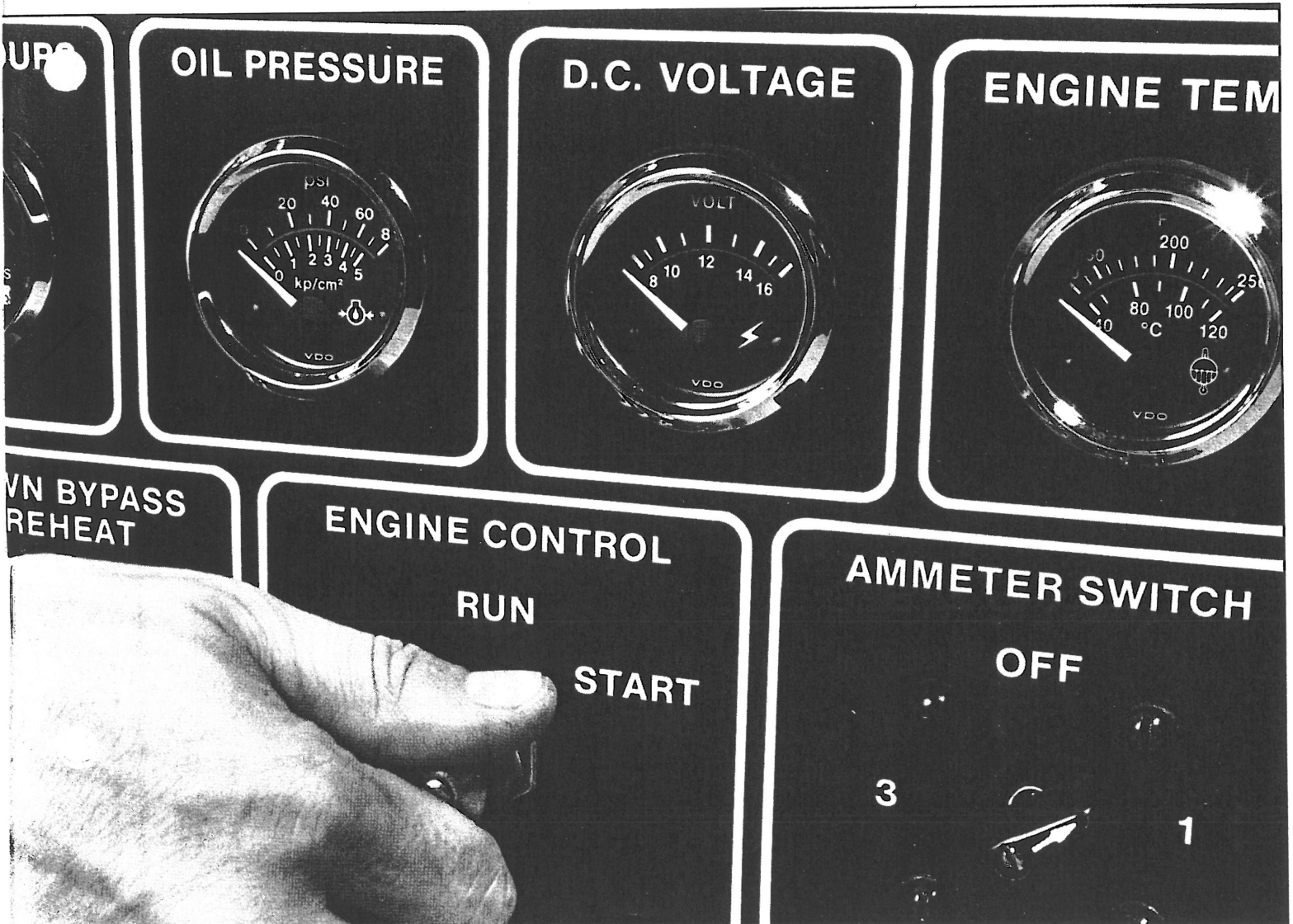




O210
NL 368, NL374, NL378,
NL484 and NL488

OPERATOR'S MANUAL




OPERATOR'S MANUAL

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.

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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.

ALASKA DIESEL ELECTRIC

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INTRODUCTION

Servicing of generator sets presents unique problems. In many cases a set cannot be moved to a repair facility. Failures often occur in remote areas far from competent assistance. 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.

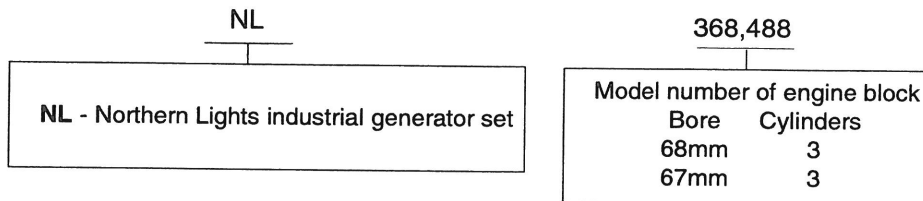
UNIT IDENTIFICATION

MODELS INCLUDED

This manual covers operating instructions for:
NL368, NL374, NL378, NL484 and NL488
industrial generator sets.

MODEL NUMBERS

Model numbers give unit's application and engine block model.

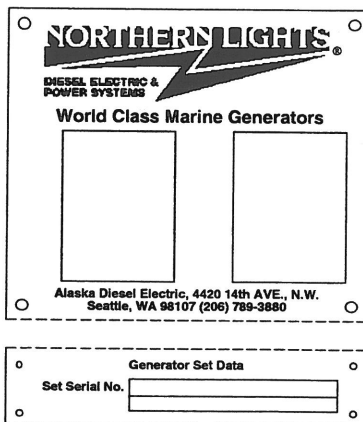


SERIAL NUMBERS

Your set has three serial numbers:

1. A engine number is stamped on a plate attached to the valve cover.
2. A generator end serial number.
3. A generator set serial number.

NOTE: Always use the generator set serial number when ordering parts or in correspondence. The generator set serial number is found on the service side of the generator and resembles the drawing below.




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:** *A high percentage of accidents are caused by careless use of engines. You can avoid accidents by observing these safety rules. Study these rules carefully and enforce them on the job.*

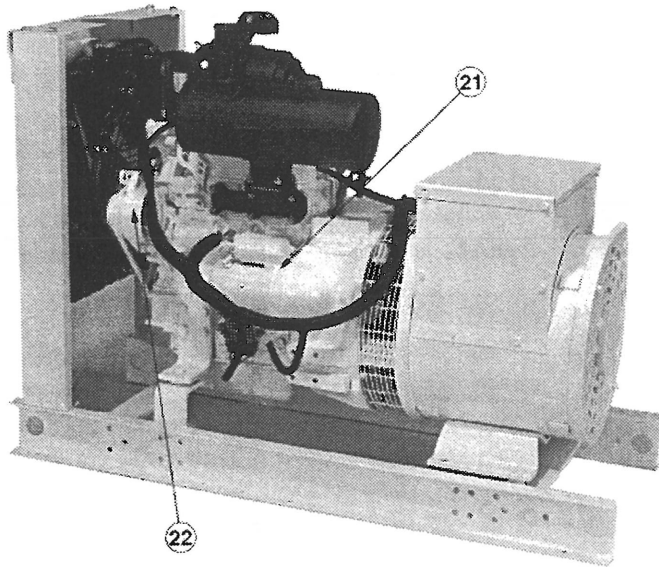
- Never leave engine without proper security.
- Turn the radiator cap slowly to relieve pressure before removing. Add coolant only when the engine is stopped and cool.
- Mount a fire extinguisher near engine.
- Always disconnect the battery ground strap before making adjustments.
- Operate engines in properly ventilated areas.
- Keep trash and other objects away from engine.
- Escaping fluids under pressure can penetrate your skin. Use a piece of cardboard or wood, not your hands, to search for leaks.
- Avoid wearing loose clothing without a belt when working around engines.
- Do not oil or grease engine while it is running.
- Use caution in handling fuel. Never refuel a hot or running engine. Do not smoke while filling fuel tank or servicing fuel system.
- Keep your hands, feet, hair and clothing away from power-driven parts.
- Check for any loose electrical connections or faulty wiring.
- Engines should be operated only by knowledgeable, qualified personnel.
- Look completely around engine to make sure that everything is clear before starting.
- Do not operate an engine that isn't in proper working order. If an unsafe operating condition is noted, tag the set and control panel so others will also know about the problem.
- Provide first aid kits.



CAUTION: *This symbol is used in this book to alert you to possible danger areas. Take special notice of these sections.*

NOTES

GENERATOR SET SERVICE POINTS.



1. Control panel
2. Hour meter
3. DC circuit breaker
4. AVR fuse
5. Secondary fuel filter
(Canister type shown. Some models have spin-on fuel filter element.)
6. Crankcase vent hose
7. Muffler outlet w/rain cap
8. Air cleaner
9. Radiator fill
10. Lube oil fills in gear timing gear cover and in valve cover (not shown)
11. Fuel injection pump
12. Fuel lift pump
13. Radiator drain
14. Lube oil filter
15. Lube oil dipstick
16. Fuel inlet & return outlet
17. Block coolant drain
18. Panel plug in.
19. Generator junction box
20. Lube oil drain in oil pan
21. Starter
22. Alternator

Note: Service points on all models are located in approximately the same location.

