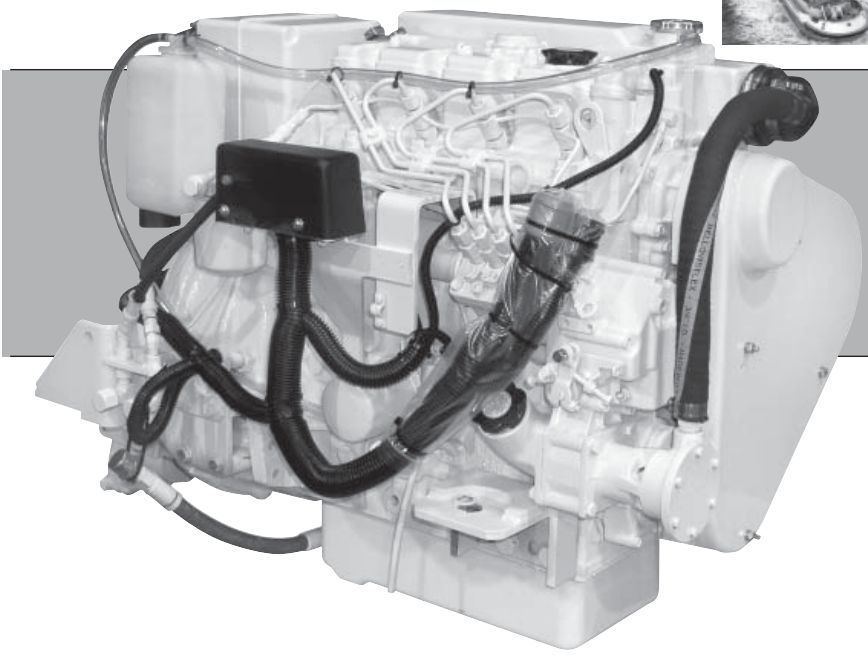


OL844D

For Model: L844D

OPERATOR'S MANUAL

Marine Generators | Marine Diesel Engines | Land-Based Generators

NORTHERN LIGHTS®

LUGGER




— CALIFORNIA —
Proposition 65 Warning:

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

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

Printed in U.S.A.
PART NO.: OL844D 03/10

OPERATOR'S MANUAL

OL844 for Model:

L844D

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

Table of Contents

Introduction

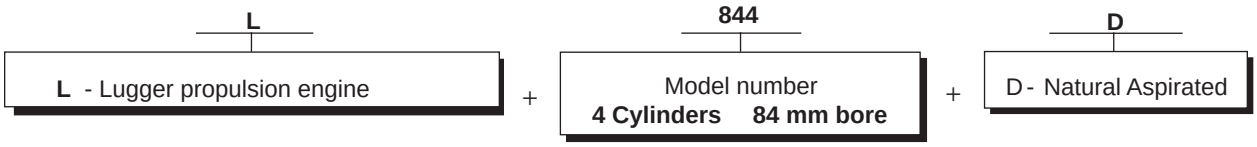
Servicing of marine engines and generator sets presents unique problems. In many cases boats cannot be moved to a repair facility. Marine engines cannot be compared to the servicing of automobiles, trucks or even farm equipment. Failures often occur in remote areas far from competent assistance. Marine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

Model Numbers

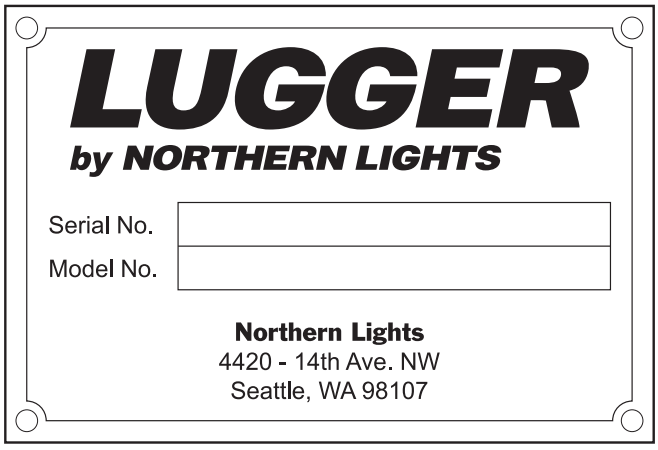
Model numbers give the unit's application, block model, and aspiration:



L844D = Northern Lights® naturally aspirated propulsion engine with a 844 engine.

Serial Numbers

When referencing Northern Lights, Inc. equipment by serial number, please refer only to the number stamped on the Northern Lights® or Lugger® serial number plate.



Warranty

A warranty registration certificate is supplied with your set. 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

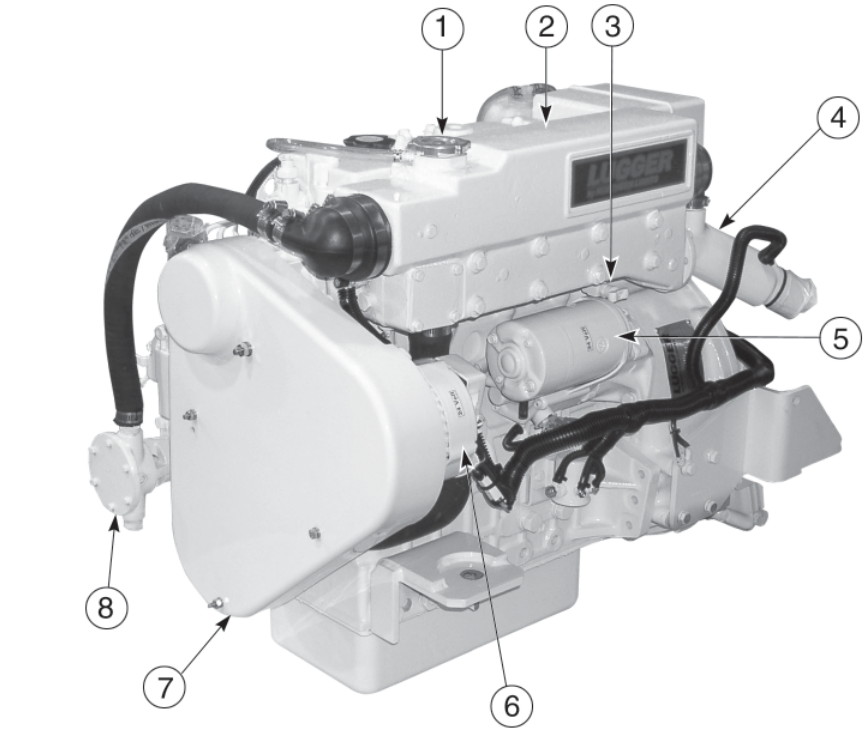
- Never leave engine without proper security.
- Turn the coolant tank cap slowly to relieve pressure before removing. Add coolant only when the engine is stopped and cool.
- Mount a fire extinguisher near engine.
- Always disconnect the battery ground strap before making adjustments.
- Operate engines 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 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.

