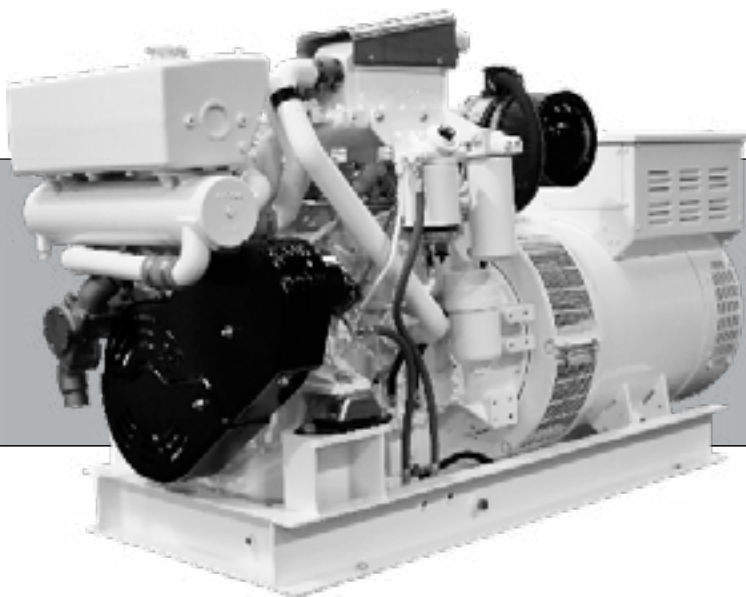




OPERATOR'S MANUAL

OM105

For Models: M4105A1, M4105A2, M4105A3, M4105A4,
M4105A5, M4105H1, M6105A1, M6105A2, M6105A3,
M6105A4, M6105A5, M6105H1, M6105H2,
C4105A1, C4105A2, C4105A3, C4105A4, C4105A5, C4105A6,
C6105A1, C6105A2, C6105A3, C6105A4, C6105A5



www.northern-lights.com



— CALIFORNIA —
Proposition 65 Warning:

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

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

For more information, go to www.P65warnings.ca.gov/diesel.

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

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PART NO.: OM105 4/26



OPERATOR'S MANUAL

for Models:

**M4105A1, M4105A2, M4105A3, M4105A4, M4105A5, M4105H1,
M6105A1, M6105A2, M6105A3, M6105A4, M6105A5, M6105H1, M6105H2,
C4105A1, C4105A2, C4105A3, C4105A4, C4105A5, C4105A6,
C6105A1, C6105A2, C6105A3, C6105A4, C6105A5**

ORIGINAL INSTRUCTIONS - Read this operator's manual thoroughly before starting to operate your equipment.

This manual contains information you will need to run and service your new unit.

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Proprietary Information

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Model Numbers

Model numbers provide the unit's application, block model and aspiration.

M, C

M - Northern Lights marine generator set

C - Northern Lights Commercial series marine generator set

4105, 6105

4 cylinders or 6 cylinders
105 mm bore

A, H

A - Jacket Water After-cooler

H - Sea Water After-cooler

M4105A

Northern Lights jacket water after-cooled marine diesel generator set with a 4-cylinder Tupy base engine and an electronically controlled fuel system.

M4105H

Northern Lights sea water after-cooled marine diesel generator set with a 4-cylinder Tupy base engine and an electronically controlled fuel system.

M6105A

Northern Lights jacket water after-cooled marine diesel generator set with a 6-cylinder Tupy base engine and an electronically controlled fuel system.

M6105H

Northern Lights sea water after-cooled marine diesel generator set with a 6-cylinder Tupy base engine and an electronically controlled fuel system.

C4105A

Northern Lights keel-cooled commercial series marine diesel generator set with an MWM base engine and an electronically controlled fuel system.

C4105H

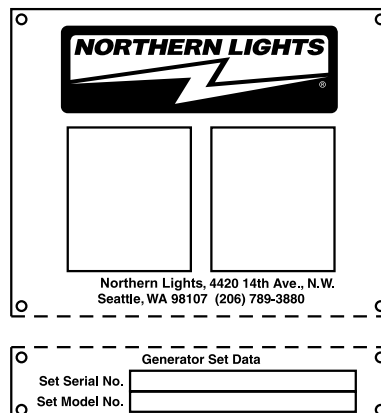
Northern Lights keel-cooled commercial series marine diesel generator set with an MWM base engine and an electronically controlled fuel system.

C6105A

Northern Lights keel-cooled commercial series marine diesel generator set with an MWM base engine and an electronically controlled fuel system.

All model numbers in parentheses will indicate an MWM base engine. All variations requiring serial numbers for proper identification will be noted as Northern Lights or MWM.

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



Introduction

GENERAL DESCRIPTION: Marinized diesel engines for use in the marine environment as inboard propulsion and constant-speed power generation

The models and units referenced in this manual are intended for marine power generation use only. Any other use is prohibited by the manufacturer.

Units must be used only by a professional or trained operator. Units must be operated at ambient lighting under normal intensity.

Servicing of marine engines and generator sets presents unique challenges. In many cases boats cannot be moved to a repair facility. 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.

This is not a comprehensive technical service manual. Its aim is to aid you in maintaining your unit properly.

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



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

IMPORTANT SAFETY INSTRUCTIONS.

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



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

Recognize Safety Symbols and Instructions

In addition to the information found in this section, this operator's manual uses three different signal words to outline potential dangers of a specific nature.

	DANGER DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
	WARNING WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	CAUTION CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

Follow All Safety Instructions

Carefully read and understand all safety messages in this manual and on your machine's safety signs. Keep signs in good and clean condition. Replace missing or damaged signs. Be sure new equipment components and repair parts include the current safety signs. For replacement signs, proper placement of safety signs or clarification on any safety issue, consult your Northern Lights dealer or the factory. There can be additional safety information contained



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

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

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

Prevent Bypass and Accidental Starting

WARNING

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



Start engine only from operator's station.