Figure 1. Three cylinder sets (NL368 shown) non-service side

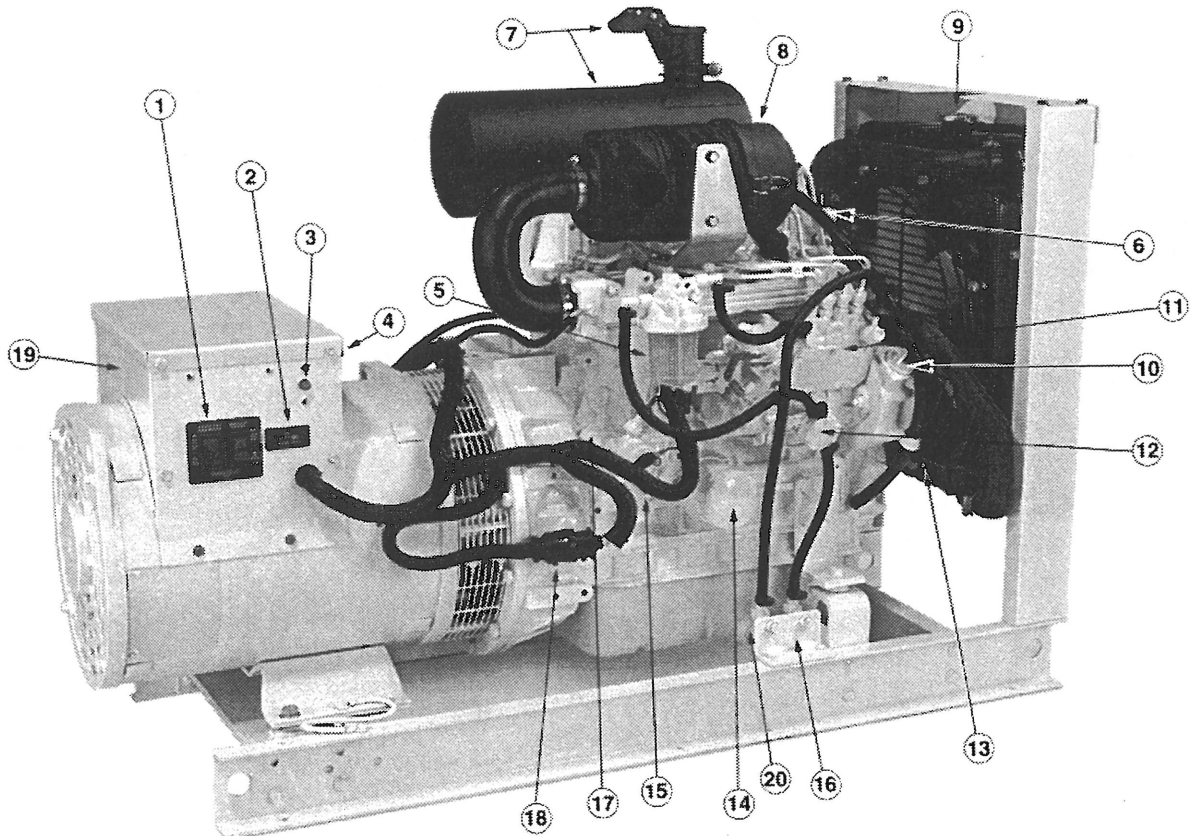


Figure 2. Four cylinder sets (NL488 shown) service side

CONTROL PANELS

SERIES 1-B GENERATOR CONTROL PANEL

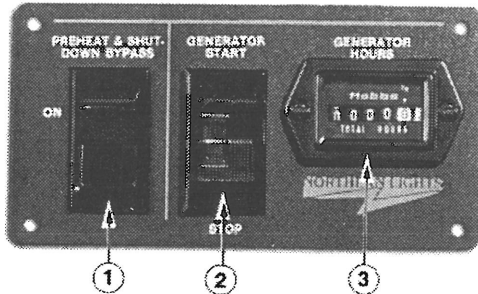


Figure 3.

SERIES 3-C GENERATOR CONTROL PANEL

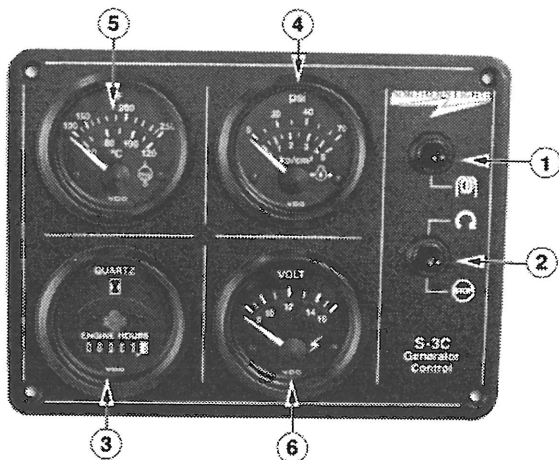


Figure 4.

1. SHUTDOWN BYPASS-PREHEAT SWITCH:

- a. There are two functions built into this switch; preheating the engine and bypassing the engine safety shutdown circuit.
- b. Hold the switch in ON position for approximately 10-20 seconds before starting a cold engine. Holding the switch ON for too long can burn out the heating elements. Preheat switch must be held in ON position during starting.

2. ENGINE CONTROL SWITCH

To start engine, hold the switch in START position until engine is running. *Note: Excessive cranking may cause engine damage.* After the engine starts release switch and it will return to RUN position. To stop engine hold switch in 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:

The oil pressure gauge shows the oil pressure in the engine lubricating system.

5. WATER TEMPERATURE GAUGE:

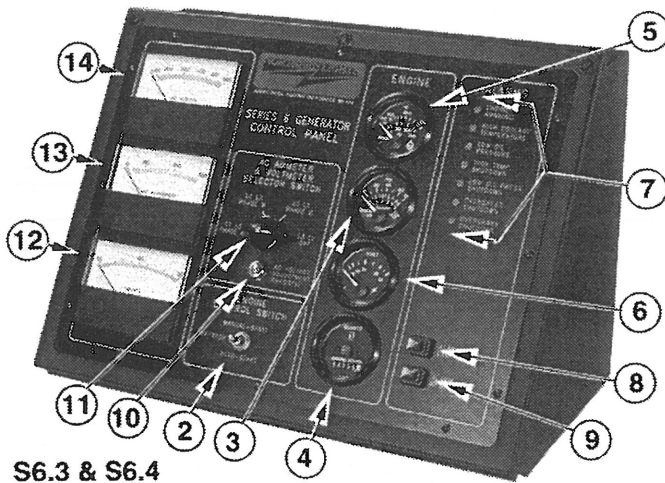
Registers temperature of cooling water.

6. D.C. VOLTMETER

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

CONTROL PANELS

SERIES 6 GENERATOR CONTROL PANEL



S6.3 & S6.4

Figure 5A.

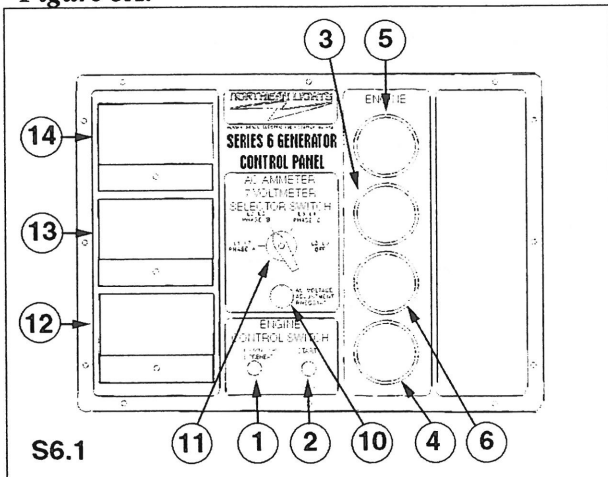


Figure 5B.

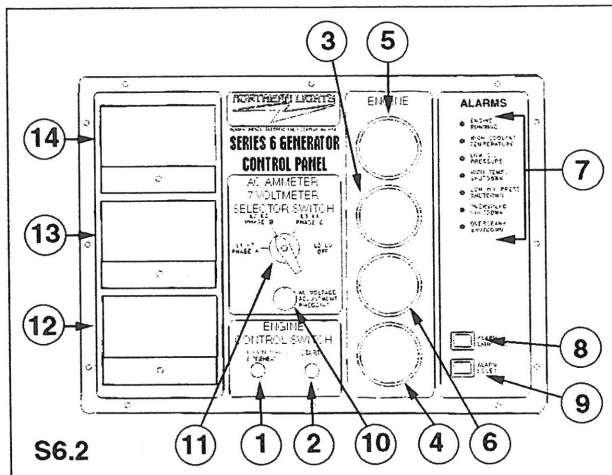


Figure 5C.

1. SHUTDOWN BYPASS SWITCH S6.1 & S6.2

This switch bypasses the safety shutdown feature during the starting procedure. Follow instructions (page 5, item 1).

2. ENGINE CONTROL SWITCH S6.1 & S6.2

Control switch starts and stops the engine. Follow starting instructions (page 5, item 2).

ENGINE CONTROL SWITCH S6.3 & S6.4

When switch is placed in auto-start position the unit will automatically start when there is a drop in utility power. When the switch is placed in the manual position the unit can be started manually. Special instructions come with auto-start module.

3. OIL PRESSURE GAUGE:

The oil pressure gauge shows the oil pressure in the engine lubricating system.

4. HOUR METER:

Keeps track of engine running time.

