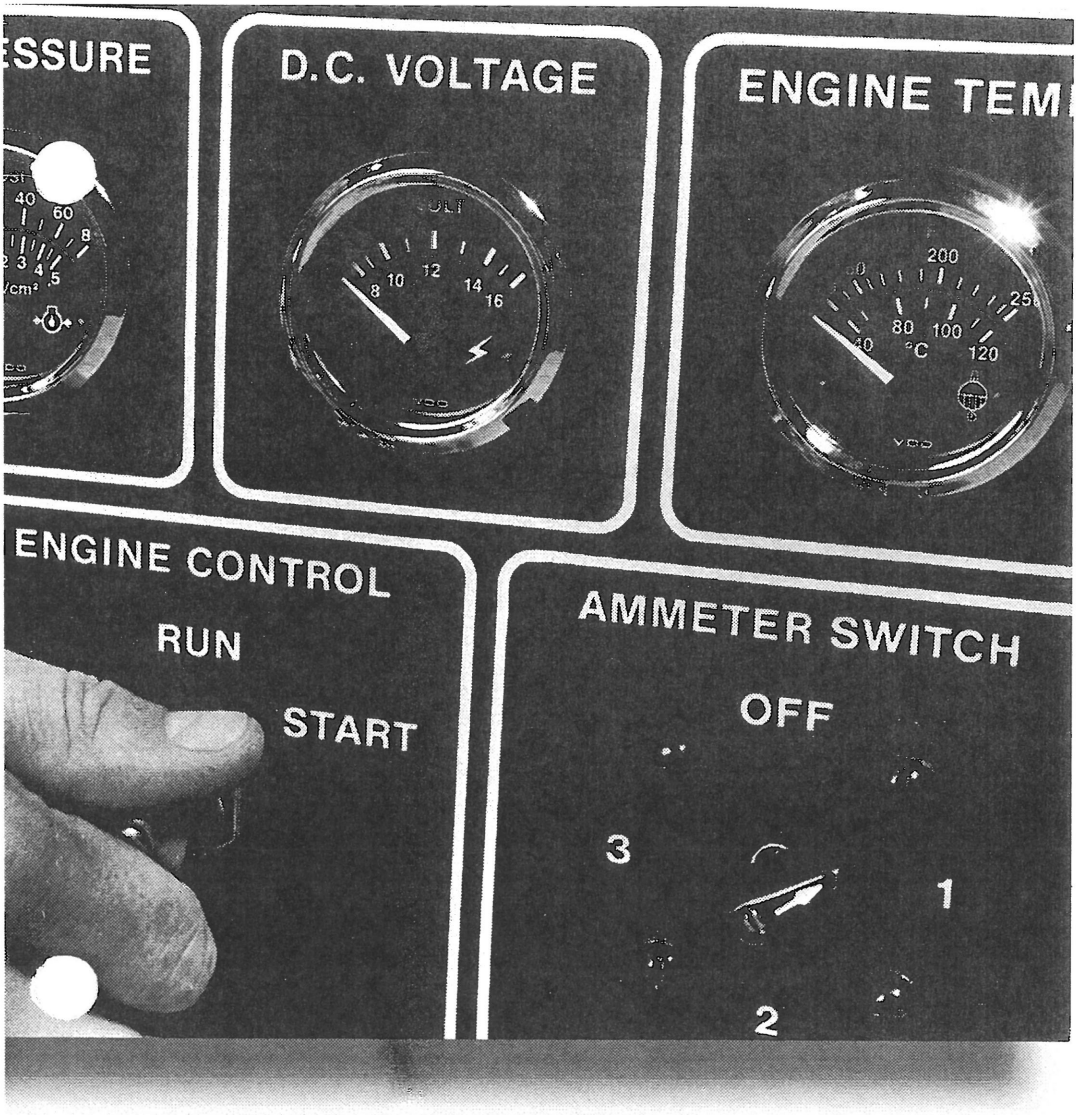
OPERATOR'S MANUAL

0844 for Models: M844, M844L, ML844, ML844L, M16C, M20C, NL844, NL844L



LUGER
NORTHERN LIGHTS
DIESEL ELECTRIC & POWER SYSTEMS
®

OPERATOR'S MANUAL O844

MODELS INCLUDED:

M844, M844L, ML844, ML844L, M16C, M20C, NL844, NL844L

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

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CALIFORNIA PROPOSITON 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.

INTRODUCTION

Servicing of marine engines and generator sets presents unique problems. In many cases boats cannot be moved to a repair facility. Marine engines cannot be compared to the servicing of automobiles, trucks or even farm equipment. Failures often occur in remote areas far from competent assistance. Marine 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 operating instructions for:

M844, ML844, M16C, NL844 use the 844 engine

M844L, ML844, M20CL, NL844L use the 844L engine

***Note:** There are two versions of the 844 engine. The standard engine is designated 844. The long stroke engine is designated 844L. You will need to know which engine you have to use this manual and to order parts.*

MODEL NUMBERS

Model numbers give unit's application, block model, aspiration and RPM with the exception of Commercial units. The root number on the commercial units indicate prime kW rating:

M, ML- NL

M, ML - Northern Lights marine generator set
NL - Northern Lights industrial generator set

844

Model number of engine block
Bore Cylinders
84 4

L, C

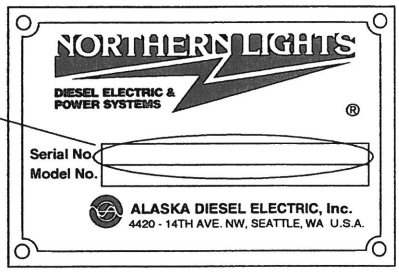
L - Long stroke version
C - Commercial version

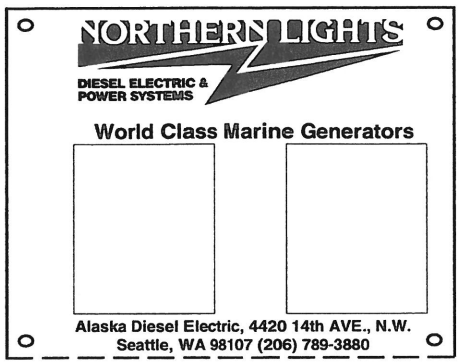
M 844	Northern Lights 16 kW marine diesel generator set with an 844 engine and a PXG generator.
M 844L	Northern Lights 20 kW marine diesel generator set with an 844L engine and a PXG generator.
ML 844	Northern Lights 16 kW marine diesel generator set with a 844 engine and a PSL generator.
ML 844L	Northern Lights 20 kW marine diesel generator set with an 844L engine and a PSL generator.
NL 844L	Northern Lights industrial diesel generator set with 844L engine and a radiator.
M 20CL	Northern Lights 20 kW commercial grade marine diesel generator with special generator.

SERIAL NUMBERS

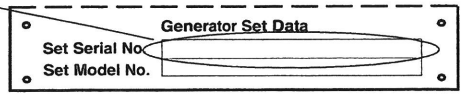
Northern Lights generator sets with PSL generators have two data plates and two serial numbers. One serial number is for the generator end, and it is found on the Generator End Data Plate. The other serial number, found with the **Generator set Data Plate, should be used when ordering parts for sets using PSL generators.** Units with PXG & BCI generators have one plate. Serial Numbers for Northern Lights are nine digits. e.g. 8442-12345

Generator Set Serial Number for units with PXG & BCI generators





Generator End Serial Number for units with PSL generators.



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.

- Never leave engine without proper security.
- Turn the coolant tank 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 throughout this book to alert you to possible danger areas. Please take special notice of these sections.

M844 AND M844L MARINE GENERATOR COMPONENT LOCATIONS

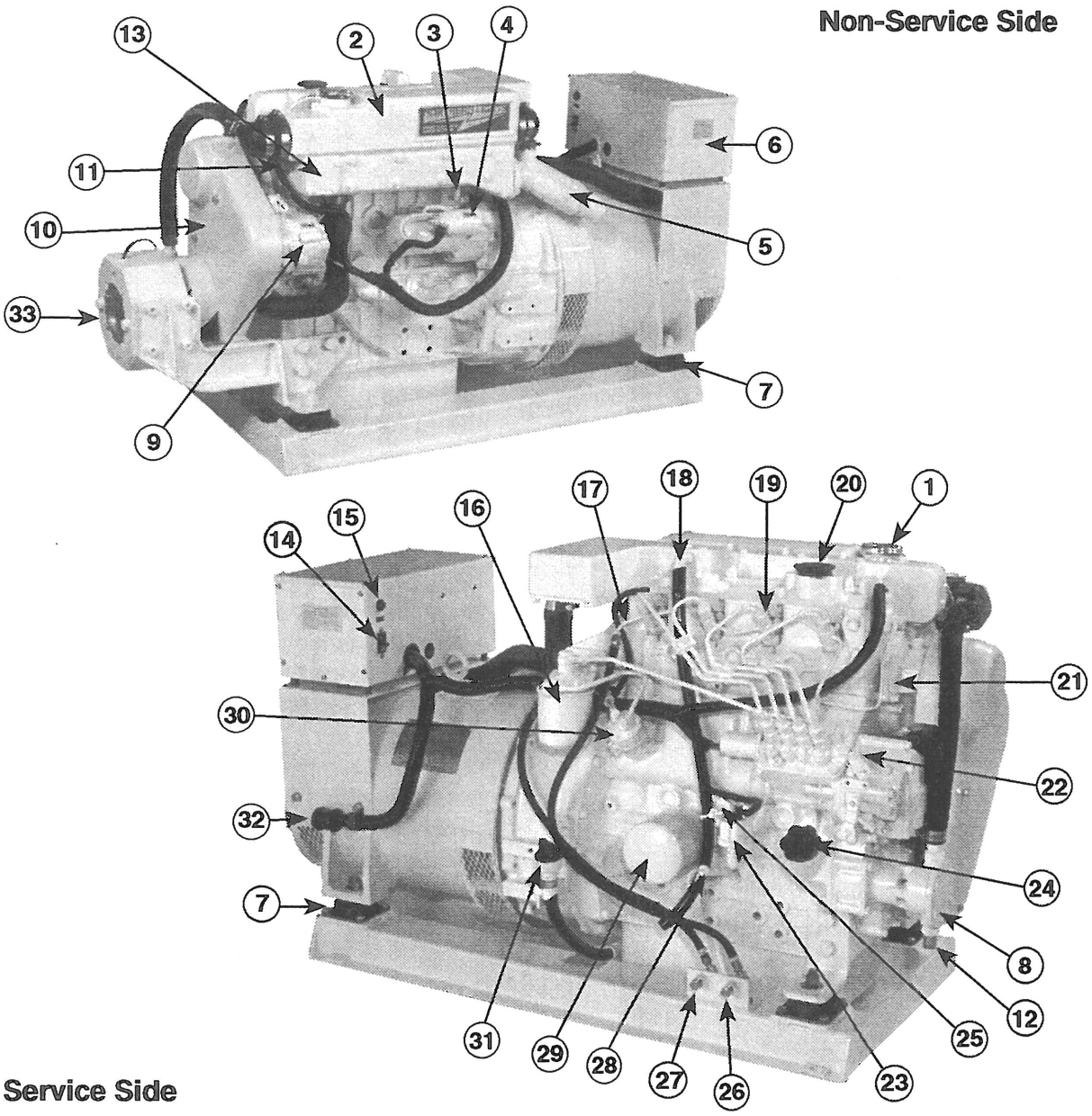


Figure 1A and 1B. M844L with PXG generator end and automatic voltage regulator.

1. Coolant Fill
2. Expansion Tank/Exhaust Manifold/Heat Exch.Tank
3. Coolant Drain
4. Starter
5. Wet Exhaust Elbow
6. Junction Box
7. Vibration Mount
8. Sea Water Pump
9. Alternator
10. Belt Guard
11. Water Temperature Sender
12. Sea Water Inlet
13. Coolant Thermostat (behind)
14. AC Circuit Breaker for Automatic Voltage Regulator
15. DC Circuit Breaker
16. Secondary Fuel Filter
17. Fuel Return Line
18. Crankcase Vent
19. Fuel Injector
20. Oil Fill Top
21. Fresh Water Pump
22. Injection Pump
23. Oil Pressure Sender
24. Oil Fill Side
25. Freshwater Block Drain
26. Fuel Return Line
27. Fuel Inlet Line
28. Oil Dipstick
29. Oil Filter
30. Fuel Lift Pump
31. Lube Oil Drain
32. Control Panel Plug-in
33. PTO (Optional).

