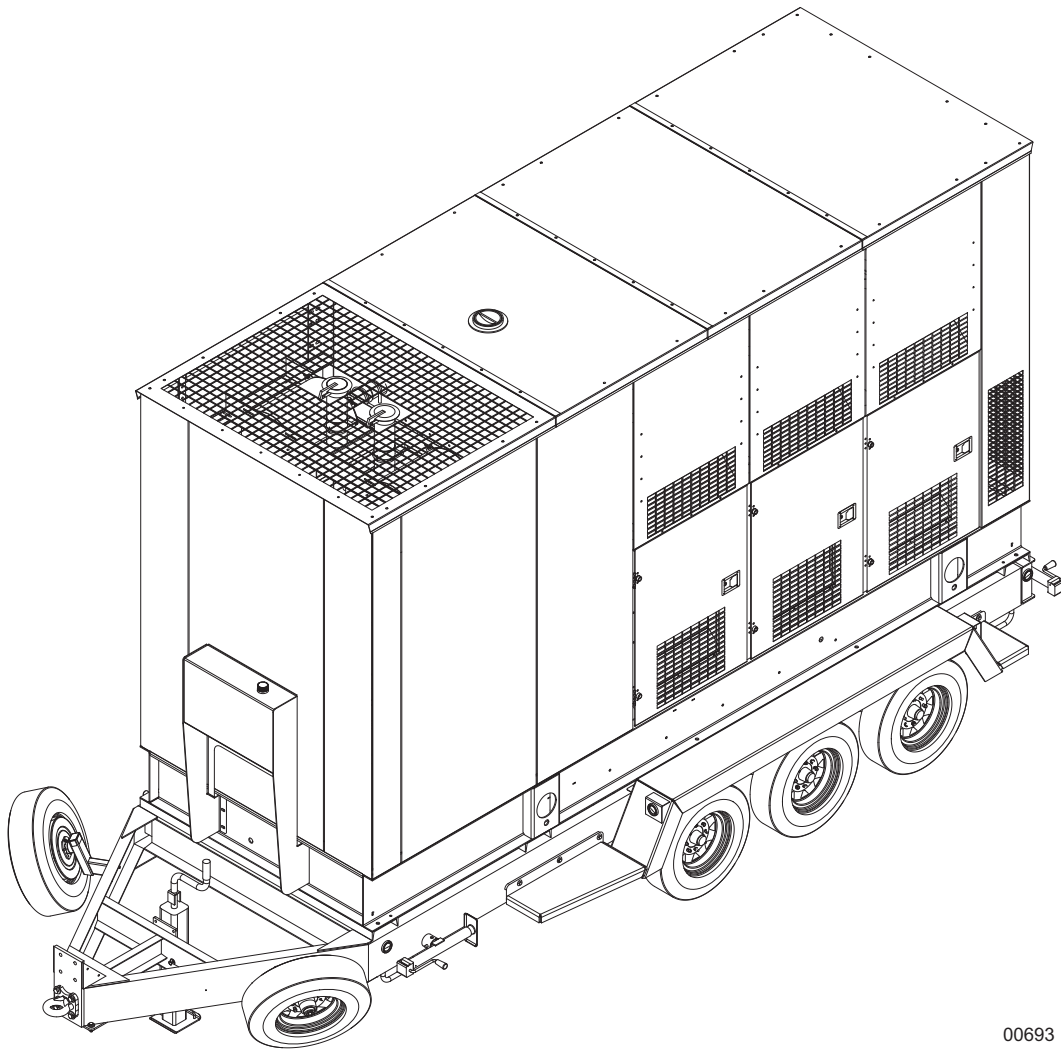


**GASEOUS GENERATOR
MGG280N2 • MGG350N2**



00693

OPERATING MANUAL

35320 Rev. B
April, 2016

Introduction

This manual provides information and procedures to safely operate and maintain the Generac Mobile Products LLC unit. For your own safety and protection from physical injury, carefully read, understand, and observe the safety instructions described in this manual. Keep a copy of this manual with the unit at all times. Additional copies are available from Generac Mobile Products LLC, or can be found at www.generacmobile.com. *The information contained in this manual was based on machines in production at the time of publication. Generac Mobile Products LLC reserves the right to change any portion of this information without notice.*

Read all of the manuals included with the unit. Each manual details specific information regarding items such as setup, use and service requirements. An engine operator's manual provides detailed operation and maintenance procedures for the engine. Additional copies of the engine operator's manual are available from the engine manufacturer.

DO NOT MODIFY or use this equipment for any application other than which it was designed for.

Generac Mobile Products LLC recommends that a trained and licensed professional perform all electrical wiring and testing functions. Any wiring should be in compliance with the National Electrical Code (NEC), state and local codes and Occupational Safety and Health Association (OSHA) guidelines.

GENERAC MOBILE PRODUCTS LLC
215 Power Drive • Berlin, WI 54923
U.S.A.
Phone: 920-361-4442
FAX: 920-361-4416
Toll Free: 1-800-926-9768
www.generacmobile.com

For technical or parts QUESTIONS, please contact the Generac Mobile Products LLC Customer Support or Technical Support team at 1-800-926-9768. Please have your serial number available.

To ORDER SERVICE PARTS, please contact the dealer from which you purchased the unit, or call Generac Mobile Products LLC to locate a dealer in your area.

Engine Make: _____
Engine Serial Number: _____
Engine Model Number: _____
Generator Make: _____
Generator Model Number: _____
Generator Serial Number: _____
Unit Model Number: _____
Unit Serial Number: _____
Dealer Name: _____
Dealer Phone Number: _____

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▲ WARNING

California Proposition 65. Engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects, and other reproductive harm. (000004)

▲ WARNING

California Proposition 65. This product contains or emits chemicals known to the state of California to cause cancer, birth defects, and other reproductive harm. (000005)

Section 1 - Safety

SAFETY NOTES



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

This manual contains DANGERS, WARNINGS, CAUTIONS, NOTICES and NOTES which must be followed to prevent the possibility of improper service, damage to the equipment, personal injury or death. The following formatting options will apply when calling the readers attention to the DANGERS, WARNINGS, CAUTIONS, NOTICES and NOTES.

▲ DANGER

INDICATES A HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY.

▲ WARNING

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

▲ CAUTION

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

NOTICE

Indicates a hazardous situation which, if not avoided, could result in property or equipment damage.

Note: Notes contain additional information important to a procedure and will be found within the regular text body of this manual.

OPERATING SAFETY



Before using the unit be sure you read and understand all of the instructions. This equipment was designed for specific applications; **DO NOT** modify or use this equipment for any application other than which it was designed for. Equipment operated improperly or by untrained personnel can be dangerous. Read the operating instructions and familiarize yourself with the location and proper use of all instruments and controls. Inexperienced operators should receive instruction from someone familiar with the equipment before being allowed to operate or set up the unit. The following points should be practiced at all times:

- All fuel types are potentially **FLAMMABLE** and/or **EXPLOSIVE** and should be handled with care. Comply with all laws regulating the storage and handling of fuels. Inspect the unit's fuel system frequently and correct any leaks immediately. Fuel supply lines must be properly installed, purged, and leak tested according to applicable fuel-gas codes before placing the equipment into service.
- The area immediately surrounding the unit should be dry, clean, and free of debris.
- **NEVER** start a unit in need of repair.
- **NEVER** operate the unit on a combustible surface.
- **NEVER** operate the unit if any of the following conditions exist during operation:
 1. Noticeable change in engine speed.
 2. Loss of electrical output.
 3. Equipment connected to the unit overheats.
 4. Sparking occurs.
 5. Engine misfires or there is excessive engine/generator vibration.
 6. Protective covers are loose or missing.

7. If the ambient air temperature is above 120°F (49°C).

- Make sure slings, chains, hooks, ramps, jacks, and other types of lifting devices are attached securely and have enough weight-bearing capacity to lift or hold the equipment safely. Always remain aware of the position of other people around you when lifting the equipment.
- **NEVER** operate a unit while tired, distracted, or under the influence of drugs or alcohol.

ENGINE SAFETY



Internal combustion engines present special hazards during operation and fueling. Failure to follow the safety guidelines described below could result in severe injury or death. Read and follow all safety warnings described in the engine operator's manual. A copy of this manual was supplied with the unit when it was shipped from the factory.

- **DO NOT** run engine indoors or in an area with poor ventilation. Engine exhaust contains carbon monoxide, a deadly, odorless and colorless gas which, if inhaled, can cause nausea, fainting, or death. Only use this unit outside and away from windows, doors, and ventilation equipment.
- **DO NOT** smoke around unit. Ensure that no combustible materials are left on or near unit, as **FIRE** or **EXPLOSION** may result.
- **DO NOT** touch or lean against hot exhaust pipes or engine block.
- **DO NOT** clean air filter with gasoline or other types of low flash point solvents.
- **DO NOT** remove engine coolant cap while engine is hot.
- **DO NOT** operate the unit without a functional exhaust system.
- Prolonged exposure to sound levels in excess of 85 dB(A) can cause permanent hearing loss. Wear hearing protection when working around a running engine.
- Keep hands, feet and loose clothing away from moving parts on the generator and engine.
- Keep area around exhaust pipes and air ducts free of debris to reduce the chance of an accidental fire.
- Batteries contain sulfuric acid which can cause severe injury or death. Sulfuric acid can cause eye damage, burn flesh or eat holes in clothing. Protective eye wear and clothing are necessary when working on or around the battery. Always disconnect the negative (-) battery cable from the corresponding terminal before performing any service on the engine or other components.

ELECTRICAL SAFETY



While the engine is running, potentially lethal voltages are present at the 120V Ground Fault Circuit Interrupt (GFCI) receptacles and lug connections if the main circuit breaker is closed. Failure to follow the safety guidelines described below could result in severe injury or death. Only a qualified and licensed electrician should make connections to the unit.

- **NEVER** start the unit under load.
- **ALWAYS** turn the battery disconnect switch to the OFF position before performing any service on the engine, generator, or any other components. Remove the negative (-) battery cable from the corresponding terminal if the unit is to be stored or transported.
- **NEVER** wash the unit with high pressure hoses or power washers.
- **ALWAYS** use extreme caution when servicing this unit in damp conditions. Do not service the unit if your skin or clothing is wet. Do not allow water to collect around the base of the unit.

TOWING SAFETY



Towing a trailer requires care. Both the trailer and vehicle must be in good condition and securely fastened to each other to reduce the possibility of an accident. Also, some states require that large trailers be registered and licensed. Contact your local Department of Transportation office to check on license requirements for your particular unit.

- Check that the hitch and coupling on the towing vehicle are rated equal to, or greater than, the trailer's Gross Vehicle Weight Rating (GVWR).
- Check tires on trailer for tread wear, inflation, and condition.
- **NEVER** tow trailer using defective parts. Inspect the hitch and coupling for wear or damage.
- Make sure the trailer hitch and the coupling are compatible. Make sure the coupling is securely fastened to the vehicle.
- Connect safety chains in a crossing pattern under the tongue and **ATTACH THE BREAKAWAY CABLE TO THE REAR BUMPER OF THE TOWING VEHICLE**. Do not attach the cable to the trailer hitch.
- Make sure directional and brake lights on the trailer are connected and working properly.
- Check that lug nuts holding wheels are tight and that none are missing.
- Maximum recommended speed for highway towing is 45 mph (72 km/h). Recommended off-road towing speed is not to exceed 10 mph (16 km/h) or less, depending on terrain.

Before towing the trailer, check that the weight of the trailer is equal across all tires. A large angle between the trailer and tow vehicle will cause more weight to be carried by one axle, which could cause premature wear on the tires and axles and cause potentially unsafe operating conditions.

The trailer is equipped with electric brakes. Check the operation of the brakes by braking the vehicle at a slow speed before entering traffic. Both the trailer and the vehicle should brake smoothly.

When towing, maintain extra space between vehicles and avoid soft shoulders, curbs and sudden lane changes. If you have not pulled a trailer before, practice turning, stopping and backing up in an area away from heavy traffic.

A film of grease on the coupler will extend coupler life and eliminate squeaking. Wipe the coupler clean and apply fresh grease each time the trailer is towed.

REPORTING TRAILER SAFETY DEFECTS

If you believe your trailer has a defect which could cause a crash or could cause injury or death, you should immediately inform the National Highway Traffic Safety Administration (NHTSA) in addition to notifying Generac Mobile Products LLC.

If NHTSA receives similar complaints, it may open an investigation; and if it finds that a safety defect exists in a group of vehicles, it may order a recall and remedy campaign. However, NHTSA cannot become involved in an individual problem between you, your dealer, or Generac Mobile Products LLC.

To contact NHTSA, you may either call the Auto Safety Hotline toll-free at 1-888-327-4236 (TTY:1-800-424-9153), go to <http://www.safercar.gov>; or write to:

Administrator
NHTSA
1200 New Jersey Avenue S.E.
Washington, DC 20590

You can also obtain other information about motor vehicle safety from <http://www.safercar.gov>.

SAFETY SYMBOL SUMMARY

This equipment has been supplied with numerous safety and operating decals. These decals provide important operating instructions and warn of dangers and hazards. Replace any missing or hard-to-read decals and use care when washing or cleaning the unit. Decal placement and part numbers can be found in the online parts manual at www.generacmobile.com. Below is a summary of the intended meanings for the symbols used on the decals.

	Safety alert symbol; used to alert you to potential personal injury hazards.		No open flames.
	Unit electrical ground.		Dangerous voltage may be present.
	Wear protective gloves.		Use protective eyewear.
	Explosion hazard.		Lift here only.
	Fire hazard.		Read and understand the supplied operator's manual before operating unit.
	Burn/scald hazard; pressurized steam.		Belt/entanglement hazard; keep body parts clear of this area.
	Hot surface(s) nearby.		Fan hazard; keep body parts clear of this area.
	Engine starting/remote starting point.		Anchor/tie down point.
	Engine can start automatically.		

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Section 2 - General Information

SPECIFICATIONS

GENERAC MODEL	MGG280N2	MGG350N2
Engine		
Make/Brand.....	PSI	PSI
Model	D146TIC	D183TIC
Induction System	Turbo CAC	Turbo CAC
Horsepower - Prime - Natural Gas hp (kW)	362 (270)	503 (375)
Horsepower - Standby - LP Liquid hp (kW)	253 (189)	337 (251)
Operating Speed rpm	1800	1800
Displacement in³ (L)	892 (14.62)	1115 (18.27)
Cylinders - qty	8	10
Spark plug gap in (mm)	0.015 (.4)	0.015 (.4)
Fuel Consumption (NG) - 100% load ft³/hr (m³/hr)	2532 (71.7)	3184 (90.2)
Fuel Consumption (NG) - 75% load ft³/hr (m³/hr)	1973 (55.9)	2482 (70.3)
Fuel Consumption (NG) - 50% load ft³/hr (m³/hr)	1385 (39.2)	1742 (49.3)
Fuel Consumption (LP) - 100% load gal/hr (L/hr)	25.0 (94.6)	40.1 (151.8)
Fuel Consumption (LP) - 75% load gal/hr (L/hr)	19.5 (73.8)	31.2 (18.1)
Fuel Consumption (LP) - 50% load gal/hr (L/hr)	13.7 (51.8)	21.9 (82.9)
Battery Type - Group Number	8D	8D
Battery Voltage (quantity per unit)	12V (2)	12V (2)
Battery Voltage (series connection)	24V	24V
Battery Rating	min. 900 CCA	min. 900 CCA
Generator		
Make/Brand.....	Stamford	Stamford
Model	HCI434C-311	HCI434D-311
Type, Insulation	Brushless, H	Brushless, H
Refer to the data plate on the generator for rated watts, amperes, frequency, voltage, phase and other important information.		
Generator Set (Engine/Generator)		
3Ø - Continuous - Natural Gas kW (kVA)	179 (223)	225 (281)
3Ø - Standby - LP Liquid kW (kVA)	162 (202)	259 (323)
Amps - 3Ø Continuous - Natural Gas (480V/277) A	269	338
Amps - 3Ø Standby - Natural Gas (480V/277) A	378	450
Amps - 3Ø Standby - LP Liquid (480V/277) A	243	389
Frequency Hz	60	60
Power Factor	0.8	0.8
AC Distribution		
Circuit Breaker Size	400	600
Voltage Regulation	+/- 1%	+/- 1%
Voltages Available 3Ø	480/277	480/277
Capacities		
Coolant (incl. engine) qt (L)	38 (43.2)	44 (50.0)
Oil (incl. filter) qt (L)	10.1 (38.1)	11.1 (42.1)
Weights		
Operating Weight, Skid Mounted lbs (kg)	11291 (5122)	12195 (5532)
Operating Weight, Trailer Mounted lbs (kg)	14462 (6560)	15366(6970)
Trailer		
Number of Axles	3	3
Capacity - Axle Rating lbs (kg)	7000 (3175)	7000 (3175)
Tire Size in	14.5	14.5
Brakes - Standard	Electric	Electric
Hitch - Standard	3" lunette ring	3" lunette ring
Maximum Tire Pressure psi	105	105

Specifications are subject to change without notice.

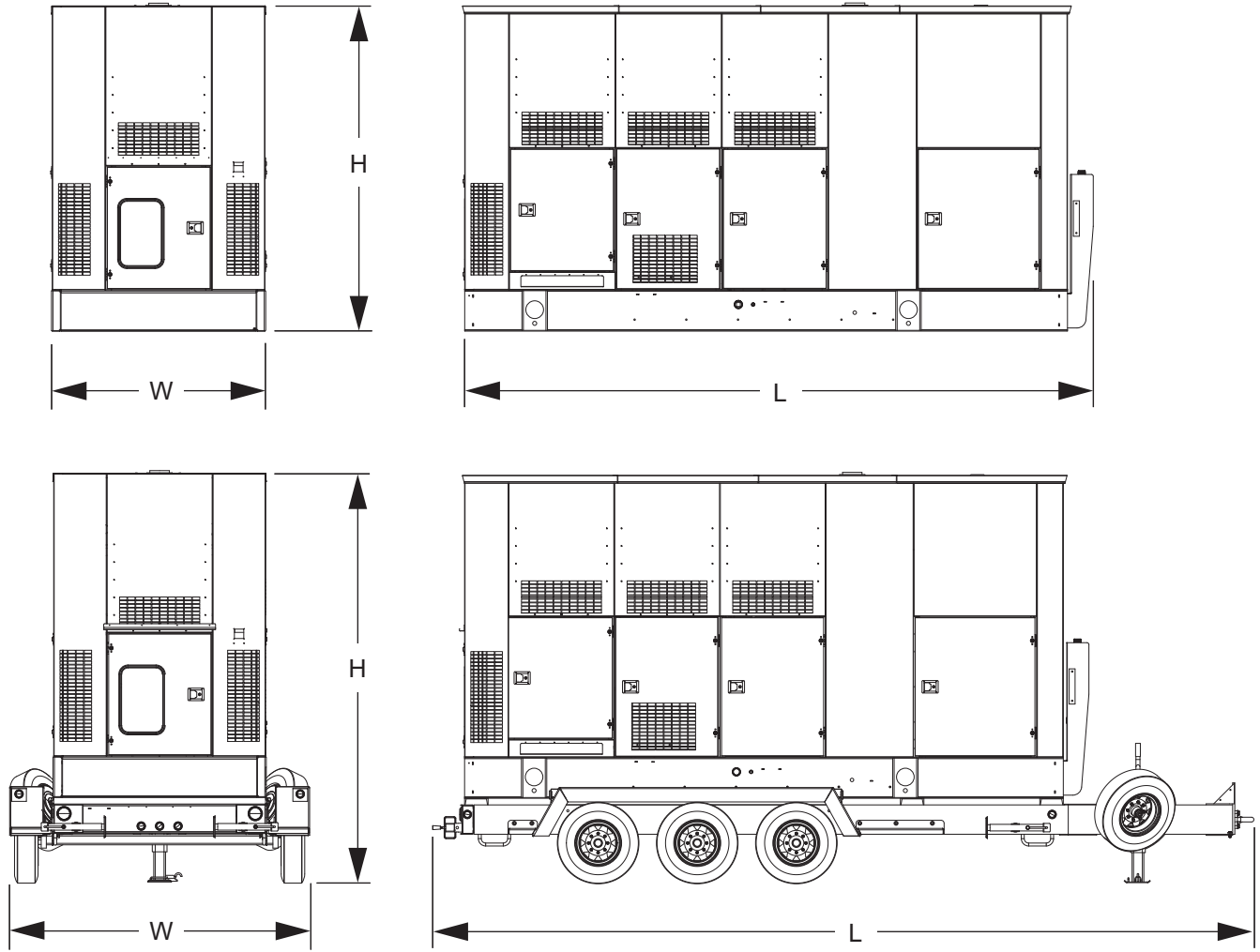
GENERAC MODEL

MGG280N2

MGG350N2

Dimensions (including antenna) L x W x H

Skid Mounted in (m)	192 x 66 x 92 (4.87 x 1.67 x 2.33)	204 x 72 x 116 (5.18 x 1.82 x 2.94)
Trailer Mounted in (m)	285 x 102 x 122 (7.25 x 2.59 x 3.09)	285 x 102 x 145 (7.25 x 2.59 x 3.68)



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Figure 1 - Unit Dimensions

Specifications are subject to change without notice.

UNIT SERIAL NUMBER LOCATIONS

Refer to the illustrated locations to find the unit ID tag and VIN tag on your unit. Important information, such as the unit serial number, model number and Vehicle Identification Number (VIN) for your trailer are found on these tags. Record the information from these tags so it is available if the tags are lost or damaged. When ordering parts or requesting technical service assistance you may be asked to provide this information.

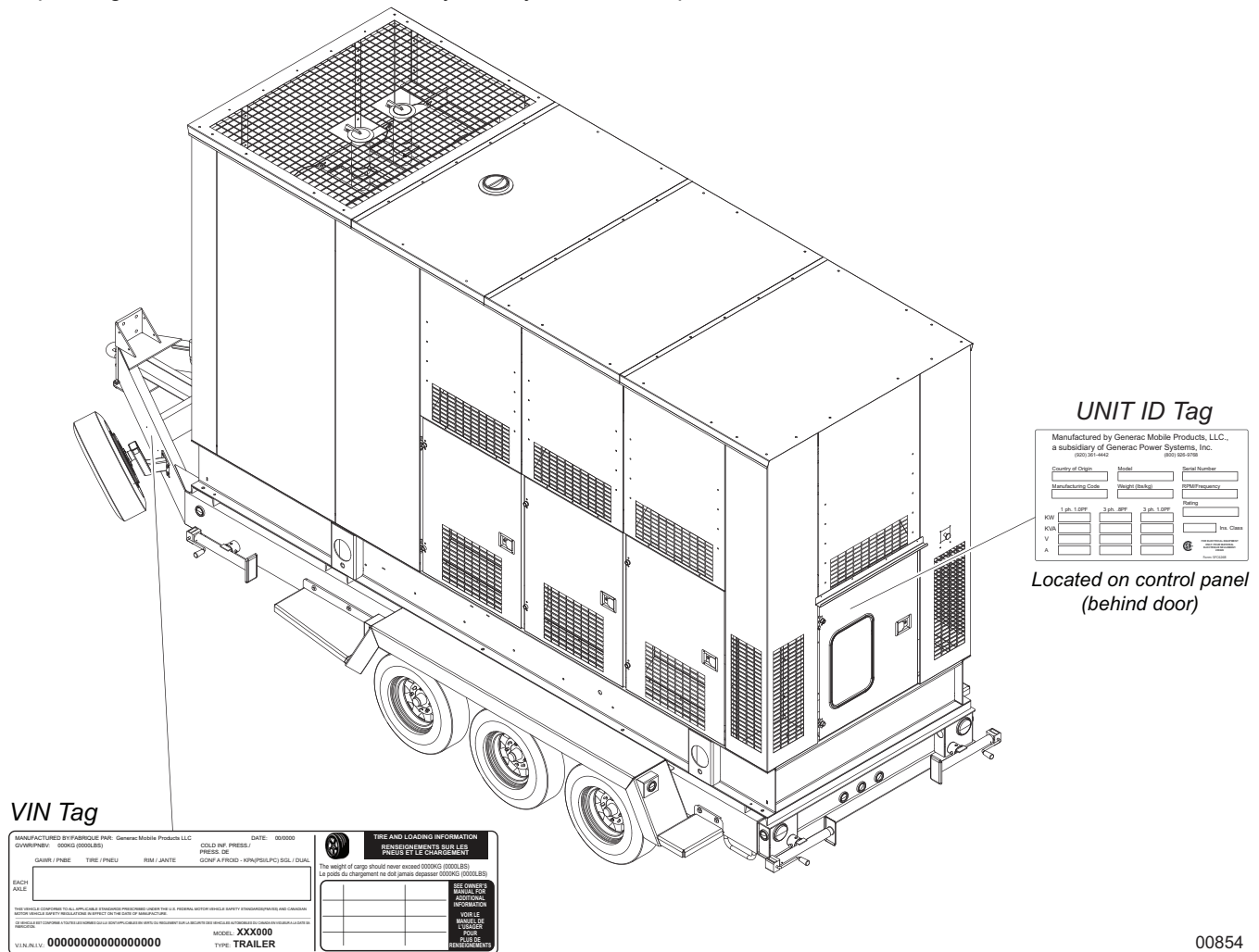


Figure 2 - Serial Number Locations

INTENDED USE

Important: Be sure you are completely familiar with all safety instructions detailed in this operating manual. Do not proceed if you are unsure of any detail. Contact Generac Mobile Products Technical Service if you have any questions.

