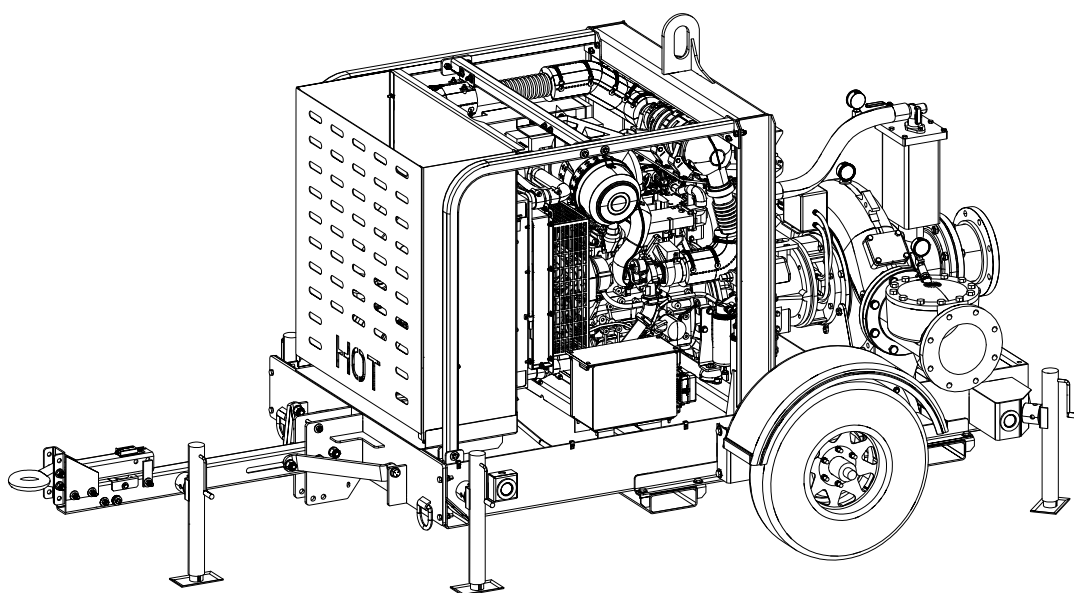


# *Owner's Manual*

## *Self-Prime Diesel Trash Pump*

**MTP8DZV • MTP8DZD**



For technical assistance contact:

[www.generacmobileproducts.com](http://www.generacmobileproducts.com)

Technical Support

1-800-926-9768

***SAVE THIS MANUAL FOR FUTURE REFERENCE***

**Use this page to record important information about your Trash Pump**

Unit Model Number	
Unit Serial Number	
Engine Model Number	
Engine Serial Number	
Pump Model Number	
Pump Serial Number	

Record the information found on your unit data label on this page. The label plate is affixed to the inside partition, to the left of the control panel console.

Engine and pump serial numbers are located on separate data plates affixed to the engine and pump respectively.


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

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

 **WARNING**

**CANCER AND REPRODUCTIVE HARM**  
[www.P65Warnings.ca.gov](http://www.P65Warnings.ca.gov)

(000393a)

 **WARNING**

Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

- Always start and operate the engine in a well-ventilated area.
- If in an enclosed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system.
- Do not idle the engine except as necessary.

For more information go to  
[www.P65Warnings.ca.gov/diesel](http://www.P65Warnings.ca.gov/diesel). (000394)

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# Section 1 Introduction and Safety

## Introduction

Thank you for purchasing a Generac Mobile Product. This unit has been designed to provide high-performance, efficient operation, and years of quality use when maintained properly.

The unit is mounted on a trailer that has a chain attach point. The fully enclosed design protects the operating components, allowing all-weather storage and operations.



### **WARNING**

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

The unit is mounted on a trailer that has a chain attach point. The fully enclosed design protects the operating components, allowing all-weather storage and operations.

If any section of the manual is not understood, contact your nearest Independent Authorized Service Dealer (IASD), or contact Generac Mobile Products at 800-926-9768, or [www.generacmobileproducts.com](http://www.generacmobileproducts.com) with any questions or concerns.

The owner is responsible for proper maintenance and safe use of the equipment.

SAVE THESE INSTRUCTIONS for future reference. This manual contains important instructions for the pump that should be followed during installation, operation and maintenance of the pump and batteries. ALWAYS supply this manual to any individual that will use this machine.

THE INFORMATION CONTAINED HEREIN WAS BASED ON MACHINES IN PRODUCTION AT THE TIME OF PUBLICATION. GENERAC RESERVES THE RIGHT TO MODIFY THIS MANUAL AT ANY TIME.

## Safety Rules

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

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

### **DANGER**

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

(000001)

### **WARNING**

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

(000002)

### **CAUTION**

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

(000003)

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

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

## General Hazards



### **DANGER**

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

(000103)

### **WARNING**

Personal injury. Do not operate unit during transport. Doing so could result in death, serious injury, or property damage.

(000231a)



### **WARNING**

Hearing Loss. Hearing protection is recommended when using this machine. Failure to wear hearing protection could result in permanent hearing loss.

(000107)



**⚠️ WARNING**

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

(000111)



**⚠️ WARNING**

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

(000108)

**⚠️ CAUTION**

Equipment or property damage. Do not block air intake or restrict proper air flow. Doing so could result in unsafe operation or damage to unit.

(000229)

**⚠️ CAUTION**

Equipment Damage. The emergency stop switch is not to be used to power down the unit under normal operating circumstances. Doing so could result in equipment damage.

(000246b)

## Explosion and Fire Hazards



**⚠️ DANGER**

Explosion and Fire. Fuel and vapors are extremely flammable and explosive. Add fuel in a well ventilated area. Keep fire and spark away. Failure to do so will result in death or serious injury.

(000105)



**⚠️ WARNING**

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

(000147)

## Trailer Hazards

**⚠️ WARNING**

Personal injury. Trailer must be securely coupled to the hitch with the chains correctly attached. Uncoupled or unchained towing could result in death or serious injury.

(000233a)

**⚠️ WARNING**

Crushing hazard. Verify unit is properly secured and on level ground. An unsecured unit can suddenly roll or move, causing death or serious injury.

(000234a)

**⚠️ WARNING**

Property or Equipment Damage. Tighten wheel lug nuts after first 50 miles to factory specifications. Failure to do so could result in death, serious injury, property or equipment damage.

(000235)

## Battery Hazards



**⚠️ WARNING**

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

(000137a)



**⚠️ WARNING**

Explosion. Do not dispose of batteries in a fire. Batteries are explosive. Electrolyte solution can cause burns and blindness. If electrolyte contacts skin or eyes, flush with water and seek immediate medical attention.

(000162)



**⚠️ WARNING**

Risk of burn. Do not open or mutilate batteries. Batteries contain electrolyte solution which can cause burns and blindness. If electrolyte contacts skin or eyes, flush with water and seek immediate medical attention.

(000163a)

**⚠️ WARNING**

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

(000130)

**⚠️ WARNING**

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)

## Pump Hazards

---

**⚠️ WARNING**

Personal Injury. Do not pump volatile, corrosive, or flammable materials. Doing so could result in death or serious injury and pump damage.

(000271)

---

**⚠️ WARNING**

Personal Injury. Verify all hoses are securely fastened. Failure to do so could result in death or serious injury.

(000272)

---

**⚠️ WARNING**

Personal Injury. Do not operate pump with flow completely restricted. Doing so could cause pump casing to explode and could result in death or serious injury.

(000273)

---

**⚠️ WARNING**

Personal Injury. Allow pump to cool completely before removal of any parts. Failure to do so could cause parts to be ejected with great force and could cause death or serious injury.

(000274)

---

## 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:

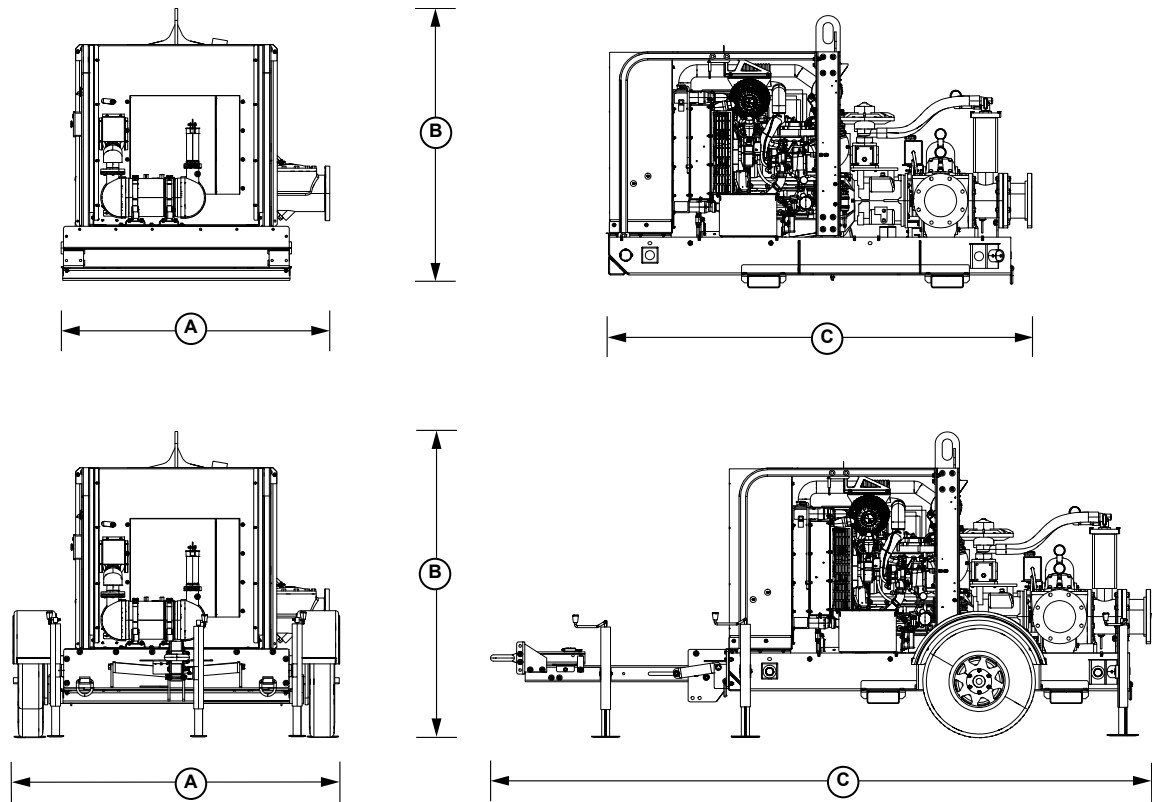
Administrator  
NHTSA  
1200 New Jersey Avenue S.E.  
Washington, DC 20590

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

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# Section 2 General Information

## Unit Dimensions



**Figure 2-1. Unit Dimensions**

	<b>A</b>	<b>B</b>	<b>C</b>
<b>Skid Mounted</b>	66 in (1.68 m)	67.5 in (1.71 m)	100.5 in (2.55 m)
<b>Trailer Mounted</b>	81.2 in (2.06 m)	73.88 in (1.877 m)	150.12 in (3.813 m)

Specifications are subject to change without notice.

## Unit Serial Number Locations

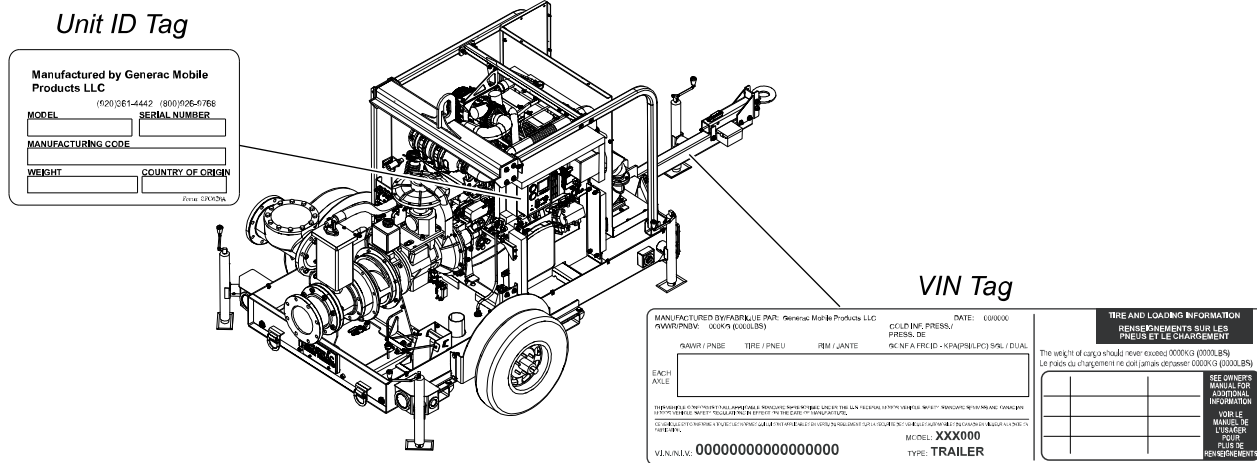
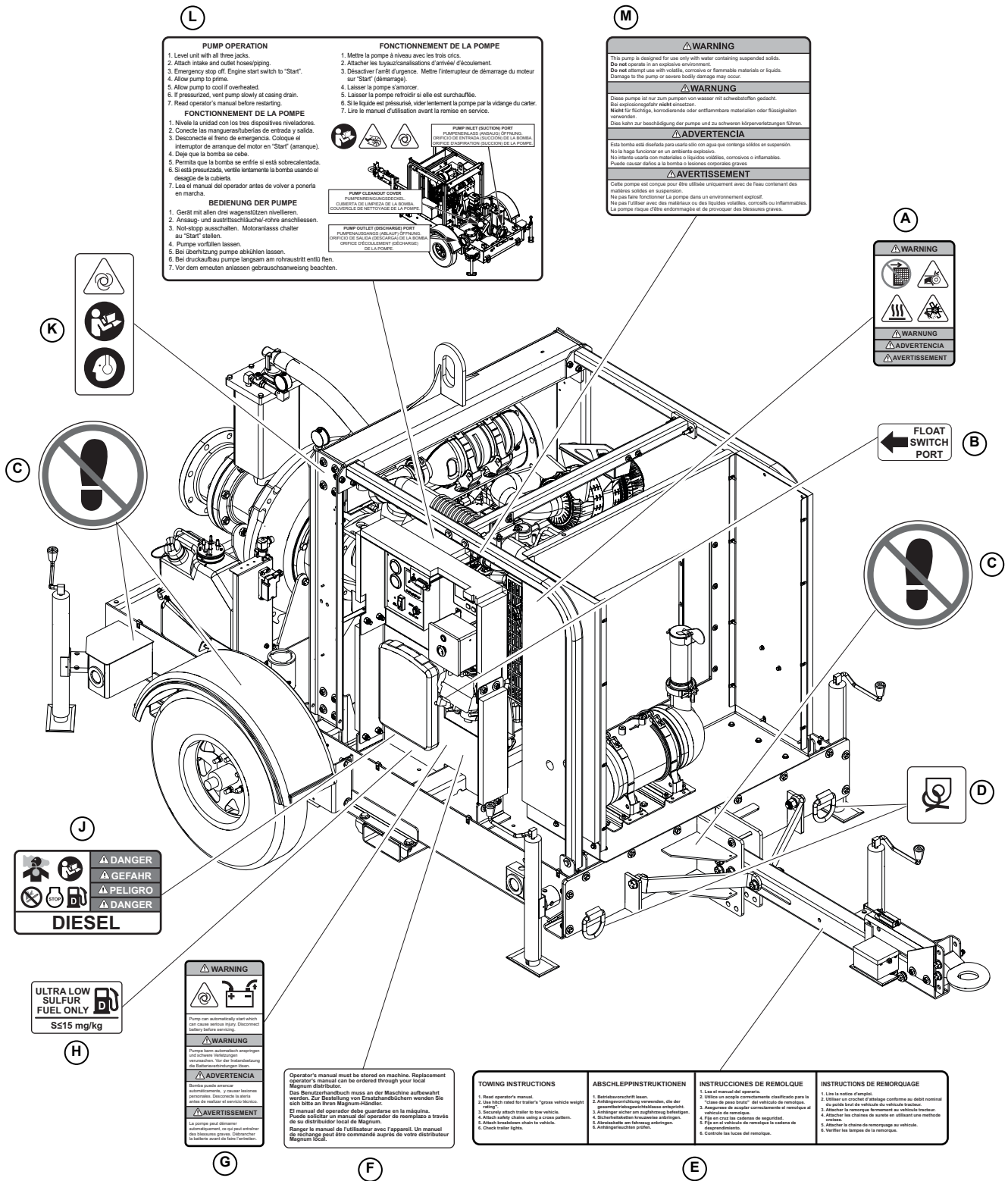


Figure 2-2. Serial Number Locations

## Safety Decal Locations

ID	Description	ID	Description
A	General safety: keep hands clear of belt, hot surfaces, and fan, and do not remove guard	N	Beware of moving blades
B	Float switch port location	P	Suction port location
C	Do not step	Q	Fuel tank drain location
D	Tie down location	R	Discharge port location
E	Towing instructions	S	Lubricant Grease every 1500 hours for optional equipment
F	Operator's manual storage location	T	Lubricant Grease every 1500 hours
G	Disconnect battery before servicing	U	Engine oil drain location
H	Fuel requirement	V	Engine coolant drain location
I	Diesel Exhaust Fluid (DEF) only	W	Disconnect battery before servicing
J	Stop the engine. Do not smoke while refueling. Do not breathe in fuel vapors. See the operators manual for further instructions. Fill the tank with diesel.	X	Hot surface
K	Autostart, understand operator's manual before operation, hearing protection required while operating unit	Y	Lifting point
L	Pump operation instructions	Z	Keep hands free of belt
M	Do not pump dangerous liquids.		





**PUMP OPERATION**

- Level unit with all three jacks.
- Attach intake and outlet hoses/piping.
- Emergency stop off. Engine start switch to "Start".
- Allow pump to prime.
- Allow pump to cool if overheated.
- If pressurized, vent pump slowly at casing drain.
- Read operator's manual before restarting.

**FUNCTIONNEMENT DE LA POMPE**

- Nivelez la unidad con los tres dispositivos niveladores.
- Conecte las mangueras/uberías de entrada y salida.
- Desconecte el freno de emergencia. Coloque el interruptor de arranque del motor en "Start" (arranque).
- Deje que la bomba se enfríe si está sobrecalentada.
- Permita que la bomba se enfríe si está sobrecalentada.
- Si está presurizada, ventile lentamente la bomba usando el desagüe de la cubierta.
- Lea el manual del operador antes de volver a ponerla en marcha.

**BEDIENUNG DER PUMPE**

- Gerät mit allen drei wegeinstellen nivellieren.
- Ansaug- und Ausstrichschlauch/e-hre anschließen.
- Not-stop ausschalten. Motoranlasser chalter auf "Start" stellen.
- Pumpe vorläufig lassen.
- Bei Überhitzung Pumpe abkühlen lassen.
- Bei druckbeaufschlagter Pumpe langsam am Rohraustritt entlüften.
- Vor dem erneuten anlassen gebrauchsanweisung beachten.

**FUNCTIONNEMENT DE LA POMPE**

- Mettre la pompe à niveau avec les trois crics.
- Attacher les tuyaux/canalisations d'entrée et d'écoulement.
- Désactiver l'arrêt d'urgence. Mettre l'interrupteur de démarrage du moteur sur "Start" (démarrage).
- Laisser la pompe à refroidir.
- Laisser la pompe à refroidir si elle est surchauffée.
- Si le liquide est pressurisé, vider lentement la pompe par le vidange du carter.
- Lire le manuel d'utilisation avant la remise en service.

**PUMP INLET (SUCTION) PORT**  
PUMPEINLAUSSCHNITTSTÜCK  
ORIFICIO DE ENTRADA (SUCCIÓN) DE LA BOMBA  
DOPPEL ANSAUGSTÄNDIG (SUCCIÓN) DE LA PUMPE

**PUMP CLEANOUT COVER**  
PUMPEINLAUSSCHNITTSTÜCK  
CUBIERTA DE LIMPIEZA DE LA BOMBA  
COVERTEIL DES REINIGUNGS DE LA PUMPE

**PUMP OUTLET (DISCHARGE) PORT**  
PUMPEAUSLAUSSCHNITTSTÜCK  
ORIFICIO DE SALIDA (DESCARGA) DE LA BOMBA  
DOPPEL AUSLAUSSCHNITTSTÜCK (DISCHARGE) DE LA PUMPE

**WARNING**

This pump is designed for use only with water containing suspended solids. Do not operate in an explosive environment. Do not attempt use with volatile, corrosive or flammable materials or liquids. Damage to the pump or severe body damage may occur.

**ADVERTENCIA**

Esta bomba está diseñada para usarse sólo con agua que contenga sólidos en suspensión. No la haga funcionar en un ambiente explosivo. No intente usarla con materiales o líquidos volátiles, corrosivos o inflamables. Puede causar daños a la bomba o lesiones graves.

**AVERTISSEMENT**

Cette pompe est conçue pour être utilisée uniquement avec de l'eau contenant des matières solides en suspension. Ne pas faire fonctionner la pompe dans un environnement explosif. Ne pas l'utiliser avec des matériaux ou des liquides volatils, corrosifs ou inflammables. La pompe risque d'être endommagée et de provoquer des blessures graves.

**DIESEL**

⚠ DANGER  
⚠ GEFAHR  
⚠ PELIGRO  
⚠ DANGER

**ULTRA LOW SULFUR FUEL ONLY**  
S≤15 mg/kg

**WARNING**

Pump can automatically start when power is restored. Disconnect battery before servicing.

**ADVERTENCIA**

Puede tener activación automática al restablecerse el suministro. Desconecte la batería antes de realizar el mantenimiento de la bomba.

**AVERTISSEMENT**

La pompe peut démarrer de manière automatique dès que le courant est rétabli. Débranchez la batterie avant de faire l'entretien.

Operator's manual must be stored on machine. Replacement operator's manual can be ordered through your local Magnum distributor. Das Benutzerhandbuch muss an der Maschine aufbewahrt werden. Zur Bestellung von Ersatzhandbüchern wenden Sie sich bitte an Ihren Magnum-Händler. El manual del operador debe guardarse en la máquina. Puede solicitar un manual del operador de reemplazo a través de su distribuidor local de Magnum. Range le manuel de l'utilisateur avec l'appareil. Un manuel de rechange peut être commandé auprès de votre distributeur régional local.

**TOWING INSTRUCTIONS**

- Read operator's manual.
- Use hitch rated for trailer's gross vehicle weight rating (GVWR).
- Securely attach trailer to tow vehicle.
- Attach safety chains using a cross pattern.
- Attach breakaway chain to vehicle.
- Check trailer lights.

**ABSCHLEPPINSTRUKTIONEN**

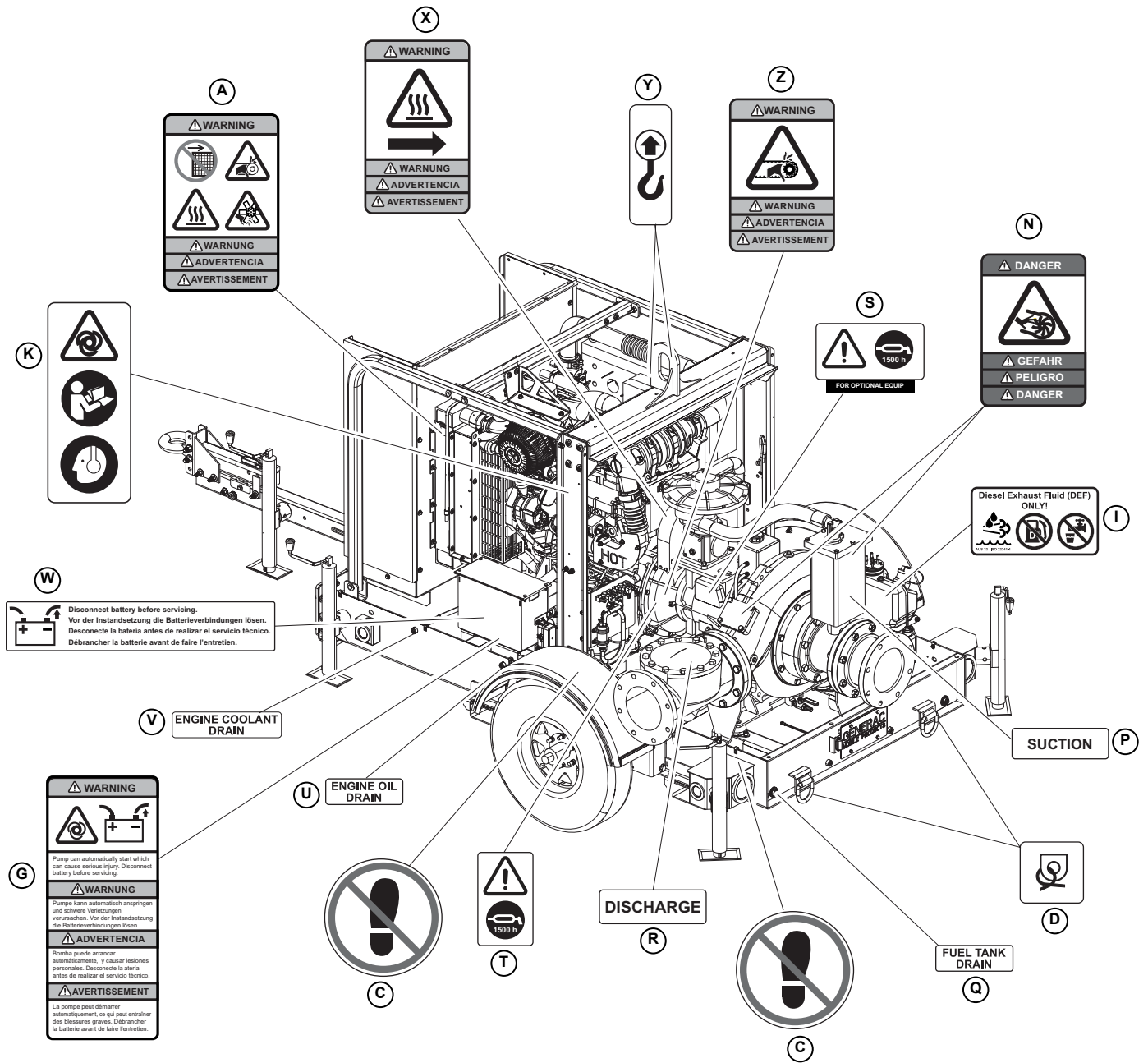
- Benutzerhandbuch lesen.
- Anhängersicherheitsverweilen, die der gewichtsbewerteten Gesamtgewicht entsprechen.
- Anhänger sicher an Zugsfahrzeug befestigen.
- Sicherheitsketten kreuzförmig anbringen.
- Abbremskette am Fahrzeug anbringen.
- Anhängersicherheitslampe prüfen.