Handle Fuel Safely - Avoid Flames

WARNING

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

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



Safety Rules (Continued)

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

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

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

Service Machines Safely

! DANGER

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

Check for any loose electrical connections or faulty wiring.

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

Wear Protective Clothing

! WARNING

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

Prolonged exposure to loud noise can cause hearing loss or impairment. Wear suitable authorized hearing protection, such as earmuffs or plugs to protect against loud noises.



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

Noise of at least 95 dB(a) is anticipated.

Practice Safe Maintenance

! CAUTION

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

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

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

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

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

Stay Clear of Rotating Drivelines

! DANGER

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

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



Safety Rules (Continued)

Install all Safety Guards

! WARNING

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



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

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

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

Safe Battery Handling

! WARNING

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



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

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

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

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

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

If acid is spilled on skin or in eyes:

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

If acid is swallowed:

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



! WARNING

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

Handle Chemical Products Safely

! WARNING

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



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

Safety Rules (Continued)

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

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

Work in Well Ventilated Areas

! CAUTION

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

Remove Paint Before Welding or Heating

! WARNING

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

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



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

Service Cooling System Safely

! WARNING

Opening a pressurized cooling system can release explosive fluids and causing serious burns. Before opening any pressurized cooling system, make sure the



engine has been shut off. Do not remove a filler cap unless it is cool enough to comfortably grip with bare hands. Slowly loosen cap to relieve pressure before opening fully.

Avoid High Pressure Fluids

! WARNING

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



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

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

Avoid Heating Near Pressurized Fluid Lines

! WARNING

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



Do Not Open High-Pressure Fuel System

! DANGER

Many Northern Lights engines use high-pressure fuel injection. High-pressure fluid remaining in fuel lines can cause serious injury. Do not disconnect or attempt any repair of fuel lines, sensors, or other

Lock Out / Tag Out Procedures

Scope

During maintenance, repairs or retooling of a Northern Lights generator set, simply turning the machine off or unplugging it while it is being worked on does not give enough protection to others who are not performing the maintenance or repair. Many serious accidents happen when someone thought the machine was turned off, or all of its energy was safely blocked or released.

General Policy

CAUTION

To avoid dangerous or hazardous situations, refrain from any of the following:

- Removing or bypassing a guard or other safety device
- Placing any part of your body in a position where you could be caught by moving machinery.
- Cleaning or oiling machinery when in operation.
- Adjusting circuits, chillers, pumps, air handlers, valves, circuit breakers or fans while in operation.
- Working on piping or high pressure systems.

Lock Out/Tag Out Instructions - Electrical Equipment

WARNING

Be sure the equipment's ON/OFF switch is in the OFF position and is unplugged from any electrical source before attempting to perform any type of work on the equipment. Obtain an electrical plug cap cover with a lockset. Secure the plug terminal end using the electrical plug lockout cap. Lock the cap and retain the key.

If the equipment is directly wired into an electrical box with a shut off switch, obtain a lock pad and/or the appropriate colored tags and place the lock and tag through the shut off lever. Retain the key until the repair is completed and the machine is safe to start. Be certain the shut off lever is in the OFF position before restarting. NEVER give a lock out key to unauthorized personnel.

If the equipment is directly wired into an electrical box without a shut off switch and lock out capability, then a circuit breaker lock out will be required. Obtain a circuit lock and tag set. Install the lock onto the circuit breaker box. Ensure the unit ON/OFF switch is in the OFF position before restarting.

Lock Out/Tag Out Instructions - Pneumatic and Hydraulic Equipment

WARNING

For servicing pneumatic and hydraulic equipment, the following additional procedures must be implemented, following completion of lock out/tag out procedures for the unit to be serviced:

Shut off air, water or supply valves at the equipment to be serviced.

Check the local bleed-off point for completed release of pressurized air, water or oil.

If shutting off of air, water or other material cannot be achieved at the local supply valve, shut off valves further back in the system and re-check the bleed-off point until complete shut-off is achieved.

Affix a DO NOT OPERATE tag to each valve handle that requires shut off. Each DO NOT OPERATE tag must be signed and dated by the authorized technician servicing the equipment.

Lock Out/Tag Out Instructions - Air Hose Connected Pneumatic Equipment

WARNING

Equipment connected to the compressed air system through an air hose with a detachable fitting must be shutdown and unplugged. Excess air must be bled prior to removing the air hose, prior to any maintenance or repair activities.

Affix a DO NOT OPERATE tag to the air hose near the detachable fitting. Each DO NOT OPERATE tag must be signed and dated by the authorized technician servicing the equipment. Check that the equipment cannot be operated by activating the ON switch.

Stored Energy

WARNING

Immediately after applying Lock Out or Tag Out devices, ensure that all potentially hazardous stored or residual energy is relieved, disconnected, restrained and otherwise rendered safe.

Verification of Isolation

CAUTION

Verify the machinery or equipment is actually isolated and de-energized prior to beginning work on a machine or on equipment that has been locked out.