The procedures presented in this manual are suggestions and it is the responsibility of the owner/operator to arrange for these procedures to be performed by licensed contractors according to all applicable codes including local codes for your Municipality/City/County and State. In addition to these suggestions, before installing your unit, you should obtain the most up to date copies of the following documents from the National Electrical Code and other authorities:

- National Electric Code, Articles 230, 250, 445, 517, 700.
- National Fire Protection Association

No. 30 – Storage, Handling and Use of Flammable Liquids.

No. 37 – Stationary Combustion Engines and Gas Turbines.

No. 99 – Essential Electrical Systems for Health Care Facilities.

No. 101 – Life Safety Code No. Systems.

No. 110 – 1985 Emergency and Standby Power Systems.

- NEMA MG1
- Local Codes applicable to Genset Installation. See your local building inspector.

NFPA (National Fire Protection Association) (617) 770-3000 (includes NEC)
1 Batterymarch Park, Quincy, MA 02169-7471 USA

NEMA (National Electrical Manufacturers Association) (703) 841-3200
1300 N. 17th Street, Suite 1847, Rosslyn, VA, 22209 USA

⚠ WARNING

The unit must be positioned over noncombustible materials and shall be located such that it prevents combustible materials from accumulating under it.

Engine Oil Recommendations

The engine has been filled with factory engine oil of a grade recommended by the engine supplier. The manufacturer recommends an initial oil and filter change after the first 50 hours (or first three months) of service operation. Use a high quality detergent oil with an appropriate classification and viscosity for the engine type and ambient temperature conditions. Refer to *“Specifications” on page 5* for oil capacity.

- SAE 15W-40 low ash
- API CD/CF or higher

Coolant Recommendation

Refer to the engine manual for coolant type. Normally a 50/50 mix of coolant and water is required. Coolant system capacity is listed in *“Specifications” on page 5*.

⚠ DANGER

DO NOT REMOVE THE RADIATOR PRESSURE CAP WHILE THE ENGINE IS HOT. SERIOUS BURNS FROM BOILING LIQUID OR STEAM COULD RESULT.

⚠ DANGER

ETHYLENE GLYCOL BASE ANTIFREEZE IS POISONOUS. DO NOT USE MOUTH-TO-SIPHON COOLANT FROM THE RADIATOR, RECOVERY BOTTLE, OR ANY CONTAINER. WASH HANDS THOROUGHLY AFTER HANDLING. NEVER STORE USED ANTIFREEZE IN AN OPEN CONTAINER BECAUSE ANIMALS ARE ATTRACTED TO THE SMELL AND THE TASTE OF ANTIFREEZE EVEN THOUGH IT IS POISONOUS.

⚠ CAUTION

Do not use any chromate base rust inhibitor with propylene glycol base antifreeze. Using any high silicate antifreeze boosters or additives also will cause overheating. The manufacturer also recommends that any soluble oil inhibitor is **NOT USED** for this equipment.

COMPONENT LOCATIONS

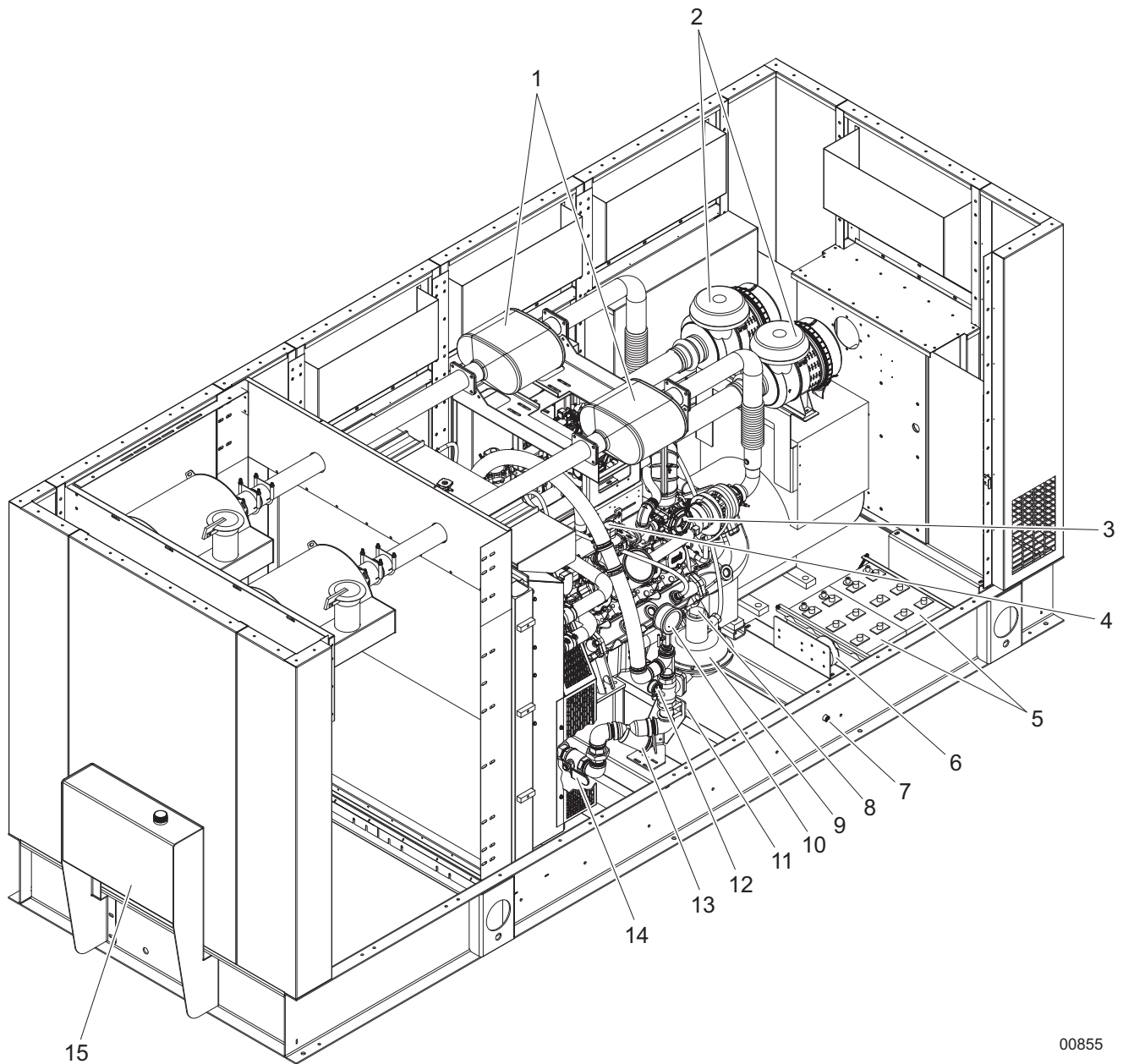
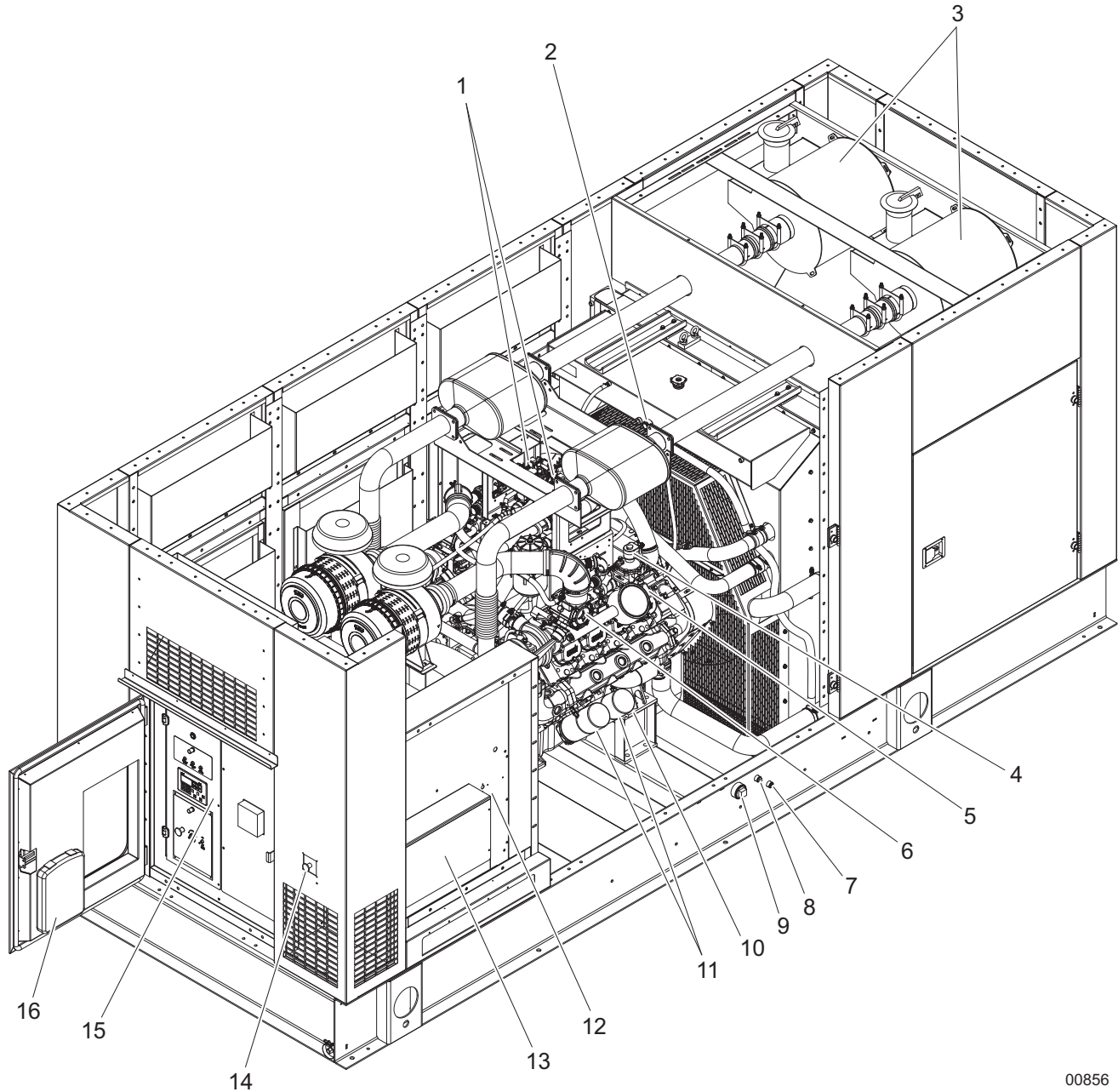


Figure 3 - MGG280N2 - Left Side

- | | |
|---------------------------------------|--|
| 1. Catalyst exhaust muffler | 9. Fuel pressure regulator |
| 2. Air filter | 10. Pressure gauge (inch water column) |
| 3. Fuel/air mixer | 11. Oil level regulator |
| 4. Natural gas lock-off | 12. Pressure gauge (psi) |
| 5. 12 volt batteries (2) | 13. Strainer access |
| 6. Battery disconnect switch | 14. Manual ball valve (natural gas) |
| 7. Oil drain | 15. Oil reservoir (16 gallon) |
| 8. Fuel pressure regulator adjustment | |

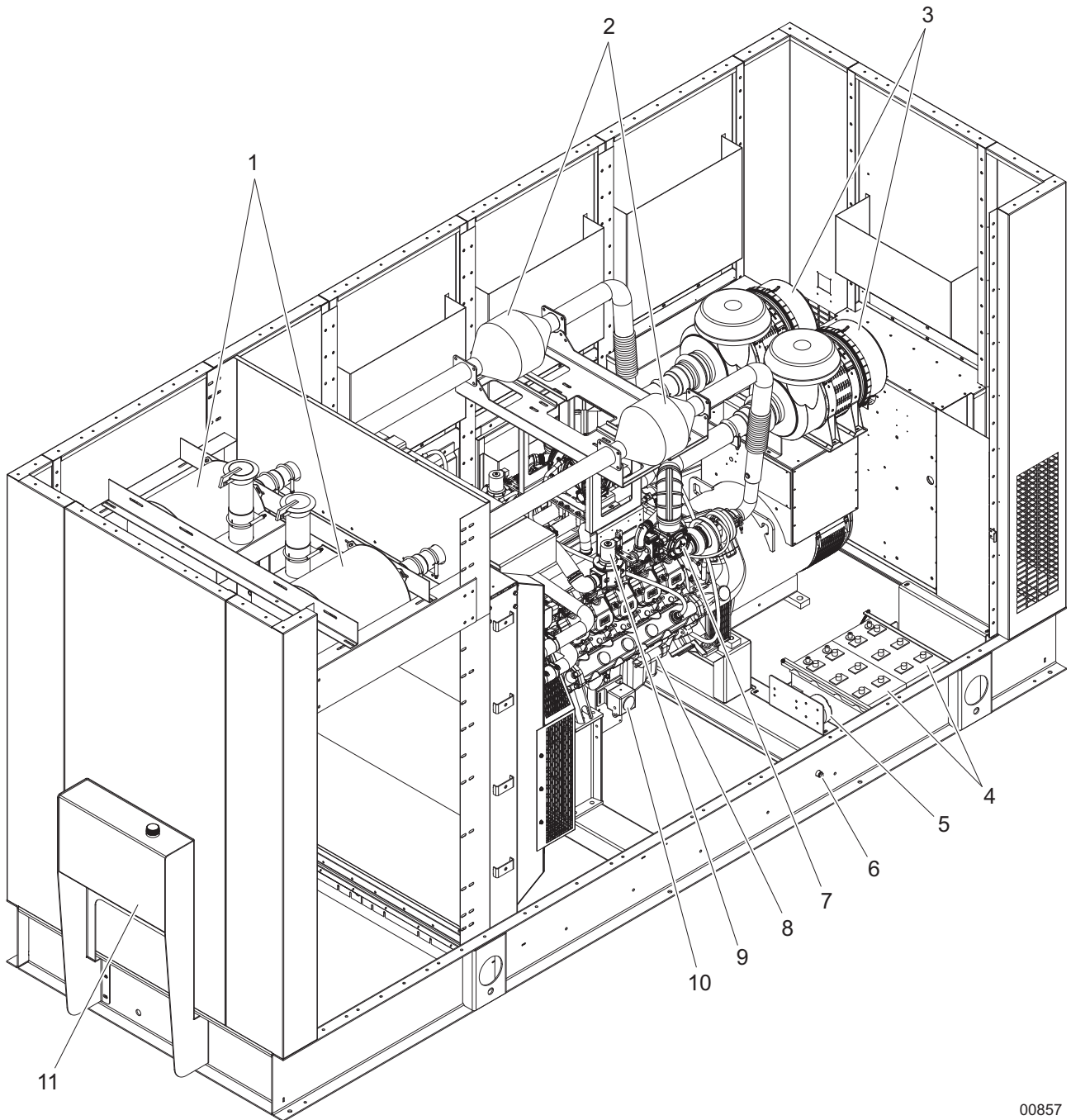
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Figure 4 - MGG280N2 - Right Side

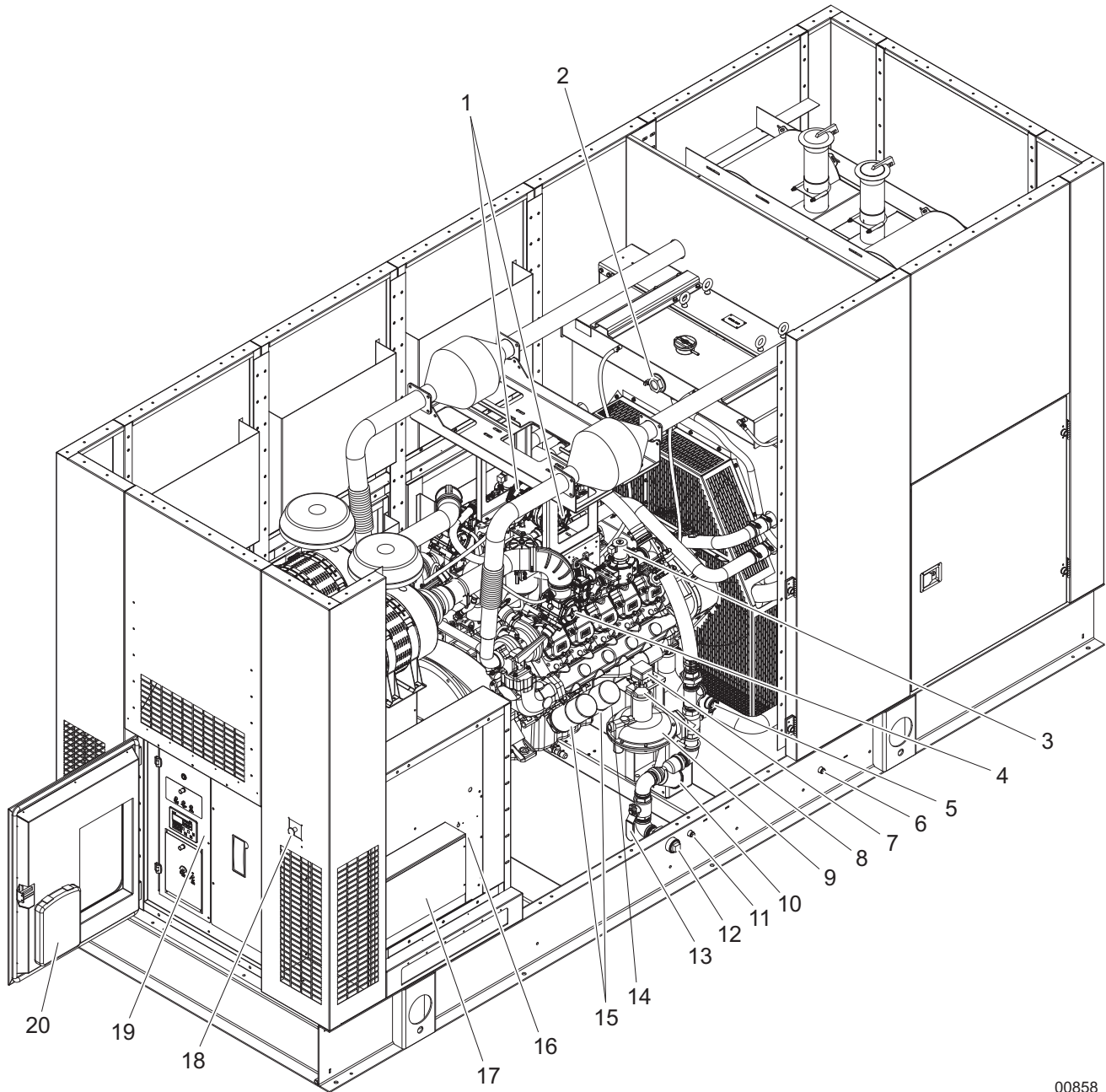
- | | |
|------------------------------|--|
| 1. Vaporizer (2) | 9. Natural gas (well gas) inlet |
| 2. Coolant level sight gauge | 10. Dipstick |
| 3. Silencers | 11. Fuel filters |
| 4. Natural gas lock-off | 12. Customer convenience receptacles |
| 5. Oil fill cap | 13. Customer connection box |
| 6. Fuel/air mixer | 14. Emergency stop switch |
| 7. Coolant drain | 15. Control panel (refer to Figure 7) |
| 8. LP liquid inlet | 16. Manual holder |



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Figure 5 - MGG350N2 - Left Side

- | | |
|------------------------------|-------------------------------|
| 1. Silencers | 7. Fuel/air mixer |
| 2. Catalyst exhaust muffler | 8. Starter motor |
| 3. Air filter | 9. Natural gas lock-off |
| 4. 12 volt batteries (2) | 10. Oil level controller |
| 5. Battery disconnect switch | 11. Oil reservoir (16 gallon) |
| 6. Oil drain | |

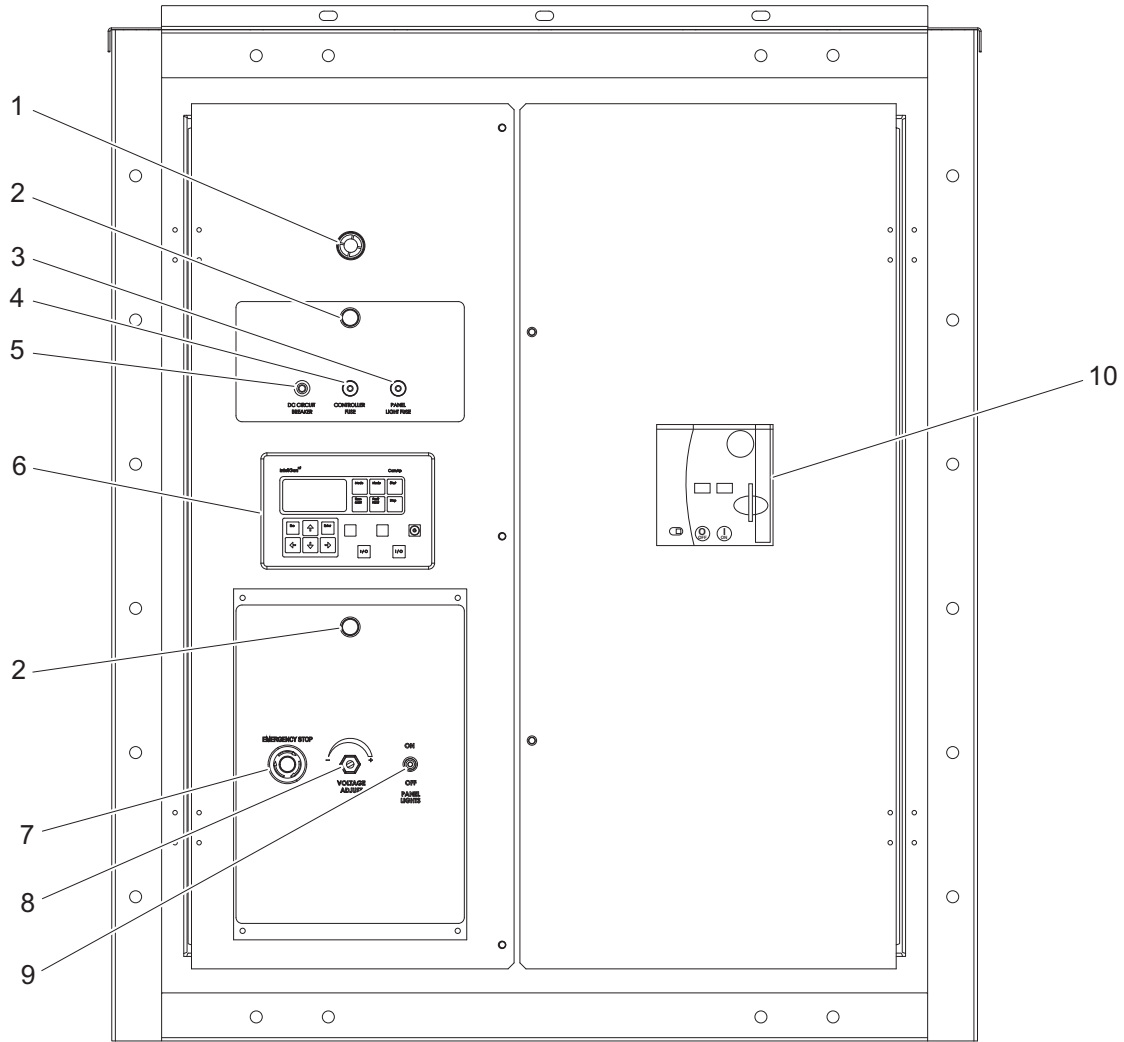


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Figure 6 - MGG350N2 - Right Side

