductors are used, apply corrosion inhibitor to conductors. After tightening terminal lugs, carefully wipe away any excess corrosion inhibitor.

Tighten terminal lugs to the torque values as noted on the decal located on the inside of the door. After tightening terminal lugs, carefully wipe away any excess corrosion inhibitor.

⚠ CAUTION

Equipment damage. Verify all conductors are tightened to the factory specified torque value. Failure to do so could result in damage to the switch base.

(000120)

Connect generator conductors to clearly marked terminal lugs in the generator as follows:

1. See **Figure 2-1**. Connect generator conductors to disconnect circuit breaker.
2. Connect the generator neutral to the neutral terminal bar.
3. Connect equipment ground to the equipment ground lug.

Connecting Control Circuit Wires

Control system interconnections may consist of N1, N2, and T1, and leads 23 and 194. The generator control wiring is a Class 1 signaling circuit. Reference instruction manual of specific engine generator for wiring connection details. Recommended wire gauge sizes for this wiring depends on the length of the wire, as recommended in the following chart:

Maximum Wire Length	Recommended Wire Size
1–115 ft (0.30–35 m)	No. 18 AWG
116–185 ft (36–56 m)	No. 16 AWG
186–295 ft (57–89 m)	No. 14 AWG
296–460 ft (90–140 m)	No. 12 AWG

Exception: Conductors of AC and DC circuits, rated 1000 volts nominal, or less, shall be permitted to occupy the same equipment, cable, or conduit. All conductors shall have an insulation rating equal to at least the maximum circuit voltage applied to any conductor within the equipment, cable, or conduit. See NEC 300.3(C)(1).

Remove Rear Panel and Stub Up Cover

1. See [Figure 5-1](#). Remove six screws with nylon washers to release rear panel (A) from enclosure. For best results, rotate left side of panel outward away from enclosure before disengaging the right side.

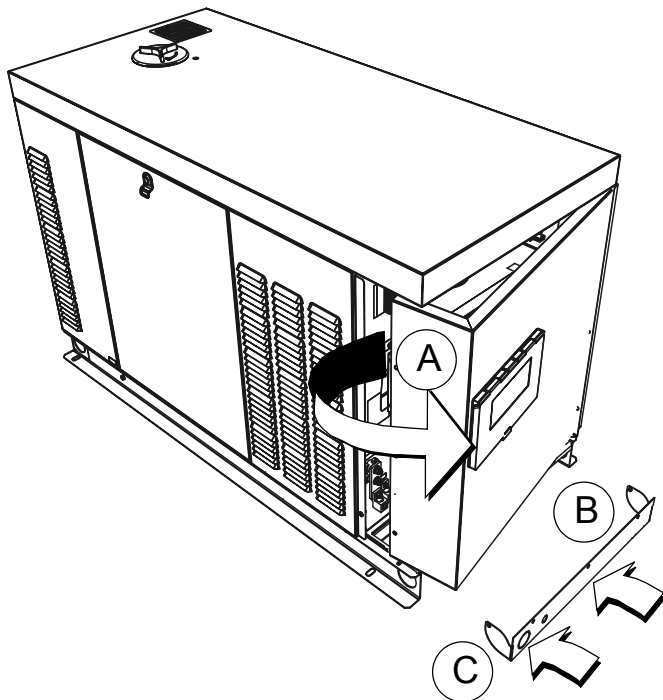


Figure 5-1. Remove Rear Panel and Stub Up Cover

2. Remove four screws with nylon washers to release fascia from control panel.
3. The stub up cover (B) and five screws with flat washers are shipped loose and found inside the enclosure. An optional knock-out (C) is provided.

Table 5-1. Frame Breakers

Frame Breaker	Generac 225 AF 2 Pole	Generac 225 AF 3 Pole	Generac 400 AF 2 Pole	Generac 400 AF 3 Pole
Range	125A-200A	50A-200A	225A-400A	225A-400A
Wire Type	Cu/Al	Cu/Al	Cu/Al	Cu/Al
Wire Temperature Rating	167° F (75° C)	167° F (75° C)	167° F (75° C)	167° F (75° C)
Lug AWG Range (Number of Conductors)	6-350 kcmil (1)	6-350 kcmil (1)	1/0 - 250 kcmil (2) or 4-600 kcmil (1)	1/0-250 kcmil (2) or 4-600 kcmil (1)

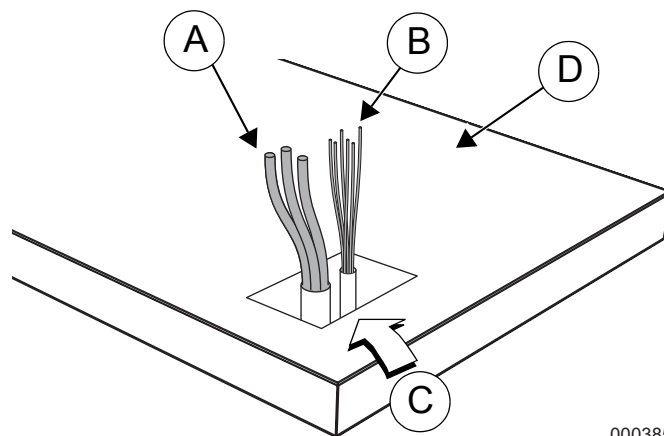
NOTE: Generac frame breakers are rated at an 80% continuous load rating. Frame breaker torque specs are on the breaker data tag.

Typical Load leads and Control Wiring in Stub Up

The illustration in [Figure 5-1](#) is for reference only. Refer to the installation drawings for unit-specific details.

NOTE: Refer to 300.3(C) and Article 725 in the NEC for routing of control wires and power wires.

NOTE: A single conduit is permitted.



000385

Figure 5-2. Typical Load Leads and Control Wiring in Stub Up

A	Load Leads	C	Stub Ups
B	Control Wiring	D	Concrete Pad

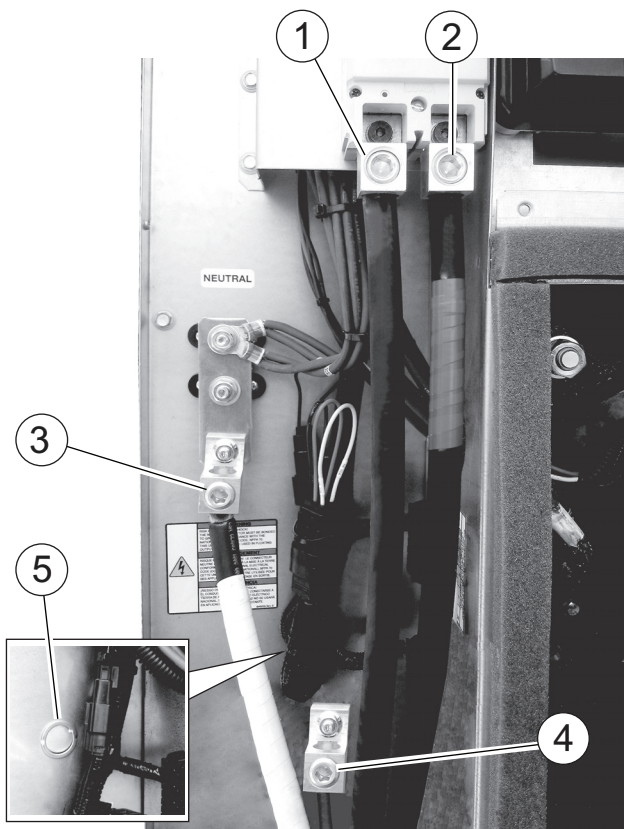
Customer Load Wiring

Customer load wiring consists of single-phase or three-phase connections between the generator Main Line Circuit Breaker (MLCB) and the transfer switch. The wiring connects to lugs E1, E2, E3 (if three phase on MLCB), neutral, and equipment ground at the generator and runs to the corresponding lugs in the transfer switch. All load wires, neutral and ground should be marked and terminated in the correct lugs in the transfer switch. Ensure all wiring is properly mounted and terminated at the appropriate connection points in both the generator and transfer switch. For general information regarding wire type, temperature rating, size range, and wire lug torque specifications, see [Table 5-1: Frame Breakers](#) and [Table 5-2: Control Wire Length/Size](#). Always refer to NEC tables for specific requirements.

NOTE: For three phase applications, use phase rotation meter to verify the generator phase rotation matches the rotation of the utility.

NOTE: For three phase, delta configured alternators (voltage code J) the second leg (N2) must be bonded to all second legs in the entire system.

Refer to [AC Connections—1/3 Phase, 6/12 Lead](#) in Section 11 for more information.



001758

Load Wiring Connections			
1	E1	4	Ground
2	E2	5	Knock Out Plug (Cold Weather Kit)
3	Neutral		
Notes: Single phase installation shown. See Figure 5-4 for typical control wiring connections.			

Figure 5-3. High Voltage Connections (Typical)

Control Wiring Connections

The Control Wire Customer Connection block is where all of the control wiring is connected.

IMPORTANT: All wiring must comply with NEC, state, and local AHJ requirements. Control wiring shall be installed per the requirements of NEC Articles 300.3(C) and 725.46. If installing conductors with different voltage insulation ratings, a 600V rated electrical sleeve is provided and can be found in the manual bag.

See [Figure 5-4](#). Depending on the type of system, control wiring includes the following. (Wire colors shown for illustration purposes only):

RTS Series Transfer Switch With T1 Fuse/ Connection

NOTE: The control wire customer connections typically use Class 1 Wiring Methods (verify with AHJ). Always follow the standards and methods appropriate to the circuits being wired.

NOTE: T1 is the 120 VAC power supply for the control panel battery charger. This circuit must be powered whether the transfer switch is in utility or generator mode. If the circuit loses power, the control board will generate a warning (Battery Charge AC Fail).

NOTE: Observe the maximum wire size for the terminal strip connections shown in the unit wiring diagram.

(1) For battery charging, connect neutral in TB2 to neutral in the transfer switch. See NOTE below for transfer switches without T1.

(2) Connect T1 in TB2 to T1 in the transfer switch. This is 120 volt supply to the unit's battery charger (normal RTS transfer switch).

(3) (4) Connect N1, N2 sensing wires in TB2 to N1 and N2 in the transfer switch. These two wires are utility sensing wires.

(5) (6) Connect 23 in TB3 to 23 in the transfer switch. Connect 194 in TB3 to 194 in the transfer switch. These are the transfer switch control wires.

NOTE: RTS Series Transfer Switch Without T1 Fuse/Connection Use a 120 volt generator protected circuit from the panel board to power the battery charger circuit (dedicated 15/20 amp circuit).

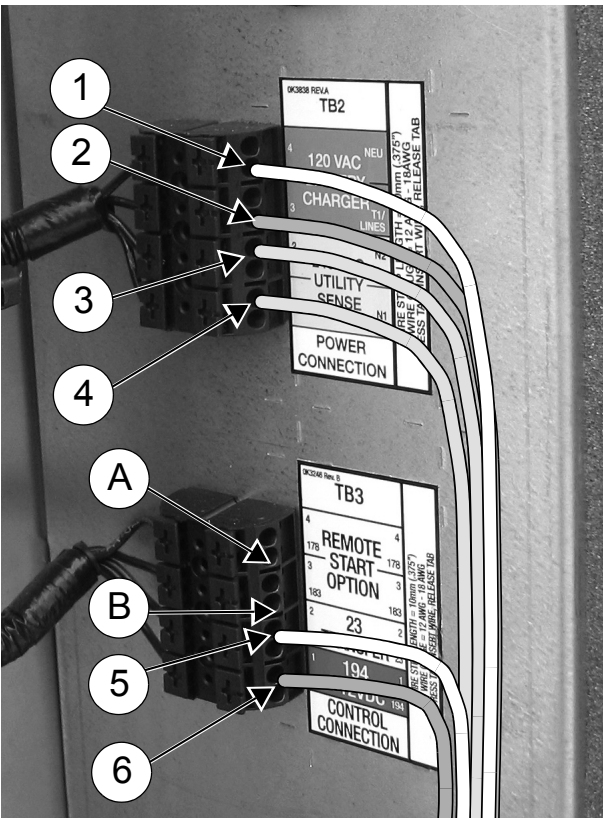


Figure 5-4. Control Wiring Connections (Typical)

TB2 Terminal Block			
Terminal		Function	Voltages
1	Neutral	Neutral for T1 Battery Charger	Neutral
2	T1	Power for T1 Battery Charger	120 VAC
3	N2	Utility Sensing from Transfer Switch	208-277 VAC
4	N1	Utility Sensing from Transfer Switch	208-277 VAC
TB3 Terminal Block			
Terminal		Function	Voltages
A	178	Two Wire Start Control [GTS]	5 VDC
B	183	Two Wire Start Control [GTS]	5 VDC
5	23	Transfer Relay Control Wire	12-0 VDC
6	194	Power for Transfer Relay	12 VDC

Two-Wire Start

To convert control panel to 2 wire start transfer switch mode of operation, see dealer for panel conversion and connection of terminals 178 and 183 in TB3. Use a 120 volt generator protected circuit from the panel board to power the battery charger circuit (dedicated 15/20 amp circuit).

The generator controller will have to be re-programmed for two-wire start by an Independent Authorized Service Dealer.