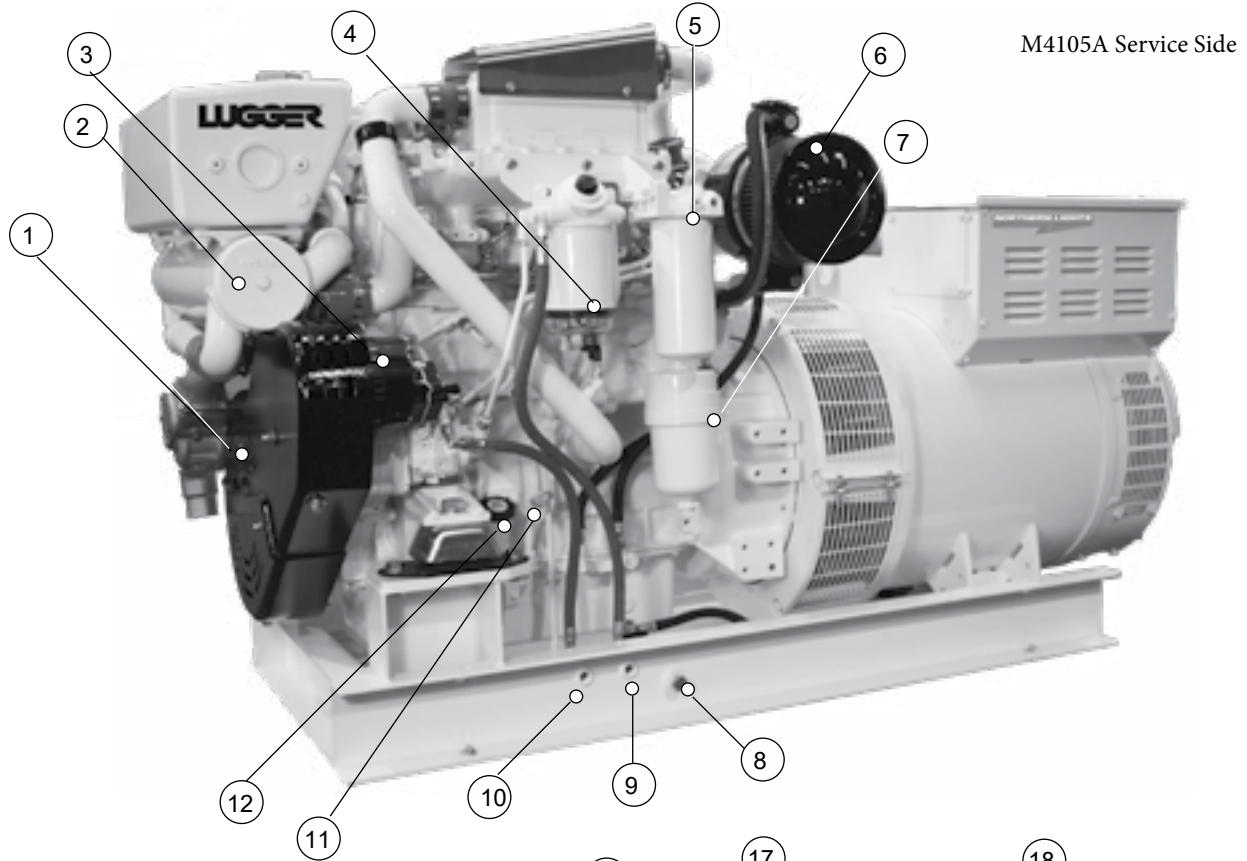
Restarting Procedures

CAUTION

Follow the procedures below prior to restoring energy:

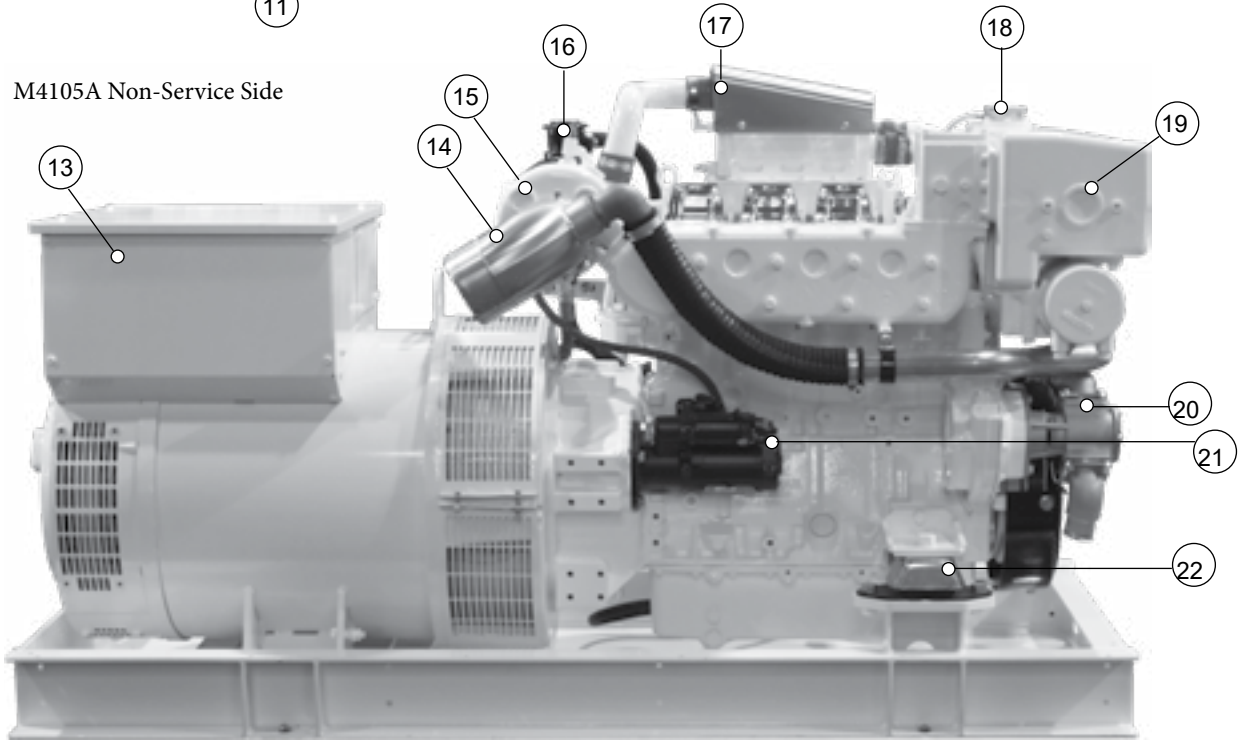
- Ensure that all machinery or equipment is properly reassembled. Inspect the machinery or equipment to verify non-essential items have been removed.
- Ensure that all personnel are safely outside danger zones. Notify personnel that lock out/tag out devices have been removed and energy will be reapplied.
- Only authorized personnel may remove lock out/tag out devices or notices.

