

# **ONL944**

For Models: NL944D2, NL944D3,  
NL944T2, and NL944T3

# **OPERATOR'S MANUAL**

Marine Generators | Marine Diesel Engines | Land-Based Generators



**NORTHERN LIGHTS**  
MARINE GENERATORS





As of January 2008, U.S. EPA regulations require the application of a permanently applied label near the fuel tank fill port for diesel driven equipment. This label is to state:

**LOW OR ULTRA LOW SULFUR FUEL ONLY**

Northern Lights is providing this label for application to the fuel inlet of the fuel supply tank for each engine or generator set. This is to be applied by the installer of the engine or gen set, or by the manufacturer of the equipment that the engine or gen set is installed in. The location of the label must be in clear site of personnel that refill the supply tank.

Note: Starting in 2011, the label will state:

**ULTRA LOW SULFUR ONLY.**



— CALIFORNIA —  
Proposition 65 Warning:

*Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.*

#### Northern Lights

4420 14th Avenue N.W.  
Seattle, WA 98107  
Tel: (206) 789-3880  
Fax: (206) 782-5455

Copyright ©2013 Northern Lights, Inc.  
All rights reserved. Northern Lights™, and  
the Northern Lights logo are trademarks of  
Northern Lights, Inc.

Printed in U.S.A.  
PART NO.: ONL944 7/13



**NORTHERN LIGHTS**  
MARINE GENERATORS

# OPERATOR'S MANUAL

## *for Northern Lights® NL944D2, NL944D3, NL944T2, and NL944T3 Diesel Generator Sets*

*Read this operator's manual thoroughly before starting to operate your equipment.  
This manual contains information you will need to run and service your new unit.*

### Table of Contents

<b>INTRODUCTION</b> .....	<b>2</b>	<b>SERVICING (Continued)</b>	
Models Included .....	<b>2</b>	V-Belts .....	<b>17</b>
Model Numbers .....	<b>2</b>	Valve Clearances.....	<b>18</b>
Serial Numbers .....	<b>2</b>	Fuels - General.....	<b>19</b>
<b>WARRANTY</b> .....	<b>3</b>	Fuel Filters .....	<b>19</b>
<b>SAFETY RULES</b> .....	<b>3 - 7</b>	Bleeding the Fuel System .....	<b>20</b>
<b>COMPONENT LOCATIONS</b>		Injector Service.....	<b>21</b>
Generator Set .....	<b>8 - 9</b>	Injection Pump.....	<b>22</b>
<b>CONTROL PANELS</b>		Cooling System .....	<b>23</b>
Northern Lights Generator Sets .....	<b>10</b>	Turbocharger.....	<b>24</b>
<b>OPERATING PROCEDURES</b>		Electrical System - General .....	<b>25</b>
Break-in Period.....	<b>11</b>	Booster Batteries.....	<b>25</b>
Before Starting.....	<b>11</b>	Battery Care.....	<b>26</b>
Starting.....	<b>12</b>	Winterizing / Out-of-Service .....	<b>26</b>
Operating .....	<b>12</b>	<b>TROUBLESHOOTING</b>	
Stopping.....	<b>12</b>	Electrical .....	<b>27</b>
Shutdowns and Alarms .....	<b>13</b>	Engine.....	<b>28 - 30</b>
Spare Parts .....	<b>13</b>	<b>WIRING DIAGRAMS</b>	
<b>SERVICING SCHEDULE CHART</b> .....	<b>14</b>	AC Electrical .....	<b>31</b>
<b>SERVICING</b>		DC Electrical .....	<b>32 - 35</b>
Lubrication - General.....	<b>16</b>		
Checking Oil.....	<b>16</b>		
Oil Changes .....	<b>16</b>		
Changing Oil Filter.....	<b>17</b>		
Air Filter .....	<b>17</b>		

#### Proprietary Information

This publication is the property of Northern Lights, Inc.  
It may not be reproduced in whole or in part without the written permission of Northern Lights, Inc.  
© Northern Lights, Inc. All rights reserved. Litho U.S.A. Publication number ONL944 7/13

## Introduction

The servicing of industrial generator sets presents unique problems. In many cases, these generators are far from a repair facility. Servicing generator engines cannot be compared to the servicing of automobiles, trucks, or even farm equipment. Failures often occur in remote areas far from competent assistance. Industrial engines are taxed far more severely than auto or truck engines; therefore, maintenance schedules must be adhered to

more strictly. Failures begin with minor problems that are overlooked and become amplified when not corrected during routine maintenance.

As operator, it is your obligation to learn about your equipment and its proper maintenance. This is not a comprehensive technical service manual. Nor will it make the reader into an expert mechanic. Its aim is to aid you in maintaining your unit properly.

## Unit Identification

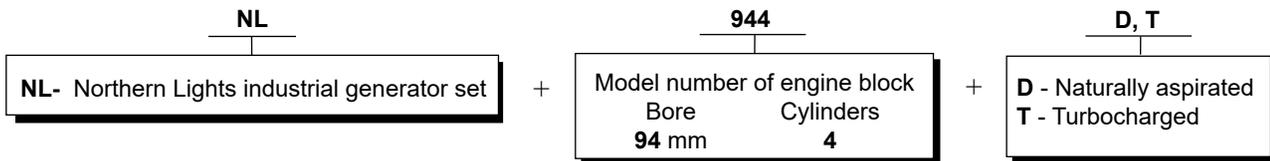
### MODELS INCLUDED

This manual covers the operating instructions for:

**NL944D2, NL944D3, NL944T2, and NL944T3** industrial generator sets, which use the 944 engine block.

### Model Numbers

Model numbers give the unit's application, block model, aspiration, and RPM:



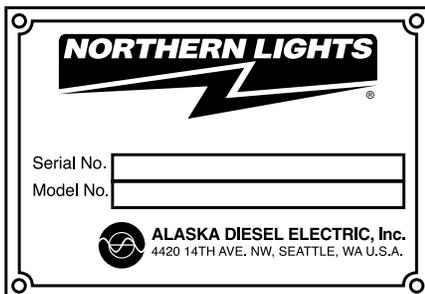
**NL944D2** = Northern Lights industrial diesel generator set with a 944 engine and a Stamford UCI224 series generator end, Tier II.

**NL944T2** = Northern Lights industrial diesel generator set with a 944 engine and a Stamford UCI224 series generator end, turbocharged, Tier II.

**NL944D3** = Northern Lights industrial diesel generator set with a 944 engine and a Stamford UCI224 series generator end, Tier III.

**NL944T3** = Northern Lights industrial diesel generator set with a 944 engine and a Stamford UCI224 series generator end, turbocharged, Tier III.

### Serial Numbers



Your set has three serial numbers: ① an engine number stamped on the block, ② a generator plate, and ③ a generator set plate.

Use the serial number on the generator set plate when ordering parts or in correspondence. The generator set plate is found on the service side of the generator and resembles the drawing in Figure 1.

*Figure 1: Generator set serial number plate.*

## Warranty

A warranty registration certificate is supplied with your set. It entitles the original purchaser of our equipment to a warranty covering material or assembly faults. The extent of coverage is described in the Limited Warranty Statement. We recommend that you study the statement carefully.

**NOTE:** If the warranty is to apply, the servicing instructions outlined in this manual must be followed. If further information is needed, please contact an authorized dealer or the factory.

## Safety Rules



**CAUTION:** *Accident reports show that careless use of engines causes a high percentage of accidents. You can avoid accidents by observing these safety rules. Study these rules carefully and enforce them on the job.*

### IMPORTANT SAFETY INSTRUCTIONS.

Electromagnetic equipment, including generator sets and their accessories, can cause bodily harm and life threatening injuries when improperly installed, operated or maintained. To prevent accidents be aware of potential dangers and act safely.

**READ AND FOLLOW ALL SAFETY INSTRUCTIONS IN THIS MANUAL, PRIOR TO THE INSTALLATION OF ANY GENERATOR SET OR ACCESSORY. KEEP THESE INSTRUCTIONS FOR FUTURE REFERENCE.**

### Recognize Safety Symbols and Instructions

In addition to the information found in this section, this operator's manual will use the CAUTION warning to outline potential dangers of a specific nature.



CAUTION indicates the presence of a potential hazard that can or will cause severe or minor property damage, personal injury or death.

### Follow All Safety Instructions

Carefully read and understand all safety messages in this manual and on your machine's safety signs. Keep signs in good and clean condition. Replace missing or damaged signs. Be sure new equipment components and



repair parts include the current safety signs. For replacement signs, proper placement of safety signs or clarification on any safety issue, consult your Northern Lights dealer or the factory.

There can be additional safety information contained on parts and components from outside suppliers that is not reproduced in this manual. Consult the suppliers for additional safety information.

Learn how to operate the machine and how to use the controls properly. Only trained personnel should operate machines, or work on or around them.

Keep you machine in proper working condition. **UNAUTHORIZED MODIFICATIONS TO THE MACHINERY MAY IMPAIR ITS FUNCTION AND SAFETY PARAMETERS.**

### Prevent Bypass and Accidental Starting

Do not start engine by shorting across start terminal. Engine will start if normal circuitry is bypassed, creating a hazard by runaway machinery.



Start engine only from operator's station.

### Handle Fuel Safely - Avoid Flames

Diesel is highly flammable and should be treated with care at all times. Do not refuel while smoking or when near sparks or open flame.

## Safety Rules

**ALWAYS STOP ENGINE BEFORE FUELING MACHINE.** Always fill portable fuel tank outdoors. Never fuel a hot engine.



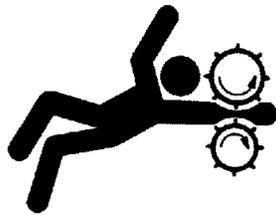
Prevent accidental discharge of starting fluids by storing all cans in a cool, safe place, away from sparks or open flame. Store with cap securely on container. Never incinerate or puncture a fuel container.

Prevent fires by keeping machine clean of accumulated trash, grease and debris. Always clean any spilled fuel as swiftly as possible. Do not store oily rags, which can ignite and burn spontaneously.

Be prepared if a fire starts. Keep a first aid kit and fire extinguisher handy. Keep emergency contact numbers for fire department, doctors, ambulance and hospital near the telephone.

### Service Machines Safely

Do not wear a necktie, scarf, necklace, rings or other jewelry, or any loose clothing when working near moving parts. Tie long hair behind your head. If any of these items get caught in moving machinery, severe injury or death could result.