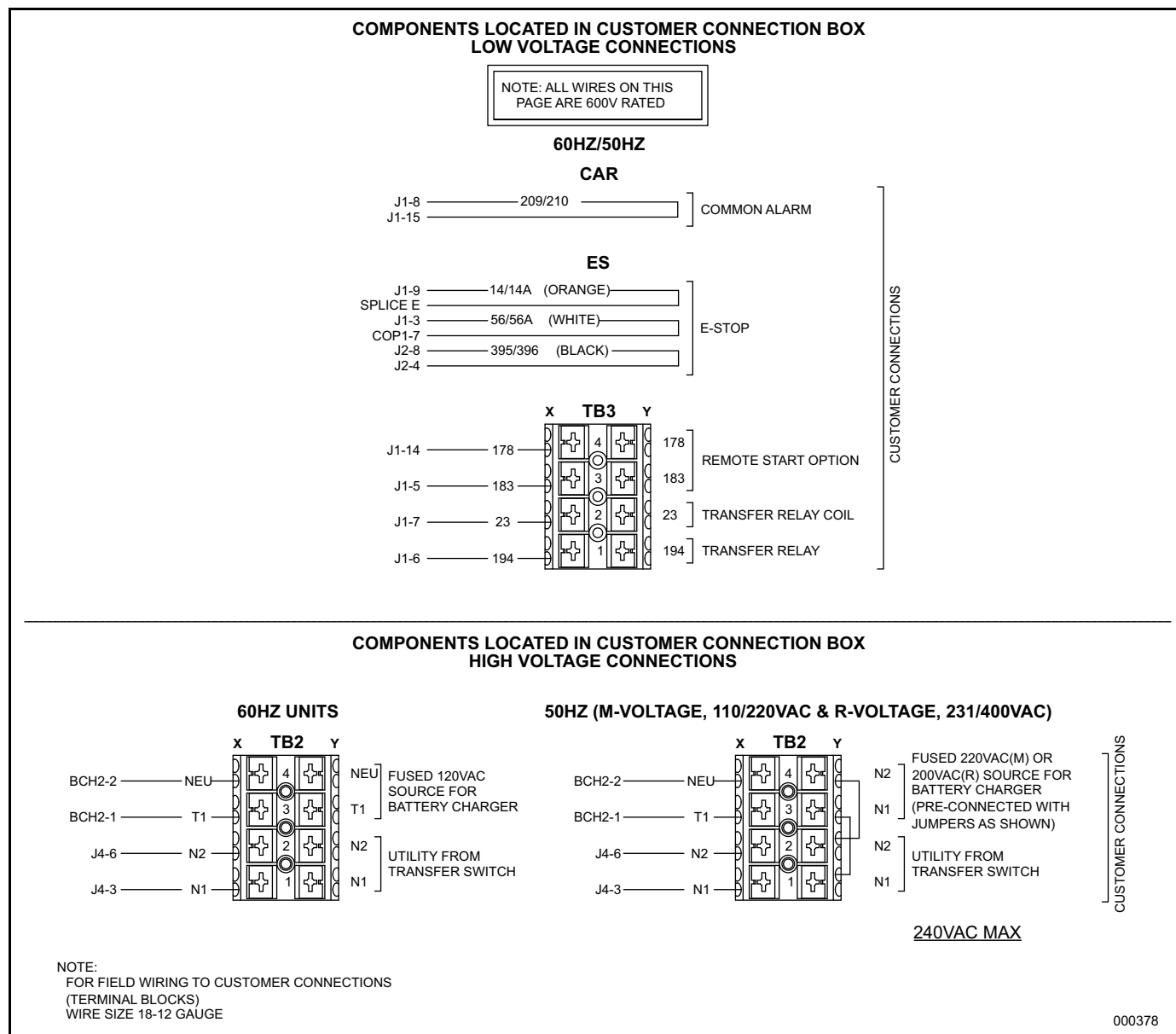


Figure 5-5. Typical Control Wiring Schematic

NOTE: The following table is provided for reference purposes only. Refer to the latest NEC, state and local AHJ requirements for proper sizing.

Table 5-2 Control Wire Length/Size

Maximum Wire Length	Recommended Wire Size
1–115 ft (0.30–35 m)	No. 18 AWG
116–185 ft (36–56 m)	No. 16 AWG
186–295 ft (57–89 m)	No. 14 AWG
296–460 ft (90–140 m)	No. 12 AWG

Optional Accessory Power

- Accessory power for optional items (battery warmer and block heater) should come from a customer utility supply source (with appropriate sized breaker), which is also powered by emergency power during an outage.
- Optional user installed GFCI receptacles. Provides a place to plug in optional battery warmer and block heater.

NOTE: Remove knockout plug and route accessory wiring to customer supplied weather-proof junction box. See [Figure 5-1](#). Verify wires do not contact moving or vibrating engine parts, as abraded wires can result in electrical problems.

Install Stub Up Cover and Rear Panel

1. Install five screws with flat washers to secure stub up cover.
2. Install four screws with nylon washers to fasten fascia over control panel.
3. Install rear panel. For best results, first engage right side of panel and then rotate left side inward toward enclosure. Alternately work left and right sides in until slots are aligned with screw holes on both sides. Install six screws with nylon washers and tighten until snug.

Transfer Switch Location

The location of the transfer switch is important. Consider the following:

1. Locate the transfer switch as close to the emergency load as practical to avoid interruptions of the emergency power system due to natural disasters or equipment failures.
2. Locate the transfer switch in a clean, dry, well ventilated location, away from excessive heat. Allow adequate working space around the transfer

switch. Refer to the latest NEC, state and local AHJ requirements for details.

3. Install power and control wires as per NEC requirements. In a three phase system, all power conduits from the generator set must contain all three phases.
4. Conduit, wire, circuit protective device sizes, insulation etc. must conform to applicable local and national codes and regulations.

Battery

General Safety Precautions



⚠ WARNING

Explosion. Batteries emit explosive gases while charging. Keep fire and spark away. Wear protective gear when working with batteries. Failure to do so could result in death or serious injury.

(000137a)



⚠ WARNING

Risk of burns. Batteries contain sulfuric acid and can cause severe chemical burns. Wear protective gear when working with batteries. Failure to do so could result in death or serious injury.

(000138a)



⚠ WARNING

Explosion. Batteries emit explosive gases. Always connect positive battery cable first to avoid spark. Failure to do so could result in death or serious injury.

(000133)

⚠ WARNING

Environmental Hazard. Always recycle batteries at an official recycling center in accordance with all local laws and regulations. Failure to do so could result in environmental damage, death or serious injury.

(000228)

Always recycle batteries in accordance with local laws and regulations. Contact your local solid waste collection site or recycling facility to obtain information on local recycling processes. For more information on battery recycling, visit the Battery Council International website at: <http://batteryrecycling.org/>.

- Stationary generators installed with automatic transfer switches will crank and start automatically when NORMAL, UTILITY source voltage is removed or is below an acceptable preset level. To prevent automatic startup and possible injury to personnel, do not connect battery cables until NORMAL source voltage at the transfer switch is correct and the system is ready to be placed into operation.

- Storage batteries give off **EXPLOSIVE** hydrogen gas. This gas can form an explosive mixture around the battery for several hours after charging. The slightest spark can ignite the gas and cause an explosion. An explosion can shatter the battery and cause blindness or other injury. Any area housing a storage battery must be properly ventilated. Do not allow smoking, open flame, sparks, or any spark producing tools or equipment near the battery.
- When working on the battery, always remove watches, rings, or other metal objects, and only use tools with insulated handles. Do not rest tools or metal parts on top of the battery.
- Discharge static electricity from the body before touching the battery by first touching a grounded metal surface.
- Wear full eye protection, protective clothing, and gloves when handling a battery.
- Immediately wash down spilled electrolyte with an acid neutralizing agent. Use a solution of 1 pound (500 grams) bicarbonate of soda to 1 gallon (4 liters) of water. Add the bicarbonate of soda solution until evidence of reaction (foaming) has ceased. Flush the resulting liquid with water.

Battery Requirements

The ability to start the engine depends upon battery capacity, ambient temperatures and coolant and oil temperatures. The engine/generator set Data Sheet lists minimum recommended battery capacity at various ambient temperatures. The recommended battery capacities are listed under cold cranking amps (CCA) at 0 °F (-18 °C). Battery capacities decrease as ambient temperatures decrease, so it is important to specify batteries with the appropriate CCA rating at a temperature no higher than the minimum ambient temperature for the application.

Battery Installation

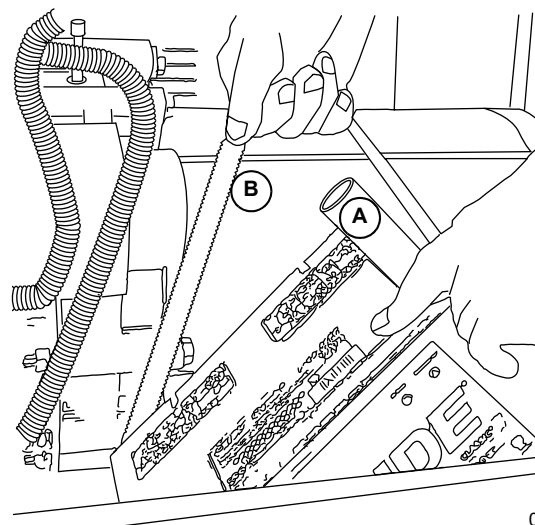
Fill the battery with the proper electrolyte fluid if necessary and have the battery fully charged before installing it.

Use appropriate tools when working with battery terminals. The use of terminal pullers, expansion pliers and terminal cleaning brushes will greatly extend the life of the battery terminals.

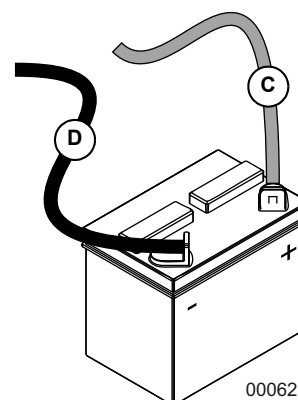
1. See [Figure 5-6](#). Install rubber protective cover (A) over positive (+) battery terminal.
2. Grasp battery strap (B) and lift battery.
3. Set battery onto battery tray.
4. Tighten two screws with nylon washers to secure hold-down clamp to battery tray.

5. Remove rubber protective cover from positive (+) battery terminal.
6. Install positive battery cable (C) (red) on positive (+) battery terminal.
7. Install negative battery cable (D) (black) on negative (-) battery terminal.

NOTE: The unit is equipped with a internal battery charger. The internal battery charger is powered by the T1 wire. Before performing any work on the battery, confirm you have safely disconnected the power supply (T1 wire).



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Figure 5-6. Battery Cable Connections

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Section 6: Control Panel/Start-Up/Testing

Control Panel Interface



Automatic start-up. Disconnect utility power and render unit inoperable before working on unit.
Failure to do so will result in death or serious injury.

(000191)

Before performing any maintenance on the generator, set to OFF, remove fuses, and disconnect battery cables to prevent accidental start up. Disconnect the cable from the battery post indicated by a NEGATIVE, NEG or (–) first, then remove the POSITIVE, POS or (+) cable. When reconnecting the cables, connect the POSITIVE cable first, the NEGATIVE cable last.

Using the AUTO/MANUAL/OFF Buttons

Button	Description of Operation
Auto	Selecting this button activates fully automatic system operation. Automatic operation allows the unit to automatically start and exercise the generator according to the exercise timer settings (see Setting the Exercise Timer section).
Off	This button shuts down the engine and also prevents automatic operation and exercise of the unit.
Manual	This button will crank and start the generator. Transfer to standby power will not occur unless there is a utility failure.

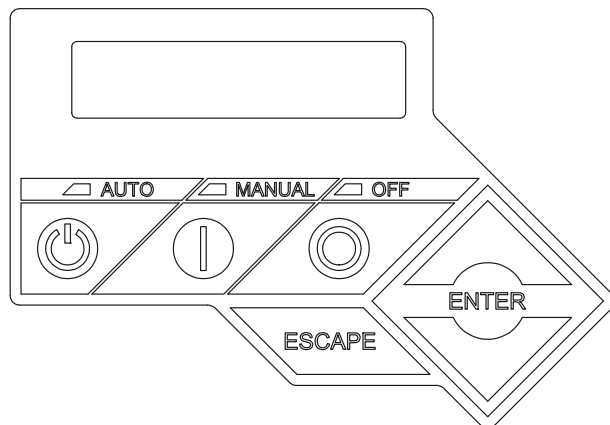


Figure 6-1. Generator Control Panel

Generator Set-up

When battery power is applied to the generator during the installation process, the controller will light up. However, the generator still needs to be activated before it will automatically run in the event of a power outage. See [Activate Unit](#).

Setting The Exercise Timer

This generator is equipped with a configurable exercise timer. There are two settings for the exercise timer.

Day/Time: Once set, the generator will start and exercise for the period defined, on the day of the week and at the time of day specified. During this exercise period, the unit runs for approximately 5 or 12 minutes, depending on the model, (see [Table 6-1](#)) and then shuts down.

Exercise frequency (how often the exercise will take place): It can be set to WEEKLY, BIWEEKLY or MONTHLY. If MONTHLY is selected, the day of the month must be selected from 1-28. The generator will exercise on that day each month. Transfer of loads to the generator output does not occur during the exercise cycle unless utility power is lost.

If the installer tests the generator prior to installation, press the “enter” button to skip setting up the exercise timer.

The exercise feature will operate only when the generator is placed in the AUTO mode and will not work unless this procedure is performed. The current date/time will need to be reset every time the 12 volt battery is disconnected and then reconnected, and/or when the fuse is removed.

Table 6-1. Exercise Parameters

Generator Size	22 kW	25 kW	27 kW	30 kW	32 kW	36 kW	38 kW	45 kW	48 kW	60 kW
Quiet Test Speed	1400	1800	1400	1800	1500	1800	1500	1800	1400	1800
Exercise Speed	1800 or 3600 RPM									
Exercise Frequency Options	Weekly, Bi-weekly, Monthly									
Exercise Duration	12 minutes									

Before Initial Start-Up

These units have been run and tested at the factory prior to being shipped and do not require any type of break-in.



Engine damage. Verify proper type and quantity of engine oil prior to starting engine. Failure to do so could result in engine damage.

(000135)

NOTE: This unit comes filled with 30 weight organic oil from the factory. Check the oil level and add the appropriate viscosity and amount if necessary.

Installation Wizard

Upon power-up, the Installation Wizard immediately appears. It allows the user to input generator settings. [Figure 6-2.](#)

The Installation Wizard will start every time AC and DC power are removed and re-applied to the generator.

Interconnect System Self Test Feature

Upon power up, this controller will go through a system self test which will check for the presence of utility voltage on the DC circuits. This is done to prevent damage if the installer mistakenly connects AC utility power sense wires into the DC terminal block. If utility voltage is detected, the controller will display a warning message and lock out the generator, preventing damage to the controller. Power to the controller must be removed to clear this warning.