5. WATER TEMPERATURE GAUGE:

Registers temperature of cooling water.

6. D.C. VOLTMETER

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

7. ENGINE MONITORING ALARMS:

Alarm lights. S6.2 and S6.3 include 7 lights and S6.4 includes 12 lights.

8. ALARM LAMP TEST BUTTON:

When pressed, alarm lights light if working.

9. ALARM RESET BUTTON:

Press to reset alarm.

10. A.C. VOLTAGE ADJUSTMENT RHEOSTAT

Voltage has been set at factory and should only be adjusted by factory trained personnel.

11. AMMETER SELECTOR SWITCH:

Used to check each phase for load condition. **Note: Always leave this switch in the "ON" position while the unit is running.**

12. FREQUENCY METER (HERTZ):

The frequency meter indicates alternating current frequency: 60 Hz (1200 or 1800 RPM or 50Hz (1500 RPM).

13. A.C. VOLTMETER:

Shows the generator output voltage.

14. A.C. AMMETER

Shows the generator load on each phase. The phase is selected with the Ammeter selector switch.

OPERATING PROCEDURES

BREAK-IN PERIOD


1. The first 100 hours on a new or reconditioned engine are critical to its life and performance.
2. Constantly check the engine temperature and oil pressure gauges.
3. Oil consumption is greater during break-in as piston rings and cylinder liners take time to seat.
4. Break-In Oil Changes: Change engine oil and filter at 50 hours. Change oil and filter again at 100 hours. (Consult Lubricants Section for oil recommendation.)
5. Retighten head bolts and adjust valves at 50 hours.

OPERATING INSTRUCTIONS

IMPORTANT: *Maintain at least a 75% load on your set for the first 100 hours. If this is not possible, maintain no less than a 50% load to ensure proper seating of the piston rings. Vary the load to help seat the piston rings.*

BEFORE STARTING

1. Check the water 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 (Service Point 13).

 **CAUTION:** *To prevent burns use protective clothing and open the filler cap only when the engine is cold.*

2. Check the oil level in the crankcase with the dipstick. The oil level must be between high and low marks on stick. Never allow the level to go below this area. Always add the same viscosity of oil already in the crankcase (Service Point 1).
3. Check the fuel tank level and open any fuel valves on the tank and at the secondary fuel filter.
4. Turn on any optional battery switch that may have been installed.

STARTING

1. Hold Shutdown Bypass-Preheat Switch in ON position for 10 to 20 seconds before starting a cold engine. Holding switch on too long can burn out the heater elements. This

step is not necessary if the engine is already warm.

2. While holding the Shutdown Bypass-Preheat Switch in ON position, push Engine Control Switch to START position.
3. As soon as the engine starts, release both switches. Do not crank starter for more than 20 seconds. If engine fails to start the first time, be sure starter has stopped before reengaging.

OPERATING

1. Units with Series 3 and 6 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. Water temperature gauge must be below 200°F (94°C.) Check AC voltage and frequency meters (Series 6 Panel.) If gauges deviate from normal levels, shut down the 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 generator set.**
2. Run engine for a 3 to 5 minute cool down period.
3. Move engine control switch to the STOP position until engine stops completely.
4. Shut off fuel valve at tank.

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.*

OPERATING PROCEDURES

2. Do the following when your warning or shut-down system is activated:
 - a. Check the temperature gauge. If above 205°F (97°C), shut off the engine immediately.
 - b. Use the Trouble Shooting Guide in this manual 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 (97°C.) Repeat troubleshooting.
3. If the 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. Heater element (glow plug)
 - h. Injector and washer
3. If your set is operating a long distance from a servicing dealer, add the following:
 - a. Complete set of injectors
 - b. For injector change
Copper washers (models NL368 & 374)
Sleeves (models NL378, 484 & 488)
 - 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
- SP4 Check air cleaner dust trap
- SP8 Check primary fuel filter
- SP14 Check cooling water level
- SP16 Check radiator trash

AFTER FIRST 50 HOURS:

- SP2-3 Change engine oil and filter
- SP5 Check V-belt tension
- SP6 Retighten cylinder head bolts
- SP7 Adjust valves

EVERY 50 HOURS:

- SP5 Check V-belt tension
- SP17 Check electrolyte in batteries

EVERY 100 HOURS:

- SP2-3 Change engine oil and filter
- SP4 Check air cleaner
- SP15-16 Check and clean radiator

EVERY 200 HOURS:

- SP9 Change primary fuel filter element
- SP10 Change secondary fuel filter

EVERY 600 HOURS:

- SP6 Check valve clearances
- SP12 Check injectors
- SP15 Check and flush cooling system
- SP18 Check state of charge of batteries

EVERY 2400 HOURS:

- SP13 Check fuel injection pump

WINTERIZING, OUT OF SERVICE:

- SP19

SERVICE POINT	PAGE	OPERATION	DAILY	50 Hours	100 Hours	200 Hours	600 Hours	2400 Hours
SP1	10	ENGINE: Check oil level	●					
SP2	10	Change engine oil		5)	●			
SP3	10	Change lube oil filters		5)	●			
SP4	10	Check air cleaner	●		●			
SP5	10-11	Check V-Belt tension		●				
SP6	11	Re-tighten cylinder head bolts		5)				
SP7	11	Check valve clearances		5)			●	
SP8	12	FUEL SYSTEM: Check primary filter	●					
SP9	12	Change primary filter element				●		
SP10	12	Change secondary fuel filter				●		
SP11	13	Bleed the fuel system						
SP12	13-14	Check injectors					●	
SP13	14	Check fuel injection pump						●
SP14	14	COOLING SYSTEM Check cooling water level	●					
SP15	14-15	Check and flush cooling system					●	
SP16	15	Check and clean radiator & radiator fins	●		●			
SP17	16	ELECTRICAL SYSTEM: Check electrolyte level in batteries		●				
SP18	16	Check condition of batteries with hydrometer					●	
SP19	16	OUT OF SERVICE: Winterizing or out-of-service						

- 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.

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 CC/CD/CE single viscosity oils.
 - b. API Service CC/CD/SF multi-viscosity oils.
3. Use the proper weight oil for your average ambient temperature.
4. Some increase in oil consumption may be expected when SAE 5W and SAE5-20W oils are used. Check oil level frequently.
5. Never put additives or flushing oil in crankcase.

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
Below -10°F (-23°C)	SAE-5W	SAE 5-20W

Figure 6. Lube Oil Recommendation

SP1. CHECK OIL

1. Check engine oil daily. See page 4, item 15. If oil level is below low mark on dipstick, fill with recommended oil. Fill only to high mark on dipstick.

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 using the oil recommended in Fig. 6. Change the oil and filter again at 100 hours using the oil recommended in Figure 6. After this, change oil and filter every 100 hours.
2. During intermittent cold weather operation, change oil every 100 hours or six weeks, whichever comes first.
3. Change oil at any seasonal change in temperature when a new viscosity of oil is required.
4. Change oil when engine is warm but not hot.
5. Never use a flushing oil.
6. Loosen plug in oil pan and drain oil into basin.
7. Dispose of waste oil in an approved manner.

8. Refill engine with recommended oil.
9. Engine capacity with new oil filter is:

368	2.5 quarts (2.4 liters)
374	2.5 quarts (2.4 liters)
378	3.8 quarts (3.6 liters)
484	6.1 quarts (5.8 liters)
488	6.1 quarts (5.8 liters)

SP3. CHANGING LUBE OIL FILTER

1. Change the lube oil filter every 100 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 1/2 turn further. **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 for all models is: 24-07301

SP4. AIR CLEANER

1. Check dust trap on bottom of air cleaner daily. Squeezing lips of rubber cap allows dirt to fall out.
2. Visually inspect air cleaner every 100 hours. In dusty conditions, check more often.
3. An element cannot be cleaned. Replace it when necessary. Part numbers are:

368	24-27301
374	24-27301
378	24-27302
484	24-27302
488	24-27302

NOTE: Make absolutely sure no impurities enter the engine while changing the element. Do not run the engine with the air cleaner removed.

SERVICING (CONT.)

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 3/8 inch (10-15mm).

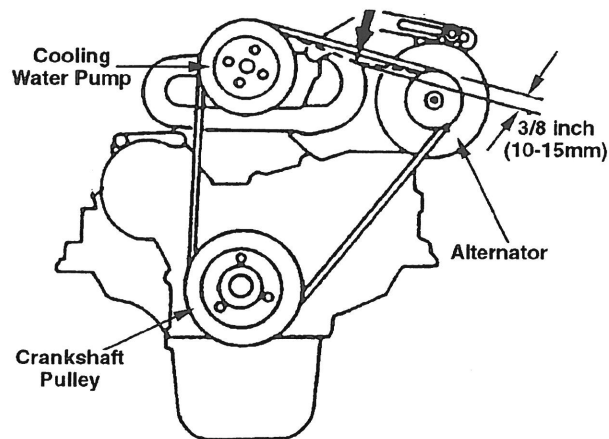


Figure 7. Alternator drive belt (V-Belt) adjustment

SP6. RETIGHTENING CYLINDER HEAD BOLTS

1. Retighten the head bolts after the first 50 hours.
2. Tighten bolts when the engine is cold.
3. Remove rocker arm cover.
4. Tighten head bolts with a torque wrench in order show in (Figs. 8&9). Tighten bolts evenly in 2 or 3 passes, ending at specified torque in final pass (Fig 10).