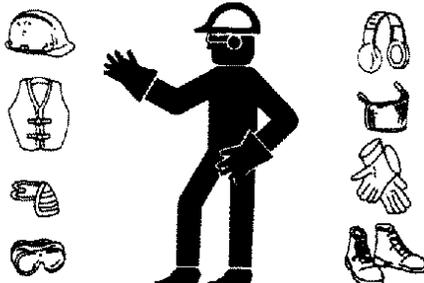
Check for any loose electrical connections or faulty wiring.

Look completely around engine to make sure that everything is clear before starting.

### Wear Protective Clothing

To prevent catching anything in moving machinery, always wear close fitting clothes and safety equipment appropriate to the job.

Prolonged exposure to loud noise can cause hearing loss or impairment. Wear suitable



authorized hearing protection, such as earmuffs or plugs to protect against loud noises.

Operating equipment requires the full attention of the operator. Do not use radio or music headphones while operating machinery.

### Practice Safe Maintenance

Understand all service procedures before starting work. Keep area clean and dry. Never lubricate, service, or adjust machine while it is in operation.

Keep hands, feet and clothing away from power-driven equipment. When shutting down an engine, disengage all power and operator controls. Allow the engine to cool completely before beginning any service work.



*Securely support any machinery elements that must be raised for service work with support or lifting machinery specifically intended for that purpose.*

Keep all parts in good conditions and properly installed. Fix damage immediately. Replace any worn or broken parts. Remove any build up of grease, oil or debris.

Disconnect battery ground cable (-) before making any adjustments or service work.

### Stay Clear of Rotating Drivelines

Entanglement in rotating drivelines can cause serious injury or death. Keep shields in place at all times. Make sure that rotating shields turn freely in pace with the drivelines.



Do not wear loose fitting equipment around rotating drivelines. Stop the engine and make sure that all moving parts have stopped before making any adjustments, connections, or performing any other type of service to the engine or other driven equipment.

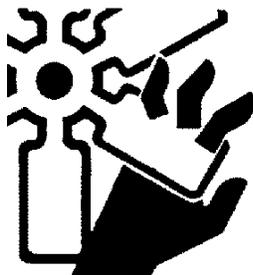
## Safety Rules (Continued)

### Install all Safety Guards

Direct contact with rotating fans, belts, pulley and drives can cause serious injury.

Keep all guards in place at all times during engine operation.

Wear close-fitting clothes. Stop the engine and be sure all fans, belts, pulleys and drives are stopped before making adjustments, connections, or cleaning near fans and their components.



Do not allow anything on your person to dangle into or come in contact with a moving fan, belt, pulley or drive. Fans can act as vacuums and pull materials up from below, so avoid that area as well while in service.

### Safe Battery Handling

#### Prevent Battery Explosions

Battery gas is highly flammable. Battery explosions can cause severe injury or death. To help prevent battery explosions, keep sparks, lighted matches and open flame away from the top of battery. When checking battery electrolyte level, use a flashlight.



Never check battery charge by contacting the posts with a metal object. Use a volt-meter or hydrometer.

Frozen batteries may explode if charged. Never charge a battery that has not been allowed to warm to at least 16°C (60°F).

Always remove grounded (-) battery clamp first and replace ground clamp last.

Sulfuric acid in battery electrolyte is poisonous and strong enough to burn skin, eat holes into clothing and other materials, and cause blindness if splashed into eyes.

### To Avoid Hazards:

- Fill batteries only in well-ventilated areas.
- Wear appropriate eye protection and rubber gloves.
- Never use air pressure to clean batteries.
- Wear appropriate ventilation equipment to avoid inhaling fumes when adding electrolyte.
- Do not spill or drip electrolyte.
- Use correct jump-start procedure if required.

### If acid is spilled on skin or in eyes:

1. Flush skin with water.
2. Apply baking soda or lime to help neutralize acid.
3. Flush eyes with water for 15-30 minutes.
4. Get medical attention immediately.

If acid is swallowed:

1. DO NOT induce vomiting.
2. Drink large amounts of water or milk, without exceeding 2 liters (2 quarts)
3. Get medical attention immediately



**WARNING:** Battery posts, terminals, and related accessories can contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Wash hands after handling.

### Handle Chemical Products Safely

Direct exposure to hazardous chemicals can cause serious injury. Among the potentially hazardous chemicals that may be used with Northern Lights products are lubricants, coolants, paints and adhesives.



All potentially hazardous chemicals come with a Material Data Safety Sheet (MSDS). The MSDS provides specific details on chemical products, including physical hazards, safety procedures and emergency response techniques.

Read and understand the MSDS for each chemical before you start any job that includes it. Follow the procedures and use appropriate equipment exactly as recommended.

## Safety Rules (Continued)

Contact your Northern Lights dealer or Northern Lights factory for MSDS's used on Northern Lights products.

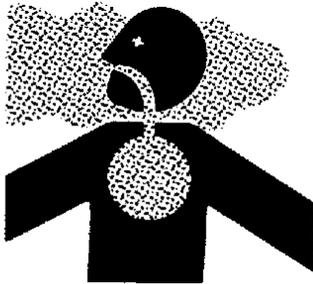
### Work in Well Ventilated Areas

Exhaust fumes from engines contain carbon monoxide and can cause sickness or death. Work in well ventilated areas to avoid prolonged exposure to engine fumes. If it is necessary to run an engine in an enclosed area, route the exhaust fumes out of the area with an approved, leak proof exhaust pipe extension.

### Remove Paint Before Welding or Heating

Hazardous fumes can be generated when paint is heated by welding, soldering or using a torch. To avoid potentially toxic fumes and dust, remove paint before heating.

- Remove paint a minimum of 100 mm (4 in.) from the area that will be affected by heat.
- If paint cannot be removed, wear an approved respirator.
- If you sand or grind paint, use an approved respirator.
- If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers from the area.
- Allow at least 15 minutes for fumes to disperse before welding or heating.

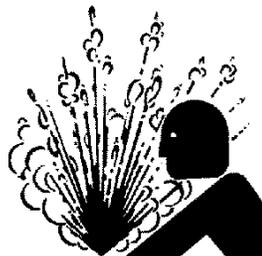


Do not use a chlorinated solvent in an area where welding will occur. Work only in areas that are well ventilated. Dispose of paint and solvent properly.

### Service Cooling System Safely

Opening a pressurized cooling system can release explosive fluids and causing serious burns.

Before opening any pressurized cooling system, make sure the engine has been shut off. Do not remove a filler cap unless it is cool enough to comfortably grip with bare hands.



Slowly loosen cap to relieve pressure before opening fully.

### Avoid High Pressure Fluids

Relieve pressure prior to disconnecting pressurized lines. Escaping fluid under pressure can penetrate the skin causing serious injury. Always relieve pressure before disconnecting hydraulic or other pressurized lines. Tighten all connections firmly before re-applying pressure.

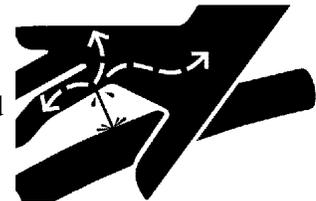


If searching for leaks, use a piece of cardboard. Always protect your hands and other body parts from high-pressure fluids.

If an accident occurs, see a doctor immediately. Any high pressure spray injected into the skin must be removed within a few hours to prevent the risk of gangrene or other infection.

### Avoid Heating Near Pressurized Fluid Lines

Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns and bodily injury. Pressurized lines can rupture when heat goes beyond the immediate flame area. Do not weld, solder or use a torch or open flame near pressurized lines or other flammable fluids.



### Do Not Open High-Pressure Fuel System

Many Northern Lights engines use high-pressure fuel injection. High-pressure fluid remaining in fuel lines can cause serious injury. Do not disconnect or attempt any repair of fuel lines, sensors, or other components between the high-pressure fuel pump and nozzles on engines with high pressure fuel systems.

**ONLY AUTHORIZED TECHNICIANS CAN PERFORM REPAIRS ON AN HIGH PRESSURE FUEL INJECTION SYSTEMS.**

## Safety Rules (Continued)

### Avoid Hot Exhaust

Avoid exposure to and physical contact with hot exhaust gases. Exhaust parts and streams can reach high temperatures during operation, leading to burns or other serious injury.

Cleaning exhaust filters can also lead to exposure to hot exhaust gas and the injury risk associated with it. Avoid exposure to and physical contact with hot exhaust gases when cleaning exhaust filters.



During auto or manual/stationary exhaust filter cleaning operations, the engine will run at elevated temperatures for an extended period of time. Exhaust parts and streams can reach high temperatures during operation, leading to burns or other serious injury.

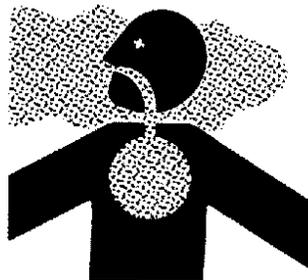
### Avoid Harmful Asbestos Dust

Inhaling asbestos fibers may cause lung cancer. Avoid breathing any dust that may be generated when handling components containing asbestos fibers, including some gaskets.

The asbestos used in these components is usually found in a resin or otherwise sealed.

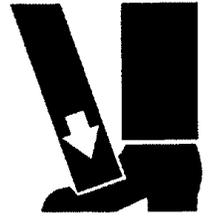
Normal handling of these components is not dangerous, as long as airborne dust containing asbestos is not generated.

Avoid creating dust. Never use compressed air for cleaning. Avoid brushing or grinding materials containing asbestos. When servicing, wear an approved respirator. A special vacuum cleaner is recommended to clean asbestos. If this vacuum is not available, apply a mist of oil or water on the material containing asbestos. Keep all bystanders away from any area where asbestos dust may be generated.



### Use Proper Lifting Equipment and Techniques

Lifting heavy components incorrectly can cause severe injury or damage to machinery. Avoid unbalanced loads. Do not use lifting eyes. Lift the generator set using lifting bars inserted through the lifting holes on the skid. Follow all recommended removal and installation procedures in this and associated Northern Lights manuals.



### Use Proper Tools

Makeshift tools and procedures can create safety hazards. Always use appropriate tools for the job.



Use power tools only to loosen threaded parts and fasteners. For loosening and tightening hardware, always use the correct sized tools. Do not use US measurement tools on metric fasteners, or vice versa. Use only service parts that meet Northern Lights specifications.