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.

CAUTION: This symbol is used throughout this book to alert you to possible danger areas. Please take special notice of these sections.

L844D Component Locations



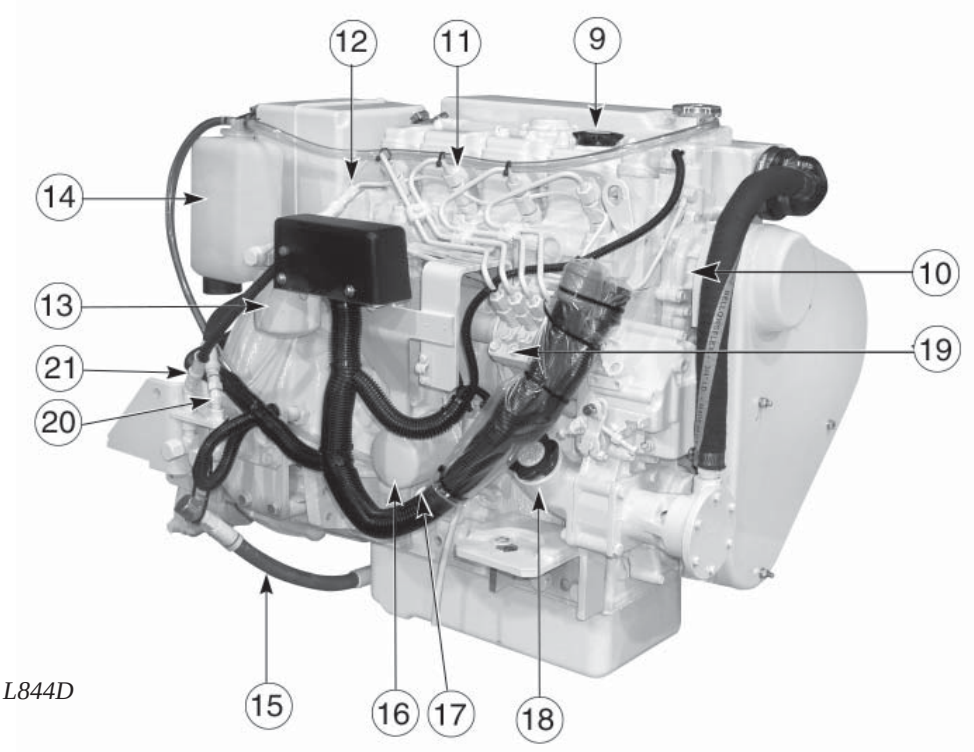


Figure 1 & 2: *L844D*

1. Coolant Fill
2. Expansion Tank/ Exhaust Manifold/ Heat Exchanger Tank
3. Coolant Drain
4. Wet Exhaust Elbow
5. Starter
6. Alternator
7. Belt Guard
8. Raw Water Pump
9. Oil Fill (Top)
10. Fresh Water Pump
11. Fuel Injector (4)
12. Fuel Return Line
13. Secondary Fuel Filter
14. Coolant Recovery Tank
15. Lube Oil Drain
16. Oil Filter
17. Oil Dipstick
18. Oil Fill (Side)
19. Injection Pump
20. Fuel Return Line
21. Fuel Inlet Line

Instrument Panel

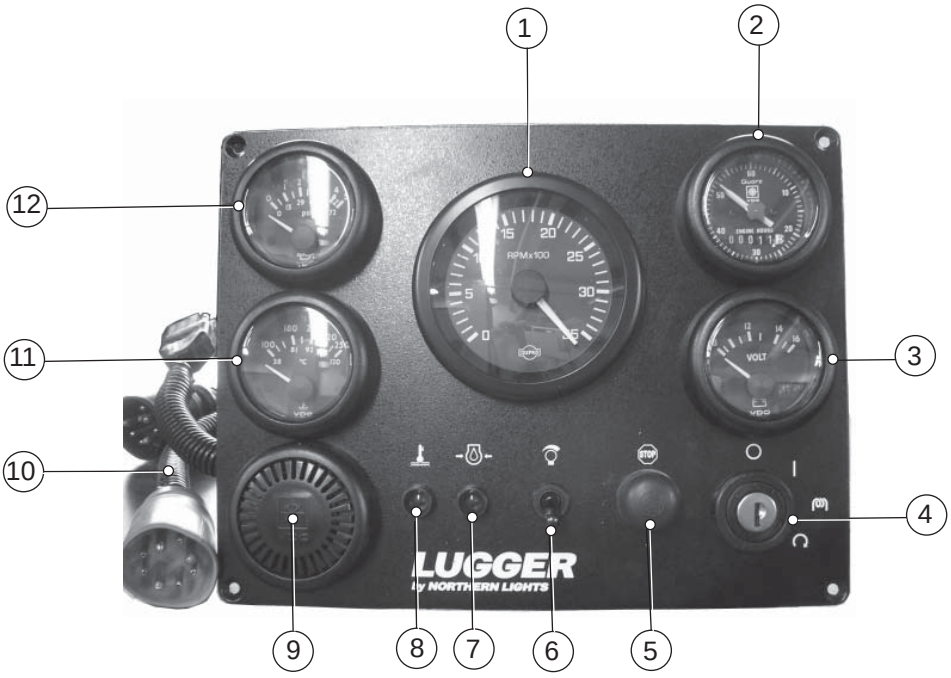


Figure 4: *Lugger Main Instrument Control Panel*

1. TACHOMETER
The tachometer shows the engine speed in revolutions per minute. (RPM). Numbers are multiples of 100.

2. HOUR METER
Keeps track of the engine running time.

3. D.C. VOLTMETER
When the engine is stopped, the voltmeter shows the condition of the battery. When the engine is running, it indicates the voltage output of the alternator.

4. KEY SWITCH
Turning the key clockwise to the first position will switch on the current. Continue turning the key clockwise to preheat the engine, then again to start the engine. When the engine starts, immediately turn the key back to the first position while the engine is running.
The key must be kept in the "on" or first position while the engine is running. Turn the key counter clockwise as far as possible to stop the engine.

Note: Optional flybridge panels have engine start switches instead of key switches.

5. COVER
(Stop button not used for this application.)

6. INSTRUMENT PANEL LIGHTING
The switch turns on the instrument panel lights.

7. OIL PRESSURE FAULT LIGHT
Indicates low oil pressure. Activates in conjunction with alarm horn.

8. ENGINE TEMPERATURE FAULT LIGHT
Indicates engine is over-heating. Activates in conjunction with alarm horn.

9. ALARM HORN
Shut down engine if possible and investigate immediately.

10. WIRE HARNESS

11. COOLANT TEMPERATURE GAUGE
Water temperature gauge shows the temperature of the engine coolant. If the gauge registers over 200^0F or drops below 140^0F, stop the engine and investigate.