**INSTRUCCIONES DE REMOLQUE**

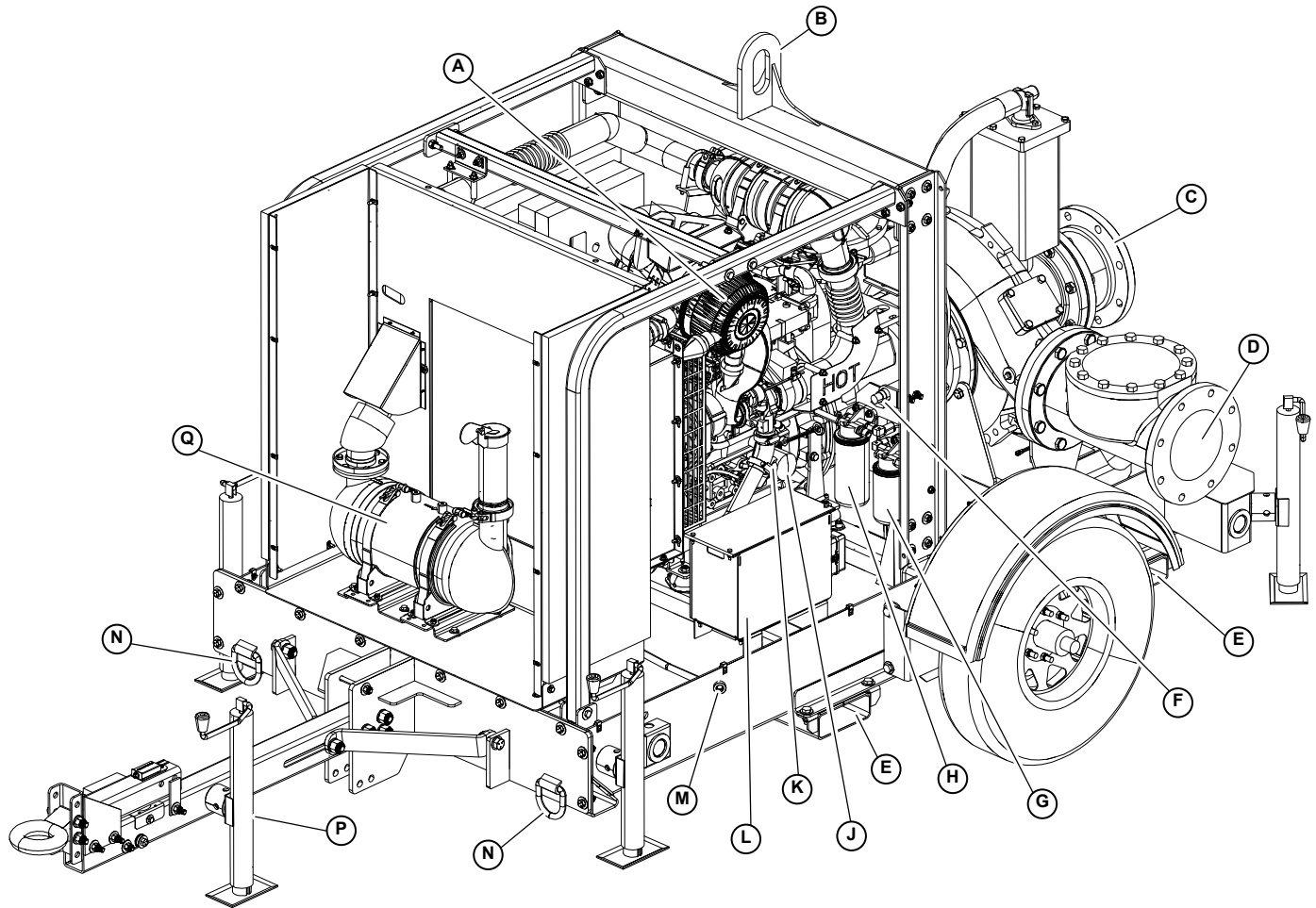
- Lea el manual del operador.
- Utilice un enganche con capacidad certificada para la "Carga de peso bruto" del vehículo de remolque.
- Desajuste de ángulo correctamente el remolque al vehículo de remolque.
- Retorcido de remolque.
- Enfile en cruz las cadenas de seguridad.
- Fije en el vehículo de remolque la cadena de freno de emergencia.
- Compruebe las luces del remolque.

**INSTRUCTIONS DE REMORQUAGE**

- Lire le manuel d'emploi.
- Utiliser un crochet d'attelage conforme au poids nominal du poids brut du véhicule de remorque à remorquer.
- Assurez le montage correct de l'angle de remorque.
- Attachez les chaînes de sécurité en utilisant une méthode en croix.
- Attachez la chaîne de remorque au véhicule.
- Vérifiez les lampes de la remorque.



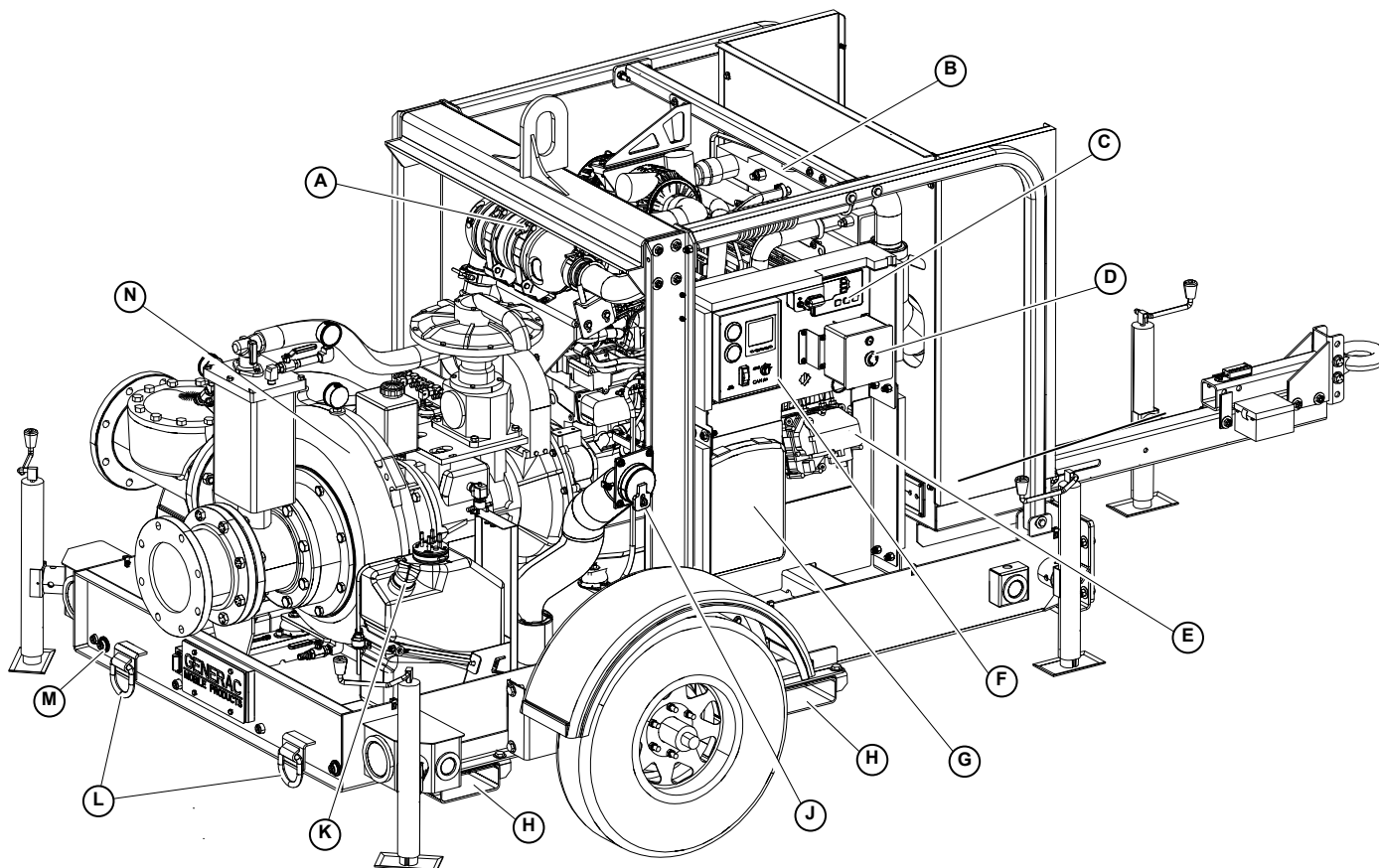
## Component Locations



**Figure 2-3. Left Side**

- |    |                              |    |                                     |
|----|------------------------------|----|-------------------------------------|
| A. | Air cleaner                  | J. | Engine oil filter                   |
| B. | Central lift point           | K. | Engine oil dipstick                 |
| C. | Pump inlet (suction) port    | L. | Battery                             |
| D. | Pump outlet (discharge) port | M. | Coolant drain                       |
| E. | Fork lift pockets            | N. | Tie down ring                       |
| F. | QuickFit Engine Oil Drain    | P. | Leveling jack                       |
| G. | Fuel pre-filter              | Q. | SCR (Selective Catalytic Reduction) |
| H. | Fuel filter (main)           |    |                                     |

\* Optional equipment shown.

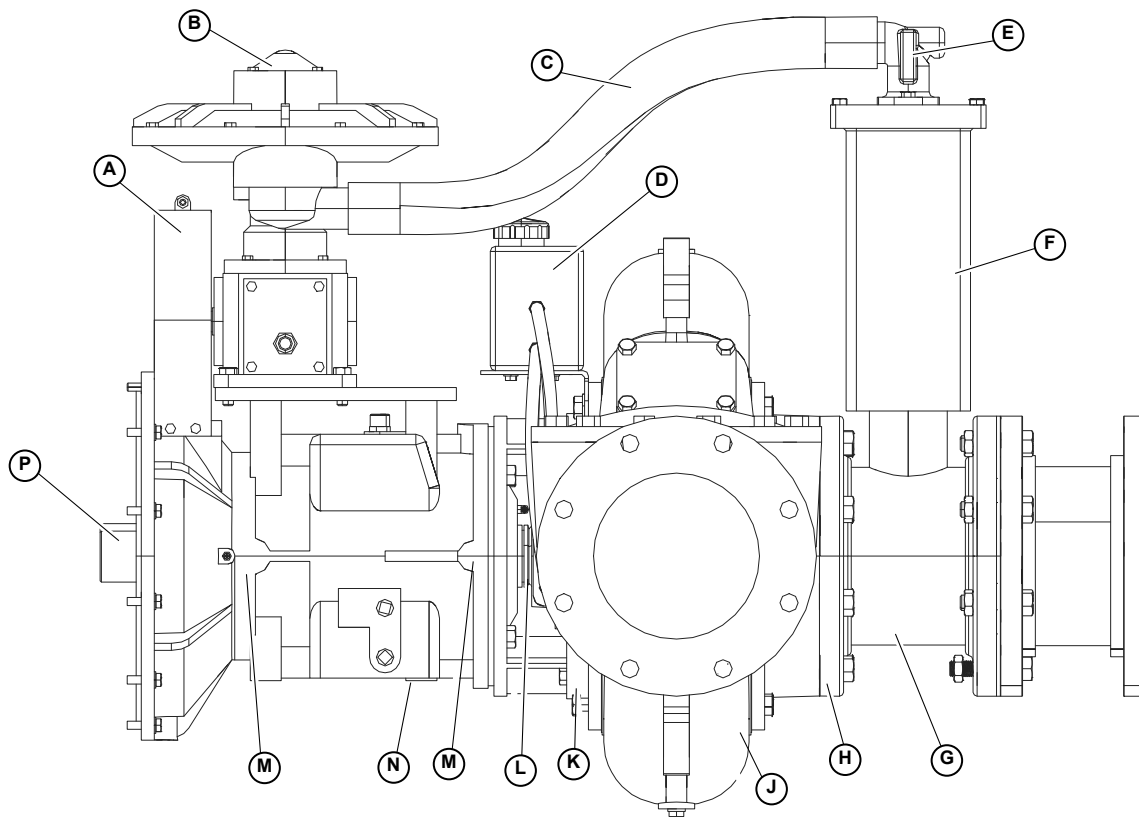


**Figure 2-4. Right Side**

- |                                   |   |
|-----------------------------------|---|
| A. DOC                            | H. Forklift pockets                             |
| B. Radiator and Charge Air Cooler | J. Fuel fill                                    |
| C. DEF controller                 | K. DEF fill port                                |
| D. Emergency stop switch          | L. Fuel tank drain                              |
| E. DEF Dosing Module              | M. Pump (See <i>Pump Component Locations</i> ). |
| F. Control panel                  |   |
| G. Manual holder                  |   |

\* Optional equipment shown.

## Pump Component Locations



**Figure 2-5. Pump Components - Left Side**

- |    |  |    |                         |
|----|--|----|-------------------------|
| A. | Belt and guard                                     | H. | Suction cover           |
| B. | Diaphragm vacuum pump or Compressor<br>(not shown) | J  | Volute                  |
| C. | Vacuum hose  | K  | Backplate               |
| D. | Mechanical seal oil reservoir                      | L. | Mechanical seal         |
| E. | Relief valve                                       | M. | Grease fittings         |
| F. | Priming chamber                                    | N. | Bearing frame           |
| G. | Suction spool                                      | P. | Drive end shaft and key |

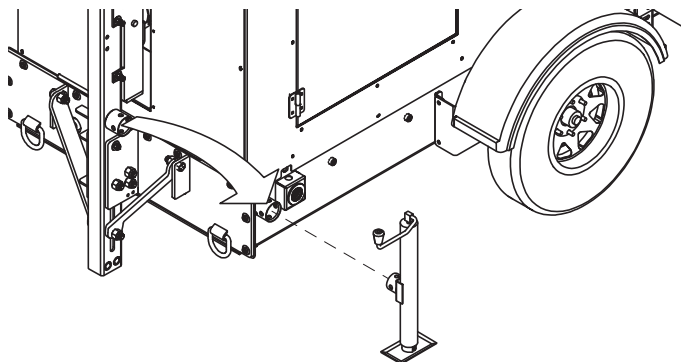
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## Section 3 Transportation

### Trailer Tongue Preparation for Use

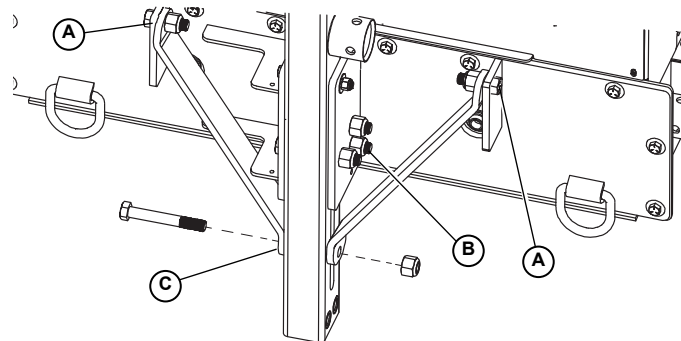
If the unit is shipped with the trailer tongue in the upright position, follow the steps below to lower the tongue.

1. See **Figure 3-1**. Move the front jack from the tongue to the location shown and lower the jack.
2. Lower the rear jacks to prevent the unit from tipping backwards during procedure.



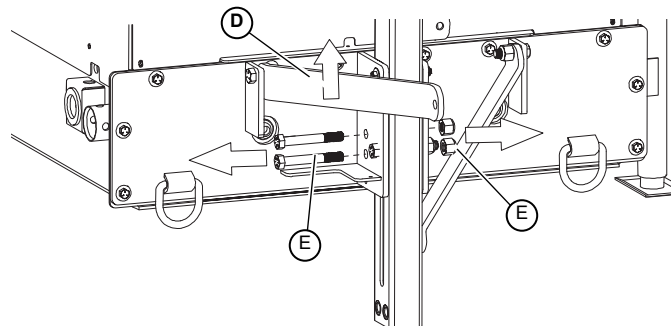
**Figure 3-1. Install Tongue Jack**

3. See **Figure 3-2**. Loosen but do not remove the nylon lock nuts on bolts **A** and **B**.
4. Remove the lower bolt and nylon lock nut securing the tongue braces to the tongue (**C**).



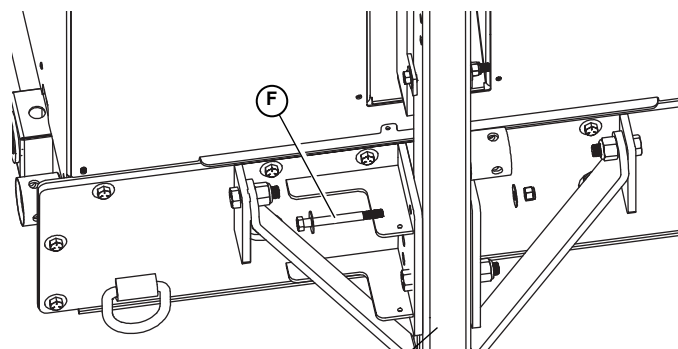
**Figure 3-2. Remove Lower Bolt**

5. See **Figure 3-3**. Move the right tongue brace (**D**) upward to allow access and then remove the rear bolts and nylon lock nuts (**E**) as shown.



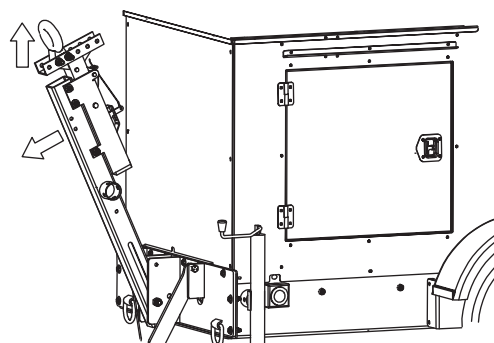
**Figure 3-3. Remove Rear Bolts**

6. See **Figure 3-4**. Remove the upper bolt, nut, and washers (**F**) to allow the tongue to pivot.



**Figure 3-4. Remove Upper Bolt, Nut, and Washer**

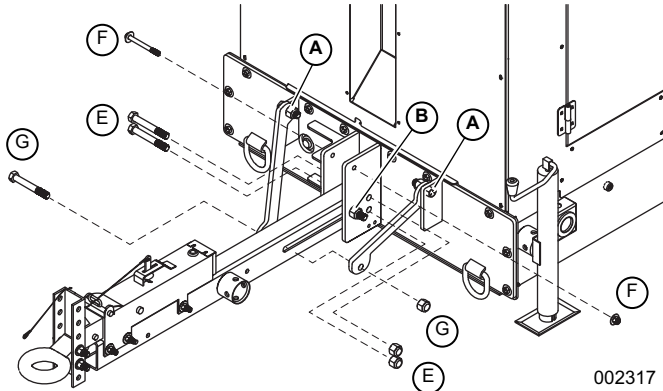
7. See **Figure 3-5**. Lower the trailer tongue and install bolts (**E**) removed in step 4 with **new** nylon lock nuts. Do not tighten until bolt (**G**) is installed and tightened.



**Figure 3-5. Lower Tongue**



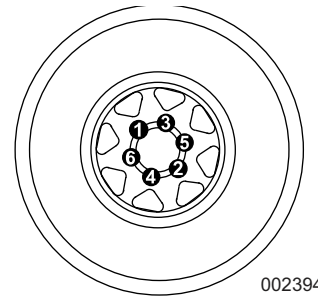
8. See **Figure 3-6**. Align the lower holes on the tongue braces with the slot in the tongue. Install the bolt with a **new** nylon lock nut (**G**). Tighten to 80-109 ft-lbs (108-148 Nm).
9. Tighten bolt (**E**) to 80-109 ft-lbs (108-148 Nm).
10. Install the upper bolt, nut, and washers (**F**) in the hole near the top of the tongue mounting bracket. The bolt should be snug against the bracket.
11. Tighten the nylon lock nuts on bolts **A** and **B** to 80-109 ft-lbs (108-148 Nm).



**Figure 3-6. Install Fasteners**

## Towing the Unit

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. Raise the rear leveling jacks to the travel position. Turn the jack handles counterclockwise until the leveling feet are fully retracted.
3. Connect any trailer wiring to tow vehicle. Check for proper operation of the directional and brake lights.
4. Verify all doors and flip hood are properly latched.
5. Check for proper inflation of the trailer tires. The maximum tire pressure is 65 PSI.
6. See **Figure 3-5**. 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:
  - a. Start all lug nuts by hand.
  - b. First pass tighten to 20-25 ft-lbs (27-33 Nm).
  - c. Second pass tighten to 50-60 ft-lbs (67-81 Nm).
  - d. Third pass tighten to 90-120 ft-lbs (122-162 Nm)



**Figure 3-5. Lug Sequence**

**NOTE:** After the first road use, tighten the lug nuts to the specified torque value.

7. 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.

## Lifting the Unit

Remove the suction and discharge piping from the pump prior to moving. Verify the equipment being used to lift the unit is in good condition and has sufficient capacity.

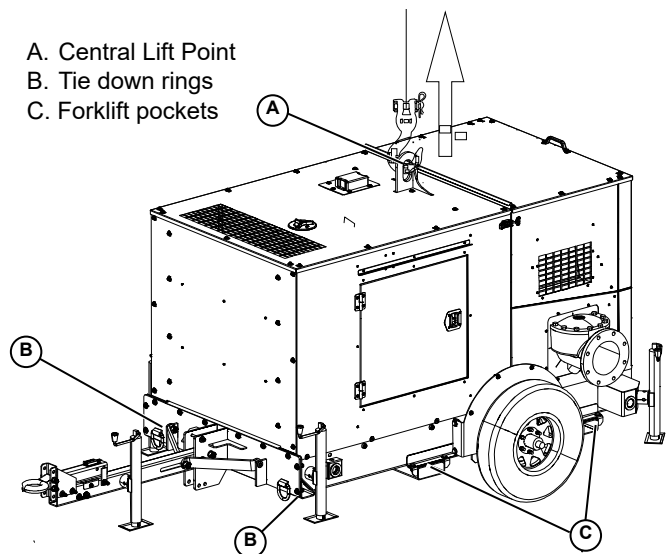
Always remain aware of the position of other people and objects around you as you move the unit.

See **Figure 3-6**. A central lift point (**A**) is located on the top of the unit. Attach any slings, chains or hooks directly to the lift point.

The tie down rings (**B**) at the front and back corners of the trailer are intended for tie down use only.

### **WARNING**

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



**Figure 3-6. Lifting Point**



## Section 4 Controls

### Control Panel Operation

Turning the Key switch to the RUN position energizes the ECU (Engine Control Unit), illuminates all LED indicators (A) once, and displays a startup screen while a self test is performed. If the display beeps for longer than one second, it indicates a self test fault. Users can attempt to rectify the fault by restoring factory defaults. Refer to the [Configuration Menu](#) for details.

Refer to the [Engine Fault Shutdown Troubleshooting](#) for fault troubleshooting information. Contact Generac Mobile Products for assistance if the fault persists.

After the startup screen is cleared, the display shows readings on its virtual gauges. Initially the analog gauges are displayed, but the display uses the last displayed screen on subsequent startups. Refer to [Preferred Screen Store](#) for details.

If the ECU is preheating when the Key switch is turned to the RUN position, the Preheat LED is illuminated. Preheat time varies with atmospheric and engine conditions. After Preheat LED extinguishes, the crank the engine by turning and holding the Key switch in the START position until the engine starts.

### LED Indicators

#### Auto Standby LED (Green)

A solidly illuminated Auto Standby LED indicates the Key switch is in the AUTO START position and the system is ready to start.



#### Preheat LED (Amber)

A solidly illuminated Preheat LED indicates the engine is preheating. When the LED extinguishes, the preheat period is complete and the engine may be cranked.

**NOTE:** The CANplus display only reports when the ECU is requesting preheat. Cold starting aids may not be installed in all engine configurations.



#### Engine Stop LED (Red)

A solidly illuminated Engine Stop LED indicates the ECU has stopped the engine due to a fault.

**NOTE:** ECU programming determines the response to warnings and failures. Typically the ECU can be programmed to shut down, derate, or run to failure. The CANplus display only displays ECU reported conditions.



#### Warning LED (Amber)

A solidly illuminated Warning LED indicates a warning reported by the ECU.

**NOTE:** The Warning LED is not used in Mechanical Governor mode

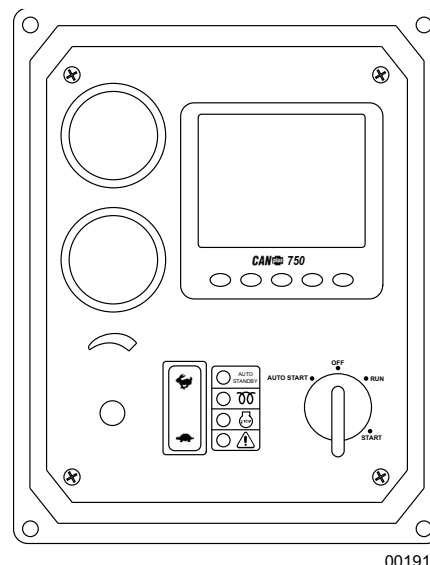


Figure 4-1. Control Panel

### Throttle Control

The type of throttle operators installed, along with the configured values of minimum requested RPM, idle RPM, intermediate RPM, run RPM and maximum requested RPM, determine throttle operation. The engine speed can be adjusted above run RPM and below idle RPM, but the requests can not fall below the set minimum requested RPM or above the set maximum requested RPM. The ECU determines how the engine responds to the throttle requests and will not allow the engine speed to fall below the ECU minimum or exceed the maximum RPM.

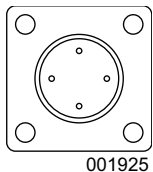
**NOTE:** To change the minimum requested RPM and maximum requested RPM settings, contact Generac Mobile Products, LLC.

### Ramp Throttle (Speed Control Switch)

The standard ramp throttle uses a momentary rocker switch to adjust the requested engine speed. When first started, the requested engine speed is Idle RPM. Pressing and releasing the Rabbit icon increases the speed requested by 25 RPM. Pressing and holding the Rabbit icon causes the speed to accelerate to full speed in a few seconds. Similarly, pressing the Turtle icon decreases the requested speed.

## Automatic START and STOP

The pump can be configured to start automatically by adding dry-contact closure float level switches. Verify that the dry-contact closure float switch harness is connected to the port on the back of the control box. Contact the Generac Mobile Products, LLC Technical Service Department at 1-800-926-9768 for more information.



Turning the key switch to AUTO START causes all LEDs to illuminate. While a self test is performed, the AUTO STANDBY indicator is illuminated and the startup screen is displayed. After the startup screen is cleared, the display shows the transducer reading and switch status on the Transducer/Switch gauge. All other CANbus values will show since the ECU is not energized at this time. After one minute, the display is powered down to reduce battery drain. The automatic start and stop system is still functioning as indicated by the Auto Standby LED.