Component Locations



M4105A Service Side

M4105A Non-Service Side



- | | | | |
|-----------------------------------|-------------------------|-----------------------|--------------------------------|
| 1. Belt Guard | 7. Oil Filter | 13. Junction Box | 18. Coolant Fill |
| 2. Heat Exchanger | 8. Oil Drain Port | 14. Exhaust Elbow | 19. Expansion Tank |
| 3. Alternator | 9. Fuel Supply Port | 15. Turbocharger | 20. Seawater Pump |
| 4. Fuel/Water Separator | 10. Fuel Return Port | 16. Coalescing filter | 21. Starter |
| 5. Final Fuel Filter | 11. Engine Oil Dipstick | 17. Aftercooler | 22. Vibration insulation mount |
| 6. Air Filter & Coalescing Filter | 12. Engine Oil Fill | | |

Component Locations

IMAGE NOT AVAILABLE AT TIME OF PUBLICATION

M4105H Service Side

IMAGE NOT AVAILABLE AT TIME OF PUBLICATION

M4105H Non-Service Side

- | | | | |
|----------------------|----------------------------|------------------------------------|--------------------------------|
| 1. Coolant Fill | 9. Air Cleaner | 17. Heat Exchanger Zinc (2) | 24. Optional Governor Actuator |
| 2. Expansion Tank | 10. DC Circuit Breaker | 18. Heat Exchanger Drain | 25. Drive Belt Cover |
| 3. DC Alternator | 11. Turbocharger | 19. Heat Exchanger | 26. Fuel Manifold |
| 4. Lube Oil Fill | 12. Wet Exhaust Elbow | 20. Raw Water Pump | 27. A.V.R. Fuse |
| 5. Lube Oil Filter | 13. Exhaust Manifold Drain | 21. Fuel Injectors (6) | 28. Fuel Filter |
| 6. Fuel Lift Pump | 14. Electric Starter | 22. Thermostat cover | |
| 7. Lube Oil Dipstick | 15. Engine Block Drain | 23. Optional Hydrolastic
Mounts | |
| 8. Lube Oil Drain | 16. Fuel Injection Pump | | |

Component Locations

IMAGE NOT AVAILABLE AT TIME OF PUBLICATION

M6105A Service Side

IMAGE NOT AVAILABLE AT TIME OF PUBLICATION

M6105A Non-Service Side

- | | | | |
|-------------------|--------------------------------|--------------------------|--|
| 1. Junction Box | 8. Coolant Fill | 15. Lube Oil Drain | 22. Injection Pump Drive
Coupling Access Cover
Plate |
| 2. Exhaust Elbow | 9. Alternator | 16. Fuel Manifold | 23. Engine Block Drain |
| 3. Turbocharger | 10. Raw Water Pump | 17. Expansion Tank | |
| 4. Air Cleaner | 11. Lube Oil Dipstick | 18. Thermostat Cover | |
| 5. Fuel Filter | 12. Lube Oil Filter | 19. Heat Exchanger Zincs | |
| 6. Fuel Lift Pump | 13. Optional Hydrolastic Mount | 20. Heat Exchanger | |
| 7. Lube Oil Fill | 14. Starter | 21. Belt Guard | |

Component Locations

IMAGE NOT AVAILABLE AT TIME OF PUBLICATION

M6105H Service Side

IMAGE NOT AVAILABLE AT TIME OF PUBLICATION

M6105H Non-Service Side

- | | | | |
|----------------------|----------------------------|------------------------------------|--------------------------------|
| 1. Coolant Fill | 9. Air Cleaner | 17. Heat Exchanger Zinc (2) | 24. Optional Governor Actuator |
| 2. Expansion Tank | 10. DC Circuit Breaker | 18. Heat Exchanger Drain | 25. Drive Belt Cover |
| 3. DC Alternator | 11. Turbocharger | 19. Heat Exchanger | 26. Fuel Manifold |
| 4. Lube Oil Fill | 12. Wet Exhaust Elbow | 20. Raw Water Pump | 27. A.V.R. Fuse |
| 5. Lube Oil Filter | 13. Exhaust Manifold Drain | 21. Fuel Injectors (6) | 28. Fuel Filter |
| 6. Fuel Lift Pump | 14. Electric Starter | 22. Thermostat cover | |
| 7. Lube Oil Dipstick | 15. Engine Block Drain | 23. Optional Hydrolastic
Mounts | |
| 8. Lube Oil Drain | 16. Fuel Injection Pump | | |

Component Locations

IMAGE NOT AVAILABLE AT TIME OF PUBLICATION

C4105A Service Side

IMAGE NOT AVAILABLE AT TIME OF PUBLICATION

C4105A Non-Service Side

Component Locations

IMAGE NOT AVAILABLE AT TIME OF PUBLICATION

C6105A Service Side

IMAGE NOT AVAILABLE AT TIME OF PUBLICATION

C6105A Non-Service Side

TSC Control Panel



The TOUGH series TSC controllers are designed to provide complete control, protection, AC metering, and engine instrumentation for both standard and electronic engines. Your S-TSC Panel has been configured by Northern Lights to work with your genset. However, if you require custom configurations, the programming can be modified using either the front panel buttons or PC configuration software. See Appendix for information. TOUGH series controllers are ideally suited for severe duty applications where reliability is critical.