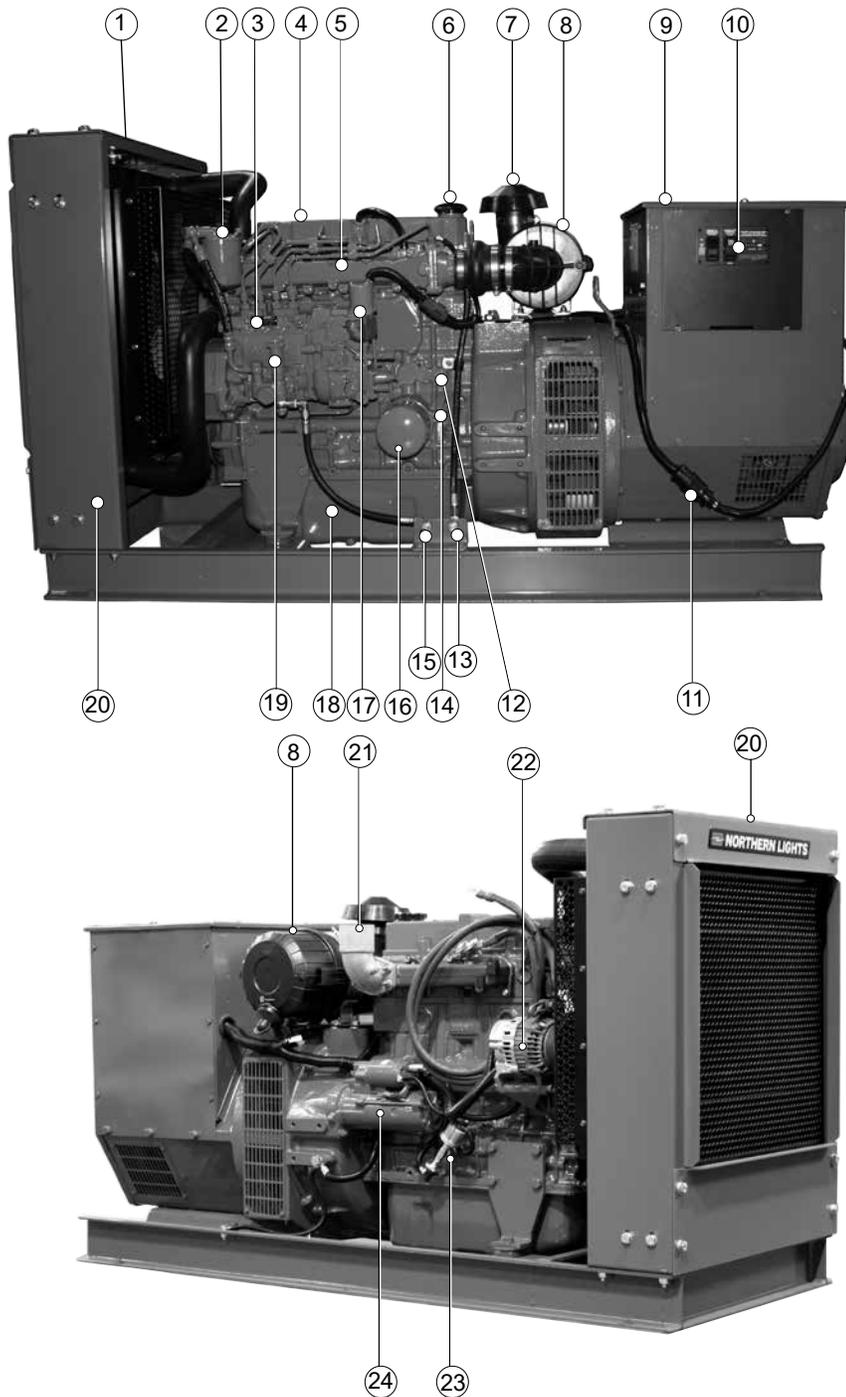
### Dispose of Waste Properly

Disposing of waste improperly can threaten the environment and lead to unsafe working conditions. Potentially harmful waste used in Northern Lights equipment can include oil, fuel, coolant, filters and batteries.

Use leakproof containers to drain fluid. Do not use food or beverage containers that may mislead someone into drinking from them.

Do not pour waste onto the ground, down a drain or into any water source.

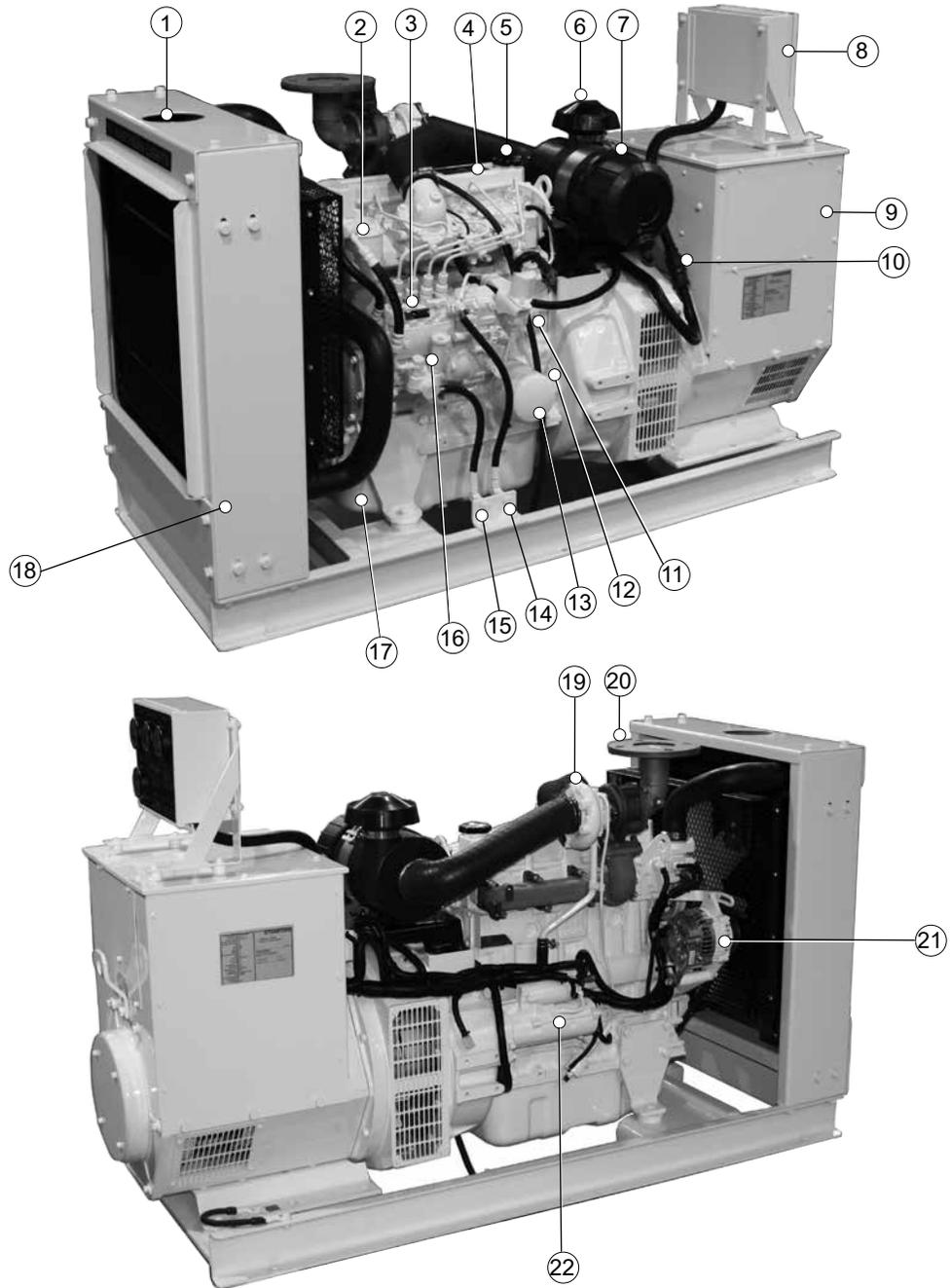
## Industrial Generator Set Component Locations



**Figure 2 & 3:** NL944D3 with UCI224 series generator end.

- |  |  |  |   |
|--|--|--|---|
| <p><b>1.</b> Coolant Fill</p> <p><b>2.</b> Fuel Filter</p> <p><b>3.</b> Injection Pump</p> <p><b>4.</b> Rocker Arm Cover</p> <p><b>5.</b> Intake Manifold</p> <p><b>6.</b> Oil Fill</p> <p><b>7.</b> Air Cleaner Cap</p> | <p><b>8.</b> Air Cleaner</p> <p><b>9.</b> Junction Box</p> <p><b>10.</b> Control Panel</p> <p><b>11.</b> Control Panel Plug</p> <p><b>12.</b> Drain Plug</p> <p><b>13.</b> Fuel Return Line</p> <p><b>14.</b> Dipstick</p> | <p><b>15.</b> Fuel Inlet Line</p> <p><b>16.</b> Oil Filter</p> <p><b>17.</b> Solenoid</p> <p><b>18.</b> Oil Pan</p> <p><b>19.</b> Fuel Primer Pump</p> <p><b>20.</b> Radiator Shroud</p> | <p><b>21.</b> Exhaust Elbow</p> <p><b>22.</b> Alternator</p> <p><b>23.</b> Oil Pressure Switch &amp; Sender</p> <p><b>24.</b> Starter</p> |
|--|--|--|---|

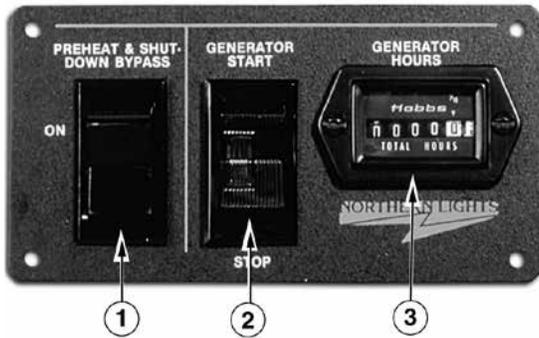
## Industrial Generator Set Component Locations



**Figure 4 & 5:** NL944T2 with LXE series generator end.

- |                     |                        |                      |                   |
|---------------------|------------------------|----------------------|-------------------|
| 1. Coolant Fill     | 8. Control Panel       | 15. Fuel Inlet Line  | 20. Exhaust Elbow |
| 2. Fuel Filter      | 9. Junction Box        | 16. Fuel Primer Pump | 21. Alternator    |
| 3. Injection Pump   | 10. Control Panel Plug | 17. Oil Pan          | 22. Starter       |
| 4. Rocker Arm Cover | 11. Water Drain        | 18. Radiator Shroud  |                   |
| 5. Oil Fill         | 12. Dipstick           | 19. Turbocharger     |                   |
| 6. Air Cleaner Cap  | 13. Oil Filter         |                      |                   |
| 7. Air Cleaner      | 14. Fuel Return Line   |                      |                   |

## Control Panels



*Figure 6-A: Series 1-B Generator Control Panel*



*Figure 6-B: Series 3 Generator Control Panel*

### 1. PREHEAT/ SHUTDOWN BYPASS

This switch serves two functions:

1. Preheats air before beginning the starting process. Press switch for 10-20 seconds before attempting startup.
2. Bypasses the safety shutdown feature during the starting process. Keep switch engaged while starting engine, and for 2 to 3 seconds afterwards, allowing oil pressure to build beyond shutdown setpoint.