For electronically governed units, once the configured automatic start condition exists, the display powers up, the panel starts the engine and follows the throttle control profile configured (see [Figure 4-2](#)). The flexible throttle profile includes various speeds and times for a variety of scenarios. See [Autostart Menu](#).

Single switch mode allows reliable operation with a single switch. Dual switch operation allows greater hysteresis when needed.

The transducer input supports simple start and stop operation by level or pressure and maintenance modes with speed modification.

- Programmable high and low set points control start and stop operation.
- Level maintenance modes monitor the operating point and adjust the engine speed to match the targeted set point with configurable aggressiveness.
- Dual switch inputs can be combined with the transducer input for redundant safety to protect against transducer sensor clog or failure.

When the configured stop conditions exist, the panel reduces the engine speed per the throttle profile and stops the engine. If the configured start conditions exist before the shutdown process is complete, the engine will return to the previous speed until the stop condition exists.

### WARNING

Accidental Start-up. Do not configure the control panel with the key turned to AUTO START. The equipment could start suddenly, which could result in death or serious injury. (000269)

Configure the control panel with the key in RUN.

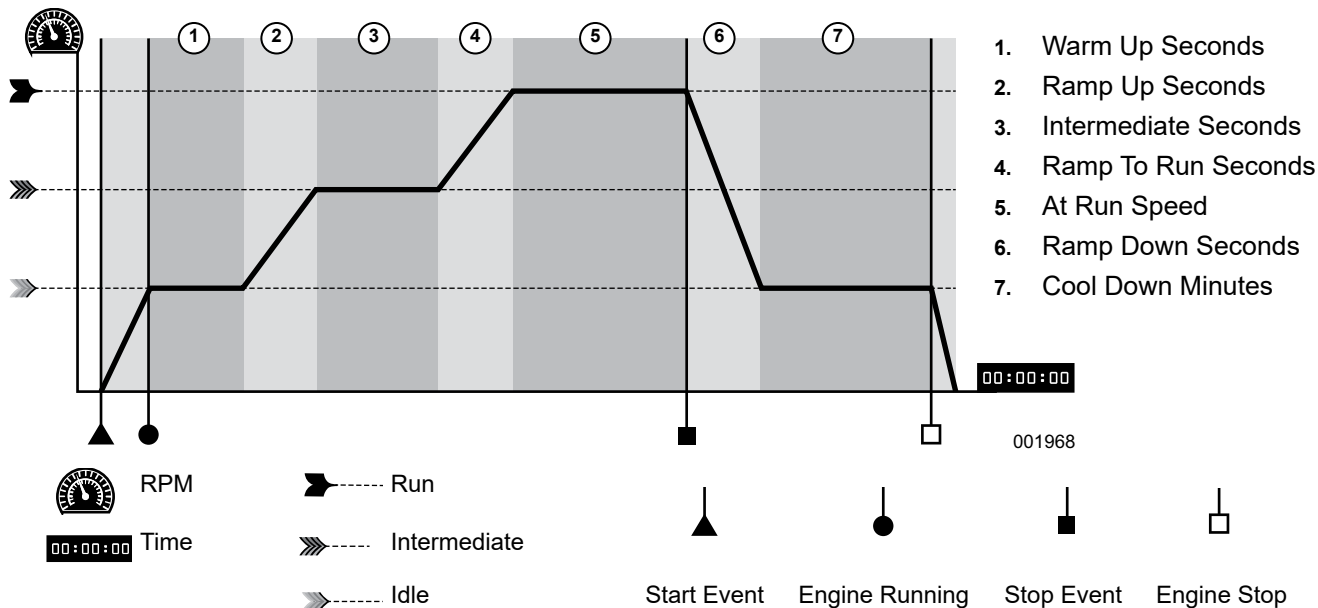


Figure 4-2. Throttle Control Profile

## Start and Stop Events

The start and stop events are determined by the combination of START and STOP mode and function.

### Start and Stop Modes:

#### Single Switch

Switch one controls automatic operation.

#### Dual Switch

Both switch inputs control automatic operation.

#### Transducer

Transducer input controls automatic operation.

#### Transducer & Switch

The transducer input controls automatic operation with dual switch mode as the backup. The switch inputs override the transducer if actuated when the transducer is not calling for an automatic cycle.

### Start and Stop Functions:

#### Empty

Uses the selected mode to *reduce* the level or pressure.

#### Fill

Uses the selected mode to *increase* the level or pressure.

#### Maintain Out

Uses the transducer to maintain the level or pressure at or *below* the target.

#### Maintain In

Uses the transducer to maintain the level or pressure at or *above* the target.

**Table 1 - Start and Stop Events**

Mode ▼	Function ►	Empty	Fill	Maintain Out	Maintain In
Single Switch	Start	SW1 Close	SW1 Open	SW1 Close	SW1 Open
	Stop	SW1 Open	SW1 Close	SW1 Open	SW1 Close
Dual Switch	Start	SW1 and SW2 Close	SW1 and SW2 Open	SW1 and SW2 Close	SW1 and SW2 Open
	Stop	SW1 and SW2 Open	SW1 and SW2 Close	SW1 and SW2 Open	SW1 and SW2 Close
Transducer	Start	Above High Set Point	Below Low Set Point	Above High Set Point	Below Low Set Point
	Stop	Below Low Set Point	Above High Set Point	Below Low Set Point	Above High Set Point
Transducer & Switch	Start	Above High Set Point or SW1 and SW2 Close	Below Low Set Point or SW1 and SW2 Open	Above High Set Point or SW1 and SW2 Close	Below Low Set Point or SW1 and SW2 Open
	Stop	Below Low Set Point or SW1 and SW2 Open	Above High Set Point or SW1 and SW2 Close	Above High Set Point or SW1 and SW2 Close	Below Low Set Point or SW1 and SW2 Open

**NOTE:** When the switch inputs are the source of the start event in Transducer & Switch mode, only the switches will stop the engine.

## Maintain Functions

The Maintain In and Maintain Out functions adjust the engine speed to keep the transducer level at the Target Set Point. The Servo Gain adjusts how aggressively the throttle is adjusted while the Servo Delay controls how often the throttle is adjusted.

**NOTE:** Maintain functions are only available in the Transducer or Transducer & Switch modes.

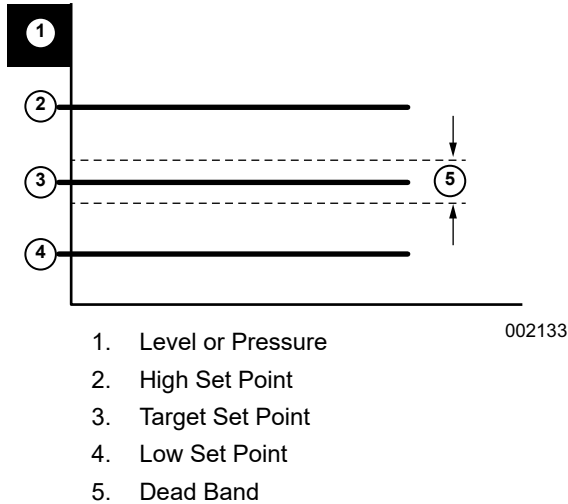
The direction of the throttle adjustment is dependent upon the selected mode as shown in the table.

**Table 2 - Maintain Functions**

Transducer State	Maintain Out	Maintain In
Above Target	Increase Speed	Decrease Speed
Below Target	Decrease Speed	Increase Speed

### Dead Band

In some situations, the transducer level may fluctuate around the Target Set Point. To limit throttle hunting using the maintain functions, a dead band can be programmed. This value prevents throttle adjustment while the level is within the band (refer to *Figure 4-3*). In essence, the speed is considered to be at the target whenever it is within the dead band.



- 1. Level or Pressure
- 2. High Set Point
- 3. Target Set Point
- 4. Low Set Point
- 5. Dead Band

Figure 4-3. Dead Band Set Points

**NOTE:** The dead band entered is the amount above and below the target point. For example, if the target is 5.0 ft (1.52 m) with a 0.1 ft (.03 m) dead band, the dead band is 4.9 to 5.1 ft (1.49 to 1.55 m).

### Digital Controller

A graphical menu is displayed when any button from 1 to 4 of the five soft buttons is pressed. The menu structure uses icons to indicate the current function of each button. The menu disappears after five seconds of inactivity.

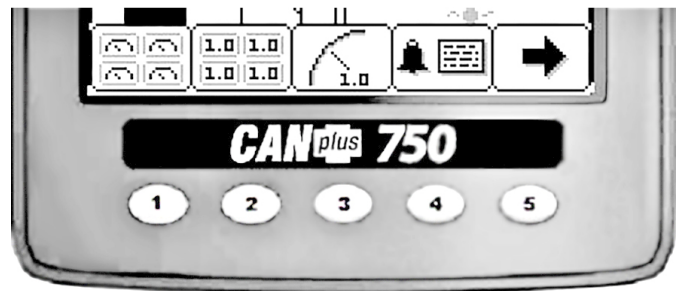


Figure 4-4. CANbus Soft Buttons

**NOTE:** Most problems with electronically controlled engines can be pinpointed via ECU diagnostic messages. Use the display or ECU diagnostic tool to view fault codes. Engine state information and diagnostic codes displayed by the CANplus display are provided via the CANbus.


### Button Lock

The controller's five buttons can be locked so the operator does not accidentally change settings or access another display mode. Button Lock is enabled by pressing and holding buttons 1 and 5 simultaneously for one second. Repeating this operation restores normal button operation.


Button 1	Button 2	Button 3	Button 4	Button 5
<b>Analog Gauge Pages</b>	<b>Digital Gauge Pages</b>	<b>Single Analog Gauge</b>	<b>Active Alarm Page</b>	<b>Gauge Adjust</b>
Press repeatedly to cycle through four pages of analog gauges (16 total)	Press repeatedly to cycle through four pages of digital gauges (16 total)	Press repeatedly to cycle through available analog gauges	Displays active alarms with description	Configures the parameters displayed by gauge pages. (Quad Adjust must be enabled.)
001908	00333	001911	001914	001908

Figure 4-5. Digital Controller Button Menu

## Analog Gauge Pages

Analog Gauge Pages provide four independent pages of analog gauges. To enable Analog Gauge Pages, press any of the first four buttons to show the top level button bar and then press button 1 . Alternate pages are selected by repeated pressing of button 1. The four standard gauge pages are shown in [Figure 4-6](#).

**NOTE:** Engine Hours are displayed as a digital value even on Analog Gauge Pages. The default gauge pages represent 13 selections since the tachometer is repeated in the upper right quadrant of each page.

All 16 gauges may be configured by the user to create an application-specific view of CANbus data. Gauges on the current page can be changed via Adjust mode, accessed by pressing button 5  when the button bar is visible. Gauges can be changed on any of the four pages by selecting the page to be changed and then entering Adjust mode.

**NOTE:** Quad Adjust must be enabled to access the Adjust mode.

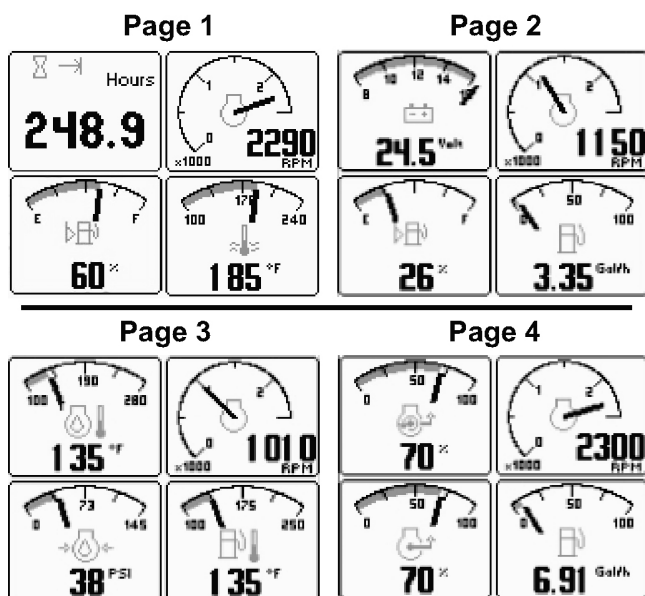








Figure 4-6. Analog Gauge Pages

In Adjust mode, a new button bar is displayed identifying the button functions. Button 1  corresponds to the upper left gauge, button 2  to the upper right gauge, button 3  to the bottom left gauge and button 4  to the bottom right gauge. Successive presses of the buttons selects a different parameter for the gauge. Adjust mode is exited by pressing button 5  and storing the new configuration even when power is removed.

**NOTE:** A gauge selection can only appear once per page. To move a gauge selection, the existing gauge location must be changed first. Gauge selections are limited to the data currently being received. Analog Gauge Pages can be configured in Demo mode to select any supported parameter. Adjust mode can be disabled

in the Configuration menu (Quad Adjust - Off) to prevent accidental changes.

## Digital Gauge Pages

Digital Gauge Pages display the same data as the Analog Gauge Pages but in digital only format. To enable Digital Gauge Pages, press any of the first four buttons to show the top level button bar and then press button 2 . Alternate pages are selected by repeated pressing of button 2. The four standard Digital Gauge Pages are shown in [Figure 4-7](#).

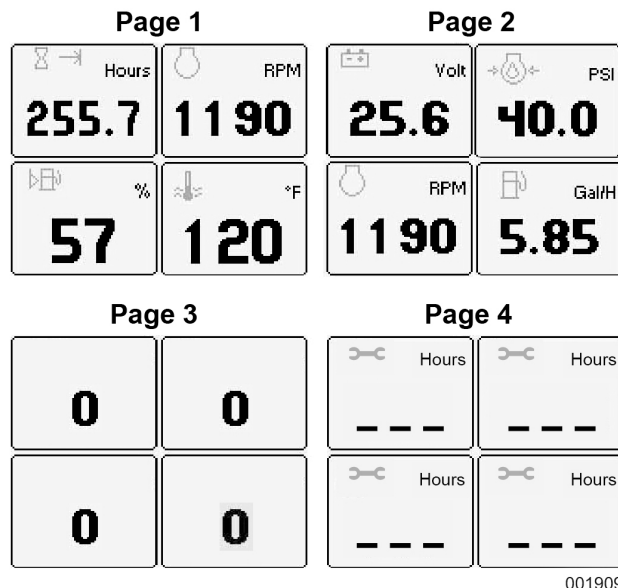



Figure 4-7. Digital Gauge Pages

**NOTE:** The 16 gauges are the same for Analog and Digital Gauge Pages. Adjustments in either Analog Gauge Pages or Digital Gauge Pages affect the same gauge in the other mode.

## Single Analog Gauge

Single Analog Gauge uses the entire display for a single large analog gauge. This mode is enabled by pressing any of the first four buttons to show the top level button bar and then pressing button 3. The gauge displayed is selectable by repeatedly pressing button 3  while in the Single Analog Gauge mode while the menu bar is visible. The currently displayed gauge is stored when power is removed. Refer to [Preferred Screen Store](#).

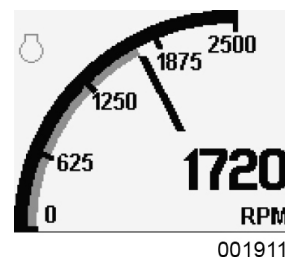


Figure 4-8. Single Analog Gauge

**NOTE:** Gauge selections are limited to the data currently being received.



## Analog Transducer/Switch Gauge

The Analog Transducer/Switch Gauge displays the transducer value and the switch input states. The left column represents the values as a bar graph with a digital value displayed below. The right column shows whether the switches are open, represented by the pointer being down, or closed, represented by the pointer being up.

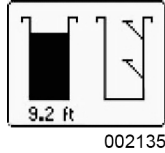


Figure 4-9. Analog Transducer/Switch Gauge

## Digital Transducer Gauge

The Digital Transducer Gauge displays the transducer value as a digital only value. The switch state is not displayed on the Digital Transducer Gauge.

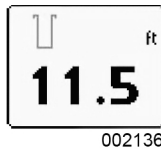


Figure 4-10. Analog Transducer/Switch Gauge

## Active Alarms

A flashing pop-up window is overlaid on the current screen when an active alarm is received. The pop-up includes a description in addition to the standard SPN/FMI (Suspect Parameter Number/Failure Mode Indicator) pair defined by the SAE J1939 standard. Additionally, if enabled, the beeper sounds as an audible cue.

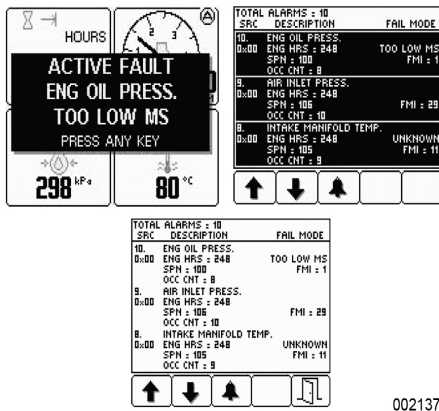


Figure 4-11. Active Alarms

The examples in [Figure 4-11](#) are alarm list screens showing unacknowledged conditions and acknowledged alarms. After acknowledgment, the exit button becomes active.

**NOTE:** Standard J1939 abbreviations are used for alarms. MS = Most Severe, MOD= Moderately Severe, LS = Least Severe.

Refer to [Diagnostic Trouble Codes \(DTS\)](#) for more information on SPN/FMI codes.

## Alarm List

To access the Alarm List, press any button while an alarm pop-up is displayed or pres any of the first four buttons to show the button bar and then press button 4 . Alarms not yet acknowledged are shown in gray on black while acknowledged alarms are shown in black on gray (see [Figure 4-11](#)). The list also indicates when the alarm occurred if engine hours are available. The most recent alarm is displayed at the top of the list. The list can be scrolled using buttons 1 and 2 and alarms acknowledged by pressing button 3 .

To close the Alarm List, press button 5 once the alarms are acknowledged.

An alarm indicator is displayed near the upper right corner of the display as long as alarms are active.

**NOTE:** Only active faults are displayed in the alarm list. Once a fault is corrected, it is automatically removed from the list. To view previously active faults, use the engine diagnostic tool.

## Configuration Menu

The Configuration menu allows the user to set various operating parameters such as US or Metric units, scale limits for tachometer and service timers.

**NOTE:** Infrequently changed parameters and those parameters that typically need to be restricted, such as Maximum RPM, are accessible only through the CANplus Configuration. The CANplus Configurator is a Windows® PC program and a hardware adapter that allows total access to the parameters of the panel. For more information about the CANplus Configurator, please contact Generac Mobile Products.

The Configuration menu is entered by pressing and holding button 5 in any mode for at least three seconds. If PIN (Personal Identification Number or 'password') entry is enabled, the correct PIN must be entered to access the Configuration menu. The top level Configuration menu is displayed as shown (see [Figure 4-12](#)). Buttons 1 and 2 allow you to choose from Display, System, Autostart, Settings, Telemetry or Db Viewer. Pressing button 4 selects the chosen menu item indicated by bold text and the selection arrow . Each item is described in detail on the following pages. Settings are automatically stored when exiting the current menu even when power is removed.

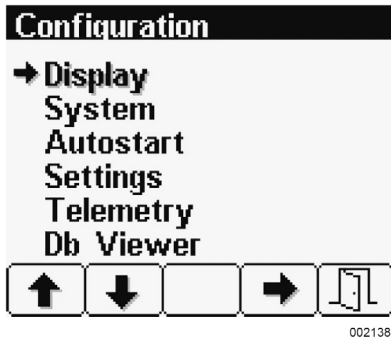


Figure 4-12. Configuration Menu

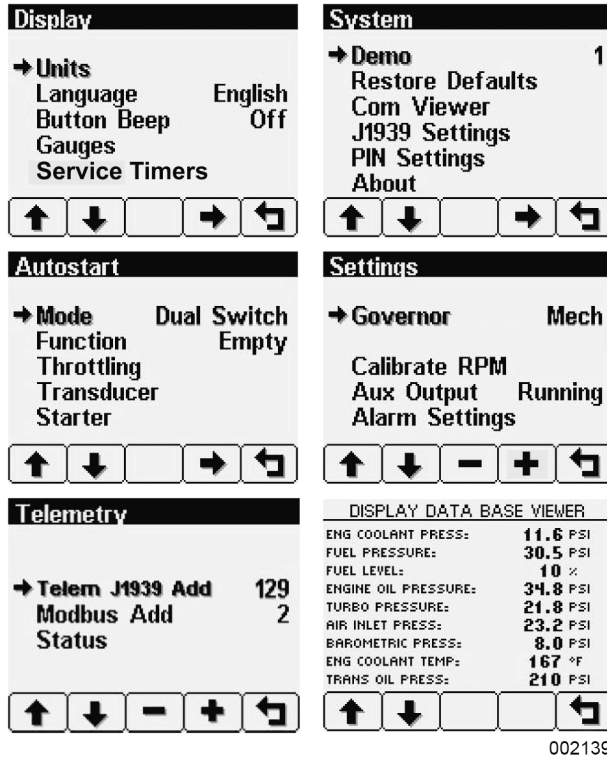


Figure 4-13. Configuration Menus

**NOTE:** Most configuration changes take effect immediately. Some, such as Idle RPM, take effect on the next power up.

### Display Menu

The Display menu allows the user to configure items affecting how information is displayed.

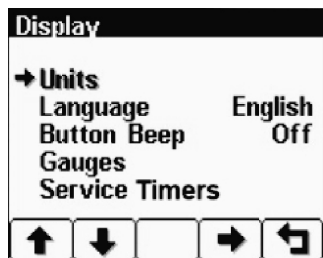


Figure 4-14. Display Menu

### Units Menu

This menu allows the user to set the units used for speed, distance, pressure, volume, and temperature independently. Button 4 cycles through the available values for the selected item.

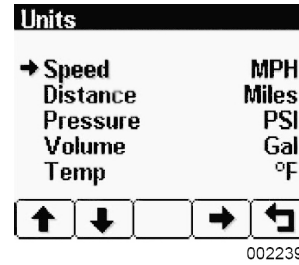


Figure 4-15. Units Menu

- Speed** MPH (miles per hour); km/h (kilometers per hour); Knts (knots)
- Distance** Miles; km (kilometers); NM (nautical miles)
- Pressure** PSI (pounds per square inch); bar (barometric units); kPa (kilopascals)
- Volume** Gal (US gallons); IGal (Imperial gallons); Liters
- Temperature** °F (Fahrenheit); °C (Celsius)

### Language Menu

This menu allows the user to choose between English, Swedish, French, German, Spanish, Italian, Dutch and Portuguese. The currently selected value is indicated by the check mark . Button 4 selects the highlighted value.

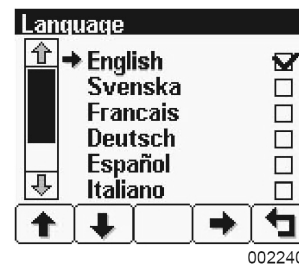


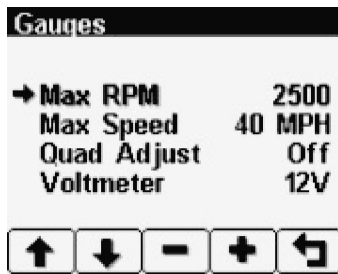
Figure 4-16. Language Menu

### Button Beep

The soft buttons emit an audible beep when this item is On. Button beep is disabled by setting this item to Off. The audible beep still sounds when an alarm occurs. Button 4 cycles between On and Off.

## Gauges Menu

This menu allows the user to configure aspects of the gauges displayed. Button 3 selects the previous value while button 4 selects the next value of the highlighted item.



002244

Figure 4-17. Gauges Menu

### Max RPM

Sets the full scale RPM indicated by the tachometer gauge.

**RPM** 2500, 3000, 3500, 4000, 4500, 5000, 6000, 7000, 8000, or 9000

### Max Speed

Sets the full scale speed indicated by the speedometer gauge.

<b>MPH</b>	15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 70, 75, 80, 85, 95, or 100
<b>km/h</b>	20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, or 160

### Quad Adjust

Allows user to disable Adjust mode of the Analog and Digital Gauge Pages. Button 3 disables while button 4 enables Quad Adjust. Disabling Adjust mode locks the current gauge configuration and prevents the operator from accidentally changing the gauge configuration.

### Voltmeter

Leave setting at the 12V factory default. (24V is not available on this unit.)

### Service Timers

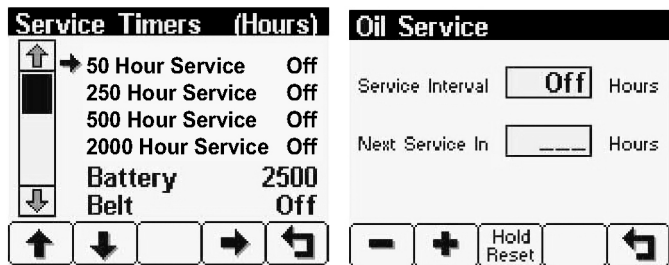
Sets the 16 service timers used to alert operator of needed maintenance and resets the service timer. Setting the service interval to 0 disables the timer and the word Off is displayed.

Pressing button 4 allows adjusting the selected service timer.

Button 1 decreases the service interval time while button 2 increases the service interval time in 10 hour increments. Holding button 3 for approximately three seconds resets Next Service In to the current service interval. The service timer descriptions can be changed using the CANplus Configurator.

The message is displayed on each power up until the elapsed timer is disabled or reset.

**NOTE:** It is not possible to set the service timers if engine hours are not being received by the display

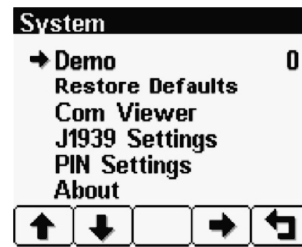


002246

Figure 4-18. Service Timers Menu

## System Menu

The System menu allows the user to configure items affecting how the system functions. Button 4 cycles through the available values for the selected item.



002247

Figure 4-19. System Menu

### Demo

The display supports several demo modes to operate with simulated data. Mode 1 simulates speed data and engine parameters. Mode 2 only simulates engine parameters. Mode 3 simulates speed data, engine parameters, and alarms. Mode 0 disables Demo mode. Demo is automatically set to 0 (Off) if live data is received.



### Restore Defaults

This allows resetting of all configuration information to default US  or Metric  units. Additionally, the display is reset to the initial configuration.