- | | |
|--|--|
| 1. Vaporizer (2) | 11. LP liquid inlet |
| 2. Oil level sight gauge | 12. Natural gas (well gas) inlet |
| 3. Natural gas lock-off | 13. Manual ball valve (natural gas) |
| 4. Fuel/air mixer | 14. Dipstick |
| 5. Pressure gauge (psi) | 15. Fuel filters |
| 6. Coolant drain | 16. Customer convenience receptacles |
| 7. Fuel pressure regulator adjustment | 17. Generator output connections |
| 8. Dipstick (to right of fuel filters) | 18. Emergency stop switch |
| 9. Fuel pressure regulator | 19. Control panel (refer to Figure 8) |
| 10. Strainer access | 20. Manual holder |

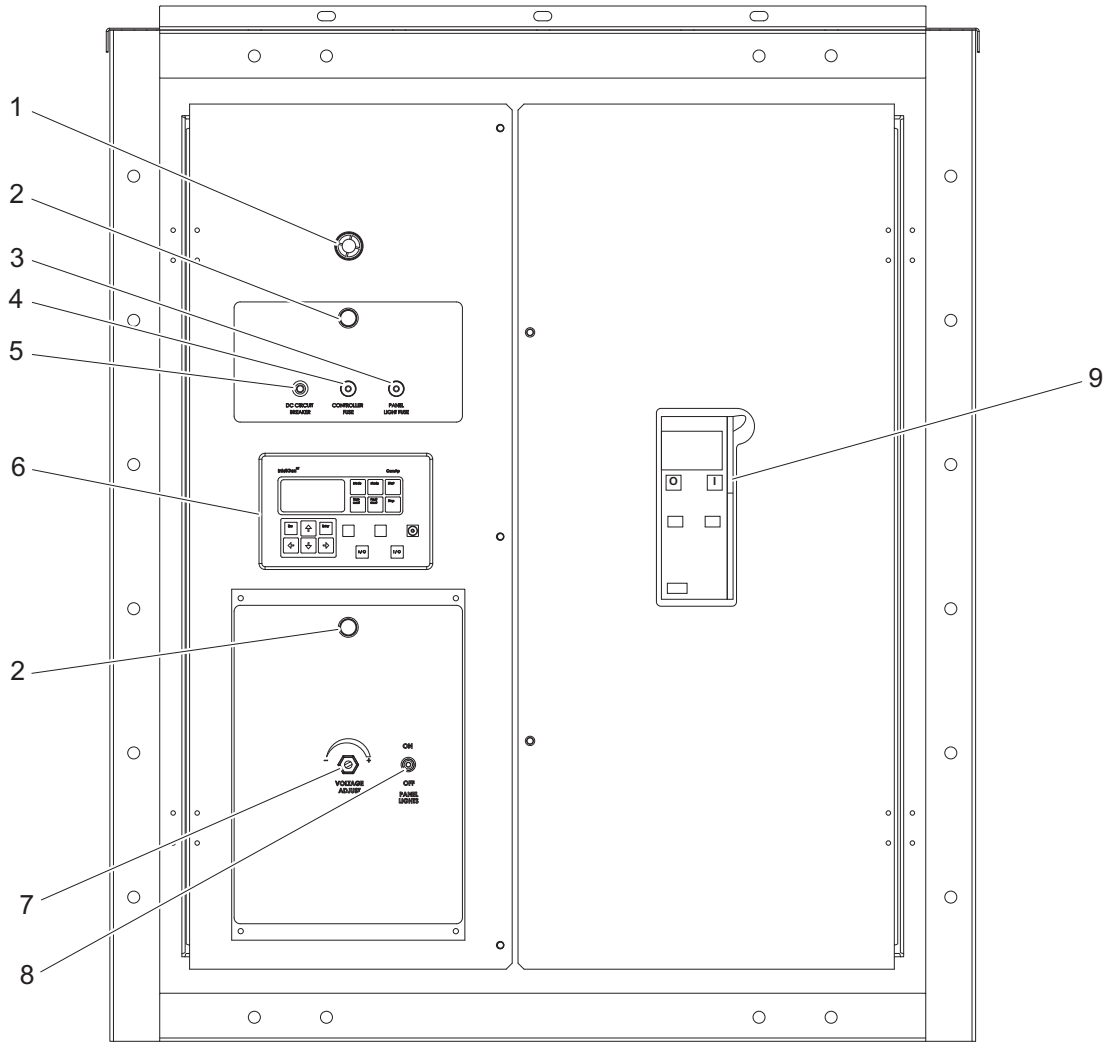
CONTROL PANEL



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Figure 7 - MGG280N2

- | | |
|------------------------------|---|
| 1. Alarm horn | 6. Digital controller |
| 2. Panel light | 7. Emergency stop switch (not on all units) |
| 3. Panel light fuse (10 amp) | 8. Voltage adjustment |
| 4. Controller fuse (5 amp) | 9. Panel lights switch |
| 5. DC circuit breaker | 10. Generator circuit breaker |



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Figure 8 - MGG350N2

- | | |
|------------------------------|-------------------------|
| 1. Alarm horn | 6. Digital controller |
| 2. Panel light | 7. Voltage adjustment |
| 3. Panel light fuse (10 amp) | 8. Panel lights switch |
| 4. Controller fuse (5 amp) | 9. Main circuit breaker |
| 5. DC circuit breaker | |

DIGITAL CONTROLLER

The Generac Mobile Products gaseous unit leaves the factory with the controller warning set at 105% load and shutdown set at 110% load. The unit is equipped with a digital controller with paralleling capabilities. The paralleling feature allows the operator to synchronize multiple controllers and distribute the load between units. Contact Generac Mobile Products Technical Service for more information about this feature.

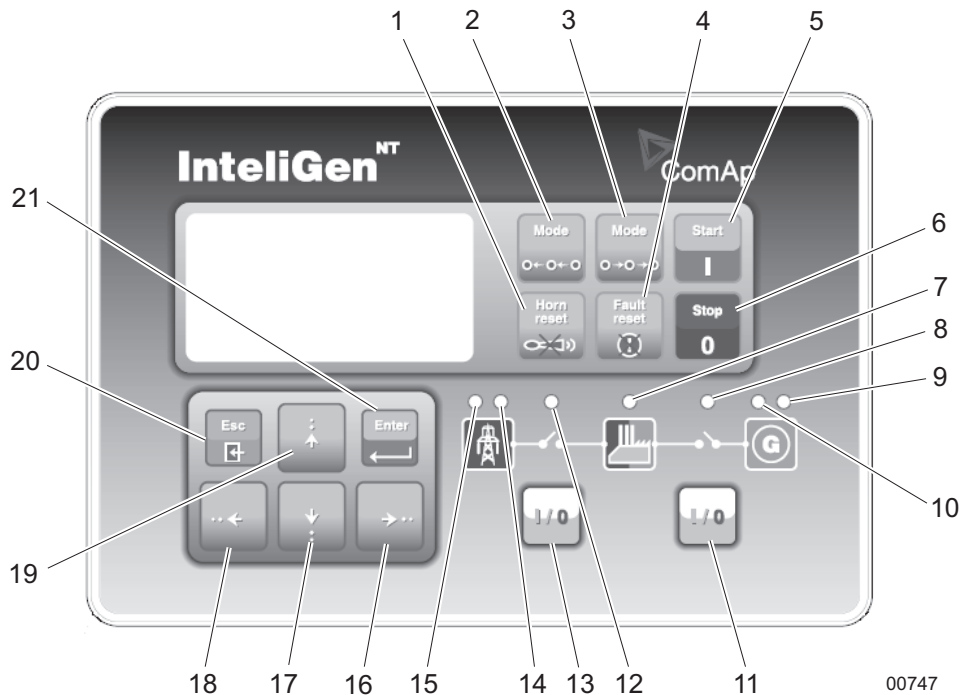


Figure 9 - Digital Controller Pushbuttons & LEDs

1. **Horn Reset:** Deactivates the horn (audible alarm).
2. **Mode ←:** Cycles backward through genset operation modes.
3. **Mode →:** Cycles forward through genset operation modes.
4. **Fault Reset:** Acknowledges faults and alarms.
5. **Start:** Starts the genset in MAN mode.
6. **Stop:** Stops the genset in MAN mode.
7. **Bus:** Green LED is on if bus voltage is present and within limits.
8. **GCB ON:** Green LED is on if GCB feedback is active. Flashes during synchronizing.
9. **Genset Failure:** Red LED starts flashing when any failure occurs. After Fault Reset button is pressed, changes to steady light (if an alarm is still active) or is off (if no alarm is active).
10. **Gen Voltage Present:** Green LED is on if generator voltage is present and within limits.
11. **GCB ON (I)/OFF (O):** Opens and closes (synchronizes) the generator circuit breaker in MAN mode.
12. **MCB ON:** Green LED is on if MCB feedback is active. Flashes during reverse synchronizing (synchronizing of the loaded genset back to the restored mains).
13. **MCB ON (I)/OFF (O):** Opens and closes (synchronizes) the mains circuit breaker in MAN mode.

- 14. **Mains Voltage Present:** Green LED is on if voltage on the mains terminals is present (in SPI and SPtM). LED is not active in MINT, COX.
- 15. **Mains Failure:** Red LED starts flashing when the mains failure occurs and genset does not run, changes to steady light when the genset starts, and then turns off when the mains restores.
- 16. →: Moves history record displayed columns to the right, five percent increase of edited setpoint's value (step given by the setpoint range), go back from Alarm list.
- 17. ↓: Selects the setpoint, select the screen, select history record or decrease setpoint value.
- 18. ←: Moves history record displayed columns to the left, five percent decrease of edited setpoint's value (step given by the setpoint range), view Alarm list from measurement screens.
- 19. ↑: Select the setpoint, select the screen, select history record or increase setpoint value.

20. **Esc:**

Where	Function
Measurement screens, Alarm list	Go to Menu screen
Setpoints screen	Go to Menu screen; within setpoint group, go to group list
Setpoint edit	Leave setpoint edit without changes
History screen	Go to Menu screen
FastEdit screen	FastEdit exit (to previous measurement screen) without changes
Language screen	Language screen exit (to Menu) without save

21. **Enter:**

Where	Function
Menu screen	Go to selected display group (Measurement DU, Measurement IO, ...)
Measurement screens, Alarm list	Go to FastEdit screen, hold Enter button for 4 seconds, then it is possible to adjust selected setpoint. (Typically Base load for standard SPtM.)
Setpoints screen	Go to selected setpoint group
Setpoint edit	Start setpoint edit/save changes
History screen	Go to the first column of the first history record
FastEdit screen	FastEdit exit (to previous measurement screen) with setpoint change
Language screen	Language screen exit (to Menu) and save selection

For more detailed controller information, refer to the controller operator guide included with the unit.

EQUIPMENT DESCRIPTION

This unit is a revolving field, alternating current type generator set. The generator is designed to supply electrical power for the operation of compatible electrical loads.

The generator's revolving field is directly connected to and driven by an engine by means of flexible discs. Generators with a four-pole rotor are driven at a rated speed of 1,800 rpm to supply a frequency of 60 Hertz.

Refer to the data label affixed to the unit for rated AC voltage, wattage, amperage, number of phases, etc.

Standard Generator Features

The generator incorporates the following features:

- The rotor insulation system is Class “H” rated, and the stator insulation is Class “H” rated as defined by NEMA MG1-22.4 and NEMA MG1-1.65.
- The generator is self-ventilated and drip-proof constructed.
- The voltage waveform deviation, total harmonic content of the AC waveform and “telephone influence factor” have been evaluated and are acceptable according to NEMA MG1-22.

Generator and Load Compatibility

The generator must be fully compatible with the rated voltage, phase rotation, and frequency of the connected electrical loads. The generator, connected electrical devices, or both, can be damaged if voltage, phase, and frequency are not compatible.

ENGINE/GENERATOR PROTECTIVE DEVICES

The unit may be required to operate for long periods of time without an operator on hand to monitor conditions such as coolant temperature, oil pressure, voltage, frequency, etc. For this reason, the unit has numerous sensors to provide the control panel with the information it needs to protect both the engine and generator. The control panel is designed to shut down the engine if potentially damaging conditions occur. These conditions can include low oil pressure, high coolant temperature, low coolant level, engine overspeed, over or under voltage, over or under frequency, etc. These settings are configured at the factory and can be changed/adjusted by an Authorized Service Technician if required.

Coolant Temperature Sensor

The control panel automatically shuts down the engine if the engine coolant temperature rises above a safe level.

Low Coolant Level Sensor

Should the engine coolant level drop below the level of the coolant temperature sensor, it is possible for the engine to overheat without automatic shutdown. To prevent such overheating, the engine has a low coolant level sensor. If the level of engine coolant drops below the level of the low coolant level sensor, the controller will shut the engine down.

Oil Pressure Sensor

This sensor monitors engine oil pressure. If oil pressure drops below a safe level, the control system automatically shuts down the engine.

Overspeed Shutdown

A speed circuit controls engine cranking, startup, operation, and shutdown. Engine speed signals are delivered to the control panel whenever the unit is running. Should the engine overspeed above a safe, preset value, the control panel initiates an automatic engine shutdown.

Overcrank Shutdown

After a pre-specified duration of cranking, this function ends the cranking if the engine has failed to start. The default settings are:

- The unit will attempt to start (crank) three times.
- Each crank cycle lasts either 10 or 15 seconds, followed by a five second rest (to cool the starter).

- After three starting attempts, the controller alarm will sound and the LCD window on the controller will display Start Fail Alarm.

RPM Sensor Loss Shutdown

If the speed signal to the control panel is lost, engine shutdown will occur.

DC FUSES

Located inside the control panel, the fuses protect the control panel wiring and components from damaging overload. For fuse location and identification, refer to [Figure 7 on page 13](#).

DUAL FUEL SYSTEM

This type of fuel system allows the unit to run on either natural gas (primary) or LP liquid (secondary). In the event that the primary source becomes unavailable, the unit will automatically switch to the secondary source. It can do so while in operation.

Natural Gas (Well Gas) Fuel System

Natural gas is supplied from a utility supply line or well site in its vapor state through in-ground piping. The vapor enters the large fuel inlet located on the right side of the unit's frame.

LP Liquid Withdrawal Fuel System

LP is supplied as a liquid in pressurized tanks. The liquid must be converted to its gaseous state before it is introduced into the engine carburetor. The unit is equipped with a vaporizer converter to accomplish this. The LP liquid enters the fuel system through the small fuel inlet located on the right side of the frame. As the liquid passes through the vaporizer, heated engine coolant is ported through the vaporizer to provide the necessary heat for conversion of the fuel from a liquid to a gaseous state.

⚠ DANGER

ALL FUEL TYPES ARE POTENTIALLY FLAMMABLE AND/OR EXPOSIVE AND SHOULD BE HANDLED WITH CARE. COMPLY WITH ALL LAWS REGULATING THE STORAGE AND HANDLING OF FUELS.

Note: *THIS UNIT IS NOT DESIGNED TO OPERATE ON LP VAPOR. If your LP supply tank does not have a liquid withdrawal system, a licensed LP supply company will need to install the correct fitting to allow for it. For special fuel system configurations, contact Generac Mobile Products Technical Service.*

UNIT SET UP

This unit is designed to operate with natural gas or well gas as the primary fuel, and LP liquid as the secondary fuel. For units operating on well site gas, a well test must be performed prior to installation of the unit. Refer to the Well Site Approval section below.

The unit should be installed, serviced, tested, adjusted, and otherwise prepared for use by a Generac Mobile Products Authorized Service Dealer. The owner is responsible for ensuring the unit's emission control system meets all applicable state and local codes and regulations. It is strongly recommended that a Generac Mobile Products Authorized Dealer provide instruction to the operator for the safe inspection, starting, operating and stopping of the unit. Read the operating manual thoroughly and understand all instructions before operating the equipment. Refer to section ["Fuel Connections" on page 23](#) for fuel supply connection information.

Well Site Approval

A well gas chromatography analysis must be performed prior to installation of the unit. A copy of the test report must be sent to, and preapproved by, Generac Mobile Products LLC. If the unit is moved to a new location, a new well test must be performed. Refer to the Generac Mobile Products General Warranty for more information or contact Generac Mobile Products Technical Service.

PRESTART CHECKLIST

When the initial installation is complete, these checks must be performed before starting the engine. These checks are not required before each start, only after the initial installation.

Units that have been in transit or storage for long periods may be subjected to extreme temperature and moisture changes. This can cause excessive condensation, and the generator windings should be thoroughly dried before bringing the genset up to full nameplate voltage. If this precaution is not taken, serious damage to the genset can result.

⚠ CAUTION

Do not apply high voltage to windings (do not start the genset) in a moisture-saturated condition. Moisture can cause insulation breakdown, making it necessary to return the genset for repair.

Note: *These precautions are especially necessary in locations such as seaboard installations and other high humidity areas. Some installations will be in environments that are much more corrosive than others.*

- Verify that the battery disconnect switch is turned to the ON position.
- Verify that the unit is positioned stably.
- Verify that proper clearance exists on all sides and top of enclosure.
- Assure that the unit is a safe distance from any flammable or combustible material.
- Verify no load is connected to unit.
- Inspect the engine and genset and verify that there are no loose wires or components. Tighten if necessary.
- Verify engine oil level is full. Refer to engine manual if necessary.
- Verify engine coolant level is full. Refer to engine manual if necessary.
- Verify the controller is in stop mode by pushing the Stop button.
- Verify the fuel select switch is set to the correct fuel type or Auto.
- Verify the fuel valve is open and the pressure and flow rate are correct.
- Remove all tools, rags, etc. from inside the unit enclosure. Close all enclosure doors and be sure no hands are inside the unit enclosure when it starts.
- Start the unit. Refer to *“Starting The Unit” on page 21* for details.
- The engine should begin to crank and start when the fuel moves through the pipe to the carburetor. If the engine fails to start, refer to *“Troubleshooting” on page 45*.

Engine running

With the engine running, several checks must be made:

- Verify there are no gas leaks. If a gas leak is detected, stop the engine immediately by pushing the Stop button on the controller. Repair the leak before proceeding.
- Verify there are no coolant or oil leaks. If a leak is detected, stop the engine immediately and repair the leak before proceeding.
- Verify that operation is smooth. If belt squeals, vibrations or other sources of noise exist, stop the engine immediately and repair before proceeding.
- Verify that the correct voltage exists (line-to-line and line-to-neutral) at the genset.
- Verify phase rotation is the same as the attached equipment.
- Minor adjustment of the output voltage is made using the voltage adjust potentiometer on the control panel.

▲ WARNING

Engine coolant is under pressure and is above the boiling point of water when engine is hot. Do not open the coolant system until the engine has completely cooled. Hot coolant can cause severe burns and other injuries. When engine is cool, coolant level can be checked.

- After the operation checks are made, stop the engine by pressing the Stop button on the controller, and wait for the engine to cool. When the engine is cool, check engine oil and coolant levels.
- Close all enclosure covers.

Section 3 - Operation

The operation of this unit should only be performed by an authorized operator, that is, someone who has been properly trained by an Authorized Service Dealer. Contact your local Authorized Service Dealer for assistance in training authorized operators.

The following instructions assume that the unit has been properly set up, serviced, tested, adjusted, and otherwise prepared for use by an Authorized Service Dealer. Read the safety information carefully before attempting to operate this equipment.

STARTING THE UNIT

The unit is designed to operate on Natural Gas (NG) or LP liquid. At oil well sites, LP liquid is typically used to start the unit until the pump jack brings the well gas (natural gas) up to the surface. The unit's fuel system will detect when there is sufficient pressure to switch to natural gas as the primary fuel source. Refer to *"Dual Fuel System" on page 18* for more information.

After initial setup, it may be necessary to purge the natural gas fuel line before operating the unit. LP liquid must be available as a secondary fuel to perform this procedure. Refer to *"LP Liquid Start Up" on page 22*.

If any leaks are detected, correct them immediately.

Natural Gas (Well Gas) Start Up

If there is sufficient pressure in the natural gas fuel line (10-20 psi), the unit can be started directly on natural gas. Follow the steps below:

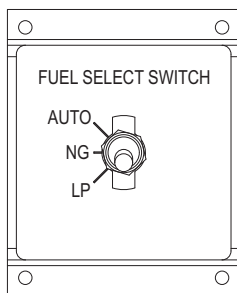
1. Before connecting the natural gas fuel line to the unit, apply pipe sealant to the NPT threads of the fitting at the end of the fuel line. Refer to *"Fuel Connections" on page 23* for pipe size information.

Note: Do not apply pipe sealant to the flared (flanged) end of the fitting.

2. Connect the fuel line to the two inch inlet, located on the right side of the frame.
3. Open the manual ball fuel valve located just inside the frame. Refer to *"MGG350N2 - Right Side" on page 12* for location.
4. Check for any leaks in the gas line.
5. Push the Start button on the digital controller. The controller will sense the type of fuel entering the system and will display ALI NG Fuel Select.

NOTICE

If the unit will not start, verify the fuel select switch, located behind the control panel door, is in the NG or Auto position.



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Figure 10 - Fuel Select Switch

LP Liquid Start Up

Purging the Natural Gas Fuel Line

1. Open the control door located at the back of the unit.
2. Remove the three screws securing the left control panel door. A fuel select switch is located behind the door. Refer to [Figure 2 on page 22](#).
3. Move the fuel select switch to the LP or Auto position.
4. Apply pipe sealant to the NPT threads of the pipe fitting at the end of the natural gas fuel line. Connect the fuel line to the 2 inch inlet located on the right side of the unit's frame. Refer to ["Fuel Connections" on page 23](#) for pipe size information.

Note: Do not apply pipe sealant to the flared (flanged) end of the fuel pipe.

5. Apply pipe sealant to the NPT threads of the pipe fitting at the end of the LP liquid fuel line. Connect the fuel line to the 1/2 inch inlet located on the right side of the unit's frame.
6. Open the LP liquid supply valve (on the tank) and the natural gas manual fuel valve, located inside the unit's frame (refer to [Figure 6 on page 12](#) for location). If any leaks are detected, correct them immediately.
7. Push the Start button on the digital controller.
8. When the natural gas pressure reaches 10-20 psi, move the fuel select switch to the NG position. (You may have to toggle the switch between NG and LP until the unit runs smoothly on NG.)
9. Move the switch to the Auto position.

Note: It will not be necessary to purge the fuel lines after shutting the unit down for maintenance or service unless the fuel lines are disconnected.

ENGINE OIL REPLENISHMENT SYSTEM

This unit is equipped with an engine oil replenishment system. The system eliminates the need for frequent filling and checking of the crankcase. The system consists of a oil reservoir tank and an oil level regulator. The regulator is mounted so the centerline of the sight glass is at the same height as the level of the oil in the crankcase. When the engine oil level is low, the float will trigger the reservoir tank to send fresh oil to the crankcase. The regulator delivers only that amount of oil required to maintain a constant oil level in the crankcase. A fine mesh screen in the regulator provides protection against damage by contaminants and abrasive foreign matter.

The regulator is pre-set to the correct level at the factory and should not require adjustment. Refer to ["Check Engine Oil Level" on page 36](#) for more information.

EMERGENCY STOP SWITCH

This unit is equipped with an emergency stop switch. The switch is located on the outside of the rear enclosure panel. Refer to ["Component Locations" on page 9](#). Activate the switch by pushing the red button in until it locks down. This will stop the engine. The switch will remain locked until the button is pulled out.