Utility voltage must be turned on and present at the N1 and N2 terminals inside the generator control panel for this test to be performed and pass.

NOTE: All appropriate panels must be in place during any operation of the generator. This includes operation by a servicing technician, while conducting troubleshooting procedures.

Before starting, complete the following:

1. Verify the generator is OFF.
2. Set the generator main circuit breaker to OFF or OPEN.
3. Turn off all breakers powered by the generator.
4. Check the engine crankcase oil level and, if necessary, fill to the dipstick FULL mark with the recommended oil. Do not fill above the FULL mark.
5. Check the fuel supply. Gaseous fuel lines must have been properly purged and leak tested in accordance with applicable fuel-gas codes. All fuel shutoff valves in the fuel supply lines must be open.

During initial start up only, the generator may exceed the normal number of start attempts and experience an “OVERCRANK” fault. This is due to accumulated air in the fuel system during installation. Reset the control board by pushing the OFF button and ENTER key, and restart up to two more times if necessary. If unit fails to start, contact an Independent Authorized Service Dealer for assistance.

Check Manual Transfer Switch Operation

Refer to the “Manual Transfer Operation” section of the Owner’s Manual for procedures.



⚠ DANGER

Electrocution. Do not manually transfer under load. Disconnect transfer switch from all power sources prior to manual transfer. Failure to do so will result in death or serious injury, and equipment damage.

(000132)

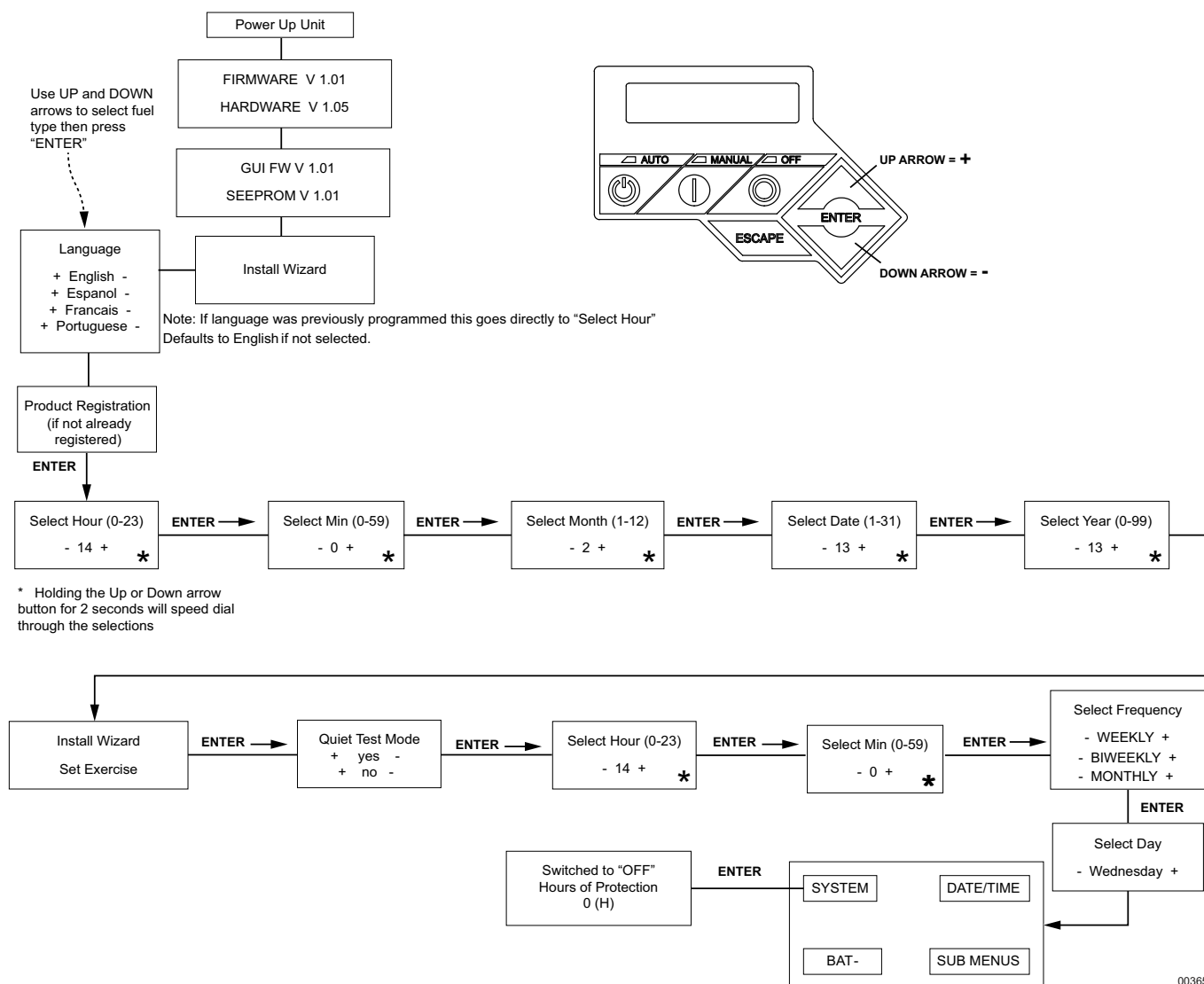
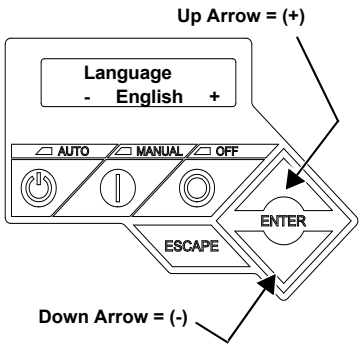


Figure 6-2. Installation Wizard Menu Map

Activate Unit

Display Reads:  Up Arrow = (+) Language - English + AUTO MANUAL OFF ENTER ESCAPE Down Arrow = (-)	Generator Active is displayed on the LCD screen when the unit is first powered up. After displaying firmware and hardware version codes, as well as other system information, the Installation Wizard is launched, and the Language screen is displayed. Use UP ARROW or DOWN ARROW to scroll to desired language. Press ENTER.	If the wrong language is selected, it may be changed later using the Edit menu.
Display Reads: Activate me (ENT) or ESC to run in manual	Press ENTER.	Press ESCAPE to abort the activation sequence. NOT ACTIVATED is displayed and the generator will run in manual mode only. Disconnect and reconnect the negative battery cable to restart the activation routine. If power is removed after a successful activation, no data is lost, but the time and date must be updated.
Display Reads: To Activate go to www.activategen.com	Go to www.activategen.com or call 1-888-9ACTIVATE (922-8482, US & Canada only) if activation passcode is not available. If activation pass code is available, wait a few seconds for the next display.	
Display Reads: SN 1234567890 PASS CODE XXXXX	Use UP ARROW or DOWN ARROW to increment or decrement the digit to correspond to the first number of the pass code. Press ENTER. Repeat step to enter remaining digits.	Press ESCAPE to return to preceding digits if a correction becomes necessary. If attempts to enter the activation code are unsuccessful, check the number against the code given on activategen.com. If it is correct, contact 1-888-9ACTIVATE (922-8482, US & Canada only).

Operational Checks

NOTE: The following procedures require special tools and skills. Contact a Generac dealer or an Independent Authorized Service Dealer to perform these tasks.

Self Test

Upon power up, the controller goes through a system self test which checks for the presence of utility voltage on the DC circuits. This is done to prevent damage if the installer mistakenly connects AC utility power sense wires into the DC terminal block. If utility voltage is detected, the controller displays a warning message and locks out the generator, thereby preventing damage to the controller. Remove power to the controller to clear this warning.

Utility voltage must be turned on and present at the N1 and N2 terminals inside the generator control panel for this test to be performed and pass.

Before starting, complete the following:

1. Verify the generator is OFF. A red LED above OFF on the control panel keypad illuminates to confirm the system is in the OFF mode.
2. Verify the Main Circuit Breaker switch on the generator control panel is in the OFF (Open) position.
3. Turn off all circuit breakers/electrical loads to be powered by the generator.
4. Check the engine crankcase oil level, coolant level, and fuel level, if necessary.

During initial start-up only, the generator may exceed the normal number of start attempts and experience an "over crank" fault. This is due to accumulated air in the fuel system during installation. Reset the control board and restart up to two more times, if necessary. If unit fails to start, contact the local dealer for assistance.

Check Manual Transfer Switch Operation

Refer to the “Manual Transfer Operation” section of the Owner’s Manual for procedures.

NOTE: Also use the appropriate transfer switch owner’s manual for manual and automatic system test.



⚠ DANGER

Electrocution. Do not manually transfer under load. Disconnect transfer switch from all power sources prior to manual transfer. Failure to do so will result in death or serious injury, and equipment damage. (000132)

Electrical Checks

NOTE: Verify all power and control wiring is properly terminated in the generator and corresponding location in transfer switch. For three phase applications, verify generator phase rotation matches utility phase rotation L1-L2-L or L3-L2-L1. Validate phase rotation L1-L2-L3 or L3-L2-L1 with a phase rotation tester (if three phase).

NOTE: To correct phase rotation, interchange any 2 leads.

Complete electrical checks as follows:

1. Verify the generator is OFF. A red LED above OFF on the control panel keypad illuminates to confirm the system is in the OFF mode.
2. Verify the Main Circuit Breaker switch on the generator control panel is in the OFF (Open) position.
3. Turn OFF all circuit breakers/electrical loads to be powered by the generator.
4. Turn on the utility power supply to the transfer switch using the means provided (such as a utility main line circuit breaker).



⚠ DANGER

Electrocution. High voltage is present at transfer switch and terminals. Contact with live terminals will result in death or serious injury. (000129)

5. Use an accurate AC voltmeter to check utility power source voltage across transfer switch terminals N1, N2, and N3 (if three phase). Normal line-to-line voltage should be equivalent to rated unit voltage. Validate phase rotation L1-L2-L3 or L3-L2-L1 with a phase rotation tester (if three phase).
6. Check utility power source voltage across terminals N1, N2, and N3 (if three phase) and the transfer switch neutral lug.
7. When certain utility supply voltage is compatible with transfer switch and load circuit ratings, turn OFF the utility power supply to the transfer switch.

8. Press MANUAL on the control panel keypad to crank and start the engine.
9. Allow the engine to warm up for about five minutes. Move the Main Circuit Breaker switch on the generator control panel up to the ON (Closed) position.
10. Connect an accurate AC voltmeter and a frequency meter across transfer switch terminal lugs E1, E2, and E3 (if three phase).
11. Successively connect the AC voltmeter test leads across terminal lugs E1, E2, and E3 (if three phase) and neutral. Voltage reading in each case should match utility voltage reading. If system is three phase, verify generator phase rotation matches utility phase rotation.
12. Move the Main Circuit Breaker switch on the generator control panel down to the OFF (Open) position.
13. Press OFF on the control panel keypad to shut the engine down.

IMPORTANT NOTE: Do not proceed unless certain that generator AC voltage and frequency are correct and within the stated limits.

Test Generator Under Load

To test the generator set with electrical loads applied, proceed as follows:

1. Verify the generator is OFF. A red LED above OFF on the control panel keypad illuminates to confirm the system is in the OFF mode.
2. Turn OFF all breakers/electrical loads to be powered by the generator.
3. Turn OFF the utility power supply to the transfer switch, using the means provided (such as a utility main line circuit breaker).



⚠ DANGER

Electrocution. Do not manually transfer under load. Disconnect transfer switch from all power sources prior to manual transfer. Failure to do so will result in death or serious injury, and equipment damage. (000132)

4. Manually set the transfer switch to the STANDBY position, i.e., load terminals connected to the generator’s E1, E2, and E3 (if three phase) terminals. The transfer switch operating lever should be down.
5. Press MANUAL on the control panel keypad. The engine should crank and start immediately.
6. Allow the engine to warm up for a few minutes.
7. Move the Main Circuit Breaker switch on the generator control panel up to the ON (Closed) position. Loads are now powered by the standby generator.

8. Turn ON the circuit breaker/electrical loads powered by the generator.
9. Connect a calibrated AC voltmeter and a frequency meter across terminal lugs E1, E2, and E3 (if three phase). Voltage should be approximately unit rated voltage.
10. Let the generator run at full rated load for 20-30 minutes. Listen for unusual noises, vibration or other indications of abnormal operation. Check for oil leaks, evidence of overheating, etc.
11. When testing under load is complete, turn OFF electrical loads.
12. Move the Main Circuit Breaker switch on the generator control panel down to the OFF (Open) position.
13. Allow the engine to run at no-load for 2-5 minutes.
14. Press OFF on the control panel keypad to shut the engine down.

Check Automatic Operation

To check the system for proper automatic operation, proceed as follows:

1. Verify the generator is OFF. A red LED above OFF on the control panel keypad illuminates to confirm the system is in the OFF mode.
2. Install front cover over the transfer switch.
3. Turn ON the utility power supply to the transfer switch, using the means provided (such as a utility main line circuit breaker).

NOTE: Transfer Switch will transfer back to utility position.

4. Move the Main Circuit Breaker switch on the generator control panel up to the ON (Closed) position.
5. Press AUTO on the control panel keypad. The system is now ready for automatic operation.
6. Turn OFF the utility power supply to the transfer switch.

With the generator ready for automatic operation, the engine will crank and start when the utility source power is turned OFF after a 10 second delay (factory default setting). After starting, the transfer switch connects load circuits to the standby side. Let the system operate through its entire automatic sequence of operation.

With the generator running and loads powered by generator AC output, turn ON the utility power supply to the transfer switch. The system transfers back to the utility position and then runs through the cool down cycle and shuts down.

Installation Summary

1. Verify the installation has been properly performed as outlined by the manufacturer and it meets all applicable laws and codes.
2. Test and confirm proper operation of the system as outlined in the appropriate installation and owner's manuals.
3. Educate the customer on the proper operation, maintenance and service call procedures.