TORQUE SEQUENCES

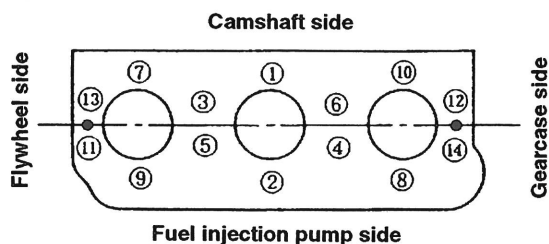


Figure 8. 3 Cylinder Head Torque Sequence

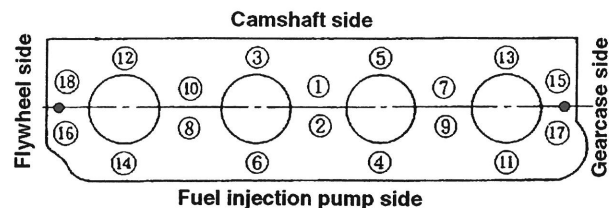


Figure 9. 4 Cylinder Head Torque Sequence

Model	Ft/lb	Kgfm	Bolt size
368	27.5 - 30.5	3.8 - 4.2	8mm
374	44 - 47	6.0 - 6.5	9mm
378	49 - 52	6.8 - 7.2	9mm
384	63 - 67	8.7 - 9.3	10mm
388	63 - 67	8.7 - 9.3	10mm

Figure 10. Cylinder head bolt torque

5. Replace rocker arm cover.

SP7. VALVE CLEARANCES

1. Readjust valve clearance after first 50 hours of operation. Adjust valves every 600 hours thereafter.
2. Valve adjustments should be done after cylinder head bolts have been tightened. Engine should be cold and NOT running.
3. Remove rocker arm cover
4. Watch the valves while turning the engine over by hand. Turn until the inlet valve starts to open and the exhaust valve starts to close (the valves are rocking.) Then turn the crankshaft one more full turn and adjust the clearance on both valves for this cylinder.
5. Loosen the lock nut and adjust the clearance between the rocker arm and valve cup of both the intake and exhaust valves with the adjustment screw. Clearance on both intake and exhaust valves should be 0.006 - 0.010 in. (0.15 - 0.25 mm). (See Fig. 11)

SERVICING (CONT.)

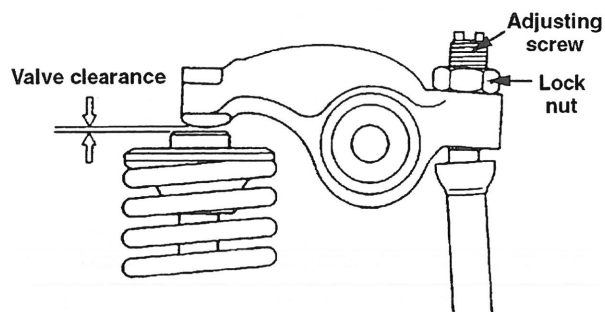


Figure 11. Valve Clearance

6. Repeat steps 3 and 4 for each cylinder. Each set of valves must be adjusted individually.
7. Replace rocker arm cover

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 and for all temperatures at an altitude of above 5,500 ft. (1500 meters.)
 - c. International fuel specifications:
 - ISO-8217-DMA
 - BS 2869 Part 1 Class A1
 - BS 2869 Part 2 Class A2
2. Use fuel having less than 1% sulphur (preferably less than 0.5%).
3. The cetane number should be a minimum of 45.
4. 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.
5. 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 FILTERS

1. Your generator set should have a primary fuel filter installed. We recommend Northern Lights brand of fuel filter-water separators.
 - a. Check the primary fuel filter daily as recommended by the filter manufacturer. Empty the collection bowl as necessary.
 - b. Change the element as often as necessary or every 200 hours.
 - c. If the bowl fills with water, change the primary and secondary elements immediately.



Part Number
Complete
Unit
24-5002
Part Number
Element
24-50012

Figure 12. Primary Fuel Filter

2. Change secondary fuel filter every 200 hours.
NOTE: The fuel filter on the engine is considered the "secondary fuel filter." The engine will be fitted with an element or canister type secondary fuel filter.
 - a. Turn off fuel valve. Remove bowl retaining ring by hand. Dispose of fuel and contaminants from bowl and wipe clean. Put in new element. Fill bowl with fuel and replace by tightening retaining ring. Open fuel valve.
 - b. Spin-on type filter:
Turn off fuel valve. Remove the spin-on filter by turning it counterclockwise with a filter wrench. Fill the new cartridge with fuel and install it after applying engine oil

SERVICING

to gasket surface. Screw on until the gasket surface comes into contact with sealing surface of filter base. Then, follow instructions on filter regarding additional tightening. DO NOT overtighten. Open fuel valve.

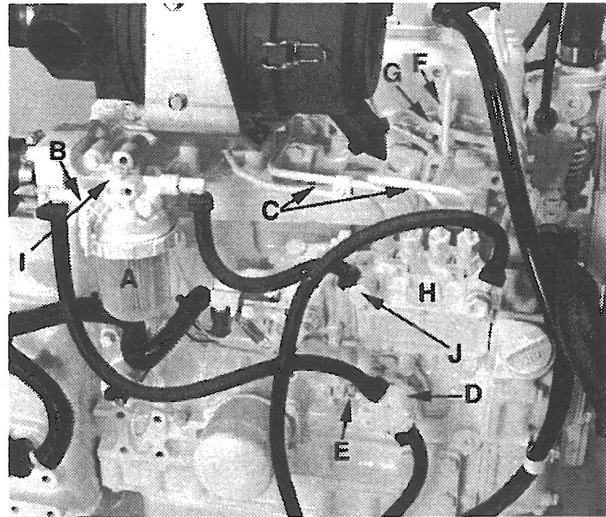
c. Fuel filter part numbers are:

Model	Element	Spin-on
NL368 & 374	124550-55700	(later date)
NL378,484&488	129100-55650	(later date)

SPI1. 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 isn't administered immediately.

1. The fuel system is self-bleeding. However, any system may need manual bleeding when:
 - a. A new fuel filter is installed;
 - b. The engine has run out of fuel;
 - c. The fuel lines injection pump or any other fuel system component has been removed and installed.
2. Loosen bleed screw on top of fuel filter (Fig. 13,I). Pump hand primer on fuel lift pump (Fig. 13,E) until pure fuel (no bubbles) escapes from bleed bolt. Tighten bleed screw.
3. Loosen bleed screw or bolt on the injection pump (Fig. 13,J). Pump hand primer until pure fuel (no bubbles) escapes, then tighten bleed screw.
4. If the engine does not start after the above bleeding process, loosen a fuel line at the injector while cranking the engine with the starter motor until pure fuel escapes. Then tighten the connection. Do each line **one-at-a-time**.
5. After engine has started, use a piece of cardboard to look for leaks.



- | | |
|--------------------------|-------------------------------|
| A. Secondary fuel filter | F. Fuel injector |
| B. Filter valve | G. Fuel return line |
| C. Fuel lines | H. Injection pump |
| D. Fuel lift pump | I. Fuel filter bleed screw |
| E. Hand primer | J. Injection pump bleed screw |

Figure 13

SPI2. INJECTOR SERVICE

NOTE: Injectors should be checked every 600 hours. Check should be made by 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 diesel fuel, see a doctor at once.

NL368 AND 374 MODELS

INJECTOR REMOVAL:

1. Clean loose dirt from around the injectors and the fuel lines.
2. Relieve high pressure in the fuel lines by loosening the delivery line flare nuts at each injector.
3. Remove delivery lines by disconnecting from 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 injection pump outlets to keep dirt out.
NOTE: On some models it is necessary to remove the air filter housing to access the fuel injection lines.

SERVICING

4. Remove the return line retaining clamps and remove return lines.
5. Put a 20mm wrench or socket over the injector and unscrew to remove.

NOTE: Do not use pry bars to remove injectors from cylinder head.

INJECTOR REPAIR AND CLEANING:

1. Take injectors to your Northern Lights dealer or local injection repair station for testing and service.

INJECTOR INSTALLATION:

1. Install a new copper sealing washer in each injector hole. Screw in injector with a 20mm wrench or socket and tighten to 36–39 ft-lbs (5.0–5.4 kgf-m).
NOTE: Overtightening can damage injector.
2. Install fuel lines
 - a. Install return lines and clamps.
 - b. Install delivery lines. Leave loose at injectors for bleeding.
 - c. Pump hand lever on fuel pump to fill lines. Tighten lines at injectors. Start engine and check for leaks using a piece of paper or cardboard.



CAUTION: DO NOT use hand to check for leaks.

NL378, 484 AND 488 MODELS

INJECTOR REMOVAL:

1. Clean loose dirt from around the injectors and the fuel lines.
2. Relieve high pressure in the fuel lines by loosening the delivery line flare nuts at each injector.
3. Remove delivery lines by disconnecting from 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 injection pump outlets to keep dirt out.
NOTE: On some models it is necessary to remove the air filter housing to access the fuel injection lines.
4. Remove the return line retaining clamps and remove return lines.
5. Remove nuts on each side of the injector body. Remove the hold down bracket with a 6mm

wrench or socket. Pull the injector body from the hole.

NOTE: Do not use pry bars to remove injectors from cylinder head.