Note: Some units are equipped with an additional emergency stop switch on the control panel.

NOTICE

Use the emergency stop switch only when the unit must be shut down immediately. For any other shut down, refer to ["Shutting Down and Restarting an Operating Generator" on page 35](#).

FUEL CONNECTIONS

Almost all operation problems are related to the installation techniques used. **DO NOT** guess, be sure pipe size is adequate for required flow rate.

Note: Before connecting fuel lines to the unit, apply pipe sealant to the NPT threads of the end fitting. Do not apply pipe sealant to the flared (flanged) end of the fitting.

1. Connect the natural gas or LP liquid pipe line using the correct size pipe for the required flow rate and length of pipe. Refer to the tables for pipe size. Be certain that all connections are sealed and no leaks are present. The installer must ensure that all gas connections comply with all building codes.
2. Verify fuel supply pressure is adequate.

Natural Gas Connections

Use the formula and chart below to determine the supply pipe size for natural gas fuel.

Formula Example:

If a unit has a 160 hp engine 60 feet from the supply, the engine needs 10,000 BTU/hr per hp to run efficiently. For natural gas fuel, there are 1015 BTU/ft³. From [Table 1](#), a 60 foot run requires a minimum 1 inch pipe at full engine load.

160 hp x 10,000 BTU/Hr per hp = 1,600,000 BTU's / per hour for proper operation

$$\frac{1,600,000}{1,015} = 1576 \text{ cubic feet per hour}$$

Note: The incoming pressure must be approximately 20 psi to unit.

Table 1 - Natural Gas Flow Rate (ft³ / m³ Per Hour) per Pipe Length

Pipe Length	Iron Pipe Size											
	1/2 in (1 cm)	3/4 in (2 cm)	1 in (3 cm)	1-1/4 in (3 cm)	1-1/2" (4 cm)	2 in (5 cm)	2-1/2 in (6 cm)	3 in (8 cm)	3-1/2 in (9 cm)	4 in (10 cm)	5 in (13 cm)	6 in (15 cm)
10 ft (3 m)	2,723 ft (830 m)	5,765 ft (1,757 m)	10,975 ft (3,345 m)	22,804 ft (6,951 m)	34,398 ft (10,485 m)	66,973 ft (20,413 m)	107,577 ft (32,789 m)	191,989 ft (58,518 m)	282,890 ft (86,225 m)	396,270 ft (120,783 m)	724,020 ft (220,681 m)	1,181,799 ft (360,212 m)
20 ft (6 m)	1,926 ft (587 m)	4,076 ft (1,242 m)	7,760 ft (2,365 m)	16,125 ft (4,915 m)	24,323 ft (7,414 m)	47,357 ft (14,434 m)	76,068 ft (23,186 m)	135,757 ft (41,379 m)	200,034 ft (60,970 m)	280,205 ft (85,406 m)	511,959 ft (156,045 m)	838,658 ft (255,623 m)
25 ft (8 m)	1,722 ft (525 m)	3,646 ft (1,111 m)	6,941 ft (2,116 m)	14,422 ft (4,396 m)	21,755 ft (6,631 m)	42,358 ft (12,911 m)	68,037 ft (20,738 m)	121,424 ft (37,010 m)	178,915 ft (54,533 m)	250,623 ft (76,390 m)	457,910 ft (139,571 m)	747,435 ft (227,818 m)
30 ft (9 m)	1,572 ft (479 m)	3,328 ft (1,014 m)	6,336 ft (1,931 m)	13,166 ft (4,013 m)	19,860 ft (6,053 m)	38,667 ft (11,786 m)	62,109 ft (18,931 m)	110,845 ft (33,786 m)	163,327 ft (49,782 m)	228,787 ft (69,734 m)	418,013 ft (127,410 m)	682,312 ft (207,969 m)
35 ft (11 m)	1,456 ft (444 m)	3,082 ft (939 m)	5,866 ft (1,788 m)	12,189 ft (3,715 m)	18,386 ft (5,604 m)	35,799 ft (10,912 m)	57,502 ft (17,527 m)	102,622 ft (31,279 m)	151,211 ft (46,089 m)	211,815 ft (64,561 m)	387,005 ft (117,959 m)	631,698 ft (192,542 m)
40 ft (12 m)	1,362 ft (415 m)	2,883 ft (879 m)	5,487 ft (1,672 m)	11,402 ft (3,475 m)	17,199 ft (5,242 m)	33,487 ft (10,207 m)	53,788 ft (16,395 m)	95,994 ft (29,259 m)	141,445 ft (43,112 m)	198,135 ft (60,392 m)	362,010 ft (110,341 m)	590,900 ft (180,106 m)
45 ft (14 m)	1,284 ft (391 m)	2,718 ft (828 m)	5,174 ft (1,577 m)	10,750 ft (3,277 m)	16,215 ft (4,942 m)	31,572 ft (9,623 m)	50,712 ft (15,457 m)	90,504 ft (27,586 m)	133,356 ft (40,647 m)	186,804 ft (56,938 m)	341,306 ft (104,030 m)	557,105 ft (169,806 m)
50 ft (15 m)	1,218 ft (371 m)	2,578 ft (786 m)	4,908 ft (1,496 m)	10,198 ft (3,108 m)	15,383 ft (4,689 m)	29,951 ft (9,129 m)	48,110 ft (14,664 m)	85,860 ft (26,170 m)	126,512 ft (38,561 m)	177,217 ft (54,016 m)	323,791 ft (98,692 m)	528,517 ft (161,092 m)
60 ft (18 m)	1,112 ft (339 m)	2,354 ft (717 m)	4,480 ft (1,366 m)	9,310 ft (2,838 m)	14,043 ft (4,280 m)	27,342 ft (8,334 m)	43,918 ft (13,386 m)	78,379 ft (23,890 m)	115,489 ft (35,201 m)	161,777 ft (49,310 m)	295,580 ft (90,093 m)	482,467 ft (147,056 m)
70 ft (21 m)	1,029 ft (314 m)	2,179 ft (664 m)	4,148 ft (1,264 m)	8,619 ft (2,627 m)	13,001 ft (3,963 m)	25,314 ft (7,716 m)	40,660 ft (12,393 m)	72,565 ft (22,118 m)	106,922 ft (32,590 m)	149,776 ft (46,652 m)	273,654 ft (83,410 m)	446,678 ft (136,148 m)
80 ft (24 m)	963 ft (294 m)	2,038 ft (621 m)	3,880 ft (1,183 m)	8,062 ft (2,457 m)	12,161 ft (3,707 m)	23,679 ft (7,217 m)	38,034 ft (11,593 m)	67,878 ft (20,689 m)	100,017 ft (30,485 m)	140,103 ft (42,703 m)	255,980 ft (78,023 m)	417,829 ft (127,354 m)
90 ft (27 m)	908 ft (277 m)	1,922 ft (586 m)	3,658 ft (1,115 m)	7,601 ft (2,317 m)	11,466 ft (3,495 m)	22,324 ft (6,804 m)	35,859 ft (10,930 m)	63,996 ft (19,506 m)	94,297 ft (28,742 m)	132,090 ft (40,261 m)	241,340 ft (73,560 m)	393,933 ft (120,071 m)
100 ft (30 m)	861 ft (262 m)	1,823 ft (556 m)	3,471 ft (1,058 m)	7,211 ft (2,198 m)	10,878 ft (3,316 m)	21,179 ft (6,455 m)	34,019 ft (10,369 m)	60,712 ft (18,505 m)	89,458 ft (27,267 m)	125,312 ft (38,195 m)	228,955 ft (69,785 m)	373,718 ft (113,909 m)
125 ft (38 m)	770 ft (235 m)	1,631 ft (497 m)	3,104 ft (946 m)	6,450 ft (1,966 m)	9,729 ft (2,965 m)	18,943 ft (5,774 m)	30,427 ft (9,274 m)	54,303 ft (16,552 m)	80,013 ft (24,388 m)	112,082 ft (34,163 m)	204,784 ft (62,418 m)	334,263 ft (101,883 m)
150 ft (46 m)	703 ft (214 m)	1,489 ft (454 m)	2,834 ft (864 m)	5,888 ft (1,795 m)	8,881 ft (2,707 m)	1,292 ft (394 m)	27,776 ft (8,466 m)	49,571 ft (15,109 m)	73,042 ft (22,263 m)	102,317 ft (31,186 m)	186,941 ft (56,980 m)	305,139 ft (93,006 m)
200 ft (61 m)	609 ft (186 m)	1,289 ft (393 m)	2,454 ft (748 m)	5,099 ft (1,554 m)	7,692 ft (2,345 m)	14,976 ft (4,565 m)	24,055 ft (7,332 m)	42,930 ft (13,085 m)	63,256 ft (19,280 m)	88,609 ft (27,008 m)	161,896 ft (49,346 m)	264,258 ft (80,546 m)
300 ft (91 m)	497 ft (151 m)	1,053 ft (321 m)	2,004 ft (611 m)	4,163 ft (1,269 m)	6,280 ft (1,914 m)	12,228 ft (3,727 m)	19,641 ft (5,987 m)	35,052 ft (10,684 m)	51,648 ft (15,742 m)	72,349 ft (22,052 m)	132,187 ft (40,291 m)	215,766 ft (65,765 m)
400 ft (122 m)	431 ft (131 m)	912 ft (278 m)	1,735 ft (529 m)	3,606 ft (1,099 m)	5,439 ft (1,658 m)	10,589 ft (3,228 m)	17,009 ft (5,184 m)	30,356 ft (9,253 m)	44,729 ft (13,633 m)	62,656 ft (19,098 m)	114,478 ft (34,893 m)	186,859 ft (56,955 m)
500 ft (152 m)	385 ft (117 m)	815 ft (248 m)	152 ft (46 m)	3,225 ft (983 m)	4,865 ft (1,483 m)	9,471 ft (2,887 m)	15,214 ft (4,637 m)	27,151 ft (8,276 m)	40,007 ft (12,194 m)	56,041 ft (17,081 m)	102,392 ft (31,209 m)	167,132 ft (50,942 m)
1,000 ft (305 m)	272 ft (83 m)	577 ft (176 m)	1097 ft (334 m)	2,280 ft (695 m)	3,440 ft (1,049 m)	6,697 ft (2,041 m)	10,758 ft (3,279 m)	19,199 ft (5,852 m)	28,289 ft (8,622 m)	39,627 ft (12,078 m)	72,402 ft (22,068 m)	118,180 ft (36,021 m)
1,500 ft (457 m)	222 ft (68 m)	471 ft (144 m)	896 ft (273 m)	1,862 ft (568 m)	2,809 ft (856 m)	5,468 ft (1,667 m)	8,784 ft (2,677 m)	15,676 ft (4,778 m)	23,098 ft (7,040 m)	32,355 ft (9,862 m)	59,116 ft (18,019 m)	96,493 ft (29,411 m)
2,000 ft (610 m)	193 ft (59 m)	408 ft (124 m)	776 ft (237 m)	1,612 ft (491 m)	2,432 ft (741 m)	4,736 ft (1,444 m)	7,607 ft (2,319 m)	13,576 ft (4,138 m)	20,003 ft (6,097 m)	28,021 ft (8,541 m)	51,196 ft (15,605 m)	83,566 ft (25,471 m)

LP Liquid Connections (Liquid Withdrawal System)

Use the following chart to determine the supply pipe size for LP liquid.

Formula Example:

If a unit has a 135 hp engine 80 feet from the supply, the engine needs 449 ft³/hr of LP vapor to run efficiently. For liquid propane vapor fuel, there is 2500 BTU/ft³. From [Table 2](#), an 80 foot run requires a minimum 1/4 inch pipe at full engine load.

$$2500 \text{ ft}^3/\text{hr} \times 449 \text{ ft}^3/\text{hr} = 1,122,500 \text{ BTU}/\text{ft}^3$$

$$\frac{449 \text{ ft}^3/\text{hr}}{36.39^*} = 12.33 \text{ gallons per hour}$$

*Cubic feet of vapor at 60°F (16°C) per gallon of liquid at 60°F (16°C).

Table 2 - LP Liquid Line Sizing Chart

Liquid Propane Flow	Iron Pipe Size													
	1/4 in (0.6 cm)		3/8 in (1 cm)		1/2 in (1 cm)		3/4 in (2 cm)		1 in (3 cm)		1-1/4 in (3 cm)		1-1/2 in (4 cm)	
	Schedule		Schedule		Schedule		Schedule		Schedule		Schedule		Schedule	
	40	80	40	80	40	80	40	80	40	80	40	80	40	80
	Distance													
10 gal/hr (38 L/hr)	729 ft (222 m)	416 ft (127 m)	-	-	-	-	-	-	-	-	-	-	-	-
15 gal/hr (57 L/hr)	324 ft (99 m)	185 ft (56 m)	-	-	-	-	-	-	-	-	-	-	-	-
20 gal/hr (76 L/hr)	182 ft (55 m)	104 ft (32 m)	825 ft (251 m)	521 ft (159 m)	-	-	-	-	-	-	-	-	-	-
40 gal/hr (151 L/hr)	46 ft (14 m)	26 ft (8 m)	205 ft (62 m)	129 ft (39 m)	745 ft (227 m)	504 ft (154 m)	-	-	-	-	-	-	-	-
60 gal/hr (227 L/hr)	20 ft (6 m)	11 ft (3 m)	92 ft (28 m)	58 ft (18 m)	331 ft (101 m)	224 ft (68 m)	-	-	-	-	-	-	-	-
80 gal/hr (303 L/hr)	11 ft (3 m)	6 ft (2 m)	51 ft (16 m)	32 ft (10 m)	187 ft (57 m)	127 ft (39 m)	735 ft (224 m)	537 ft (164 m)	-	-	-	-	-	-
100 gal/hr (379 L/hr)	7 ft (2 m)	4 ft (1 m)	33 ft (10 m)	21 ft (6 m)	119 ft (36 m)	81 ft (25 m)	470 ft (143 m)	343 ft (105 m)	-	-	-	-	-	-
120 gal/hr (454 L/hr)	-	-	23 ft (7 m)	15 ft (5 m)	83 ft (25 m)	56 ft (17 m)	326 ft (99 m)	238 ft (73 m)	-	-	-	-	-	-
140 gal/hr (530 L/hr)	-	-	15 ft (5 m)	9 ft (3 m)	61 ft (19 m)	41 ft (12 m)	240 ft (73 m)	175 ft (53 m)	813 ft (248 m)	618 ft (188 m)	-	-	-	-
160 gal/hr (606 L/hr)	-	-	13 ft (4 m)	8 ft (2 m)	47 ft (14 m)	32 ft (10 m)	184 ft (56 m)	134 ft (41 m)	623 ft (190 m)	473 ft (144 m)	-	-	-	-
180 gal/hr (681 L/hr)	-	-	-	-	37 ft (11 m)	25 ft (8 m)	145 ft (44 m)	106 ft (32 m)	491 ft (150 m)	373 ft (114 m)	-	-	-	-
200 gal/hr (757 L/hr)	-	-	-	-	30 ft (9 m)	20 ft (6 m)	118 ft (36 m)	86 ft (26 m)	399 ft (122 m)	303 ft (92 m)	-	-	-	-
240 gal/hr (908 L/hr)	-	-	-	-	21 ft (6 m)	14 ft (4 m)	81 ft (25 m)	59 ft (18 m)	277 ft (84 m)	211 ft (64 m)	-	-	-	-
280 gal/hr (1,060 L/hr)	-	-	-	-	15 ft (5 m)	10 ft (3 m)	60 ft (18 m)	44 ft (13 m)	204 ft (62 m)	155 ft (47 m)	-	-	-	-
300 gal/hr (1,136 L/hr)	-	-	-	-	13 ft (4 m)	9 ft (3 m)	52 ft (16 m)	38 ft (12 m)	177 ft (54 m)	135 ft (41 m)	785 ft (239 m)	623 ft (190 m)	-	-
350 gal/hr (1,325 L/hr)	-	-	-	-	-	-	38 ft (12 m)	28 ft (9 m)	130 ft (40 m)	99 ft (30 m)	578 ft (176 m)	459 ft (140 m)	-	-
400 gal/hr (1,514 L/hr)	-	-	-	-	-	-	30 ft (9 m)	22 ft (7 m)	99 ft (30 m)	75 ft (23 m)	433 ft (132 m)	344 ft (105 m)	980 ft (299 m)	794 ft (242 m)

How to use chart:

1. Having determined the required flow at point of use, locate this flow in the left hand column. If this falls between two figures, use the larger of the two.
2. Determine total length of piping required from source to point of use.

3. Read across chart from left (required flow) to right to find the total length which is equal to, or exceeds, the distance from source to use.
4. From this point, read up to find the correct size of pipe required.

Valve and Fitting Pipe Equivalents

Table 3 - Valve & Fitting Pipe Equivalents

Fitting	Equivalent Length Of Steel Pipe													
	Nominal Pipe Size (NPT)													
	3/4 in (2 cm)		1 in (3 cm)		1-1/4 in (3 cm)		1-1/2 in (4 cm)		2 in (5 cm)		2-1/2 in (6 cm)		3 in (8 cm)	
	Schedule		Schedule		Schedule		Schedule		Schedule		Schedule		Schedule	
	40	80	40	80	40	80	40	80	40	80	40	80	40	80
45° Screwed Elbow	1.2 ft (0.4 m)	0.9 ft (0.3 m)	1.3 ft (0.4 m)	1.2 ft (0.4 m)	1.7 ft (0.5 m)	1.5 ft (0.5 m)	2.0 ft (0.6 m)	1.8 ft (0.5 m)	2.6 ft (0.8 m)	2.4 ft (0.7 m)	3.0 ft (0.9 m)	2.8 ft (0.9 m)	3.8 ft (1.2 m)	3.7 ft (1.1 m)
90° Screwed Elbow	1.8 ft (0.5 m)	1.6 ft (0.5 m)	2.3 ft (0.7 m)	2.1 ft (0.6 m)	3.1 ft (0.9 m)	2.9 ft (0.9 m)	3.7 ft (1.1 m)	3.4 ft (1.0 m)	4.6 ft (1.4 m)	4.4 ft (1.3 m)	5.3 ft (1.6 m)	5.1 ft (1.6 m)	6.9 ft (2.1 m)	6.5 ft (2.0 m)
Screwed T Thru Run	1.4 ft (0.4 m)	1.3 ft (0.4 m)	1.7 ft (0.5 m)	1.6 ft (0.5 m)	2.4 ft (0.7 m)	2.3 ft (0.7 m)	2.8 ft (0.9 m)	2.6 ft (0.8 m)	3.6 ft (1.1 m)	3.3 ft (1.0 m)	4.2 ft (1.3 m)	4.0 ft (1.2 m)	5.4 ft (1.6 m)	5.0 ft (1.5 m)
Screwed T Thru Branch	4.6 ft (1.4 m)	4.0 ft (1.2 m)	5.6 ft (1.7 m)	5.3 ft (1.6 m)	7.9 ft (2.4 m)	7.3 ft (2.2 m)	9.3 ft (2.8 m)	8.6 ft (2.6 m)	12.0 ft (3.7 m)	11.0 ft (3.4 m)	15.0 ft (4.6 m)	14.0 ft (4.3 m)	17.0 ft (5.2 m)	16.0 ft (4.9 m)
Screwed Globe Valve*	14.0 ft (4.3 m)	10.0 ft (3.0 m)	21.0 ft (6.4 m)	16.0 ft (4.9 m)	24.0 ft (7.3 m)	19.0 ft (5.8 m)	39.0 ft (11.9 m)	27.0 ft (8.2 m)	42.0 ft (12.8 m)	34.5 ft (10.5 m)	24.0 ft (7.3 m)	20.0 ft (6.1 m)	46.0 ft (14.0 m)	39.0 ft (11.9 m)
Screwed Angel Valve*	11.0 ft (3.4 m)	8.0 ft (2.4 m)	13.0 ft (4.0 m)	10.0 ft (3.0 m)	10.5 ft (3.2 m)	8.5 ft (2.6 m)	20.0 ft (6.1 m)	16.0 ft (4.9 m)	32.0 ft (9.8 m)	26.5 ft (8.1 m)	7.5 ft (2.3 m)	6.0 ft (1.8 m)	19.0 ft (5.8 m)	16.0 ft (4.9 m)
Flanged Globe Valve*	-	-	-	-	-	-	30.0 ft (9.1 m)	24.0 ft (7.3 m)	4.10 ft (1.2 m)	34.0 ft (10.4 m)	-	-	46.0 ft (14.0 m)	39.0 ft (11.9 m)
Flanged Angle Valve*	-	-	-	-	-	-	12.0 ft (3.7 m)	10.0 ft (3.0 m)	14.5 ft (4.4 m)	12.0 ft (3.7 m)	-	-	19.0 ft (5.8 m)	16.0 ft (4.9 m)

* Reg O A7500 series valves.

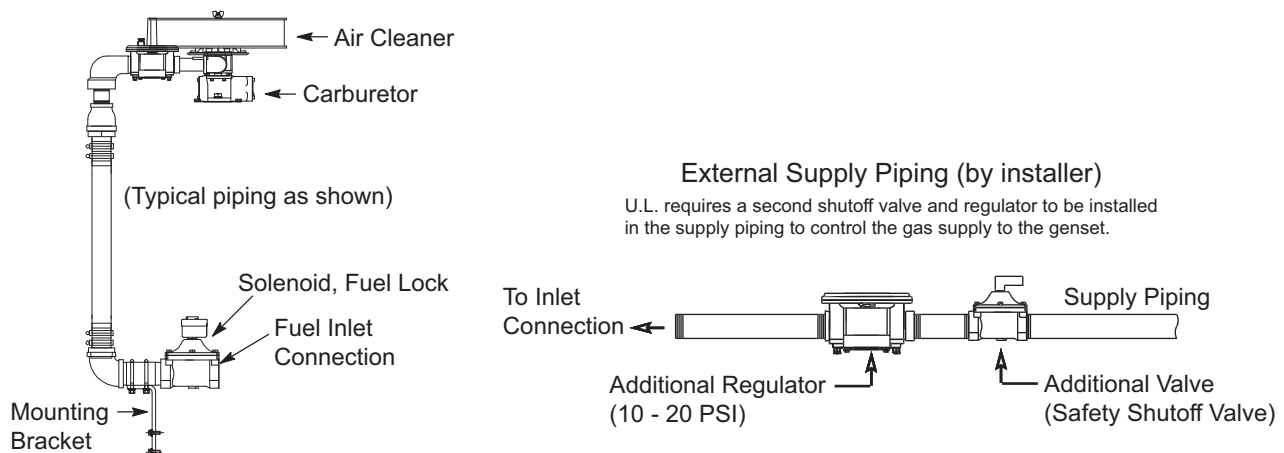


Figure 11 - Gas Line Connections

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TRANSFER SWITCH

If the unit is connected to an emergency power system, a transfer switch must be used. The emergency power system may include several gensets and several transfer switches. Multiple gensets can be arranged either in parallel or separately connected to dedicated emergency loads. *Figure 12* shows a typical arrangement of two gensets in parallel with transfer switches for loads that have different levels of priority. A typical multiple genset installation is shown for NFPA 110 level 1 and level 2 emergency power circuits and a priority control to select the appropriate transfer switch. For a wiring diagram of paralleling generators see “*CAN Parallel Communication Connection*” on page 59.

Wattmeters should be installed on each genset so load sharing can be checked. The control system includes an automatic paralleling control. Paralleling identical gensets is not difficult, but paralleling dissimilar sets can cause load sharing problems. When designing an installation that includes the paralleling of dissimilar generators, contract your Generac Mobile Products Authorized Dealer.

A typical transfer switch provides isolation to ensure that generator power and utility power can never be connected to a load at the same time. One or the other is permitted, both is never permitted. This ensures that generator power will not backfeed onto the utility power lines and harm utility workers and damage your own equipment.