ML844 AND ML844L MARINE GENERATOR COMPONENT LOCATIONS

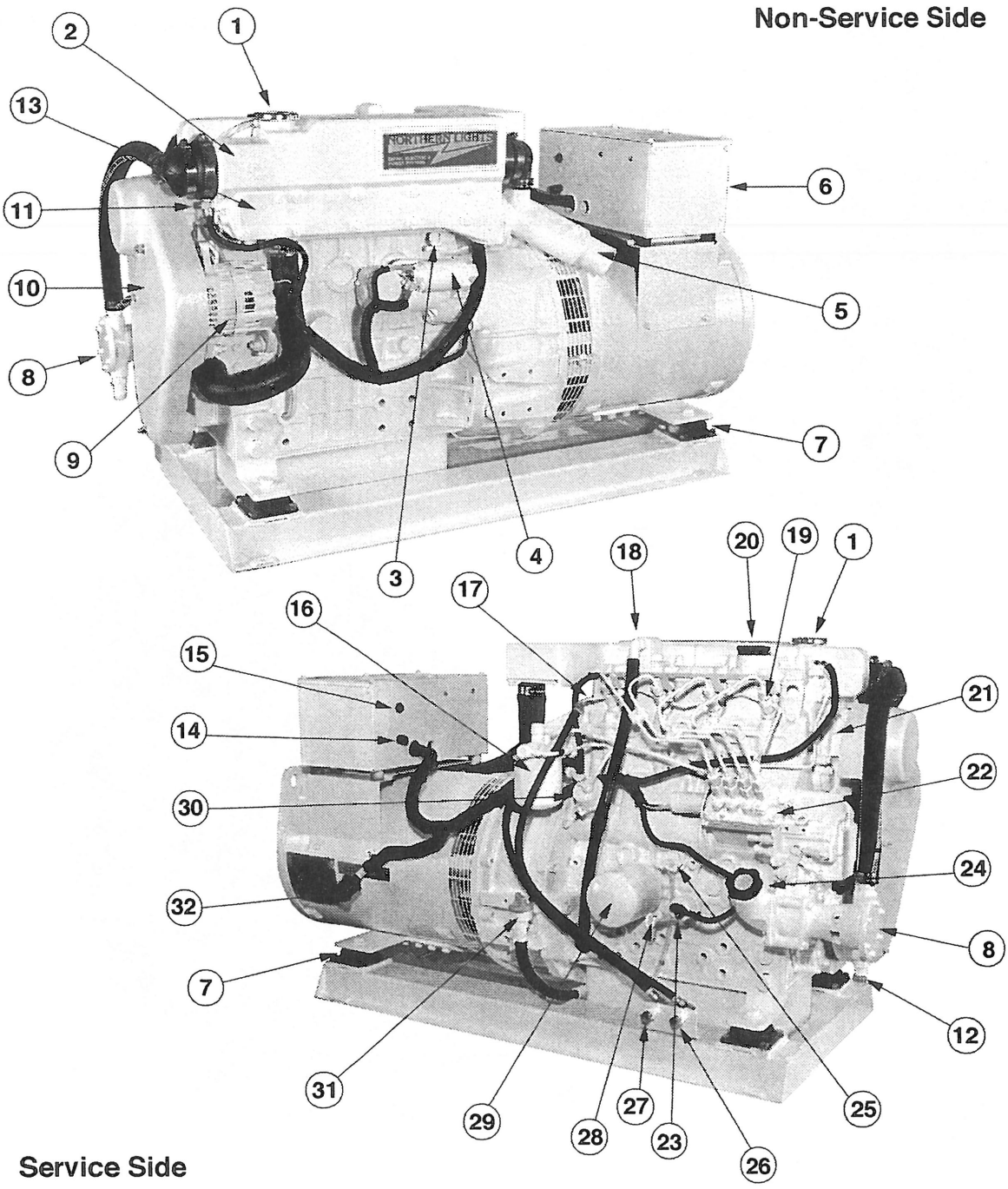


Figure 1C and 1D. ML844 with PSL generator end and automatic voltage regulator. (ML844L Service in same locations.)

1. Coolant Fill
2. Expansion Tank/Exhaust Manifold/Heat Exch.Tank
3. Coolant Drain
4. Starter
5. Wet Exhaust Elbow
6. Junction Box
7. Anti-Vibration Mount
8. Sea Water Pump
9. Alternator
10. Belt Guard
11. Water Temperature Sender
12. Sea Water Inlet
13. Coolant Thermostat (behind)
14. AC Circuit Breaker for Automatic Voltage Regulator
15. DC Circuit Breaker
16. Secondary Fuel Filter
17. Fuel Return Line
18. Crankcase Vent
19. Fuel Injector
20. Oil Fill Top
21. Fresh Water Pump
22. Injection Pump
23. Oil Pressure Sender
24. Oil Fill Side
25. Freshwater Block Drain
26. Fuel Return Line
27. Fuel Inlet Line
28. Oil Dipstick
29. Oil Filter
30. Fuel Lift Pump
31. Lube Oil Drain
32. Control Panel Plug-in

M16C & M20C COMMERCIAL MARINE GENERATOR COMPONENT LOCATIONS

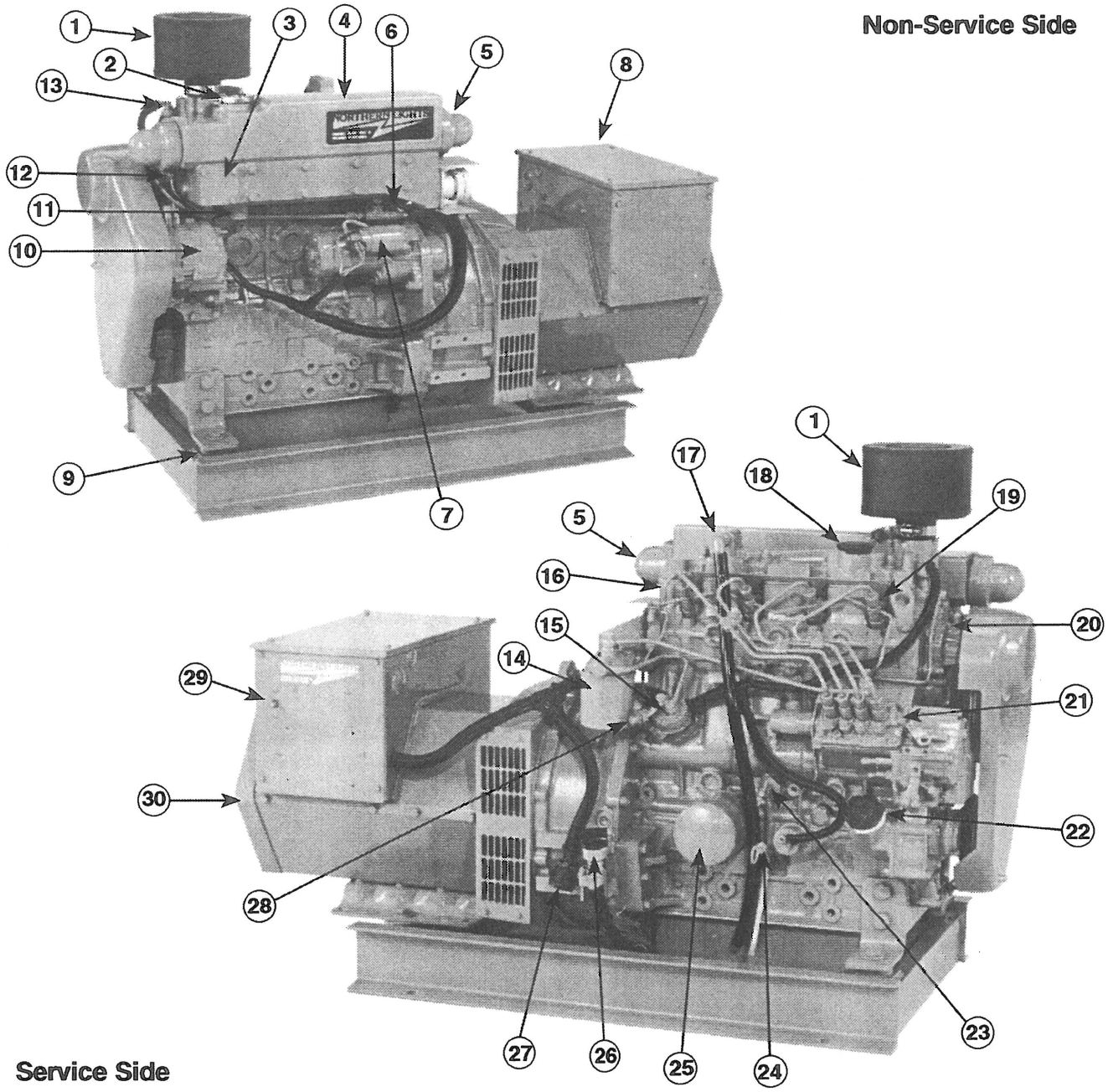


Figure 2A and 2B. M20CL with BCI generator end

1. Air Filter
2. Coolant Fill
3. Coolant Thermostat (under)
4. Expansion Tank/Manifold/ Heat Exchanger Tank
5. Manifold End Caps (2)
6. Coolant Drain
7. Starter
8. Junction Box
9. Vibration Mount
10. DC Alternator
11. Keel Cooler Return
12. Water Temperature Sender
13. Oil Pressure Switch
14. Secondary Fuel filter
15. Fuel Lift Pump
16. Fuel Return Line
17. Crankcase Vent
18. Oil Fill Top
19. Fuel Injector
20. Fresh Water Pump
21. Injection Pump
22. Oil fill side
23. Freshwater Block Drain
24. Oil Dipstick
25. Oil Filter
26. Lube Oil Drain
27. Control Panel Plug-in
28. Fuel Inlet
29. DC Circuit Breaker
30. Generator End

NL844 & NL844L INDUSTRIAL GENERATOR SET COMPONENT LOCATIONS

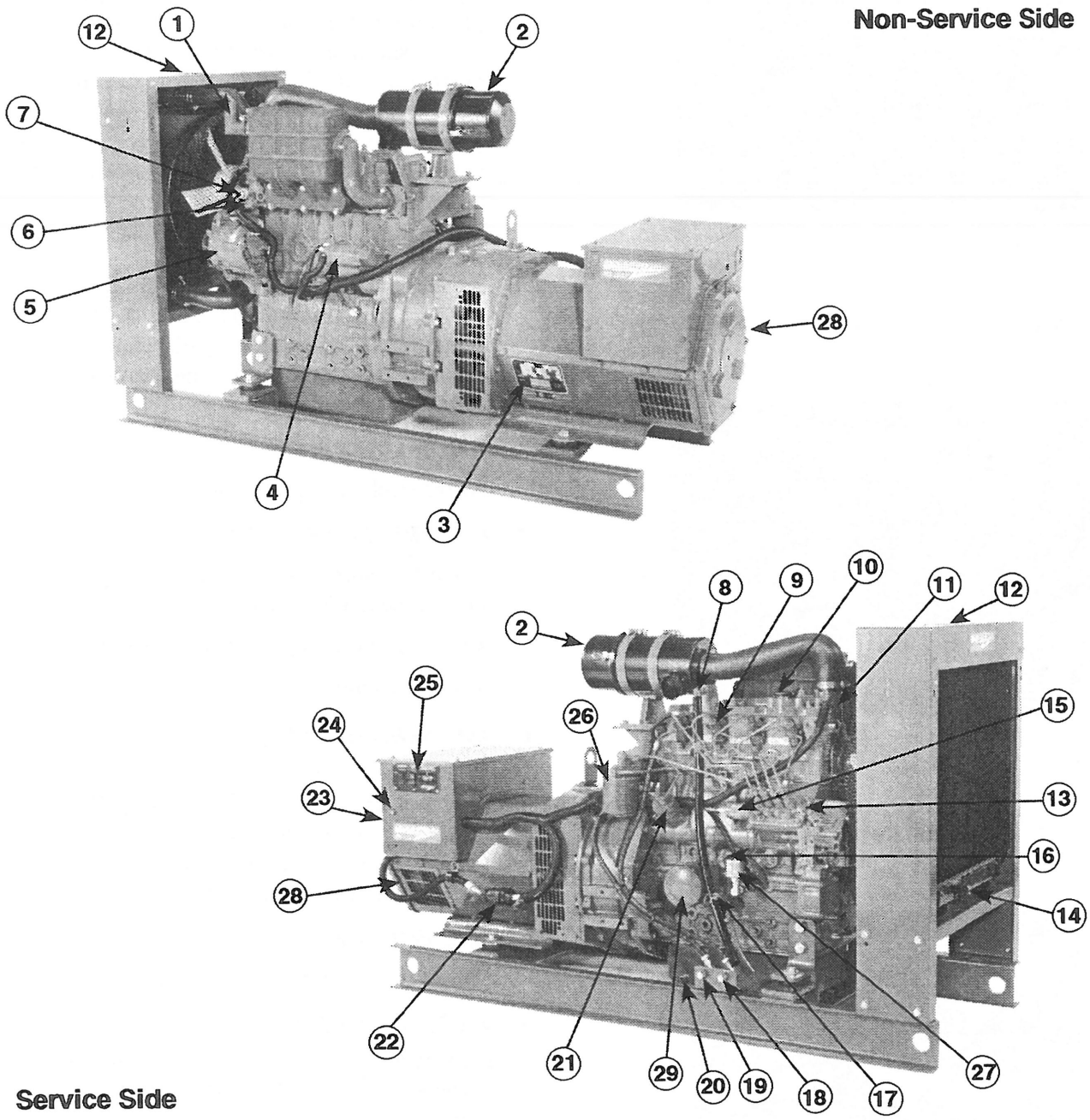


Figure 3A and 3B. NL844 L with BCI generator end

NL844L Service side.