IMPORTANT! If the customer ever finds it necessary to turn the generator off during prolonged utility outages to conserve fuel or perform maintenance, alert them to these important steps:

To turn the generator OFF (while running in AUTO and online):

1. Turn OFF (or open) the main Utility disconnect.
2. Move the Main Circuit Breaker switch on the generator control panel down to the OFF (Open) position.
3. Allow the unit to run for a few minutes to cool, and then press OFF on the control panel keypad. A red LED illuminates to confirm the system is in the OFF mode.

To turn the generator back ON:

1. Press AUTO on the control panel keypad. Allow the unit to start and warm up for a few minutes.
2. Move the Main Circuit Breaker switch on the generator control panel up to the ON (Closed) position.

The system is now operating in the automatic mode. The main utility disconnect can be turned ON (Closed), but to shut the unit off, this complete process must be repeated.

NOTE: At temperatures of 32 °F (0 °C) and below, it is recommended that a pad type battery heater be installed to aid in cold climate starting. This is available as a cold weather kit through an Independent Authorized Service Dealer.

Section 7: Installation Checklists

Safety Checklist

NOTE: See [Safety Rules & General Information](#) for more information.

- ☐ Are manuals, wiring diagrams and other documentation readily available?
- ☐ Is there any evidence of freight damage?
- ☐ Does the enclosure have scratches or damage to painted surfaces (which would indicate lifting without a spreader bar)?
- ☐ Are all guards, covers, insulation blankets and other protective devices in place?
- ☐ Are any parts or components worn, damaged or missing?
- ☐ Is the generator properly grounded?
- ☐ Is a fire extinguisher kept near the generator?
- ☐ Is there any evidence of oil or coolant leaks?
- ☐ Are any combustible materials left in the generator compartment?
- ☐ Is the area surrounding the generator clean and free of debris?
- ☐ Do these parameters meet all applicable codes and local jurisdiction?

Installation Planning Checklist

NOTE: See [Installation Planning](#) for more information.

- ☐ Is the generator set readily accessible for maintenance, repair, and firefighting purposes?
- ☐ Is the site clean and dry? Is the site provided with adequate drainage?
- ☐ Is there minimum clearance around the generator set to facilitate the repair or replacement of major components?
- ☐ Have adequate provisions been made for installation of the fuel supply?
- ☐ Do these parameters meet all applicable codes and local jurisdiction?

Foundations and Mounting Checklist

NOTE: See [Site Selection and Preparation](#) for more information.

- ☐ Is the generator set installed on a concrete pad capable of supporting its weight and accessories?
- ☐ Is the generator securely fastened to the concrete pad using suitable grade, size and style fasteners?
- ☐ Is the concrete pad seated on a prepared solid subsurface using appropriate reinforcing bar or expanded wire mesh?
- ☐ Does the concrete pad extend beyond the frame rails at least three (3) inches (7.62 cm) on all sides?
- ☐ Is the concrete pad flat and level to within 1/2 inch (13 mm)?
- ☐ Are plugs installed in the tie-down holes of the frame rail?
- ☐ If installed on a roof or combustible floor, is the generator seated on a layer of sheet metal and non-combustible insulation? Do the sheet metal and insulation extend beyond the generator base at least 12 inches (300 mm) on all sides?
- ☐ Is the base frame stub-up cover plate installed?
- ☐ Do all fuel, coolant, exhaust, and electrical lines have flexible sections where they connect to the generator?
- ☐ Is all piping properly supported and secured?
- ☐ Do these parameters meet all applicable codes and local jurisdiction?

Ventilation System Checklist

NOTE: See [Site Selection and Preparation](#) for more information.

- ☐ Is there sufficient air flow for cooling and ventilation?
- ☐ Are all bushes, shrubs and other vegetation a minimum of 3 feet (1 m) away?
- ☐ Does the air inlet face the direction of prevailing winds?
- ☐ Has system piping been properly sized? Have all gas loads been taken into consideration?
- ☐ Has system been properly protected from freeze up and corrosion?
- ☐ Have standby equipment heaters been specified?
- ☐ Have system drain valves and air eliminators been installed?
- ☐ Does the air outlet face noise sensitive areas without noise attenuating devices?
- ☐ Does the installation appear to have the necessary accessories to enable fast, reliable starting and operation in adverse weather conditions (such as engine block heaters, battery warmers, etc.)?
- ☐ Do these parameters meet all applicable codes and local jurisdiction?

Exhaust System Checklist

NOTE: See [Gaseous Fuel Systems](#) for more information.

- ☐ Are exhaust discharges directed away from combustible surfaces and inhabited areas?
- ☐ Is exhaust piping kept clear of fuel supply, fuel lines, etc.?
- ☐ Is off-engine exhaust piping covered with high temperature insulation blankets where necessary?
- ☐ Do these parameters meet all applicable codes and local jurisdiction?

Gaseous Fuel System Checklist

NOTE: See [Gaseous Fuel Systems](#) for more information.

- ☐ Are fuel supply lines properly sized and installed? Were fuel supply lines purged and leak tested?
- ☐ Are sediment traps installed to remove water and condensate from the gas flow?
- ☐ Is the fuel pressure regulator properly sized?

- ☐ Is a pressure test port installed before the fuel shutoff solenoids at the inlet to the unit mounted regulator?
- ☐ Does the generator have a dedicated fuel line which is not shared with any other appliances?
- ☐ Is the regulator sized to have a fuel flow delivery rating (CFH) at least 10% greater than the 100% rated kW fuel consumption requirement of the generator?
- ☐ Is the fuel pressure regulator approved for a mechanized engine application?
- ☐ Does the fuel pressure regulator have an accuracy rating of 1% or less and/or have a maximum allowable pressure drop of 1-2 inches (2.5- 5.1 cm) w.c. under all operating conditions, that is, static, cranking, running at no load, and running at full load (as measured at the primary fuel pressure regulator)?
- ☐ Does the fuel pressure regulator have a spring rating appropriate for the required fuel pressure as listed in the unit specification sheet?
- ☐ Does the system use black iron piping or other approved gas line?
- ☐ Is the gas line rigidly mounted and protected against vibration?
- ☐ Is a length of flexible hose installed between the generator connection point and the rigid supply piping? Is the flexible hose straight without bends, twists or kinks?
- ☐ Is the piping correctly sized to maintain the required supply pressure and volume under varying load conditions?
- ☐ Was an approved pipe sealant or joint compound used on all threaded fittings?
- ☐ Is a fuel shutoff valve installed near the unit? Was proper operation of the fuel shutoff valve verified?
- ☐ Was the Final Operating Test performed to verify that the system operates correctly in all modes of operation?
- ☐ Is there any evidence of leakage at any hoses, clamps or fittings?
- ☐ Do these parameters meet all applicable codes and local jurisdiction?

Electrical System Checklist

NOTE: See [Electrical System](#) for more information.

- ☐ Is all wiring correctly sized for load and length of run?
- ☐ Is all wiring correctly routed?
- ☐ Is all wiring correctly connected?
- ☐ Are wire lugs fastened to buss bars using appropriate hardware? Is hardware properly tightened to specified torque?
- ☐ Are all other terminals correctly tightened using the specified torque?
- ☐ Are batteries correctly sized?
- ☐ Are batteries correctly installed?
- ☐ Are the battery fluid levels correct?
- ☐ Are battery cables and connections clean and free of corrosion?
- ☐ Are the battery cables correctly connected? Are the terminal lugs correctly tightened?
- ☐ Is the battery condition and state of charge acceptable?
- ☐ Is area housing storage battery properly ventilated?
- ☐ Are batteries located near a source of flame or spark?
- ☐ Are AC wire sizes and connections correct?
- ☐ Are DC and communication wire sizes and connections correct?
- ☐ Are block heaters, battery charger, etc. properly matched with utility supply voltage?
- ☐ Are battery charger and block heater properly connected?
- ☐ Are remote start Wires 178 & 183 pulled and connected inside lower control panel of generator and inside transfer switch?
- ☐ Is the AUTO/OFF/MANUAL mode in the "OFF" position?
- ☐ Is the block heater operational?
- ☐ Is the battery charger operational?
- ☐ Are all AC electrical connections tight at the circuit breaker and transfer switch?
- ☐ Are all electrical connections (wiring, wire ties, clamps, terminal ends, connectors) on the generator tight?
- ☐ Are all electrical plugs throughout the generator seated correctly and fully inserted into their receptacles?
- ☐ Is there proper voltage and phase rotation at the transfer switch?

- ☐ Is manual operation of the transfer switch smooth and non-binding?
- ☐ Do these parameters meet all applicable codes and local jurisdiction?

Oil Maintainer System Checklist

(if equipped)

NOTE: See [Lube Oil Maintainer System](#) for more information.

- ☐ Has the oil maintainer oil supply tank been filled with the recommended engine oil and tested?
- ☐ Has the oil maintainer been tested to the proper level?

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Section 8: Lube Oil Maintainer System

Lube Oil Maintainer System

Description

NOTE: Oil reservoir is empty when shipped from factory. Fill with clean engine oil to activate the system.

Oil reservoir capacity: 2.5 gallons (9.46 liters)

The 36 kW, 45 kW, and 60 kW models are equipped with a Lube Oil Maintainer System. The system is installed at the factory and calibrated at the factory to the correct engine-running crankcase oil level. As needed, the system keeps the engine lubricating oil full by automatically adding clean oil from the oil supply tank.

NOTE: The Lube Oil Maintainer System is equipped with three wires (red, white, black (G)) which are not used in this unit.

See [Figure 8-1](#). The green bar (B) observed through the viewing lens (A) shows the normal oil level operating range (C) of the Lube Oil Maintainer Regulator during

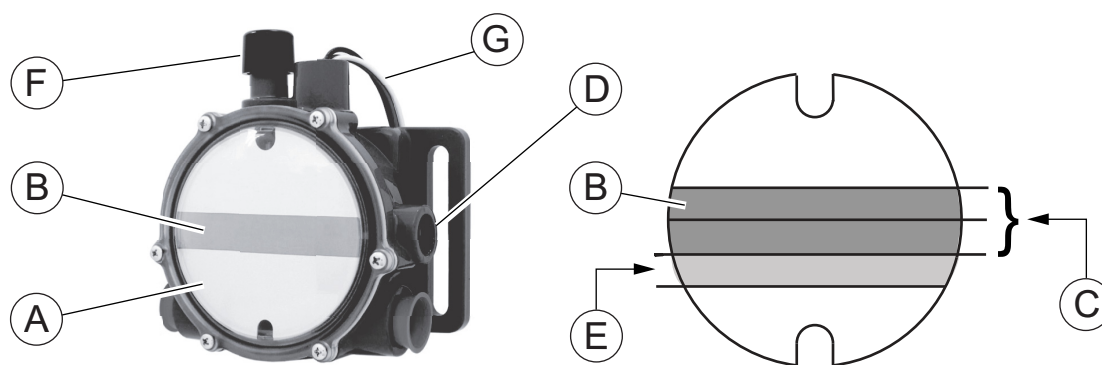
engine running operation. When the oil level is within the green bar, the internal float holds the inlet valve closed to keep the crankcase oil at the current level.

As the engine uses oil, the float drops to open the inlet valve. Clean oil is drawn through the oil inlet screen (D) and into the crankcase, replenishing engine oil to the full mark indicated on the oil dipstick. The float then rises with the crankcase oil level until it reaches a point where the inlet valve closes.

When the oil level as observed through the viewing lens is low (E) and below the normal operating range green bar, it is an indication the oil supply tank is low or the oil inlet screen is clogged.

Test the operation of the float and switch by pressing the test button (F).

NOTE: It is normal for the oil level to be above the normal operating range green bar when engine is not running.



001757

Figure 8-1. Lube Oil Maintainer Regulator

NOTE: When changing engine oil, always close the shutoff valve to avoid draining the clean oil in the oil supply tank with the crankcase oil. See [Figure 8-3](#).

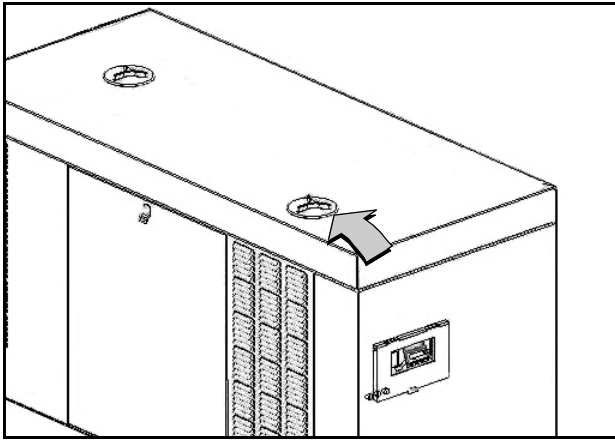


Figure 8-2. Access Oil Supply Tank

Fill Oil Supply Tank

1. See [Figure 8-2](#). Rotate plastic cover counterclockwise and remove from top of enclosure.
2. Remove fill cap at top of oil supply tank.
3. Add clean engine oil to oil supply tank (2-1/2 gallons [9.46 liters] capacity).
4. Install fill cap at top of oil supply tank.
5. Install plastic cover at top of enclosure and rotate clockwise until tight.

Test Functionality

See A of [Figure 8-1](#). Momentarily press the test button to confirm the float is operating correctly.

IMPORTANT NOTE: Do not hold the test button down for a prolonged period of time or the crankcase can be over filled. Overfilling the crankcase can result in engine damage.

Shutoff Valve

See [Figure 8-3](#). When draining engine crankcase oil, always close shutoff valve to avoid draining clean oil from supply tank.