12. OIL PRESSURE GAUGE
Shows the oil pressure in the engine lubricating system. If the pressure drops below 15 PSI at a speed higher than idling, stop the engine immediately.

Operating Procedures

BEFORE STARTING

1. Check the water level by removing the pressure cap from the expansion tank. In order to give the cooling water room 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 should be between the "waffled area" and the "Add". Never allow the level to go below the "Add". Do not fill above the crosshatch pattern. Oil levels within the crosshatch are considered in the acceptable operating range. Always add the same viscosity of oil as is already in the crankcase **(see Service Point #1)**.
3. Check the fuel tank level and open any fuel valves.
4. Check the oil level in the reverse gear. Methods may vary from gear to gear. See your Gear Owner's Manual.
5. Close the seacock, check and clean the strainer and reopen the seacock.
6. 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. Put the gear control in the neutral position.
2. Move the throttle control to the idle position.
3. Turn the key switch to the first position. Check the voltage meter to see the condition of the batteries. For starting, the voltmeter should not read below 12 volts (24 volts for 24 volt systems).
4. Turn the key to the starting position and as soon as the engine starts, release the key. Move the throttle up until the engine is running at approximately 1000 RPM.
5. Do not crank the starter for more than 15 seconds consecutively. If the engne fails to start with the first attempt, be sure that the starter has stopped completely before re-engaging.
   NOTE: *Never race a cold engine. Operate at 1000 RPM for a 3 to 5 minute warm-up period.*

Operating

1. Check oil pressure as soon as the engine has started. Oil pressure should be above 15 PSI. The engine must never be run if the oil pressure is below 15 PSI.
2. Check the voltmeter. It should read 13 to 14 volts (26-28 volts, 24 volt systems) at 60°F (16°C).
3. Water temperature should not rise over 200°F (94°C). If it does, shut down the engine and investigate the cause of overheating.
4. Do not exceed 800 RPM when shifting marine gear. Repeated shifts at higher engine speeds can damage the reverse gear.
5. Low idle is 800 RPM. Maximum working engine speed is: 2800 RPM for 40 Hp.6. If the proper propeller is used, the engine should reach its appropriate maximum RPMs at full throttle. If the maximum rated RPMs for your engine application is exceeded at full throttle, then your propeller is too small. If you cannot reach your maximum rated RPMs at full throttle, either your propeller is too large or bottom growth is slowing the boat.
7. To establish Maximum Cruising RPM: Establish the RPM at full throttle and subtract 200-300 RPM. This will promote engine life and reduce fuel consumption.

Shutdown

1. Run engine three to five minutes in neutral at 1000 RPM, for cool down period.
2. Return engine to low idle.
3. Turn the key switch counterclockwise as far as possible to stop the engine.
4. Close the sea cock and fuel valves and put the battery switch in OFF position.

NOTE: *Do not turn the battery switch to OFF while the engine is running.*

ALARMS

1. Your unit is fitted with a warning system to indicate high water temperature or low oil pressure.

Propulsion engines have warning horns to sound and warn you of a problem. Remember- when the engine is not running the horn will sound when the key is in the "ON" position because there is no oil pressure.

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 shutdown system is activated:

   a. Check the temperature gauge. If the temperature is above 205°F (97°C), shut off the engine immediately.
   b. Use the Trouble Shooting Guide on pages 18- 19 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 180°F (83°C).
   d. Watch the temperature gauge regularly and turn off the unit if the temperature rises above 200°F (94°C). Repeat the troubleshooting process.

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 after a few seconds of operation.
   c. If the oil level is normal, DO NOT restart the engine. Call your Northern Lights or Lugger dealer for assistance.

BREAK-IN PERIOD

1. Your engine is ready to be put into service. However, the first 100 hours on a new or reconditioned engine are critical to its life and performance. This is especially true of an engine that runs at a constant speed such as a propulsion engine does.

2. Operate with an averager of 75% load on your engine for the first 100 hours. Maintain no less than a 50% load to ensure proper seating of the piston rings.

3. Oil consumption is greater during break-in as piston rings take time to seat.

4. Your engine comes equipped with break-in oil. Change engine oil and filter at 50 hours using API Service Category CC, CD, or CE break-in oil. Change the oil and filter again at 100 hours. (Consult the lubricants section for oil recommendations.)

5. Frequently check the engine temperature and oil pressure gauges.

OPERATING INSTRUCTIONS

Never run full speed for more than 5 minutes during the first 50 hours. Run engine at 50% to 75% of maximum working speed for the first 20 hours with as little idling time as possible. Extended idling can inhibit ring seating, causing cylinder walls to glaze.

Servicing Schedule Chart

The Servicing Schedule Chart below shows the service schedule required for proper maintenance of your marine engine or 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
- SP14 Check cooling water level
- SP24 Check sea water strainer

AFTER FIRST 50 HOURS:
- SP2 Change engine oil
- SP3 Change lube oil filter

EVERY 50 HOURS:
- SP20 Check electrolyte in batteries

FIRST 100 HOURS:
- SP2 Change engine oil
- SP3 Change lube oil filter

EVERY 200 HOURS:
- SP2 Change engine oil
- SP3 Change lube oil filter
- SP4 Check air cleaner
- SP8 Change primary fuel filter element
- SP9 Change secondary fuel filter
- SP12 Check condition of exhaust elbow
- SP18 Check zinc electrodes

EVERY 600 HOURS / YEARLY:
- SP4 Replace air cleaner
- SP5 Check V-belt condition
- SP6 Check valve clearances
- SP10 Check injectors
- SP15 Check and flush cooling system
- SP19 Change impeller in raw water pump
- SP21 Check the state of the charge of the batteries

EVERY 2500 HOURS:
- SP16 Check and clean heat exchanger
- SP17 Check and clean gear oil cooler

SERVICE POINT	PAGE	OPERATION		DAILY	50 Hours	200 Hours	600 Hours	2500 Hours	
		ENGINE:							
SP1	10	Check oil level		•					
SP2	10	Change engine oil	1)			•			
SP3	10	Change lube oil filters	1)			•			
SP4	10	Check (replace) air cleaner	1) 3)			•	•		
SP5		Check belt condition	1)				•		
SP6	11	Check valve clearances	1)				•		
		FUEL SYSTEM:							
SP7	12	Check primary filter (Racor)	2)	•					
SP8	12	Change primary filter element (Racor)	2) 3)			•			
SP9	12	Change secondary fuel filter	1) 3)			•			
SP10		Check injectors	1)				•		
SP12		Check condition of exhaust elbow	4)			•			
		COOLING SYSTEM:							
SP14	15	Check cooling water level		•					
SP15	15	Check and flush cooling system	1)				•		
SP16	15	Check and clean heat exchanger	1)					•	
SP17		Check and clean gear oil cooler	1)					•	
SP18	15	Check zinc electrodes	1) 3)			•			
SP19	16	Change impeller in raw water pump	1) 3)				•		
SP24		Check sea water strainer		•					
		ELECTRICAL SYSTEM:							
SP20	17	Check electrolyte level in batteries	1) 3)		•				
SP21	17	Check condition of batteries with hydrometer	1)				•		
		OUT OF SERVICE:							
SP22	17	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.