1. Exhaust Outlet
2. Air Filter
3. Generator Plate
4. Starter
5. DC Alternator
6. High Water Coolant Temp. (HWT) Shutdown Switch
7. Coolant Temperature Sender
8. Crankcase Vent
9. Fuel Injector
10. Oil Fill Top
11. Low Oil Pressure Shutdown Switch
12. Coolant Fill
13. Injection Pump
14. Radiator Coolant Drain
15. Shutdown Solenoid
16. Block Drain
17. Oil Dipstick
18. Fuel Return Line
19. Fuel Inlet Line
20. Lube Oil Drain
21. Fuel Lift Pump
22. Control Panel Plug-in
23. Generator Junction Box
24. DC Circuit Breaker
25. Control Panel
26. Secondary Fuel Filter
27. Oil Pressure Sender
28. Generator End
29. Oil Filter

SERIES 1-B GENERATOR CONTROL PANEL

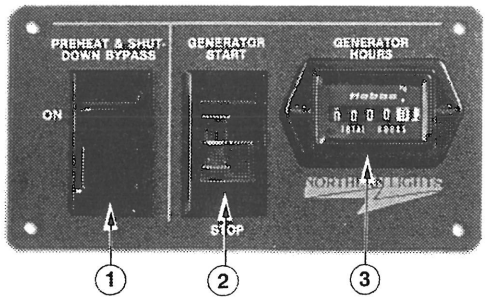


Figure 4A.

SERIES 3-C GENERATOR CONTROL PANEL

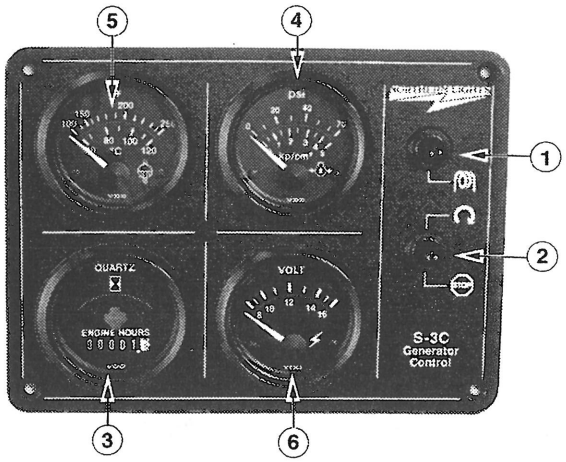


Figure 4B.

SERIES 4 GENERATOR CONTROL PANEL

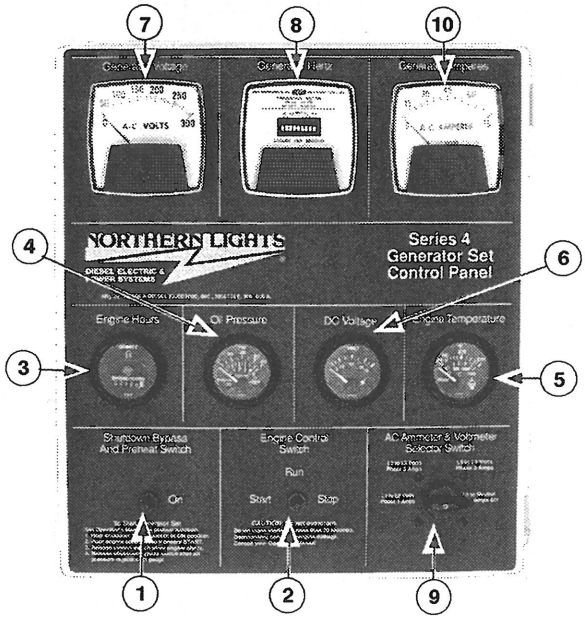


Figure 4C.

1. ***SHUTDOWN BYPASS-PREHEAT SWITCH:***

   Two functions are built into this switch: The preheating of the engine, and bypassing of the engine safety shutdown circuit. Hold switch in on position 10-20 seconds before starting engine and continue holding on during engine cranking. Release the switch as soon as engine is running. Holding the switch on too long can burn out the heater elements.

2. ***ENGINE CONTROL SWITCH***

   To start the engine, hold switch in start position until the engine is running. After the engine starts, release switch and it will return to the center positon. To stop engine, move switch to stop position and release.

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. ***ENGINE TEMPERATURE GAUGE:***

   Registers temperature of coolant.

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.

For Series 4 Control Panels Only:

7. ***A.C. VOLTMETER:***

   Shows the generator output voltage.

8. ***FREQUENCY METER (HERTZ):***

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

9. ***AMMETER/VOLTMETER SELECTOR SWITCH:***

   Used to check voltage and current of each phase. Return to "Amps Off" position when not monitoring.

10. ***A.C. AMMETER***

    Shows the generator load on each phase. The phase is selected with the Ammeter Selector Switch, #9.

SERIES 7.0 THRU 7.6 GENERATOR CONTROL PANEL

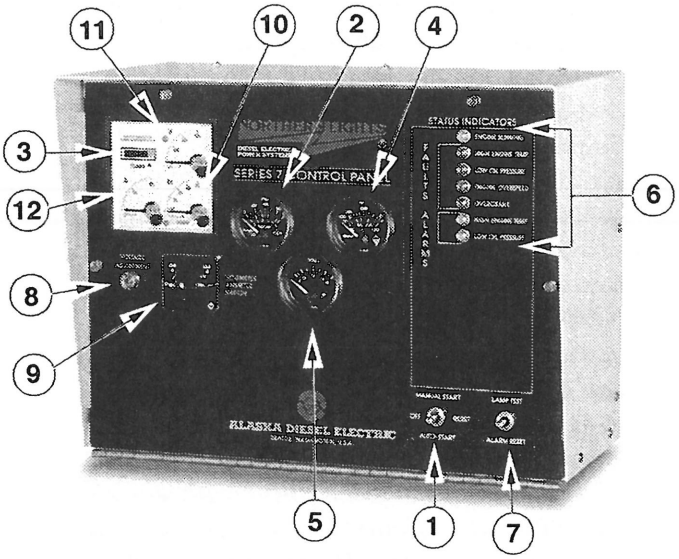


Figure 4D.

STATUS INDICATORS FOR S-7.0 THRU S-7.6 GENERATOR CONTROL PANELS

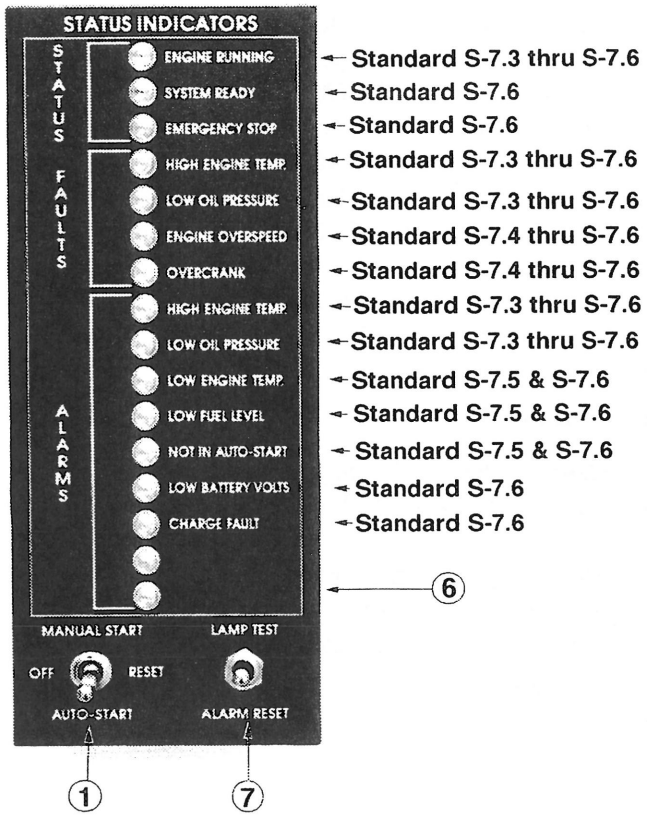


Figure 4E.

1. ***ENGINE STOP-START-PREHEAT SWITCH***
   S-7.1 & S-7.3 manual start panels. 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 the run position. To stop engine hold switch in the stop position.
   S-7.0, S-7.2, S-7.4, S-7.5 & S7.6 auto start panels. When the switch is placed in the auto-start position the unit will automatically start when there is a drop in utility power.
2. ***OIL PRESSURE GAUGE:***
   The oil pressure gauge shows the oil pressure in the engine lubricating system.
3. ***HOUR METER:***
   Keeps track of engine running time.
4. ***ENGINE TEMPERATURE GAUGE:***
   Registers temperature of coolant.
5. ***D.C. VOLTMETER***
   When the engine is running, the voltmeter indicates the voltage output of the alternator.
6. ***STATUS INDICATOR PANEL:***
   Engine monitoring alarms and lamps for monitoring engine functions. See ⑥ in the previous column for standard equipment.
7. ***ALARM LAMP TEST AND ALARM RESET SWITCH:***
   Press up to test the indicator lights and press down to reset alarms.
8. ***A.C. VOLTAGE ADJUSTMENT RHEOSTAT***
   Voltage has been set at factory and should only be adjusted by factory trained personnel.
9. ***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.***
10. ***FREQUENCY METER (HERTZ):***
    The frequency meter indicates alternating current frequency: 60 Hz (1200 or 1800 RPM or 50Hz (1500 RPM).
11. ***A.C. VOLTMETER:***
    Shows the generator output voltage.
12. ***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 (Sets with Series 3 – 7 panels).
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 at 50 hours. (See page 14.)

Operating Instructions

Generator Sets: 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 rings.

BEFORE STARTING

1. Check the water level by removing the pressure cap from the expansion tank or 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 in the waffled area on 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.
4. Marine sets: close the seacock, check and clean the sea strainer and reopen the seacock.
5. Marine sets: 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 regulator could be ruined.

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 glow plugs. 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.

NOTE: Excessive cranking of starter on marine sets equipped with water lift muffler can cause engine damage. If engine does not start after three, 20 second cranks, remove impeller from the seawater pump. This will prevent the muffler from filling with water and backfilling the exhaust line and engine. Once engine starts, shut it off immediately and reinstall the impeller. Restart and check the exhaust overboard outlet for gushes of water.

OPERATING

1. Units with Series 3 and 4 Control Panels: Check gauges often. Oil pressure must be above 15PSI. The D.C. voltmeter should read between 11 and 15 volts at 80°(25°C) ambient temperature. Water temperature gauge must be below 200°F (94°C). Check AC voltage and frequency meters (Series 4 & 7 Panels). 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 momentarily.
4. Marine sets: shut off seacock, fuel valve and battery switch.

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: 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 (97°C), shut off the engine immediately.
   b. Use the Trouble Shooting Guide on page 21 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.
   d. Make repairs and restart after the temperature gauge registers below 200°F (94°C.)
   e. 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. Some marine models already have "On-Board-Kits,"a handy box that contains the most common parts you will need.
2. All owners should have the following:
   a. Primary and secondary fuel filter elements
   b. Oil filters
   c. Air filter (industrial only)
   d. Alternator belt
   e. Thermostat and gaskets
   f. Seawater pump impeller & gaskets (Marine only)
   g. 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. 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
- SP7 Check primary fuel filter
- SP13 Check cooling water level
  Check sea strainer (marine)

AFTER FIRST 50 HOURS:
- SP2/3 Change engine oil and filter
- SP5 Check V-belt tension
- SP6 Adjust valves
- SP18 Check electrolyte in batteries
  Re-tighten head bolts (see pg. 14)

EVERY 50 HOURS:
- SP5 Check V-belt tension
- SP18 Check electrolyte in batteries

EVERY 100 HOURS:
- SP2/3 Change engine oil and filter
- SP4 Check air cleaner
- SP16 Check and clean radiator (industrial only)

EVERY 200 HOURS:
- SP8 Change primary fuel filter element
- SP9 Change secondary fuel filter

EVERY 600 HOURS:
- SP6 Check valve clearances
- SP11 Check injectors
- SP14 Check and flush cooling system
- SP17 Change impeller (marine)
- SP19 Check state of charge of batteries

EVERY 2400 HOURS:
- SP12 Check fuel injection pump
- SP15 Check and clean heat exchanger (marine only)

SERVICE POINT	PAGE	OPERATION		DAILY	50 Hours	100 Hours	200 Hours	600 Hours	2400 Hours
SP1	10,13	**ENGINE:** Check oil level		●					
SP2	13	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)		●				
SP6	14	Check valve clearances	1)		5)			●	
SP7	14,15	**FUEL SYSTEM:** Check primary filter	2)	●					
SP8	15	Change primary filter element	2) 3)				●		
SP9	14	Change secondary fuel filter	1) 3)				●		
SP10	15	Bleed the fuel system	3)						
SP11	15-17	Check injectors	1)					●	
SP12	17	Check fuel injection pump							●
SP13	10,17	**COOLING SYSTEM** Check cooling water level		●					
SP14	17,18	Check and flush cooling system						●	
SP15	18	Check and clean heat exchanger (marine)							●
SP16	18	Check and clean radiator fins (industrial)				●			
SP17	18	Change impeller in seawater pump (marine)	1) 3)					●	
SP18	19	**ELECTRICAL SYSTEM:** Check electrolyte level in batteries	1) 4)		●				
SP19	19	Check condition of batteries with hydrometer	1)					●	
SP20	19	**DRIVEN EQUIPMENT:** Clutch and PTO Service	2)						
SP21	19	**OUT OF SERVICE:** 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.