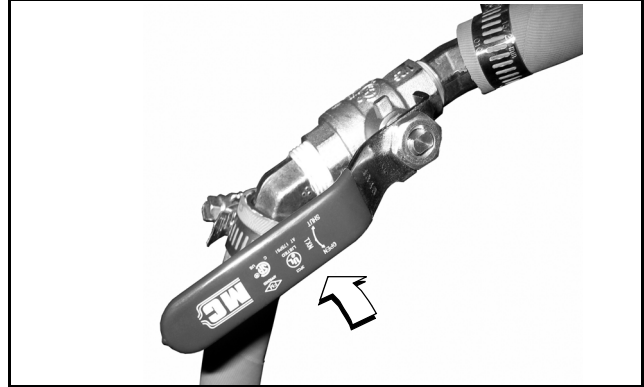
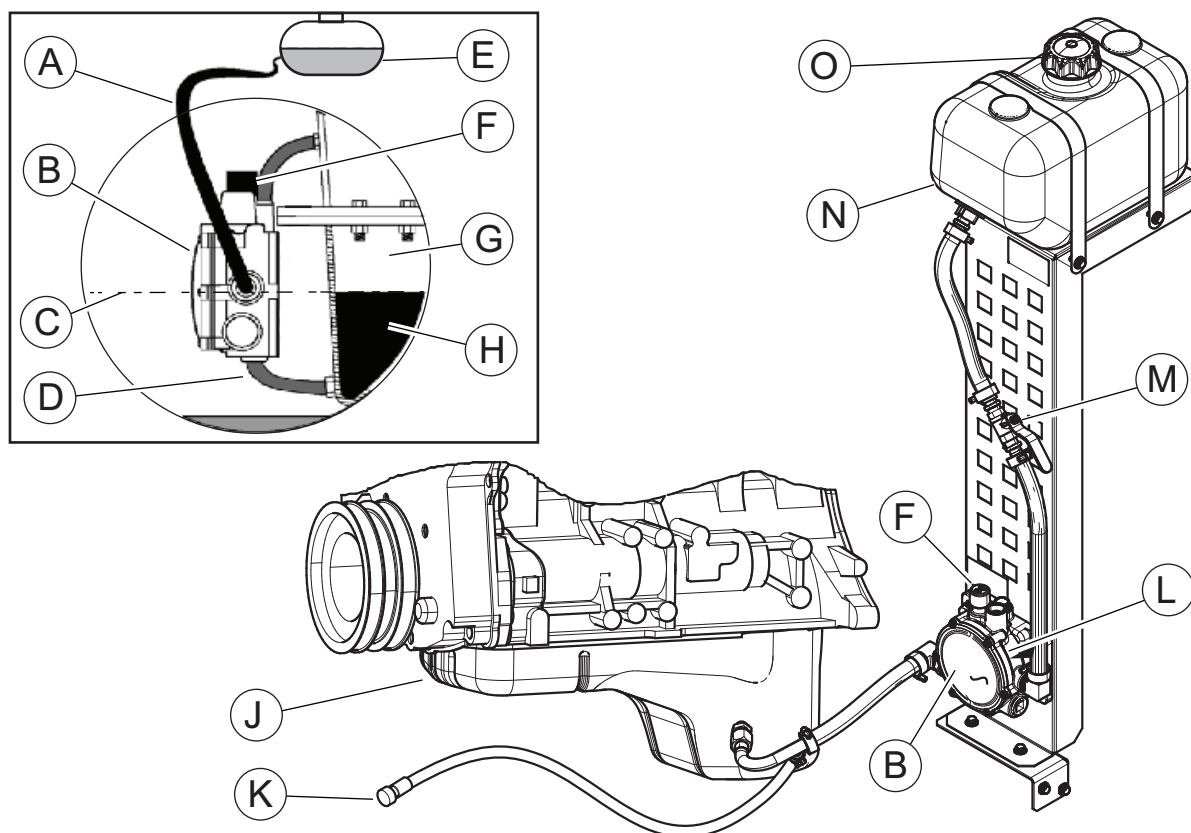


Figure 8-3. Shutoff Valve (Shown in Open Position)

After filling crankcase with clean oil, remember to open shutoff valve to enable operation of Lube Oil Maintainer System.



001756

Figure 8-4. Lube Oil Maintainer Assembly and Function Diagram

A	Oil Inlet Hose	F	Test Button	L	Regulator
B	Regulator Viewing Lens	G	Running Engine Crankcase	M	Shutoff Valve
C	Center of Green Bar	H	Oil Level	N	2-1/2 Gallon Oil Supply Tank
D	Crankcase Hose	J	Engine Crankcase Oil Pan	O	Fill Cap
E	Oil Supply Tank	K	Oil Drain Hose	—	—

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Section 9: Troubleshooting / Quick Reference Guide

Troubleshooting

Problem	Cause	Correction
Engine will not crank.	1. Fuse blown. 2. Loose, corroded or defective battery cables. 3. Defective starter contact. 4. Defective starter motor. 5. Dead Battery.	1. Correct short circuit condition by replacing 7.5 Amp fuse in generator control panel. 2. Tighten, clean or replace as necessary.* 3. *See #2. 4. *See #2. 5. Charge or replace battery.
Engine cranks but will not start.	1. Out of fuel. 2. Defective fuel solenoid (FS). 3. Open Wire 14 from engine control board. 4. Defective spark plug(s). 5. Valve lash out of adjustment.	1. Replenish fuel / Turn on fuel valve. 2. * 3. * 4. Clean, re-gap or replace plug(s). 5. Reset valve lash.
Engine starts hard and runs rough.	1. Air cleaner plugged or damaged. 2. Defective spark plug(s). 3. Fuel pressure incorrect. 4. Unit not converted for proper fuel source and/or not programmed for proper fuel source.	1. Check / replace air cleaner. 2. Clean, check gap, replace plug(s) if needed. 3. Confirm fuel pressure to regulator is 5–14 in. water column (9–26 mm HG) for natural gas or 11-14 in water column for LP. 4. Convert and program unit for proper fuel source.
Generator is set to OFF, but the engine continues to run.	1. Controller wired incorrectly 2. Defective control board.	1. * 2. *
No AC output from generator.	1. Main line circuit breaker is in the OFF (or OPEN) position. 2. Generator internal failure.	1. Reset circuit breaker to ON (or CLOSED). 2. *
No transfer to standby after utility source failure.	1. Main line circuit breaker is in the OFF (or OPEN) position. 2. Defective transfer switch coil. 3. Defective transfer relay. 4. Transfer relay circuit open. 5. Defective control logic board.	1. Reset circuit breaker to ON (or CLOSED). 2. * 3. * 4. * 5. *
Unit consumes large amounts of oil.	1. Engine over filled with oil. 2. Engine breather defective. 3. Improper type or viscosity of oil. 4. Damaged gasket, seal or hose.	1. Adjust oil to proper level. 2. * 3. See "Engine Oil Recommendations". 4. Check for oil leaks.
* Contact an Independent Authorized Service Dealer for assistance.		

Quick Reference Guide

To clear an active alarm, press the ENTER button twice and then press AUTO. If the alarm reoccurs, contact an Independent Authorized Service Dealer.

Active Alarm	LED	Problem	Things to Check	Solution
NONE	GREEN	Unit running in AUTO but no power in house.	Check MLCB.	Check MLCB. If the MLCB is in the ON position, contact an Independent Authorized Service Dealer.
HIGH TEMPERATURE	RED	Unit shuts down during operation.	Check the LED's / Screen for alarms.	Check ventilation around the generator, intake, exhaust and rear of generator. If no obstruction, contact IASD.
OVERLOAD REMOVE LOAD	RED	Unit shuts down during operation.	Check the LED's / Screen for alarms.	Clear alarm and remove household loads from the generator. Put back in AUTO and restart.
RPM SENSE LOSS	RED	Unit was running and shuts down, attempts to restart.	Check the LED's / Screen for alarms.	Clear alarm and remove household loads from the generator. Put back in AUTO and restart. If generator does not start, Contact IASD.
NOT ACTIVATED	NONE	Unit will not start in AUTO with utility loss.	See if screen says unit not activated.	Refer to Activate Unit .
NONE	GREEN	Unit will not start in AUTO with utility loss.	Check screen for start delay countdown.	If the start up delay is greater than expected, contact IASD.
LOW OIL PRESSURE	RED	Unit will not start in AUTO with utility loss.	Check the LED's / Screen for alarms.	Check Oil Level / Add Oil Per Owners Manual. If oil level is correct, contact IASD.
RPM SENSE LOSS	RED	Unit will not start in AUTO with utility loss.	Check the LED's / Screen for alarms.	Clear alarm. Check the battery option in the control menu. If it states battery is GOOD, contact IASD. If it states CHECK BATTERY, replace the battery.
OVERCRANK	RED	Unit will not start in AUTO with utility loss.	Check the LED's / Screen for alarms.	Check fuel line shutoff valve is in the ON position. Clear alarm. Attempt to start the unit in MANUAL. If it does not start or starts and runs rough, Contact IASD.
LOW VOLTS REMOVE LOAD	RED	Unit will not start in AUTO with utility loss.	Check the LED's / Screen for alarms.	Clear alarm and remove household loads from the generator. Put back in AUTO and restart.
FUSE PROBLEM	RED	Unit will not start in AUTO with utility loss.	Check the LED's / Screen for alarms.	Check the 7.5amp fuse. If it is bad replace it with an ATO 7.5Amp fuse, if not contact Independent Authorized Service Dealer.
OVERSPEED	RED	Unit will not start in AUTO with utility loss.	Check the LED's / Screen for alarms.	Contact IASD.
UNDERVOLTAGE	RED	Unit will not start in AUTO with utility loss.	Check the LED's / Screen for alarms.	Contact IASD.
UNDERSPEED	RED	Unit will not start in AUTO with utility loss.	Check the LED's / Screen for alarms.	Contact IASD.
STEPPER OVERCURRENT	RED	Unit will not start in AUTO with utility loss.	Check the LED's / Screen for alarms.	Contact IASD.
MISWIRE	RED	Unit will not start in AUTO with utility loss.	Check the LED's / Screen for alarms.	Contact IASD.

Active Alarm	LED	Problem	Things to Check	Solution
OVERVOLTAGE	RED	Unit will not start in AUTO with utility loss.	Check the LED's / Screen for alarms.	Contact IASD.
LOW BATTERY	YELLOW	Yellow LED illuminated in any state.	Check the screen for additional information.	Clear alarm. Check the battery option in the control menu. If it states battery is GOOD, contact IASD. If it states CHECK BATTERY, replace the battery.
BATTERY PROBLEM	YELLOW	Yellow LED illuminated in any state.	Check the screen for additional information.	Contact IASD.
CHARGER WARNING	YELLOW	Yellow LED illuminated in any state.	Check the screen for additional information.	Contact IASD.
SERVICE A	YELLOW	Yellow LED illuminated in any state.	Check the screen for additional information.	Perform SERVICE A maintenance. Press ENTER to clear.
SERVICE B	YELLOW	Yellow LED illuminated in any state.	Check the screen for additional information.	Perform SERVICE B maintenance. Press ENTER to clear.
INSPECT BATTERY	YELLOW	Yellow LED illuminated in any state.	Check the screen for additional information.	Inspect Battery. Press ENTER to clear.

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Section 10: Accessories

Performance enhancing accessories are available for liquid-cooled generators.

Accessory	Description
Cold Weather Kit G006175-0—25 & 30 kW G005630-1—36, 45, & 60 kW	Recommended in areas where temperatures fall below 32 °F (0 °C).
Extreme Cold Weather Kit G006174-0—25 & 30 kW G005616-0—36, 45, & 60 kW	Engine block heater. Used in conjunction with the appropriate Cold Weather Kit. NOTE: Engine oil must be replaced with synthetic oil.
Scheduled Maintenance Kit G006176-0—25 & 30 kW G006172-0—36 & 45 kW G006171-0—60 kW	Includes all pieces necessary to perform maintenance on the generator along with oil recommendations.
Auxiliary Transfer Switch Lockout	Enables any of the transfer switches to completely lock out one large electrical load by tying into its control system.
Mobile Link™ (USA only) G006463-4	Provides a personalized web portal that displays the generator status, maintenance schedule, event history and much more. This portal is accessible via computer, tablet or smart phone. Sends emails and/or text notifications the moment there is any change in the generator's status. Notification settings can be customized to what type of alert is sent and how often. For more information, visit www.MobileLinkGen.com .
Touch-Up Paint Kit G005703-0—Bisque G005704-0—Gray	Very important to maintain the look and integrity of the generator enclosure. This kit includes touch-up paint and instructions.
Wireless Local Monitor G006664-0	Completely wireless and battery powered, the Wireless Local Monitor provides you with instant status without ever leaving the house. Status lights (red, yellow and green) alert owners when the generator needs attention. Magnetic backing permits refrigerator mounting and gives a 600 foot line of sight communication.
Extended Warranty Coverage	Extend your generator warranty coverage by purchasing extended warranty coverage. Covers both parts and labor. Extended coverage can be purchased within 12 months of the end-users purchase date. This extended coverage is applicable to registered units and end-user proof of purchase must be available upon request. Available for Generac® products. Not available for all international purchases.
Liquid Cooled Generator Pad 10000005771	Reinforced composite pad for 32kW-60kW Protector gaseous series.