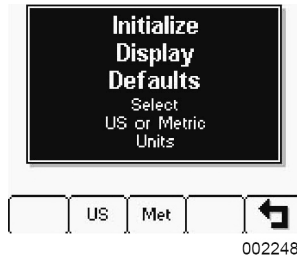


Figure 4-20. Restore Defaults Menu

The default settings are:

Setting	US	Metric
Language	English	
Button Beep	On	
Service Timers	Off	
Display Mode	Analog Gauges	
Gauge Pages	Defaults	
Quad Adjust	On	
Demo Mode	0 (Off)	
Engine Source	0	
Display CAN Address	40	
Alarm Filter	Glb	
SPN Version	1	
Speed Source	Auto	
PIN Entry	Off	
PIN	1111	
Max Gauge RPM	2500	
Max Gauge Speed	40 MPH	60 km/h
Speed Units	MPH	km/h
Distance Units	Miles	km
Pressure Units	PSI	kPa
Volume Units	Gal	l
Temperature Units	°F	°C

### Com Viewer

Displays CANbus data received and engine configuration transmitted by the ECU

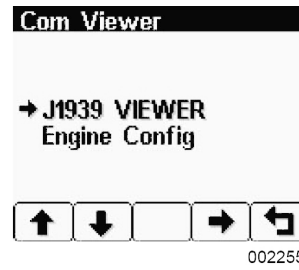


Figure 4-21. Com Viewer Menu

### J1939 Viewer

This screen provides a hexadecimal dump of the messages received on the CANbus. This viewer displays the raw data. To see the decoded data, use the Db Viewer.

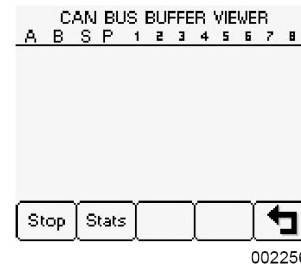


Figure 4-22. J1939 Viewer Menu

Button 1  freezes the display while button 2  shows the CANbus data statistics screen.

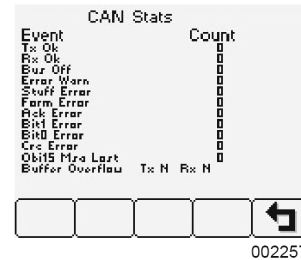


Figure 4-23. J1939 Viewer Menu

### Engine Configuration

This screen displays the engine configuration information received from the ECU. Button 2  selects the next page of engine configuration while button 1  selects the previous page.

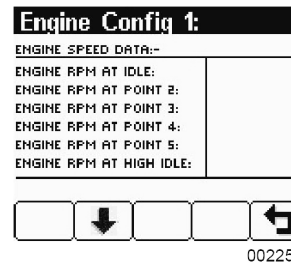


Figure 4-24. Engine Config Menu

### J1939 Settings

This screen allows adjustments specific to the J1939 data link.

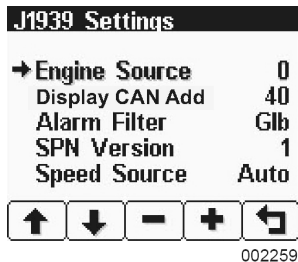


Figure 4-25. J1939 Settings Menu

### Engine Source

Selects which source the display listens to for gauge data. Every device on a J1939 network has a unique address (in the range 0-254) to which the display can choose to listen. The display listens to a single data source; usually the ECU at address 0.

**NOTE:** Incorrectly configuring the Engine Source address will result in no data available for display.

### Display CAN Add

The default display has the unique address of 40, the recommended address for single engine setups.

**NOTE:** Incorrectly configuring the Display CAN Address can result in data collisions on the CANbus.

### Alarm Filter

This setting specifies whether the display will display alarms from all sources (*Glb* or global) or only the source address specified in the “Engine Source” setting (*Src* or source).

### SPN Version

Selects the default SPN (Suspect Parameter Number) conversion method version automatically.

**NOTE:** Selecting the wrong version will cause alarm data to be displayed incorrectly.

### Speed Source

There are three sources of speed data the display can decode. The settings for this parameter are Auto, NMEA, Wheel, Nav, and Off. Auto prioritizes the sources (highest to lowest); NMEA, Wheel (PGN 65265), Nav (PGN 65272). The selection can be forced to one of the available sources by selecting it explicitly. Selecting Off stops the display listening to any source of speed data.

### PIN Settings

By default, PIN (Personal Identification Number) security is disabled. The user is prompted to enter a PIN every time the Configuration menu is accessed after this feature is enabled.

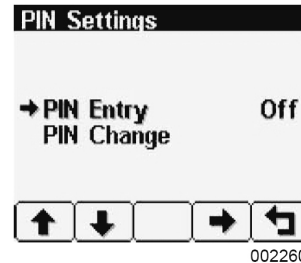


Figure 4-26. PIN Settings Menu

### PIN Entry

This menu allows the user to turn PIN Entry on or off. To enable the PIN Entry feature, select PIN Settings and press button 4 to enable. As a security feature, a default pin number must be entered. Contact Generac Mobile Products to obtain the number. Once the PIN has been entered, the feature is enabled. PIN Entry is disabled by setting PIN Entry to Off.

The digits of the PIN are entered by using the buttons corresponding to the digits of the PIN.

Button 1 adjusts the first digit of the PIN. Button 2 adjusts the second digit, button 3 the third digit and button 4 the fourth digit. The PIN is entered using button 5 .

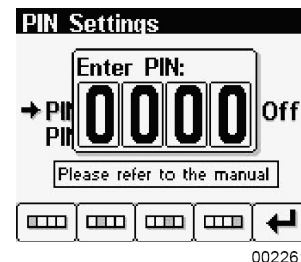


Figure 4-27. PIN Entry

### PIN Change

This allows changing of the PIN. The user is prompted for the current PIN.

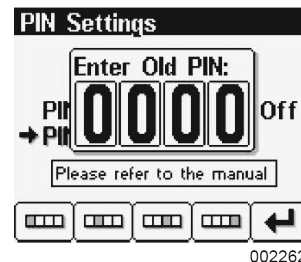


Figure 4-28. PIN Change - Old PIN

The user is prompted for the new PIN.

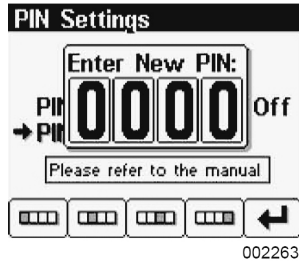


Figure 4-29. PIN Change - New PIN

The new PIN must be confirmed before the PIN is changed.

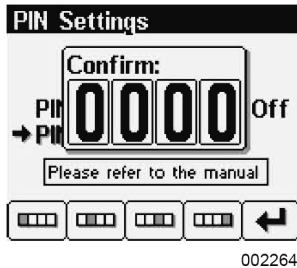


Figure 4-30. PIN Change - Awaiting Confirmation

If the new PINs match, a confirmation screen is displayed.

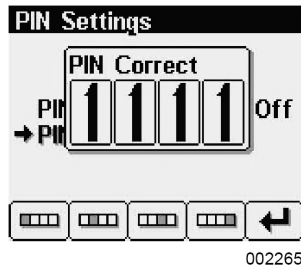


Figure 4-31. PIN Change - Confirmed

If the two PINs do not match, an error message is displayed and the PIN is unchanged.

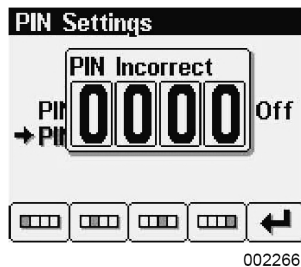


Figure 4-32. PIN Change - PIN Incorrect

**IMPORTANT NOTE:** If the PIN is changed from the default and the new PIN is lost, the configuration mode will not be accessible. Clearing the PIN requires returning the display to LOFA Industries Inc. for service. Contact LOFA Industries Inc. at 770-569-9828.

**About**

Displays the following product information:

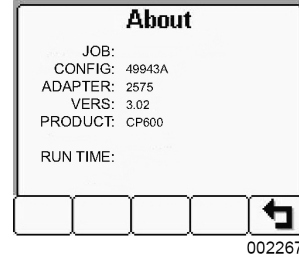


Figure 4-33. About Menu

<b>JOB</b>	N/A
<b>CONFIG</b>	Generac programmed controller part number
<b>ADAPTER</b>	Last adapter serial number used to program the controller
<b>VERS</b>	Software version number
<b>PRODUCT</b>	Controller model name
<b>RUN TIME</b>	Hours the unit has been run

**NOTE:** This screen can not be exited until the checksum calculation is complete. Checksum calculation takes approximately 10 seconds and is complete when the checksum value changes from “Calculating”... to a hexadecimal value such as 0x704E – OK.

**Autostart Menu**

This submenu allows the user to configure automatic start/stop operation. Refer to **Automatic START and STOP** for more information.

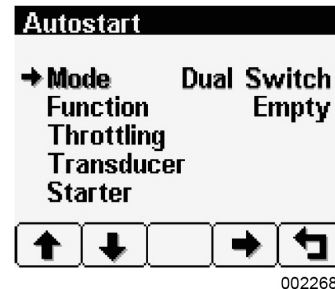


Figure 4-34. Autostart Menu

**Mode**

This menu selects the basic automatic start and stop operation mode. Button 4 cycles between Single Switch, Dual Switch, Transducer, and Transducer & Switch.

**Function**

This menu selects the automatic start and stop function. Button 4 cycles between Empty, Fill, Maintain Out and Maintain In.

## Throttling Menu

The throttling menu allows the user to configure throttle control. It also allows programming of the automatic start and stop throttle profiles as shown in *Figure 4-2*.

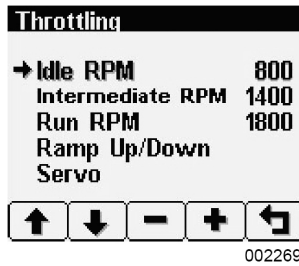


Figure 4-35. Throttling Menu

### Idle RPM

Selects the RPM that the control system will request for idle speed. Idle can be set to compensate for parasitic loads such as hydraulic pumps or compressors. Idle RPM is the low speed setting of the optional two state or three state throttle switches.

**NOTE:** The minimum engine speed is set by the ECU. Requesting a lower speed causes the engine to run at the ECU minimum speed. RPM limits are programmed into the panel to limit the requested speed. Contact Generac Mobile Products for information on changing the panel minimum requested RPM and maximum requested RPM.

### Intermediate RPM

Selects the RPM that the control system will request for intermediate speed. The intermediate speed can be used to prime pump or charge lines during automatic start and stop operation. Intermediate RPM is the middle setting of optional three state throttle switches.

**NOTE:** Setting the Intermediate RPM to the same speed as Idle RPM and Ramp to Run to zero seconds is effectively two speed automatic operation.

### Run RPM

Selects the RPM that the control system will request for run speed. The run speed is the normal operating speed during automatic start and stop operation. Run RPM is the high speed setting of the optional two state or three state throttle switches.

### Ramp Up/Down

This submenu configures the speed profile for automatic start and stop operation.

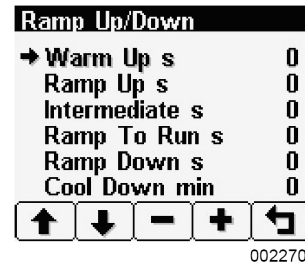


Figure 4-36. Ramp Up/Down Menu

### Warm Up s

Selects the number of seconds to operate at idle speed before beginning the ramp to intermediate speed. The warm-up time begins when the starter is disengaged.

### Ramp Up s

Selects the number of seconds to ramp from idle speed to intermediate speed after warm-up.

### Intermediate s

Selects the number of seconds to operate at intermediate speed before ramping to run speed.

### Ramp to Run s

Selects the number of seconds to ramp from intermediate speed to run speed after intermediate warm-up.

### Ramp Down s

Selects the number of seconds to ramp from current speed to idle speed. The ramp down time begins when the automatic start and stop system detects a stop event.

### Cool Down m

Selects the number of minutes to operate at idle speed after ramp down time. At the end of the cool down period, the engine will be stopped.

### Servo

Configures the servo profile for autostart maintain modes.

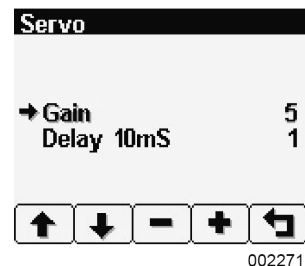


Figure 4-37. Servo Menu

### Gain

Controls the aggressiveness of the maintain servo modes.

### Delay 10mS

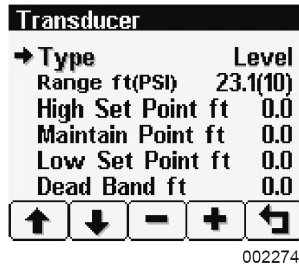
Controls how quickly the maintain servo mode responds to changes in level.

### Transducer

This submenu configures the transducer type and set points.

#### Type

Selects between Level and Pressure CANplus Configurator.



002274  
Figure 4-38. Transducer Type Menu

#### Range

Selects appropriate range for the transducer type.

#### High Set Point

For Empty and Maintain Out modes, sets the level that begins and autostart cycle. For Fill and Maintain In modes, sets the level that ends the cycle.

#### Maintain Point

Sets the target point for maintain modes.

#### Low Set Point

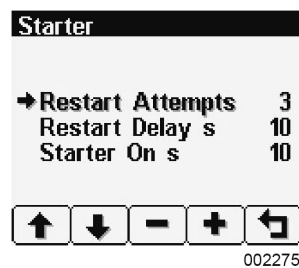
For Empty and Maintain Out modes, sets the level that ends an autostart cycle. For Fill and Maintain In modes, sets the level that begins a cycle.

#### Dead Band

Sets the amount of change from the target point required to alter the engine speed.

### Starter

This submenu configures starter control options for auto-start.



002275  
Figure 4-39. Starter Menu

#### Restart Attempts

Selects the number of times to attempt restart.

#### Restart Delay Sec

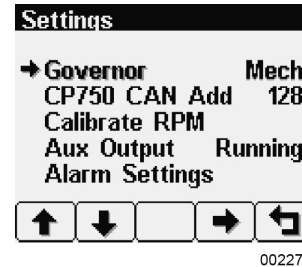
Selects the number of seconds to wait before attempting a restart.

#### Start on Sec

Selects the maximum number of seconds the starter can be engaged.

### Settings Menu

This submenu allows the user to configure CANplus hardware.



002276  
Figure 4-40. Settings Menu

#### Governor

Selects between Elect (electronically governed) and Mech (mechanically governed) engines modes. For mechanically governed engines, the CANplus I/O Board functions as an ECU, broadcasting engine parameters such as oil pressure and temperature on the CANbus.

**NOTE:** Switching governor modes requires cycling power before calibrating the RPM. The CANplus Configurator must be used to configure mechanical engine parameters.

#### CP750 CAN Add

Selects the address used by the display to communicate with the CANplus I/O Board. The default I/O Board address is 128.

**NOTE:** Engine data is always transmitted using address 0 in mechanically governed mode.

**IMPORTANT NOTE:** Incorrectly configuring the CP750 CAN Address prevents the display from receiving I/O Board data for the display menus and can result in data collisions on the CANbus.

### Calibrate RPM

Calibrates the tachometer input for mechanically governed engines to allow the CANplus I/O Board to measure the engine speed. This signal may be provided by an alternator frequency tap, proximity switch. An optional amplifier/divider can be added for use with a magnetic pickup.

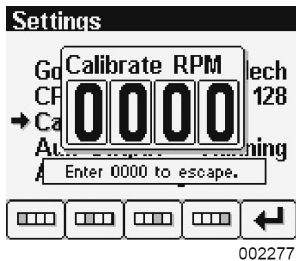


Figure 4-41. Calibrate RPM Menu

**NOTE:** Calibrate RPM is only available on mechanically governed engines. The RPM must be calibrated for automatic start and stop operation to function.

Crank the engine and measure the engine RPM with a hand-held tachometer. Select Calibrate RPM and enter the digits of the measured RPM using the buttons corresponding to the digits of the RPM. Button 1 adjusts the first digit of the RPM. Button 2 adjusts the second digit, button 3 the third digit, and button 4 the fourth digit. The RPM is entered using button 5 .

When the calibration is complete, the LEDs will begin a blinking sequence. The power must be cycled to continue configuration or operation.

### Aux Output

Selects the Aux Output function and provides a one amp low side switch.

- Running** The output is active when the engine RPM exceeds 500 RPM.
- AS Armed** The output is active when the Key switch is in the Autostart position and the engine has not stopped due to a fault.
- At Speed** The output is active when the engine is at or above the operating RPM.
- Prestart** The output is prestart alarm activated 10 seconds before the engine automatically starts.

**NOTE:** The Aux Output is available on a connector in the I/O Board only. Changing the prestart alarm time requires using the LOFA Configurator.

### Alarm Settings

Configures the set points for the transducer alarm messages. The alarm is transmitted as SPN 1083 with FMI 1

for a low alarm and FMI 0 for a high alarm.

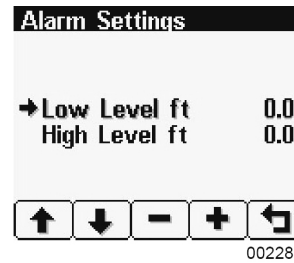


Figure 4-42. Alarm Settings Menu

#### Low Level ft

Sets the transducer low level alarm set point.

#### High Level ft

Sets the transducer high level alarm set point.

### Telemetry Menu

This menu allows configuring the optional telemetry system.

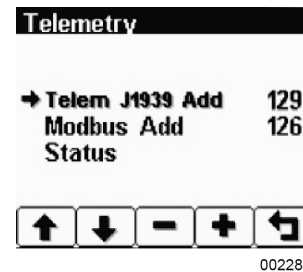


Figure 4-43. Telemetry Menu

#### Telem J1939 Address

Defines the address the telemetry module is using for CANbus communications.

**NOTE:** The display will be unable to communicate with the telemetry module if this address is incorrect.

#### Modbus Address

Selects the Modbus slave address the telemetry module will use for Modbus communications.

#### Status

Displays telemetry and modem status information retrieved from the telemetry module:

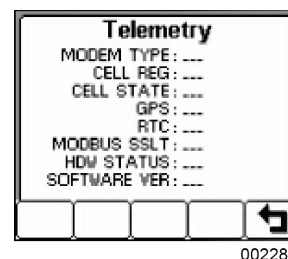





Figure 4-44. Status Menu

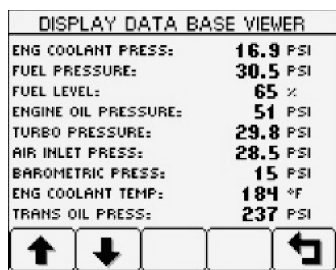
## DB Viewer

<b>MODEM TYPE</b>	Identifies the modem type
<b>CELL REG</b>	Identifies cell modem registration
<b>CELL STATE</b>	Indicates cell state and signal strength
<b>GPS</b>	Indicates GPS status
<b>RTC</b>	Indicates number of days since real time clock cellular update
<b>MODBUS SSLT</b>	Indicates Modbus slave status
<b>HDW STATUS</b>	Indicates various hardware status items
<b>SOFTWARE VER</b>	Indicates the version of software in the Messenger

The Database Viewer displays and decodes all data monitored by the display. This diagnostic tool allows viewing data not normally displayed.

The list can be scrolled using buttons 1  and 2  and closed by pressing button 5 .

**NOTE:** The Database Viewer is always in English regardless of language selected.



002290

Figure 4-45. DB Viewer Menu

## Preferred Screen Store

The display automatically stores the current screen as the preferred screen after a delay of approximately 15 seconds. The display will use the last stored screen on the next power up.

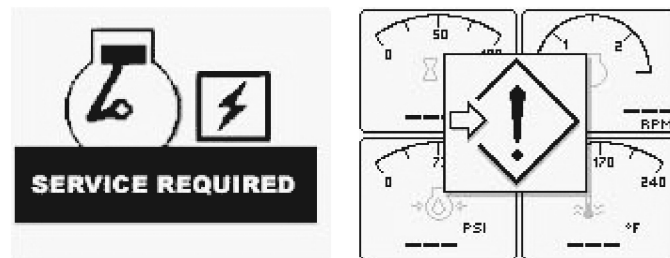
**NOTE:** Selecting Restore Defaults restores the Analog Gauge Pages and default gauges.

## Pop-Up Messages and Alerts

### Service Required

Users can set up to 16 service timers in hours in the Configuration menu (refer to [Service Timers](#)). The Service Required pop-up is displayed at power up when one or more service timers has expired. Pressing any button

removes the pop-up. If no button is pressed, the pop-up closes in approximately five seconds.



002286


Figure 4-46. Pop-up Warnings of Service Required and Data Communications Failure

### Data Communications Failure



The Data Communications Failure pop-up icon flashes if the display does not detect data. The warning disappears and normal operation resumes once data is detected.

**NOTE:** Incorrectly configuring the Engine Source address will result in no data available for display.

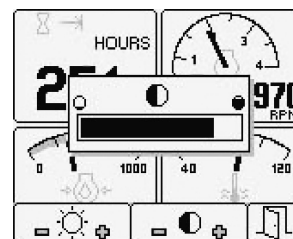
### Data Not Available

Gauges and the Db Viewer will display  if the desired data is not available. The display value returns to normal when parameter data is received.

## Adjusting Lighting and Contrast


Pressing button 5 when there is no menu bar opens the lighting and contrast menu bar. The display has a number of backlighting levels, allowing the display to be read in the dark. The level is adjusted by pressing button 1 to decrease, or button 2 to increase  illumination. Contrast is adjusted in the same manner using buttons 3 and 4 .

**NOTE:** The display adjusts the contrast with ambient temperature. Manual contrast adjustments are only necessary with extreme climate change.



002289


























Figure 4-47. Lighting And Contrast Menu

Exit menu by pressing button 5 . The lighting and contrast settings are retained after the unit is powered off.































**NOTE:** If the contrast has been adjusted poorly, the factory setting is restored by pressing buttons 1 through 4 simultaneously. This action does not change other user-configured settings.

## Data Parameters Monitored

This table lists the engine and transmission parameters monitored via the CANbus. Parameters can be displayed by the user-configurable gauge pages or the single analog gauge. DB is an abbreviation for the internal database which stores all data transmitted from the engine/transmission. The complete database can be accessed on the display via the DB Viewer in the Configuration menu.

Icon	Parameter	Gauge Pages	Single Gauge	Database
	Electrical Potential	●	●	●
	Battery Voltage, Switched	●	●	●
	Net Battery Current	●		●
	Alternator Voltage	●	●	●
	Alternator Current	●	●	●
<b>Fuel (L, Gal, iGal) or (L/h, Gal/h iGal/h) or (km/L, MPG or IMPG)</b>				
	Fuel Level	●	●	●
	Fuel Rate	●	●	●
	Fuel Temperature	●	●	●
	Instantaneous Fuel Economy	●		●
	Trip Fuel Economy	●		●
	Trip Fuel	●		●
	Trip Fuel Rate	●		●
	Total Fuel Used			●
	Fuel Leakage 1			●
	Fuel Leakage 2			●
<b>Distance (km, Miles or Nmiles)</b>				
	Distance Remaining	●		●
	Trip Distance	●		●
	Total Vehicle Distance	●		●
<b>Pressure (kPa, PSI or bar)</b>				
	Fuel Pressure	●		●
	Barometer Pressure	●		●
	Auxiliary Pressure 1	●		●
	Turbo Pressure	●	●	●
	Air Inlet Pressure	●		●
	Air Filter Differential Pressure	●		●
	Injector Metering Rail 1 Pressure	●		●
	Injector Metering Rail 2 Pressure	●		●
	Engine Coolant Pressure	●		●
	Engine Oil Pressure	●	●	●



Icon	Parameter	Gauge Pages	Single Gauge	Database
	Transmission Oil Pressure	●	●	●
	Clutch Pressure	●		●
	Air Start Pressure	●		●
	Injector Control Pressure	●	●	●
<b>Temperature (°C, °F)</b>				
	Engine Coolant Temperature	●	●	●
	Engine Intercooler Temperature	●		●
	Engine Oil Temperature	●	●	●
	Transmission Oil Temperature	●	●	●
	Turbo Oil Temperature	●		●
	Intake Manifold Temperature	●	●	●
	Air Inlet Temperature	●	●	●
	Exhaust Temperature	●	●	●
	Auxiliary Temperature 1	●	●	●
	Engine ECU Temperature			●
	Exhaust Gas Port 1 Temperature	●		●
	Exhaust Gas Port 2 Temperature	●		●
	Turbo Inlet Temperature	●		●
<b>Percentage (%)</b>				
	Acceleration Position	●		●
	Engine Oil Level	●	●	●
	Coolant Level	●	●	●
	Fan Speed	●		●
	Drivers Demand Percent Torque	●		●
	Actual Engine Percent Torque	●	●	●
	Percent Load at RPM	●	●	●
<b>Speed (RPM, km/h, MPH or KTS)</b>				
	Input Shaft Speed	●		●
	Output Shaft Speed	●		●
	Engine Speed	●	●	●
	Turbo 1 Speed	●		●
	Engine Desired Operating Speed	●		●
	Fan Speed	●		●
	Vehicle Speed	●	●	●

Icon	Parameter	Gauge Pages	Single Gauge	Database
<b>Time (h)</b>				
⌂ →	Total Engine Hours	●		●
⌂ ←	Trip Engine Hours	●		●
	Service Hours			●
<b>Miscellaneous</b>				
	Torque Converter Lock-Up Engaged			●
U	Transducer	●	●	●
F N R	Current Gear	●		●
F N R	Selected Gear	●		●
	CANTX Disable			●
	CANplus I/O			●

## DEF Controller

Monitors DEF fluid level and temperature.

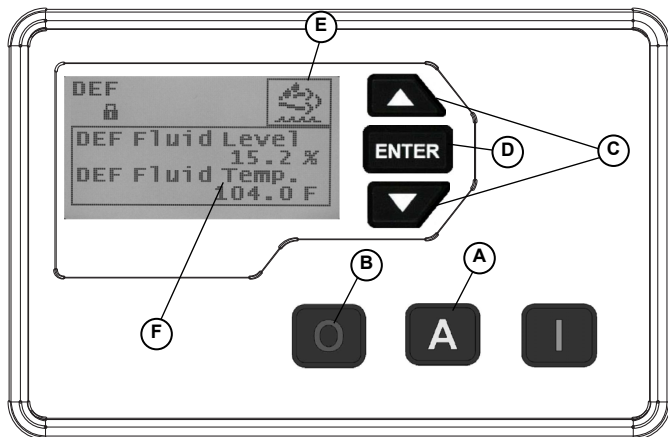


Figure 4-48. DEF Controller

### (A) Auto

Places unit in automatic DEF refill mode.

### (B) OFF

Disables DEF refill operation.

### (C) Up/Down

Scrolls screen.

### (D) Enter

Locks screen.

### (E) DEF lamp

Alerts operator of main engine DEF status. When the icon is solid this indicates that the DEF level is low. When the icon is flashing this is a warning of the DEF fluid secondary severity level.