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 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
Below -10°F (-23°C)	SAE-5W	SAE 5-20W

Figure 5. Lube Oils

4. Some increase in oil consumption may be expected when SAE 5W and SAE 5-20W oils are used. Check oil level frequently.
5. Never put additives or flushing oil in crankcase.

SP1. CHECKING OIL LEVEL

1. Check the oil level in the crankcase with the dipstick. The oil level must be in the waffled area on stick. Never allow the level to go below this area. Follow the lubrication recommendations above.

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 RPM Delo Series 100, 30 weight or equivalent Service CC 30 weight oil during the first 100 hours.
   • Change the oil and filter again at 100 hours using the oil recommended in the above diagram. 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.
5. Dispose of waste oil in an approved manner.
6. Never use a flushing oil.
7. Loosen clamp on oil change tube. Remove cap. Drain oil. Replace cap and tube.
8. Refill engine with recommended oil.
9. Engine capacity oil filter is 2.1 gal. (8.2 liters)

SP3. CHANGING 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 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:
   24-03100

SP4. AIR FILTER

1. Inspect air cleaner every 100 hours. In dusty conditions, check more often.
2. M844, M844L, ML844, ML844L: Remove plate on bottom of air intake manifold. Inspect element. If dirty, wash element in soapy water. Rinse and dry thoroughly before reinstalling.
3. M16C, M20CL, NL844, NL844L: Element cannot be cleaned. Replace it when necessary. Part number: M16C, M20CL: 24-20001
   NL844, NL844L (element only): 314531127
4. ***NOTES:***
   • Make absolutely sure no impurities enter the engine while changing the element.
   • Do not run the engine with the air cleaner removed.
   • Do NOT clean 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 of the belt can be depressed about 3/16 in. (5mm.)

RETIGHTENING CYLINDER HEAD BOLTS

1. Retighten the head bolts after the first 50 hours.
2. Tighten bolts when the engine is cold.
3. Loosen the nuts and remove rocker arm cover.
4. Tighten head bolts with a torque wrench in order show in figures below. Tighten bolts evenly in 2 or 3 passes, ending at specified torque in final pass.
   All models: 65.1-68.7 ft/lbs (9.0-9.5 kg/m)

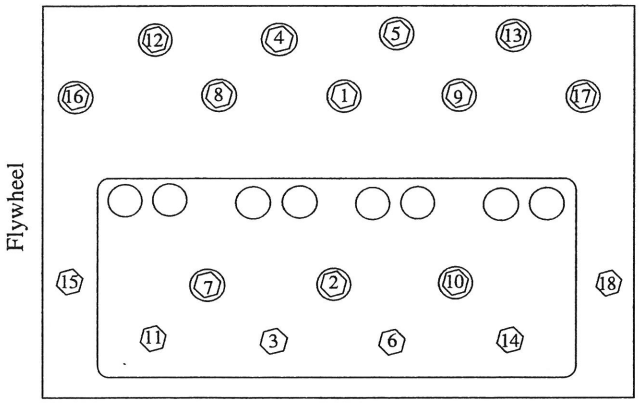


Figure 6. 844 and 844L Head Torque Sequence

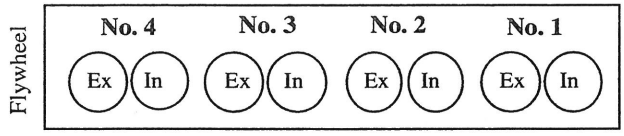


Figure 7. 844 and 844L Valve sequence

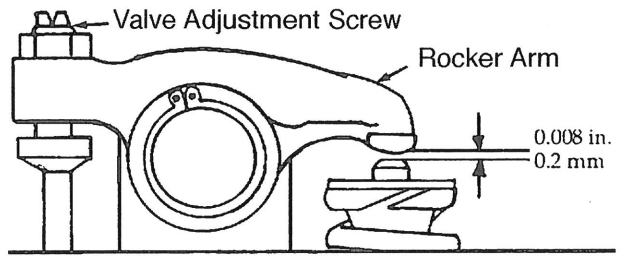


Figure 8 Valve Adjustment

SP6. VALVE CLEARANCES

1. Readjust valve clearance after first 50 hours of operation and every 600 hours thereafter.
2. Valve adjustments should be done after the cylinder head bolts have been retightened. Engine should be cold and NOT running.
3. 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.
4. Loosen the lock nut and adjust the clearance between the rocker arm and valve guide of both the intake and exhaust valves with the adjustment screw. Clearance on both intake and exhaust valves should be 0.008 in. (0.2 mm).
5. Repeat steps 3 and 4 for each cylinder. Each set of valves must be adjusted individually.
6. 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.)
2. Use fuel having less that 1% sulphur (preferably less that 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.

SP7-9. FUEL FILTERS

1. Your generator set should have a primary fuel filter installed. We recommend the Racor 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 element immediately.

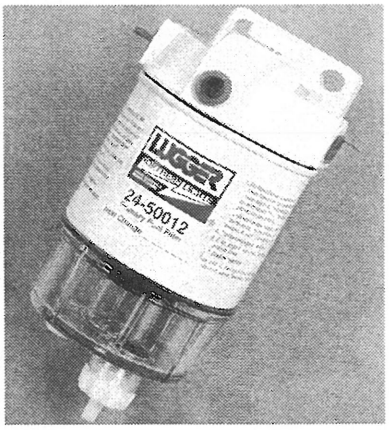


Figure 9. Primary Fuel Filter

2. Change secondary fuel filter every 200 hours.

NOTE: The fuel filter on the engine is considered the "secondary fuel filter."

a. 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 to gasket surface. Screw on until the gasket surface comes into contact with sealing surface of filter base. Then, tighten it two-thirds of a turn by hand. Do not overtighten.

b. Fuel filter part number is: 24-52020.

SP10. 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 bolt "A" (Figure 10) on top of filter. Pump hand primer "B" on fuel lift pump until pure fuel (no bubbles) escapes from bleed bolt "A". Tighten bleed screw "A".
3. Loosen bleed screw or bolt "C" (Figure 10). Pump hand primer "B" until pure fuel (no bubbles) escapes. Tighten bleed screw "C".
4. If the engine does not start after the above bleeding process, loosen a fuel line at the injector. Crank engine until pure fuel escapes. Tighten the connection. Do each line **one-at-a-time.**
5. After the engine has started use a piece of cardboard to look for fuel leaks.

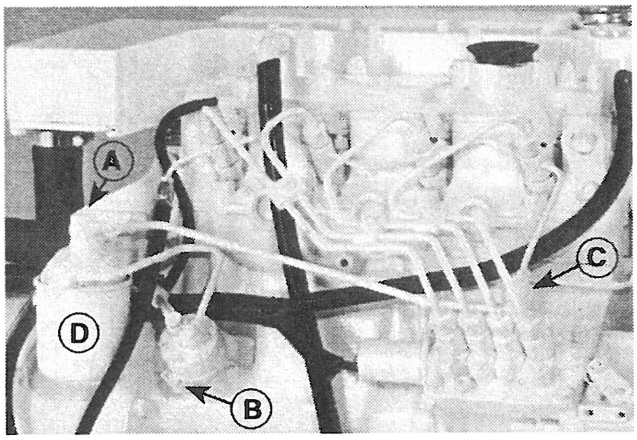


Figure 10. Fuel System Service Points

SP11. INJECTOR SERVICE

1. 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.

3. 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 (Figure 11).