For starting and stopping using the TSC control panel, see page 15.

FEATURES AND FUNCTIONS

- SAE J1939 CAN Bus Protocol
- RPM via J1939, Magnetic Pickup, or Generator
- Autostart on low battery and other sensors
- Trim feature for AC monitoring and sensors
- Maintenance counter
- Exerciser Clock
- 150 Event Log
- Conformity coated for protection against moisture
- Gasket for water ingress protection IP65
- Passcode protected
- Automatic shutdowns and warnings
- Manual and Remote start
- Pre-heat and many other configurable timers
- Accepts common senders (VDO, Datcon)

AVAILABLE DISPLAYS:

- Engine Temperature
- Oil Pressure
- Fuel Level
- Engine Speed
- AC Metering
- Battery Voltage
- Real Time Clock
- Engine Hours
- Time to Maintenance
- Text
- Custom Senders
- Warnings and Failures



Paralleled TSC panels showing sample installation

Emission-Related Installation & Instructions

Failing to follow these instructions when installing a certified engine in a vessel violates federal law (40 CFR 1068.105(b)), subject to fines or other penalties as described in the Clean Air Act.

The installed exhaust system should not create exhaust back pressure greater than 30" (760 mm) of water for a turbocharged engine and 48" (1200 mm) for a non-

turbocharged unit, measured at the engine exhaust elbow. If you install the engine in a way that makes the engine's emission control information label hard to read during normal engine maintenance, you must place a duplicate label on the vessel, as described in 40 CFR 1068.105.

Please reference model-specific emission related installation instructions, L982, for critical information.

Operating Procedures

BEFORE STARTING

WARNING: *To prevent personal injury or death, provide ventilation when operating an engine in a closed area. Inhalation of exhaust gas can be fatal.*



The operator shall fully understand the usage and the function of all controls and instruments.

1. Check battery charge
2. Check the engine oil. If it is lower than specified, replenish it.
3. Check cooling system fluid level.

CAUTION: *To avoid damage to the engine, use engine oil as specified in Servicing Section: Lubrication-General on page 20. Comply with the maximum oil level.*



4. Check fuel level.
5. Check DEF level on SCR system reservoir, if applicable.
6. Check the air filter for impurities and clogging, and the air intake ducts for cuts, cracks and damages on sealing.
7. Inspect for coolant, fuel or oil leaks.
8. Check for loose or hanging electrical connections.
9. Add the recommended fuel. See Acceptable Fuel Blends on page 26.
10. Inspect the exhaust system/SCR for clogging or damage.

STARTING/SHUTDOWN

The generator set engine starts through the standard TSC control module.

1. Ensure that the controller is in AUTO setting.
2. Press the RUN button to start the engine.
3. Press the OFF button to shutdown the engine.

For a list of available TSC functions, see page 14.

OPERATING

1. Check Gauges Often: Oil pressure must be above 29 PSI (if not above 15 PSI within 5 seconds of starting, the engine should be stopped and the problem should be explored). Normal oil pressure is 90 PSI at rated load speed (1800 RPM). The D.C. voltmeter should read between 13.5 and 14.5 volts (27-29 volts, 24 volt systems).
2. Check AC voltage and frequency meters. If gauges deviate from normal levels, shut down the set and investigate.
3. Check belt for proper alignment and good condition.
4. Let the unit run unloaded for a three to five minute warm-up period before applying load.
5. Do not add full electrical load until engine is at operating temperature.

Operating Procedures

SHUTDOWNS AND ALARMS

1. Your unit is fitted with a system to protect it from high water temperature or low oil pressure.
 - a. Generator sets have shutdown systems to stop the engine. They have no warning horns.
 - b. Alarms and shutdowns are pre-programmed into the TSC control panel. Consult factory for more information.

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 36-38 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 (93.3°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 was normal, DO NOT restart the engine. Call your Northern Lights or Luger 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 generator engine.
2. Operate the engine under various conditions, particularly heavy loads with minimal idling, to help seat engine components properly.
3. Oil consumption is greater during break-in as piston rings take time to seat.
4. Change engine oil and filter at 50 hours using API Service Category CI-4 oil. Change the oil and filter again at 100 hours. (Consult the lubricants section for oil recommendation.)
5. Frequently check the engine temperature and oil pressure gauges.

Service Schedule Chart

SERVICE POINT	PAGE	OPERATION (note)	DAILY	After 50 Hrs	After 100 Hrs	Every 50 Hrs	Every 100 Hrs	Every 250 Hrs	Every 500 Hrs	Every 2500 Hrs
ENGINE:										
SP-1	20	Check oil level	•							
SP-2	20	Replace engine oil (1)		•	•			•		
SP-3	21	Replace lube oil filters (1)		•	•			•		
SP-6	22-25	Check valve clearances (1)							•	
SP-10	27	Inspect crankshaft damper (4)								
		Basic visual inspection	•							
FUEL SYSTEM:										
SP-7	26	Check primary filter/RACOR (1)	•							
SP-8	26	Change primary filter element/RACOR (2) (3)						•		
SP-9	26	Change final fuel filter (1) (3)							•	
TURBOCHARGER:										
SP-11	30	Check air, oil & cooling water lines for leakage (1) (3)				•				
INTAKE SYSTEM:										
SP-4	21	Replace Coalescing Filter							•	
SP-4	21	Inspect/clean air intake filter (1)						•		
SP-19	34	Check crankcase vent	•							
SP-19	34	Change crankcase vent filter						•		
COOLING SYSTEM:										
SP-12	32	Check coolant level	•							
SP-13	32	Cooling system flush								•
SP-14	32	Inspect/clean heat exchanger (1)								•
SP-15	33	Inspect zinc electrodes (1) (3)						•		
SP-16	33	Check raw water strainer	•							
ELECTRICAL SYSTEM:										
SP-5	21	Inspect alternator belt tension, adjust as needed (1)		•				•		
SP-5	21	Replace alternator belt							•	
SP-17	34	Service battery per manufacture recommendation (1) (3)		•						
SP-18	34	Check battery condition with hydrometer (1)							•	
OUT OF SERVICE:										
SP-22	35	Winterizing or out of service (3)								