6. After removing injectors, discard the sleeves from the injector hole in the head. Cover holes to prevent dirt and debris from entering cylinders.

IMPORTANT: Make sure you pull the sleeve out of the injector hole, as it may not come out with the injector.

INJECTOR REPAIR AND CLEANING:

1. Take injectors to your Northern Lights dealer or local injection repair station for testing and service.

INJECTOR INSTALLATION:

1. Place new sleeve in injector hole. Slide injector into hole or on the injector. Replace hold down bracket and nuts. Tighten nuts evenly to 5–6.5 ft-lbs. (0.7–0.9 kgf-m).
2. Install fuel lines
 - a. Install return lines and clamps.
 - b. Install delivery lines. Leave loose at injectors for bleeding.
 - c. Pump hand lever on fuel pump to fill lines. Tighten lines at injectors. Start engine and check for leaks using a piece of paper or cardboard.



CAUTION: DO NOT use hand to check for leaks.

SP13. INJECTION PUMP

1. Since operating conditions may vary considerably, it is difficult to give a definite service interval. But, as a rule, the pump settings, maximum speed, idle speed and exhaust smoke should be checked by your dealer after every 2400 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 malfunctions. Before servicing pump, check the other possible causes.
 - a. Check cleanliness of air filter.
 - b. Check valve clearances.
 - c. Clean and check injectors.

SERVICING

3. Any repair which involves disassembly of the injection pump must be carried out by specially-trained mechanics with the proper tools and test devices.

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

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. CHECKING COOLANT LEVEL

1. Check the coolant level each day before starting the engine.
 - a. Remove the pressure cap from the radiator and check water level. 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. The pressure valve in the filler cap releases when the pressure is approximately 12 PSI (0.9 kg/cm².) Use a cap pressure tester to check cap if you suspect it is faulty.

SP15. COOLING SYSTEM FLUSHING

1. Flush the cooling system every 600 hours or every 12 months, whichever comes first.
2. Remove radiator cap and open drains on radiator and engine block. The radiator drain is a rubber cap on the bottom of the radiator. Loosen the hose clamp and remove the clamp and cap. The hex headed engine block drain is on the service side of the engine below the intake manifold, next to the flywheel housing.
3. Pour clean water into radiator until water coming from radiator drain is clear of discoloration. Close the radiator drain and continue flushing until water from engine drain is clear. Open all drains and drain the engine and radiator completely. Close drains and refill the radiator with recommended coolant mixture.

4. Use 50% water/50% ethylene glycol anti-freeze. Antifreeze mixture is recommended as a good year-round coolant.
5. Check hoses and connections and repair any leakage.
6. Start engine and check for leaks. Run engine for 5 minutes and shut down engine. Let engine cool and then check coolant level in the radiator. Add coolant as needed.

SP16. CLEAN RADIATOR

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

GENERATOR ENDS

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.

D.C. ELECTRICAL SYSTEM - GENERAL

1. Never turn an optional battery switch off or break the circuit between the alternator and batteries while the engine is running. Regulator damage can result.
2. Do NOT reverse the polarity of battery cables when installing the battery.
3. When welding on the unit, disconnect the regulator and battery. Isolate the leads.
4. Disconnect battery cables when servicing the DC alternator.
5. Never test with a screwdriver, etc., against any terminal to see if it emits sparks.
6. Do not polarize the alternator or regulator.
7. A DC circuit breaker protects your control panel and wiring harness. It is located in the side of the generator junction box.

GLOW PLUGS AND INTAKE HEATERS

1. **NL368, 374 glow plugs**
Each cylinder is supplied with a glow plug which serves to heat the combustion chamber. The glow plugs are next to the fuel injectors in the cylinder head.
 - a. To check the glow plugs, loosen the current carrying wire between the terminals of the glow plugs. Connect a DC test

SERVICING

bulb between the positive (+) pole of the battery and the terminal of the glow plug. If the bulb lights up, the glow plug is functioning properly. Check all glow plugs and replace any faulty ones.

- b. Torque new glow plugs to: 11–14 ft/lbs (1.5–2.0 kgf-m)

2. NL378, 484, 488 intake heater

These models have a heater element in the end of the intake manifold.

To test the heater element, remove the power wire from the terminal. Connect DC test bulb between the positive (+) pole of the battery and the terminal of the heater. If the bulb lights up the heater is functioning properly. If not the heater isn't functioning, replace the heater elements.

BOOSTER BATTERIES

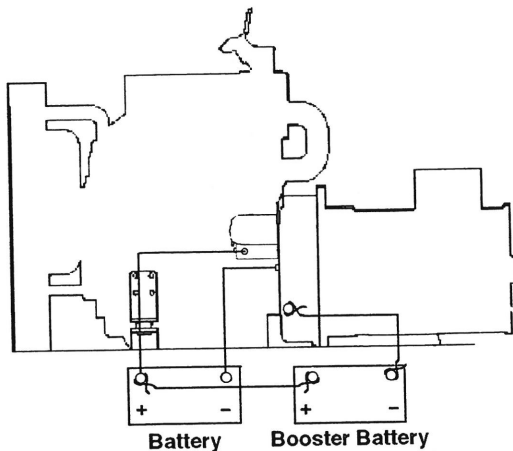


Figure 14. Battery Connections (NL488 shown)

CAUTION: Battery Gas Can Explode. Keep all flames and sparks away from batteries.

1. Before changing or using booster batteries, check battery electrolyte level. Add distilled water if necessary.
2. Booster and main batteries must have the same voltage rating.
3. First, connect positive (+) terminal of booster battery to positive (+) terminal of main battery. Then, connect negative (-) terminal of booster battery to ground on the engine block. (Fig. 14.)
4. Remove booster battery after starting engine.

5. Sealed batteries: See manufacturer charging and booster instructions.

SP17-18. BATTERY CARE

1. Check electrolyte level every 50 hours or once per month. Add distilled water to 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 corrosion.
3. Check the battery condition with a hydrometer every 600 hours.

SP19. WINTERIZING, OUT-OF-SERVICE

1. Drain and flush 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 fuel tank or add biocide as per manufacturer's instructions.
3. Seal air cleaner inlet, exhaust opening, crankcase breather pipe and fuel tank vent with plastic bags and tape.
4. Change the crankcase oil and filter.
5. Loosen the alternator belt.
6. Disconnect and clean battery. Remove to warm storage place if possible.
7. Clean outside of unit. Paint any scratched or chipped surfaces. Put corrosion preventative on all exposed metal surfaces.
8. Store the set in a dry, protected place. If unit must be stored outside, be sure it is well protected with a cover.

TROUBLESHOOTING

DC ELECTRICAL SYSTEM

✓ Battery will not charge

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.

✓ Starter inoperative

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 output:

- Check specific gravity of each battery.
- Check electrolyte level of each battery.

Defective electrical system ground wire:

- Repair or replace.

✓ Starter cranks slowly

Low battery output:

- Batteries too small.
- Battery cables 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.

✓ Entire electrical system does not function

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.

ENGINE

✓ Engine hard to start or will not start

Improper starting procedure.

- See starting section of this manual. Take special note of Bypass Switch operation.

ENGINE (CON'T.)

No fuel.

- Check level of fuel in fuel tank.

Low battery output:

- Check electrolyte level and condition.

Excessive resistance in starting circuit:

- Clean and tighten all battery connections

Crankcase oil too heavy:

- Use oil of proper viscosity.

Improper type of fuel:

- Consult fuel supplier and use proper type of fuel for operating condition.

Water, dirt or air in fuel system:

- Drain, flush, fill and bleed system.

Clogged primary fuel filter element:

- Clean or replace filter element.

Clogged secondary fuel filter element:

- Replace filter element.

Dirty or faulty injection nozzles:

- Have your dealer check injection nozzles.

✓ Engine runs irregularly or stalls frequently

Below normal engine temperature:

- Remove and check thermostat.

Clogged primary fuel filter element:

- Clean or replace filter element.

Clogged secondary fuel filter element:

- Replace secondary filter element.

Water or dirt in the fuel system.

- Drain, flush, fill and bleed system.

Dirty or faulty injection nozzles:

- Have your dealer check injection nozzles.

Air in fuel system:

- Inspect clamps and hoses on suction side of fuel pump for air leak.

Improper type of fuel:

- Consult fuel supplier and use proper type of fuel for operating condition.

✓ Lack of engine power

Engine overloaded:

- Reduce electrical load.

Intake air restriction:

- Service air cleaner.

Clogged primary fuel filter element:

- Clean or replace filter element.

Clogged secondary fuel filter element:

- Replace filter element.

Improper type of fuel:

- Consult fuel supplier and use proper type of fuel for operating conditions.

TROUBLESHOOTING

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

Lack of engine power (cont.)

Overheated engine:

- See "Engine Overheats" in next category.

Below normal engine temperature:

- Remove and check thermostat.

Improper valve clearance:

- Reset valves. Best done by dealer.

Dirty or faulty injection nozzles:

- Replace injectors. Best done by dealer.

✓ **Engine overheats**

Engine overloaded:

- Reduce electrical load.

Low coolant level:

- Fill tank or radiator to proper level.
- Check hoses for loose connections and leaks.

Radiator fins dirty.

- Remove debris and clean radiator.

Cooling system needs flushing.

- Flush cooling system.

Defective thermostat:

- Remove and check thermostat.

Defective temperature gauge:

- Check water temperature with thermometer and replace gauge if necessary.