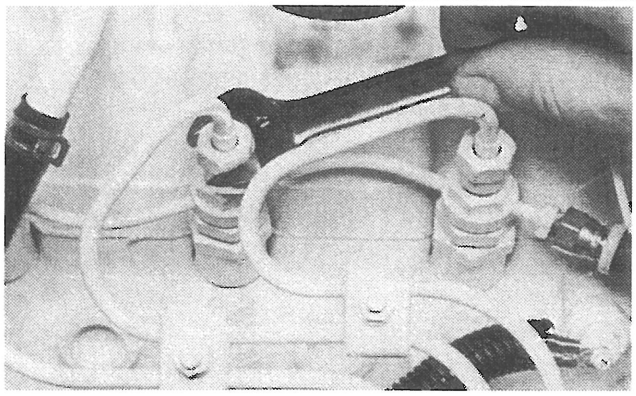


Figure 11. Remove Delivery Line Flare Nuts

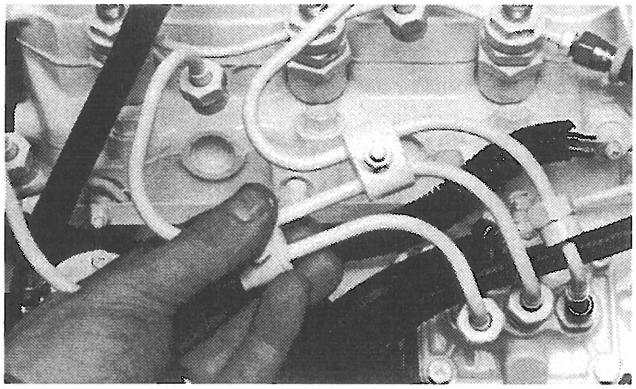


Figure 12. Remove Delivery Lines

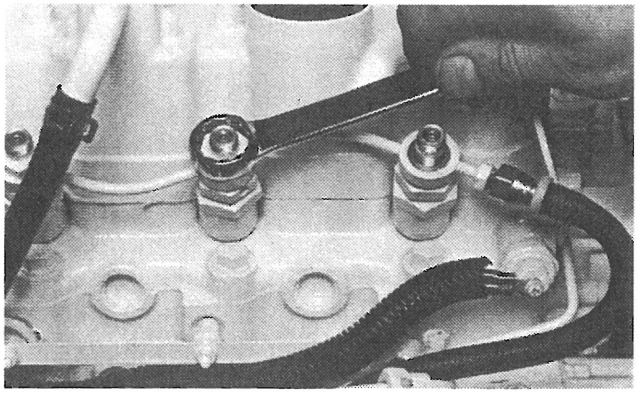


Figure 13. Remove Return Line Nuts

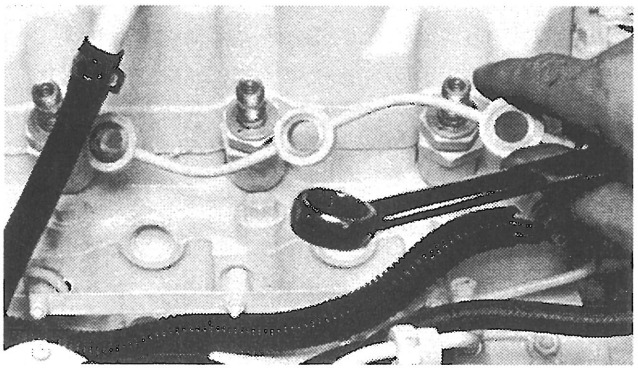


Figure 14. Remove Return Line

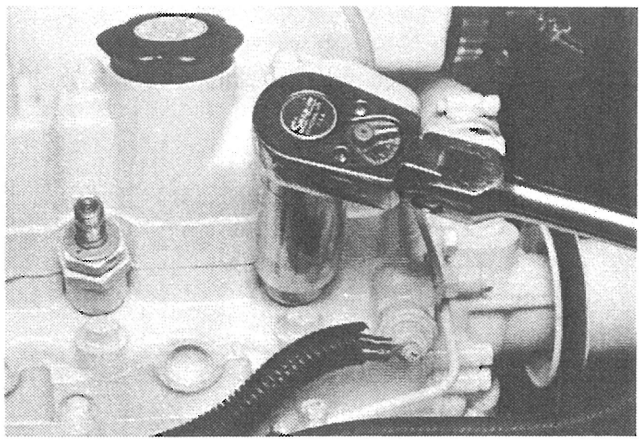


Figure 15. Unscrew Injector

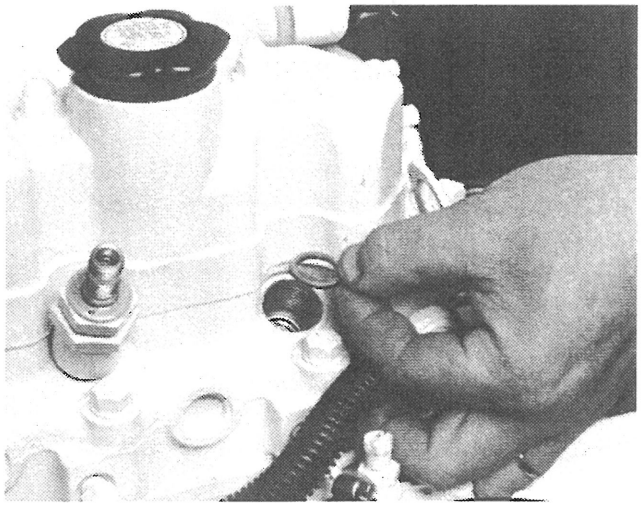


Figure 16. Remove and Replace Copper Sealing Washer

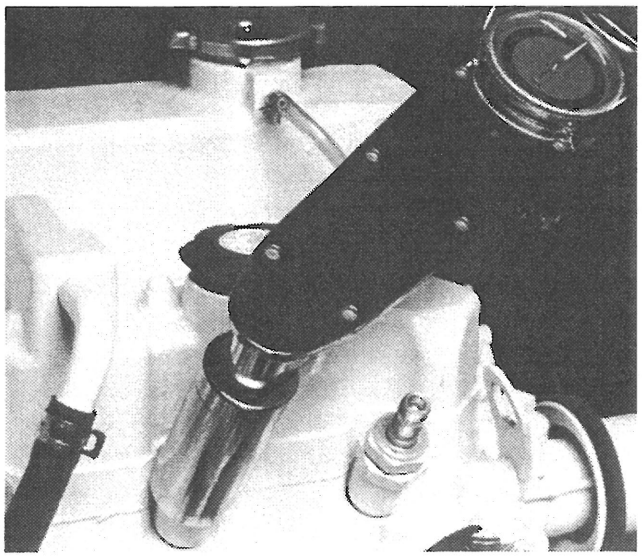


Figure 17. Reinstall Injector. Torque to Proper Tightness

SP11. INJECTOR SERVICE (CON'T.)

c. Remove delivery lines by disconnecting from injectors and injection pump (Figure 12.) 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.

d. Remove the return line retaining bolts (13.) Remove the return line (14.)

e. Unscrew and remove the injectors (15.)

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

f. After removing injectors, discard the copper sealing washers from the injector hole in the head (16.) Cover holes to prevent dirt and debris from entering cylinders.

4. Injector repair and cleaning: Take injectors to your Northern Lights dealer or local injection repair station for testing and service.
5. Injector installation:
   a. Install a new copper sealing washer in each injector hole (Figure 16.)
   b. Screw in injector and tighten to 44-51 ft/lbs (6 to 7 Kgm) (Figure 17.)

   NOTE: Overtightening can damage injector.

   c. Install return line using new sealing washer below each connection. Tighten return line retaining bolts to 22-30 ft/lbs.
   d. Install delivery lines. Leave loose at injectors for bleeding.
   e. Crank engine to fill lines. Tighten lines at injectors to 11-18 ft./lbs. Start engine and check for leaks using a piece of paper or cardboard. **DO NOT use hand to check for leaks.**

SP12. 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 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 malfunction. Before servicing the pump, check other possible causes:
   a. Check cleanliness of 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 ***NOTE: All warranties on the engine become null and void if the injection pump seals are broken by unauthorized persons.***

COOLING SYSTEM - GENERAL

NOTE: Marine sets–Be sure to close the seacock before working on the engine cooling system.

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.

SP13. CHECK THE COOLANT LEVEL

1. Check the coolant level each day before starting the engine. Remove the pressure cap from the expansion tank or 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.
2. The pressure valve in the filler cap releases when the pressure is approximately 7 PSI (0.5 bar.) Use a cap pressure tester to check cap if you suspect it is faulty.

SP14. COOLING SYSTEM FLUSHING

1. Flush the cooling system every 600 hours or every 12 months, whichever comes first.
   MARINE:
   a. Remove expansion tank cap and drain engine block.
   b. Open block drain cock. Remove hose from bottom of heat exchanger tank.
   c. Pour clean water into expansion tank until water coming from drains is free of discoloration and sediment. Let water drain completely. Close drains and refill with recommended mixture.

INDUSTRIAL:

a. Remove radiator cap and open drain cocks on radiator and engine block.
b. Pour clean water into radiator until water coming from radiator is clear of discoloration.
c. Close the radiator drain and continue flushing until water from engine drain is clear.
d. Open all drain cocks and drain completely.
e. Close drain cock and refill with recommended coolant mixture.
f. Clean leaves, dust and other debris off radiator fins .

2. Coolant Specifications.
   Use 50% water/50% ethylene glycol antifreeze mix. Antifreeze mixture is recommended as a good year-round coolant.
3. Check hoses and connections and repair any leakage.

SP15. HEAT EXCHANGER (MARINE)

1. Clean the heat exchanger core once a year or after 2400 hours of operation.
2. Drain expansion tank and heat exchanger.
3. Remove heat exchanger end covers and remove core.
4. Clean the inside of exchanger core tubes using a metal rod. Flush, inspect and clean again if necessary.
5. Reassemble. Fill the cooling system, start the engine and check for leaks.

SP16. CLEAN RADIATOR (INDUSTRIAL)

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.

SP17. RAW WATER PUMP (MARINE)

1. Change the seawater pump impeller every 600 hours, or as needed.
2. Remove the pump end cover. Pry out the impeller using needle-nose pliers or two screwdrivers. Be sure you remove all pieces of failed impeller. ***NOTE: Place some kind of protection under the screwdrivers in order not to damage the pump housing.***
3. Clean the inside of the housing.
5. Press in the new impeller and place the sealing washers in the outer end of the impeller center if this has not already been done.
6. Replace the cover using a new gasket. ***NOTE: Make sure that there is always an extra impeller and cover gasket in reserve on board.***

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.

ELECTRICAL SYSTEM - GENERAL

1. Never switch 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.

GLOW PLUGS

1. Each cylinder is supplied with a glow plug which serves to heat the combustion chamber.
2. To check the glow plugs, loosen the current carrying flat wire between the plus-poles of the glow plugs (Figure 18.) Connect a DC test bulb between the plus-pole of the battery and the plus-pole of the glow plug. If the bulb lights up, the glow plug is functioning properly.
3. Check all glow plugs and replace any faulty ones.

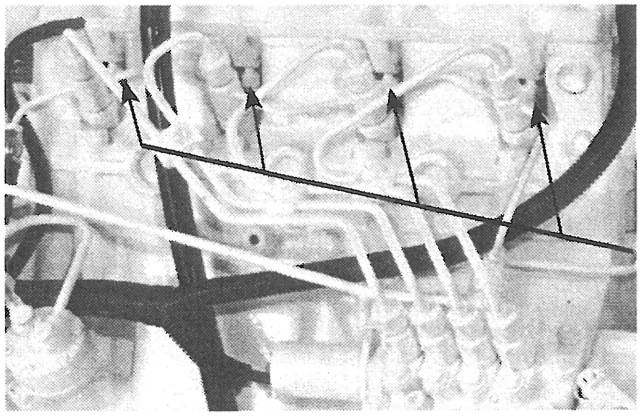


Figure 18. Glow Plugs (behind injectors)

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.

BOOSTER BATTERIES

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. (See Figure 19.)
4. Remove booster battery after starting engine.
5. Sealed batteries: See manufacturer charging and booster instructions.

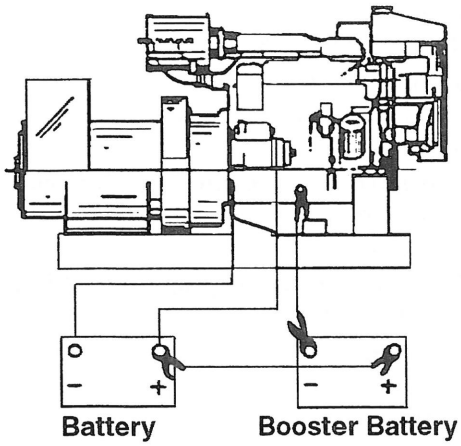


Figure 19. Booster Battery Connections

SP18-19. BATTERY CARE

1. Check electrolyte level every 50 hours or once per month. Add distilled water to manufacturers 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.

SP20. PTO

1. Manufacturer's service recommendations vary. See your Owner's Manual for service information. If you do not have a manual, see your local dealer for the equipment in question. *Note: Some PTO's have rigid lubrication requirements. Follow service recommendations closely.*

SP21. WINTERIZING, OUT-OF-SERVICE

MARINE:

Remember to close seacocks before opening drain cocks.

1. Drain fresh water and seawater cooling systems completely. Flush fresh water system and refill with proper antifreeze mixture.
2. Drain water supply lines and wet exhaust line.
3. Loosen the seawater pump cover and drain pump.

INDUSTRIAL:

1. Drain and flush radiator and cooling system. Refill with antifreeze-water mixture. 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. Store the set in a dry, protected place. If unit must be stored outside, be sure it is well protected with a cover.

MARINE AND INDUSTRIAL:

1. Change the crankcase oil and filter.
2. Loosen the alternator belt.
3. Disconnect and clean battery. Remove to warm storage place if possible.
4. Clean outside of unit. Paint any scratched or chipped surfaces. Put corrosion preventative on all exposed metal surfaces.

TROUBLESHOOTING

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

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.

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 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.

Overheated engine:
- See "Engine Overheats" in next category.

TROUBLESHOOTING

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

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.
- See your local 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.

Keel cooling tubes have been painted (marine.)
- Remove paint from tubes.

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.

Water pump impeller worn/broken (marine.)
- Check impeller and replace 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.

NORTHERN LIGHTS M844 DATA SHEET

Kilowatt Rating Prime ..... 16 kW ..... Common ..... 12 kW
Rated RPM/Frequency ..... 1800/60Hz ..... Data 1500/50Hz

General Information

Engine Type ..... Lugger 4 cycle, swirl chamber, diesel
Cylinders ..... Inline 4
Displacment ..... 121in³ (1.995 liters)
Cycles 4
Bore x Stroke ..... 3.3 x 3.5 in (84 x 90 mm)
Rotation (Facing Flywheel) ..... counter-clockwise
Compression Ratio 22:1
Crankcase Capacity including Oil Filter ..... 2.1 gal (8.2 liter)
Aspiration ..... Natural
Flywheel Housing Size ..... SAE 4
Flywheel Drive Size ..... 7.5 in. (190.5 mm)
Rated Flywheel HP ..... 26 HP ..... 21.5 HP
Dry Weight w/H.E. ..... 860 lbs. (390 kg)
Length ..... 45.9 in (1166 mm)
Width ..... 19.2 in (487 mm)
Height ..... 26.9 in (684 mm)

Cooling System

Approx. Coolant Cap. ..... 1.2 gal (4.5 liter)
Minimum Through Hull Dia. ..... 3/4 in (20 mm)
Sea Water Pump Inlet Hose ID ..... 3/4 in (20 mm)
Minimum Sea Water Discharge ..... 3/4 in (20 mm)
Heat Rejection to Jacket Coolant ..... 1018 BTU/min ..... 763 BTU/min
Fresh Water Pump Cap. ..... 12.9 gpm (49 lpm) ..... 10.7 gpm (40 lpm)
Seawater Pump Cap. ..... 9.0 gpm (34 lpm) ..... 7.5 gpm (28 lpm)
Maximum Seawater Pump Suction Head ..... 39 in (1M)
Keel Cooler TurboTube Length ..... 4 feet (1.2 M)
Keel Cooler Head Dia. ..... 1 in (25.4 mm)
Keel Cooler Water Hose ID ..... 1.25 in (31.5 mm)

D.C. Electrical

Minimum Battery Capacity ..... 120 Amp Hour
Battery Cable Size ..... '0'
Starting Voltage, Negative Ground. ..... 12 Volt

A.C. Electrical

120/240 Volt Amperage ..... 66.6 amps ..... –
120 Volt Amperage ..... 133.2 amps ..... –
110/220 Volt Amperage ..... – ..... 54.5 amps
240 Volt Amperage ..... – ..... 50.0 amps
110 Volt Amperage ..... – ..... 109.0 amps
Phase ..... 1 Phase Std./3 Phase Opt.