### 2. ENGINE CONTROL SWITCH

To start the engine, hold this switch in the START position until the engine is running. After the engine starts, release the switch and it will return to RUN position. To stop the engine, hold the switch in the STOP position.

**NOTE: The rocker switch is used on Series 1 panels only, and has a light that glows when the set is running.**

### 3. HOUR METER

Keeps track of engine running time.

### 4. OIL PRESSURE GAUGE

Shows the oil pressure in the engine lubricating system.

### 5. WATER TEMPERATURE GAUGE

Registers the temperature of the cooling water.

### 6. D.C. VOLTMETER

When the engine is stopped, the voltmeter indicates the condition of the battery. When the engine is running, the voltmeter indicates the voltage output of the alternator.

---

## Operating Procedures

---

### BREAK-IN PERIOD

1. Your engine is ready to be put into service. However, the first 100 hours on a new or reconditioned engine are critical to its life and performance. This is especially true of an engine that runs at a constant speed such as a generator engine.
2. Operate the engine under various conditions, particularly heavy loads with minimal idling, to help seat engine components properly..
3. Oil consumption is greater during break-in as piston rings take time to seat.
4. Your engine comes equipped with break-in oil. Change engine oil and filter at 50 hours using API Service Category CC, CD, or CE break-in oil. Change the oil and filter again at 100 hours. (Consult the lubricants section for oil recommendation.)
5. Frequently check the engine temperature and oil pressure gauges.

### BEFORE STARTING

1. Check the coolant level by removing the pressure cap from the radiator. In order to give the cooling water an opportunity to expand, the level should be about 1 in. (2.5 cm) below the filler cap sealing surface when the engine is cold.



**CAUTION:** Use protective clothing and open the filler cap carefully when the engine is warm to prevent burns.

---

2. Check the oil level in the crankcase with the dipstick. The oil level must be between high and low marks on the stick. Never allow the level to go below this area. Always add the same viscosity of oil as is already in the crankcase.
3. Check the fuel tank level and open any fuel valves on the tank and at the secondary fuel filter, if equipped with one.
4. Place the battery switch in the ON position.

**NOTE:** The battery switch must always be kept ON while the engine is running. If the switch is turned OFF while the engine is running, the battery charging alternator could be damaged.

---

## Operating Procedures

---

### STARTING

1. Hold the Shutdown Bypass switch in the ON position.
2. While holding the Shutdown Bypass switch in the ON position, push the Engine Control switch to the START position.
3. As soon as the engine starts, release both switches. Do not crank the starter for more than 20 seconds consecutively. If the engine fails to start with the first attempt, be sure that it has stopped completely before re-engaging the starter.

### OPERATING

1. Units with Series 3 Control Panels: check gauges often. Oil pressure must be above 15 PSI. The D.C. voltmeter should read between 11 and 15 volts at 80° F (25° C) ambient temperature. The water temperature gauge must be below 200° F (94° C). Check the A.C. voltage. If the gauges deviate from normal levels, shut down the generator set and investigate.
2. Let the unit run unloaded for a three to five minute warm-up period.
3. Add electrical load.

### STOPPING

1. Remove electrical load from the generator set.
2. Run the engine for a three to five minute cool-down period.
3. Move the Engine Control switch to the STOP position until the engine stops completely.
4. Shut off fuel valve and battery switch.

---

## Operating Procedures

---

### SHUTDOWNS AND ALARMS

1. Your unit is fitted with a system to protect it from high water temperature or low oil pressure.
  - a. Generator sets have shutdown systems to stop the engine. They have no warning horns.
  - b. Other alarms and shutdowns are available as optional equipment.

**NOTE: If your unit is equipped with optional shutdowns and alarms, do not rely on your warning or shutdown system to the exclusion of careful gauge monitoring. Watching your gauges can prevent damage to the unit and dangerous power losses.**

2. Do the following when your warning or shutdown system is activated:
  - a. Check the temperature gauge. If above 205° F (96° C), shut off the engine immediately.
  - b. Use the Trouble Shooting Guide on page 25 to isolate the cause of the overheat.



***CAUTION: Do not remove the water fill cap of an overheated engine. Escaping high temperature steam can cause severe burns. Allow the engine to cool and then remove the cap slowly using protective clothing.***

- c. Make repairs and restart after the temperature gauge registers below 200° F (94° C).
  - d. Watch the temperature gauge regularly and turn off the unit if the temperature rises above 205° F (96° C). Repeat troubleshooting.
3. If shutdown is activated and the temperature gauge shows temperature within normal temperature range:
    - a. Check the engine crankcase oil level.
    - b. If the oil level is low, fill with recommended lubricating oil and restart. Watch the oil pressure gauge carefully and shut off the engine if it does not show a normal reading (20-60 PSI) after a few seconds of operation.
    - c. If the oil level is normal, DO NOT restart the engine. Call your dealer for assistance.

### SPARE PARTS

1. ADE recommends that you keep the following spare parts on hand for field service. The parts are available from your local Northern Lights dealer.
  - a. Primary and secondary fuel filter elements
  - b. Oil filters
  - c. Air filter elements
  - d. Alternator belt
  - e. Thermostat and gaskets
  - f. Glow plugs
  - g. Injector and washer
2. If your set is operating a long distance from a servicing dealer, add the following:
  - a. Complete set of injectors
  - b. Copper washers for injector change
  - c. Complete set of glow plugs
  - d. Fuel lift pump

## Servicing Schedule Chart

The Servicing Schedule Chart below shows the service schedule required for proper maintenance of your generator set. More detailed coverage of each Service Point (SP) is listed on the page noted in the 'page' column.

**DAILY:**

- SP1 Check oil level in engine
- SP8 Check primary fuel filter
- SP14 Check cooling water level

**AFTER FIRST 50 HOURS:**

- SP2/3 Change engine oil and filter
- SP5 Check V-belt tension
- SP7 Adjust valves
- SP19 Check electrolyte level in batteries

**EVERY 50 HOURS:**

- SP5 Check V-belt tension
- SP19 Check electrolyte level in batteries

**AFTER FIRST 100 HOURS:**

- SP2/3 Change engine oil and filter

**EVERY 100 HOURS:**

- SP21 Check air, oil, and coolant lines for leaks near turbo

**EVERY 250 HOURS:**

- SP2/3 Change engine oil and filter
- SP4 Check air cleaner

**EVERY 500 HOURS:**

- SP6 Check valve clearances
- SP9 Change primary fuel filter element
- SP10 Change secondary fuel filter
- SP12 Check injectors
- SP15 Check cooling system
- SP20 Check state of charge of batteries

**EVERY 2000 HOURS or as needed:**

- SP13 Check fuel injection pump
- SP16 Check and clean radiator
- SP24 Inspect starter and alternator

SERVICE POINT	PAGE	OPERATION	DAILY	50 Hours	100 Hours	250 Hours	500 Hours	2000 Hours
<b>ENGINE:</b>								
SP1	12	Check oil level	•					
SP2	12	Change engine oil 1) 5)		•		•		
SP3	13	Change lube oil filters 1) 5)		•		•		
SP4	13	Check air cleaner 1) 4)				•		
SP5	13	Check V-belt tension 1)					•	
SP7	14	Check valve clearances 5)					•	
<b>FUEL SYSTEM:</b>								
SP8	15	Check primary filter 2)	•					
SP9	15	Change primary filter element 2) 3)					•	
SP10	15	Change secondary fuel filter 1) 3)					•	
SP11	16	Bleed the fuel system 3)						
SP12	17	Check injectors 1) 7)					•	
SP13	18	Check fuel injection pump						•
<b>TURBOCHARGER:</b>								
SP21	20	Check air, oil, & coolant lines for leakage 3)			•			
<b>COOLING SYSTEM:</b>								
SP14	19	Check cooling water level	•					
SP15	19	Check and flush cooling system 8)						•
SP16	20	Check and clean radiator 4)						•
<b>ELECTRICAL SYSTEM:</b>								
SP19	22	Check electrolyte level in batteries 1) 4)		•				
SP20	22	Check condition of batteries with hydrometer 1)					•	
SP24		Inspect alternator and starter 3)						
<b>OUT OF SERVICE:</b>								
SP23	22	Winterizing or out-of-service 3)						

- 1) Perform all maintenance once a year even if hour level has not been reached.
- 2) Consult manufacturer's maintenance schedule, note on chart.
- 3) Whenever necessary.
- 4) More often if necessary.

- 5) After first 50 hours.
- 6) Adjust at first 100 hours.
- 7) Fuel inj. opening pressure: 11.77 MPa (120 kgf/cm<sup>2</sup>) 1710 PSI
- 8) Or every 1 year

---

**Service Record Notes:**

---

---

## Servicing

---

### LUBRICATION - GENERAL

1. Use only clean, high quality lubricants stored in clean containers in a protected area.
2. These lubricants are acceptable:
  - a. API Service CD, CE, and CF-4 single viscosity oils.
  - b. API Service CD, CE, and CF-4 multi-viscosity oils.
3. Use the proper weight oil for your average operation temperature.

Air Temperature	Single Viscosity	Multi-Viscosity
Above 32° F (0° C)	SAE 30W	SAE 15-40W
-10° to 32° F (-23° to 0° C)	SAE 10W	SAE 10-30W

Figure 7: Lube Oils

4. Never put additives or flushing oil in crankcase.

### SP1. CHECKING OIL LEVEL

1. While the engine is stopped, check the oil level in the crankcase with the dipstick daily. The oil level must be between the high and low marks on the stick. Fill with the recommended oil, and fill only to the high mark on the dipstick. Follow the lubrication recommendations in Figure 7.