## (F) DEF Tank Programmable Settings

- DEF Low Level
- DEF High Level
- DEF Pump Max. ON Timer
- DEF Fluid Pump Re-Cycle Timer
- DEF Fluid Level Failure
- DEF Fluid Level Trigger Delay
- DEF/SCR Fluid Temperature Enable

## (F) DEF Heater Programmable Settings

- Bypass Timer
- Output On Temp
- Output Off Temp

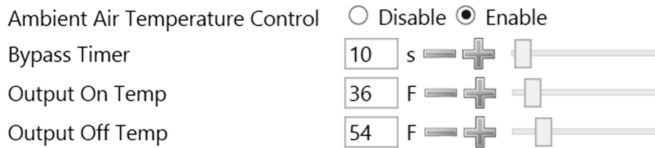
## DEF Transfer Pump Output Test Procedure

1. Place DEF controller in AUTO mode.
2. Start and run the engine. Once the engine is running the DEF controller should display the DEF level and DEF fluid temperature.
3. See [Figure 4-49](#). Set the DEF controller DEF Low Level to 15%.
4. After the delay indicated by the DEF Fluid Level Trigger Delay value, the DEF transfer pump output will turn on for the time indicated by the DF Pump Max ON timer.

**NOTE:** Output can be measured by reading the resistance between relay pack terminals J2 and J3. Continuity between J2 and J3 indicates output is ON.

- After the transfer pump has run for the DEF Pump Max On Timer value, the pump will turn off and remain off for the time indicated by the DEF Fluid Pump Re-Cycle Timer. After this delay if the DEF level remains below the value of the DEF High Level setting, the pump will turn back on for the time indicated by the DEF Pump Max Timer. This process will repeat until the DEF level rises above the DEF High Level.

**NOTE:** If the DEF level drops below the DEF Level Failure value, the DEF controller will disable DEF transfer pump control.



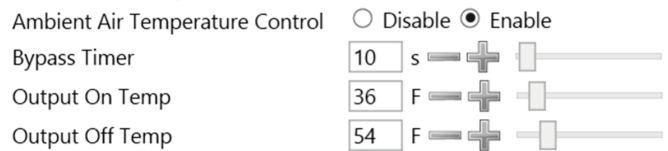
**Figure 4-49. DEF Transfer Pump Test Procedure**

### DEF Line Heater Output Test Procedure

- Place the DEF controller in the AUTO position
- Start and run the engine. Once the engine is running the DEF controller should display the DEF level and DEF fluid temperature.
- See **Figure 4-50**. Set the DEF controller Ambient Air Temperature to 32F.
- After the delay indicated by the Bypass Timer value, the DEF line heater output will turn on for the time indicated by the Bypass Timer Value.

**NOTE:** Output can be measured by reading the resistance between relay pack terminals J5 and J6. Continuity between J5 and J6 indicates output is ON.

- The DEF line heater output will remain on until the temperature exceeds the temperature indicated by the Output Off Temp value. Once the temperature exceeds this value the output will turn OFF.



**Figure 4-50. DEF Line Heater Test Procedure**

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## Section 5 Setup

### Hood Operation (if equipped)

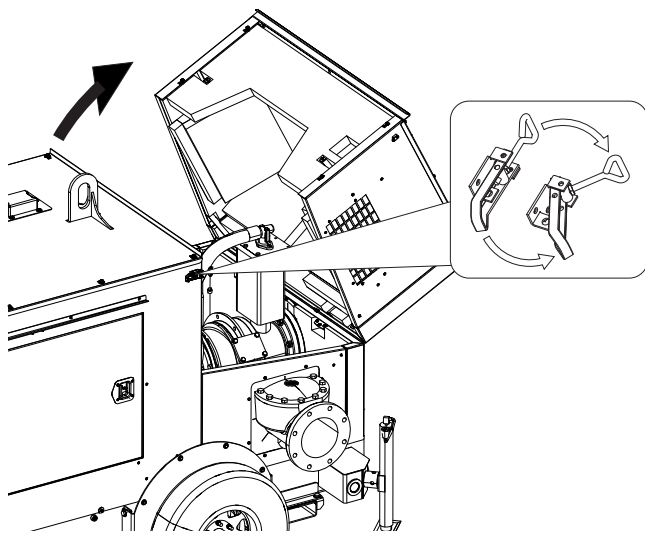


Figure 5-1. Hood Latches

#### To open the rear hood:

1. Verify there is proper clearance to accommodate swing of hood to the full-open position.
2. Release hood latches.
3. Stand at the rear of the unit and firmly grasp the handle at the rear of the hood and slowly tilt the hood rearward until fully open.



#### WARNING

Pinch Point. Hood could slam shut. Keep hands and fingers clear. Failure to do so could result in death or serious injury.

(000267)

**NOTE:** Pump hoods are heavy. Use caution when opening or closing.

#### To close the rear hood:

1. Verify all contact surfaces for hood are clean of debris.
2. Stand at the rear of the unit and firmly grasp the handle at the rear of the hood and slowly tilt the hood forward until fully closed.
3. Verify hood has fully seated and secure the hood latches.

### Pump Set Up

1. Disconnect the pump from the tow vehicle by turning the tongue jack handle clockwise to raise the tongue from the hitch.
2. Block the wheels to prevent the unit from rolling.
3. Disconnect all safety chains, surge brake cables, and the trailer wiring harness.
4. Lower the rear leveling jacks from the travel position. Turn the jack handles clockwise until the leveling feet are in firm contact with the ground. Adjust the jacks until the pump is level.
5. Attach fittings to the intake and outlet openings of the pump, verifying they match the fittings on the hoses. Verify a gasket/seal is in place between the pump volute and the flange on the attached fitting.
6. Tighten all hardware completely to maintain an airtight seal. Threaded fittings require the use of pipe thread sealant.
7. Attach a rigid hose/pipe to the intake (suction) side of the pump.

**NOTE:** The suction hose/piping should be at least as large as the pump flange, never smaller.

**NOTE:** The pump should be at the highest point of the hose/piping.

**NOTE:** All suction piping and fittings should be checked for any foreign material (rocks, bolts, wire, etc.) and also any sharp burrs that could disrupt the flow.

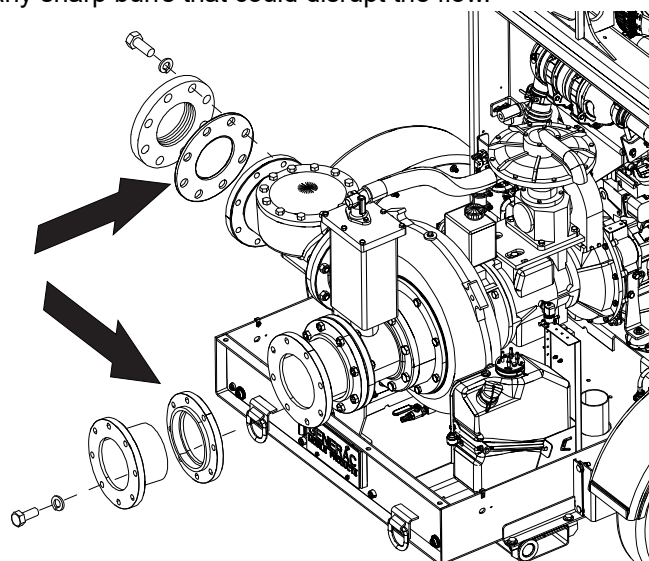


Figure 5-2. Pump Seals

**NOTE:** Verify the O-ring seal is present in the fitting on the pump before attaching the fitting. Lubricate the O-ring seal with grease to maintain an airtight seal.

**NOTE:** The suction and discharge pipe/hose material must be compatible with the liquid being pumped. Hoses used on a suction line must be of the reinforced type to prevent collapse under suction lift.

**NOTE:** If a manual shutoff valve is installed in the discharge line, it must be open during operation.

8. Attach a rigid intake screen or strainer to the end of the suction hose before placing it in the liquid. This prevents large items or excessive trash from entering the pump housing.

**NOTE:** The intake screen must have enough openings to equal 28 sq. in. (181 sq. cm) or more (6 in. pump). The screen should be rigid enough to prevent collapse when flow is reduced due to clogging.

9. Place the intake hose into the liquid to be pumped.

**NOTE:** The submergence of the suction pipe into the liquid should be at least four to five times the pipe diameter. If this is not possible, provide a baffle or a floating board. This is to prevent any vortex action from allowing air into the pipe/hose.

**NOTE:** For best performance, a bell mouth fitting is recommended.

**NOTE:** Recommended bell diameters and pipe submergences for various flows are shown in [Table 3](#). The table data is referenced from ANSI/HI 9.8-1998.

**CAUTION**

Equipment damage. Exceeding maximum suction lift height of pump could result in cavitation/damage to the pump.

(000268)

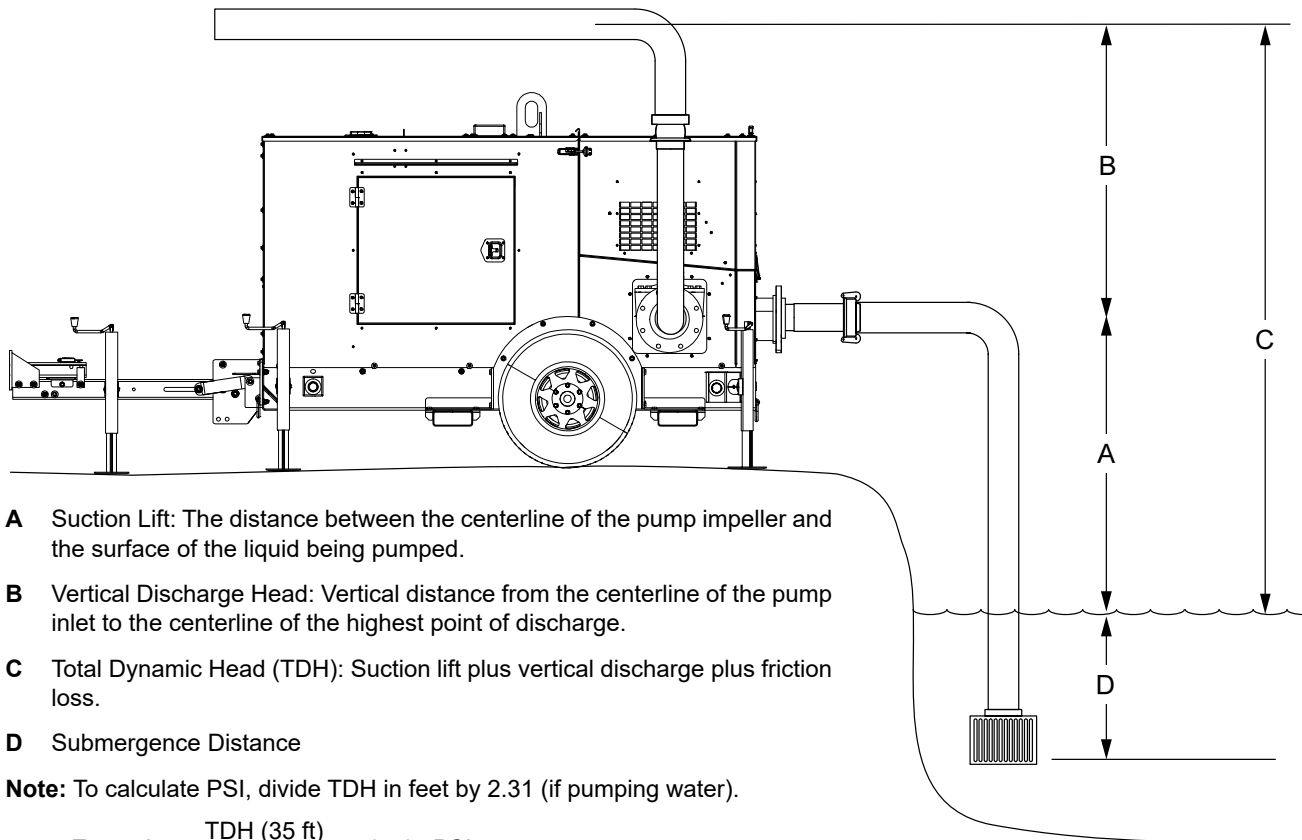
10. Attach a flexible hose/pipe to the outlet (discharge) side of the pump.

**NOTE:** Verify the O-ring seal is present in the fitting on the pump before attaching the fitting. Lubricate the O-ring seal with grease to maintain an airtight seal.

11. Use a concentric taper on the discharge side to increase discharge pipe/hose diameters.

**NOTE:** All valving and fittings should be the same size as the discharge main-line. The discharge size should be adequate to maintain reasonable velocities and reduce friction losses. It is strongly recommended that a pressure relief valve is installed on the discharge piping.

12. Check the intake and outlet hoses for sharp bends or kinks that may restrict pump flow. The intake hose should slope upwards toward the pump to avoid development of air pockets in the hose, which may lead to pump cavitation. Keep the hoses as straight as possible.



**A** Suction Lift: The distance between the centerline of the pump impeller and the surface of the liquid being pumped.

**B** Vertical Discharge Head: Vertical distance from the centerline of the pump inlet to the centerline of the highest point of discharge.

**C** Total Dynamic Head (TDH): Suction lift plus vertical discharge plus friction loss.

**D** Submergence Distance

**Note:** To calculate PSI, divide TDH in feet by 2.31 (if pumping water).

$$\text{Example } \frac{\text{TDH (35 ft)}}{2.31} = 15.15 \text{ PSI}$$

**Figure 5-3. Suction Specifications**

Table 3: Pipe Submergences

FLOW (GPM)	500	1000	1500	2000	2500	3000	3500	4000	4500
<b>SUMMERGENCE WITH BELL (FT)</b>									
Bell Diameter (in)	6.1	8.6	10.6	12.2	13.6	14.9	16.1	17.2	18.3
Submergence (ft)	2.1	2.6	3.0	3.3	3.5	3.7	3.9	4.1	4.3
<b>SUBMERGENCE WITHOUT BELL (FT)</b>									
PIPE ID (in) - No Bell	SUBMERGENCE WITHOUT BELL (FT)								
3	4.7								
4	3.3	6.3							
6	2.1	3.7	5.3						
8	1.7	2.8	3.8	4.9	6.0				
10	1.6	2.3	3.1	3.8	4.6	5.4	6.1	6.9	7.6

Figure 5-4.

## Pump Pre-use Checkpoints

Before using the pump, check the following:

- Place the pump as close as possible to the liquid being pumped, keeping the number of hose sections and couplings to a minimum.
- The pump should be the highest point between the intake and outlet section of the suction hoses.
- Verify the ground is firm and as level as possible.
- Block the wheels on the trailer to prevent it from moving.
- Check the pump discharge area; verify discharge will not erode the material under the pump or damage any nearby structures.
- Verify all hose couplings are of the same size and type.
- All hoses/piping should be supported, braced and lined up square before connecting to the pump flanges.
- A flexible fitting is recommended on both suction and discharge to eliminate misalignment loads or stresses being transmitted to the pump.

**NOTE:** Flexible pipe couplings must be restrained so as not to transmit any strain to the pump flanges when expanding or contracting under pressure. Unrestrained expansion fittings can transmit enormous forces to the pump flanges.

### CAUTION

Equipment damage. Use recommended strainer to prevent debris from entering the pump. Failure to do so could result in equipment damage.

(000241)

## Prestart Checklist

- Verify all fasteners at gasketed surfaces are properly tightened.
- Verify belts and couplings (shaft) are properly adjusted and aligned, and all guards are in place.
- Verify all protective covers and screens are in place.
- Verify pump drain is closed.
- Check valves for proper position. If connecting to a system that has a discharge gate valve, start with the valve closed. The speed of opening depends upon the size and length of the discharge pipe and capacity of the pump. The valve should not be more than 0.25 in. (6.35 mm) open until the line is filled. This will reduce the possibility of a water hammer of shock if filling is too rapid.
- Verify all hose couplings, covers and plugs are tight.

### WARNING

Personal Injury. Verify all hoses are securely fastened. Failure to do so could result in death or serious injury.

(000272)

- Check the oil level in the mechanical seal oil reservoir bottle. Do not allow the bottle to run dry.
- For diaphragm vacuum pumps: Check the oil level in the sight glass located at the base of the assembly. Add oil if necessary.

### CAUTION

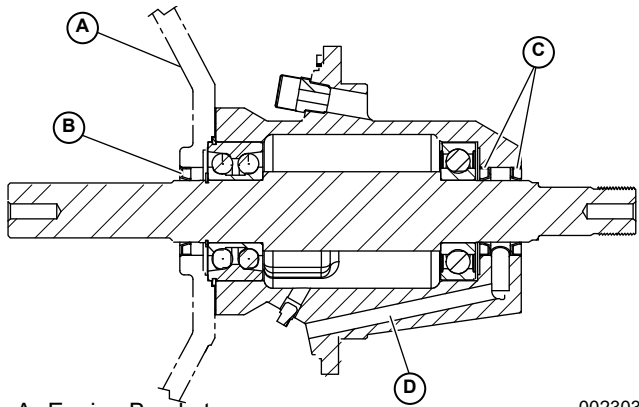
Equipment damage. Verify proper type and quantity of oil prior to starting pump. Failure to do so could result in pump damage.

(000275)

- ❑ Check lip seal vent for leakage. The bearing oil and mechanical seal oil are each sealed by a shaft lip seal, and a vent to atmosphere exists between these two lip seals to indicate oil leaks from either cavity. If either the bearing oil or mechanical seal oil lip seals leak, oil will leak from the vent.

- ❑ Check the engine oil level, coolant level and fuel level.
- ❑ Verify the battery is connected.
- ❑ Verify the Emergency Stop switch is pulled out (deactivated).

The unit is now ready for use.



002303

- A. Engine Bracket
- B. Drive End Lip Seal
- C. Pump End Lip Seals
- D. Oil Leak Path

**Figure 5-5. Lip Seals**



# Section 6 Operation

## Starting the Unit

1. Turn key switch to the right RUN position. A startup screen will appear. After the startup screen is cleared, the display will show readings on virtual gauges.
2. Once the gauges appear, crank the engine by turning and holding the key switch in the start position until the engine starts. Refer to **Starting the Unit** for details.
3. The pump should self prime and begin to discharge liquid within minutes.

**NOTE:** The pump may not prime immediately because the suction line must first fill with liquid. If the pump fails to prime within five minutes, stop the pump and check the suction line for leaks.

Refer to **Throttle Control** for information on adjusting pump flow. Several factors can influence pump output:

- The temperature, viscosity, and amount of entrained solids in the liquid being moved.

- The length, diameter, and number of bends of the intake and outlet hoses.
- The total suction height (lift) of the pump.
- The altitude above sea level where the pump is operating.



**WARNING**  
Personal Injury. Do not operate pump with flow completely restricted. Doing so could cause pump casing to explode and could result in death or serious injury.

(000273)

**NOTE:** As the pump operates, avoid sucking an air/liquid mixture into the intake side of the pump as this may cause the pump to cavitate, causing damage to the pump impeller. The intake hose must be kept 4-5 times the hose diameter (4-5 x 6 in. = 24-30 in. [4-5 x 15 cm = 60-75 cm]) below the surface of the liquid being pumped.

**NOTE:** Do not exceed the maximum recommended operating pressure for the pump.

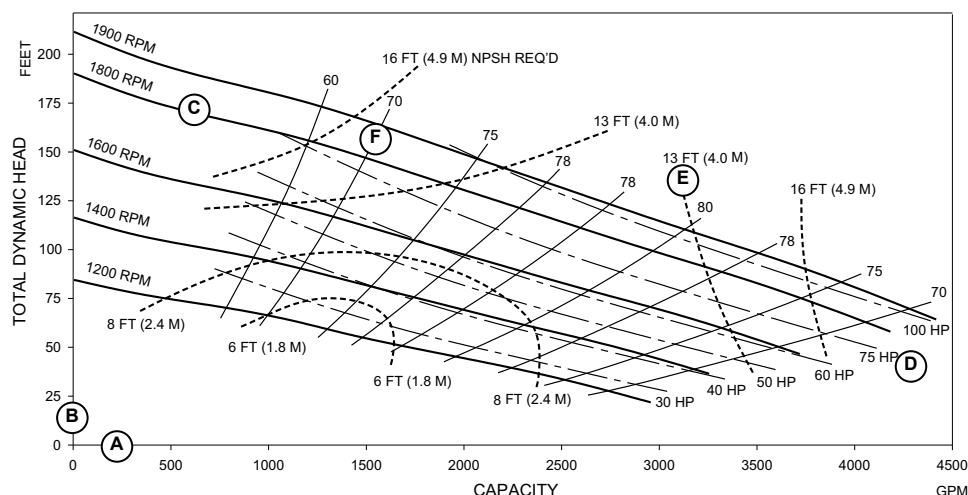
## Flow Rates

Pump performance is impacted by the flow of liquid available and the pumping pressure required. The interaction between flow and pressure is captured in a flow rate chart that allows the user to maximize performance and pump life by running the pump at peak efficiency.

See **Figure 6-1**. Flow Capacity, located on the x-axis of the chart (A,) is the volume being discharged from the pump. Total Dynamic Head (B), is the pressure generated from water flowing in a system, and is comprised of the vertical rise and friction losses from the pipe. Pump operating speeds are listed as varying RPM's and are shown as sloping solid lines (C). Horsepower is displayed as downward sloping hashed lines (D), and is noted as a minimum requirement to operate the pump. Net Positive

Suction Head Requirement (NPSHR) is the dynamic head required to protect the pump from cavitation and overall performance issues and is displayed by the dotted lines with head requirement listed above (E). Efficiency can be determined by the vertical solid lines with the corresponding percentages listed above (F).

As an example, in **Figure 6-1** a pump is required to have a flow capacity of 2,000 GPM with a dynamic head of 100 feet. With this information it can be determined that the pump will run most efficiently at 1600 rpm with a minimum required power input of HP and NPSHR of 8'. Under these conditions, the pump will be operating at approximately 78% efficiency.

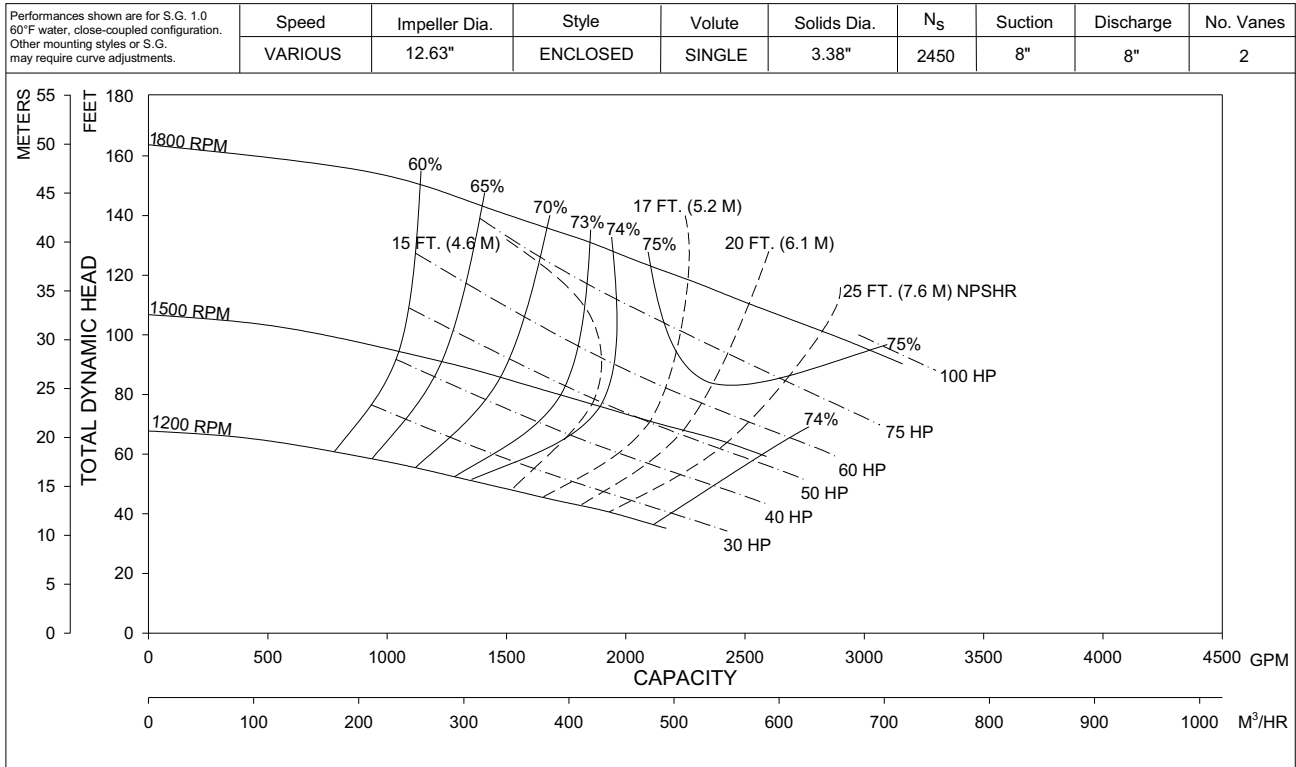


**Figure 6-1. Reading a Flow Rate Chart**

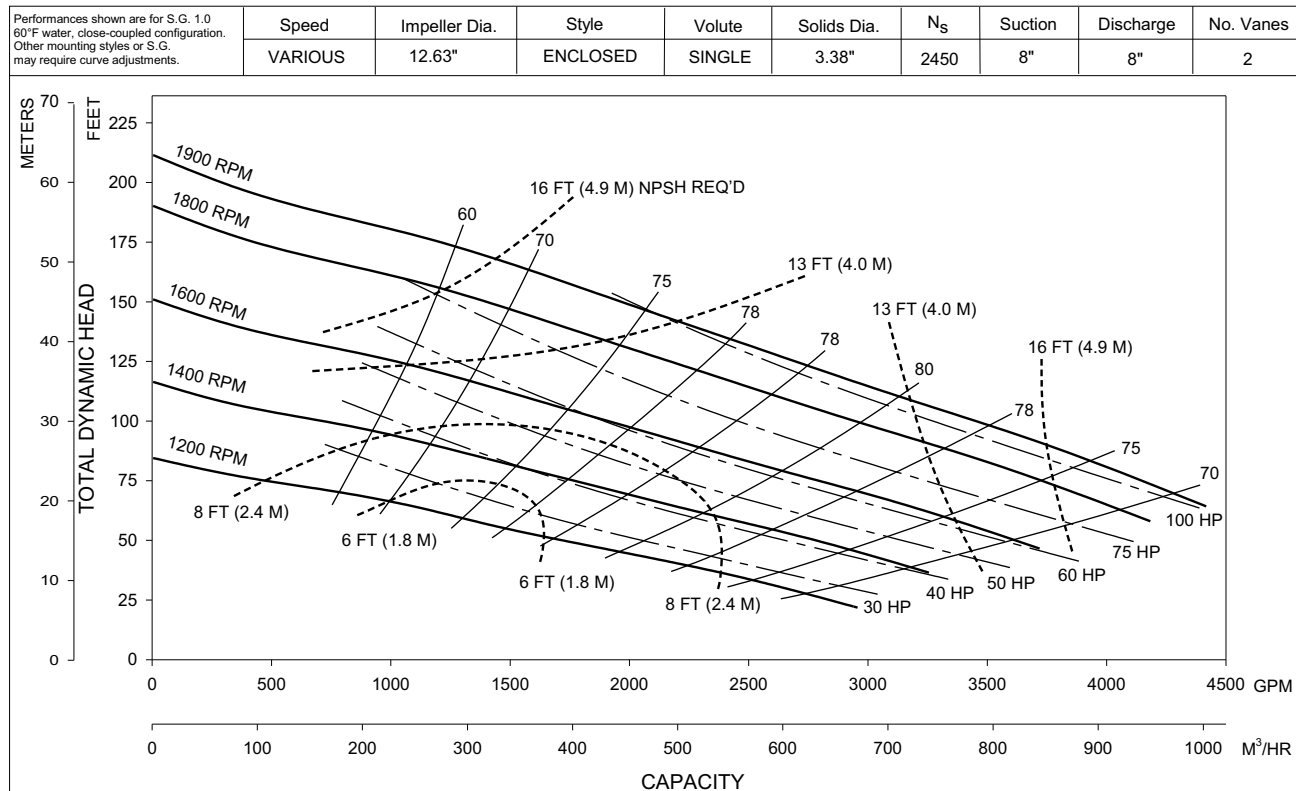
### Flow Rate Charts

To prolong the life of the pump, Generac recommends the pump be operated as close to the pump's best efficiency point (BEP) as possible.