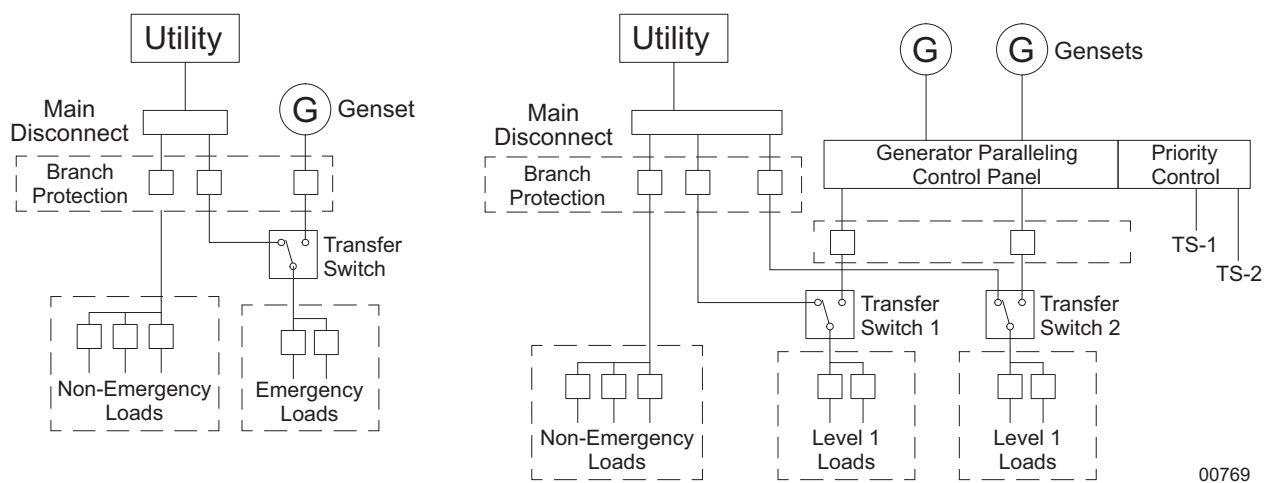


Figure 12 - Typical Emergency Power System Installations

The transfer switch location is important and key considerations are:

- Locate the transfer switch as close to the emergency load as practical to avoid interruptions of the emergency power system due to natural or man-made disasters, or to equipment failures. Consider several small transfer switches instead of one large one to increase reliability.
- Locate the transfer switch in a clean, dry, well ventilated location, away from excessive heat. When the ambient air is above 104°F (40°C), fuses and circuit breakers must be derated. Allow adequate working space around the transfer switch.
- A circuit breaker (or fuses) should be installed in the line between the generator and the transfer switch. Generac Mobile Product gensets are available with properly sized circuit breaker built into the generator control. The circuit breaker can be separately mounted. In the case of very large circuit breakers, a separate floor mounted circuit breaker is easier to wire up than a wall mounted breaker.
- Install power and control wires in separate solid conduit with flexible sections at the genset. The flexible sections prevent vibration from damaging the conduit. All power conduits from the genset must contain all three phases.
- Never install control wires in the same conduit as power conductors.
- Conduit, wire, circuit protective device sizes, insulation etc. must conform to applicable local and national codes and regulations.
- The transfer switch should be located near the main breaker box or the disconnect box.

- The transfer switch must be kept away from any location that might allow water to get on it.
- If the transfer switch is mounted outside, it must be protected from the environment and it's elements.
- Do not mount the transfer switch on the generator set.
- Do not mount the transfer switch where flammable liquids or vapors are present.

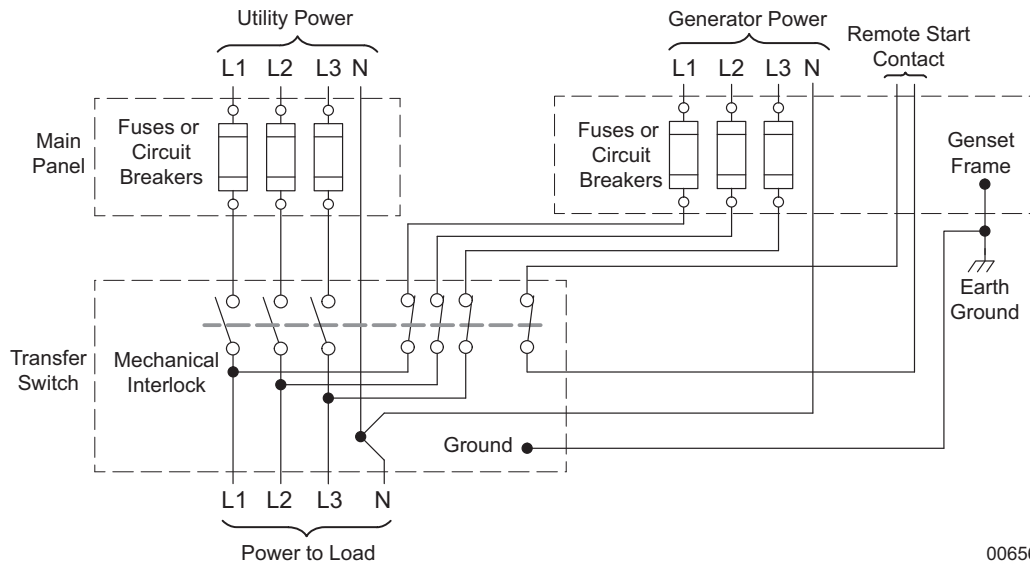


Figure 13 - Typical Transfer System

Electrical Connections

Class 1 wiring methods must be used for field wiring connections to terminals of a class 2 circuit. It is the responsibility of the owner/operator to arrange for these procedures to be performed by a licensed electrical contractor and ensure conformance to all applicable codes, including local codes specific to your municipality/city/county and state. Wire size and insulation type should be as required by National Electrical Code (NEC) and local codes.

⚠ WARNING

Never connect this unit to the electrical system of any building unless a licensed electrician has installed an approved transfer switch. The National Electrical Code (NEC) requires that connection of a generator to any electrical circuit normally powered by means of an electric utility must be connected by means of approved transfer switch equipment to isolate the electrical circuit from the utility distribution system when the generator is operating. Failure to isolate the electrical circuits by such means may result in injury or death to utility power workers due to backfeed of electrical energy onto the utility lines.

⚠ WARNING

Incorrect installation of this unit could result in property damage, injury or death. Connection of the unit to its fuel source must be done by a qualified professional technician or contractor.

⚠ WARNING

Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that grounds are connected. Electrical shock can cause serious or fatal injury. NEC requires that the frame and exposed conductive surfaces (metal parts) be connected to an approved earth ground. Local codes may also require proper grounding of generator systems.

GENERATOR OUTPUT CONNECTIONS

The unit is equipped with lug connections, located inside the customer connection box. The connection box is located behind the door on the right side of the unit. Refer to *Figure 5 on page 11*. The lugs provide connection points for attachment of external loads to the generator.

⚠ WARNING

It is **HIGHLY RECOMMENDED** that only a trained and licensed electrician perform any wiring and related connections to the generator. Installation should be in compliance with the National Electrical Code (NEC), state and local regulations. Failure to follow proper installation requirements may result in equipment or property damage, personal injury, or death.

⚠ WARNING

Before any connections are made to the generator, make sure that the main circuit breaker and the battery disconnect switch are in the OFF (O) position. Potentially lethal voltages may be present at the generator connection lugs.

Connections to the lugs should be made by running the power cables up through the opening in the bottom of the box. **DO NOT** make any connections directly to the lugs without routing the cables through the slot. Use a hex-wrench to tighten the cable connections.

The connection box door is equipped with a safety interlock switch that will trip the main circuit breaker and disable the voltage regulator if the door is opened while the unit is operating.

⚠ DANGER

NEVER ATTEMPT TO DISABLE OR MODIFY THE CONNECTION BOX DOOR SAFETY SWITCH. EQUIPMENT DAMAGE, PERSONAL INJURY OR DEATH MAY RESULT.

A ground connection is located next to the lugs. The generator neutral is bonded to ground when it is shipped from the factory. The bonding plate may need to be removed if the generator is used as a standby power source. **INSTALLATION SHOULD BE IN COMPLIANCE WITH THE NATIONAL ELECTRICAL CODE (NEC), STATE AND LOCAL REGULATIONS.**

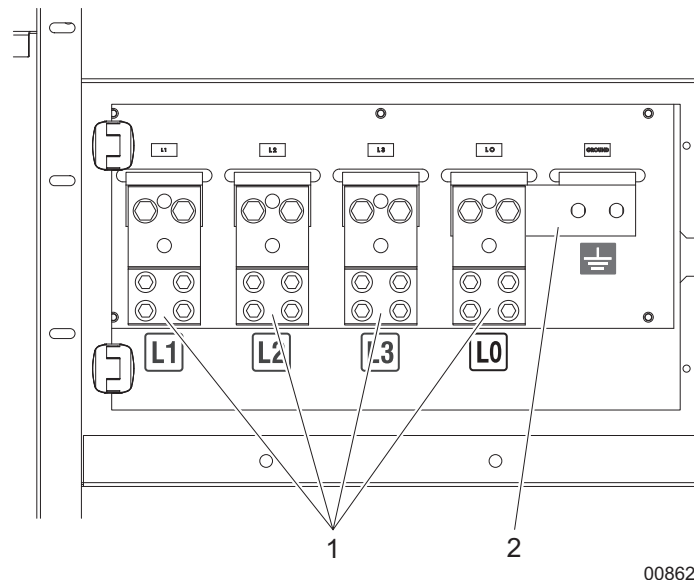


Figure 14 - Generator Output Connections

1. Connections lugs
2. Bonding plate

CUSTOMER CONVENIENCE RECEPTACLES

The unit is equipped with two 120V GFCI receptacles, located to the right of the customer connection box. These receptacles are not routed through the main circuit breaker. Each receptacle has its own circuit breaker, located directly above it.

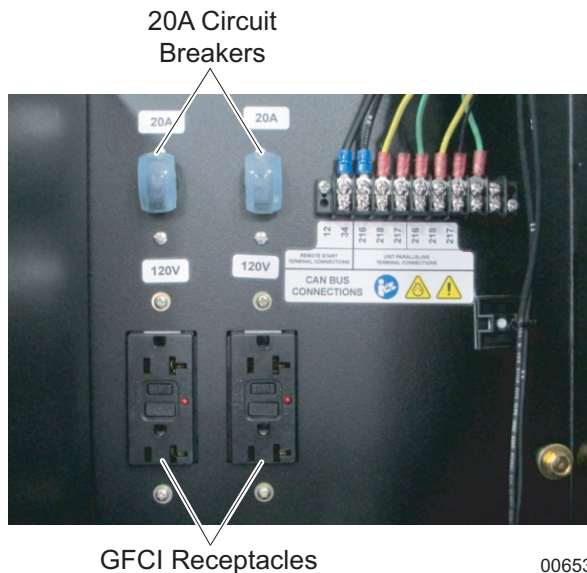


Figure 15 - 120V GFCI Receptacles

NOTICE

Power to the receptacles is available any time the generator is running, **EVEN IF THE MAIN CIRCUIT BREAKER IS OFF (O). MAKE SURE THAT ANY EQUIPMENT CONNECTED TO THE CONVENIENCE RECEPTACLES IS TURNED OFF BEFORE TURNING THE BREAKERS ON.** Make sure the output voltage is correct for the equipment that is connected to the receptacles. Improper voltage may cause equipment damage or malfunction.

GENERATOR CIRCUIT BREAKER

The generator circuit breaker is to the right of the control panel at the rear of the unit. When the breaker is in the OFF (O) position, power is interrupted between the lug connections and the generator. Once connections have been made to the lugs and the generator has been started and allowed to reach normal operating temperature, the breaker may be switched to the Auto position.

The generator circuit breaker will be tripped, disconnecting power to the lug connections, if any of the following conditions occur while the unit is running:

- Overload of the generator circuits to the bus connections connection. At 105% load, there will be an audible warning. At 110% load, the breaker opens and power will be disconnected.
- The customer connection box door is opened.
- If the emergency stop switch is activated.

Make sure that any problems that cause the main circuit breaker to trip are corrected before returning the switch to the Auto position.

⚠ WARNING

The main circuit breaker interrupts power to the lugs only. The customer convenience receptacles have power even if the main circuit breaker is in the OFF (O) position. To disconnect power to the convenience receptacles, use the individual circuit breakers located near each receptacle.

Remote Start

Connect the remote start contact (from transfer switch) to the remote start and connections located in the customer connection box.

Three Phase Power Connections

Output power connections must be fused within 25 feet of the unit. If the wires to the transfer switch are shorter than 25 feet, connect L1, L2, L3 and N to the transfer switch, being sure to follow the NEC and local codes. If the wires to the transfer switch are longer than 25 feet, UL requires that branch circuit protection be provided.

The bonding plate may have to be removed. Refer to the NEC and local codes.

Frame Ground Connection

It is important for safety reasons that the genset and transfer switch share a common ground and neutral.

The NEC may require that the frame and exposed metal surfaces be at local ground reference potential to avoid electrical shock hazard. A local ground reference may require a driven earth ground conductor at the unit installation site. Make the ground connection to the ground located on the outside of the frame. Refer to [Figure 16](#). Use the appropriate size wire as required by the NEC and local codes.



Figure 16 - Frame Ground Connection

Determine ground stud location and connect the ground wire to the “earth ground” terminal shown in [Figure 16](#). This ground is the local reference ground to ground the unit frame only.

General Wiring Considerations

- When routing the interface wiring, do not route it up against anything that could cut or chafe the wiring. Do not route the wire up against any hot or potentially hot object.
- Make sure that all the electrical components (generator set, transfer switch, etc.) share a common hard wired ground.
- Check with your local building inspector to determine what you must do to comply with the local regulations for grounding of this type of permanent installation.

⚠ WARNING

Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that grounds are connected. Electrical shock can cause serious or fatal injury. The NEC may require that the frame and exposed conductive surfaces (metal parts) be connected to an approved earth ground. Local codes may also require proper grounding of the unit.

⚠ CAUTION

This unit must have a battery installed for operation. The battery is used during starting and during operation. If engine operation is attempted while the battery is removed, damage to the engine's electrical components may result.

BATTERY CONNECTIONS

Installation and servicing of batteries is to be performed or supervised by personnel knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from batteries.

⚠ WARNING

Do not dispose of a battery or batteries in a fire. The battery is capable of exploding. If the battery explodes, electrolyte solution can be released in all directions. Battery electrolyte solution is caustic and can cause severe burns and blindness. If electrolyte contacts skin or eyes, immediately flush the area with water and seek medical attention quickly.

⚠ WARNING

Do not mutilate the battery. The battery contains electrolyte solution which is caustic and can cause severe burns and blindness. If electrolyte contacts skin or eyes, immediately flush the area with water and seek medical attention quickly.

A battery presents a risk of electrical shock hazard and high short circuit current, as well as being caustic and corrosive. The following precautions are to be followed when working on batteries:

- Remove watches, rings, necklaces and all other metal objects.
- Use tools with insulated handles.
- Wear rubber gloves and boots.
- Wear full eye protection (safety glasses or goggles) and protective clothing.
- Where electrolyte contacts the skin, flush the area immediately with water and wash it off using soap and water.
- Where electrolyte contacts the eyes, immediately flush the eye thoroughly with water and seek medical attention quickly.
- Spilled electrolyte is to be washed down with an acid neutralizing agent. A common practice is to use a solution of one pound (500 grams) bicarbonate of soda (baking soda) to one gallon (four liters) of water. The bicarbonate solution is to be added until evidence of reaction (foaming) has ceased. The resulting liquid is to be flushed with water and the area dried.

⚠ WARNING

A battery presents a risk of fire because they generate hydrogen gas. Hydrogen gas is extremely explosive. Never jump start a battery, smoke in the area around the battery or cause any spark to occur in the area around the battery.

- Do not smoke when near batteries.
- Do not cause flame or spark in battery area.
- Discharge static electricity from body before touching batteries by first touching a grounded metal surface.

⚠ WARNING

Disconnect the battery's ground terminal before working in the vicinity of the battery or battery wires. Contact with the battery can result in electrical shock when a tool accidentally touches the positive battery terminal or wire. The risk of such shock is reduced when the ground lead is removed during installation and maintenance.

Battery Disconnect Switch

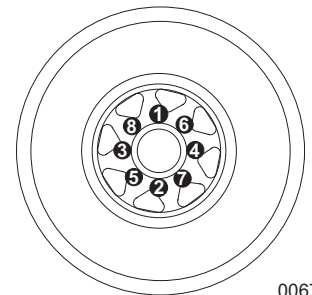
The unit is equipped with a battery disconnect switch which allows the operator to disconnect power from the batteries by turning the switch to the OFF position.

DERATING FOR ALTITUDE

All units are subject to derating for altitude and temperature; this will reduce the available power for operating tools and accessories connected to the receptacles. Typical reductions in performance are a derate of -3% for every 1000 ft (305 m) above 1200 ft (366 m) above sea level and a derate of -1% per 10°F (-12°C) increase in ambient air temperature over 77°F (25°C).

TOWING THE TRAILER

1. Use the jack to raise or lower the trailer onto the hitch of the towing vehicle. Lock the hitch coupling and attach the safety chains or cables to the vehicle. Raise the jack foot completely.
2. Connect any trailer wiring to the tow vehicle. Check for proper operation of the directional and brake lights.
3. Make sure all doors are properly latched.
4. Check for proper inflation of the trailer tires. For maximum tire pressures, refer to *"Specifications" on page 5*.
5. Check the wheel lugs. Tighten or replace any that are loose or missing. If a tire has been removed for axle service or replaced, tighten the lugs in the order shown to the following specifications:
6. Start all lug nuts by hand.
 - a. First pass tighten to 20-25 ft-lbs (27-33 Nm).
 - b. Second pass tighten to 50-60 ft-lbs (67-81 Nm).
 - c. Third pass tighten to 90-120 ft-lbs (122-162 Nm).



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Note: After the first road use, re-torque the lug nuts in sequence.

Maximum recommended speed for highway towing is 45 mph (72 km/h). Recommended off-road towing speed is not to exceed 10 mph (16 km/h) or less, depending on terrain.

TRAILER WHEEL BEARINGS

Some trailers are equipped with a grease zerk fitting to allow lubrication of the wheel bearings without the need to disassemble the axle hub. To lubricate the axle bearings, remove the small rubber plug on the grease cap, attach a standard grease gun fitting to the grease zerk fitting and pump grease into the fitting until new grease is visible around the nozzle of the grease gun. Use only a high quality grease made specifically for lubrication of wheel bearings. Wipe any excess grease from the hub with a clean cloth and replace the rubber plug when finished. The minimum recommended lubrication is every 12 months or 12,000 miles (19,312 km). More frequent lubrication may be required under extremely dusty or damp operating conditions.

Section 4 - Maintenance

Normal maintenance service and replacement of parts is the responsibility of the owner/operator and, as such, are not considered defects in materials or workmanship within the terms of the warranty. It is strongly recommended that the equipment be periodically checked by a Generac Mobile Products Authorized Dealer.

DISABLING A GENERATOR FOR MAINTENANCE

Shutting Down and Restarting an Operating Generator

1. Ensure that power to the load can be interrupted (warn any equipment users that there will be a temporary power disruption). There may be other procedures that must be done before shutting a unit down, depending on application.
2. Open the Main Circuit Breaker (MCB) by pushing the right I/O button on the controller.
3. Allow the unit to cool down (running at no-load) for approximately five minutes to prevent damage to critical engine components.
4. Turn the battery disconnect switch to the OFF position.
5. Perform the necessary maintenance checks or tasks (based on the hourly requirements).
6. When all checks have been completed and any discrepancies corrected, turn the battery disconnect to the ON position.
7. Ensure the correct fuel is selected (or in Auto position) at the fuel select switch. Refer to *“Starting The Unit” on page 21*.
8. Push the Start button on the controller.
9. When the unit is running, and all engine/generator parameters (voltage, frequency, coolant temp, oil pressure, etc.) have been verified as correct, close the Main Circuit Breaker (MCB) by pushing the right I/O button on the controller. The unit will accept and carry the load.
10. Make a last visual inspection of the unit to make sure it is operating properly.

MAINTENANCE TASKS

Daily checks must be performed when the unit is operated continuously for extended periods of time. Daily checks and routine monthly checks can be performed by an authorized operator.

Verify the trailer is level and the tires are blocked. Verify the radiator and exhaust areas are clear of debris.

Daily Walk Around Inspection

Look for conditions that could hinder performance or safety, such as (but not limited to) oil, coolant, gas (natural or LP) leakage, blocked vents, loose or missing hardware and electrical connections. Check for foreign matter blocking the vents and on top of the unit.

When the unit is not running:

- Visually inspect the fan belt for cracks, fraying and stretching. Ensure the belt is properly seated in the pulley grooves. Every 750 hours, it is recommended that the belt be removed and checked for wear. While the belt is removed, inspect pulleys and bearing. Rotate and feel for hard turning or unusual sounds.
- Coolant should be checked daily. Coolant should be visible in the sight glass located near the top of the radiator. Refer to *“Adding Coolant” on page 37*.

- Check the tire pressure. Refer to *“Specifications” on page 5* for maximum tire pressure.
- Check electrical connectors, battery and battery disconnect switch connections, and ground points. Look for loose or missing hardware.
- Check all flexible rubber hoses for deterioration.

Check Fuel System

Check fuel supply pressure. At the well fuel inlet, the well gas should be a minimum of 10 psi (69 kPa) and a maximum of 20 psi (138 kPa).

Check Engine Fluids

The following checks can be performed by a trained authorized operator. Observe all safety precautions outlined in *“Safety” on page 1*.

Check Engine Oil Level

An authorized operator should check the engine oil level daily. The oil level should be maintained between the “FULL” and “ADD” marks on the engine dipstick. Recommended fluids are listed in subsection *“Engine Oil Recommendations” on page 8*.

Check the level on the oil level regulator sight glass. The oil level should be about halfway up the sight glass when the engine is running. If not, adjust the regulator height by loosening the two screws on the regulator bracket and slowly sliding the regulator along the slots until the oil is at the proper level. Re-tighten the screws.

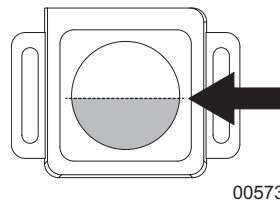


Figure 17 - Oil Level Sight Glass

This unit is equipped with an auxiliary engine oil reservoir. The level in the oil reservoir should be checked periodically and oil added as needed. Ensure the reservoir valve is open to allow oil to drain into the oil level regulator. Close the valve before moving the unit.

To check the engine oil using the dipstick:

1. Locate the engine oil dipstick. Refer to *“Component Locations” on page 9*.
2. The most accurate oil level readings are measured when the engine is cold. If the engine was running, wait at least 10 minutes before proceeding.
3. Remove the dipstick and wipe it dry with a clean, lint free cloth.
4. Slowly insert the clean dipstick into the tube. Visually confirm that the dipstick is fully seated in the dipstick tube. A visual inspection is required because some dipsticks will require more effort than others to fully seat.
5. After 10 seconds, remove the dipstick and look at the oil level on both sides. The lower of the two readings will be the correct oil level measurement.
6. Add oil (if necessary) to adjust the level. After adding or changing the oil, the engine should run for one minute before checking the oil level. Remember to wait 10 minutes to allow the engine to cool and oil to fully drain into the oil pan.

Typical causes of inaccurate oil level readings:

- Reading the high level of the dipstick.
- Reading the dipstick before the oil fully drains into the oil pan.
- Inserting and removing the dipstick too quickly.
- The dipstick is not fully seated in the dipstick tube.

Changing the Oil

Note: *When changing oil, it is not necessary to drain the oil from the reservoir.*

1. Close the valve below the oil reservoir.
2. Place a container below the oil drain port, located on the left side of the skid frame. Remove the oil drain plug with an allen head wrench.
3. Open the drain valve at the engine oil pan. Ensure the oil level regulator valve is open.
4. Allow the oil to drain completely into the container.
5. Remove the oil filter and discard it. Make sure the old gasket did not separate from the filter and become stuck to the engine. If so, remove the gasket and discard it.
6. Before installing the new oil filter, lubricate the new gasket with a thin film of clean engine oil.
7. Install the new oil filter, turning one full turn after initial gasket contact.
8. Close the engine oil drain valve and reinstall the plug at the skid frame drain port.
9. Remove the oil fill cap on the engine valve cover and add fresh oil. Refer to *“Specifications” on page 5* for oil capacities and *“Engine Oil Recommendations” on page 8* for oil type.
10. Check that the fuel level is between the “FULL” and “ADD” marks on the dipstick.
11. Open the oil reservoir valve.
12. Top off the oil in the reservoir.
13. There is no need to run the unit and re-check the oil level. The filter will automatically fill up with oil and the oil switch will allow the proper amount of oil to feed the engine until full.