### SP2. OIL CHANGES

1. The set is delivered with special break-in oil. Change the engine oil and oil filter after 50 hours of operation. Use Service CC30 weight oil during the first 100 hours.
2. Change the oil and filter again at 100 hours using the oil recommended in the above diagram. After this, change oil and filter every 250 hours.
3. During intermittent cold weather operation, change oil every 100 hours or six weeks, whichever comes first.
4. Change oil at any seasonal change in temperature when a new viscosity of oil is required.
5. Change oil when engine is warm but not hot.
6. Dispose of waste oil in an approved manner.
7. Never use a flushing oil.
8. Loosen clamp on oil change tube. Remove cap. Drain oil. Replace cap and tube.
9. Refill engine with recommended oil.
10. Engine capacity with new oil filter is:  
Model NL944D2, D3, T2, T3.....10.5 qts.  
(10 liters)

---

## Servicing

---

### SP3. CHANGING LUBE OIL FILTER

1. Change the lube oil filter every 250 hours.
2. Use a filter wrench to remove old filter. Dispose of filter in approved manner.
3. Make sure the gasket from the old filter is removed and discarded. Clean mount face.
4. Spread a thin film of engine oil on the rubber gasket on the new filter and screw it on nipple until gasket meets the sealing surface.
5. Using hands only – no wrench – tighten filter one-half turn farther. Overtightening can do damage to filter housing.
6. Fill engine with recommended oil. Start engine and check for leakage. Stop engine, wait 3 minutes, and check oil level. Add additional oil if necessary.
7. Oil filter part number is:  
**Models NL944D2, D3, T2, & T3.....#24-01201**

### SP4. AIR CLEANER

1. Visually inspect air cleaner every 250 hours. In dusty conditions, check more often.
2. Remove the plate on the bottom of the air intake manifold. Remove and inspect the foam element. If dirty, wash element in soapy water. Rinse and dry thoroughly before reinstalling.

**Note: Make absolutely sure no impurities enter the engine while changing the element, and do not run the engine with the air cleaner removed.**

**Do not clean the filter with diesel fuel, solvent, or gasoline. Serious engine damage can result.**

### SP5. V-BELTS

1. Check the tension and wear on the V-belt after every 50 hours.
2. Use your thumb to press on the belt at the midpoint between the crankshaft and alternator pulleys. The tension is correct if the belt can be depressed about .39 to .47 in. (10 - 12 mm) with 22 lbs. (10 kg) force.

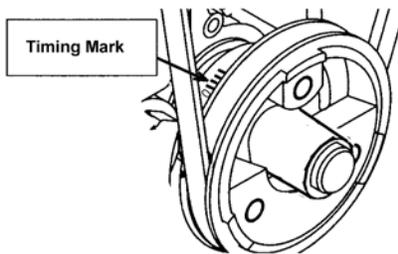
---

## Servicing

---

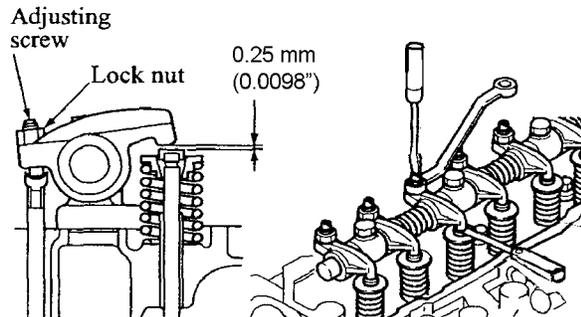
### SP7. VALVE CLEARANCES

1. Readjust valve clearance after first 50 hours of operation. Check valves every 500 hours thereafter.
2. Check the valves when the engine is cold.
3. Rotate the crankshaft in a clockwise direction in the front 180° to bring each piston to the top dead center on the compression stroke. Top dead center (TDC) is when notch on the pulley aligns with the pointer and the two valves on cylinder No. 1 “rock”. Rocking is when the rocker arms (for the two valves on a given cylinder) are moving in opposite directions, one up closing the valve and one down opening the other valve. The moment when the two rocker arms are exactly aligned with each other is when they “rock”.



**Figure 8:** Timing Mark

4. Measure the valve clearance for each of the valves, with a feeler gauge, in the firing order (1-3-4-2). Standard valve clearances for a cold engine are:  
Intake (IN).....0.0098 in. (0.25 mm)  
Exhaust (EX).....0.0098 in. (0.25 mm)
5. To adjust valve clearance, loosen the lock nut on the adjustment screw. Insert a feeler gauge between the rocker arm and the valve stem cap. Adjust, while measuring the clearance, until the feeler gauge slides with a slight drag. Tighten the lock nut and recheck the clearance (Figure 9).



**Figure 9:** Valve Adjustment

6. Adjust the remaining valves.
7. Replace the rocker arm cover.

---

## Servicing

---

### FUELS - GENERAL

1. Use only clean, high quality fuels of the following specifications, as defined by ASTM designation D975 for diesel fuels:
  - a. Use grade No. 2 diesel at ambient temperatures above freezing 32° F (0° C).
  - b. Use grade No. 1 at ambient temperatures below freezing.
  - c. International fuel specifications:
    - JIS K2204
    - ISO-8217-DMA
    - BS 2869 Part 1 Class A1
    - BS 2869 Part 2 Class A2
2. Use fuel having less than .2% sulphur of weight (less than 0.05% recommended).
3. The cetane number should be 45 or higher.
4. Particulate contaminate should be 5.0 mg/l (0.00018 oz/U.S. gal) or lower.
5. DO NOT use these unsuitable grades of fuel:
  - a. Domestic heating oils, all types.
  - b. Class B engine.
  - c. Class D domestic fuels.
  - d. Class E, F, G or H industrial or marine fuels.
  - e. ASTM-D975-60T No. 4-D and higher number fuels.
6. Storing fuel:
  - a. Keep dirt, scale, water, and other foreign matter out of fuel.
  - b. Avoid storing fuel for long periods of time.
  - c. Fill the fuel tank at the end of each day's operation. This will reduce condensation.

### SP8-10. FUEL FILTER

1. Your generator set should have a fuel filter installed. We recommend the Northern Lights brand of fuel filters.
  - a. Check the primary fuel filter daily as recommended by the filter manufacturer.
  - b. Change the filter as often as necessary or every 250 hours.
  - c. Remove the fuel filter with a filter wrench.
  - d. Apply a coating of fuel to the o-ring of the new fuel filter.
  - e. Tighten the new filter by hand, do not use a filter wrench for tightening.
  - f. The filter should be dry.
  - g. Do not add fuel to the fuel filter before installation, as this could cause unfiltered fuel to enter the fuel pump.
  - h. Bleed the air out of the filter.

The fuel filter part number is:

**NL944D2, D3, T2, T3.....24-51201**

## Servicing

### SP11. BLEEDING THE FUEL SYSTEM



**CAUTION:** Escaping diesel fuel under pressure can penetrate skin causing serious personal injury. Before disconnecting lines be sure to relieve all pressure. Before applying pressure, be sure all connections are tight and lines, pipes and hoses aren't damaged. Fuel escaping from a very small hole can be almost invisible. Use a piece of cardboard or wood, rather than hands, to search for suspected leaks. If injured by escaping fuel, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.

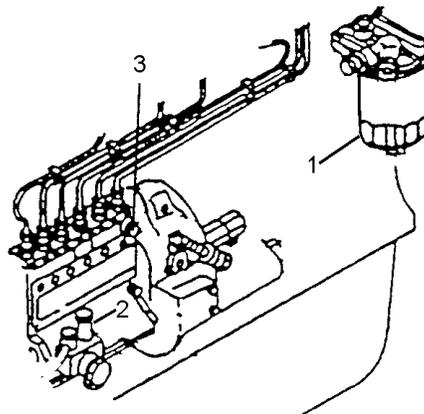


Figure 10 Fuel Feed Pump

1. Fuel system air bleeding may be needed when:
  - a. After fuel has been added to a newly installed engine.
  - b. A new fuel filter is installed.
  - c. The engine has run out of fuel.
  - d. The fuel lines, injection pump, or any other fuel system component has been removed and installed.
2. After changing the fuel filter, air only needs to be bled from the fuel filter. To do this:
  - a. Loosen the air vent plug (#1 on Figure 10) on the fuel filter by about 1-1/2 turns. (Be sure to cover the vent with a cloth to prevent fuel from splashing.)
  - b. Turn the priming pump cap on the fuel feed pump counterclockwise to unlatch it. Move the priming pump plunger (#2 on Figure 10) up and down. To close the pump turn the cap clockwise while depressing it.
  - c. Close the air vent plug when no more air bubbles can be seen in the fuel flowing from the air vent plug hole.
3. To bleed air at the fuel injection pump:
  - a. Turn the air vent plug (#3 on Figure 10) about 1-1/2 turns to loosen it. (Cover the vent with a cloth to prevent fuel from splashing.)
  - b. Pump the feed pump cap up and down.
  - c. When there are no air bubbles to be seen in the fuel flowing from the air vent plug hole, push down the priming pump cap and turn it clockwise to lock it in place.
4. If the engine does not start after this bleeding process, loosen a fuel line at the injector while cranking the engine with the starter motor until pure fuel escapes. Then tighten the connections. Do each line one-at-a-time. After the engine has started, use a piece of cardboard to look for fuel leaks.

#### NOTE:

**Do not close the air vent plug before locking the priming pump cap in place, because the internal pressure in the pump will prevent the priming pump cap from returning to the original position.**

---

## Servicing

---

### SP12. INJECTOR SERVICE

1. Injectors should be checked every 500 hours. This check should be made by a Northern Lights dealer or local injection repair station.



**CAUTION:** Escaping diesel fuel under pressure can have sufficient force to penetrate the skin causing serious personal injury. If injured by escaping fuel, see a doctor at once.

2. Injector removal:
  - a. Clean loose dirt from around the injectors and the fuel lines.
  - b. Relieve high pressure in the fuel lines by loosening the delivery line flare nuts at each injector.
  - c. Remove delivery lines by disconnecting them from the injectors and injection pump. Remove all lines as an assembly; do not remove the spacers. Cover the ends of the lines, the injector inlets, and the injection pump outlets to keep dirt out.
  - d. Remove the return line retaining bolts, washers, and return line.
  - e. Loosen the injector retaining nuts at the same time a little at a time. Remove the injector.
  - f. Remove the injector seat. Cover the holes to prevent debris from entering the cylinders.

**Note:** Do not use pry bars to remove injectors from the cylinder head.

3. Injector repair and cleaning:
  - a. Take injectors to your Northern Lights dealer or local injection repair station for testing and service.
4. Injector installation:
  - a. Install new injector seal washer seat and injector. Evenly tighten the injector retaining nuts to 39.1 to 47.7 ft/lbs (53.0 to 64.7 N•m), or 5.4 to 6.6 kgf•m. Do not overtighten.
  - b. Reinstall the return line using new sealing washers. Tighten bolts to 13.0 to 15.9 ft/lbs (17.7 to 21.6 N•m), or 1.8 to 2.2 kgf•m.