Service Record

Service Point	OPERATION	HOURS/DATE									
	50 HOURS										
SP20	Check electrolyte in batteries										
	200 HOURS										
SP2	Change engine oil										
SP3	Change lubricating oil filters										
SP4	Check air cleaner										
SP7	Change primary fuel filter element										
SP9	Change secondary fuel filter										
SP12	Check turbocharger air, oil & cooling lines for leakage										
SP18	Check zinc electrodes										
	600 HOURS										
SP4	Replace air cleaner										
SP5	Check belt condition										
SP6	Check valve clearances										
SP10	Check injectors										
SP13	Check turbocharger boost pressure										
SP15	Check and flush cooling system										
SP19	Change impeller in raw water pump										
SP21	Check state of charge of batteries										
	2500 HOURS										
SP16	Check and clean heat exchanger										
SP17	Check and clean reverse gear oil cooler										
SP23	Check crankshaft damper										

LUBRICATION

Break-in oil

1. Use one of the following during the first 100 hours of operation:
   a. John Deere Engine Break-In Oil
   b. API Service CC, CD oil
   c. ACEA Specification E1
2. *Do not use* John Deere PLUS-50 oil or engine oils meeting API CF-4, API CG-4, API CH-4, API CI-4, ACEA E2, ACEA E3, ACEA E4, or ACEA E5 performance levels during the first 100 hours of operation of a new or rebuilt engine. These oils will not allow the engine to break-in properly.

Lubrication - General

1. Use only clean, high quality lubricants stored in clean containers in a protected area.
2. These oils are acceptable after the first 100 hours:
   a. API Service CH-4, CI-4 multi-viscosity oils.
   b. API Service CD/CG-4/CF-4 multi-viscosity oils.
   c. ACEA Specification E3
   d. ACEA Specification E4/ E5
3. Use the proper weight oil for your average operation temperature.

Air Temperature	Single Viscosity	Multi Viscosity
Above 32°F (0°C)	SAE-30W	SAE15-40W
-10°F to 32°F (-23°C to 0°C)	SAE-10W	SAE10-30W
Below -10°F (-23°C)	SAE-5W	SAE5-20W

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. CHECK ENGINE OIL LEVEL

1. Check the oil level in the crankcase, with the oil dipstick, daily.
2. The oil level must be between the “Waffled area” and the “Add”. Never allow the level to go below the “Add”.
3. Always add the same viscosity of oil as is already in the crankcase.

SP2. OIL CHANGES

1. Using the oil recommended above, change the engine oil and filter after the first 50 hours of operation, and every 200 hours thereafter.
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.

Marine Generator Sets:

   a. Remove plug from outlet in base frame. Screw in owner-supplied drain hose.
   b. Open valve at oil pan outlet. After oil has been drained into suitable container, close valve, remove drain hose and replace plug in base frame outlet.
   c. Refill engine with recommended oil.

4. Engine Lube Oil Capacity:

844	2.1 gallons	8.2 liters

SP3. CHANGING OIL FILTER

1. Change the lube oil filter every 200 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.
4. Lubricate the rubber gasket on the new filter and screw it on nipple until gasket meet 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 and check oil level. Add additional oil if necessary.

SP4. AIR CLEANER

1. Inspect air cleaner every 100 hours. Replace filter every 600 hours, or yearly, whichever comes first.
2. Clean the rubber tube at the cleaner. Loosen the hose clamp and the attaching strip for the cleaner.
3. Make sure the rubber tube is in good condition and that new filter is absolutely clean and installed properly.
4. Start the engine and check for leaks.

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

SP6. VALVE CLEARANCES

1. Adjust valve clearance after the first 50 hours of operation and every 600 hours thereafter.
2. 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.

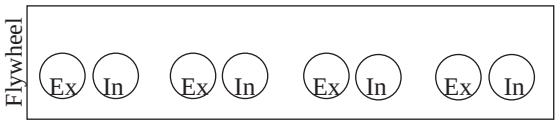


Figure 3: *844 Valve sequence*

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 (Figure 4). Clearance on both intake and exhaust valves should be 0.008 inches (0.2 mm).
5. Repeat steps 3 and 4 for each cylinder. Each set of valves must be adjusted individually.
6. Replace the rocker arm cover. Tighten cover nuts to 5 - 8 ft/lbs (0.8 - 2.3 kg/m).

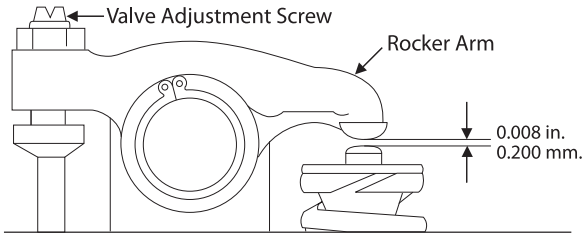


Figure 4: *Valve adjustment*

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 30°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. Sulphur content should not exceed 0.5% (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.
   f. JP4
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 engine or 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 every 200 hours or whenever necessary.
   c. If the bowl fills with water, change the primary and secondary elements immediately.
2. Change secondary fuel filter every 200 hours.

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

   a. Turn off the fuel.
   b. Be sure area around fuel filter assembly is clean.
   c. Remove the cap from the fuel filter housing. A wrench or pliers may be needed.

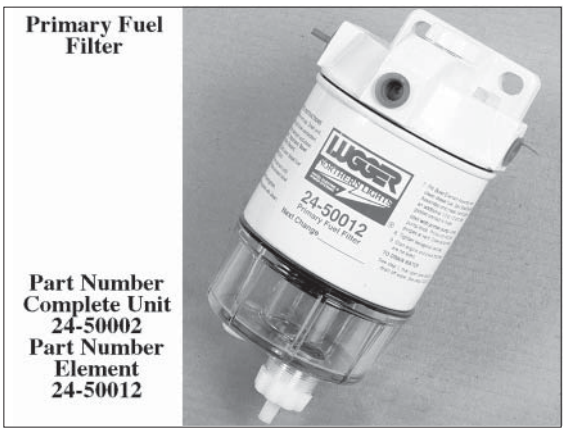


Figure 5: *Primary Fuel filter*

   d. Operate the hand primer until the fuel filter pops up. If this does not happen, use a small screw driver and carefully pry under the filter flange.
   e. Install new filter cartridge, do not reuse the old one. A stalled engine could result from air bubbles in the old filter cartridge causing fuel to overflow from the housing.
   f. Ensure that the fuel level is between the minimum and maximum marks on the center tube in the middle of the filter housing. If the fuel is below the minimum level, use the hand primer to add more fuel. Fuel level below the minimum could cause the engine to stall because of trapped air in the new filter. Fuel level above the maximum could cause the fuel to overflow from the filter housing when the fuel filter is installed.
   g. Install new filter, replace cap, restart engine and run for five minutes minimum.
   h. Remove and clean the water separator bowl, by first disconnecting the wiring connector from the water-in-fuel sensor.
   i. Drain the fuel from the separator bowl. Use a strap wrench close to the top of the bowl, while gripping bowl and twisting it with the other hand to remove it. Clean and dry the bowl. Reinstall and hand tighten. Reconnect sensor.