NOTES:

- 1) Perform all maintenance once a year even if hour level has not been reached.
- 2) Consult manufacturer's maintenance schedule and note on provided chart.
- 3) Whenever necessary
- 4) Replace crankshaft damp at 4500 hours or 60 months, whichever occurs first.

Service Schedule Chart, Electronically Controlled Fuel System

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

DAILY:

- Basic visual inspection
- SP-1 Check oil level in engine
- SP-7 Check primary fuel filter/RACOR
- SP-19 Check crankcase vent
- SP-12 Check coolant level
- SP-16 Check raw water strainer

AFTER FIRST 50 HOURS:

- SP-2 Replace engine oil
- SP-3 Replace lube oil filters
- SP-5 Inspect alternator belt tension; adjust as needed
- SP-17 Service battery per manufacturer recommendation

AFTER FIRST 100 HOURS

- SP-2 Replace engine oil
- SP-3 Replace lube oil filters

EVERY 50 HOURS

- SP-11 Check turbocharger lines for leakage

EVERY 250 HOURS :

- SP-2 Replace engine oil
- SP-3 Replace lube oil filters
- SP-8 Change primary fuel filter
- SP-4 Inspect/clean air intake filter
- SP-19 Change crankcase vent filter
- SP-15 Inspect zinc electrodes
- SP-5 Inspect alternator belt tension; adjust as needed

EVERY 500 HOURS :

- SP-6 Check valve clearances
- SP-9 Change final fuel filter
- SP-5 Replace alternator belt
- SP-18 Check battery condition with hydrometer
- SP-4 Replace coalescing filter

EVERY 2500 HOURS :

- SP-13 Cooling system flush
- SP14 Inspect/clean heat exchanger

Service Record

Service Point	OPERATION	HOURS/ DATE									
EVERY 50 HOURS											
SP-11	Check turbocharger										
EVERY 250 HOURS											
SP-2	Replace engine oil										
SP-3	Replace lube oil filters										
SP-8	Change primary fuel filter										
SP-4	Inspect/clean air intake filter										
SP-19	Change crankcase vent filter										
SP-15	Inspect zinc electrodes										
SP-5	Inspect alternator belt, adjust as needed										
EVERY 500 HOURS											
SP-6	Check valve clearances										
SP-9	Change final fuel filter										
SP-5	Replace alternator belt										
SP-18	Check battery condition with hydrometer										
SP-4	Replace coalescing filter										
EVERY 2500 HOURS											
SP-13	Cooling system flush										
SP-14	Inspect/clean heat exchanger										

Servicing

LUBRICATION

1. The American Petroleum Institute (API) defines engine oil quality by service categories that define oil performance measured in standardized engine tests.
2. API CI-4 oils, or better, are recommended in order to meet current emission standards.
3. API CI-4 oils provide protection against:
 - Engine wear
 - Piston deposits
 - Soot related viscosity increase, deposits and wear
 - Viscosity lose due to shear
 - Oxidative thickening
 - Oil foaming and aeration
4. Oil Viscosity
The Society of Automotive Engineers defines oil viscosity (thickness) by grade. Colder temperatures require lower grade oils for correct flow during starting. Higher temperatures require higher grade oils for satisfactory lubrication.

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

SP-1. CHECK ENGINE OIL LEVEL

NOTE: Do not check the oil level with the engine running or immediately after turning it off.

1. Turn the engine off, and wait for fifteen minutes before removing dipstick or opening oil fill.
2. Before removing the oil level dipstick, clean all areas around the filler neck and dipstick.
3. Remove oil level dipstick from engine.
4. If oil level is below operating range, fill with recommended oil for environmental operating climate.
5. If oil level is between the maximum and minimum marks, the engine can operate normally. For best performance between service intervals, fill oil up to the upper mark (MAXIMUM), without exceeding it. Do not operate the engine with oil below the lower mark (MINIMUM).

CAUTION: To avoid damage to the engine:



- Assure oil level readings are within the crosshatched operating range on the oil level gauge.
- Do not overfill the engine with oil.
- Do not operate engine if oil level is above or below operating range.

Model	Imperial	Metric
M4105A, H M6105A, H	12.15 qts. 18.00 qts.	11.5 liters 17.0 liters

SP-2. OIL CHANGES

1. Using the oil recommended above, change the engine oil and filter after the first 50 hours of operation, the first 100 hours and every 250 hours thereafter.
 - 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.

CAUTION: Use multigrade lubricating oil in accordance with SAE 15W40 standard and API-CI4 class or superior.



Servicing

SP-3. CHANGING OIL FILTER

1. Change the lube oil filter every 250 hours, after the initial 50 and 100 hour change.
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.

SP-4. AIR CLEANER

1. Inspect intake air filter every 250 hours. Replace filter every 500 hours, or yearly, whichever comes first.
2. To replace coalescing filter; Remove v-band clamp and air filter. Carefully remove silencer lid and o-rings. Carefully raise service handle on intake air filter. Pull out of housing with equal force. Once primary element is removed, reach inside housing and remove coalescing filter. Discard both elements and replace with new. Reassemble by placing o-rings, silencer lid, v-band and air filter back into place.
3. 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.