**NOTE:** Overtightening can damage injectors.

- c. Reinstall injection lines. Tighten flare nuts at injection pump to 19.5 to 23.9 ft/lbs (26.5 to 32.4 N•m), or 2.7 to 3.3 kgf•m. Leave the lines loose at injectors for bleeding.
- d. Bleed the injection lines. Crank the engine to fill the lines. Tighten flare nuts at injectors to 15.2 to 18.1 ft/lbs (20.6 to 24.5 N•m), 2.1 to 2.5 kgf•m.
- e. Start the engine and check for leaks using a piece of paper or cardboard. Do not use your hand to check for leaks.
- f. The fuel injector opening pressure is:  
11.77 MPa (120 kgf/cm<sup>2</sup>) 1710 PSI

## Servicing

### SP13. INJECTION PUMP

1. Since operating conditions may vary considerably, it is difficult to give a definite interval for checking the injection pump. But as a rule, pump settings, maximum speed, idle speed and exhaust smoke should be checked after every 2000 hours of operation. Service of the fuel injection pump should only be done if checks indicate pump malfunction.
2. Black smoke can be an indication of pump malfunction. Before servicing the pump, check other possible causes:
  - a. Check cleanliness of the air filter.
  - b. Check valve clearances.
  - c. Clean and check injectors.
3. Any repair which involves disassembly of the injection pump must be carried out by specially trained mechanics with the proper tools and test equipment.

**NOTE: All warranties on the engine become null and void if the injection pump seals are broken by unauthorized persons.**

#### 4. Injection Pump Removal:



**CAUTION: Escaping diesel fuel under pressure can have sufficient force to penetrate the skin, causing serious personal injury. If injured by escaping diesel fuel, see a doctor at once.**

- a. Clean the injection pump, hoses, and area around the pump with a cleaning solvent or steam cleaner.

**NOTE: Never steam clean or pour cold water on an injection pump while the engine is running or the pump is warm.**

- b. Remove the injection lines from the pump and injectors. Remove all lines as an assembly. Do not remove the spacers. Cover the ends of the lines, the injector inlets, and the injection pump outlets to keep dirt out of the injectors, lines, and pump.
- c. Align timing marks on timing gears.
- d. Remove the pump support bracket on rear of pump.
- e. Remove the 4 mounting nuts.

- f. Take the pump to your Northern Lights dealer or an injection repair station for testing and service.

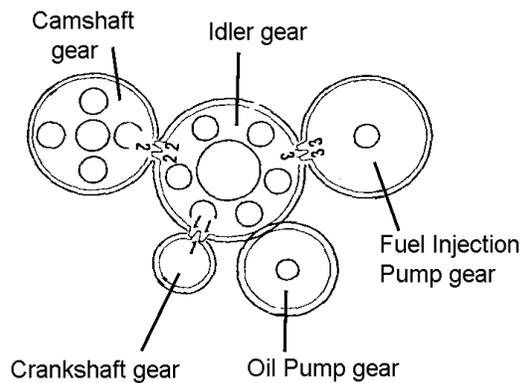


Figure 11: Timing Marks

#### 5. Injection Pump Installation:

- a. Install the fuel injection pump after having aligned its gear alignment mark with that of the idler gear alignment mark as shown in Figure 9 above. When the alignment marks of the timing gears align as in the diagram to the right, the No. 1 piston is top dead center in the compression stroke.
- b. Install the injection pump to the side of the engine first then put in the end bolts, and then the tube with its bolts, and then the side bracket.
- c. Torque mounting bolts to 13.0 - 18.1 ft/lbs (17.7 to 24.5 N•m), 1.8 to 2.5 kgf•m.

---

## Servicing

---

### COOLING SYSTEM - GENERAL



**CAUTION:** *The cooling water in the engine reaches extremely high temperatures. You must use extreme caution when working on hot engines to avoid burns. Allow the engine to cool before working on the cooling system. Open the filler cap carefully, using protective clothing when the engine is warm.*

#### SP14. CHECK THE COOLANT LEVEL

1. Check the coolant level each day before starting the engine.
  - a. Check the water level by removing the pressure cap from the expansion tank. In order to give the cooling water an opportunity to expand, the level should be about 1 in. (2.5 cm) below the filler cap sealing surface when the engine is cold.
  - b. Soft water with about a pH about 6.5 to 8.5 combined with an antifreeze in a 30% to 50% (maximum) solution should be used.
  - c. The antifreeze should not contain amine, silicate, or borate.

#### SP15. COOLING SYSTEM FLUSHING

1. Flush the cooling system every 2000 hours or every 12 months, whichever comes first.
2. Remove fill cap and open drains on engine block. The engine block drain is on the service side of the engine above the dipstick, next to the flywheel housing.
3. Pour clean water into the engine until water coming from engine is clear of discoloration. Close drains and refill the engine with recommended coolant mixture.
4. Use 50% water / 50% (maximum) ethylene glycol antifreeze mix. Antifreeze mixture is recommended as a good year-round coolant.
5. Coolant capacity is approximately 3 gal. (11.4 liters).
6. Check hoses and connections and repair any leakage.
7. Start the engine and check for leaks. Run the engine for five minutes, then shut it down. Let engine cool, and then check the coolant level in the engine. Add coolant as needed.

---

## Servicing

---

### SP16. RADIATOR

1. Check for leaks.
2. Remove debris from radiator fins daily.
3. In very dusty applications clean the radiator with compressed air or steam cleaner every 100 hours or as needed. Clean in reverse direction of airflow.

### SP21. TURBOCHARGER

1. Check for air leaks every 250 hours. Air leakage will lower engine output and may cause black exhaust smoke and soot.
2. Listen along air line while the engine is running. A whistling or hissing sound indicates leakage.
3. Leakage on the pressure side, between turbo and engine, can be found by applying soapy water to the air line.
4. Tighten the hose clamps and replace hoses or gaskets as required.
5. Check to see that the lubrication and cooling lines are tight and without leaks.

---

## Servicing

---

### GENERATOR END

The maintenance and operation recommendations for the generator end are in a separate Owner's Manual. If you do not have one of these manuals, contact your local dealer.

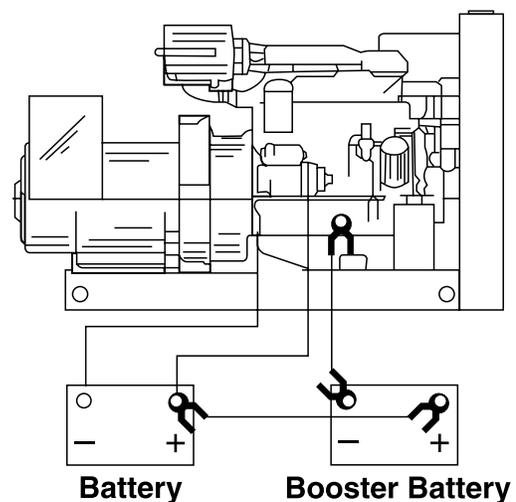
### ELECTRICAL SYSTEM - GENERAL

1. Never switch the battery switch off or break the circuit between the alternator and the batteries while the engine is running. Alternator damage can result.
2. Do not reverse the polarity of the battery cables when installing the battery.

### BOOSTER BATTERIES

**!** *CAUTION: Battery gas can explode. Keep all flames and sparks away from batteries.*

1. Before changing or using booster batteries, check the battery electrolyte level. Add distilled water if necessary.
2. Booster and main batteries must have the same voltage rating.
3. First, connect the positive (+) terminal of the booster battery to the positive (+) terminal of the main battery. Then, connect the negative (-) terminal of the booster battery to ground on the engine block (Figure 12).
4. Remove the booster battery after starting the engine.
5. Sealed Batteries:  
See the manufacturer's charging and booster instructions.



*Figure 12: Booster Battery Connections*

---

## Servicing

---

### SP21-22. BATTERY CARE

1. Check the electrolyte level every 50 hours, or once a month. Add distilled water to the manufacturer's recommended level.
2. Batteries, cables, and cable terminals should be checked and cleaned every 100 hours. Clean corrosion with a water and baking soda solution. Flush with clean water. Tighten terminals and grease them to inhibit future corrosion.
3. Check the battery condition with a hydrometer every 500 hours.
6. Loosen the alternator belt.
7. Disconnect and clean battery. Remove to warm storage place if possible.
8. Clean outside of unit. Paint any scratched or chipped surfaces. Put corrosion preventative on all exposed metal surfaces.

### SP23. WINTERIZING / OUT-OF-SERVICE

For engines not going to be used for more than three months:

1. Drain and flush the radiator and cooling system. Leave dry or refill with antifreeze-water mixture. If refilling, start the engine and run to circulate the antifreeze.
2. Fill the fuel tank or add biocide as per manufacturer's instructions.
3. Seal the air cleaner inlet, exhaust opening, crankcase breather pipe, and fuel tank vent with plastic bags and tape.
4. Store the set in a dry, protected place. If unit must be stored outside, be sure it is well protected with a cover.
5. Change the crankcase oil and filter.

## Troubleshooting

### DC ELECTRICAL SYSTEM

PROBLEM	POSSIBLE CAUSE	RECOMMENDATION(S)
<b>Battery Will Not Charge</b>	Loose or corroded connections	• Clean and tighten battery connections.
	Sulfated or worn out batteries	• Check specific gravity of each battery. • Check electrolyte level of each battery.
	Loose or defective alternator belt	• Adjust belt tension. • Replace belt.
<b>Starter Inoperative</b>	Check DC circuit breaker	• If the breaker is tripped, reset it.
	Loose or corroded connections	• Clean and tighten loose battery and harness plug connection.
	Low battery condition	• Check specific gravity of each battery. • Check electrolyte level of each battery.
	Defective electrical system ground wire:	• Repair or replace.
<b>Starter Cranks Slowly</b>	Low battery condition	• Battery is too small. • Battery cables are too small.
	Check specific gravity of each battery	• Replace battery if necessary.
	Check electrolyte level of each battery	• If low, fill cells with distilled water.
	Crankcase oil too heavy	• Fill with oil of appropriate viscosity.
	Loose or corroded connections	• Clean and tighten loose connections.
<b>Entire Electrical System Does Not Function</b>	Check DC circuit breaker	• If breaker is tripped, reset it.
	Faulty connection	• Clean and tighten battery and harness plug connections.
	Sulfated or worn out batteries	• Check specific gravity and electrolyte level of each battery.