BLEEDING THE FUEL SYSTEM

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

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 6) on top of the 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 "C". Pump hand primer "B" until pure fuel (no bubbles) escapes. Then tighten bleed screw "C".

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 the engine has started, use a piece of cardboard to look for fuel leaks.

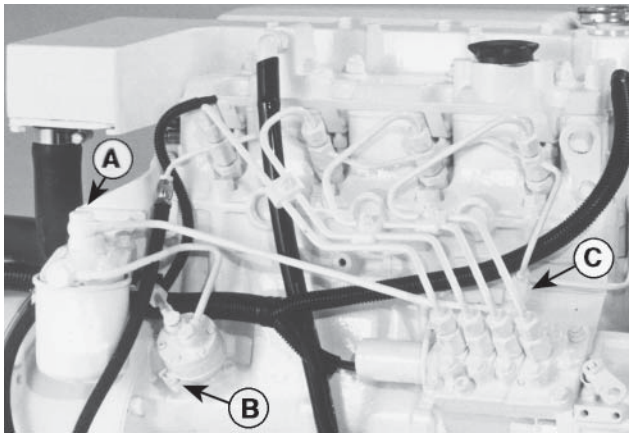


Figure 6

COOLING REQUIREMENTS

1. To meet cooling system protection requirements, the coolant solution must consist of:
   a. Quality water
   b. Ethylene glycol concentrate (EGC) commonly known as antifreeze.
   c. Supplemental coolant additives (SCA's).
2. A coolant solution of ethylene glycol concentrate (EGC-antifreeze), quality water and supplemental coolant additives (SCA's) ***MUST*** be used ***YEAR ROUND*** to protect against freezing, boil-over, liner erosion or pitting and to provide a stable, noncorrosive environment for cooling system components.
3. **Ethylene glycol coolant concentrate (antifreeze) normally DOES NOT contain the SCA chemical inhibitors needed to control liner pitting or erosion, rust, scale, and acidity.**

WATER QUALITY

1. Distilled, deionized, soft water is preferred for use in cooling systems. Bottled distilled water from a food store or water supplier is recommended. Tap water often has a high mineral content. Tap water should NEVER be put in a cooling system unless first tested by a water quality laboratory.
2. Here are acceptable water quality specifications:

Contaminates	Parts per Million	Grains per Gallon
Maximum Chlorides	40	2.5
Maximum Sulfates	100	5.9
Maximum Dissolved Solids	340	20.0
Maximum Total Hardness	170	10.0
		PH Level 5.5 to 9.0

3. If chlorides, sulfates or total dissolved solids are higher than the above given specification, the water must be distilled, demineralized, or deionized before it is used in a cooling system.
4. If total hardness is higher than 170 ppm and all other parameters are within the given specifications, the water must be softened before it is used to make coolant solution.

EGC: ETHYLENE GLYCOL CONCENTRATE (ANTIFREEZE)

CAUTION: *EGC (Antifreeze) is flammable. Keep it away from any open flame. Avoid contact with eyes. Avoid contact with skin. Do not take internally. In case of contact, immediately wash skin with soap and water. For eyes, flush with large amounts of water for at least 15 minutes. Call a physician. KEEP OUT OF REACH OF CHILDREN. Follow all warnings on the container.*

1. Ethylene glycol coolant concentrate is commonly mixed with water to produce an engine coolant with a low freeze point and high boiling point.
2. A ***low silicate*** form of ethylene glycol coolant is recommended for all diesel engines.
3. Use an ethylene glycol coolant concentrate meeting ASTM D 6210, D4985P, and D5345.
4. This product is concentrated and should be mixed to the following specification.
5. If additional coolant solution needs to be added to the engine due to leaks or loss, the glycol concentration should be checked with a hydrometer to assure that the desired freeze point is maintained.

	Distilled Water %	EGC % Antifreeze	Freeze Point	Boiling Point
Optimum	50%	50%	-37°C -34°F	+109°C +226°F
Minimum	60%	40%	-24°C -12°F	+106°C +222°F
Maximum	40%	60%	-52°C -62°F	+111°C +232°F

IMPORTANT

1. **DO NOT** use methyl alcohol or methoxy propanol base EGC. These concentrates are not compatible with chemicals used in supplemental coolant additives. Damage can occur to rubber seals on cylinder liners which are in contact with coolant.
2. **DO NOT** use an EGC containing sealer or stop-leak additives.
3. **DO NOT** use EGC containing more than 0.1% anhydrous metasilicate. This type of concentrate, which is intended for use in aluminum engines, may cause a gel-like deposit to form that reduces heat transfer and coolant flow. Check container label or consult with supplier.

SP14. CHECKING COOLANT LEVEL

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.*

1. Check the coolant level each day before starting the engine.
2. Remove the pressure cap from the expansion tank and check water level. In order to give the coolant 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.
4. The makeup coolant, added to compensate for loss or leaks, must meet engine coolant requirements outlined in previous section.

SP15. FLUSHING THE 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.*

1. Flush the cooling system and check for leaks and blockage every 600 hours, or yearly. **The engine must be stopped and cold.**
2. Close the seacock.
3. Remove the pressure cap from the expansion tank with caution. If applicable, open the cooling system air vent on top of turbocharger.
4. Open the drains on the exhaust manifold and engine block. Drain the fresh water system (see Component Locations, page 4).
5. For vessels with keel cooling, the vessel must be out of the water to allow draining of the keel cooler.
6. With drains open, pour clean water into the expansion tank. When the water from drain is clear and free from discoloration and sediment, close that drain. When all drains are closed, flushing is complete.
7. Fill the fresh water system by pouring the recommended coolant mixture as described in previous sections.
8. Open the seacock.
9. Start the engine. Check hoses and connections and repair any leakage.

SP16. HEAT EXCHANGER CLEANING

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.

SP18. ZINC ANODES

1. Zincs are installed in the cooling system to protect your engine from electrolysis. Check them faithfully every 200 hours. If you are in warm salt water or where electrolysis is a known problem, check them more often.

SP19. RAW WATER PUMP

Heat exchanged cooled engines only.