Use **Figure 6-2** and **Figure 6-3** to determine the RPM the pump should be run at to achieve the pump's BEP at a given flow rate and dynamic head.



**Figure 6-2. 8NNT (Non-Cutter) Flow Rate Chart**



**Figure 6-3. 8NNW (With Cutter) Flow Rate Chart**

## Pump Priming Systems

### Venturi Pump System

The venturi prime system relies on a compressor that is driven by the pump shaft. This compressor blows air through a venturi connected to the top of the priming chamber.

### Diaphragm Pump System (if equipped)

The diaphragm prime system utilizes a mechanically driven diaphragm pump to displace air directly from the priming chamber. The diaphragm pump has greater displacement than the venturi prime system, resulting in faster pump priming performance.

**NOTE:** All dry-prime pump systems come with run-dry capability, which allows the pump to operate even if prime is lost. See [Run-Dry™ System](#) for more information.

## Priming Operation

As air is withdrawn from the priming chamber, water is forced into the suction line and fills the priming chamber, lifting the float assembly. Once the valve is closed, the pump is primed. Priming time is a function of the volume of air in the suction line and the RPM of the vacuum pump. High lifts and larger suction line diameters require longer priming times. If the pump will not prime or maintain prime, or if the vacuum pump runs hot or passes water, refer to [Pump Troubleshooting Guide](#).

**IMPORTANT NOTE:** Do not attempt to reduce the priming time by operating the pump at speeds exceeding recommendations. Doing so will shorten the life of the vacuum pump.

When pumping in extremely cold conditions, ice may form on the prime valve seat or linkage, preventing closure and allowing water into the vacuum pump. Close observation must be maintained and the pump shut down at the first signs of excessive water coming from the vacuum pump.

Should the discharge check valve become plugged, the pump must be shut down and the valve cleaned out. Refer to [Discharge Check Valve](#). Clogging of the suction strainer or hose may result in loss of prime without recovery. A vacuum gauge can be connected to the tap on the side of the priming chamber to aid in diagnosing such clogs.

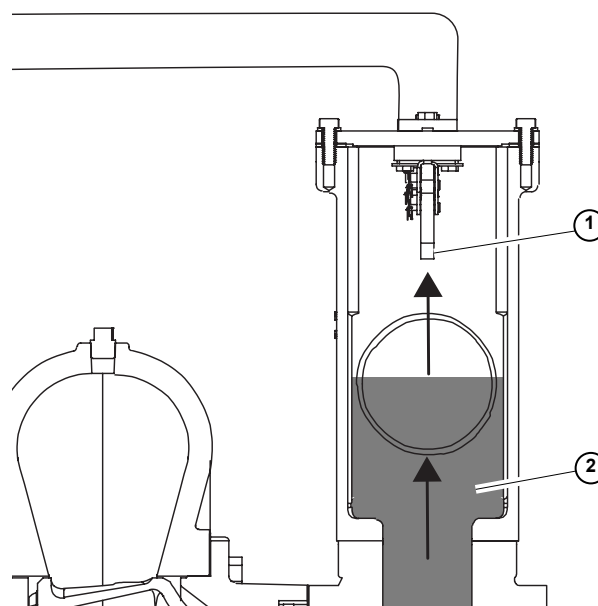


Figure 6-4. Priming Chamber

1. Float assembly
2. Liquid

## Run-Dry™ System

The pump is equipped with a run-dry feature. The run-dry feature employs an auxiliary gland and reservoir mounted to the backplate. The rotation of the drive shaft circulates oil from the reservoir to the gland, then back to the reservoir. The oil cools the seal faces even when there is no liquid in the pump casing.

With the run-dry feature, the pump can operate for a short period of time with no liquid in the pump casing without causing damage to the mechanical seal. The run-dry system is not intended for extended periods of operation without liquid in the pump casing, but rather as a safety feature to save the mechanical seal should the pump unexpectedly lose prime or inadvertently be started without being primed.

### Recommended reservoir oil:

- Chevron Turbine Oil GST32 or other ISO viscosity grade 32 or below (synthetic oil recommended)
- Transmission fluid or hydraulic oil

The reservoir oil should be a non-volatile substance that is compatible with the mechanical seal elastomers, will not cause rusting, and will not freeze in cold climates. Refer to [Wear Rings](#) for more information.



Equipment Damage. Always run pump with water in the priming chamber. Failure to do so will result in equipment damage and/or failure.

(000280)

## Liquid Temperature and Overheating

The maximum liquid temperature for this pump is 160 °F (71 °C). Do not apply it at a higher operating temperature. Overheating can occur if the pump is operated with the valves in the suction and/or discharge lines closed. Operating against closed valves could bring the liquid to a boil, build pressure, and cause the pump to rupture or explode. If overheating occurs, stop the pump and allow it to cool before servicing it. Fill the pump casing with cool liquid.

### WARNING

Personal Injury. Do not operate pump with flow completely restricted. Doing so could cause pump casing to explode and could result in death or serious injury.

(000273)

## Pump Vacuum Check

With the pump inoperative, install a vacuum gauge in the system. Block the suction line and start the pump. At operating speed, the pump should pull a vacuum of 20 in. (67.7 kPa) of mercury or more. If it does not, check for air leaks at the suction piping gaskets.

## Bearing Temperature Check

Bearings normally run at higher than ambient temperatures because of heat generated by friction. Temperatures up to 160 °F (71 °C) are considered normal for bearings, and they can operate safely to at least 180 °F (82 °C). Measure the bearing temperature with a contact-type thermometer.

## Stopping The Unit

Allow the engine to idle briefly before switching the Key switch to the OFF position.

## Emergency Stop Switch

The unit is equipped with one emergency stop switch. For location of the emergency stop switch, refer to [Component Locations](#). The red button is clearly labeled “EMERGENCY STOP.”

Activate the emergency stop switch by pushing the button in until it locks down. The switch will remain locked until the button is pulled out.

### CAUTION

Equipment Damage. The emergency stop switch is not to be used to power down the unit under normal operating circumstances. Doing so could result in equipment damage.

(000246b)

## Automatic Shutdown

The low oil pressure and high temperature automatic shutdown stops the engine if oil pressure drops too low or the engine exceeds normal operating temperature. Return the key switch to the OFF position to reset the controller; restart the engine after you have determined the cause of the shutdown. Refer to [Engine Fault Shutdown Troubleshooting](#) for more information.

## Remote/Auto Starting Option

The unit can be configured to start automatically by adding dry-contact closure float level switches. Contact the Generac Mobile Products, LLC Technical Service Department at 1-800-926-9768 for more information.

## Section 7 Maintenance

Normal maintenance, service, and replacement of parts are the responsibility of the owner/operator and, as such, are not considered defects in materials or workmanship within the terms of the warranty.

Poorly maintained equipment can become a safety hazard. In order for the equipment to operate safely and properly over a long period of time, periodic maintenance and occasional repairs are necessary.

### **WARNING**

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

(000130)

Attach a “DO NOT START” sign to the control panel. This will notify everyone that the unit is being serviced and will reduce the chance of someone inadvertently trying to start the unit.

For detailed engine maintenance procedures, refer to the engine operator’s manual, which was supplied with the unit when it was shipped from the factory.



### **WARNING**

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

(000100a)

Before servicing:

1. Verify that the key switch is turned to OFF and the negative (-) cable on the battery is disconnected.
2. If the pump or components are hot, allow adequate cooling prior to servicing the unit.
3. Close the suction and discharge valves.
4. Vent the pump slowly and drain completely.



### **WARNING**

Risk of burns. Do not open coolant system until engine has completely cooled. Doing so could result in serious injury.

(000154)

Do not allow compressed air to pressurize the pump or vent-off compressed air through the pump, as this may damage the pump and cause serious personal injury.

If this unit is used to handle any hazardous materials that can cause injury or illness, take precautions by wearing approved protective clothing and use appropriate safety equipment.

When servicing the unit, use only components provided by the OEM or Generac Mobile Products, LLC. Any use of non-authorized parts could result in sub-standard performance, damage to equipment and possible injury to personnel. Use of unauthorized parts will also void the warranty.

Refer to Section 5 **Pump Troubleshooting Guide** to help diagnose operational or performance problems. Only disassemble the unit components required to remedy the problem condition. Select a clean suitable location for any required maintenance, and note that all work must be performed by qualified personnel.

### Daily Walk Around Inspection

Look for conditions that could hinder performance or safety, such as (but not limited to) oil/coolant/fuel leakage, blocked vents, loose/missing hardware and electrical connections.

Visually inspect the engine fan belt for cracks, fraying, and stretching. Verify the belt is properly seated in pulley grooves. Replace the belt according to the manufacturer’s recommendations.

Failure to perform a daily inspection may result in serious damage to the prime mover.

### General Maintenance

Refer to the original equipment manufacturer’s operating manual for a complete list of maintenance requirements. Failure to comply with the procedures as described in the engine operator manual will nullify the warranty, decrease performance and cause equipment damage or premature equipment failure. Maintenance records may be required to complete a warranty request.

Use the schedule in the following table as a guide for regular maintenance intervals.

**Table 4 - Basic Maintenance Schedule**

Item	Daily	50 Hours	Every 500 Hours	Every 1000 Hours	Every 1500 Hours	Every 2 Years	As Required
Check Coolant Level	◆						
Check Oil Level Sight Gauge (diaphragm only)	◆						
Check Fuel Level	◆						
Check Tire Pressure	◆						
Check Electrical Connections	◆						
Inspect Radiator Fins for Debris (clean as required)	◆						
Check Mechanical Seal Oil Level	◆						
Check Flange Fitting Hardware	◆						
Check Engine for Leaks	◆						
Check Exhaust System for Leaks	◆						
Check Suction Air Filter/Dry Air Filter	◆						
Empty Water Tank in the Fuel Pre-filter	◆						
Check Engine V-belts			◆				
Check Coolant (additive concentration)			◆				
Check Intake Air Pipes for Damage			◆				
Replace Pump Lubricating Oil			◆				
Replace Fuel Filter Cartridge			◆				
Change Engine Oil and Filter		◆*	◆				
Check Battery and Cable Connectors				◆			
Check Engine Mounting (tighten, replace if damaged when necessary)				◆			
Check Fastenings & Hose Unions/Clips				◆			
Replace Engine Air Cleaner Element				◆			
Replace V-belt				◆			
Change Compressor Air Cleaner Element				◆			
Grease Pump Bearings					◆**		
Change DEF dosing unit filter						◆	
Clean DEF tank						◆	◆
Replace after-treatment DEF tank header suction screen						◆	◆

\* Change the engine oil and oil filter after the initial 50 hours of operation, then at the appropriate interval thereafter. Refer to engine manual for engine oil recommendations.

\*\* Add three to six pumps of grease at each grease fitting with a hand grease gun. Refer to [Figure 2-5](#) and [Figure 4-1](#) for grease fitting locations.



## Checking the Engine Oil

Low engine oil and overfilling lead to engine damage. The oil level may only be checked with the engine in a horizontal position and switched off. If the engine is warm, switch off the engine and check the oil level after five minutes. If the engine is cold, you can check it immediately.

### **WARNING**

Skin irritation. Avoid prolonged or repeated contact with used motor oil. Used motor oil has been shown to cause skin cancer in laboratory animals. Thoroughly wash exposed areas with soap and water.

(000210)



### **WARNING**

Risk of burns. Allow engine to cool before draining oil or coolant. Failure to do so could result in death or serious injury.

(000139)

1. Pull out the dipstick and wipe off with a lint-free, clean cloth.
2. Insert the dipstick into the engine again as far as it will go.
3. Pull out the dipstick again and read the oil level. The oil level must always be between the MIN and MAX marks. Add oil up to the MAX mark if necessary.

### **CAUTION**

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

(000135)

## Checking the Oil Level Sight Gauge (Diaphragm Pump Only)

Check that oil is visible in the sight glass located on the side of the bearing housing of the diaphragm vacuum pump. (It is recommended that the sight glass be checked daily.) If no oil is visible, oil will need to be added.

1. Shut down the unit.
2. Remove the pipe plug located at the top of the housing (refer to [Figure 4-6](#)).
3. Add 10W-30 oil until the static oil level is below the center of the sight glass. **DO NOT OVERFILL.**
4. Install the pipe plug.

## Changing the Engine Oil

1. Warm up the engine (oil temperature greater than 176 °F (80 °C)).
2. Verify the engine is in a level position.
3. Turn the engine off.
4. Place a collecting receptacle underneath the lube oil drain.
5. Open the oil drain valve and drain the oil into the receptacle.
6. After the oil has drained completely, close the oil drain valve.
7. Remove the engine oil fill cap and add the recommended amount and type of oil. Refer to the engine manual for specifications.
8. Warm up the engine (oil temperature greater than 176 °F (80 °C)).
9. Verify the engine is level and check the oil level. Refer to [Checking the Engine Oil](#).

## Changing the Oil Filter

**NOTE:** The filter cartridge should never be pre-filled. There is a danger of dirt contamination.

1. Loosen and unscrew the filter with filter tool. Refer to engine manual for more information.
2. Collect the draining engine oil.
3. Clean the sealing surface of the filter support with a lint-free, clean cloth.
4. Oil the gasket of the new filter cartridge lightly.
5. Screw on the new filter by hand until the gasket is touching and then torque to 11-13 ft-lbs (15-17 Nm).

## Adding Coolant

1. 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.
2. Let engine cool (not at operating temperature, not running), before adding coolant.
3. Add a 50/50 mixture of the correct antifreeze and distilled or deionized water to the coolant system. Add until it is 3/4 in. (19 mm) below the filler neck.



### **WARNING**

Risk of burns. Do not open coolant system until engine has completely cooled. Doing so could result in serious injury.

(000154)

## Diesel Exhaust Fluid (DEF)

**NOTE:** Unit does not ship from factory with DEF in tank.

### DEF Specification

#### **CAUTION**

Equipment damage. Do not alter DEF. Use approved DEF only. Failure to do so could cause equipment damage.

(000337)

Diesel exhaust fluid (DEF) is a high-purity liquid that is injected into the exhaust system of SCR engines. Maintaining the purity of DEF is important to avoiding malfunctions in the SCR system. Engines requiring DEF shall use a quality product that meets the requirements for Aqueous Urea Solution 32 (AUS 32) according to ISO 22241-1. Use DEF certified by the American Petroleum Institute (API) Diesel Exhaust Fluid Certification Program, or by the AdBlue™ Diesel Exhaust Fluid Certification program. Look for the API certification symbol or the AdBlue name on the container.

**NOTE:** Do not create DEF by mixing agricultural grade urea with water. Do not use additives, as this can damage the after treatment system.

### DEF Warning

DEF can be corrosive to material such as steel, iron, zinc, nickel, copper, aluminum, and magnesium. The recommended material for transport and storage of DEF is made of polyethylene, polypropylene, or stainless steel. These are not all-inclusive lists. For additional information, see ISO 22241 or contact a DEF supplier.

### DEF Storage Guidelines

#### **WARNING**

Risk of poisoning. Do not ingest diesel exhaust fluid. Seek medical attention immediately if consumed. Failure to do so could result in serious injury.

(000334)

#### **WARNING**

Personal injury. Do not inhale diesel exhaust fluid fumes. If breathing becomes difficult, move to an area with fresh air and seek medical attention immediately. Failure to do so could result in serious injury. (000335a)

#### **WARNING**

Personal injury. Avoid contact with eyes. Flush eyes thoroughly with water and seek medical attention immediately. Failure to do so could result in serious injury.

(000336)

**NOTE:** See the Materials Safety Data Sheet (MSDS) for additional information.

DEF freezes at temperatures below 12 °F (-11 °C). Do not use additives to reduce the freezing temperature. Additives currently available are more corrosive than DEF, and will cause component and system degradation and negatively impact reliability. For more information, see the operator manual, or contact a DEF supplier.

DEF quality degrades rapidly at temperatures above 140 °F (60 °C). To maintain emissions compliance, the urea concentration must remain between 31.8–33.2%.

Ideal conditions for storage of DEF are:

- Store at temperatures between 23–86 °F (-5–30 °C)
- Store in sealed dedicated containers to avoid contamination and evaporation

Under these conditions, DEF is expected to remain usable for a minimum of 18 months. Storing DEF at higher temperatures can reduce its useful life by approximately six months for every 9 °F (5 °C) above 86 °F (30 °C). Long-term storage in the DEF tank (over 12 months) is not recommended. If long-term storage is necessary, test DEF prior to operating engine. See [Testing DEF](#).

### Refilling DEF Tank

#### **WARNING**

Personal injury. Avoid prolonged contact with skin. Wash skin thoroughly with soap and water. Remove contaminated clothing and wash before reuse. Seek medical attention if skin becomes irritated. Failure to do so could result in personal injury. (000338a)

#### **CAUTION**

Equipment Damage. Immediately clean any surfaces with water that come in contact with diesel exhaust fluid. Failure to do so could result in equipment damage.

(000365)

**IMPORTANT NOTE:** If DEF is filled into engine fuel tank or other fluid compartment, do not operate engine until system is properly purged of DEF. Contact your Deutz dealer immediately to determine how to clean and purge the system.

**NOTE:** Use only distilled water to rinse components that are used to deliver DEF. Tap water can contaminate DEF. If distilled water is not available, rinse with clean tap water, then thoroughly rinse with ample amounts of DEF.

Reasonable care should be taken when refilling the DEF tank. Verify the DEF tank cap area is free of debris before removing the cap. Wipe clean with a lint free cloth to remove debris from tank cap. Seal DEF containers between use to prevent contamination and evaporation.



Avoid splashing DEF, and do not allow DEF to come into contact with skin, eyes, or mouth.

DEF can be corrosive to materials such as steel, iron, zinc, nickel, copper, aluminum, and magnesium. Use suitable containers to transport and store DEF. Containers made of polyethylene, polypropylene, or stainless steel are recommended.

**NOTE:** Keep anything used to store or dispense DEF clean of dirt and dust. Wash and rinse containers or funnels thoroughly with distilled water to remove contaminants.

If an unapproved fluid, such as diesel fluid or coolant is added to the DEF tank, **contact your Deutz dealer immediately** to determine how to clean and purge the system.

If water has been added to the DEF tank, a tank cleaning is necessary. After refilling the tank, check the DEF concentration. See *Testing DEF*. The operator must maintain appropriate DEF levels at all times. Check the DEF level daily and refill the tank as needed. The filling port is identified by a blue colored cap embossed with the DEF symbol.

## Testing DEF

**NOTE:** Using DEF with the correct concentration is critical to engine and after-treatment system performance. Extended storage and other conditions can adversely alter the DEF concentration.

If DEF quality is questionable, draw a sample out of the DEF tank or storage tank into a clear container. DEF must be crystal clear. If DEF appears cloudy or has a colored tint, it is likely not within specification. DEF in this condition should not be used. Drain the tank, flush with distilled water, and fill with new DEF. After filling the tank, check DEF concentration.

If the DEF passes the visual and smell tests, check the DEF concentration with a handheld refractometer calibrated to measure DEF.

DEF concentration should be checked when the engine has been stored for extended periods, or if there is suspicion the engine or packaged DEF has been contaminated with water.

Follow the instructions included with either tool to obtain the measurement.

The correct DEF concentration is 31.8–33.2% urea. If DEF concentration is not within specification, drain the DEF tank, flush with distilled water, and fill with new or good DEF. If packaged DEF is not within specification, dispose of DEF packages and replace with new or good DEF.

**NOTE:** Do not create DEF by mixing agricultural grade urea with water. Agricultural grade urea does not meet the necessary specifications and can damage the after treatment system.

## DEF Tank Cleaning

1. Drain DEF tank into a suitable container. See *Disposal of DEF*.
2. Flush DEF tank with distilled water, and fill with new or good DEF.

## Disposal of DEF

Large amounts of DEF should be contained. If large spills occur, contact local environmental authorities for assistance with clean up.

If a substantial quantity of DEF is not within specification, contact the DEF supplier for assistance with disposal. Do not dump large quantities of DEF onto the ground or send DEF to wastewater treatment facilities.

## Servicing The Pump

### Wear Rings

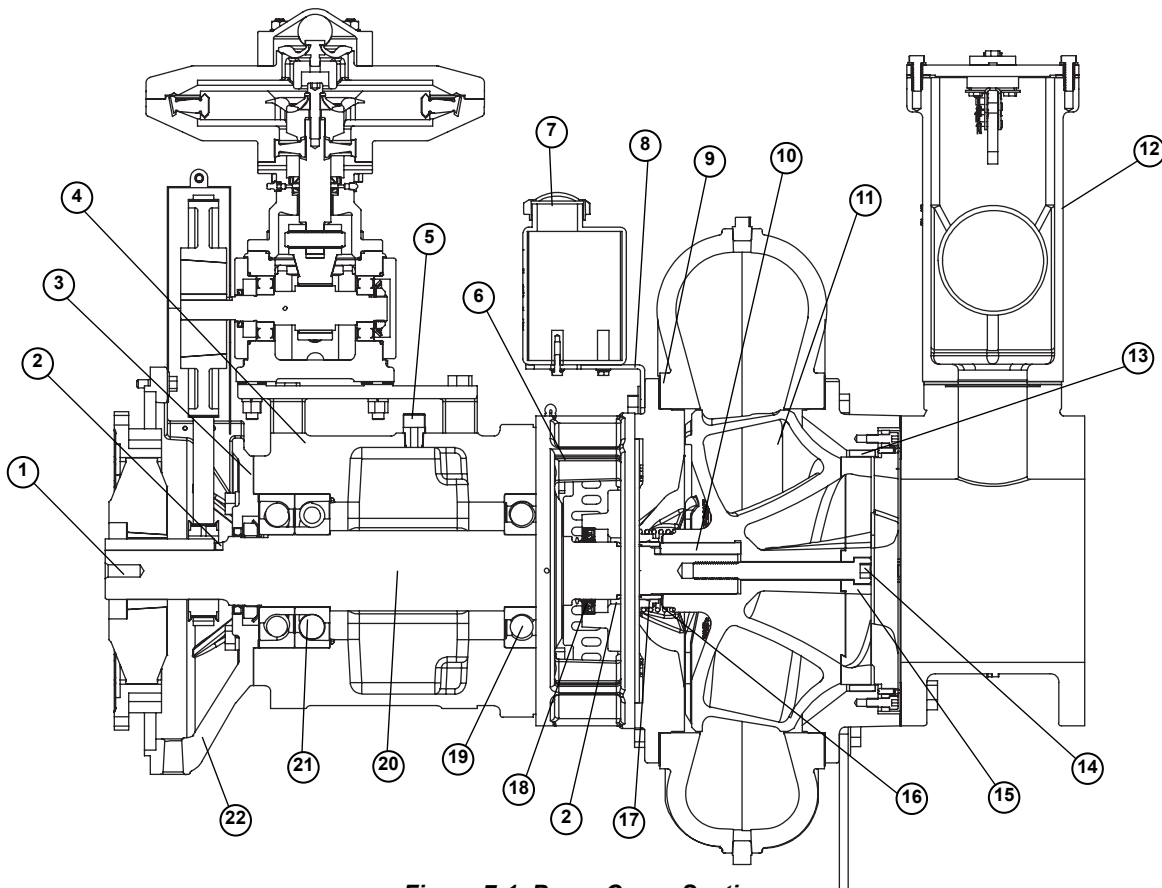
Wear rings are vital for pump operation. They should be replaced if the clearance has increased to about 0.03 in (0.76 mm) per side.

### Pump Disassembly

1. Remove all capscrews from the volute. Insert two capscrews into the tapped holes in the backplate. Do not allow the volute to fall onto the impeller.
2. See *Figure 7-1*. Remove the impeller lockscrew with a breaker bar. Do not use an impact wrench. Apply steady and even torque to break lockscrew loose. Allen head tooling to remove the lockscrew should be in excellent condition. Discard the lockscrew. Remove the impeller washer.
3. Remove any flush lines to the seal gland.
4. Remove the gland capscrews evenly until capscrews are free of the backplate.
5. Space wedges in pairs 180° apart between the impeller and backplate. Verify the wedges are placed along impeller vanes. Tap opposed wedges at the same time to force off the impeller. Use extreme care to avoid damage to impeller, shaft and bearings.
6. Remove the impeller and impeller key.
7. Unbolt and remove the backplate from the bracket.
8. Remove the mechanical seal.
9. The suction wear ring can be removed by drilling the ring longitudinally in three places to relieve compression and collapsing the three sections together. Use care not to drill into the volute casting. Better control is obtained if small pilot holes are first drilled and then enlarged to “cut” the ring. This same technique can be used to remove the hub wear ring.

## Pump Assembly

1. Each mechanical seal has its own particular assembly procedures. Refer to **Wear Rings**.
2. Install the backplate.
3. Use new gaskets. In case of an emergency situation where you need to reuse the old gaskets, verify the gaskets are moist and flat.
4. Install the impeller key and impeller. For solids handling pumps, install the impeller shims to maintain 0.030 inch (.76 mm) minimum clearance between the backplate and impeller backvanes. Use the a long capscrew and several washers to press on the impeller. Do not use the impeller lockscrew. The threads must be long enough to enter the shaft approximately eight threads or eight turns by hand. This is necessary to protect the threads in the shaft.
5. After installing the impeller, remove the long capscrew and replace with the impeller lockscrew with the impeller washer. The impeller lockscrew should always be new. Refer to table **Lockscrew Torque Values** for torque requirements.
6. Install the volute, sliding it carefully over the register. Bolt the volute to the backplate.
7. For seals, bring the gland and gasket against the face at the seal chamber and tighten the bolts evenly.