If you cannot correct problems with these procedures, see your **Northern Lights** dealer.

## Troubleshooting

### ENGINE

PROBLEM	POSSIBLE CAUSE	RECOMMENDATION(S)
<b>Engine Hard to Start or Will Not Start</b>	Improper starting procedure	<ul style="list-style-type: none"> <li>• See starting section of this manual. Take special note of Bypass Switch operation.</li> </ul>
	No fuel	<ul style="list-style-type: none"> <li>• Check level of fuel in fuel tank.</li> </ul>
	Low battery condition	<ul style="list-style-type: none"> <li>• Check electrolyte level and condition.</li> </ul>
	Excessive resistance in starting circuit	<ul style="list-style-type: none"> <li>• Clean and tighten all battery connections.</li> </ul>
	Crankcase oil too heavy	<ul style="list-style-type: none"> <li>• Use oil of proper viscosity.</li> </ul>
	Improper type of fuel	<ul style="list-style-type: none"> <li>• Consult fuel supplier and use proper type of fuel for operating condition.</li> </ul>
	Water, dirt or air in fuel system	<ul style="list-style-type: none"> <li>• Drain, flush, fill and bleed system.</li> </ul>
	Clogged primary fuel filter element	<ul style="list-style-type: none"> <li>• Clean or replace filter element.</li> </ul>
<b>Engine Runs Irregularly or Stalls Frequently</b>	Clogged secondary fuel filter element	<ul style="list-style-type: none"> <li>• Replace filter element.</li> </ul>
	Dirty or faulty injection nozzles	<ul style="list-style-type: none"> <li>• Have your dealer check injection nozzles.</li> </ul>
	Below normal engine temperature	<ul style="list-style-type: none"> <li>• Remove and check thermostat.</li> </ul>
	Clogged primary fuel filter element	<ul style="list-style-type: none"> <li>• Clean or replace filter element.</li> </ul>
	Clogged secondary fuel filter element	<ul style="list-style-type: none"> <li>• Replace secondary filter element.</li> </ul>
	Water or dirt in the fuel system	<ul style="list-style-type: none"> <li>• Drain, flush, fill and bleed system.</li> </ul>
	Dirty or faulty injection nozzles	<ul style="list-style-type: none"> <li>• Have your dealer check injection nozzles.</li> </ul>
	Air in fuel system	<ul style="list-style-type: none"> <li>• Inspect clamps and hoses on suction side of fuel pump for air leak.</li> </ul>
<b>Lack of Engine Power</b>	Improper type of fuel	<ul style="list-style-type: none"> <li>• Consult fuel supplier and use proper type of fuel for operating condition.</li> </ul>
	Engine overloaded	<ul style="list-style-type: none"> <li>• Reduce the load.</li> </ul>
	Intake air restriction	<ul style="list-style-type: none"> <li>• Service air cleaner.</li> </ul>
	Clogged primary fuel filter element	<ul style="list-style-type: none"> <li>• Clean or replace filter element.</li> </ul>
	Clogged secondary fuel filter element	<ul style="list-style-type: none"> <li>• Replace filter element.</li> </ul>
	Overheated engine	<ul style="list-style-type: none"> <li>• See “Engine Overheats” in next category.</li> </ul>
	Below normal engine temperature	<ul style="list-style-type: none"> <li>• Remove and check thermostat.</li> </ul>
	Improper valve clearance	<ul style="list-style-type: none"> <li>• Reset valves. Best done by dealer.</li> </ul>
	Dirty or faulty injection nozzles	<ul style="list-style-type: none"> <li>• Replace injectors. Best done by dealer.</li> </ul>

## Troubleshooting

### ENGINE

PROBLEM	POSSIBLE CAUSE	RECOMMENDATION(S)
<b>Lack of Engine Power</b> <i>(continued)</i>	Low compression pressure (worn piston rings, etc...)	<ul style="list-style-type: none"> <li>• Consult dealer.</li> </ul>
<b>Engine Overheats</b>	Engine overloaded	<ul style="list-style-type: none"> <li>• Reduce the electrical load.</li> </ul>
	Low coolant level	<ul style="list-style-type: none"> <li>• Fill tank or radiator to proper level.</li> <li>• Check hoses for loose connections and leaks.</li> </ul>
	Cooling system needs flushing	<ul style="list-style-type: none"> <li>• Flush cooling system.</li> </ul>
	Defective thermostat	<ul style="list-style-type: none"> <li>• Remove and check thermostat.</li> </ul>
	Defective temperature gauge	<ul style="list-style-type: none"> <li>• Check water temperature with thermometer and replace gauge if necessary.</li> </ul>
<b>Engine Knocks</b>	Insufficient oil	<ul style="list-style-type: none"> <li>• Call your dealer.</li> </ul>
	Injection pump out of time	<ul style="list-style-type: none"> <li>• Call your dealer.</li> </ul>
	Below normal engine temperature	<ul style="list-style-type: none"> <li>• Check your thermostats.</li> <li>• Check water temperature to see if temperature gauge is working properly.</li> </ul>
	Faulty fuel injector	<ul style="list-style-type: none"> <li>• Call your dealer.</li> </ul>
	Engine overheating	<ul style="list-style-type: none"> <li>• See “Engine Overheating” section.</li> </ul>
<b>High Fuel Consumption</b>	Improper type of fuel	<ul style="list-style-type: none"> <li>• Use correct fuel for temperature.</li> </ul>
	Clogged or dirty air cleaner	<ul style="list-style-type: none"> <li>• Service air cleaner.</li> </ul>
	Engine overloaded	<ul style="list-style-type: none"> <li>• Reduce the electrical load.</li> </ul>
	Improper valve clearance	<ul style="list-style-type: none"> <li>• See your dealer.</li> </ul>
	Injection nozzles dirty	<ul style="list-style-type: none"> <li>• See your dealer.</li> </ul>
	Injection pump timing off	<ul style="list-style-type: none"> <li>• See your dealer.</li> </ul>
	Engine not at proper temperature	<ul style="list-style-type: none"> <li>• Check your thermostats.</li> <li>• Check water temperature with thermometer and replace gauge if necessary.</li> </ul>
<b>Below Normal Engine Temperature</b>	Thermostats not working properly	<ul style="list-style-type: none"> <li>• Check thermostats.</li> </ul>
	Temperature gauge not working properly	<ul style="list-style-type: none"> <li>• Check water temperature with thermometer.</li> </ul>
<b>Low Oil Pressure</b>	Low oil level	<ul style="list-style-type: none"> <li>• Fill crankcase to proper level.</li> </ul>
	Improper type of oil	<ul style="list-style-type: none"> <li>• Drain and fill crankcase with correct oil.</li> </ul>
	Partially plugged oil filter	<ul style="list-style-type: none"> <li>• Replace filter.</li> </ul>

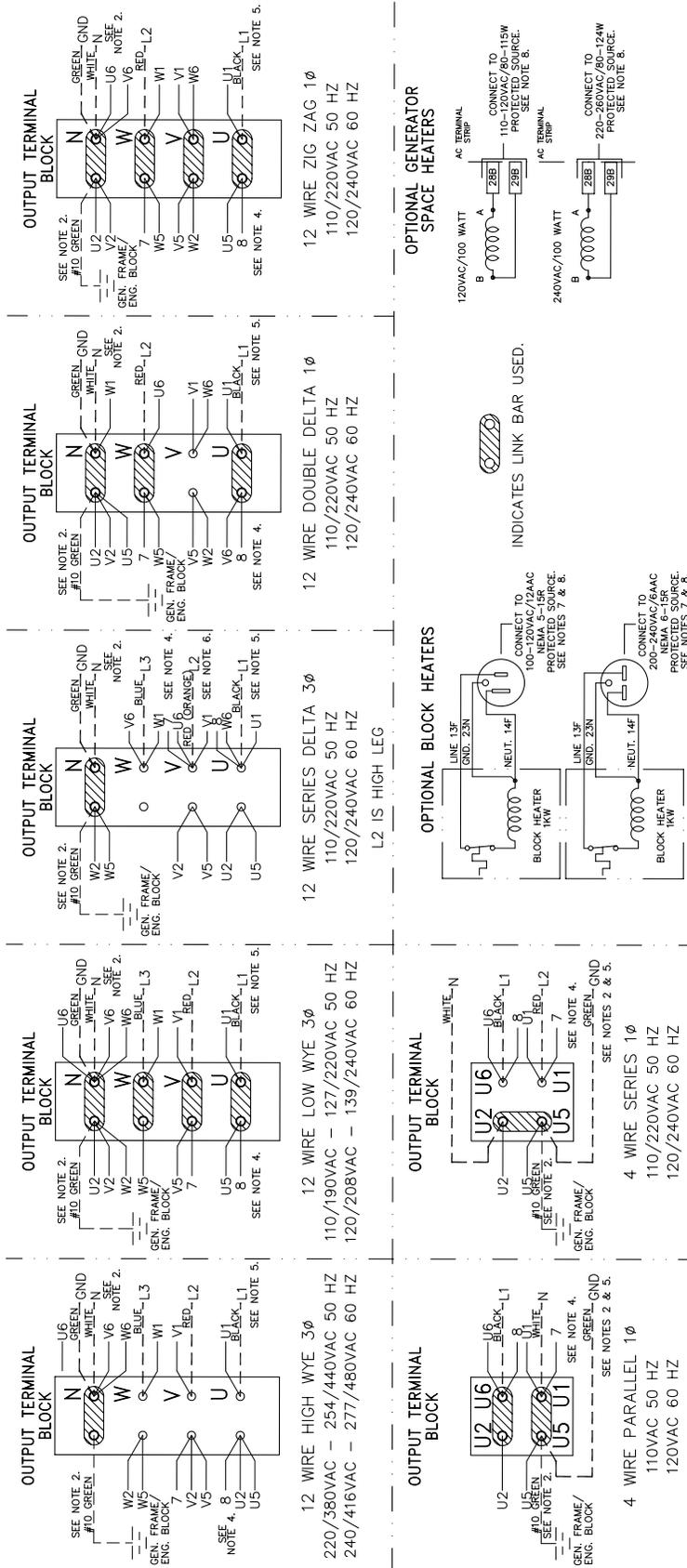
If you cannot correct problems with these procedures, see your **Northern Lights** dealer.