Adding Coolant

Visually check the coolant level in the sight glass located near the top of the radiator. If coolant is not visible, coolant will need to be added to the system. Let engine cool (not at operating temperature, not running), before adding coolant. Add a 50/50 mixture of the correct antifreeze and distilled or deionized water to the coolant system.

▲ DANGER

**DO NOT REMOVE THE RADIATOR PRESSURE CAP WHILE THE ENGINE IS HOT.
SERIOUS BURNS FROM BOILING LIQUID OR STEAM COULD RESULT.**

⚠ DANGER

ETHYLENE GLYCOL BASE ANTIFREEZE IS POISONOUS. DO NOT USE MOUTH-TO-SIPHON COOLANT FROM THE RADIATOR, RECOVERY BOTTLE, OR ANY CONTAINER. WASH HANDS THOROUGHLY AFTER HANDLING. NEVER STORE USED ANTIFREEZE IN AN OPEN CONTAINER BECAUSE ANIMALS ARE ATTRACTED TO THE SMELL AND THE TASTE OF ANTIFREEZE EVEN THOUGH IT IS POISONOUS.

⚠ DANGER

DO NOT USE ANY CHROMATE BASE RUST INHIBITOR WITH PROPYLENE GLYCOL BASE ANTIFREEZE. USING ANY HIGH SILICATE ANTIFREEZE BOOSTERS OR ADDITIVES WILL CAUSE OVERHEATING. THE MANUFACTURER RECOMMENDS THAT NO SOLUBLE OIL INHIBITOR BE USED FOR THIS EQUIPMENT.

Integrated Electronic Pressure Regulator (IEPR) Maintenance and Inspection

If the IEPR fails to operate or develops a leak, it should be repaired or replaced with the OEM recommended replacement parts. When inspecting the system, check for the following items:

- Check for any fuel leaks at the inlet and outlet fittings.
- Check for any fuel leaks in the IEPR body.
- Check the inlet and outlet fittings of the coolant supply lines for water leaks, if applicable.
- Ensure the IEPR is securely mounted and the mounting bolts are tight.
- Check the IEPR for external damage.
- Check the IEPR electrical connection to ensure the connector is seated and locked.

Checking/Draining Oil Build-up in the Vaporizer Regulator

During the course of normal operation for LPG engines, oil or “heavy ends” may build inside the secondary chamber of the vaporizer regulator. These oil and heavy ends may be a result of poor fuel quality, contamination of the fuel, or regional variation of the fuel make up. A significant build up of oil can affect the performance of the secondary diaphragm response. It is recommended that the oil be drained periodically. Refer to the [“Maintenance Schedule” on page 39](#) for intervals. This is the minimum requirement to maintain the emission warranty.

We recommend that the vaporizer regulator be drained at every engine oil change if contaminated or sub-standard fuel is suspected or known to have been used. Failure to follow this recommendation may be used to deny a warranty claim.

Note: *Draining the regulator when the engine is warm will help the oils to flow freely from the regulator.*

To drain the regulator, follow the steps below:

1. Ensure the equipment is in a well-ventilated area and no external ignition sources are present.
2. Start the engine.
3. With the engine running, close the manual valve.
4. When the engine runs out of fuel, press the stop button on the controller and turn the battery disconnect switch to the OFF position.
5. Loosen the hose clamps at the inlet and outlet hoses on the regulator and remove the hoses.
6. Remove the regulator mounting bolts.

7. Place a small receptacle in the engine compartment under the regulator.
8. Rotate the regulator 90° so that the outlet fitting is pointing down into the receptacle and drain the regulator.
9. Inspect the secondary chamber of the regulator for any large dried particles and remove.
10. Rotate the regulator back to its original position and reinstall the regulator mounting bolts.
11. Remove the receptacle. Dispose of any drained material in a safe and proper manner.
12. Reinstall the fuel hoses.
13. Reconnect any other hoses removed during this procedure.
14. Slowly open the manual service valve.

Note: *The fuel cylinder manual valve contains an excess flow check valve. Open the manual valve slowly to prevent activation the excess flow check valve.*

15. Check for leaks at the inlet and outlet fittings using a soapy solution or an electronic leak detector. If leaks are detected, repair the leaks.
16. Check coolant line connection to ensure no leaks are present.
17. Start engine.
18. Recheck for leaks at the regulator.

MAINTENANCE SCHEDULE

Periodic inspection, service, and maintenance of this unit is critical in ensuring its reliable operation. The following is the manufacturer's recommended maintenance schedule. The maintenance items will need to be performed more frequently if the unit is used in severe applications (such as very high or very low ambient conditions or extremely dirty/dusty environments). Use the unit hour meter or calendar time, whichever occurs first, from the previous maintenance interval to determine the next required maintenance interval. Note that some checks are based on hours of operation.

Be sure to follow all applicable safety and caution statements found in the unit operating manual or engine service/maintenance manual before performing any maintenance checks or service.

This maintenance schedule reflects the minimum tasks that need to be accomplished to ensure that the unit remains operational. Some of the tasks can be performed by an authorized operator and others must be performed by an Authorized/Qualified Service Dealer Technician.

Note: *An authorized operator is one who has been trained by a Manufacturer Authorized Service Dealer in the proper operation and inspection of this unit.*

Use the schedule in the following table as a guide for regular maintenance intervals. For additional maintenance information, refer to the engine manual.

Item	Daily	First 50 Hours*	Every 750 Hours	8000 Hours (Annually)
General Maintenance				
Walk Around Inspection	◆			
Check Oil Level	◆			
Check Coolant Level	◆			
Check Tire Pressure	◆			
Check Belts	◆			
Check Electrical Wiring	◆			
Inspect Radiator for Signs of Obstruction or Damage	◆			
Inspect Gas Piping and Hoses for Leaks and Damage	◆			
Sample Engine Oil		◆	◆	◆
Change Oil, Replace Oil Filters**		◆	◆***	◆
Inspect/Replace Crankcase Ventilation Filters		◆	◆	◆
Check All Flex Hoses		◆	◆	◆
Check and Adjust Intake and Exhaust Valve Clearance		◆	◆	◆
Service Battery			◆	
Check Battery Connections and Disconnect Switch				◆
Lubricate Trailer Leveling Jacks				◆
Check Engine and Generator Mounts				◆
Engine Coolant				
Drain, Flush and Refill Cooling System				◆
Inspect Coolant Hoses		◆	◆	◆
Engine Ignition System				
Replace Spark Plugs			◆	◆
Replace Ignition Coils				◆
Fuel System				
Visually Inspect Air Filter (replace if necessary)		◆	◆	◆
Inspect Shutoff Valve for Leaks and Closing		◆	◆	◆
Check Engine Air Induction for Leaks		◆	◆	◆
Drain LPL Vaporizer Oil Build Up		◆	◆	◆
Engine Exhaust System				
Inspect Exhaust/Catalyst		◆	◆	◆

* Break-in period, one time.

**Actual oil life and change interval is determined through oil sampling and analysis. If operator is not sampling the oil regularly, recommended oil change is every 250 hours.

***Oil changes every 750 hours only in optimal conditions. Recommended oil change is every 250 hours.

JACK MAINTENANCE

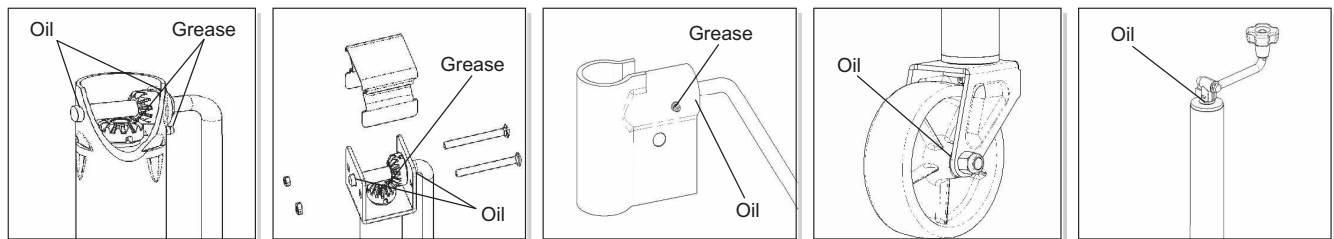
The following procedures should be performed at least annually.

Side-wind models

- The internal gearing and bushings of the jack must be kept lubricated. Apply a small amount of automotive grease to the internal gearing by removing the jack cover, or if equipped, use a needle nose applicator or standard grease gun on the lubrication point found on the side of the jack near the crank. Rotate the jack handle to distribute the grease evenly.
- A lightweight oil must be applied to the handle unit at both sides of the tube.
- If equipped, the axle bolt and nut assembly of the caster wheel must also be lubricated with the same lightweight oil.

Top-wind models

- Apply a lightweight oil to the screw stem.



00243

Figure 18 - Lubrication Points

Battery Inspection

⚠ DANGER

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 THAT HOUSES A STORAGE BATTERY MUST BE PROPERLY VENTILATED. DO NOT ALLOW SMOKING, OPEN FLAME, SPARKS, OR ANY SPARK PRODUCING TOOLS OR EQUIPMENT NEAR THE BATTERY.

⚠ CAUTION

Battery electrolyte fluid is an extremely caustic sulfuric acid solution that can cause severe burns. Do not permit fluid to contact eyes, skin, clothing, painted surfaces, etc. Wear protective goggles, protective clothing and gloves when handling a battery. If fluid is spilled, flush the affected area immediately with clear water.

DO NOT dispose of the battery in a fire. The battery is capable of exploding.

DO NOT open or mutilate the battery. Released electrolyte can be toxic and harmful to the skin and eyes.

The battery represents a risk of high short circuit current. When working on the battery, always remove watches, rings, or other metal objects, and only use tools that have insulated handles.

An authorized operator should inspect the engine battery system monthly. At this time, the battery fluid level should be checked and distilled water added if needed. Battery cables and connections should also be inspected for cleanliness and corrosion.

Once every six months, an Authorized Service Technician should inspect the battery system. At this time, the battery condition and state of charge should be checked using a battery hydrometer. The battery should be recharged or replaced as required.

Servicing of the battery is to be performed or supervised by personnel knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from batteries.

Observe the following precautions when working on batteries:

- Turn the battery disconnect switch to the OFF position.
- Remove the five amp controller fuse from the control panel.
- Remove watches, rings, or other metal objects.
- Use tools with insulated handles.
- Wear rubber gloves and boots.
- Do not lay tools or metal parts on top of the battery.
- Disconnect the charging source prior to connecting or disconnecting battery terminals.
- Wear full eye protection and protective clothing.
- Where electrolyte contacts the skin, wash it off immediately with water.
- Where electrolyte contacts the eyes, flush thoroughly and immediately with water and seek medical attention.
- Spilled electrolyte is to be washed down with an acid neutralizing agent. A common practice is to use a solution of one pound (500 grams) bicarbonate of soda (baking soda) to one gallon (four liters) of water. The bicarbonate of soda solution is to be added until the evidence of reaction (foaming) has ceased. The resulting liquid is to be flushed with water.

Lead-acid batteries present a risk of fire because they generate hydrogen gas.

- **DO NOT SMOKE** when near the battery.
- **DO NOT** cause flame or spark in battery area.
- Discharge static electricity from the body before touching the battery by first touching a grounded metal surface.

Note: A negative ground system is used. Battery connections are shown on the wiring diagrams. Make sure the battery is correctly connected and terminals are tight. Observe battery polarity when connecting the battery to the unit.

Battery Installation and Replacement

When required, the battery must be replaced with one of equivalent size, voltage, and CCA (cold crank amp capacity). Refer to [“Specifications” on page 5](#) or contact the local Authorized Service Dealer for proper battery sizing.

A new battery must be filled with the proper electrolyte and be fully charged before installing.

Preliminary Instructions

▲ 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)

1. Turn the battery disconnect switch to the OFF position.

Battery cables are connected to the generator connection points at the factory. Connect the cables to the battery posts as follows.

24VDC System

1. Connect the red battery cable from the starter contactor to the positive (POS or +) battery post.
2. Connect the black battery cable from the battery disconnect to the negative (NEG or -) battery post.
3. Attach the second black cable from the battery disconnect to the back of the engine.

⚠ CAUTION

Damage will result if the battery connections are made in reverse.

Final Instructions

1. Turn the battery disconnect switch to the ON position.
2. Refer to *“Starting The Unit” on page 21.*

Other Maintenance Checks

The following inspections should be performed by a qualified/authorized service technician, or a properly trained authorized operator. These maintenance items require a high level of experience and skill to evaluate and correct.

- Inspect engine accessory drive belts.
- Inspect hoses and connections.
- Inspect fuel supply system.
- Inspect exhaust system.
- Inspect exhaust pipe sleeve.

NOTICE

All recommended service maintenance or repairs should be completed by an authorized service technician to maintain the warranty status of a unit.

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Section 5 - Troubleshooting

Problems and Solutions

Some of the more common problems are listed in the table below. This information is intended to be a check or verification that simple causes can be located and fixed. It does not cover all types of problems. Procedures that require in-depth knowledge or skills (like flashing the field) should be referred to an authorized service department.

Table 4 - General Troubleshooting Guide

Problem	Possible Cause	Solution
Engine Cranks But Will Not Start	No fuel. Low oil level Restricted air flow. No spark.	Check that fuel valves are open. Low Oil Pressure Shutdown activated. Replenish oil to full. Check/replace air filter. Check/replace spark plug(s).
Engine Will Not Crank (Electric Start)	Dead battery. Emergency stop is activated.	Remove batteries and trickle charge. Never jump start. Even if only one battery is bad, it is recommended that both batteries be replaced at the same time. Reset controller after an emergency stop.
Engine Starts But Will Not Run Smoothly	Fuel or ignition problem.	Refer to engine manual. Contact Generac Mobile Products Technical Service.
Engine Overheats	Excessive load. Debris or dirt buildup on engine/radiator.	Remove one or more electrical loads. Remove debris. Clean engine surfaces to allow cooling.
No Output Voltage	Circuit breaker tripped or failed. Internal failure of alternator.	Reset circuit breaker or replace if required. Check electrical connections. Contact Generac Mobile Products Technical Service.
High Output Voltage	Excessive speed (fixed speed mode).	Check engine for malfunction. Verify engine RPM.
Electrical Shock When Frame Is Touched	Static charge. Grounded armature or field coil.	Ground unit frame at local reference ground. Contact service.
Mechanical Noise	Internal failure of alternator. Loose flexplate. Engine fan or belts issues.	Contact service. Tighten flexplate to flywheel and alternator shaft. Contact Generac Power Products Technical Service.

Table 5 - Digital Controller Troubleshooting Guide

Problem	Possible Cause	Solution
Controller Does Not Power Up Even With Correct DC Power Applied	Wiring mistake. Overload condition.	Check that there are no wiring errors/short circuits connected to the controller. Check breaker on the control panel. Check fuses on control panel.
LCD Display Cannot Be Viewed	Improper supply voltage. Improper contrast adjustment	Check DC supply voltage at terminals B+ & B- (10-30VDC). Adjust LCD contrast for best display.
Controller Cannot Be "Reset"	Engine not stopped. Controller not in OFF mode.	Verify the engine is at a complete stop before trying to reset. Set the controller to the OFF mode before trying to reset.

Table 5 - Digital Controller Troubleshooting Guide

Problem	Possible Cause	Solution
No "RUN" Output Signal	"Shutdown Faults" not reset. Engine speed not detected at cranking.	All shutdown faults must be reset (red shutdown LED must be off). Engine speed signal must be detected (speed signal green LED on) during cranking if the "run-output fail safe" feature is enabled. Verify correct magnetic pickup signal at cranking (2.0VAC min. during cranking).
Overspeed Shutdown Occurs At Normal Speed	Controller programmed values are wrong or controller has failed.	Verify the controller programmed values are correct for the number of flywheel teeth, nominal RPM, and overspeed set point percentage. Replace controller if failed.
Voltage Or Current Metering Is Incorrect	Controller programmed values are wrong. Ground is missing. Voltage sensing wiring mistake.	Verify the controller programmed values are correct for the voltage sensing PT ratio and/or current sensing CT ratio. Verify that the battery supply DC negative conductor is properly grounded to the engine block (i.e. to a common ground point). Verify the voltage sensing wiring connection to the controller matches power distribution type. NOTE: Standard direct voltage connection requires that the generator's neutral is solidly grounded.
Engine Temperature Or Oil Pressure Display Is Incorrect	Failed engine sensor. Ground is missing.	Verify engine sensors. NOTE: Engine sensors must be factory supplied units only. Verify that the battery supply DC negative conductor is properly grounded to the engine block (i.e. to a common ground point).
Engine Alarms Are On For High Engine Temperature Or Low Oil Pressure When Engine Is Operating Properly	Wrong temp or pressure calibration.	Verify the engine mounted senders have correct resistance values for corresponding input temperature or pressure. Verify calibration.
Keypad Buttons (Switches) Do Not Operate	Keypad not connected to controller.	Verify the interconnecting ribbon cable between the lexan faceplate and main printed circuit board is correctly connected. Replace controller if failed.

Table 6 - Digital Controller Alarm Abbreviations

AI	Analog Input
AO	Analog Output
ATS	Automatic Transfer Switch (switches load to supplied bus (by mains or generators))
AVR	Automatic Voltage Regulator
BI	Binary Input
BO	Binary Output
BOC	Breaker Open & Cool-down - protection type (see application manual for details)
BTB	Bus-Tie Breaker
CAN1	CAN bus for ComAp extension modules (e.g. IGS-PTM) and engine ECU connection
CAN2	CAN bus for communication between ComAp controllers and communication modules connection (e.g. I-LB+)

Table 6 - Digital Controller Alarm Abbreviations

COX	Application for Complex Systems where actions are taken by a PLC and controller only follows orders => needs an external driver (cox)
CT	Current Transformer
ECU	Engine Electronic Control Unit
ESF	Engine Specific File
Forward Synchronisation	Synchronisation of unloaded genset to mains (GCB closing process)
FMI	Failure Mode Identifier
GC	Graphical Characters - option for additional support of one "graphical" language
GCB	Generator Circuit Breaker
CHP	Combined Heat & Power - co-generation application, usually with gas engine
I-AOUT8	Extension module with 8 AO
I-CB	Communication Bridge - interfaces IS, IG/IS-NT, ID controllers and non-standard engine ECU
IG-AVRi	IG Automatic Voltage Regulator interface
IG-EE	InteliGen for Electronic Engines (HW optimized for connection to an engine equipped with ECU)
IG-EEC	InteliGen EE controller with extended communication possibilities + switchable sensing ranges of AC voltages and currents
IG-IB	IG-Internet Bridge - for internet/ethernet communication
IGL-RA15	Indication panel with LEDs signaling state of 15 BO
IG-NT	InteliGen New Technology gen-set controller
IG-NTC	InteliGen NT controller with extended communication possibilities + switchable sensing ranges of AC voltages and currents
IGS-NT-LSM+PMS	Dongle for IG-XX and IS-NT to enable Load Sharing and VAr sharing control loops and PMS
IGS-PTM	Extension module with 8 BI/BO, 4 AI and 1 AO
I-LB	Local Bridge – for direct and modem monitoring and control of multiple gen-sets
IM-NT	InteliMains New Technology - Mains supervision controller; the same controller with a different SW configuration can work as a bus-tie synchronizer
I-RB	Relay Board
IS-AIN8	Extension module with 8 AI
IS-BIN8/16	Extension module with 8 BO and 16 BI
IS-NT	InteliSys New technology gen-set controller
IS-NT-BB	InteliSys New Technology Basic Box (without display)
KWP2000	Key Word Protocol of Scania S6 unit (for engine diagnostics)
LAI	Logical Analog Inputs (card in GenConfig which is used to assign source signal to controller Logical Analog Input functions, e.g. Oil press)
LBI	Logical Binary Inputs (card in GenConfig which is used to assign source signal to controller Logical Binary Input functions, e.g. Sys Start/Stop)

Table 6 - Digital Controller Alarm Abbreviations

LS	Load Sharing - analog load sharing line to interconnect gen-sets on site (for island parallel or mains parallel operation of multiple gen-sets); IG/IS/IM-NT controllers use digital Load Sharing via the CAN2 bus
LSM	Load Sharing Module
LT	Option for Low Temperature modification (display equipped with heating foil)
MCB	Main Circuit Breaker
MGCB	Master Generator Circuit Breaker (sometimes used with multiple gen-sets in island parallel or mains parallel operation)
MINT	Multiple application with INTernal control loops - for multiple gen-sets in island parallel or mains parallel operation; Load Sharing and VAr Sharing controlled internally; PMS available
MP	Mains Protection
MultIsOp	Multiple Island Operation (MCB is opened, GCB's are closed)
MultParOp	Multiple Parallel Operation (MCB is closed, GCB's are closed)
NPU	Mains protection relay (voltage, frequency, vector shift protections)
OC	Occurrence Count (number of fault occurrences transmitted in diagnostic frame from ECU)
OfL	Off load - protection type (see application manual for details)
PF	Power Factor
PGN	Parameter Group Number (refer to SAE J1939-71)
PMS	Power Management System - ensures optimization of running gen-sets on sites with multiple gen-sets; based on kW/kVA spinning reserve or on relative (%) load; no-master system ensures high reliability
Reverse synchronisation	Synchronisation of loaded genset to mains (MCB closing process)
RTC	Real Time Clock
SG	Speed Governor
SHAIN	SHared (virtual) Analog INput module
SHAOUT	SHared (virtual) Analog OUTput module
SHBIN	SHared (virtual) Binary INput module
SHBOUT	SHared (virtual) Binary OUTput module
Soft load	Generator soft loading according to Load ramp loop setting
Soft unload	Generator soft unloading according to Load ramp loop setting
SPI	Single Parallel Island application - for single gen-sets in parallel with mains or in island operation; suitable for CHP applications; no MCB control
SPM	Single Prime Mover application - for single gen-sets without mains
SPN	Suspect Parameter Number (refer to SAE J1939-71)
SPTM	Single Parallel to Mains application - for single gen-sets in parallel with mains or in island operation, with AMF support; both MCB and GCB controlled

Table 6 - Digital Controller Alarm Abbreviations

SSB	Single Stand-By application - for single gen-sets with mains and break transfer to mains
VPIO	Virtual periphery I/O module – internal “SW wires” linking binary outputs to inputs controllers via inter-controller CAN2
VS	VAr Sharing - ensures VAr sharing between gen-sets on site via the CAN2 bus (for island parallel or mains parallel operation of multiple gen-sets)
VT	Voltage Transformer
#	Setting of setpoints (with this character in front of them) is shared between controllers controllers via inter-controller CAN2

Table 7 - Digital Controller List of Alarms

NT Alarm/History Record	Description
ECU	Indication of error in communication with ECU. Check if the ECU is: <ul style="list-style-type: none"> - correctly connected to the CAN1 port of the controller (refer to Comap Electronic Engines Support manual for information about ECU connection) - powered up - terminating resistors are properly connected - the CAN bus Low and High wires are not swapped
SHAIInCfgErr	Shared Analog module configuration error – i.e. more than one source module (SHAOUT) were configured (on the CAN2 bus). Make sure that only one SHAOUT x module is configured in controllers.
ECUdiagBlocked	Alarm is active when Comms settings: ECU diag = DISABLED . This setting means that ECU alarms are not displayed and considered by controller and this alarm is the setting notification.
Wrong config	Wrong controller configuration indication. Indicates that controller hardware doesn't support PLC used in configuration. To check it send the IDch and Dngl strings3 from controller Info screen 2 and archive to your technical support.
RTCbatteryFlat	This warning message "RTCbatteryFlat" appears in Alarmlist when battery is close to be completely flat. If power supply cut comes when the RTC battery is flat, the statistic values, history and setpoints settings are lost. Send a controller to your distributor for battery exchange if the RTCbatteryFlat message is displayed.
AI/Hist. msg 1-165	AI/Hist. msg 1-16 activity indication (AI/Hist. msg means Alarm/History message). AI/Hist. msg can be used as a customized message for additional protection configured to any controller internal value. See GenConfig manual - Protections.
Batt volt	Indication of battery voltage protection activity. This protection is based on Analog protect: Batt >V, Batt <V, and Batt volt del setpoints. Check if engine alternator or independent battery charger works properly.