✓ **Engine knocks**

Insufficient oil:

- Call your dealer.

Injection pump out of time:

- Call your dealer.

Below normal engine temperature:

- Check your thermostats.
- Check water temperature to see if temperature gauge is working properly.

Engine overheating:

- See "Engine Overheating section."

✓ **High fuel consumption**

Improper type of fuel.

- Use correct fuel for temperature.

Clogged or dirty air cleaner:

- Service air cleaner.

Engine overloaded:

- Reduce electrical load.

Improper valve clearance:

- See your dealer.

Injection nozzles dirty:

- See your dealer.

Injection pump out of time:

- See your dealer.

Engine not at proper temperature:

- Check your thermostats.
- Check water temperature with thermometer and replace gauge if necessary.

✓ **Below normal engine temperature**

Thermostats not working properly:

- Check thermostats.

Temperature gauge not working properly:

- Check water temperature with thermometer.

✓ **Low oil pressure**

Low oil level.

- Fill crankcase to proper level.

Improper type of oil:

- Drain and fill crankcase with correct oil.

Partially plugged oil filter:

- Replace filter.

✓ **High oil consumption**

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.

Engine overheats:

- See "Engine Overheats."

✓ **Engine emits black or gray exhaust smoke**

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.

Engine overloaded:

- Reduce electrical load.

Injection nozzles dirty:

- See your dealer.

Engine out of time:

- See your dealer.

✓ **Engine emits white smoke**

Improper fuel.

- Use correct fuel for temperature.

Cold engine:

- Warm up engine to normal operating temperature.

Defective thermostat:

- Remove and check thermostat.

Engine out of time:

- See your dealer.

SPECIFICATIONS AND INSTALLATION DATA

MODEL	NL368		NL374	
Rated RPM	1800	1500	1800	1500
Kilowatt Rating	6	5	8	6
Frequency (Hz)	60	50	60	50
General Information & Dimensions	Versions		Versions	
Description	3 cyl., 4 cycle, in-line naturally aspirated diesel		3 cyl., 4 cycle, in-line naturally aspirated diesel	
Displacement	47.87 cid (.78 ltr)		61.41 cid (1.006 ltr)	
Bore x Stroke	2.68/2.83 in (68/72 mm)		2.91/3.07 in (74/78 mm)	
Rotation (Facing Flywheel)	counterclockwise		counterclockwise	
Compression Ratio	23:0		23:0	
Engine Lube Oil Capacity	2.5 qts (2.41 ltr)		2.5 qts (2.41 ltr)	
Flywheel Housing and Drive Size	SAE 5 w/C107 drive		SAE 5 w/C107 drive	
Dry Weight Complete Unit	504 lbs (229 kg)		504 lbs (229 kg)	
Length x Width x Height in(mm)	L 43.4in (1100mm) W 18.7in (476mm) H 31in (787mm)		L 43.4in (1100mm) W 18.7in (476mm) H 32.4in (821mm)	
Cooling System				
Approx. Cooling System Capacity	3 qts (2.8 ltr)		3 qts (2.8 ltr)	
Heat Rejection to Jacket Water	424 btu/min		547 btu/min	
Electrical				
Min. Battery Capacity @ 0F (-17°C)	100 amp hrs		100 amp hrs	
Battery Cable Size	#2AWG up to 10 ft (3.048 m)		#2AWG up to 10 ft (3.048 m)	
Starting Voltage, Negative Ground	12 volt		12 volt	
Air, Exhaust, Fuel & Misc.				
Intake Air Flow	25 cfm (.71 m ³ /m)	23 cfm (.65 m ³ /m)	32 cfm (.91 m ³ /m)	30 cfm (.85 m ³ /m)
Exhaust Outlet (OD)	1.69 in (43 mm)		1.69 in (43 mm)	
Maximum Exhaust Back Pressure	48 in (1200 mm) H ₂ O		48 in (1200 mm) H ₂ O	
Maximum Exhaust Temperature	1022°F (550°C)		1022°F (550°C)	
Fuel Inlet and Return Outlet	1/4 in NPT		1/4 in NPT	
Approximate Fuel Rate - Full Load	@ 1800 rpm - 0.52 gph (0.43 Imp gph) (1.9 lph)		@ 1800 rpm - 0.68 gph (0.56 Imp gph) (2.6 lph)	
Approximate Fuel Rate - 3/4 Load	@ 1800 rpm - 0.39 gph (0.32 Imp gph) (1.5 lph)		@ 1800 rpm - 0.51 gph (0.42 Imp gph) (1.9 lph)	
Approximate Fuel Rate - 1/2 Load	@ 1800 rpm - 0.26 gph (0.22 Imp gph) (1.0 lph)		@ 1800 rpm - 0.34 gph (0.28 Imp gph) (1.3 lph)	
Rated Flywheel HP	10	8.3	12.9	10.7
MODEL	NL378			
Rated RPM	1800	1500		
Kilowatt Rating	10	8		
Frequency (Hz)	60	50		
General Information & Dimensions	Versions			
Description	3 cyl., 4 cycle, in-line naturally aspirated diesel			
Displacement	73.48 cid (1.204 ltr)			
Bore x Stroke	3.07/3.31 in (78/84 mm)			
Rotation (Facing Flywheel)	counterclockwise			
Compression Ratio	18:0			
Engine Lube Oil Capacity	3.8 qts (3.6 ltr)			
Flywheel Housing and Drive Size	SAE 4 w/C107 drive			
Dry Weight Complete Unit	646 lbs (293 kg)			
Length x Width x Height in(mm)	L: 43.8in(1113mm) W: 18.7in(476mm) H: 32.3in(821mm)			
Cooling System				
Cooling System Capacity w/Radiator	2.5 qts (2.41 ltr)			
Heat Rejection to Jacket Water	687 btu/min			
Electrical				
Min. Battery Capacity @ 0F (-17°C)	100 amp hrs			
Battery Cable Size	#2AWG up to 10 ft (3.048 m)			
Starting Voltage, Negative Ground	12 volt			
Air, Exhaust, Fuel & Misc.				
Intake Air Flow	38 cfm (1.1 m ³ /m)	36 cfm (1.0 m ³ /m)		
Exhaust Outlet (OD)	1.69 in (43 mm)			
Maximum Exhaust Back Pressure	48 in (1200 mm) H ₂ O			
Maximum Exhaust Temperature	1022°F (550°C)			
Fuel Inlet and Return Outlet	1/4 in NPT			
Approximate Fuel Rate - Full Load	@ 1800 rpm - 0.85 gph (0.77 Imp gph) (3.2 lph)			
Approximate Fuel Rate - 3/4 Load	@ 1800 rpm - 0.64 gph (0.53 Imp gph) (2.4 lph)			
Approximate Fuel Rate - 1/2 Load	@ 1800 rpm - 0.42 gph (0.35 Imp gph) (1.6 lph)			
Rated Flywheel HP	16.2	13.5		
*Approximate				