Air Intake and Exhaust

Generator Cooling Air Flow
Single and Three Phase ..... 441 cFm (12.6 m³/min) ..... 315 cFm(9m³/min)
Air Consumption ..... 65 cfm (1.8 M³/m) ..... 54 cfm (1.5 M³/m)
Maximum Exhaust Backpressure ..... 48 in (1219 mm) H_2O
Wet Exhaust Elbow OD ..... 2 in (51 mm)
Exhaust Gas Volume ..... 153 cfm (4.3 M³/m) ..... 127 cfm (3.6 M³/m)
Exhaust Gas Temperature ..... 1022 degree F (550 degree C)

Fuel System

Minimum Suction Line ..... 5/16-.3125 in (7.9 mm)
Minimum Return Line ..... 5/16-.3125 in (7.9 mm)
Maximum Fuel Pump Suction Head ..... 39 in (1M)
Specific Fuel Consumption at Max. Load ..... 185 grams/hp/hr
Approximate Fuel Rate at Max. Load ..... 1.38 US gph (5.2 lph) ..... 1.23 US gph (4.65 lph)

Maximum Engine Operating Angle (degrees)

	Front Down	Rear Down	Left Down	Right Down
Continuous Operation (More than two minutes requires use of a remote expansion tank)	0	0-10	0-20	0-20
Intermittent Operation (Sustained up to two minutes)	0-35	0-35	0-35	0-35

NORTHERN LIGHTS M844L (LONG STROKE) DATA SHEET

Kilowatt Rating Prime ..... 20 kW ..... Common ..... 16 kW
Rated RPM/Frequency ..... 1800/60Hz ..... Data 1500/50Hz

General Information

Engine Type ..... Lugger 4 cycle, swirl chamber diesel
Cylinders ..... Inline 4
Displacment ..... 135 in³ (2.216 L)
Cycles 4
Bore x Stroke ..... 3.3 x 3.9 in (84 x 100 mm)
Rotation (Facing Flywheel) ..... counter-clockwise
Compression Ratio 22:1
Crankcase Capacity including Oil Filter ..... 2.1 gal (8.0 liter)
Aspiration ..... Natural
Flywheel Housing Size ..... SAE 4
Flywheel Drive Size ..... 7.5 in. (190.5 mm)
Rated Flywheel HP ..... 32 HP ..... 26.5 HP
Dry Weight w/H.E. ..... 940 lbs. (426 kg)
Length ..... 45.9 in (1166 mm)
Width ..... 19.2 in (487 mm)
Height ..... 27.8 in (705 mm)

Cooling System

Approx. Coolant Cap. ..... 1.3 gal (4.8 liters)
Minimum Through Hull Dia. ..... 3/4 in (20mm)
Sea Water Pump Inlet Hose ID ..... 3/4 in (20mm)
Minimum Sea Water Discharge ..... 3/4 in (20 mm)
Heat Rejection to Jacket Coolant ..... 1273 BTU/min ..... 1019 BTU/min
Fresh Water Pump Cap. ..... 12.9 gpm (49 lpm) ..... 10.7 gpm (40 lpm)
Seawater Pump Cap. ..... 9.0 gpm (34 lpm) ..... 7.5 gpm (28 lpm)
Maximum Seawater Pump Suction Head ..... 39 in (1M)
Keel Cooler Turbo Tube Length ..... 5 feet (1.5 M)
Keel Cooler Head Dia. ..... 1 in (25.4 mm)
Keel Cooler Water Hose ID ..... 1.25 in (31.5 mm)

D.C. Electrical

Minimum Battery Capacity ..... 120 Amp Hour
Battery Cable Size ..... '0'
Starting Voltage, Negative Ground. ..... 12 Volt

A.C. Electrical

120/240 Volt Amperage ..... 83.3 amps ..... –
120 Volt Amperage ..... 166.6 amps ..... –
110/220 Volt Amperage ..... – ..... 78.7 amps
240 Volt Amperage ..... – ..... 66.6 amps
110 Volt Amperage ..... – ..... 145.4 amps
Phase ..... 1 Phase Std./3 Phase Opt.

Air Intake and Exhaust

Generator Cooling Air Flow
Single and Three Phase ..... 483 cFm (13.8 m³/min) ..... 441 cFm(12.6 m³/min)
Air Consumption ..... 72 cfm (2.0 M³/m) ..... 60 cfm (1.7 M³/m)
Maximum Exhaust Backpressure ..... 48 in (1219 mm) H_2O
Wet Exhaust Elbow OD ..... 2 in (51 mm)
Exhaust Gas Volume ..... 171 cfm (4.8 M³/m) ..... 142 cfm (4.0 M³/m)
Exhaust Gas Temperature ..... 1022 degrees F (550 degrees C)

Fuel System

Minimum Suction Line ..... 5/16-.3125 in (7.9 mm)
Minimum Return Line ..... 5/16-.3125 in (7.9 mm)
Maximum Fuel Pump Suction Head ..... 39 in (1M)
Specific Fuel Consumption at Max. Load ..... 185 grams/hp/hr
Approximate Fuel Rate at Max. Load ..... 1.73 US gph (6.5 lph) ..... 1.38 US gph (5.2 lph)

Maximum Engine Operating Angle (degrees)

	Front Down	Rear Down	Left Down	Right Down
Continuous Operation (More than two minutes requires use of a remote expansion tank)	0	0-10	0-20	0-20
Intermittent Operation (Sustained up to two minutes)	0-35	0-35	0-35	0-35

NORTHERN LIGHTS ML844 DATA SHEET

Kilowatt Rating Prime ..... **16 kW** ..... **Common** ..... **12 kW**
Rated RPM/Frequency ..... **1800/60Hz** ..... **Data** **1500/50Hz**

General Information

Engine Type ..... Lugger 4 cycle, swirl chamber, diesel
Cylinders ..... Inline 4
Displacment ..... 121in³ (1.995 liters)
Cycles 4
Bore x Stroke ..... 3.3 x 3.5 in (84 x 90 mm)
Rotation (Facing Flywheel) ..... counter-clockwise
Compression Ratio 22:1
Crankcase Capacity including Oil Filter ..... 2.1 gal (8.2 liter)
Aspiration ..... Natural
Flywheel Housing Size ..... SAE 4
Flywheel Drive Size ..... 7.5 in. (190.5 mm)
Rated Flywheel HP ..... 26 HP ..... 21.5 HP
Dry Weight w/H.E. ..... 840 lbs. (381kg)
Length ..... 45.2 in (1149 mm)
Width ..... 19.3 in (490 mm)
Height ..... 26.7 in (678 mm)

Cooling System

Approx. Coolant Cap. ..... 1.2 gal (4.5 liter)
Minimum Through Hull Dia. ..... 3/4 in (20 mm)
Sea Water Pump Inlet Hose ID ..... 3/4 in (20 mm)
Minimum Sea Water Discharge ..... 3/4 in (20 mm)
Heat Rejection to Jacket Coolant ..... 1018 BTU/min ..... 763 BTU/min
Fresh Water Pump Cap. ..... 12.9 gpm (49 lpm) ..... 10.7 gpm (40 lpm)
Seawater Pump Cap. ..... 9.0 gpm (34 lpm) ..... 7.5 gpm (28 lpm)
Maximum Seawater Pump Suction Head ..... 39 in (1M)
Keel Cooler TurboTube Length ..... 4 feet (1.2 M)
Keel Cooler Head Dia. ..... 1 in (25.4 mm)
Keel Cooler Water Hose ID ..... 1.25 in (31.5 mm)

D.C. Electrical

Minimum Battery Capacity ..... 120 Amp Hour
Battery Cable Size ..... '0'
Starting Voltage, Negative Ground. ..... 12 Volt

A.C. Electrical

120/240 Volt Amperage ..... 66.6 amps ..... –
120 Volt Amperage ..... 133.2 amps ..... –
110/220 Volt Amperage ..... – ..... 54.5 amps
240 Volt Amperage ..... – ..... 50.0 amps
110 Volt Amperage ..... – ..... 109.0 amps
Phase ..... 1 Phase Std./3 Phase Opt.

Air Intake and Exhaust

Generator Cooling Air Flow
Single and Three Phase ..... 441 cFm (12.6 m³/min) ..... 315 cFm(9m³/min)
Air Consumption ..... 65 cfm (1.8 M³/m) ..... 54 cfm (1.5 M³/m)
Maximum Exhaust Backpressure ..... 48 in (1219 mm) H_2O
Wet Exhaust Elbow OD ..... 2 in (51 mm)
Exhaust Gas Volume ..... 153 cfm (4.3 M³/m) ..... 127 cfm (3.6 M³/m)
Exhaust Gas Temperature ..... 1022 degree F (550 degree C)

Fuel System

Minimum Suction Line ..... 5/16-.3125 in (7.9 mm)
Minimum Return Line ..... 5/16-.3125 in (7.9 mm)
Maximum Fuel Pump Suction Head ..... 39 in (1M)
Specific Fuel Consumption at Max. Load ..... 185 grams/hp/hr
Approximate Fuel Rate at Max. Load ..... 1.38 US gph (5.2 lph) ..... 1.23 US gph (4.65 lph)

Maximum Engine Operating Angle (degrees)

Continuous Operation (More than two minutes	Front Down	Rear Down	Left Down	Right Down
requires use of a remote expansion tank)	0	0-10	0-20	0-20
Intermittent Operation (Sustained up to two minutes)	0-35	0-35	0-35	0-35

NORTHERN LIGHTS ML844L (LONG STROKE) DATA SHEET

Kilowatt Rating Prime ..... 20 kW ..... Common ..... 16 kW
Rated RPM/Frequency ..... 1800/60Hz ..... Data 1500/50Hz

General Information

Engine Type ..... Lugger 4 cycle, swirl chamber diesel
Cylinders ..... Inline 4
Displacment ..... 135 in³ (2.216 L)
Cycles 4
Bore x Stroke ..... 3.3 x 3.9 in (84 x 100 mm)
Rotation (Facing Flywheel) ..... counter-clockwise
Compression Ratio 22:1
Crankcase Capacity including Oil Filter ..... 2.1 gal (8.0 liter)
Aspiration ..... Natural
Flywheel Housing Size ..... SAE 4
Flywheel Drive Size ..... 7.5 in. (190.5 mm)
Rated Flywheel HP ..... 32 HP ..... 26.5 HP
Dry Weight w/H.E. ..... 961 lbs. (436 kg)
Length ..... 47.7 in (1212 mm)
Width ..... 19.3 in (490 mm)
Height ..... 27.5 in (699 mm)

Cooling System

Approx. Coolant Cap. ..... 1.3 gal (4.8 liters)
Minimum Through Hull Dia. ..... 3/4 in (20mm)
Sea Water Pump Inlet Hose ID ..... 3/4 in (20mm)
Minimum Sea Water Discharge ..... 3/4 in (20 mm)
Heat Rejection to Jacket Coolant ..... 1273 BTU/min ..... 1019 BTU/min
Fresh Water Pump Cap. ..... 12.9 gpm (49 lpm) ..... 10.7 gpm (40 lpm)
Seawater Pump Cap. ..... 9.0 gpm (34 lpm) ..... 7.5 gpm (28 lpm)
Maximum Seawater Pump Suction Head ..... 39 in (1M)
Keel Cooler Turbo Tube Length ..... 5 feet (1.5 M)
Keel Cooler Head Dia. ..... 1 in (25.4 mm)
Keel Cooler Water Hose ID ..... 1.25 in (31.5 mm)

D.C. Electrical

Minimum Battery Capacity ..... 120 Amp Hour
Battery Cable Size ..... '0'
Starting Voltage, Negative Ground. ..... 12 Volt

A.C. Electrical

120/240 Volt Amperage ..... 83.3 amps ..... –
120 Volt Amperage ..... 166.6 amps ..... –
110/220 Volt Amperage ..... – ..... 78.7 amps
240 Volt Amperage ..... – ..... 66.6 amps
110 Volt Amperage ..... – ..... 145.4 amps
Phase ..... 1 Phase Std./3 Phase Opt.