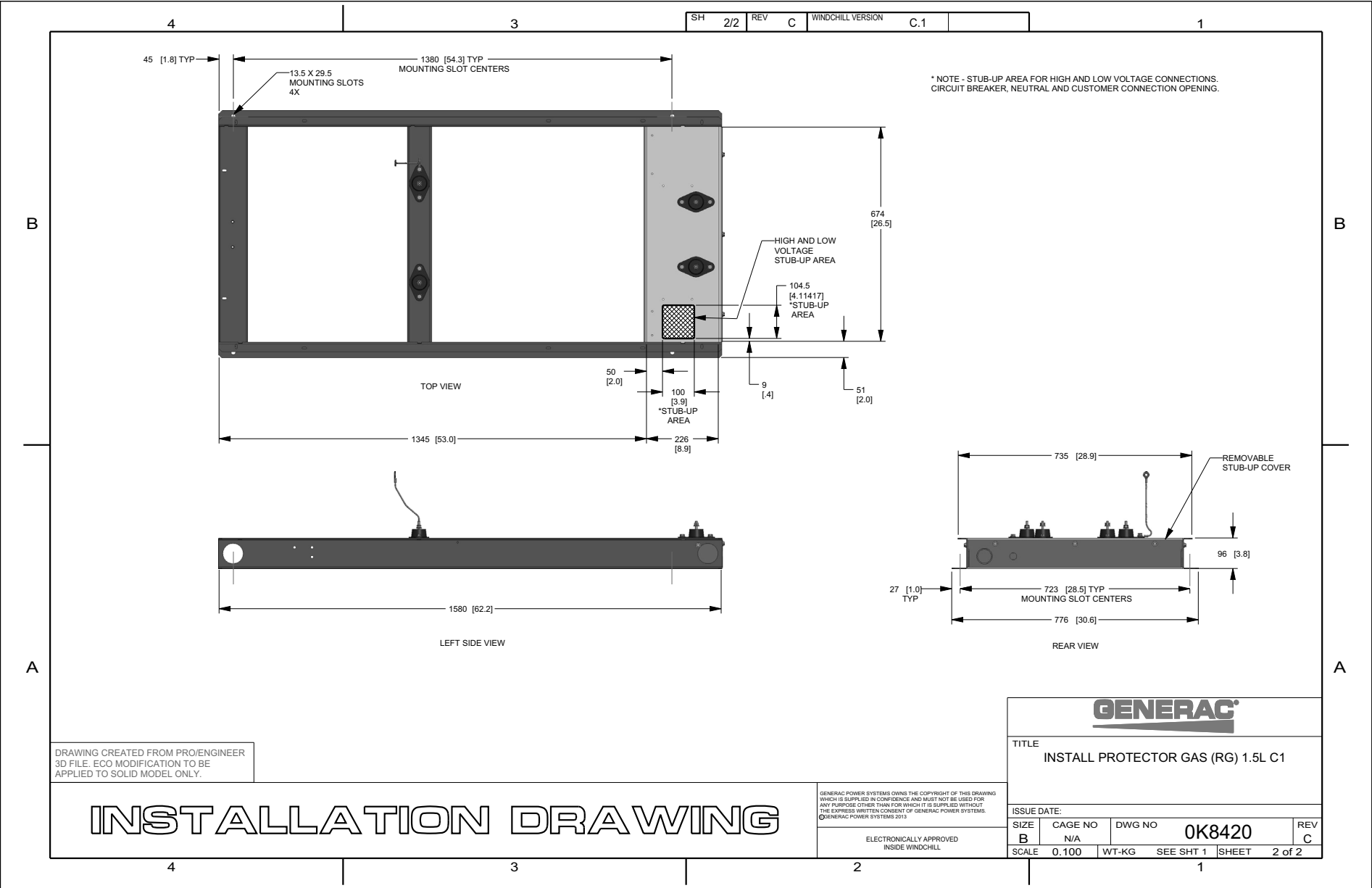
NOTE: Contact an Independent Authorized Service Dealer or visit www.generac.com for additional information on accessories and extended warranties.

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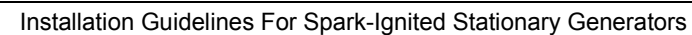
0K8420-C 25/30 kW (1.5 L) Page 1 of 2