Table 7 - Digital Controller List of Alarms

NT Alarm/History Record	Description
EarthFaultCurr	Indication of Earth fault current protection activity. This protection is based on Gener protect: <i>EarthFaultCurr</i> and <i>EthFltCurr del</i> setpoints. Setpoint <i>EarthFltCurrCT</i> from Basic settings group of setpoints is related to this protection too.
Gen V unbal	Generator voltage unbalance alarm is based on Gener protect: <i>Gen V unbal</i> and <i>Gen V unb del</i> setpoints. The voltage unbalance is calculated as a maximum difference between phase voltages.
Gen I unbal	Generator voltage unbalance alarm is based on Gener protect: <i>Gen V unbal</i> and <i>Gen V unb del</i> setpoints. The voltage unbalance is calculated as a maximum difference between phase voltages.
BusL I unbal	Left bus current asymmetry (unbalance) alarm is based on Gener protect: <i>BusL I unbal</i> and <i>BusL I unb del</i> setpoints. The current unbalance is calculated as a maximum difference between phase currents.
Mains V unbal	Mains voltage unbalance alarm is based on Mains protect: <i>Mains V unbal</i> and <i>MainsV unb del</i> setpoints. The voltage unbalance is calculated as a maximum difference between phase voltages.
Mains I unbal	Mains current asymmetry (unbalance) alarm is based on Mains protect: <i>Mains I unbal</i> and <i>Mains Iunb del</i> setpoints. The current unbalance is calculated as a maximum difference between phase currents.
Bus V unbal	Bus voltage unbalance alarm is based on Gener protect (Bus protect): <i>Bus V unbal</i> and <i>Bus V unb del</i> setpoints. The voltage unbalance is calculated as a maximum difference between phase voltages.
BusL V unbal	Left bus voltage unbalance alarm is based on BusL protect: <i>BusL V unbal</i> and <i>BusL V unb del</i> setpoints. The voltage unbalance is calculated as a maximum difference between phase voltages.
BusR V unbal	Right bus voltage unbalance alarm is based on BusR protect: <i>BusR V unbal</i> and <i>BusR V unb del</i> setpoints. The voltage unbalance is calculated as a maximum difference between phase voltages.
Dongle incomp	Incompatible (usually missing) dongle indication. IGS-NT-LSM+PMS dongle (green one) is required if load sharing and power management functions are used in MINT, COX or COMBI application. Check a Reference Guide for information whether a dongle is required for requested functionality or not.
Emergency stop	Emergency stop activity indication. Check binary input with <i>Emergency stop</i> function.
CAN2 bus empty	This alarm is active if controller doesn't "see" any other controllers on the CAN2 bus. Alarm activation can be enabled/disabled using setpoint Comm settings: <i>CAN2empt-Detect</i> . This setpoint should be set to DISABLED for single genset applications. Check Reg16/Reg32 strings to see which controllers are in the same group18.
ChrgAlternFail	Charger fail detection. This alarm means that voltage on the D+ terminal is lower than 80% of controller power supply voltage and it means that battery is no longer charged. Check function of engine alternator or independent battery charger.

Table 7 - Digital Controller List of Alarms

NT Alarm/History Record	Description
Sd Stop fail	<p>Engine stop fail indication. Stop fail means that engine does not reach “still engine” state within Engine params: Stop time.</p> <p>“Still engine” conditions:</p> <ul style="list-style-type: none"> - Engine speed (RPM) = 0 and - AI: Oil press < <i>Starting POil</i> and - D+ terminal is not active and - BI: RunIndication 1 and 2 and 3 are not active and - Generator voltage < 15V (in all phases) and - Generator frequency = 0 Hz <p>- if all these conditions are fulfilled, additional 2s delay is used to confirm “still engine” state.</p>
Overspeed	Gen-set over speed alarm is based on Engine protect: Overspeed setpoint setting.
Underspeed	Gen-set over speed alarm is based on Engine protect: Overspeed setpoint setting.
Pickup fail	<p>Pickup fail indication. Pickup fail means loss of RPM signal in running state (“engine running” state is active).</p> <p>“Engine running” conditions:</p> <ul style="list-style-type: none"> - Engine speed > Engine params: Starting RPM or - AI: Oil press > <i>Starting POil</i> or - D+ terminal active (this condition is used only if Engine params: D+ function = ENABLED) or - BI: RunIndication 1 or 2 or 3 is active or - Generator voltage > 15V (in any phase) <p>Refer to <i>Speed pick-up input</i> section in the Technical data chapter in IGS-NT-x.y.-Installation Guide manual for information about requested pick-up signal parameters.</p>
Sd BatteryFlat	Alarm is activated if controller “wakes up” after a start attempt which caused battery voltage drop (voltage drop below 6V) and consequently controller switch-off. ComAp I-LBA module may help to solve this problem, for information about this module, refer to IGS-NT-x.y.-Installation Guide manual.
WrnServiceTime	This alarm is activated when at least one of controller count down service timers Engine protect: Service time X has reached zero. It is necessary to set again a non-zero value to a corresponding setpoint to reset this alarm.
Not lubricated	This Alarm list message is active until the first lubrication cycle has been finished. Refer to <i>Engine states</i> chapter in IGS-NT-x.y.-Reference Guide.
Start fail	<p>This alarm is issued if genset start-up fails. It means that several crank attempts has been done (number of attempts is given by Engine params: Crank attempts) and engine did not start.</p> <p>For more information refer to <i>Engine starting procedures</i> chapter in IGS-NT-x.y.-Reference Guide.</p>
Start blocking	This message means that a binary input with Startblocking function is active and engine start is blocked. If active, NotReady state is shown on the controller screen and the message appears in the Alarm list. As soon as input is deactivated, engine start is enabled again.
Wrn CylTemp1-32	Warning protection on AI Cylinder temperature 1-32 is active. Check corresponding setpoints in the Engine protect group.
Wrn MCB fail	<p>MCB failure was detected.</p> <p>Refer to <i>Circuit breakers operation sequence, GCB/MCB fail detection</i> chapter in IGS-NT-x.y.-Reference Guide.</p>

Table 7 - Digital Controller List of Alarms

NT Alarm/History Record	Description
Stp GCB fail	GCB failure was detected. Refer to <i>Circuit breakers operation sequence, GCB/MCB fail detection</i> chapter in IGS-NT-x.y-Reference Guide.
Wrn BTB fail	BTB failure was detected. Refer to <i>Circuit breakers operation sequence, GCB/MCB fail detection</i> chapter in IGS-NT-x.y-Reference Guide. It applies to BTB breaker too.
Wrn MGCB fail	MGCB failure was detected. Refer to <i>Circuit breakers operation sequence, GCB/MCB fail detection</i> chapter in IGS-NT-x.y-Reference Guide. It applies to MGCB breaker too.
Sd Oil press B	Engine shut-down was activated by binary input with “Oil press” function (refer to LBI card in GenConfig for information about source signal for this function).
Wrn RSync fail	Reverse synchronization failure indication, genset or group of gensets was not synchronized to mains within Sync/Load ctrl: Sync timeout time. Check setting of setpoints in the Sync/Load ctrl and Volt/PF ctrl groups. Frequency regulation loop, Angle regulation loop and Voltage regulation loop are active during synchronisation and you may need to adjust their setting. Actual state of synchronization is visible on the controller measurement screen with synchroscope where speed and voltage regulator's outputs, slip frequency and generator and mains voltages can be observed during the synchronization process.
Stp Sync fail	Synchronization failure indication (alarm Sync timeout is active), gen-set or group of gensets was not synchronized to mains/bus within Sync/Load ctrl: Sync timeout time. Check setting of setpoints in the Sync/Load ctrl and Volt/PF ctrl groups. Frequency regulation loop, Angle regulation loop and Voltage regulation loop are active during synchronisation and you may need to adjust their setting. Actual state of synchronization is visible on the controller measurement screen with synchroscope where speed and voltage regulators' outputs, slip frequency and generator and mains/bus voltages can be observed during the synchronization process.
Wrn Sync fail	Synchronization failure indication (alarm Sync timeout is active), gen-set or group of gensets was not synchronized to mains/bus within Sync/Load ctrl: Sync timeout time. Check setting of setpoints in the Sync/Load ctrl and Volt/PF ctrl groups. Frequency regulation loop, Angle regulation loop and Voltage regulation loop are active during synchronisation and you may need to adjust their setting. Actual state of synchronization is visible on the controller measurement screen with synchroscope where speed and voltage regulators' outputs, slip frequency and generator and mains/bus voltages can be observed during the synchronization process.
BOC L1, L2 or L3 under	Generator L1, L2 or L3 voltage was under the <i>Gen <V BOC</i> limit for <i>Gen V del</i> time. Undervoltage protections are based on Gener protect: Gen <V BOC and <i>Gen V del</i> setpoints. This alarm is issued if voltage protections are based on phase to neutral voltages. It means that Basic settings: FixVoltProtSel is set to PHASE-NEUTRAL. 19
BOC L1, L2 or L3 over	Generator L1, L2 or L3 voltage was over the <i>Gen >V BOC</i> limit for <i>Gen V del</i> time. Overvoltage protections are based on Gener protect: Gen >V BOC and <i>Gen V del</i> setpoints. This alarm is issued if voltage protections are based on phase to neutral voltages. It means that Basic settings: FixVoltProtSel is set to PHASE-NEUTRAL. 19
Sd L1, L2 or L3 over	Generator L1, L2 or L3 voltage was over the <i>Gen >V SD</i> limit for <i>Gen V del</i> time. Overvoltage protections are based on Gener protect: Gen >V SD and <i>Gen V del</i> setpoints. This alarm is issued if voltage protections are based on phase to neutral voltages. It means that Basic settings: FixVoltProtSel is set to PHASE-NEUTRAL. 19

Table 7 - Digital Controller List of Alarms

NT Alarm/History Record	Description
BOC L12, L23 or L31 under	Generator L12, L23 or L31 voltage was under the <i>Gen <V BOC</i> limit for <i>Gen V del</i> time. Undervoltage protections are based on Gener protect: Gen <V BOC and <i>Gen V del</i> setpoints. This alarm is issued if voltage protections are based on phase to phase voltages. It means that Basic settings: FixVoltProtSel is set to PHASE-PHASE. 19
BOC L12, L23 or L31 over	Generator L12, L23 or L31 voltage was over the <i>Gen >V BOC</i> limit for <i>Gen V del</i> time. Overvoltage protections are based on Gener protect: Gen >V BOC and <i>Gen V del</i> setpoints. This alarm is issued if voltage protections are based on phase to phase voltages. It means that Basic settings: FixVoltProtSel is set to PHASE-PHASE. 19
Sd L12, L23 or L31 over	Generator L12, L23 or L31 voltage was over the <i>Gen >V SD</i> limit for <i>Gen V del</i> time. Overvoltage protections are based on Gener protect: Gen >V SD and <i>Gen V del</i> setpoints. This alarm is issued if voltage protections are based on phase to phase voltages. It means that Basic settings: FixVoltProtSel is set to PHASE-PHASE. 19
BOC fgen under	Generator frequency was under the <i>Gen <f</i> limit for <i>Gen f del</i> time. Under frequency protection is based on Gener protect: Gen <f and <i>Gen f del</i> setpoints. 20
BOC fgen over	Generator frequency was over the <i>Gen >f</i> limit for <i>Gen f del</i> time. Over frequency protection is based on Gener protect: Gen <f and <i>Gen f del</i> setpoints. 20
BOC ReversePwr	This alarm is issued by the reverse power protection. This protection is based on Gener protect: Reverse power and <i>ReversePwr del</i> setpoints. This alarm means that either engine speed/power control does not work properly or generator current transformers (CT's) are connected in a wrong way. 20
MP L1, L2 or L3 under	Mains L1, L2 or L3 voltage was under the <i>Mains <V MP</i> limit for <i>Mains V del</i> time. Undervoltage protections are based on Mains protect: Mains <V MP and <i>Mains V del</i> setpoints. This alarm is issued if voltage protections are based on phase to neutral voltages. It means that Basic settings: FixVoltProtSel is set to PHASE-NEUTRAL.
MP L1, L2 or L3 over	Mains L1, L2 or L3 voltage was over the <i>Mains >V MP</i> limit for <i>Mains V del</i> time. Overvoltage protections are based on Mains protect: Mains >V MP and <i>Mains V del</i> setpoints. This alarm is issued if voltage protections are based on phase to neutral voltages. It means that Basic settings: FixVoltProtSel is set to PHASE-NEUTRAL.
MP L12, L23 or L31 under	Mains L12, L23 or L31 voltage was under the <i>Mains <V MP</i> limit for <i>Mains V del</i> time. Undervoltage protections are based on Mains protect: Mains <V MP and <i>Mains V del</i> setpoints. This alarm is issued if voltage protections are based on phase to phase voltages. It means that Basic settings: FixVoltProtSel is set to PHASE-PHASE.
MP L12, L23 or L31 over	Mains L12, L23 or L31 voltage was over the <i>Mains >V MP</i> limit for <i>Mains V del</i> time. Overvoltage protections are based on Mains protect: Mains >V MP and <i>Mains V del</i> setpoints. This alarm is issued if voltage protections are based on phase to phase voltages. It means that Basic settings: FixVoltProtSel is set to PHASE-PHASE.
Mains Avg x >V	If the value of 10 min. average mains voltage of any phase (<i>Mains Avg V1</i> , <i>Mains Avg V2</i> , <i>Mains Avg V3</i>) exceed value given by setpoint <i>Mains Avg >V MP</i> (<i>Mains protect</i> group), the MCB is opened and message <i>Mains Avg x >V</i> appears in alarm list and history record. <i>BO Common MP</i> is activated (<i>x indicates number of phase</i>).
MP fmns under	Mains frequency was under the <i>Mains <f</i> limit for <i>Mains f del</i> time. Under frequency protection is based on Mains protect: Mains <f and <i>Mains f del</i> setpoints.
MP fmns over	Mains frequency was over the <i>Mains >f</i> limit for <i>Mains f del</i> time. Over frequency protection is based on Mains protect: Mains >f and <i>Mains f del</i> setpoints.

Table 7 - Digital Controller List of Alarms

NT Alarm/History Record	Description
Bus meas error	Bus measurement error is issued if bus voltage is out of limits. For details, refer to description of the Gener protect: BusMeasError setpoint in IGS-NT-x.y-Reference Guide.
OfL StartBlick	This alarm indicates wrong setpoints setting that disables engine start or load takeover. Incorrect combination of ProcessControl: Island enable; ParallelEnable; Synchro enable; MF start enable setpoints setting is the reason why this alarm is issued. Refer to <i>AUT mode</i> section of the <i>OFF-MAN-AUT mode</i> chapter in IGS-NT-x.y-Reference Guide for SPTM, SPI or COMBI application.
StartBlick	This alarm indicates wrong setpoints setting that disables start of gensets. Incorrect combination of ProcessControl: Island enable; ParallelEnable; Synchro enable; MF start enable setpoints setting is the reason why this alarm is issued. Refer to <i>OFF-MAN-AUT mode</i> chapter in IM-NT-MCB-MGCB Reference Guide.
BOC IDMT	Indicates current IDMT protection activation. Current IDMT protection is inverse definite minimum time protection which is based on the generator current. Protection reaction time depends on overcurrent value. High overcurrent means short reaction time whereas low overcurrent means longer reaction time. Protection is based on setpoints Generator protect: 2Inom del and Basic settings: Nomin current .
MPR Imains IDMT	Indicates current IDMT protection activation. Current IDMT protection is inverse definite minimum time protection which is based on the mains current. Protection reaction time depends on overcurrent value. High overcurrent means short reaction time whereas low overcurrent means longer reaction time. This protection is active if the <i>Mns2Inom prot</i> setpoint is set to ENABLED. Protection is based on setpoints Mains protect: Mains2Inom del and Basic settings: Nomin current .
BOR IbusL IDMT	Indicates current IDMT protection activation. Current IDMT protection is inverse definite minimum time protection which is based on the left bus current. Protection reaction time depends on overcurrent value. High overcurrent means short reaction time whereas low overcurrent means longer reaction time. This protection is active if the <i>BusL2Inom prot</i> setpoint is set to ENABLED. Protection is based on setpoints BusL protect: BusL2Inom del and Basic settings: Nomin current .
BOC ShortCurr	Generator short current protection was activated. Generator current was over Generator protect: Ishort level for <i>Ishort del</i> time.
BOC Overload	Indicates overload IDMT protection activation. Overload IDMT protection is inverse definite minimum time protection which is based on the generator power. Protection reaction time depends on generator power value. High generator overload means short reaction time whereas low generator overload means longer reaction time. Protection is based on setpoints Generator protect: OverldStrtEval and <i>2POverldStEvDel</i> .
MPR Pmains IDMT	Indicates overload IDMT protection activation. Overload IDMT protection is inverse definite minimum time protection which is based on the mains power. Protection reaction time depends on mains power value. High mains overload means short reaction time whereas low mains overload means longer reaction time. This protection is active if the <i>Mns2POvrldProt</i> setpoint is set to ENABLED. Protection is based on setpoints Mains protect: OverldStrtEval and <i>2POverldStEvDel</i> .
BOR PbusL IDMT	Indicates overload IDMT protection activation. Overload IDMT protection is inverse definite minimum time protection which is based on the left bus power. Protection reaction time depends on the left bus power value. High left bus overload means short reaction time whereas low left bus overload means longer reaction time. This protection is active if the <i>BusL2POvrldProt</i> setpoint is set to ENABLED. Protection is based on setpoints BusL protect: OverldStrtEval and <i>2POverldStEvDel</i> .

Table 7 - Digital Controller List of Alarms

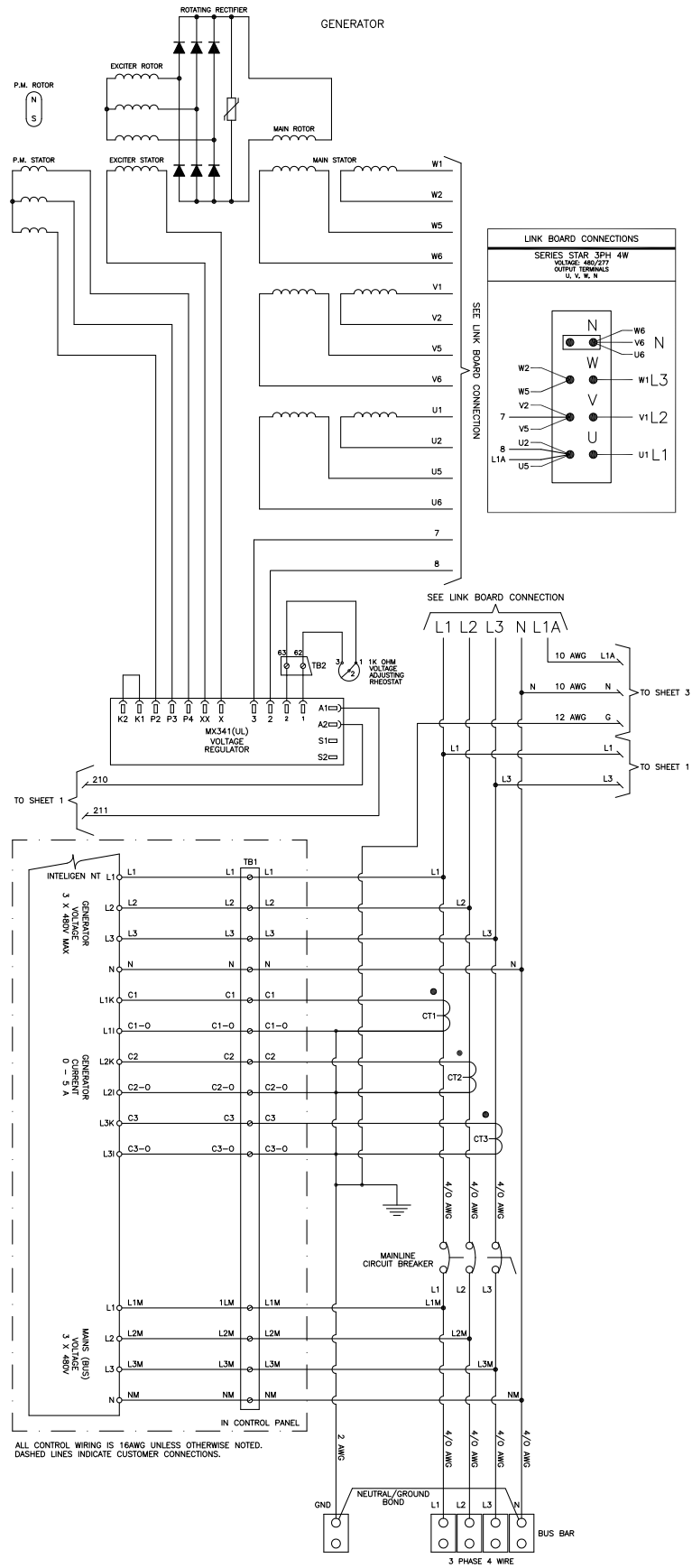
NT Alarm/History Record	Description
BOC NCB fail	NCB fail is detected if the <i>NeutralCB fdb</i> input doesn't follow <i>Neutral CB C/O</i> output within 400 ms.
Wrn BadPwrCfg	Power format is set differently in controllers which are part of the same control group. Check Power formats setting in GenConfig on the Miscellaneous card (available in the Advanced mode only).
WrnTstOnLdFail	This alarm is issued if the Test on load function is activated (by closing corresponding BI) and genset is not able to take over mains load completely (mains import = 0) within the Sync/Load ctrl: Load ramp time. Message "WrnTstOnLdFail" is recorded into controller history in case of this failure. It is either necessary to extend the <i>Load ramp</i> time or check engine speed regulation.
Wrn SpdRegLim	This alarm indicates that controller Speed governor output has reached its limit. Warning is issued if Speed governor output stays close to one of the limit values for more than 2 seconds. Close to one of the limits means that Speed governor output value is within SpeedGovLowLim+0,2V range or SpeedGovHiLim-0,2V range. This alarm gives you information that engine speed governor is either connected in a wrong way or one of the speed control related regulation loops6 is set in a wrong way. Warning is blocked if binary output functions SPEED up and SPEED down are configured. Refer also to <i>Sync/load control</i> .
Wrn VoltRegLim	This alarm indicates that controller AVRi output has reached its limit. Warning is issued if the AVRi output stays close to 0% or 100% limit for more than 2 seconds. Close to limit means that AVRi output value is either <2% or >98%. This alarm gives you information that generator voltage regulator is either connected in a wrong way or one of the voltage control related regulation loops7 is set in a wrong way. Warning is blocked if binary output functions AVR up or AVR down are configured. Refer also to <i>Volt/PF control adjustment</i> chapter in an IGS-NT-x.y-Reference Guide.
G L neg8	Generator phase is inverted. Check generator phases connection, one of generator phases is connected the other way round (swap generator coil leads connection).
G ph+L neg8	Wrong generator phases sequence, additionally one phase is inverted.
G ph opposed8	Wrong generator phases sequence
M L neg9	Mains phase is inverted. Check mains transformer phases connection, one of transformer phases is connected the other way round (swap transformer coil leads connection).
M ph+L neg9	Wrong mains phases sequence, additionally one phase is inverted.
M ph opposed9	Wrong mains phases sequence.
B L neg13	Bus phase is inverted.
B ph+L neg13	Wrong bus phases sequence, additionally one phase is inverted.
B ph opposed13	Wrong bus phases sequence.
BL L neg12	Left bus phase is inverted.
BL ph+L neg12	Wrong left bus phases sequence, additionally one phase is inverted.
BL ph opposed	Wrong left bus phases sequence.
BR L neg	Right bus phase is inverted.
BR ph+L neg	Wrong right bus phases sequence, additionally one phase is inverted.