**Figure 7-1. Pump Cross-Section**

- |                                  |                        |                       |
|----------------------------------|------------------------|-----------------------|
| 1. Shaft key                     | 9. Volute gasket       | 16. Impeller shims    |
| 2. Lip seals (3)                 | 10. Impeller key       | 17. Mechanical seal   |
| 3. Shims                         | 11. Impeller           | 18. Shaft sleeve      |
| 4. Frame                         | 12. Priming chamber    | 19. Pump end bearing  |
| 5. Breather                      | 13. Wear ring          | 20. Shaft             |
| 6. O-ring (sleeve)               | 14. Impeller lockscrew | 21. Drive end bearing |
| 7. Mechanical seal oil reservoir | 15. Impeller washer    | 22. Engine bracket    |
| 8. Backplate                     |                        |                       |

## Impeller Lockscrew Installation

Impeller lockscrews are always right hand socket head capscrews. Stainless steel lockscrews are supplied with Loctite 262, which should be applied to lockscrew threads and shaft prior to installation.

First determine the size and material of the lock, then torque to the appropriate value listed in table.

**Table 5 - Lockscrew Torque Values**

Size	Torque for Stainless Steel Lockscrew (nonmagnetic) 302, 303, 304, 316 Series
.38-6UNC	20 ft-lbs (27 Nm)
.50-13UNC	40 ft-lbs (54 Nm)
.62-UNC	90 ft-lbs (122 Nm)
.75-10UNC	135 ft-lbs (183 Nm)
1.00-8UNC	265 ft-lbs (359 Nm)
1.12-7UNC	360 ft-lbs (488 Nm)
1.25-7UNC	510 ft-lbs (691 Nm)
1.50-7UNC	875 ft-lbs (1186 Nm)

### Lubrication

Do not lubricate the impeller lockscrew or tapped hole, between the lockscrew and impeller washer, or between the impeller washer and impeller. Verify parts are clean and dry; however, it is not necessary to remove the protective coating from the screw. Lubricated bolts can be overstressed with the torques indicated.

**NOTE:** Do not use the lockscrew to install the impeller.

**NOTE:** Lockscrew failure can damage the impeller and volute. The impeller screw must be of the best material, properly forged and machined to rigid specifications not available from local suppliers. Purchase only lockscrews available from Generac Power Products for assurance of quality.

### Impeller Lockscrew Removal

1. Break impeller lockscrew loose with a breaker bar.

**NOTE:** Care should be taken when removing lockscrew to prevent damaging the screw head.

2. If the breaker bar will not loosen the impeller lockscrew, apply heat to the lockscrew for 2-4 minutes. Do not exceed 400°F (204°C).



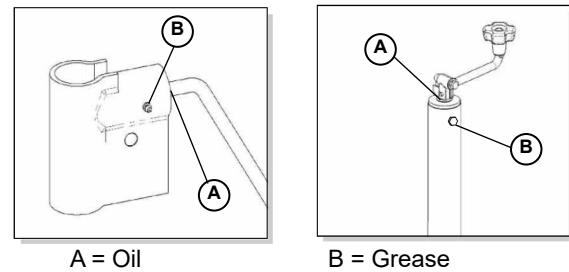
Risk of Burns. Take care when applying heat to the lockscrew. Failure to do so could result in serious injury.

(000276)

3. Allow lockscrew to cool and remove with a breaker bar.

## Jack Maintenance

Apply lightweight oil to the screw stem.



**Figure 4-1. Lubrication Points**

## Frame Disassembly and Assembly

### Disassembly

1. Remove the deflectors from the shaft.
2. Remove the drive end shaft key.
3. Remove the capscrews from the bearing cover or drive end bracket.

**NOTE:** Grease lubricated frames have a single lip seal at the drive end pump ends. If the lip seals are to be saved, the shaft should be cleared of burrs or sharp protrusions which would cut the seal. If the seals are removed or replaced, refer to [Figure 7-1](#) or [Figure 4-6](#) for orientation of the lips. Paired seals have a grease passageway between them and are arranged so that the grease will move through the inner and outer seal.

4. Slide the bearing cover or drive end bracket off the shaft. Remove the capscrews from the pump bracket. Slide the pump bracket off the shaft.
5. The shaft and bearings can now be removed by pressing on the drive end of the shaft.
6. Remove the bearings from the shaft with a bearing puller. If the bearings are to be saved, keep them absolutely clean. If contaminated, wash only in clean fluid.

**NOTE:** Never hammer the shaft or parts attached to the shaft or you will damage both the shaft and the bearings.

### Assembly

1. Press the drive end and pump end bearings onto the shaft. Pressure should be applied to the inner race.
2. Press the shaft into the frame through the drive end until the pump end bearing is approximately flush with the pump end of the frame.

3. Install the pump end lip seal(s) into the bracket. Slide the pump bracket over the shaft, taking care not to damage or fold the lip seal(s). Install and tighten the capscrews.
4. Install lip seal(s) in bearing cover or drive end bracket. Install the shims in the drive end of the frame (if present when disassembled). If new shaft, bearings, frame, bearing cover or drive end bracket are being installed, insert shims to maintain 0.007-0.012 in. (0.177-0.304 mm) shaft end play. Slide the bearing cover or drive end bracket over the shaft. Install and tighten the capscrews.
5. Install the deflector and lubricate. Refer to [Lubrication Instructions](#).

## Lubrication Instructions

Bearings in all frames are greased at the factory before shipment.

Lubrication requirement vary with speed, power, load, ambient temperatures, exposure to contamination and moisture, seasonal or continuous operation and other factors. The brief recommendations which follow are general in nature and must be coupled with good judgment and consideration of the application conditions. For re-greasing periods, refer to the table below. When adding

grease, verify the grease and fittings are absolutely clean. Grease used for these bearings should be equivalent to one of the following manufacturer's products:

- G.E. Long Life Grease No. D682C5
- Mobil Mobilux No. EP2
- Shell Alvania EP2
- Texaco Multifak AFB 2

To lubricate frame bearings, remove the plastic cover and grease fittings. Verify the fitting and end of the grease gun are clean. Use a hand-operated grease gun and pump a small amount into each bearing cavity. The surplus grease will go through the bearing and into the center part of the frame.

For re-greasing periods and approximate quantity, refer to the table below.

First determine frame size (located on serial number plate).

Example: 5HH-65B4, 4NNT-VF16, 10YB-F18DB, 6NHTA-VC18, 4RB-EM1.

**Table 6 - Recommended Re-Greasing Periods for Frames**

	Frame Size				
	2-5-11 and EM309	6-7-8-16 60B4 through 68B4	10-12-13-13D 18-18D	20-24	30
<b>Total Running Time</b>	2,000 hours	1,500 hours	1,000 hours	1,350 hours	2,000 hours
<b>8 Hour Day Service</b>	36 weeks	27 weeks	18 weeks	24 weeks	36 weeks
<b>24 Hour Day Service</b>	12 weeks	9 weeks	6 weeks	8 weeks	12 weeks
<b>Approximate Amount of Grease per Line Fitting</b>	.5 cubic inch	1.25 cubic inch	2 cubic inch	3 cubic inch	4 cubic inch
<b>Approximate No. of Pumps with Grease Gun (hand operated)</b>	3 pumps	6 pumps	12 pumps	18 pumps	23 pumps

## Mechanical Seal Maintenance

The location of the mechanical seal in your pump is shown in [Figure 7-1](#). The stationary seat is held in the backplate. All other parts of the seal rotate with the shaft and impeller. The seal chamber must be full of liquid before operating the pump.

No maintenance is required for the mechanical seal. However, the pump should be examined at regular intervals for leakage resulting from wear of the sealing faces. Occasionally, new installations will leak for a short time. These must be inspected daily. If the leakage does not reduce to almost zero, the assembly should be examined for proper seal installation. Replace damaged seals or mechanical seal oil as necessary.

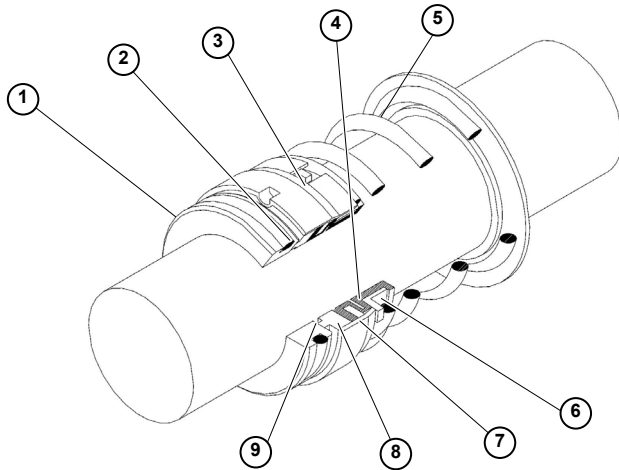
## Mechanical Seal Oil

The mechanical seal oil level should be maintained to the top line of the reservoir; however, oil will circulate as long as the oil level is above line of the reservoir. Refer to the [Table 4](#) for recommended mechanical seal oil change interval.

Mechanical seal oil can be added either during pump operation or while shut down. If water begins to accumulate in the reservoir, or the oil level depletes rapidly, this may indicate mechanical seal failure. Leakage of oil from the gland would indicate a damaged or worn lip seal. Refer to [Installing the Mechanical Seal](#) for oil recommendations.

## Removing the Mechanical Seal

If the seal is to be removed, remove the impeller according to the instructions for dismantling the pump. The rotating portion of the seal may now be seen. Slide off the seal spring. Lubricate the shaft and remove the remainder of the rotating portion, being careful to avoid damaging the primary seal. The rubber bellows will be firmly attached to the shaft and considerable pressure will be required to remove it. Refer to [Figure 7-2](#).



002309

**Figure 7-2. Mechanical Seal Components**

- |                    |                         |
|--------------------|-------------------------|
| 1. Stationary seat | 6. Driving band         |
| 2. O-ring seat     | 7. Disc                 |
| 3. Retainer        | 8. Rotating seal face   |
| 4. Bellows         | 9. Stationary seal face |
| 5. Spring          |                         |

## Removing the O-ring Seat

If the seal is being replaced, remove the backplate (gland is built in) and press out the stationary seat.

## Installing the O-ring Seat

Clean all parts before starting assembly. Oil the outer surface of the seat and O-ring with a light oil (not grease). Place a cardboard disc on the sealing face to avoid damage. Press the seat into the gland or stuffing box using firm, steady pressure. Verify the seat is all the way in. Slide the gland with the gasket or backplate over the shaft. Install the backplate, then press the seat into the backplate.

## Installing the Mechanical Seal

Clean all parts before starting assembly. Special attention should be given to the backplate and impeller hub.

1. Clean and lubricate the shaft.

**NOTE:** Once the rotating portion has been placed on the shaft, the rest of the installation must be made at once.

2. Install the stationary seat in the backplate.
3. Oil the outer surface of the seat and O-ring with a light oil (not grease). Place a cardboard disc on the sealing face to avoid damage. Press the seat into the gland or stuffing box using firm, steady pressure. Verify the seat is all the way in. Slide the gland with the gasket over the shaft.
4. Wipe the lapped sealing faces of the seat and the primary seal perfectly clean. Use extreme care to avoid marking the sealing face or the primary seal. Slide the rotating portion of the seal, including the spring, along the shaft.

**NOTE:** Once the rotating portion has been placed on the shaft, the rest of the installation must be made at once. Delay may result in the rubber bellows seizing on the shaft in the wrong position.

5. Install the impeller. Verify the spring slides over the impeller hub and pushes against the backshroud of the impeller.

## Priming Chamber

### Float Removal

1. Loosen the hose clamp and disconnect the air hose from the prime valve.
2. Remove the four 3/8 in. hex nuts and capscrews from the priming chamber cover.
3. Lift off the priming chamber cover, complete with float linkage and prime valve assemblies.
4. Unscrew the float from the rod set screw.

### Installation

1. Screw the float onto the rod and lock with set screw.
2. Install the priming chamber cover, complete with float linkage and prime valve assemblies.
3. Install the four 3/8 in. hex nuts and capscrews and tighten against the gasket.
4. Reconnect air hose and secure with a hose clamp.

### Prime Valve Removal and Installation

1. Remove the priming chamber cover, complete with float linkage and prime valve assembly. Refer to [Float Valve Linkage Removal and Installation](#).
2. The valve body can be separated from the priming chamber cover by removing the 3/8 in. capscrews for access to the O-ring. No other parts are directly accessible from outside of the cover.



## Float Valve Linkage Removal and Installation

There is normally no reason to remove or replace the float valve linkage unless parts are damaged. In the event that replacement is required, use the following instructions:

1. Separate the linkage frame from the cover by removing the two 5/16 in. capscrews. There may also be stainless flat washers between the frame and cover. It is important to replace these washers when replacing the frame.
2. All elements of the linkage are held in position with clevis pins, side links and cotter pins. To remove any damaged element, straighten and remove the necessary cotter pins and clevis pins.

**NOTE:** The tow actuator arms are very similar in appearance. Before removing either of these parts, note their position and direction in relationship to other parts.

3. The valve stem assembly may be removed by a similar action of pin removal. Two cross-drilled holes in the lower end of this part, with slightly separated center lines, accommodate accumulated tolerances in the assembled linkage parts. In most instances the drill from which the clevis pin has been removed will be the one to re-use on reassembly.

## Linkage Replacement

1. Reverse the previous procedure steps.
2. When the linkage is correctly assembled and fastened to the cover, the valve seat O-ring should seat firmly when the float ball is raised to its uppermost position, and a 1/8 in. (3 mm) minimum gap should remain between the two actuator arms. If the arms can come together, the valve may not be adequately seating.

## Strainer/Baffle

At factory assembly, the strainer is pushed onto the bottom of the priming chamber and is held in place by friction. During normal operation this strainer can drop loose from the cone and rest on the slotted suction spool pipe. This is NOT a problem. Air being evacuated from the suction piping can travel freely through the slots and around the strainer.

## Separator

There is no regular maintenance to be performed on the separator. However, there are precautions for operation during freezing conditions. In freezing conditions, verify that there is no ice in the separator chamber to impede the separator float movement. Warm water can be poured over the separator or into the separator chamber through the separator hose connection. When pumping in extremely cold conditions, ice may form on the separator valve seat,

preventing closure and allowing water into the compressor. Close observation must be maintained and the pump shut down at the first signs of water coming from the compressor.

**NOTE:** During an initial re-prime, there may be liquid remaining in the suction spool above the slots. This may allow brief misting out the discharge before the prime valve has closed. If at any other time during operation pumpage is seen continuously exhausting from the compressor, the pump should immediately be shut down and the priming chamber cover should be removed. Inspect the float assembly for any impediment to its movement. It should be able to fully close the valve stem assembly to the valve seat. Also check the prime valve for any damage or debris.

## Discharge Check Valve

The discharge check valve enables automatic priming of the pump by closing the air leakage path on the discharge side of the pump. This allows the primer to pull the pump casing vacuum down sufficiently that atmospheric pressure will push the check valve open and allow the flow of liquid through the discharge.

The presence of the check valve, as with any other fitting in the piping system, add resistance (pipe friction) to the total head the pump must overcome during normal operation, and not just while priming for start-up. The amount of this added friction varies with the rate of flow, as well as with pipe size. To determine the extent of the addition for a specific performance point, refer to the flow rate charts. See [Flow Rates](#).

If the check valve disc should be prevented from completely closing due to debris or damage, the pump will not re-prime. In such a case it will be necessary to remove the inspection cover and clean out the debris or service the valve.

## Maintenance

The check valve requires no scheduled lubrication or maintenance. For service or inspection, the valve can be serviced without disconnecting the inlet or outlet hoses. If inspection of the valve is required, follow the disassembly instructions.

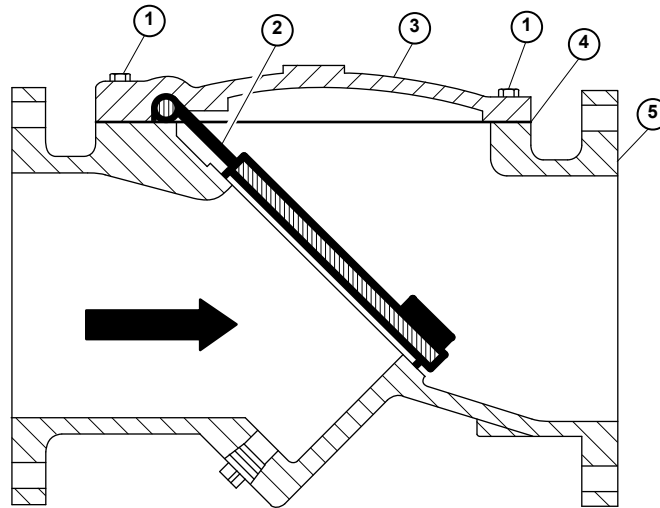


Figure 7-3. Discharge Check Valve

- |                |                     |
|----------------|---------------------|
| 1. Cover bolts | 4. Gasket           |
| 2. Disc        | 5. Check valve body |
| 3. Cover       |                     |

### Disassembly

The valve can be disassembled without removing it from the pump.



Personal injury. Drain water line to relieve pressure before removing cover. Failure to do so could result in minor or moderate injury.

(000270)

To relieve pressure and drain the pump:

1. Remove the cover bolts from the top cover.
2. Pry the cover loose and lift off the valve body.
3. Remove the disc and inspect for cracks, tears, or damage in the rubber sealing surface.
4. Clean and inspect the parts. Replace worn parts as necessary.

### Assembly

All parts must be cleaned. Gasket surfaces should be cleaned with a stiff wire brush in the direction of the serrations or machine marks. Worn parts and gaskets should be replaced during assembly.

1. Place the disc over the seat with the beaded seating surface directed down.
2. Lay the cover gasket and cover over the bolt holes and disc hinge.
3. Insert the lubricated bolts, noting that the bolts in the hinge area are longer than the others.

4. Cover bolts should be tightened to the following specification during assembly.

Table 7 - Bolt Torque Values

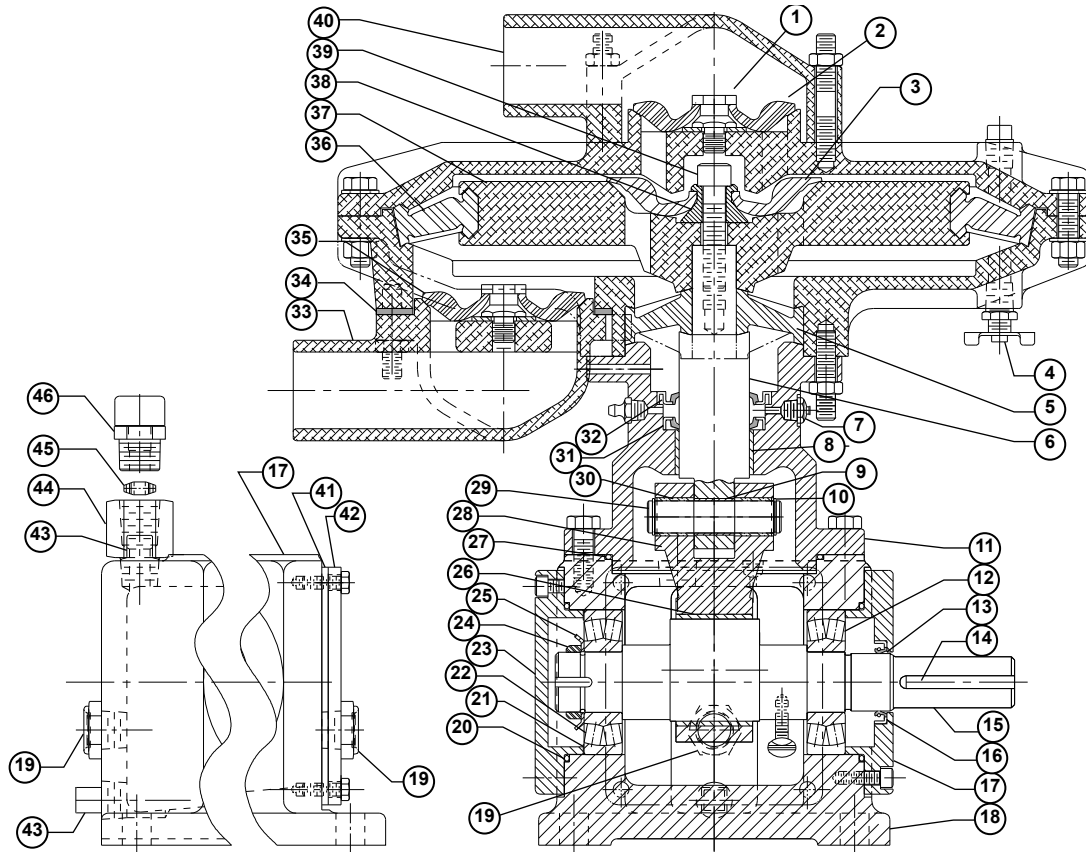
Bolt Size	Torque
3/8 in.	24 ft-lbs (33 Nm)
1/2 in.	59 ft-lbs (80 Nm)
5/8 in.	117 ft-lbs (159 Nm)
3/4 in.	205 ft-lbs (278 Nm)

## Diaphragm Pump System

### Disassembly

1. Loosen the clamp and disconnect the air hose from the priming valve.
2. Drain the oil from the seal oil reservoir via the line on the lower reservoir connection.
3. Disconnect the lower oil line at the reservoir, hold the disconnected end over a container and move the line and container down to below the connected end of the oil line. This will drain the remaining oil from the lines and gland.
4. Disconnect the oil lines from the gland and unbolt the gland only if further pump disassembly is planned.
5. Remove the bolts and nuts holding the two halves of the vacuum pump belt guard together. Remove the two bolts and nuts holding the guard halves to the vacuum pump support table. Remove the belt guard halves.

6. Loosen (do not remove) the four bolts securing the vacuum pump to the support table. The belt is tensioned by means of shims under the vacuum pump. Loosen the support table bolts and insert a large screwdriver or pry bar between the vacuum pump and support table. Lift the vacuum pump enough so that the shims can be removed.
7. Lower the vacuum pump to create sufficient slack to remove the belt. Once the belt is removed, the vacuum pump can be completely unbolted and removed if desired.
8. The vacuum pump support table and seal oil reservoir can now be unbolted and removed if desired.



**Figure 4-6. Vacuum Pump Cross-section**

- |                              |                            |                                   |
|------------------------------|----------------------------|-----------------------------------|
| 1. Valve stud                | 17. Drive end cover        | 32. Wiper lip seal                |
| 2. Suction and exhaust valve | 18. Bearing housing        | 33. Suction nozzle                |
| 3. Actuator valve            | 19. View gauge (2)         | 34. Suction nozzle gasket         |
| 4. Stop cock                 | 20. O-ring (bearing cover) | 35. Suction and exhaust valve (2) |
| 5. Actuator neck seal        | 21. Shims                  | 36. Actuator seal                 |
| 6. Actuator shaft            | 22. O.D.E bearing          | 37. Actuator                      |
| 7. Grease relief valve       | 23/ O.D.E. bearing cover   | 38. Actuator washer               |
| 8. Actuator shaft bearing    | 24. Locknut                | 39. Actuator lock screw           |
| 9. Pedestal bearing          | 25. Lock washer            | 40. Exhaust nozzle                |
| 10. Retaining ring (2)       | 26. Crankshaft bearing     | 41. Inspection plate gasket       |
| 11. Pedestal                 | 27. O-ring (pedestal)      | 42. Inspection plate              |
| 12. Drive end bearing        | 28. Connecting rod         | 43. Pipe plug (remove to add oil) |
| 13. Speed-sleeve location    | 29. Fulcrum pin            | 44. Adapter                       |
| 14. Shaft key                | 30. Fulcrum pin bearing    | 45. Breather disc                 |
| 15. Crankshaft               | 31. Internal lip seal      | 46. Breather (bearing housing)    |
| 16. Lip seal                 |                            |                                   |



## Assembly

1. Install the vacuum pump support table and oil reservoir.
2. Orient the oil reservoir so that the inlet and outlet ports are on the same side of the pump as the inlet and outlet ports of the gland.
3. Install the oil lines between the gland and reservoir. The upper and lower ports of the gland and reservoir should be connected together.
4. Install the pulley on the pump main shaft. Position the toothed drive belt in the adapter support bracket and install the pulley. Alternately, the pulley can be installed into the SAE adapter support bracket before the belt is installed on the pulley. Install the SAE adapter bracket to the adapter support bracket. Install the engine drive coupling.
5. Place the vacuum pump on the support table and loosely install the bolts and nuts.
6. Place the drive belt over the pulleys on the main shaft and vacuum pump shaft. Place shims evenly under the vacuum pump mounting until proper belt tension is obtained and tighten the bolts. A load of 3.0 lbs (1.36 kg) applied across the belt at mid-span should give a deflection at that point of 1/8 in. (3.17 mm). Check the belt tension after tightening the vacuum pump mounting bolts. The belt need only be tight enough to prevent "jumping" from one tooth to another.
7. Connect the air hose between the inlet on the bottom side of the vacuum pump housing and the priming valve nozzle. Verify the clamps are properly tightened.

**NOTE:** During operation, once the pump is fully primed, no air should be felt exiting the vacuum pump exhaust. Close off the vacuum pump exhaust with the palm of the hand. If air pressure builds, then check all priming chamber to vacuum pump hose connections for leakage.

8. Verify the drain plugs are installed and fill the oil reservoir to within 1/2 in. (6.35 mm) of the upper level glass. Check the oil level in the vacuum pump bearing housing and add oil if necessary. The oil level should be visible in the center of the level glass. **DO NOT OVERFILL.**
9. Once the pump assembly has been mounted to the baseplate, and the couplings between the pump shaft and driver have been installed and aligned, replace the vacuum pump belt guard halves. Bolt the halves to each other and then to the support table.
10. Check all bolts for tightness.

## Suction Valve Removal and Installation

1. Remove the hose to the priming chamber.
2. Remove the four 3/8 in. nuts.
3. Remove the suction valve elbow and discard the gasket.
4. Lift the valve over the head of the valve stud; do not remove the bolt.
5. Clean the valve chamber and seat.
6. Lubricate the valve stud and push the new valve on over the head of the stud. Tuck the elastomeric shoulder of the valve completely under the head of the valve stud.
7. Fit the new gasket and install the suction valve elbow and 3/8 in nuts.
8. Connect the priming chamber hose and tighten the hose clamp.

## Actuator Neck Seal Removal and Installation

1. Remove the actuator assembly as described in [Suction Valve Removal and Installation](#).
2. Remove the priming chamber hose from the suction nozzle.
3. Remove the four hex nuts holding the lower housing to the pedestal.
4. Remove the vacuum pump lower housing and actuator neck seal.
5. Lubricate the new actuator neck seal and push it into the vacuum pump lower housing.
6. Fit the assembly over the actuator shaft.
7. Orient the vacuum pump inlet suction nozzle to face the priming chamber and install the four hex nuts.
8. Install the actuator/seal assembly and remaining components. Refer to [Suction Valve Removal and Installation](#).