1. Change the sea water pump impeller as needed.
2. Remove the pump end cover. Remove impeller with water pump pliers. Be sure you remove all pieces of a failed impeller.
3. Clean the inside of the housing.
4. Press in the new impeller and place the sealing washer in the outer end of the impeller center if this has not already been done.
5. Replace the cover using a new gasket.

Note: *Make sure there is always an extra impeller and cover gasket in reserve and on-board.*

DRIVEN EQUIPMENT

Gears and PTO's

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 and marine gears have rigid lubrication requirements. Follow service recommendations closely.*

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.
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. A DC circuit breaker protects your control panel and wiring harness.

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.
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.

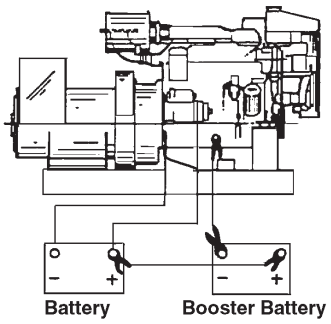


Figure 7: *Booster Battery Connections*

4. Then, connect negative (-) terminal of booster battery to ground on the engine block (see Figure 7).
5. Remove booster battery after starting engine.
6. Sealed batteries: see manufacturer charging and booster instructions.

SP20 - 21. BATTERY CARE - LEAD/ACID TYPE BATTERIES

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 750 hours.

SP22. WINTERIZING, OUT-OF-SERVICE

The following long term storage preparation guides are good for storage up to one year, after that the engine should be started, warmed up, and prepared again for long term storage.

1. Change oil and replace filter. Used oil will not give adequate protection.
2. Service the air cleaner.
3. For storage less than a year it is not necessary to drain and flush the cooling system. For a year or more of storage the cooling system should be drained, flushed and refilled with appropriate coolant.
4. Remove the fan and alternator belts, optional.
5. Remove and clean the batteries. Store them in a cool dry place and be sure they are fully charged.
6. Disengage the clutch to engine drivelines.
7. Clean the exterior of the engine with salt-free water and touch up painted surfaces with good paint.
8. Coat all exposed machined metal surfaces with grease or corrosion inhibitors if they cannot be painted.
9. Seal all openings with plastic bags and tape.
10. Store the engine in a dry protected place. If the engine must be outside, cover with waterproof canvas or other protective material and use strong waterproof tape.

Troubleshooting

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

✔ Engine Will Not Crank

Weak battery:
- Replace battery.

Corroded or loose battery connections:
- Clean battery terminals and connections.

Defective main switch or start safety switch:
- Repair switch as required.

Starter/solenoid defective:
- Replace starter or solenoid.

✔ Hard to Start or Will Not Start

Poor fuel quality:
- Drain fuel and replace with proper grade fuel.

Slow cranking speed:
- Check for problems in the charging or starting system.

✔ Engine Misfiring or Runs Irregularly

Basic engine problem:
- See your dealer.

✔ Lack of Engine Power

Poor fuel quality:
- Drain fuel and replace correct grade fuel.

Intake air restriction:
- Service air cleaner.

Clogged primary fuel filter:
- Clean or replace filter element.

Clogged secondary fuel filter element:
- Replace secondary filter element.

Crankcase oil too heavy:
- Fill with oil of appropriate viscosity.

✔ Low Oil Pressure

Low crankcase oil level:
- Fill crank case to proper level.

Clogged oil cooler or filter:
- Remove and inspect oil cooler. See your dealer.

High oil temperature:
- Remove and inspect oil cooler. See your dealer.

Defective oil pump:
- Remove and inspect oil pump. See your dealer.

Oil pressure regulating valve failure:
- Remove and inspect oil pressure regulating valve. See your dealer.

Broken piston spray jet:
- Replace piston spray jet. See your dealer.

Clogged oil pump screen or cracked pick-up tube:
- Remove oil pan and clean screen/ replace pick-up tube.

Excessive main or connecting rod bearing clearance:
- Determine bearing clearance. See your dealer.

✔ High Oil Pressure

Regulating valve not operating correctly:
- Remove and inspect oil pressure regulating valve. See your dealer.

Plugged piston spray jet:
- Replace piston spray jet. See your dealer.

Filter bypass valve stuck or damaged:
- Remove and inspect filter bypass valve. See your dealer.

✔ High Oil Consumption

Crankcase oil too low viscosity:
- Drain crankcase and refill with correct oil.

Crankcase oil level too high:
- Drain oil until level is correct.

External oil leak:
- Check for leaks in lines around gaskets and drain plug.

Oil control rings worn or broken:
- Replace piston rings. See your dealer.

Scored cylinder liners or pistons:
- Remove and inspect cylinders and liners; replace as required. See your dealer.

Worn valve guides or stems:
- Inspect and measure valve stems and valve guides; repair as required. See your dealer.

Piston grooves worn:
- Remove and inspect pistons. See your dealer.

Piston rings sticking in ring grooves:
- Remove and inspect pistons. See your dealer.

Insufficient piston ring tension:
- Remove and inspect pistons. See your dealer.

Piston ring gaps not staggered:
- Remove and inspect pistons. See your dealer.

Front and/or rear crankshaft oil seal faulty:
- Replace oil seals. See your dealer.

✔ Excessive Fuel Consumption

Intake air restriction:
- Service air cleaner.

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

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

Excessive Fuel Consumption (continued)

Engine overloaded :

- Reduce load on engine.

Compression too low:

- Determine cause of low compression and repair.

Leaks in fuel supply:

- Locate source of leak and repair as required.

✔ **Abnormal Engine Noise**

Worn main or connecting rod bearings:

- Determine bearing clearance. See your dealer.

Excessive crankshaft end play:

- Check crankshaft end play. See your dealer.

Loose main bearing caps:

- Check bearing clearance, replace bearings and bearing cap screws as needed. See your dealer.

Worn connecting rod bushings and piston pins:

- Inspect piston pins and bushings. See your dealer.

Scored pistons:

- Inspect pistons. See your dealer.

Worn timing gears or excessive back lash:

- Check timing gear back lash. See your dealer.

Excessive valve clearance:

- Check and adjust valve clearance. See your dealer.

Worn camshaft lobes:

- Inspect camshaft. See your dealer.

Worn rocker arm shafts:

- Inspect rocker arm shafts. See your dealer.

✔ **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 Emits White Smoke**

Engine compression too low:

- Determine cause, see dealer.

Defective thermostat (does not close):

- Remove and check thermostats, replace if needed.

Coolant entering combustion chamber, maybe a failed cylinder head gasket or cracked cylinder head:

- Repair, see your dealer.

✔ **Engine Emits White Smoke**

Water-to-air aftercooler fails:

- Remove and inspect water-to-air aftercooler. See your dealer.

✔ **Engine Idles Poorly**

Improper type of fuel:

- Replace with correct fuel grade.