Air Intake and Exhaust

Generator Cooling Air Flow
Single and Three Phase ..... 483 cFm (13.8 m³/min) ..... 441 cFm(12.6 m³/min)
Air Consumption ..... 72 cfm (2.0 M³/m) ..... 60 cfm (1.7 M³/m)
Maximum Exhaust Backpressure ..... 48 in (1219 mm) H_2O
Wet Exhaust Elbow OD ..... 2 in (51 mm)
Exhaust Gas Volume ..... 171 cfm (4.8 M³/m) ..... 142 cfm (4.0 M³/m)
Exhaust Gas Temperature ..... 1022 degrees F (550 degrees C)

Fuel System

Minimum Suction Line ..... 5/16-.3125 in (7.9 mm)
Minimum Return Line ..... 5/16-.3125 in (7.9 mm)
Maximum Fuel Pump Suction Head ..... 39 in (1M)
Specific Fuel Consumption at Max. Load ..... 185 grams/hp/hr
Approximate Fuel Rate at Max. Load ..... 1.73 US gph (6.5 lph) ..... 1.38 US gph (5.2 lph)

Maximum Engine Operating Angle (degrees)

	Front Down	Rear Down	Left Down	Right Down
Continuous Operation (More than two minutes requires use of a remote expansion tank)	0	0-10	0-20	0-20
Intermittent Operation (Sustained up to two minutes)	0-35	0-35	0-35	0-35

NORTHERN LIGHTS M20CL DATA SHEET

Kilowatt Rating Prime ..... 20 kW ..... Common ..... 16 kW
Rated RPM/Frequency ..... 1800/60Hz ..... Data 1500/50Hz

General Information

Engine Type ..... Lugger 4 cycle, swirl chamber diesel
Cylinders ..... Inline 4
Displacment ..... 135 in^3 (2.216 L)
Cycles 4
Bore x Stroke ..... 3.3 x 3.9 in (84 x 100 mm)
Rotation (Facing Flywheel) ..... counter-clockwise
Compression Ratio 22:1
Crankcase Capacity including Oil Filter ..... 2.1 gal (8.0 liter)
Aspiration ..... Natural
Flywheel Housing Size ..... SAE 4
Flywheel Drive Size ..... 7.5 in. (190.5 mm)
Rated Flywheel HP ..... 32 HP ..... 26.5 HP
Dry Weight ..... 890 lbs. (403 kg)
Length ..... 47.75 in (1213 mm)
Width ..... 21 in (533 mm)
Height ..... 33 in 838 mm)

Cooling System

Approx. Coolant Cap. ..... 1.3 gal (4.8 liters)
Minimum Through Hull Dia. ..... 3/4 in (20mm)
Sea Water Pump Inlet Hose ID ..... 3/4 in (20mm)
Minimum Sea Water Discharge ..... 3/4 in (20 mm)
Heat Rejection to Jacket Coolant ..... 1273 BTU/min ..... 1019 BTU/min
Fresh Water Pump Cap. ..... 12.9 gpm (49 lpm) ..... 10.7 gpm (40 lpm)
Seawater Pump Cap. ..... 9.0 gpm (34 lpm) ..... 7.5 gpm (28 lpm)
Maximum Seawater Pump Suction Head ..... 39 in (1M)
Keel Cooler Turbo Tube Length ..... 5 feet (1.5 M)

D.C. Electrical

Minimum Battery Capacity ..... 120 Amp Hour
Battery Cable Size ..... '0'
Starting Voltage, Negative Ground. ..... 12 Volt

A.C. Electrical

120/240 Volt Amperage ..... 83.3 amps ..... –
120 Volt Amperage ..... 166.6 amps ..... –
110/220 Volt Amperage ..... – ..... 78.7 amps
240 Volt Amperage ..... – ..... 66.6 amps
110 Volt Amperage ..... – ..... 145.4 amps
Phase ..... 1 Phase Std./3 Phase Opt.

Air Intake and Exhaust

Generator Cooling Air Flow
Single and Three Phase ..... 287 cFm (8.1 m^3/min) ..... 239 cFm(6.7 m^3/min)
Air Consumption ..... 70 cfm (2.0 M^3/m) ..... 60 cfm (1.7 M^3/m)
Maximum Exhaust Backpressure ..... 48 in (1219 mm) H_2O
Wet Exhaust Elbow OD ..... 2 in (51 mm)
Exhaust Gas Volume ..... 171 cfm (4.8 M^3/m) ..... 142 cfm (4.0 M^3/m)
Exhaust Gas Temperature ..... 1022 degrees F (550 degrees C)

Fuel System

Minimum Suction Line ..... 5/16-.3125 in (7.9 mm)
Minimum Return Line ..... 5/16-.3125 in (7.9 mm)
Maximum Fuel Pump Suction Head ..... 39 in (1M)
Specific Fuel Consumption at Max. Load ..... 185 grams/hp/hr
Approximate Fuel Rate at Max. Load ..... 1.73 US gph (6.5 lph) ..... 1.38 US gph (5.2 lph)

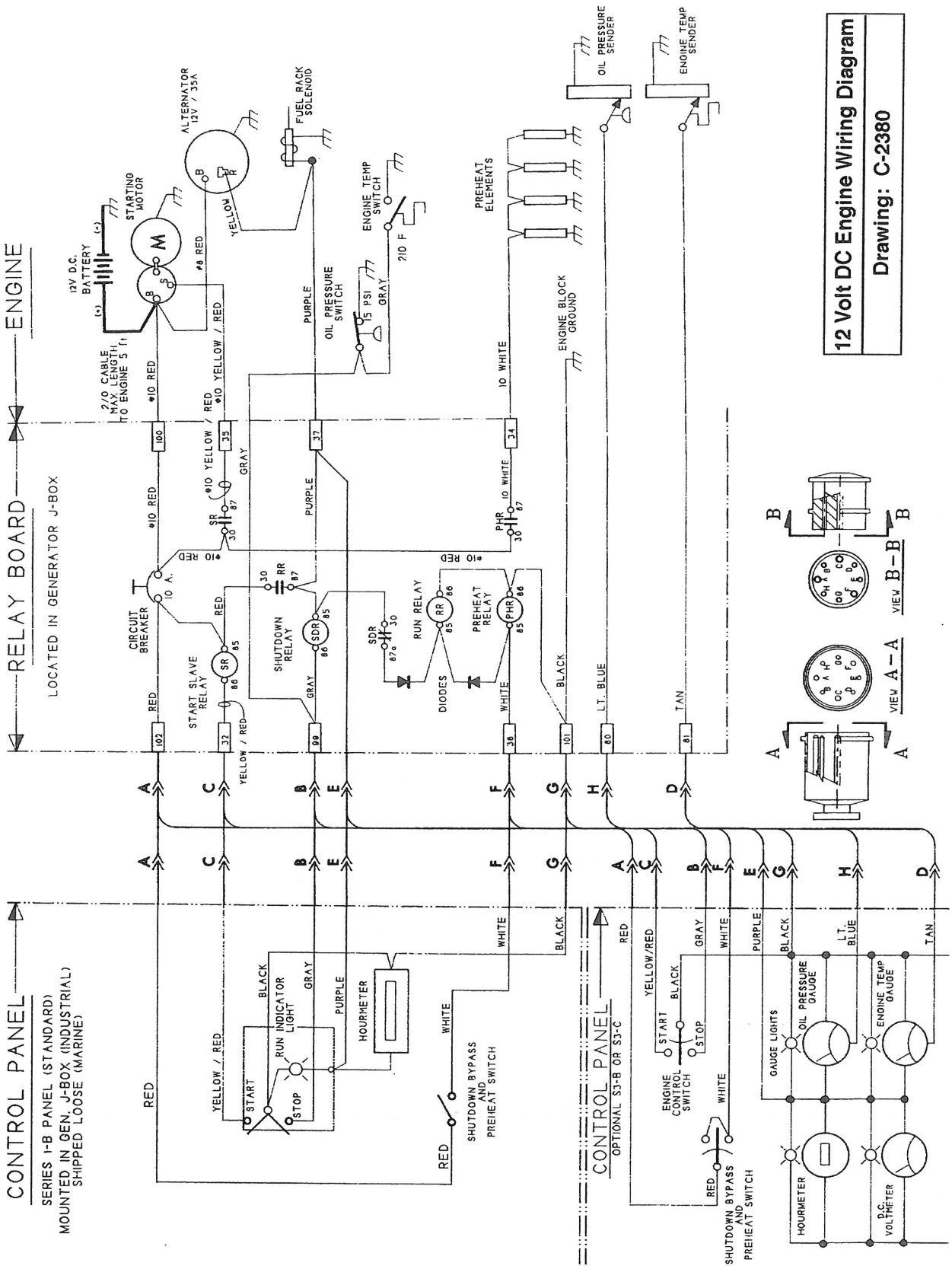
Maximum Engine Operating Angle (degrees)

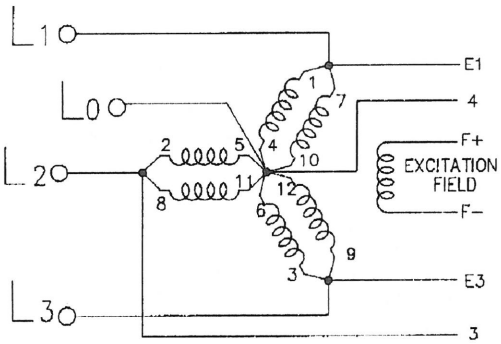
	Front Down	Rear Down	Left Down	Right Down
Continuous Operation (More than two minutes requires use of a remote expansion tank)	0	0-10	0-20	0-20
Intermittent Operation (Sustained up to two minutes)	0-35	0-35	0-35	0-35

NORTHERN LIGHTS NL844L (LONG STROKE, INDUSTRIAL) DATA SHEET

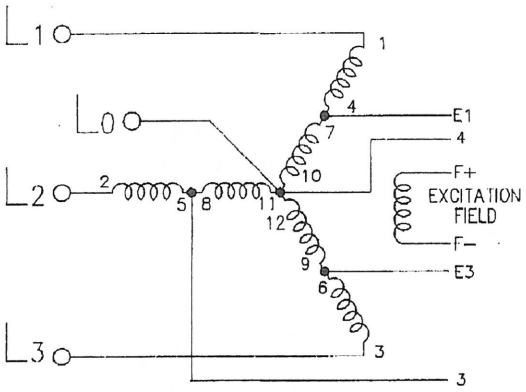
RPM/Frequency/kW	1800/60Hz/20 kW	Common	1500/50Hz/16 kW
General Information			
Engine Type	Lugger 4 cycle,swirl chamber diesel		
Cylinders	Inline 4		
Aspiration	Natural		
Displacement	135 in³ (2.216 liters)		
Piston Speed	1170 ft/sec (21400 M/min)		975 ft/sec (17833 M/min)
Bore x Stroke	3.3 x 3.9 in (84 x 100 mm)		
Rotation (Facing Flywheel)	counter-clockwise		
Compression Ratio	22:1		
Crankcase Capacity including Oil Filter	2.1 gal (8.0 liters)		
Flywheel Housing Size	SAE 4		
Flywheel Drive Size	7.5 in (190.6 mm)		
Rated Horsepower	30.5 HP w/fan (32 w/o fan)		25.5 HP w/fan (26.5 w/o fan)
Brake mean effective pressure	104 psi (711 kPa)		86 psi (589 kPa)
Approximate Dry Weight	1056 lbs (479 kg)		
Length x Height x Width	63.7"x21.4' x 35.1" (162x 54x35mm)		
Cooling System			
Coolant Capacity engine only	0.87 gal (3.3 liters)		
Jacket Water Pump Capacity	12.9 gpm (49 lpm)		10.7 gpm (40 lpm)
Maximum static pressure of coolant	6.5 psi (0.45 kg/ccm)		
Recommended pressure cap	12.7 psi (0.9 kg/ccm)		
Maximum external pressure loss in cooling system	2.8 psi (0.19 kg/ccm)		
Standard thermostat modulating range	179-194 degrees F (82-90 degrees C)		
Maximum coolant temperature	230 degrees F (110 degrees C)		
Minimum allowable coolant expansion space	0.11 gal (0.4 liters)		
Radiator capacity	1.2 gal (4.5 liters)		
Cooling fan air flow	1690 cfm (48 m³/m)		1340 cvfm (38 m³/m)
Allowable restriction	3 in (76 mm) H_2O		
Ventilation Requirements			
Engine combustion air consumption @ 77deg.F (25deg.C) Prime	70 f³m (2 m³/m)		60 f³m (1.7 m³/m)
Heat radiated by engine	50 btu/min		38 btu/min
Heat dissipated by generator fan	127 btu/min		95 btu/min
Generator cooling fan capacity	287cFm (8.1 m³/min)		239 cFm (6.7m³/min)
Maximum allowable air intake restriction	Clean Element 10 in (250 mm)H_2O		
	Dirty Element 25 in (638 mm) H_2O		
Heat rejected to coolant	1273 Btu/min		1019 Btu/min
Exhaust System			
Exhaust gas flow at rated speed	171 cfm 4.85 M³/m)		142 cfm (4.02 M³/m
Exhaust gas temperature at rated speed	1022 degrees F (550 degrees C)		
Maximum allowable backpressure	48 in. (1219 mm) H_2O		
Minimum exhaust pipe size	2 in (51 mm)		
Fuel System			
Fuel injection pump type	In-line Bosch type		
Minimum suction line	5/16 in (7.9 mm)		
Minimum return line	5/16 in (7.9 mm)		
Fuel pump suction and return size, female	1/4 in NPT		
Maximum fuel pump suction head	39 in (1M)		
Maximum fuel flow to pump	4.1 gph (15.5 lph)		3.6 gph (13.6 lph)
Maximum fuel spill rate	4.0 gph (15.1 lph)		3.5 gph (13.2 lph)
Fuel temperature used for engine rating	104 degrees F (40degrees C)		
Derating for fuel temperature above 104 degrees F	Consult factory		
Derating for high altitude	3% per 1000 ft.		
Recommended fuel type	ASTM D975 Nos. 1 & 2		
Cetane Rating	Minimum 45		
Brake specific fuel consumption at max. load	185 grams/hp/hr		
Approx. fuel consumption @ 100% load	1.73 US gph (6.5 lph)		1.38 US gph (5.2 lph)
A.C. Electrical			
AC Output ratings	20 kW		16 kW
Number of poles	4		
Standard output: 1 Phase, 1.0 power factor. Optional voltages (zig zag)	120/240 volts		110/220, 115/230 volts
Optional output: 3 Phase, .8 power factor			
Standard low voltage (wye)	120/208 volts		127/220 volts
Standard high voltage (wye)	277/480 volts		220/380 volts
Opt. voltages (wye)	127/220, 139/240, 220/380, 240/416, 254/480110/190, 120/208, 240/416		
Optional voltages (delta)	120/240volts		
Rated ambient air temperature	104 degrees F (40 degrees C)		
Rated temperature rise	221 degrees F(105 degrees C)		
Insulation class	F/H		
Lubrication System			
System Capacity High level	2.1 gal (6.5 liter)		
Oil pressure shutdown	14.2 psi (1.0 Kg/ccm)		
Lube oil filter type	Spin-on		
Lube oil type	API CC/CD		
Maximum lube oil temperature	240 degrees F (115 degrees C)		
D.C. Electrical			
Minimum Battery Capacity	120 Amp Hours		
Battery Cable Size	'0'		
Standard system is negative ground.	12 Volts		
Starter rolling current at 32 degrees F	650 Amp.		
Alternator charging capacity	35 Amp		