## Crankshaft Removal and Installation

### Removal

1. Remove the actuator neck seal as described in [Actuator Neck Seal Removal and Installation](#).
2. Remove the 1/2 in. NPT drain plug from bearing housing; drain and discard oil.
3. Remove the four 3/8 in. capscrews from the pedestal lower flange.
4. Carefully remove the vacuum pump pedestal complete with seals and linear bearing. Remove and discard the O-ring taking special care not to damage the actuator rod surface.

5. Remove the four 1/4 in. capscrews from the inspection plate.
  6. Remove the inspection cover. Remove and discard gasket.
  7. Remove the thumbscrew dippers from the crankshaft.
  8. Remove the four 1/4 in. capscrews from the O.D.E. bearing cover.
  9. Remove the bearing cover and O-ring. Discard the O-ring.
  10. Bend back the lock washer tabs and remove the bearing locknut; use 'C' spanner SKF REF HN5 or equivalent.
  11. Remove the lock washer.
  12. Remove the four 1/4 in. capscrews from the drive end bearing cover.
  13. Remove the drive end bearing cover complete with lip seal.
  14. Remove the O-ring and discard.
  15. Carefully pull the shaft from the housing, complete with drive end bearing.
  16. Remove the connecting rod actuator shaft assembly and inspect the bushings.
  17. Use a bearing puller to remove the bearing from the shaft.
8. If the actuator shaft has been disassembled from connecting rod, assemble with the bushing fulcrum pin and snap rings before continuing.
  9. Carefully lower the pedestal, complete with seal O-ring and linear bearing, over the actuator shaft. (Assembly tool [P/N: 52655] is available to assist with reassembly of the pedestal without damage to the lip seals. Contact Generac Technical Service.)
  10. Secure the pedestal with the top flat relief properly oriented to clear the inlet nozzle.
  11. Fit the actuator neck seal and remaining components. Refer to [Actuator Neck Seal Removal and Installation](#).
  12. Fill the bearing housing with 10W-30 oil. Fill so static oil level is at the center of the sight glass. Do not overfill.

## Installation

1. On a new shaft, with a zero lead ground lip seal surface, no speed-sleeve is required. On an old shaft, when surface condition dictates, or on a new shaft with a turned surface, install a speed-sleeve 0.06-0.12 in. (1.52-3.0 mm) past the outside drive end shoulder. Refer to [Figure 4-6](#).
2. Carefully slide the opposite drive end of the shaft and bearing assembly into the drive end of the housing through the con-rod bushing and engage the shaft end in the ODE bearing.
3. Fit the lock washer, engaging locating tab in the shaft groove.
4. Fit the bearing locknut and tighten with 'C' spanner; bend lock washer tab into groove.
5. install the appropriate total thickness of shims to leave 0.007 in. to 0.010 in. (.177-.254mm) clearance between the ODE bearing and installed cover.
6. Fit the ODE bearing cover and new O-ring; secure with four 1/4 in. capscrews. Tighten to 10 ft-lbs (13.5 Nm).
7. Fit the drive end bearing cover complete with lip seal and new O-ring. Secure with four 1/4 in. capscrews. Tighten to 10 ft-lbs (13.5 Nm).

## Crankshaft Lip Seal Removal and Installation

1. Remove the 1/2 in NPT drain plug from the bearing housing. Drain and discard oil.
2. Remove the four 1/4 in. capscrews from the drive end bearing cover.
3. Remove the drive end bearing cover complete with lip seal.
4. Remove and discard the O-ring.
5. Pull the lip seal from the cover and discard.
6. Clean and lubricate the lip seal cavity. Press in the lip seal fully against the shoulder (lip nearest the bearing).
7. Inspect the speed-sleeve; replace if required.
8. Lubricate the shaft sealing surface.
9. Fit the new O-ring on the bearing cover and slide the assembly over the shaft. Align the screw holes.
10. Secure the cover to the bearing housing with four 1/4 in. capscrews. Tighten to 10 ft-lbs (13.5 Nm).
11. Fill the bearing housing with 10W-30 oil to where the static oil level is below the center of the sight glass. Do not overfill.

## Roller Bearing Removal and Installation

Follow procedures in [Crankshaft Removal and Installation](#) and [Crankshaft Lip Seal Removal and Installation](#).

## Connecting Rod/Drive Rod Assembly

It is recommended that these items be purchased pre-assembled with bearing finish machined and reamed. For removal, refer to [Crankshaft Removal and Installation](#) and [Crankshaft Lip Seal Removal and Installation](#).

## Pedestal Bearing and Seals Removal and Installation

1. Remove the vacuum pump pedestal assembly, complete with lip seals, following the steps in [Crankshaft Removal and Installation](#).
2. Remove the seals from the housing.
3. Use a bearing drift to push out the pedestal bearing.
4. Lubricate the new bearing and press it into the housing until the bottom edges of the bearing and housing are flush with one another.
5. Lubricate the seal housing and press in the lower seal (lip nearest to bearing). (Assembly tool [P/N: 52655] is available to assist with assembly of the lip seals in pedestal. Contact Generac Technical Service.)
6. Press the wiper seal into the pedestal with wiper lip uppermost.

Install the pedestal assembly and remaining components, complete with lip seal, following the steps in [Crankshaft Removal and Installation](#). Check the bearing housing oil level daily and add 10W-30 oil as necessary. Fill to the center of the sight glass. Do not overfill.

Every six months or every 1500 hours, drain the bearing housing and fill with fresh 10W-30 oil. If pumpage is seen exhausting from the vacuum pump discharge, shut the pump down and inspect the priming chamber.

## Trailer Wheel Bearings

Some trailers are equipped with a grease 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 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 install 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.

## Welding on Equipment with Electronic Controls

Proper welding procedures are required to avoid damage to electronic controls, sensors and associated components. The component should be removed for welding if possible.

The following procedure must be followed if the component must be welded while installed on equipment with electronic controls. This procedure will minimize the risk of component damage.

**NOTE:** Do not ground the welder to electrical components such as the control ground or sensors. Improper grounding can cause damage to electrical components. Clamp the ground cable from the welder to the component being welded. Place the clamp as close as possible to the weld to reduce the possibility of damage.

1. Stop the engine. Turn Key switch to OFF position.
2. Disconnect negative (-) battery cable from battery.
3. Open any installed Battery Disconnect switch.
4. Unplug control system if possible.
5. Connect welding ground cable as close as possible to the area to be welded.
6. Protect wiring harness from welding debris and splatter.
7. Use standard welding methods to weld the materials.

## Storage

The unit is adequately prepared for outside storage prior to shipment. Use the following list of additional suggestions for extended storage.

### Extended Storage Preparation

1. Disconnect the battery cables.
2. Store the unit off the ground so no water will accumulate around the equipment.
3. Protect the unit from blowing sand and dirt.
4. Stack no other items on top of the pump/equipment.
5. Protect the unit from the entry of any animals.
6. Periodically rotate shaft to lubricate bearings and protect bearings from brinelling.
7. Protect unit with approved drying agents (Silica Gel).
8. Verify all bare metal areas are coated with a rust preventative.
9. Inspect unit every four weeks and replace drying agents (Silica Gel) as required, or a minimum of every six months.
10. Keep an inspection record showing dates of inspection with any maintenance performed and condition of drying agents (Silica Gel).
11. Before use, verify that all rust protection has been removed. Also, remove any foreign material that may have accumulated during storage.
12. Before use, remove all drying agents (Silica Gel).
13. Drain all water from the main pump piping, including the suction line and discharge line. Remove the volute drain plug and vent plug to empty the pump casing.

14. Verify correct oil level in the engine and seal oil reservoir. Add oil as necessary.
15. Add grease to the main pump bearing frame fittings. Three to six strokes at each fitting with a hand grease gun should be sufficient.
16. Jog the main pump motor for 10 to 15 seconds. Install all plugs removed for draining.

## Winter Storage

Follow the steps in *Extended Storage Preparation*. Occasional motor starts once every month are recommended. Run the unit until it reaches operating temperature. This will help to replace and maintain a lubricating film on the bearings and operating parts.

## Commission Unit for Use

In installations where winter shutdown and storage is the normal situation, it is recommended that lubricating oil and seal barrier oil be drained and replaced to correct levels before the beginning of each new season.

- Add fresh grease to the main bearing frame and vacuum pump pedestal fittings
- Check all gasketed flanges, especially those on the suction side of the pump, for bolt tightness to eliminate the effect of air leaks on the priming time.

# Section 8 Troubleshooting

## Pump Troubleshooting Guide

Symptom	Possible Cause
No discharge	1, 2, 3, 4, 5, 7, 8, 9, 10, 17, 18, 19, 20, 37
Reduced capacity	2, 3, 4, 5, 7, 8, 9, 10, 11, 17, 19, 20, 21, 38, 39, 40, 47
Reduced pressure	5, 7, 8, 11, 13, 18, 19, 38, 39, 40, 47
Loss of prime	2, 3, 4, 7, 10, 11, 20, 21, 22, 23
Power consumption excessive, engine runs hot	6, 12, 13, 17, 18, 19, 24, 33, 34, 35, 36, 37, 38, 41, 42, 43, 44
Vibration and noise	2, 4, 9, 10, 14, 15, 17, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 39, 40, 41, 42, 43, 44, 48
Seal: excessive leakage, short life, seal housing overheating	22, 23, 25, 33, 34, 35, 36, 41, 44, 45, 46
Bearings: overheating, short life, noise	26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 41, 42, 43, 44
Pump overheating, seizes	1, 8, 9, 14, 33, 34, 35, 36, 41, 42, 43, 44
Corrosion, erosion, pitting, oxidation or other loss of material	7, 8, 11, 14, 15, 16

1. Pump not primed	16. Electrolysis	33. Pipe strain
2. Suction line not filled	17. Impeller obstructed	34. Temperature growth
3. Air pocket in suction line	18. Rotation direction wrong	35. Misalignment
4. Suction inlet or foot valve obstructed, insufficiently submerged, or too small	19. Low speed	36. Coupling improperly installed
5. System head higher than pump design head	20. Air leak into suction line	37. Impeller installed backwards
6. System head lower than pump design head	21. Air leak through mechanical seal	38. Worn wear rings
7. Insufficient Net Positive Suction Head (NPSH)	22. Seal fluid contaminated, hot or insufficient	39. Impeller damage
8. Parallel pump application is incorrect	23. Seal fluid system not vented	40. Improper balance (after repair)
9. Suction pressure to vapor pressure below minimum	24. High speed	41. Bent shaft
10. Suction lift too high	25. Mechanical seal insufficient	42. Excessive thrust
11. Excess vapor in pumpage	26. Bearing housing excessively cooled	43. Rotational element dragging
12. Specific gravity of pumpage housing different than design	27. Low oil pressure (oil lube bearings)	44. Worn or incorrectly installed bearings
13. Viscosity of pumpage different than design	28. Improper or poor lubrication	45. Mechanical seal not properly set, O-rings damaged or hardened
14. Operation at below rated capacity	29. Lubrication defective	46. Shaft scored at seal
15. Cavitation	30. Dirt in lubrication/bearings	47. Volute O-ring
	31. Moisture in lubricant/bearing housing	48. Foundation not rigid or settled
	32. Lubricant excess	

## Engine Fault Shutdown Troubleshooting

Symptom	Possible Cause	Solution
Low oil pressure shutdown	Low oil level	Check oil level, replace as necessary
	Faulty oil pressure sender	Replace oil pressure sender
	Incorrect oil grade	Change engine oil, refer to engine operating manual
	Worn oil pump	Refer to engine operating manual
	Oil leak	Refer to engine operating manual
High temperature shutdown	Low coolant level	Check coolant level, replace as necessary
	Faulty temperature sender	Replace temperature sender
	Coolant leaks	Refer to engine operating manual, replace components as necessary
	Worn water pump	Refer to engine operating manual
Overcrank shutdown	Pump engine will not start	Refer to engine operating manual
Overspeed shutdown	Pump cavitation	Reduce engine speed, lower intake hose
	Air trapped in intake hose	Relocate and/or straighten intake hose
	Intake insufficiently submerged	Lower intake hose
	Air leak in intake hose	Inspect intake hoses and couplings for damage or missing components and seals
	Air leak at pump housing	Inspect gaskets, seals and O-rings at pump intake flange, clean out cover and priming port
No speed signal shutdown	Engine magnetic pickup damaged or misaligned	Inspect magnetic pickup for damage/alignment
Low fuel shutdown	Low fuel level	Refill fuel tank with clean diesel fuel
Low coolant shutdown	Low coolant level	Allow engine to cool. Check coolant level in radiator. Add coolant until it is 3/4 in. (19 mm) below the filler neck

## Control System Troubleshooting

Symptom	Possible Cause	Solution
Control system does not perform self test	Faulty connection to battery	Correct battery connections
	Faulty control system	Repair or replace control system
Control system shuts down	Engine stop LED illuminated	Correct ECU stop condition, use ECU diagnostics
Display does not display data	Display lost power	Turn on key, verify display plugged into harness
	Engine source address incorrect	Change engine address in <i>Configuration</i>
	Display address incorrect	Change display address to 40 (default)
	Display configuration problem	Reset display using <i>Restore Defaults</i>
	CANbus failure	Check CANbus
	ECU not sending data	Repair or replace ECU
Engine will not crank	Fuel level/pressure low (SPN 524057)	Check fuel level Check if fuel supply line is loose Prime fuel system: Turn key to Start position. Let pump run for 10-15 seconds. (May need to repeat.)

### Diagnostic Trouble Codes (DTS)

CANbus Diagnostic Trouble Codes are a pair of numbers: the Suspect Parameter Number (SPN) and Failure Mode Identifier (FMI). The SPN indicates the faulting subsystem and the FMI identifies the type of failure.

### SPN Codes

Standard SPN codes are defined by SAE J1939-71. Not all standard codes are provided by ECUs. Manufacturers may add additional SPN codes beyond the codes identified in J1939-71. Contact a Deutz dealer or Generac Technical Service for more information.

**Table 8 - Typical SPN Codes**

SPN	Description
51	Throttle Position
91	Accelerator Pedal Position
94	Fuel Delivery Pressure
98	Engine Oil Level
100	Engine Oil Pressure
110	Engine Coolant Temperature
111	Coolant Level

**FMI Codes**

FMI codes are defined by SAE J1939-71. Refer to ECU documentation for correct interpretation of FMI codes for a specific SPN.

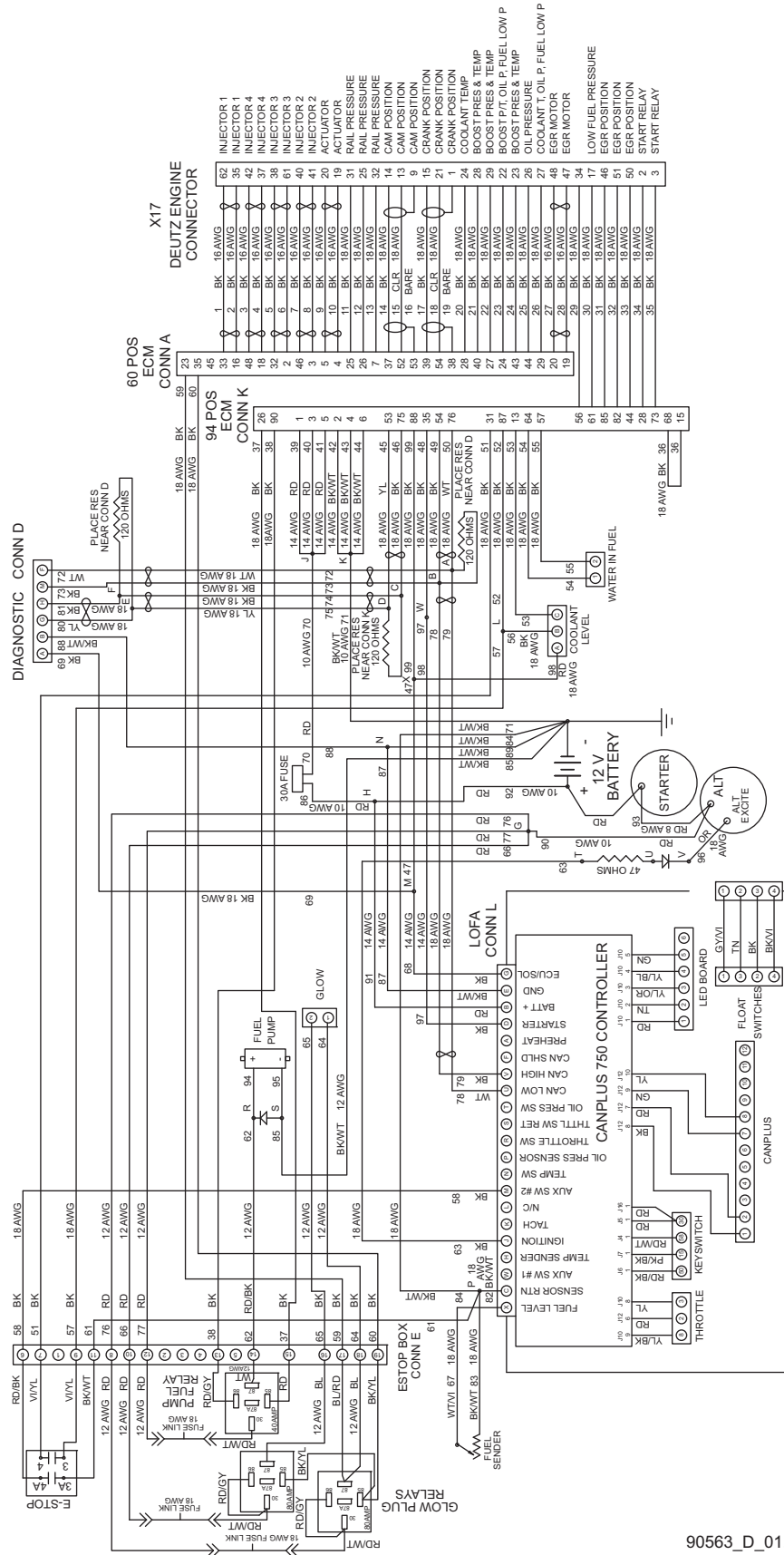
**Table 9 - FMI Codes**

<b>FMI</b>	<b>Description</b>
0	Data valid but above normal operational range
1	Data valid but below normal operational range
2	Data erratic, intermittent or incorrect
3	Voltage above normal or shorted high
4	Voltage below normal or shorted low
5	Current below normal or open circuit
6	Current above normal or grounded circuit
7	Mechanical system not responding properly
8	Abnormal frequency, pulse width or period
9	Abnormal update rate
10	Abnormal rate of change
11	Failure mode not identifiable
12	Bad intelligent device or component
13	Out of calibration
14	Special instructions
15	Data valid but above normal operational range (least severe)
16	Data valid but above normal operational range (moderately severe)
17	Data valid but below normal operational range (least severe)
18	Data valid but below normal operational range (moderately severe)
19	Received network data in error
20-30	Reserved for future assignment
31	Not available or condition exists



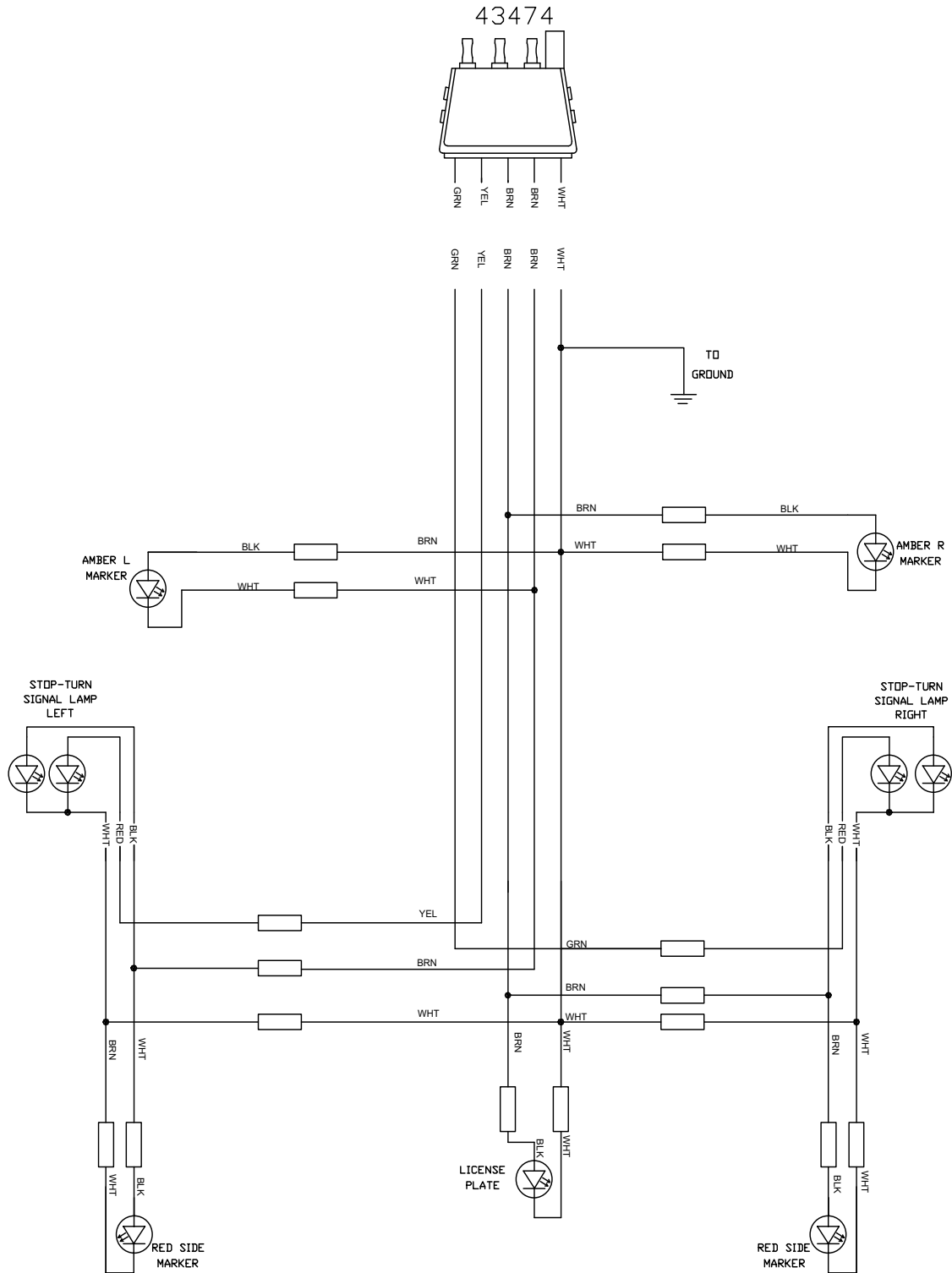
# Section 9 Installation Diagrams and Service Log

## DC Wiring Diagram



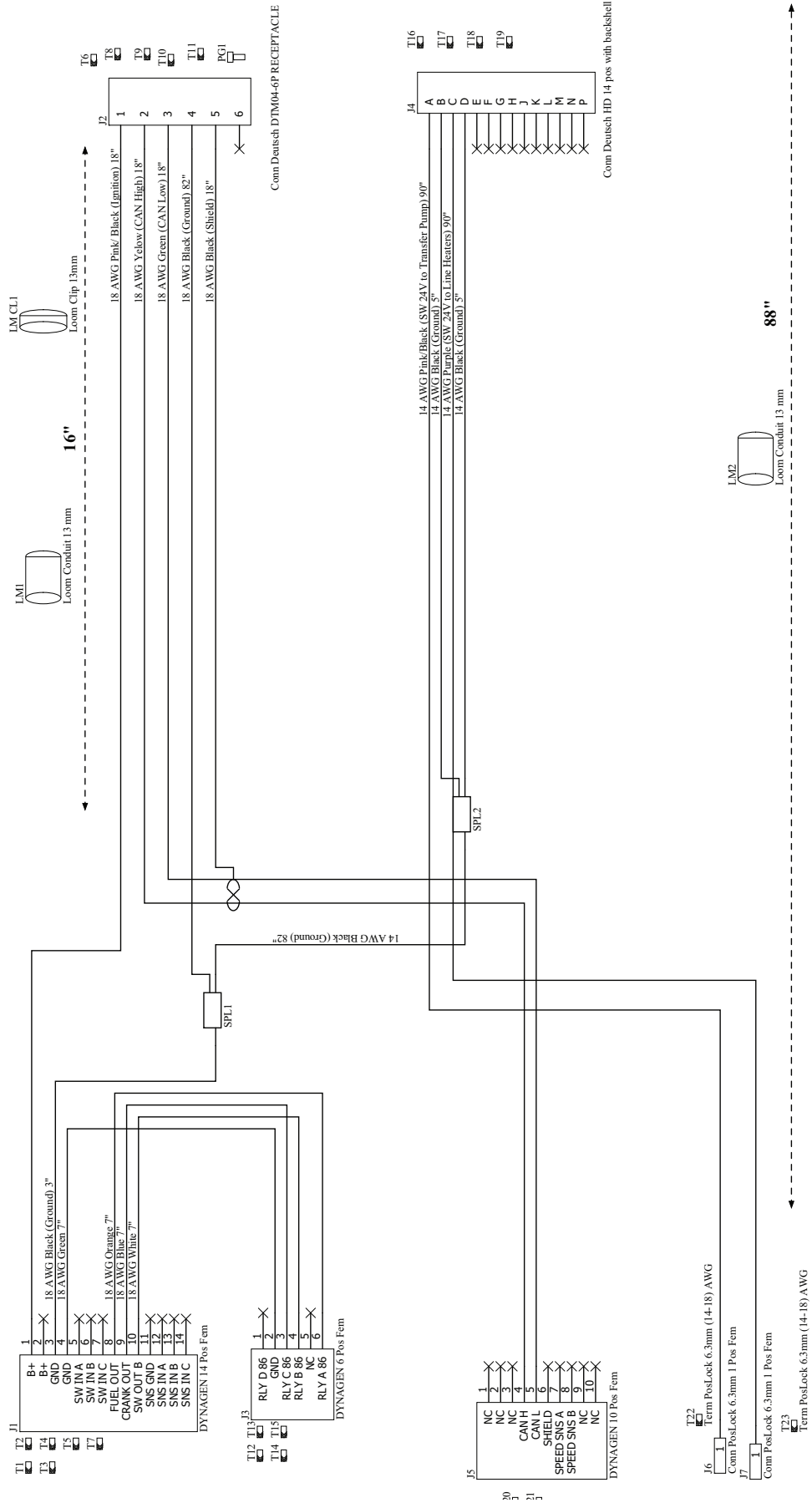
90563\_D\_01.26.15

# Trailer Lights Wiring Diagram



54017\_ORG\_06.03.16

# Wire Harness Wiring Diagram













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