Air leak on suction side of air intake:

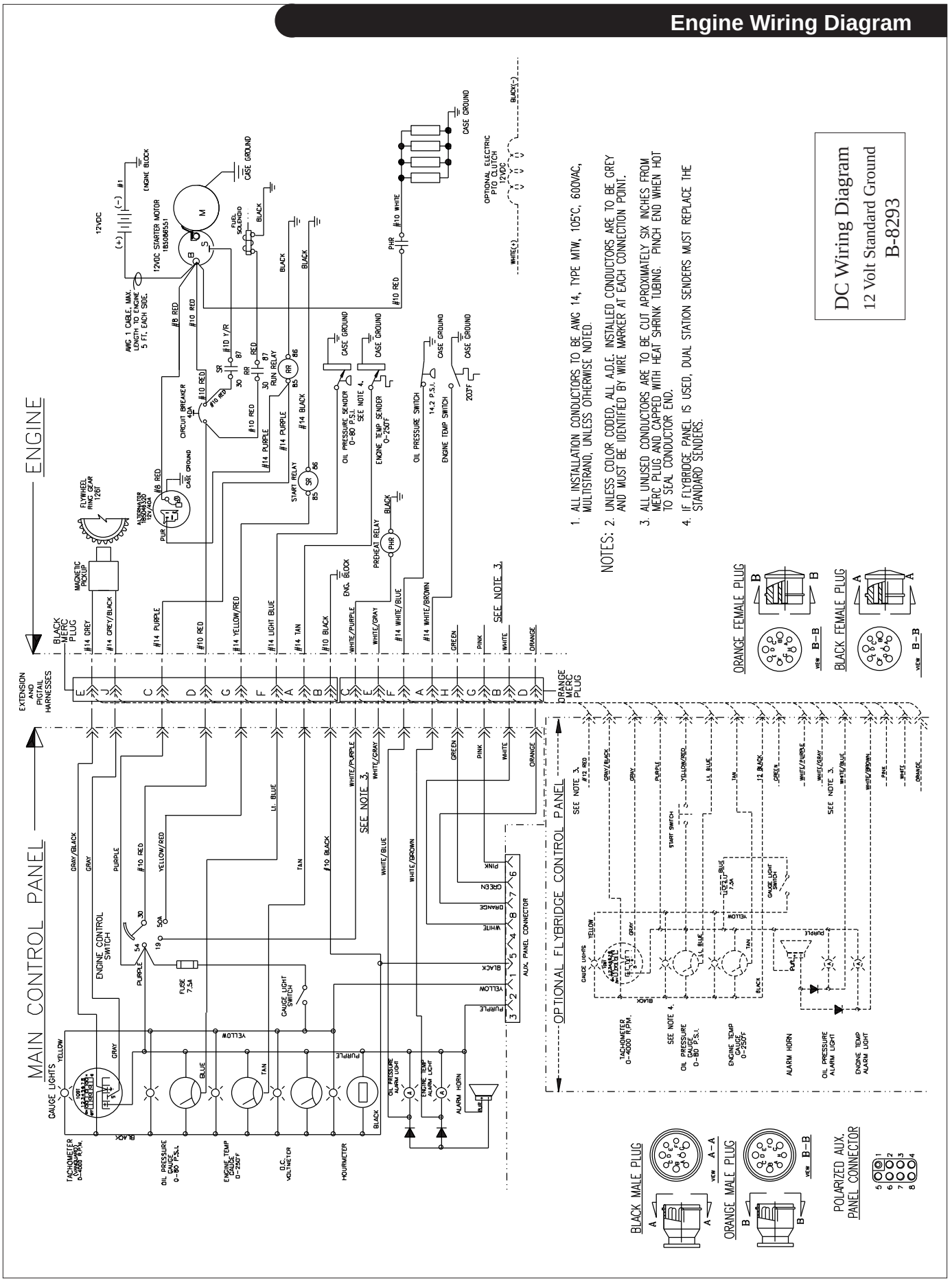
- Check hose and pipe connections for tightness, repair as required.

L844D Data

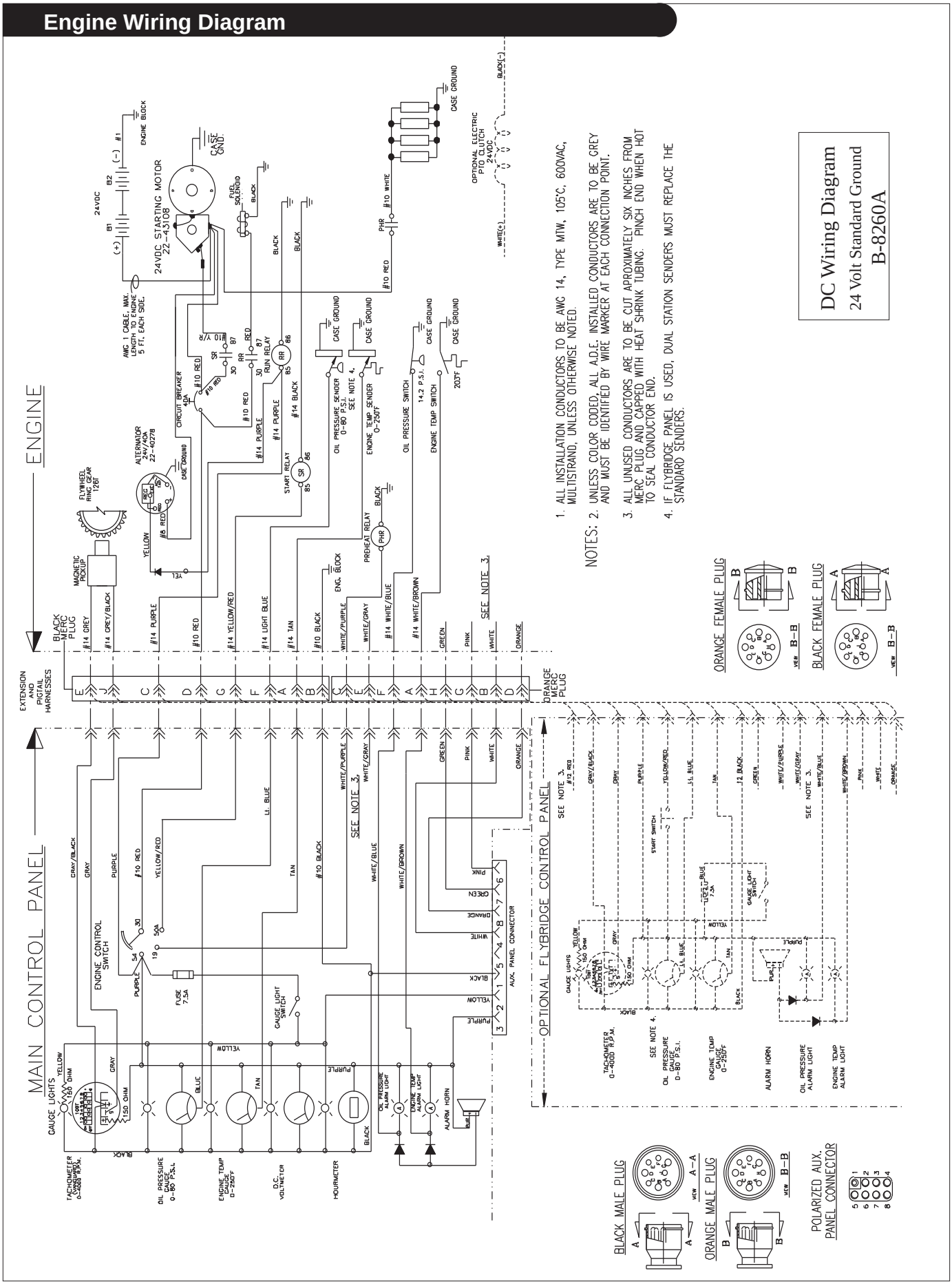
Hp/ RPM	40 Hp 2800 RPM
General Information	
Engine Type	Lugger 4 cycle, swirl chamber diese
Cylinders	Inline 4
Displacement	121in^3 (1.995 liters)
Cycles	4
Bore x Stroke	3.3 x 3.5 in (84 x 90 mm)
Rotation (Facing Flywheel)	counter-clockwise
Compression Ratio	22:1
Crankcase Capacity including Oil Filter	2.1 gal (8.2 liter)
Aspiration	Natural
Flywheel Housing Size	SAE 4
Flywheel Drive Size	C-107
Rated Crankshaft Hp[1]	40 Hp
Rated Crankshaft kW[2]	29.6 kW
Dry Weight w/Heat Exchanger, Single Phase	873 lbs. (396 kg)
Length	31.1 in (789 mm)
Width	19.75 in (502 mm)
Height	26.7 in (678 mm)
Cooling System	
Approx. Coolant Cap.	1.4 gal (5.3 liter)
Minimum Through Hull Diameter	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	1567 BTU/min
Fresh Water Pump Cap.	20.1 gpm (76 lpm)
Seawater Pump Cap.	14 gpm (53 lpm)
Maximum Seawater Pump Suction Head	39 in (990 mm)
Keel Cooler TurboTube Length	6 feet (1.8 M)
Keel Cooler Head Diameter	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	#1
Starting Voltage, Negative Ground	12 Volt
Air Intake and Exhaust	
Air Consumption	101 cfm (2.86 M^3/m)
Maximum Exhaust Backpressure	48 in (1219 mm) H_2O
Wet Exhaust Elbow OD	2 in (51 mm)
Exhaust Gas Volume	238 cfm (6.7 M^3/m)
Exhaust Gas Temperature	1022° F (550° 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 (990 mm)
Specific Fuel Consumption at Max. Load	.421 lbs/hp/hr
Approximate Fuel Rate at Max. Load	2.37 US gph (8.9 lph)