0K8420-C 25/30 kW (1.5 L) Page 2 of 2

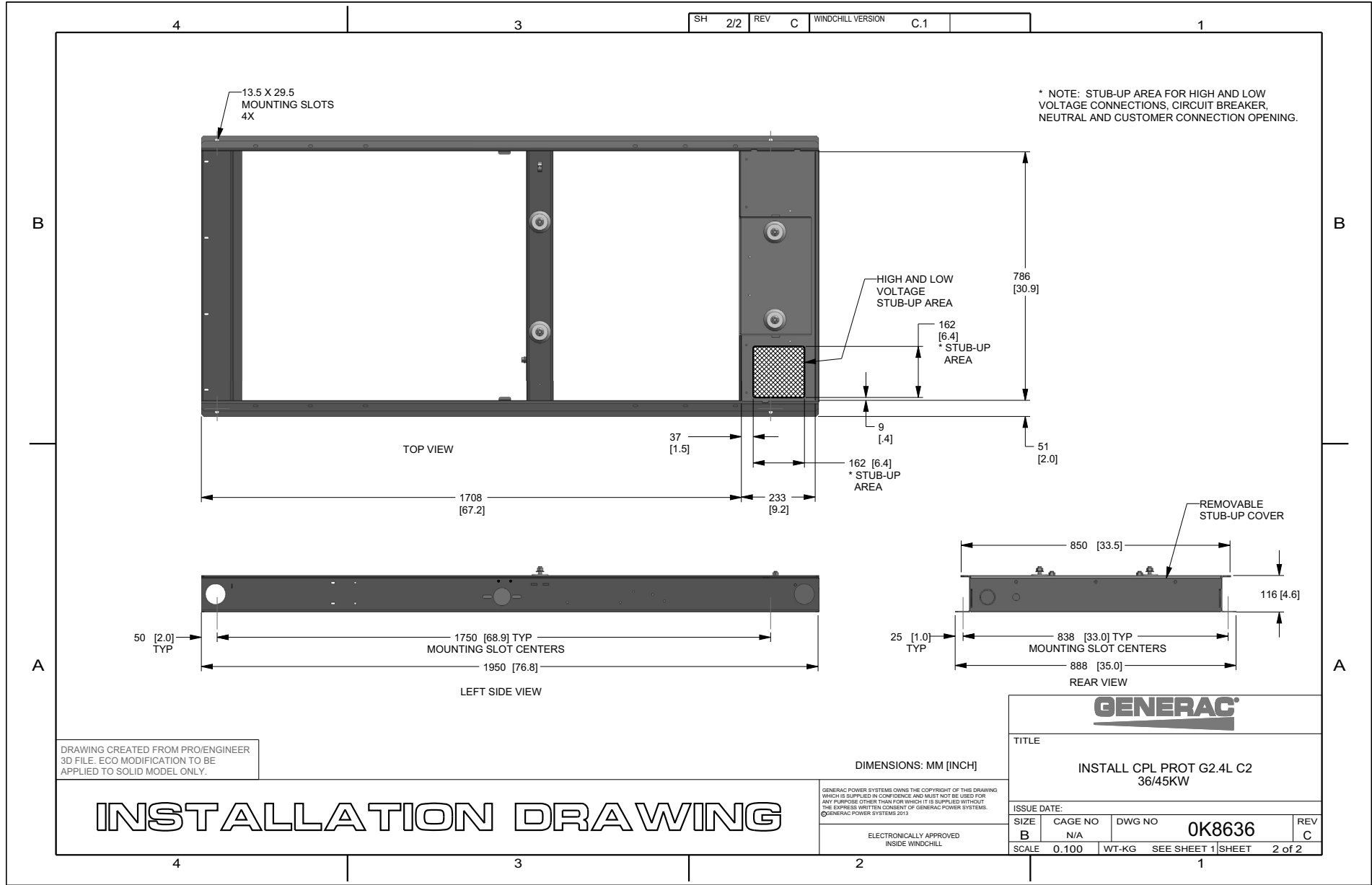






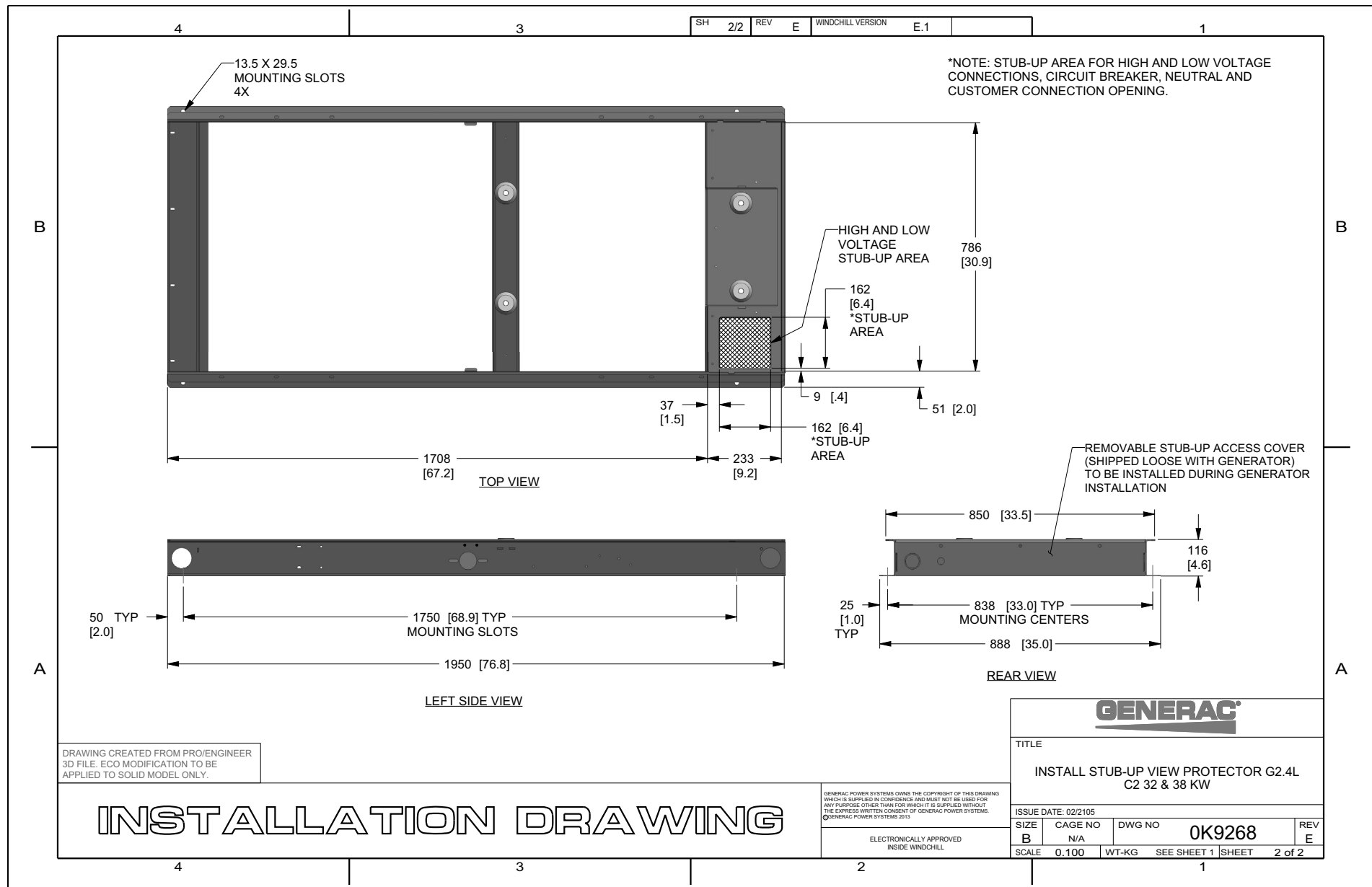


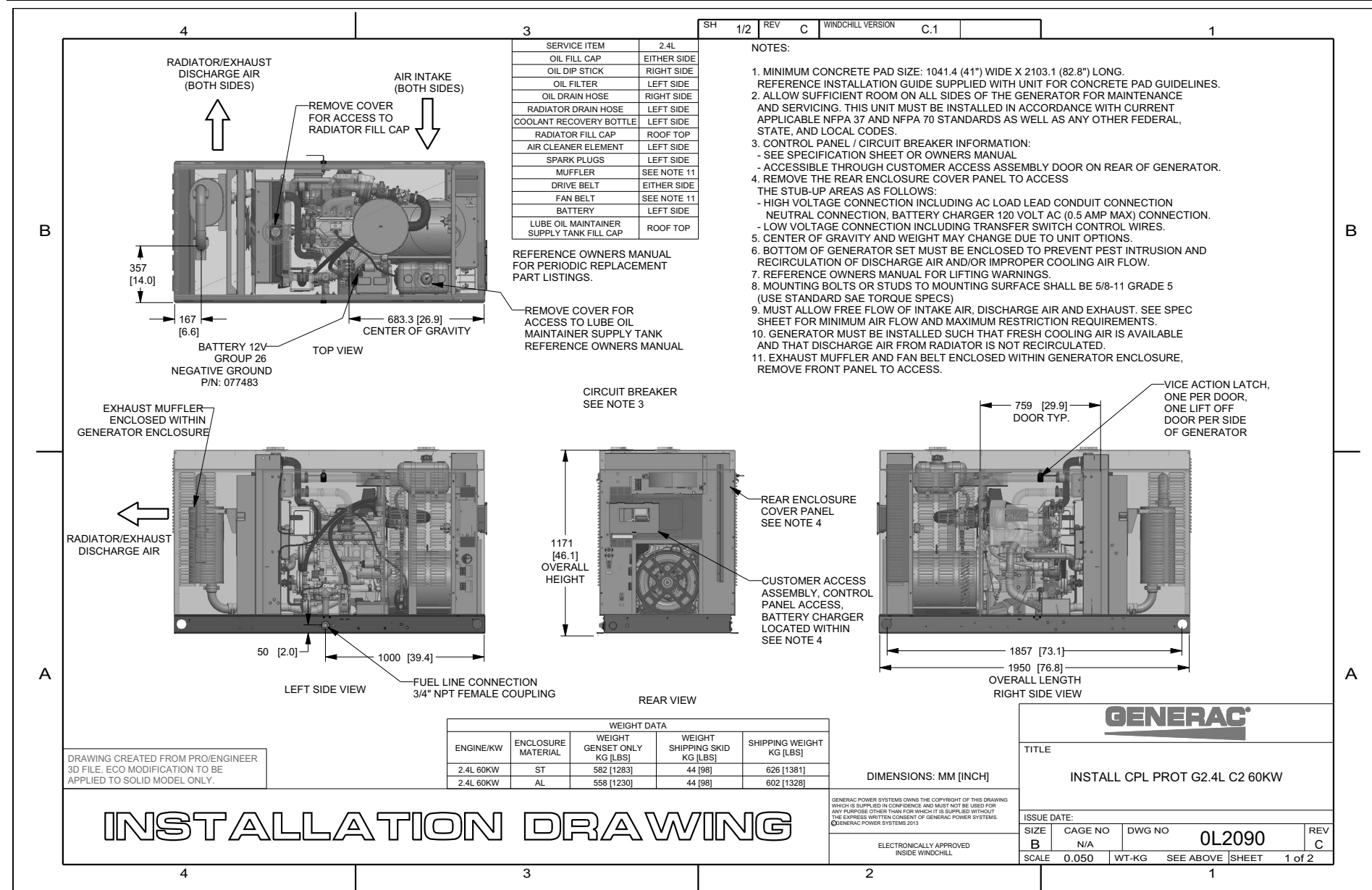
0K8636-C 36/45 kW (2.4 L) Page 2 of 2

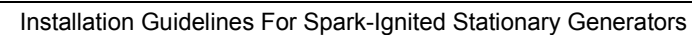


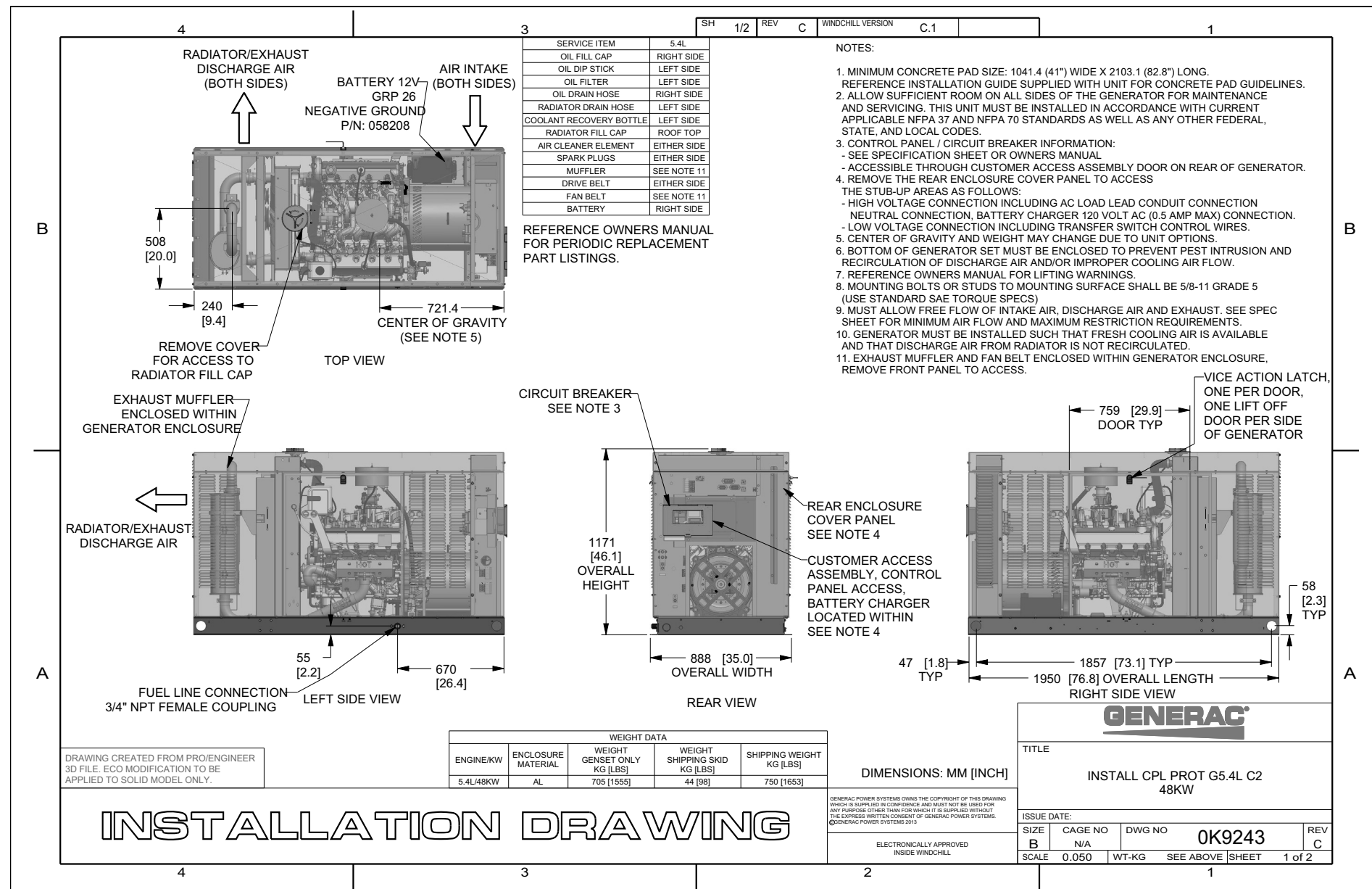


0K9268-E 32/38 kW (2.4 L) Page 2 of 2

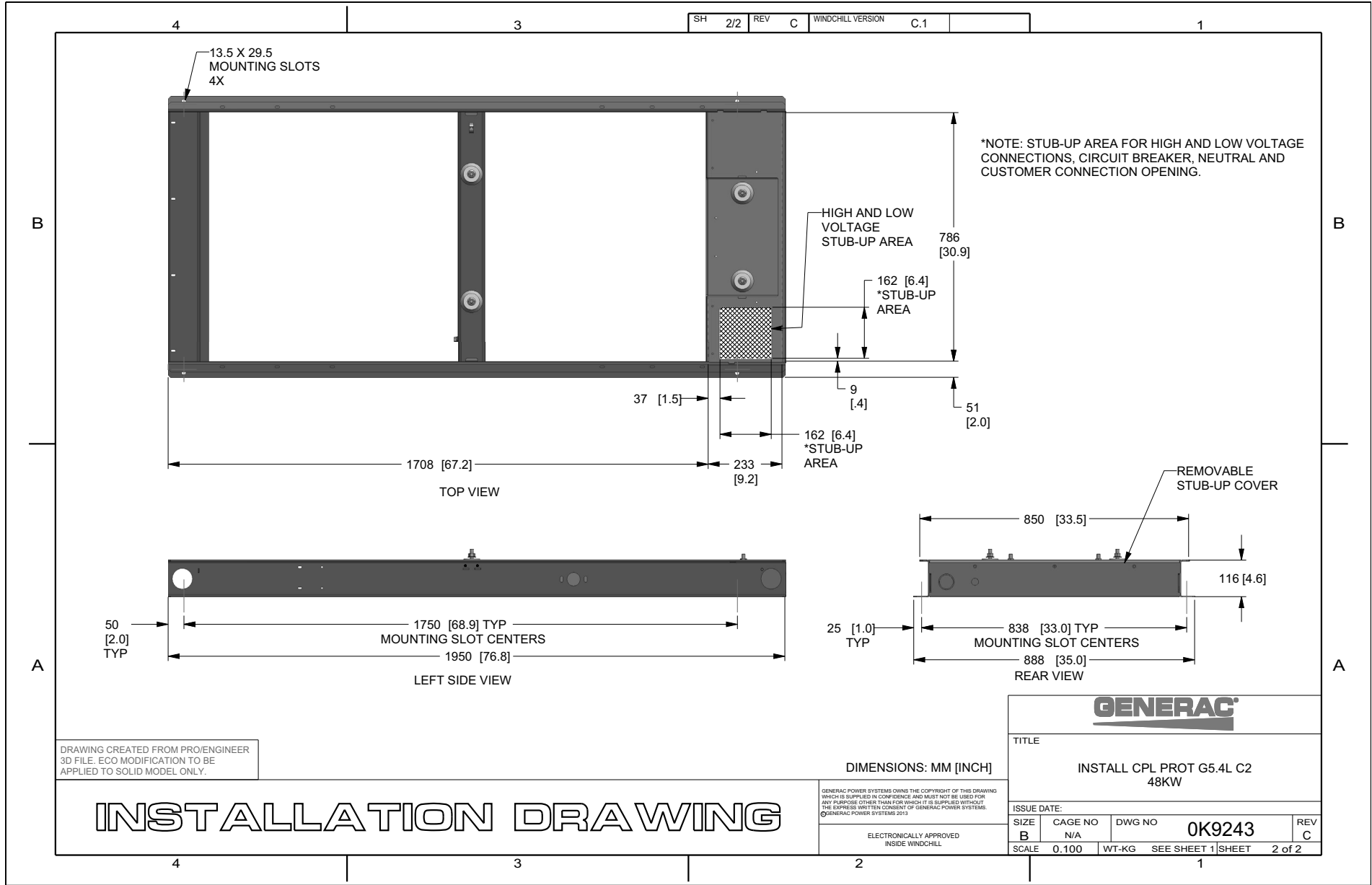








0K9243-C 48 kW (5.4 L) Page 2 of 2



AC Connections—1/3 Phase, 6/12 Lead

(1 of 2)

General Information

ALTERNATOR AC LEAD CONNECTIONS

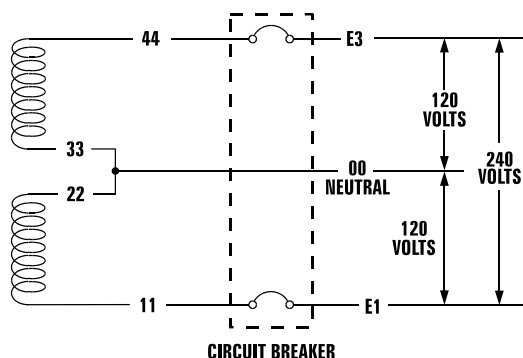
The electrical wires in the unit's AC connection (lower) panel should be installed according to the number of leads and the voltage/phase required for the application. The voltage and phase are described on the generator data label. The number of lead wires can be identified using the Specifications section and the power output rating on the generator data label. For example, if the generator produces 130kW, 277/480 Volt, 3-phase power, the generator has 12 alternator output leads. Figure 7.3 describes the stator power winding connection for the generator.

FOUR-LEAD, SINGLE-PHASE STATOR

Four-lead alternators (see Figure 7.1) are designed to supply electrical loads with voltage code "A" (240V, 1-phase, 60 Hz). Electrical power is produced in the stator power windings. These windings were connected at the factory to the main circuit breaker as shown in Figure 7.1.

The rated voltage between each circuit breaker terminal is 240V. The rated voltage between each circuit breaker terminal and the neutral point 00 is 120V.

Figure 7.1 — Four-lead, Single-phase Stator



ALTERNATOR POWER WINDING CONNECTIONS

3-PHASE ALTERNATORS ("Y" CONFIGURATION)

The Stationary Generator is designed to supply 3-phase electrical loads. Electric power is produced in the alternator power windings. These windings were connected at the factory to the main circuit breaker with a "Y" configuration as shown in Figures 7.2 through 7.6.

The rated voltage between circuit breaker terminals E1-E2, E1-E3 and E2-E3 is 480V, 208V or 600V depending on the model.

The rated voltage between each circuit breaker terminal and the neutral point 00 is 277V, 120V, or 346V depending on the model.

Figure 7.2 — Stator Power Winding Connections - 3-phase, 277/480V (6 Lead)

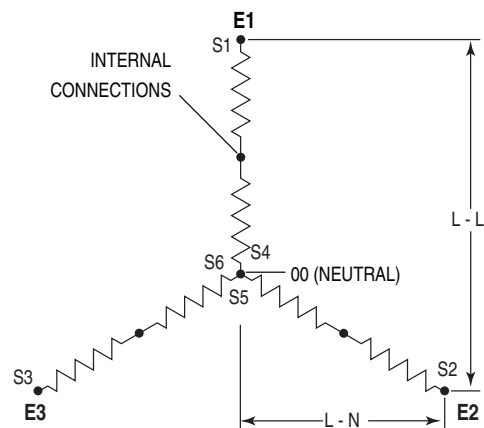
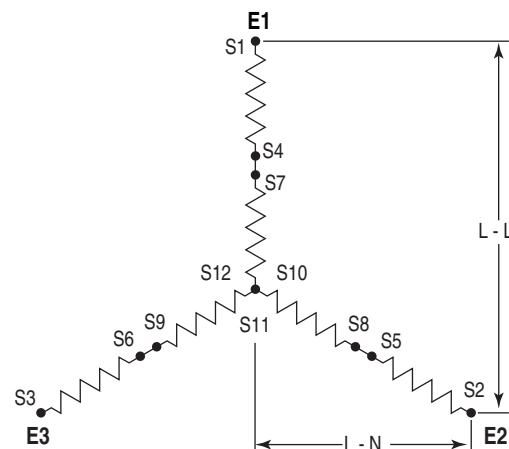


Figure 7.3 — Stator Power Winding Connections - 3-phase, 277/480V (12 Lead)



AC Connections—1/3 Phase, 6/12 Lead

(2 of 2)

General Information

Figure 7.4 — Stator Power Winding Connections - 3-phase, 120/208V (6 Lead)

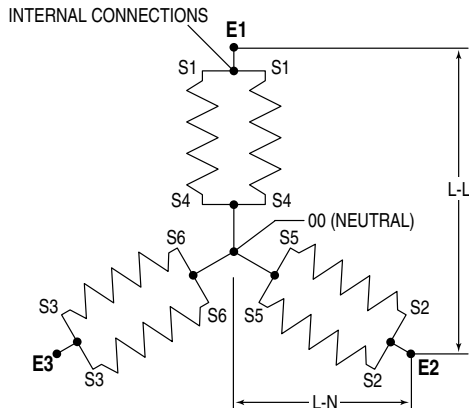


Figure 7.5 — Stator Power Winding Connections - 3-phase, 120/208V (12 Lead)

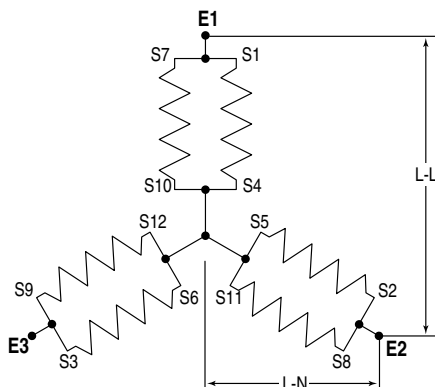
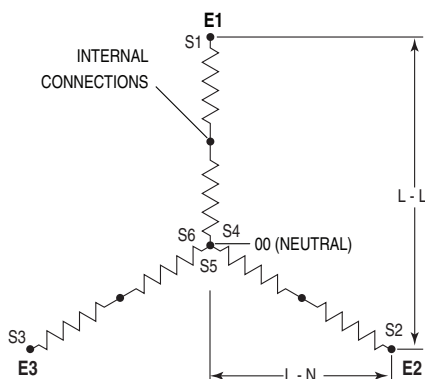


Figure 7.6 — Stator Power Winding Connections - 3-phase, 346/600V (6 Lead)



3-PHASE ALTERNATORS ("DELTA" CONFIGURATION)

The Stationary Generator is designed to supply 3-phase electrical loads. Electric power is produced in the alternator power windings. These windings were connected at the factory to the main circuit breaker with a "Delta" configuration as shown in Figures 7.7 and 7.8.