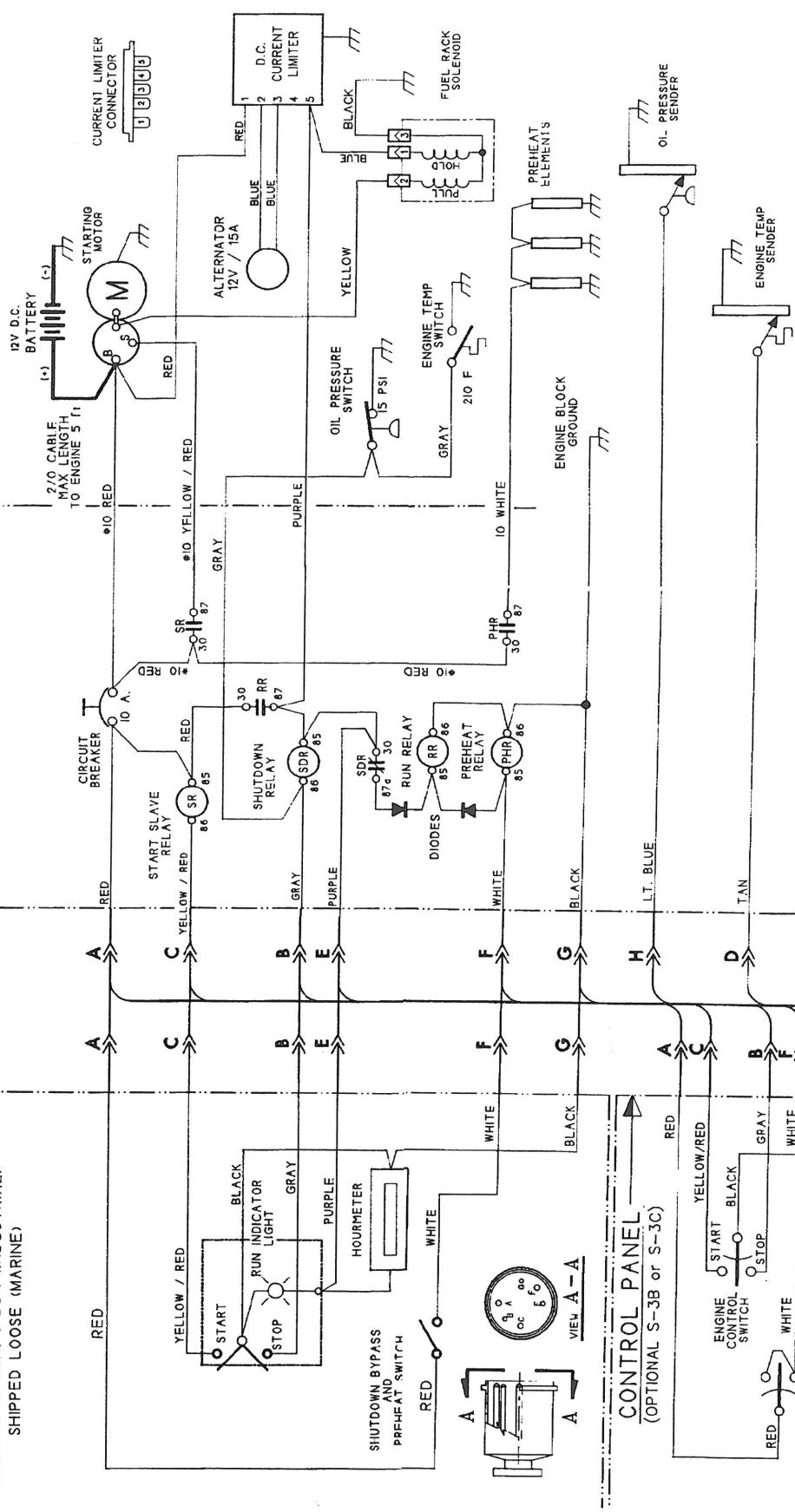
SPECIFICATIONS AND INSTALLATION DATA

MODEL		NL484		
Rated RPM	1800	All Versions	1500	
Kilowatt Rating	16		12	
Frequency (Hz)	60		50	
General Information & Dimensions				
Description	4 cyl., 4 cycle, in-line naturally aspirated diesel			
Displacement	121.74 cid (1.995 ltr)			
Bore x Stroke	3.31/3.54 in (84/90 mm)			
Rotation (Facing Flywheel)	counterclockwise			
Compression Ratio	18:0			
Engine Lube Oil Capacity	6.1 qts (5.8 ltr)			
Flywheel Housing and Drive Size	SAE 4 w/C107 drive			
Dry Weight Complete Unit	839 lbs (381 kg)			
Length x Width x Height in(mm)	L: 51.6in(1311mm) W: 20.2in(512mm) H: 32.3in(821mm)			
Cooling System				
Cooling System Capacity w/Radiator	6 qts (5.7 ltr)			
Heat Rejection to Jacket Water	1125 btu/min			
Electrical				
Min. Battery Capacity @ 0F (-17°C)	100 amp hrs			
Battery Cable Size	#2AWG up to 10 ft (3.048 m)			
Starting Voltage, Negative Ground	12 volt			
Air, Exhaust, Fuel & Misc.				
Intake Air Flow	63 cfm (1.8 m ³ /m)		59.5 cfm (1.7 m ³ /m)	
Exhaust Outlet (OD)	2.125 in (54 mm)			
Maximum Exhaust Back Pressure	48 in (1200 mm) H ₂ O			
Maximum Exhaust Temperature	1022F (550°C)			
Fuel Inlet and Return Outlet	1/4 in NPT			
Approximate Fuel Rate - Full Load	@ 1800 rpm - 1.39 gph (1.15 Imp gph) (5.3 lph)			
Approximate Fuel Rate - 3/4 Load	@ 1800 rpm - 1.0 gph (0.83 Imp gph) (3.8 lph)			
Approximate Fuel Rate - 1/2 Load	@ 1800 rpm - 0.69 gph (0.57 Imp gph) (2.6 lph)			
Rated Flywheel HP	26.5		22.3	
MODEL		NL488		
Rated RPM	1800	All Versions	1500	
Kilowatt Rating	20		16	
Frequency (Hz)	60		50	
General Information & Dimensions				
Description	4 cyl., 4 cycle, in-line naturally aspirated diesel			
Displacement	133.62 cid (2.189 ltr)			
Bore x Stroke	3.46/3.54 in (88/90 mm)			
Rotation (Facing Flywheel)	counterclockwise			
Compression Ratio	18:0			
Engine Lube Oil Capacity	6 qts (5.7 ltr)			
Flywheel Housing and Drive Size	SAE 4 w/C107 drive			
Dry Weight Complete Unit	926 lbs (420 kg)			
Length x Width x Height in(mm)	L: 53.6in(1361mm) W: 20.2in(512mm) H: 32.3in(821mm)			
Cooling System				
Cooling System Capacity w/Radiator	6 qts (5.72 ltr)			
Heat Rejection to Jacket Water	1316 btu/min			
Electrical				
Min. Battery Capacity @ 0F (-17°C)	100 amp hrs			
Battery Cable Size	#2AWG up to 10 ft (3.048 m)			
Starting Voltage, Negative Ground	12 volt			
Air, Exhaust, Fuel & Misc.				
Intake Air Flow	69.6 cfm (2 m ³ /m)		65 cfm (1.8 m ³ /m)	
Exhaust Outlet (OD)	2.125 in (54 mm)			
Maximum Exhaust Back Pressure	48 in (1200 mm) H ₂ O			
Maximum Exhaust Temperature	1022F (550°C)			
Fuel Inlet and Return Outlet	1/4 in NPT			
Approximate Fuel Rate - Full Load	@ 1800 rpm - 1.6 gph (1.3 Imp gph) (6.0 lph)			
Approximate Fuel Rate - 3/4 Load	@ 1800 rpm - 1.2 gph (1.0 Imp gph) (4.6 lph)			
Approximate Fuel Rate - 1/2 Load	@ 1800 rpm - .8 gph (0.66 Imp gph) (3.0 lph)			
Rated Flywheel HP	31		24.5	

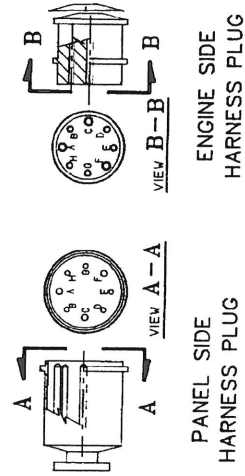
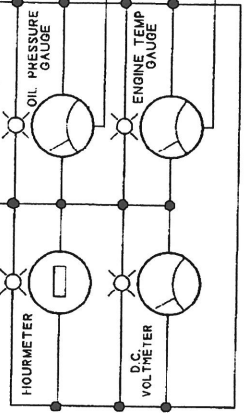
CONTROL PANEL
 SERIES 1-B PANEL (STANDARD)
 MOUNTED IN GEN. J-BOX (INDUSTRIAL)
 SHIPPED LOOSE (MARINE)

RELAY BOARD
 LOCATED IN GENERATOR J-BOX

ENGINE



CONTROL PANEL
 (OPTIONAL S-3B or S-3C)