D.C. WIRING DIAGRAM

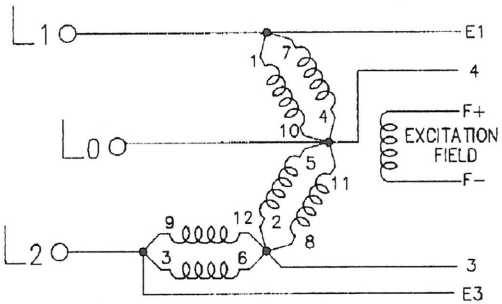




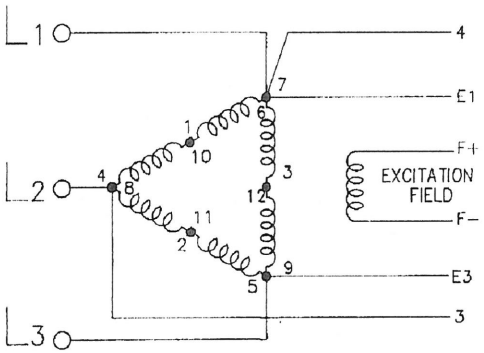
208Y/120V 3 PH 60 Hz
(220Y/110V 3 PH 50 Hz)
(PARALLEL WYE)



480Y/277V 3 PH 60 Hz
(380Y/220V 3 PH 50 Hz)
(HIGH-WYE)



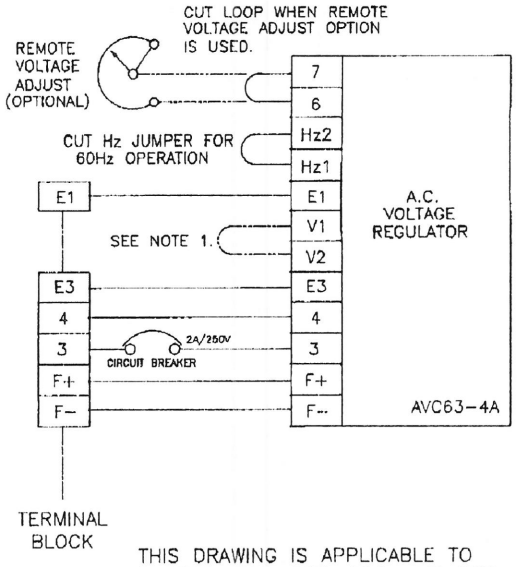
240/120V 1 PH 60 Hz
(220/110V 1 PH 50 Hz)
(ZIG-ZAG)



240V 3 PH 60 Hz
(220V 3 PH 50 Hz)
(SERIES DELTA)

NOTES:

1. FOR 120V NOMINAL SENSING, MAKE NO CONNECTION TO TERMINALS V1 AND V2. FOR 240V NOMINAL SENSING, SHORT TERMINALS V1 AND V2 TOGETHER.



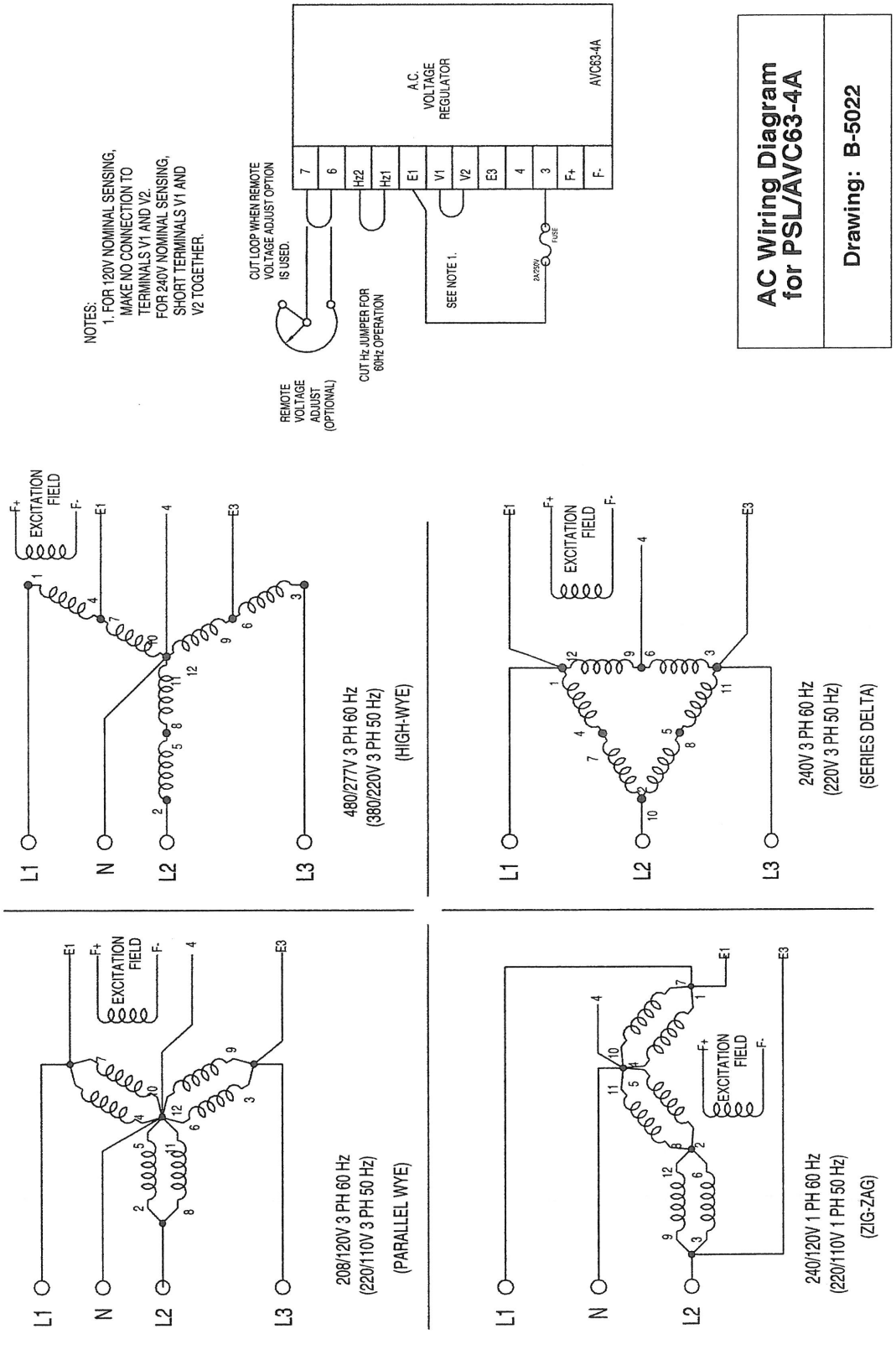
THIS DRAWING IS APPLICABLE TO PXG302, 303, 305, 306, AND 307 12 WIRE GENERATORS.

A.C. Wiring Diagram for PXG/AVC63-4A

Dwng: B-5021

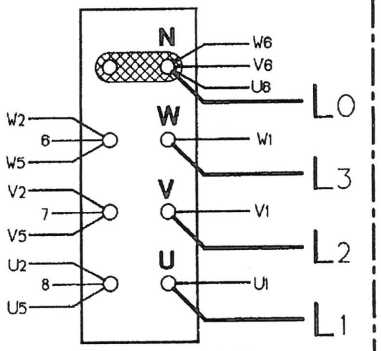
A.C. WIRING DIAGRAM

A.C. WIRING DIAGRAM



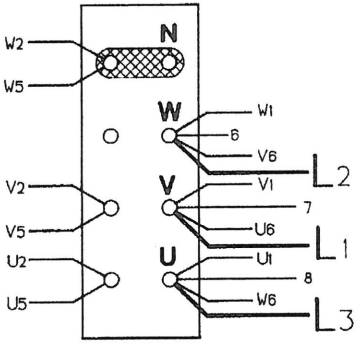
NOTE : 1. REGULATOR WIRE No.6 IS NOT REQUIRED. MAY BE ELIMINATED FOR CONVIENCE.

OUTPUT TERMINAL BLOCK



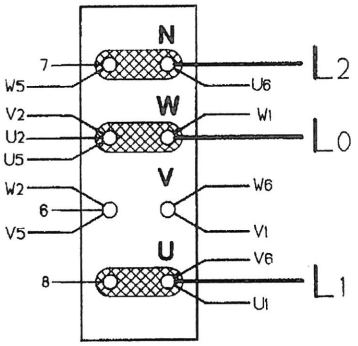
277/480V 3PH 60 Hz
(220/380V 3PH 50 Hz)
HIGH-WYE

OUTPUT TERMINAL BLOCK

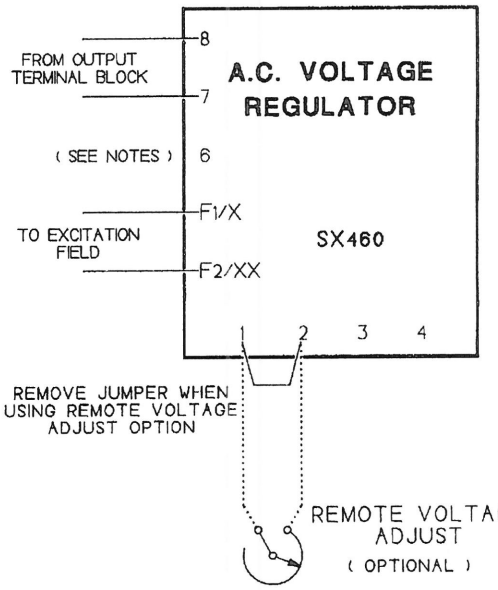


240V 3PH 60 Hz
(220V 3PH 50 Hz)
SERIES DELTA

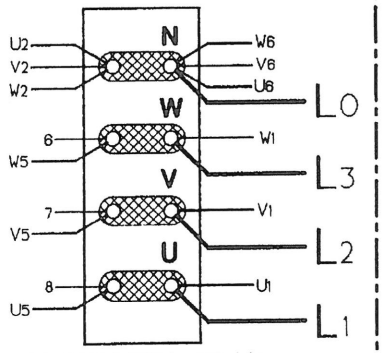
OUTPUT TERMINAL BLOCK



120/240V 1PH 60 Hz
(110/220V 1PH 50 Hz)
(DOUBLE DELTA)

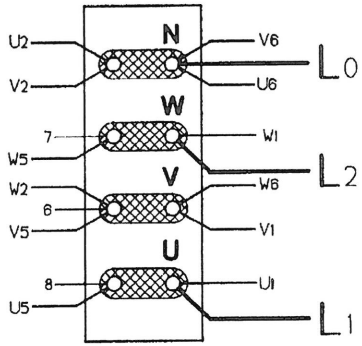


OUTPUT TERMINAL BLOCK



120/208V 3PH 60 Hz
(110/220V 3PH 50 Hz)
PARALLEL STAR

OUTPUT TERMINAL BLOCK



120/240V 1PH 60 Hz
(110/220V 1PH 50 Hz)
ZIG-ZAG

INDICATES USE OF LINK BARS

THIS DRAWING IS REFERENCED TO DA7-A100 "NEWAGE INTERNATIONAL Ltd."

AC Wiring Diagram for BCI/SX460

Drawing: B-4569

NOTES

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