The rated voltage between circuit breaker terminals E1-E2, E1-E3 and E2-E3 is 240V.

The rated voltage between E2 and the neutral point 00 is 208V. The rated voltage E1-00 and E3-00 is approximately 120V.

NOTE: The voltage measured from E2 to 00 can greatly vary when single phase load is placed on alternator.

Figure 7.7 — Stator Power Winding Connections - 3-phase, 120/240V (6 Lead)

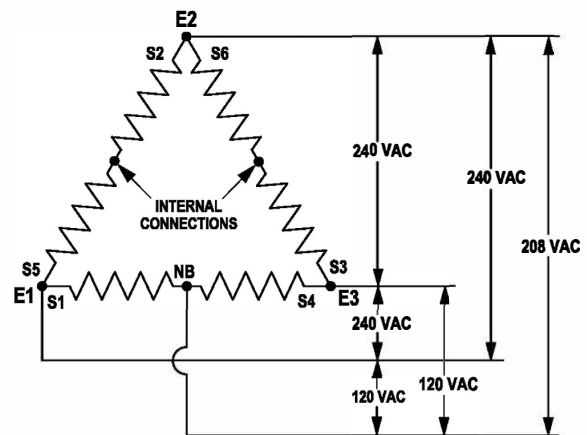
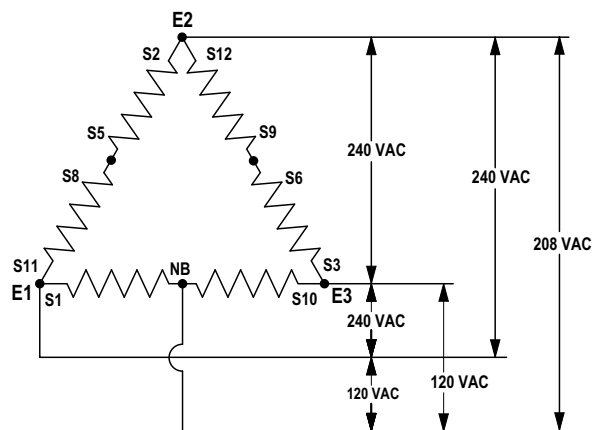


Figure 7.8 — Stator Power Winding Connections - 3-phase, 120/240V (12 Lead)



(1 of 4)

OPTION 1 - SINGLE PHASE, CPL CONTROL PANEL

GENERATOR OUTPUT CUSTOMER CONNECTIONS
 E1 TO E2] *240VAC OR 220VAC
 E1 TO NB] *120VAC OR 110VAC
 E2 TO NB]

***NOTE: THE 8TH DIGIT OF THE MODEL NUMBER SPECIFIES OUTPUT VOLTAGE**
 "A" = 120/240VAC 60HZ
 "M" = 110/220VAC 50HZ

LEGEND
 AR - ALTERNATOR ROTOR
 AS - ALTERNATOR STATOR
 BA - BRUSH ASSEMBLY
 EF - EXCITER FIELD
 MLCB - MAIN LINE CIRCUIT BREAKER
 NB - NEUTRAL BLOCK
 TB - TERMINAL BLOCK

OPTION 2 - THREE PHASE, CPL CONTROL PANEL, 120/208V

GENERATOR OUTPUT CUSTOMER CONNECTIONS
 E1 TO E2] *208VAC
 E2 TO E3]
 E1 TO E3]
 E1, E2 OR E3 TO NB = *120VAC

***NOTE: THE 8TH DIGIT OF THE MODEL NUMBER SPECIFIES OUTPUT VOLTAGE**
 "G" = 120/208VAC 60HZ

***S7-S12 EXIST ONLY ON A 12-WIRE ALTERNATOR**

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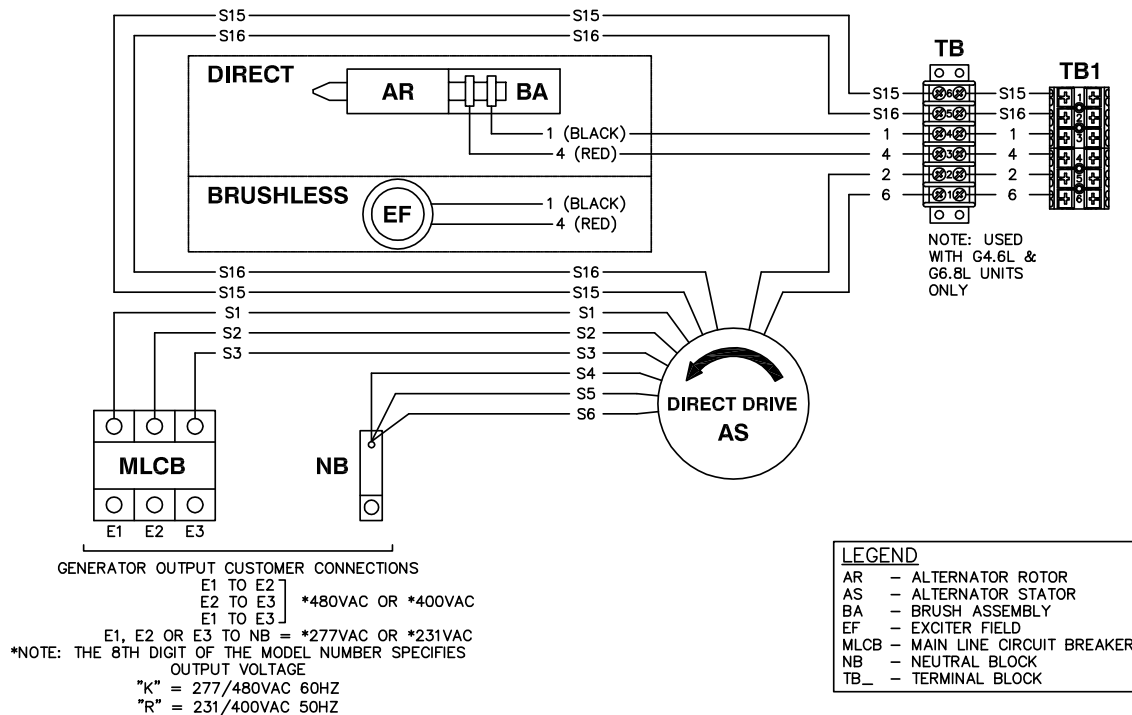
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CPL ALTERNATOR
DRAWING #: 0H6342

Alternator Wiring Diagram

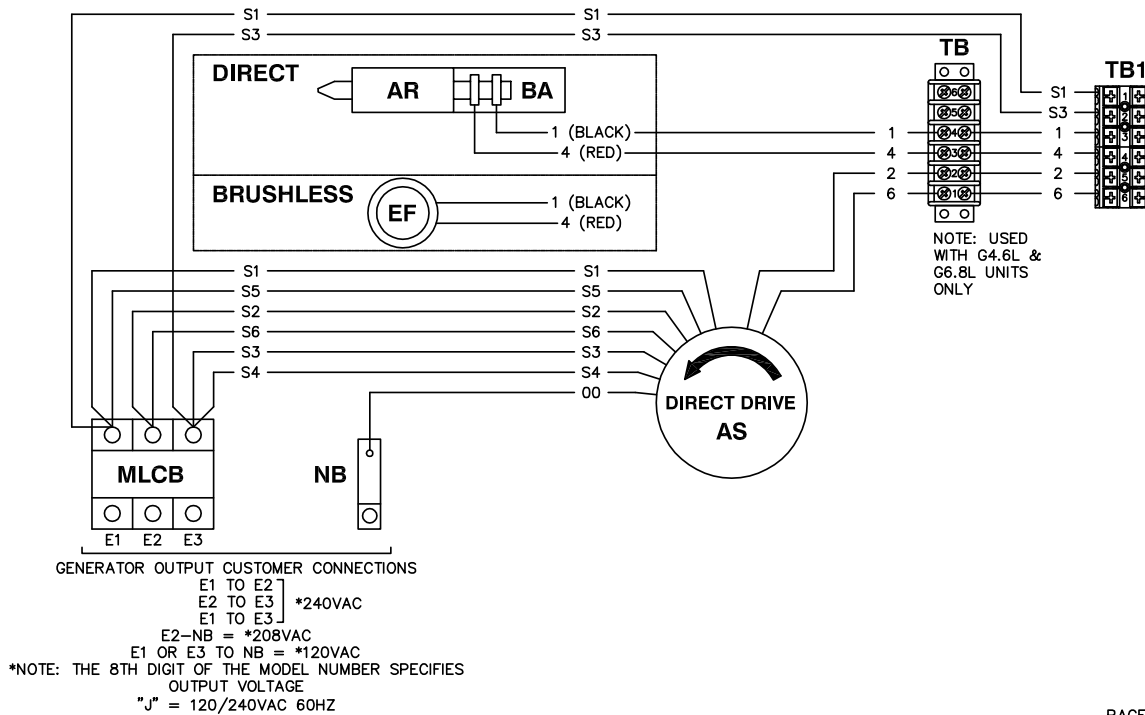
(2 of 4)

GROUP G

OPTION 3 - THREE PHASE, CPL CONTROL PANEL, 6-WIRE 277/480V



OPTION 4 - THREE PHASE DELTA, CPL CONTROL PANEL, 7-WIRE 120/240V



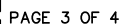
PAGE 2 OF 4

REVISION: K-4322-F
DATE: 10/30/15

WIRING - DIAGRAM
CPL ALTERNATOR
DRAWING #: 0H6342

(3 of 4)

OPTION 5 - THREE PHASE, CPL CONTROL PANEL, GEARBOX (REVERSE ROTATION)



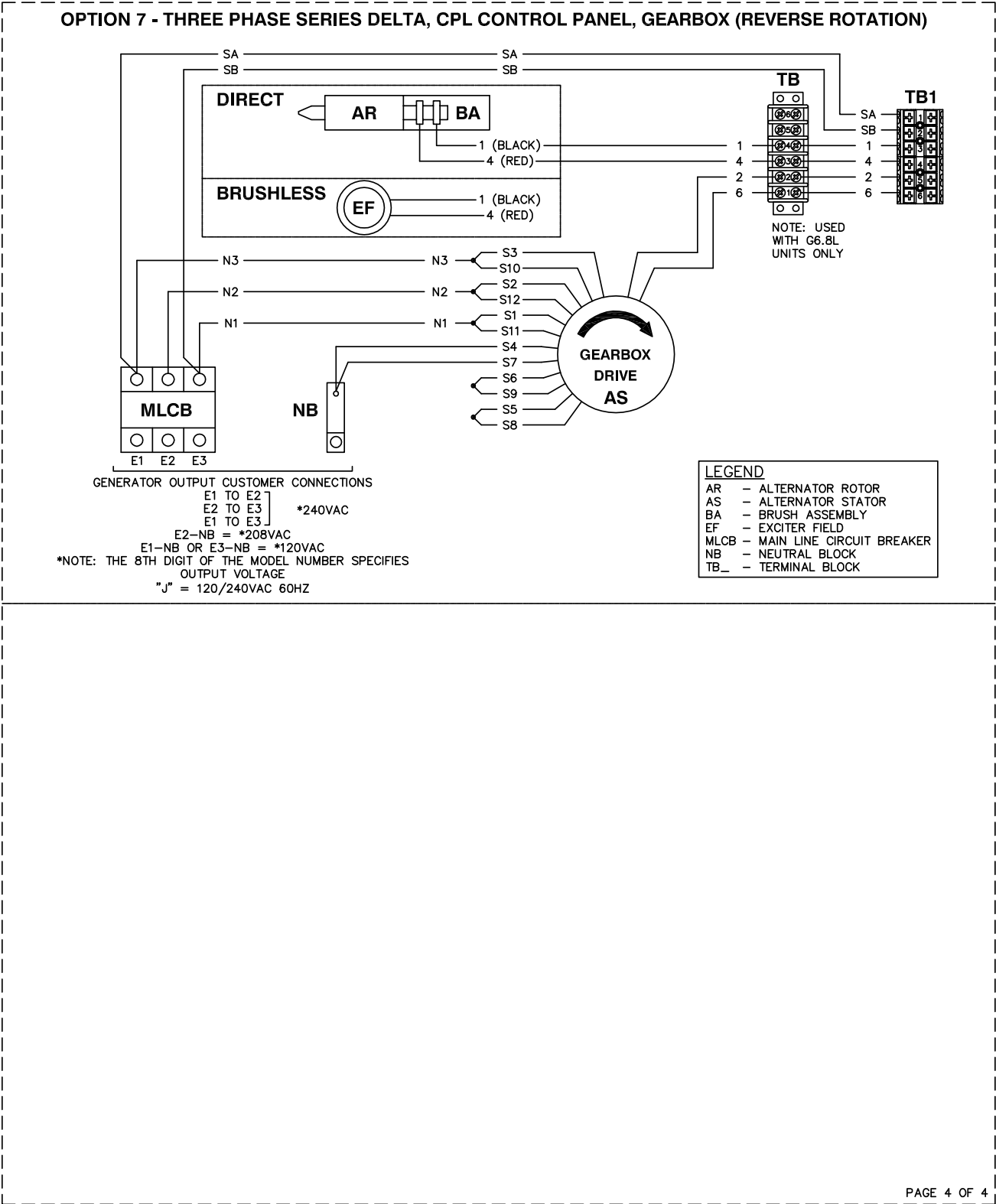
"K" = 277/480VAC 60HZ

REVISION: K-4322-F

Alternator Wiring Diagram

(4 of 4)

GROUP G



PAGE 4 OF 4

REVISION: K-4322-F
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WIRING - DIAGRAM
CPL ALTERNATOR
DRAWING #: 0H6342

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