Maximum Engine Operating Angle		
Continuous Operation	Front Down	Rear Down
(More than 2 minutes requires use of a remote expansion tank)	0°	0° - 10°
Intermittent Operation (Sustained up to two minutes)	0° - 35°	0° - 35°

1. Based on SAE J816b.
2. Based on EN ISO 8665:2006.


DC Wiring Diagram
12 Volt Standard Ground
B-8293
NOTES:
1. ALL INSTALLATION CONDUCTORS TO BE AWG 14, TYPE MTW, 105°C, 600VAC, MULTISTRAND, UNLESS OTHERWISE NOTED.
2. UNLESS COLOR CODED, ALL A.D.E. INSTALLED CONDUCTORS ARE TO BE GREY AND MUST BE IDENTIFIED BY WIRE MARKER AT EACH CONNECTION POINT.
3. ALL UNUSED CONDUCTORS ARE TO BE CUT APROXIMATELY SIX INCHES FROM MERC PLUG AND CAPPED WITH HEAT SHRINK TUBING. PINCH END WHEN HOT TO SEAL CONDUCTOR END.
4. IF FLYBRIDGE PANEL IS USED, DUAL STATION SENDERS MUST REPLACE THE STANDARD SENDERS.
ENGINE
MAIN CONTROL PANEL
OPTIONAL FLYBRIDGE CONTROL PANEL
EXTENSION AND PIGTAIL HARNESSES
BLACK MERC PLUG
ORANGE MERC PLUG
ORANGE FEMALE PLUG
BLACK FEMALE PLUG
BLACK MALE PLUG
ORANGE MALE PLUG
POLARIZED AUX. PANEL CONNECTOR
AUX. PANEL CONNECTOR
12VDC STARTER MOTOR
ALTERNATOR
FLYWHEEL RING GEAR 126T
MAGNETIC PICKUP
CIRCUIT BREAKER
START RELAY
RUN RELAY
PREHEAT RELAY
FUEL SOLENOID
OIL PRESSURE SENDER
ENGINE TEMP SENDER
OIL PRESSURE SWITCH
ENGINE TEMP SWITCH
OPTIONAL ELECTRIC PTO CLUTCH
ENGINE CONTROL SWITCH
GAUGE LIGHT SWITCH
FUSE
CASE GROUND
ENG. BLOCK
SEE NOTE 3.
SEE NOTE 4.
TACHOMETER
OIL PRESSURE GAUGE
ENGINE TEMP GAUGE
D.C. VOLTMETER
HOURMETER
OIL PRESSURE ALARM LIGHT
ENGINE TEMP ALARM LIGHT
ALARM HORN
START SWITCH

Engine Wiring Diagram



Safety at sea depends on careful preparation, product knowledge, and having the right tools and parts. Below is a list of parts Alaska Diesel Electric, Inc. recommends you carry onboard at all times.

Onboard Parts Kits are available from your dealer. “Standard” Kits are suitable for inland and offshore cruising. “World Class” Kits are for world cruising and trans-ocean cruising.

We consider these minimum quantities. Your vessel's operating conditions may require more of a given part. Consult your dealer.

Item	Description	Standard	World Class
1	Lube Oil Filter	4	4
2	Air Filter Element	1	1
3	Fuel Filter	2	2
4	Injector	0	4
5	Thermostat	2	2
6	Thermostat Ring	2	2
7	Relay	0	2
8	Valve Cover Gasket	1	2
9	Gasket Kit Top	0	1
10	Gasket Kit Bottom	0	1
11	Zinc*	6	12
12	Raw Water Pump Impeller*	2	2
13	Raw Water Pump Cover Gasket*	2	2
14	Raw Water Pump*	0	1
15	Workshop Manual	0	1
16	Set of Alternator Belts	1	1
17	Fuel Washer Kit	Std.1	w/c 1

*Heat exchanger cooled engines only

www.northern-lights.com

4420 14th Ave. NW., Seattle WA 98107
Tel: (206) 789-3880 • 1-800-762-0165 • Fax: (206) 782-5455