12 Volt DC Engine Wiring Diagram
 For Models: NL368 and 374
 S1-B, S3-C
 Drawing: C-3163

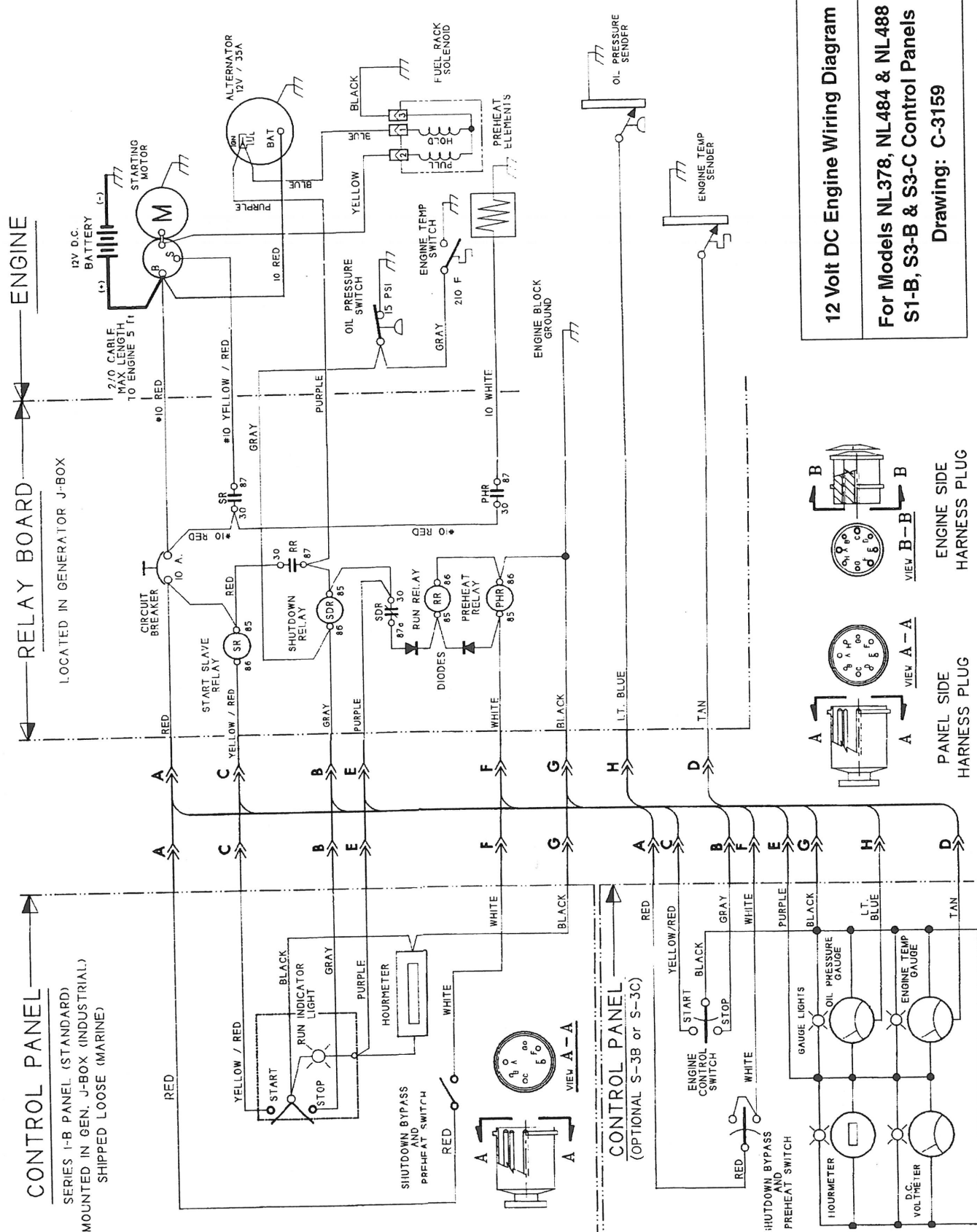
CONTROL PANEL

SERIES 1-B PANEL (STANDARD)
MOUNTED IN GEN. J-BOX (INDUSTRIAL)
SHIPPED LOOSE (MARINE)

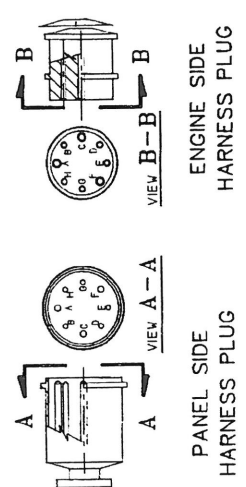
RELAY BOARD

LOCATED IN GENERATOR J-BOX

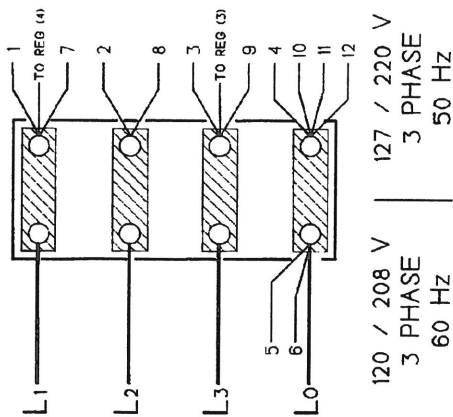
ENGINE



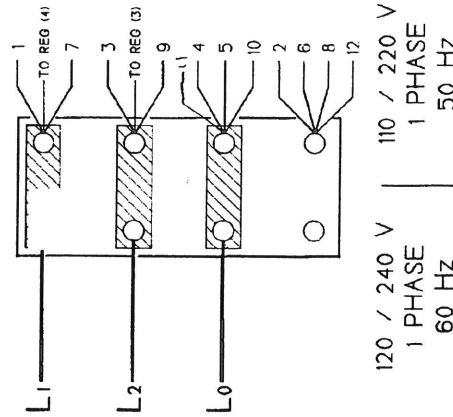
12 Volt DC Engine Wiring Diagram
For Models NL378, NL484 & NL488
S1-B, S3-B & S3-C Control Panels
Drawing: C-3159



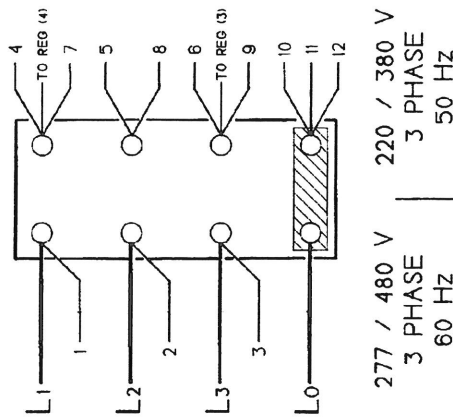
TERMINAL BLOCK



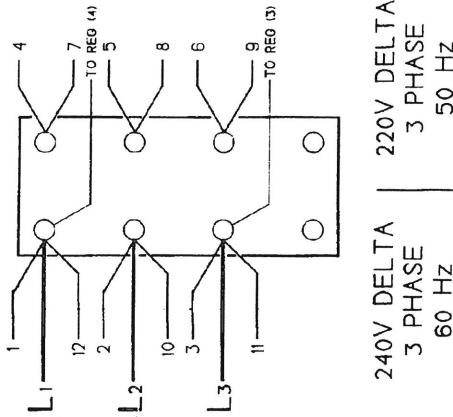
TERMINAL BLOCK



TERMINAL BLOCK



TERMINAL BLOCK

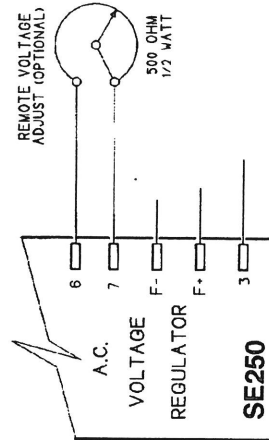
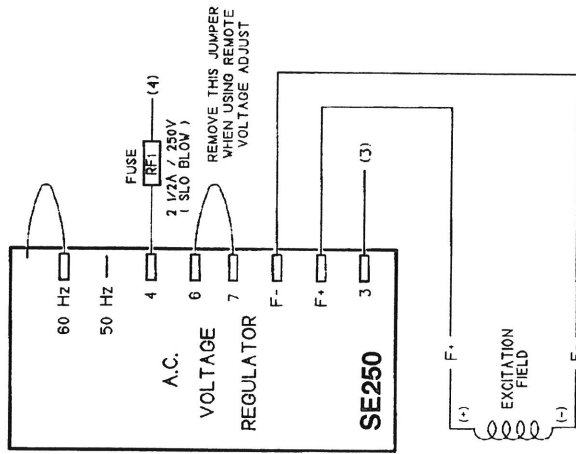


INDICATES USE OF
TERMINAL LINK



NOTES:

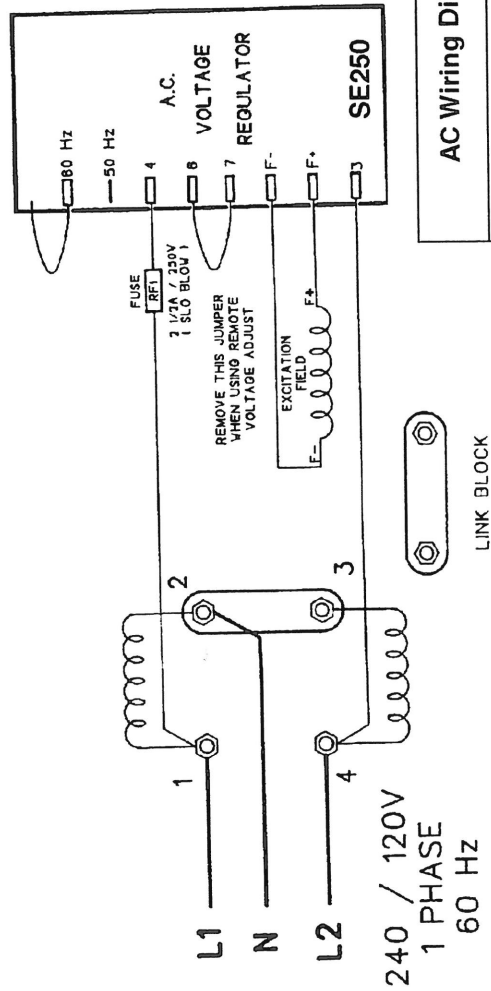
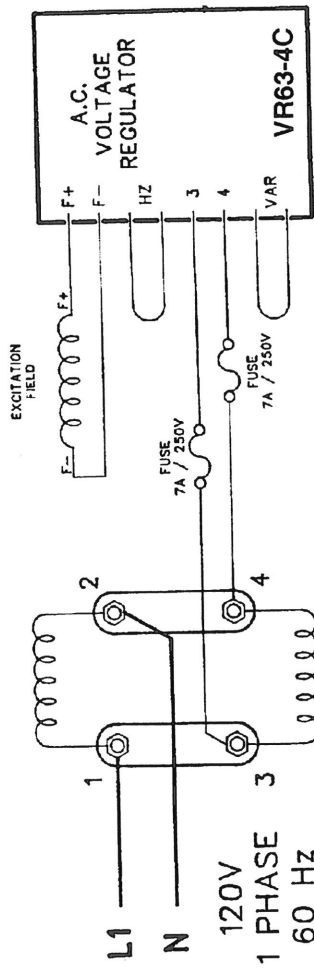
1. GROUNDING TO BE IN ACCORDANCE WITH THE "NATIONAL ELECTRICAL CODE" AND ANY APPLICABLE LOCAL CODES.



AC Wiring Diagram 12 Wire Generator End

For Models: NL368, NL374, NL378
NL484 and NL488
Drawing: C-3012

Wiring Diagrams subject to change without notice.



AC Wiring Diagram 4 Wire Generator Ends

For Models: NL368, NL374, NL378
NL484 and NL488
Drawing: B-4859

Wiring Diagram subject to change without notice.

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