SP-5. ALTERNATOR BELT

1. Check the tension and wear on the alternator belt daily.
2. Use your thumb to press on the belt at the midpoint between the crankshaft and alternator pulleys. The tension is correct if the belt can be depressed about 3/16 in. (5 mm).
3. Every 500 hours, replace the alternator belt with the correct Northern Lights part.

Servicing

SP-6. VALVE CLEARANCES

To adjust valves:

1. Use a new valve cover gasket, ensuring that it is fitted correctly.



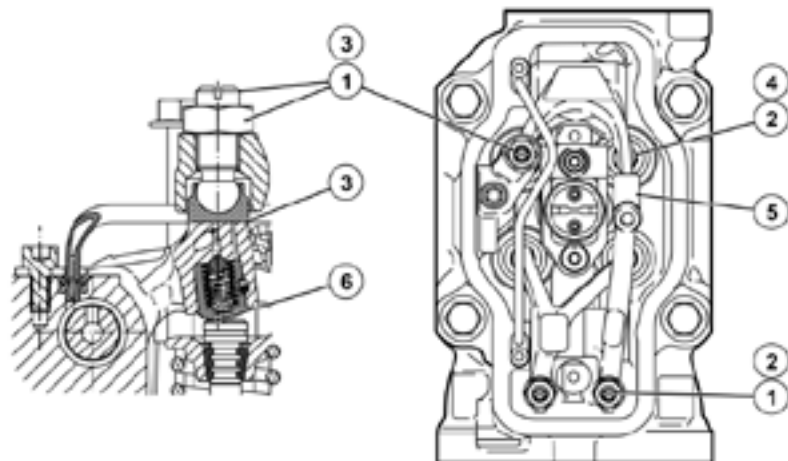
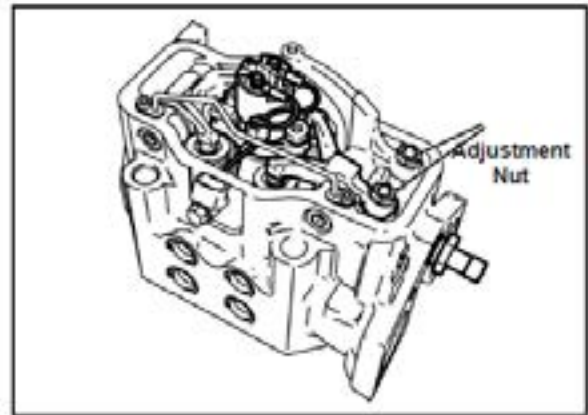
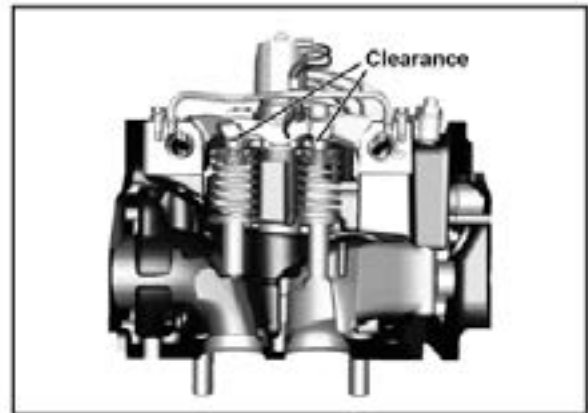
2. Using a M6x60 bolt, install the valve cover applying the correct torque.

Torque: 8.5 ± 1 Nm



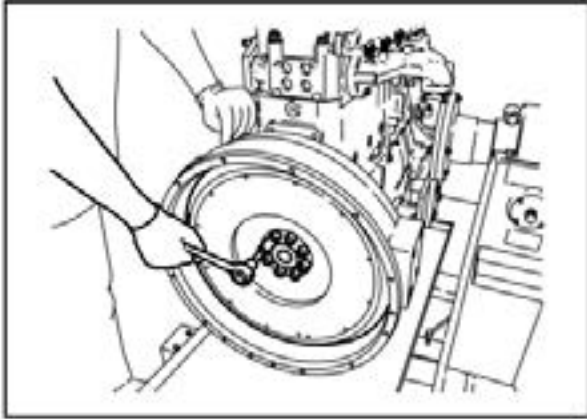
Intake and Exhaust Valve adjustment

1. With the engine cold, turn the crankshaft until the cylinder 4 (on M4105 models) or cylinder 6 (or M6105 models) intake and exhaust valves are closed. Ensure that the camshaft is not acting on the rocker arm that will be adjusted.



Servicing

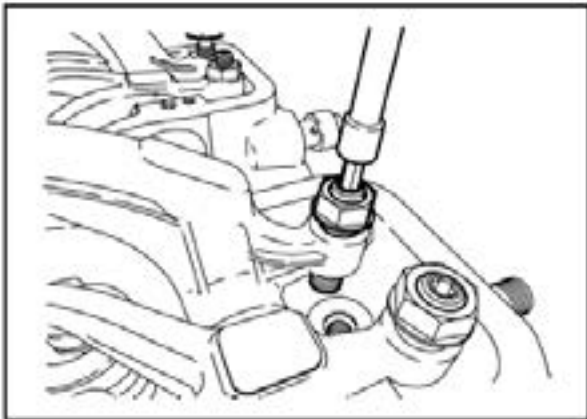
2. Select the cylinder to be adjusted and position the piston on top of dead center in order to ensure that all valves are completely closed.