## Troubleshooting

### ENGINE

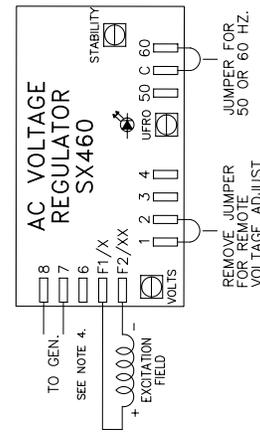
PROBLEM	POSSIBLE CAUSE	RECOMMENDATION(S)
<b>High Oil Consumption</b>	Break-in period	• Oil consumption decreases after break in.
	Crankcase oil too light	• Use proper viscosity oil.
	Oil leaks	• Check for leaks in lines around gaskets and drain plug.
	Crankcase over full	• Remove excess oil.
<b>Engine Emits Black or Gray Exhaust Smoke</b>	Clogged or dirty air cleaner	• Service air cleaner.
	Defective muffler (back pressure too high)	• Have dealer check back pressure.
	Improper fuel	• Use correct fuel for temperature.
	Fuel pump faulty	• See your dealer.
	Injection nozzles dirty	• See your dealer.
	Engine overloaded	• Reduce the electrical load.
	Injection nozzles dirty	• See your dealer.
	Injection pump faulty	• Consult your dealer.
	Engine timing off	• See your dealer.
Incorrect valve clearance	• Consult your dealer.	
<b>Engine Emits White Smoke</b>	Improper fuel	• Use correct fuel for temperature.
	Cold engine	• Warm up engine to normal operating temperature.
	Defective thermostat	• Remove and check thermostat.
	Engine timing off	• See your dealer.
	Low Compression Pressure	• See your dealer.
	Low engine oil viscosity	• Use proper viscosity of oil to ambient temperature.
	Excessive amount of engine oil	• Maintain correct oil level.
	Fuel injection nozzles faulty (uneven injection)	• See your dealer.

# Wiring Diagram



- NOTES:**
1. ALL INSTALLATION CONDUCTORS ARE TO BE AWG 14, TYPE MTW, 105°C, 600VAC, STRANDED, EXCEPT AS NOTED.
  2. MARINE GENSETS ARE TO BE GROUNDED BY CUSTOMER ONLY. AT CUSTOMER'S DISCRETION, INDUSTRIAL GENSETS TO BE GROUNDED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND ANY APPLICABLE CODES.
  3. DELETE NEUTRAL CONNECTION IF L-N VOLTAGE IS NOT REQUIRED.
  4. CONNECT LEADS SEVEN AND EIGHT TO TERMINALS SEVEN AND EIGHT ON THE SX460. REMOVE AND DISCARD UNUSED LEAD SIX.
  5. HIDDEN (DASHED) LINES INDICATE CUSTOMER SUPPLIED AND CONNECTED MAIN OUTPUT CONDUCTORS. SIZING DETERMINED PER INSTALLATION.
  6. HIGH LEG IS TO BE MARKED ORANGE WHERE NEUTRAL IS PRESENT. IN ACCORDANCE WITH ARTICLE 215-8 OF THE NATIONAL ELECTRICAL CODE.
  7. REMOVE THREE-POLE PLUG AND WIRE BLOCK HEATER LEADS TO TERMINALS NUMBERED AS INDICATED FOR MARINE UNITS ONLY.
  8. DO NOT ENERGIZE HEATERS WHEN UNIT IS IN OPERATION.

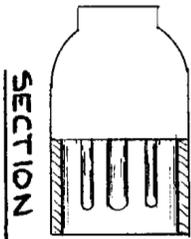
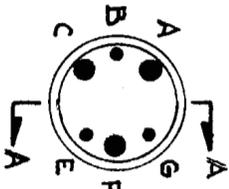
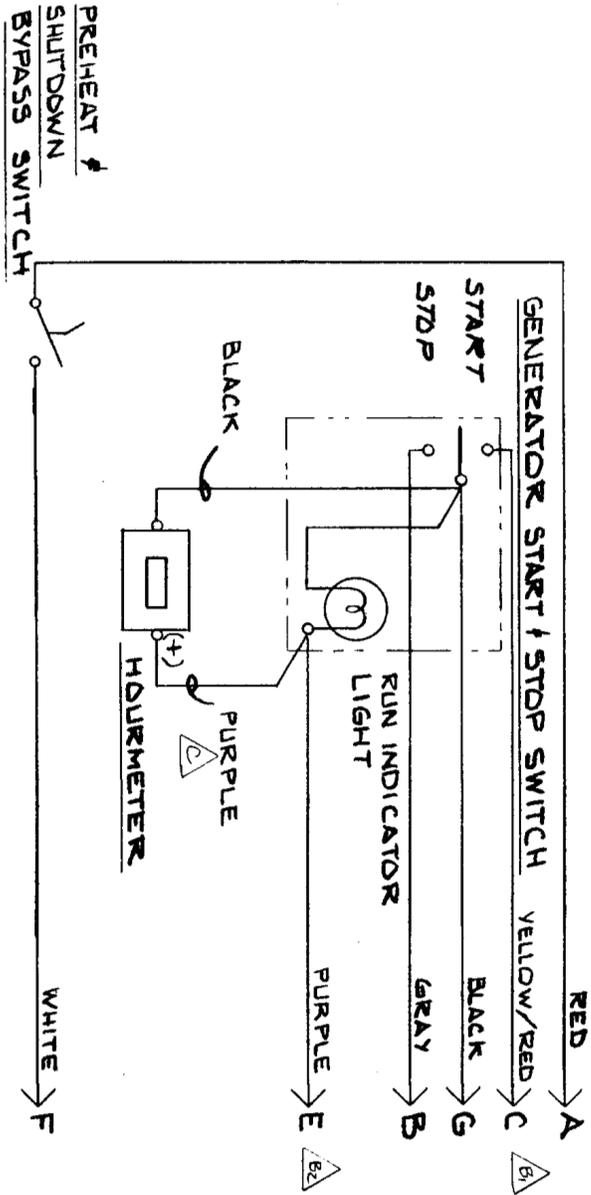
Northern Lights AC Wiring Diagram –  
SX460 Voltage Regulator  
Drawing B-5703L







**Wiring Diagram**

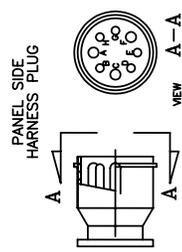
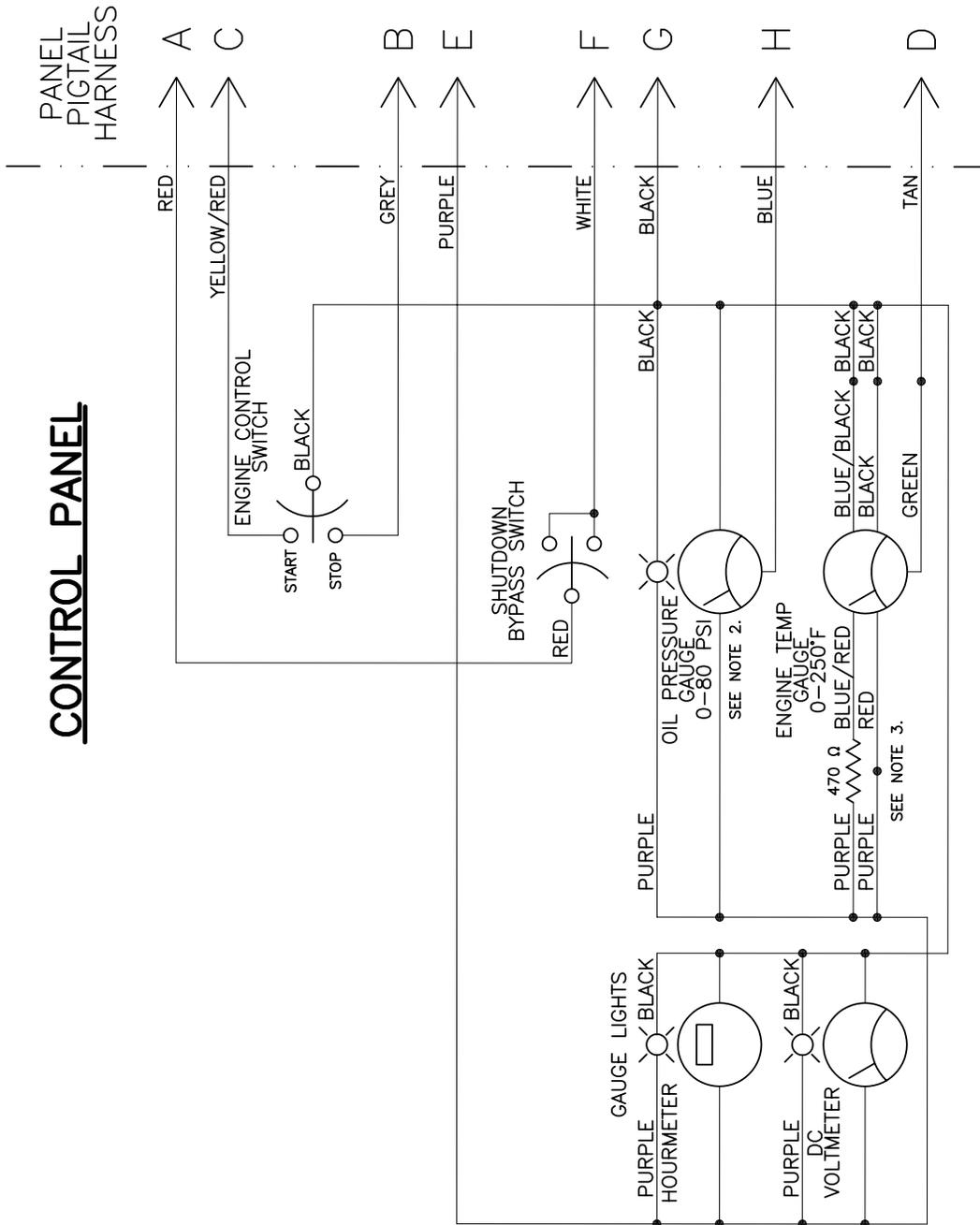


MOLEX 6 PIN PLUG (BLACK)

DC Wiring Diagram  
 12 V DC Standard Ground w/ S-1B  
 A-3170

**Wiring Diagram**

**CONTROL PANEL**



NOTES:

DC Wiring Diagram  
12 V DC Standard Ground w/ S-3C  
A-12572B





4420 14th Ave. NW., Seattle WA 98107

Tel: (206) 789-3880 • 1-800-762-0165 • [www.northern-lights.com](http://www.northern-lights.com)

Northern Lights and Lugger are registered trademarks of Northern Lights, Inc.

© 2013 All rights reserved. Litho USA.