Table 7 - Digital Controller List of Alarms

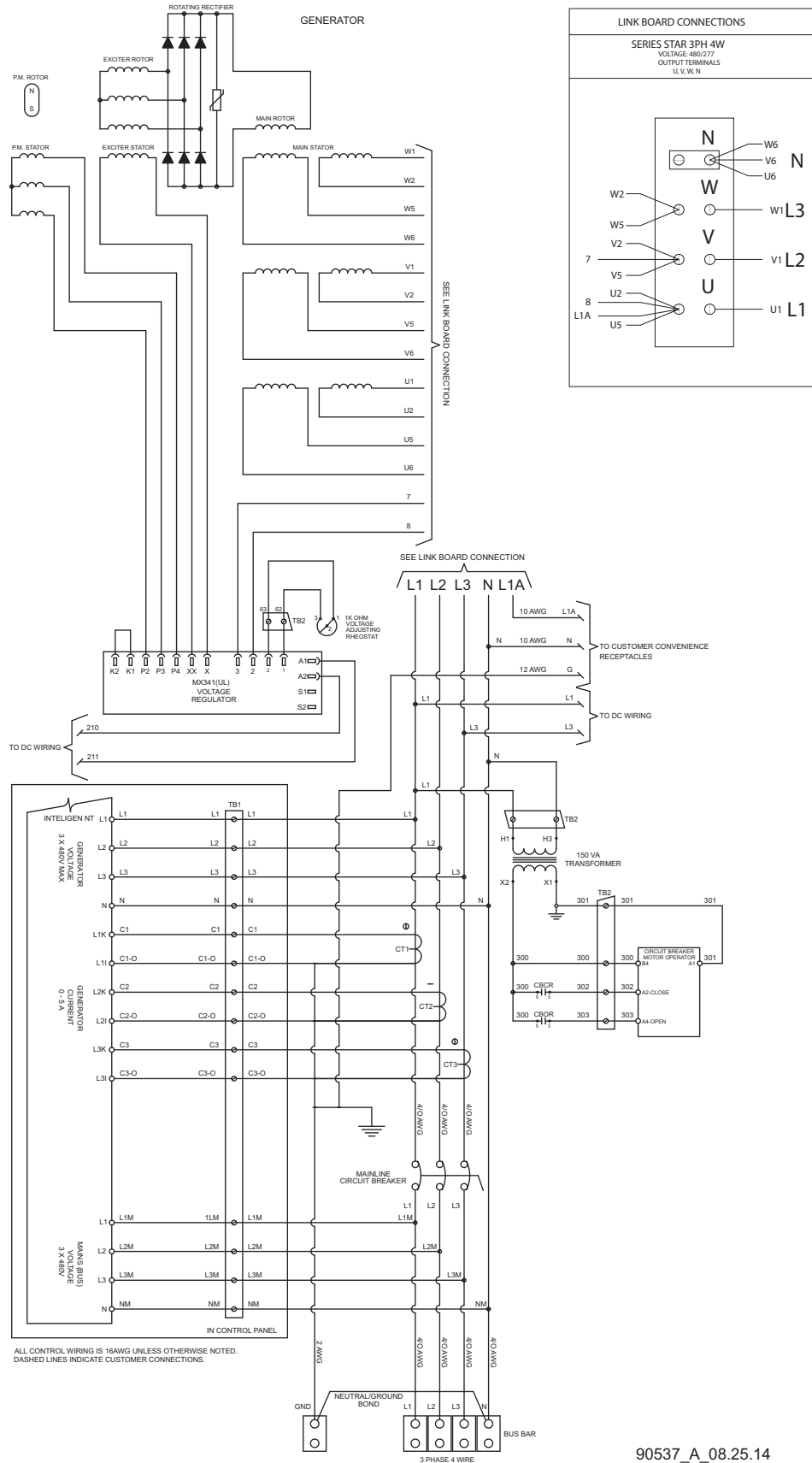
<p align="center">NT Alarm/History Record</p>	<p align="center">Description</p>
<p>BR ph opposed</p>	<p>Wrong right bus phases sequence.</p>
<p>ActCallCH1Fail, CH2Fail, CH3-Fail</p>	<p>Indication of unsuccessful active call 1-3. Refer to Inteli Communication Guide for information about active calls. Refer to the IGS-NT-x.y-Reference Guide for description of setpoints which are part of the Act.calls/SMS group and are used for active call setup.</p>
<p>PassInsertBlck</p>	<p>Break through password function can be ENABLED/DISABLED from the password management window in InteliMonitor (initial status is DISABLED). Warning "<i>PassInsertBlck</i>" appears in alarm list when controller is blocked. It is not allowed to insert the password in case that controller is blocked. There is information that controller is blocked for next password attempt and time remaining till the end of blocation instead of password input window at the terminal screen. The controller is locked for 5 minutes when the password is wrongly entered six times (in case of next six wrong attempts (correct password was not inserted at all) for 30, 60, 120, 240 minutes). <i>Incorrect password</i> message appears in the history of the controller when the invalid password is used.</p>

Section 6 - Wiring Diagrams

AC WIRING—MGG280N2-G34

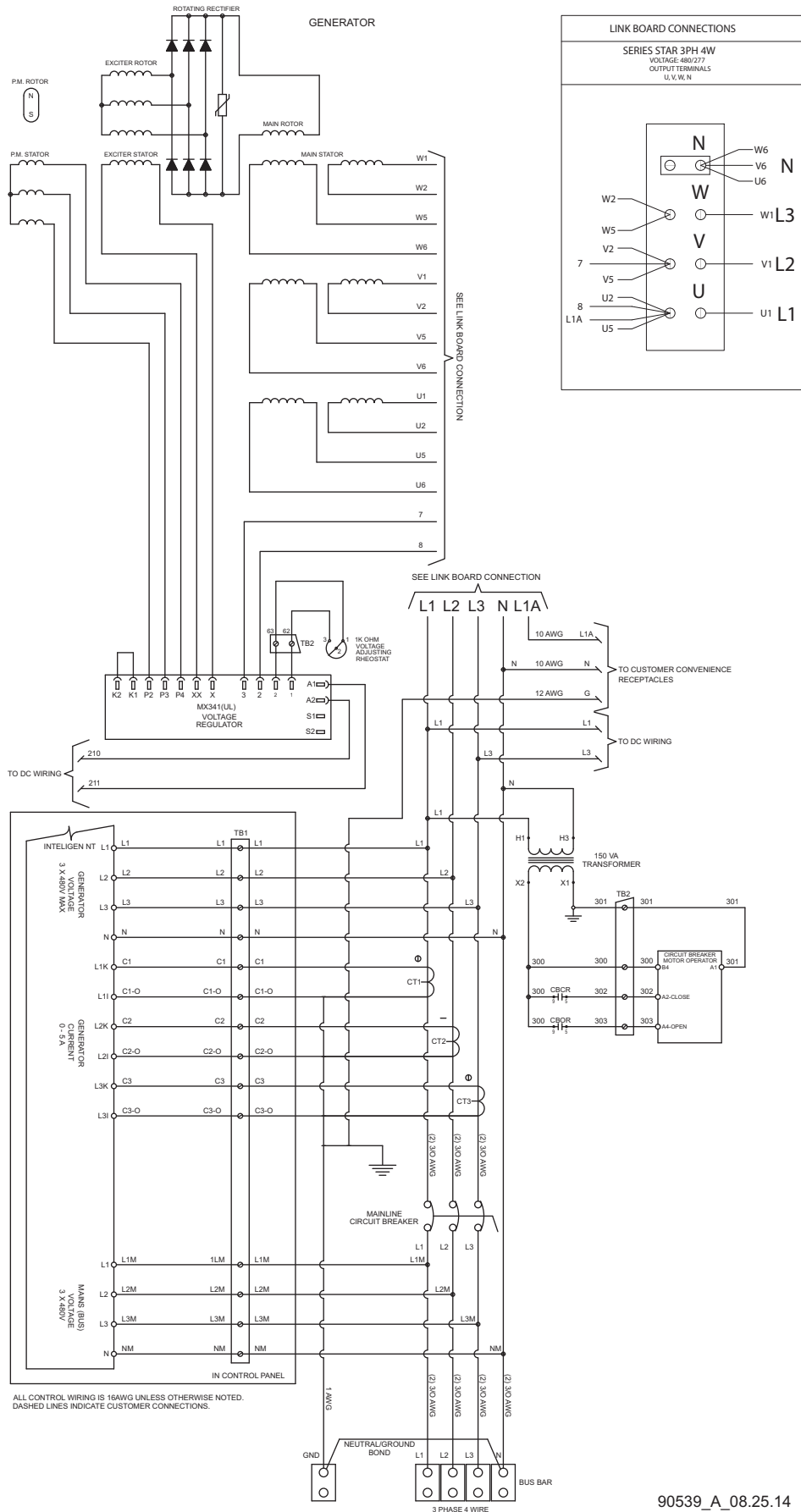


AC WIRING—MGG280N2-G25



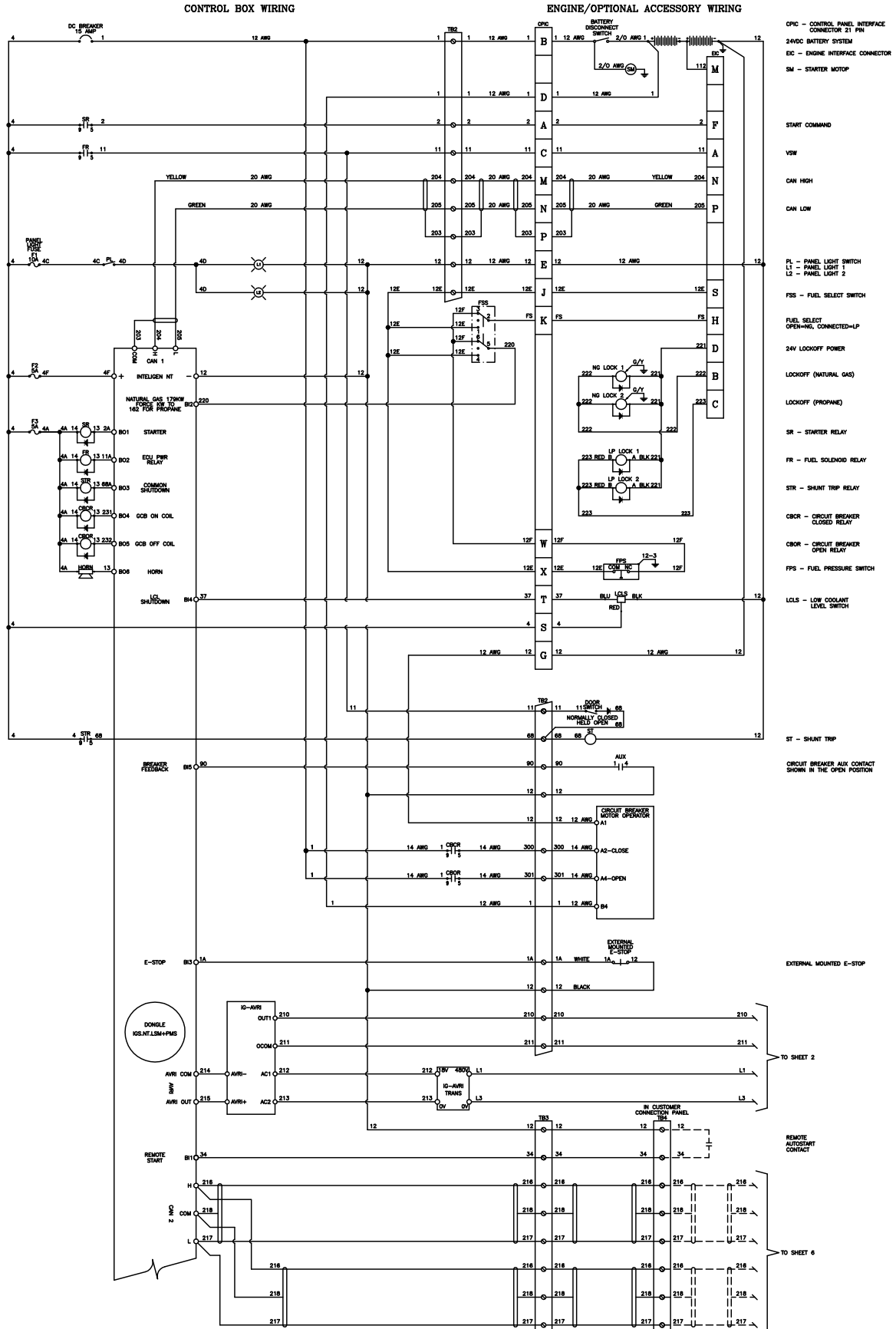
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AC WIRING—MGG350N2-G23



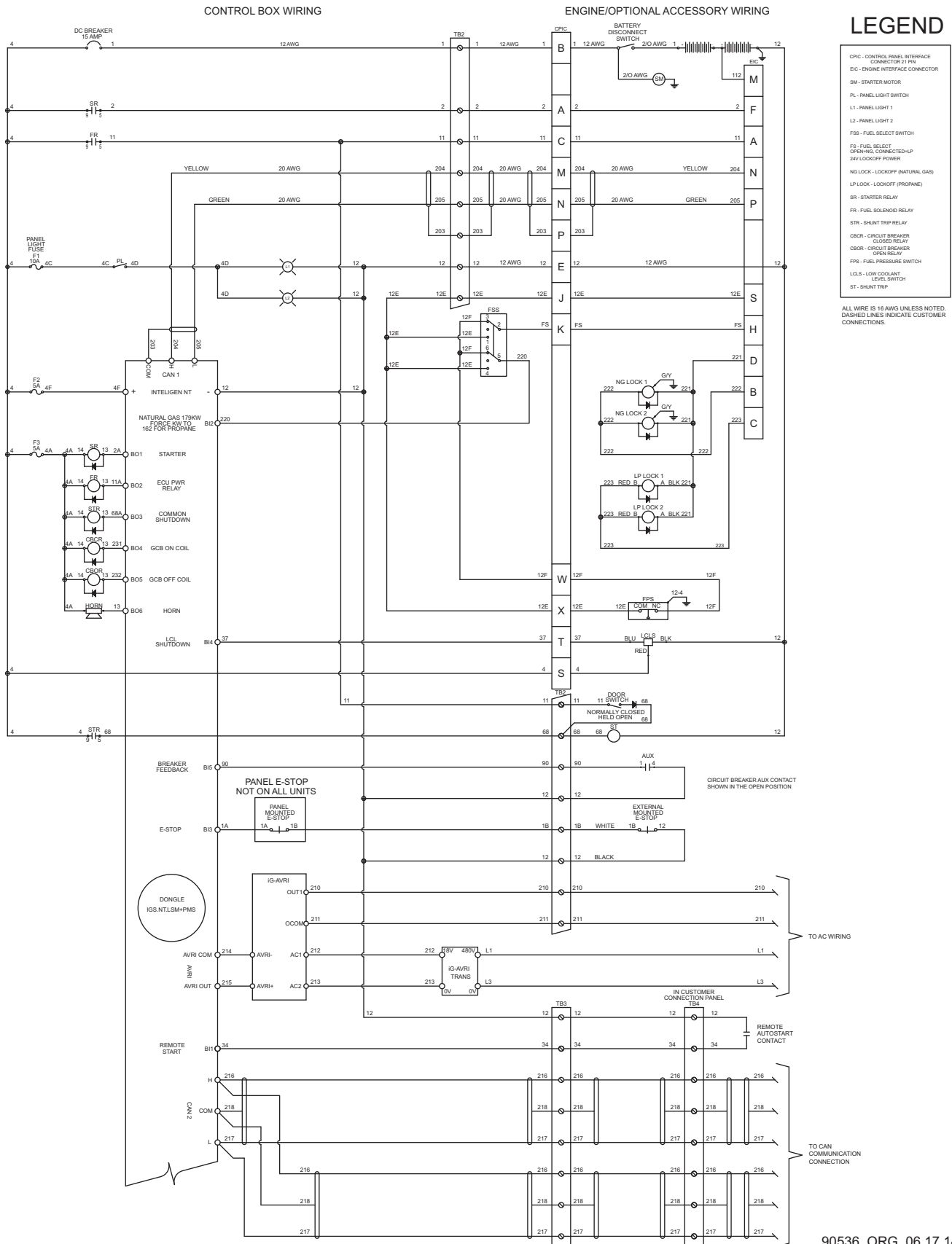
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DC WIRING—MGG280N2-G34

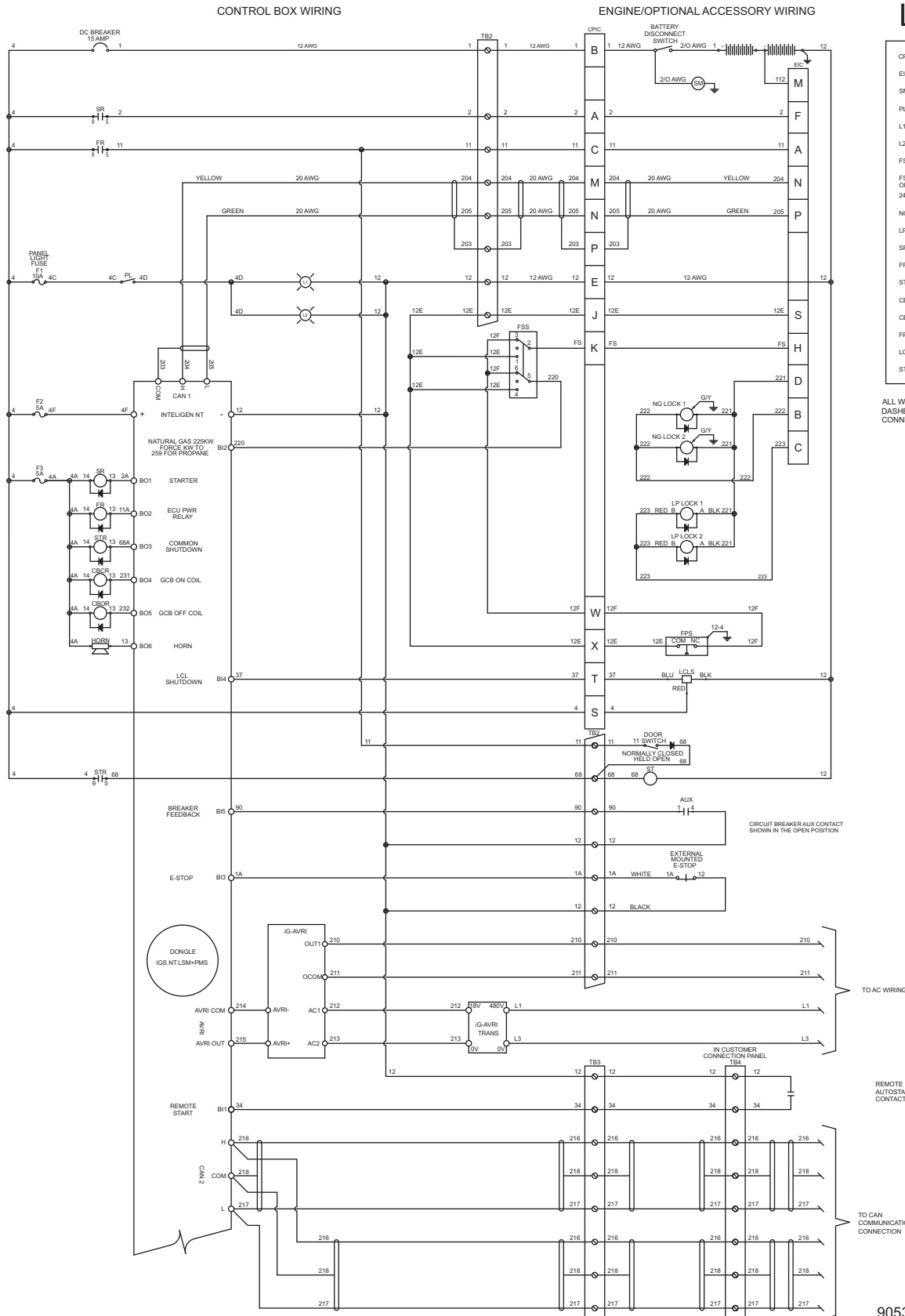


ALL WIRE IS 16 AWG UNLESS NOTED.
DASHED LINES INDICATE CUSTOMER CONNECTIONS.

DC WIRING—MGG280N2-G25

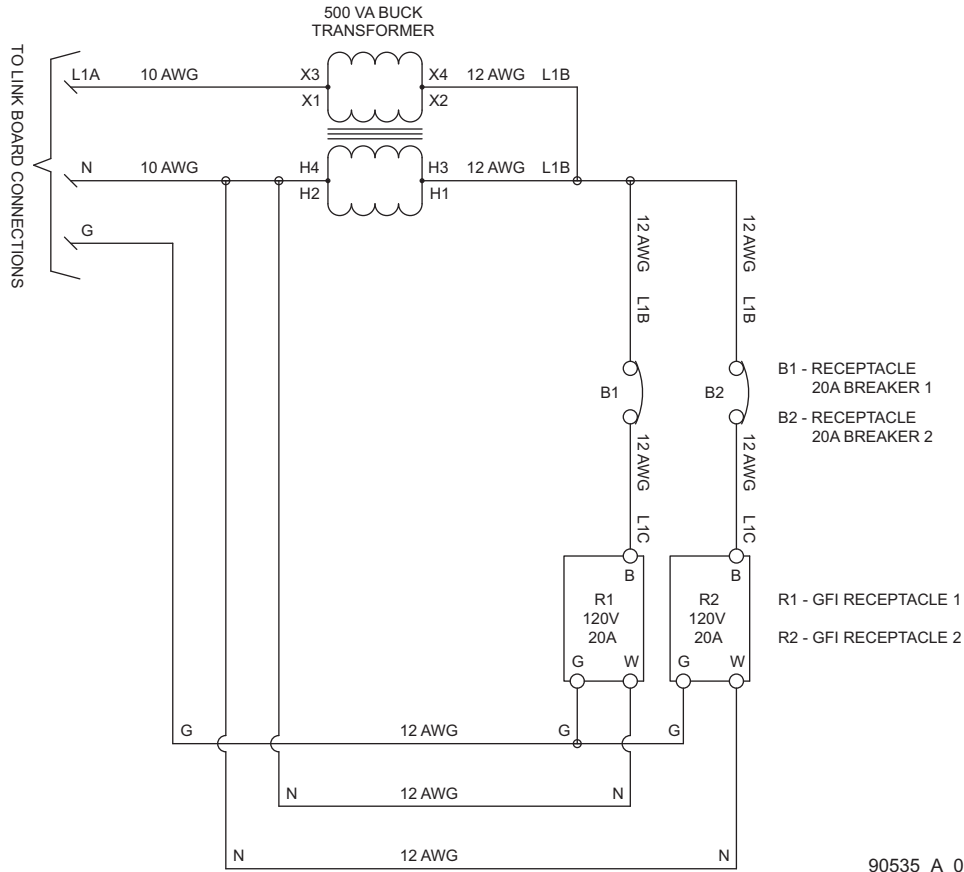


DC WIRING—MGG350N2-G23



90538_ORG_06.17.14

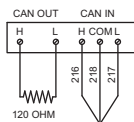
CUSTOMER CONVENIENCE RECEPTACLES



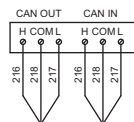
90535_A_08.25.14

CAN PARALLEL COMMUNICATION CONNECTION

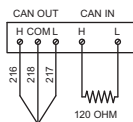
FIRST GENERATOR



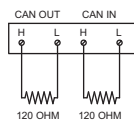
MIDDLE GENERATORS



LAST GENERATOR



SINGLE GENERATOR



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Service Log

OIL GRADE: _____ BRAND: _____

COOLANT MIXTURE: _____ BRAND: _____

Date	Hours to Service	Oil Level	Coolant Level

Date	Hours to Service	Oil Level	Coolant Level