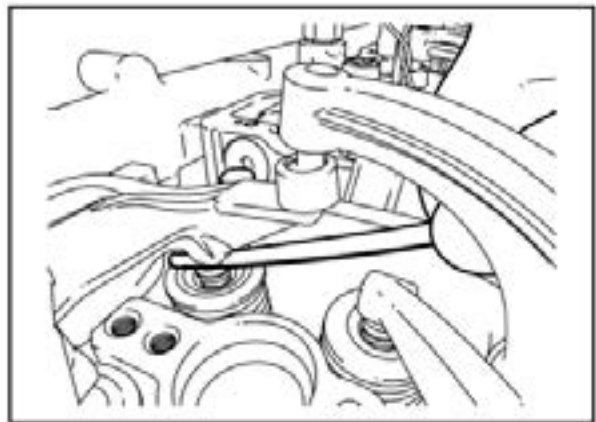
4. Using a screwdriver and wrench, loosen the pivot and lock nut, located on pivot support.



3. Using a screwdriver and wrench, loosen the clearance valve adjusting bolt and lock nut, located on intermediary rocker arm.



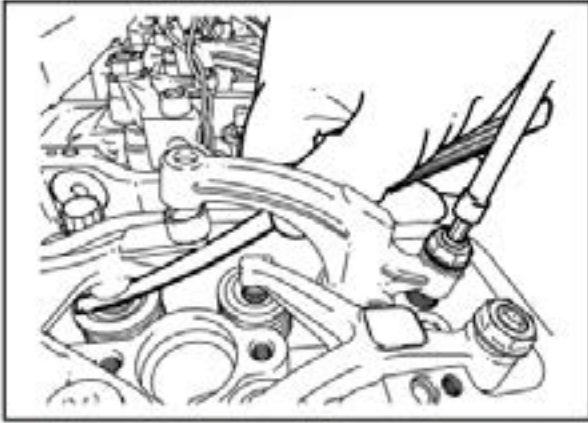
5. Insert 0.3 mm adjustment blade between the exhaust valve cap and rocker arm, at the side without the actuator.



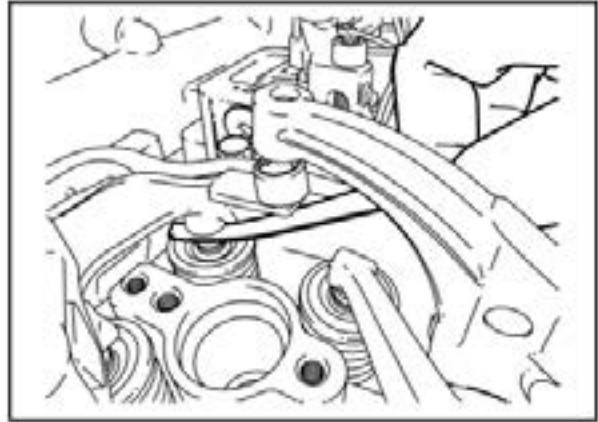
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Servicing

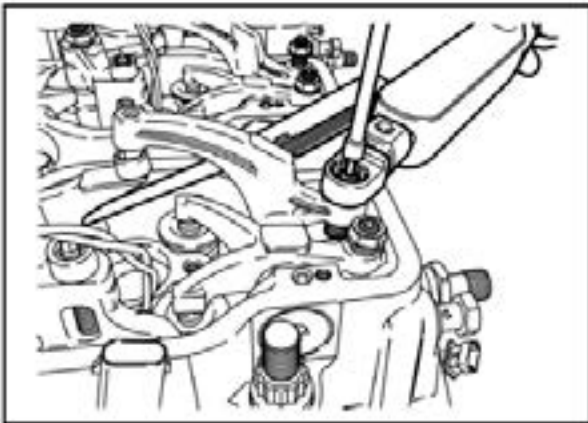
- Using a screwdriver and wrench, lean the valve adjustment bolt on the intermediary rocker arm until the blade slides with light pressure between the parts.



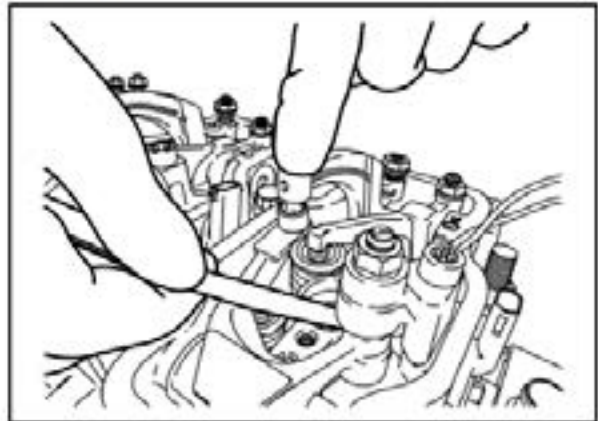
- Ensure that the clearance between the valve cap and rocker arm is 0.3 mm. Readjust if necessary.



- Remove the adjusting blade, securing the lock nut to its position with a screwdriver.



- Push the exhaust rocker arm downwards, gently but firmly, by hand. Insert the 0.2 mm adjusting blade between the top of the exhaust rocker arm and pivot seal.

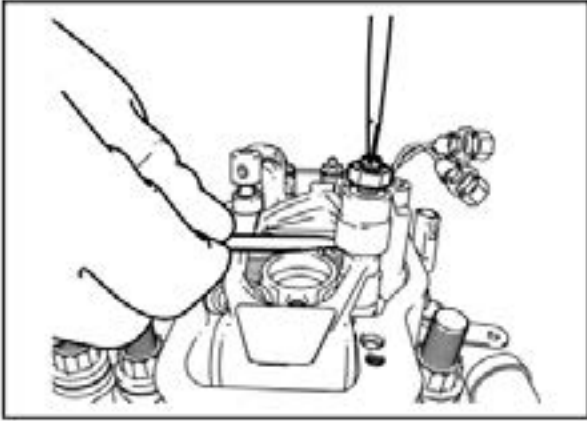


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Servicing

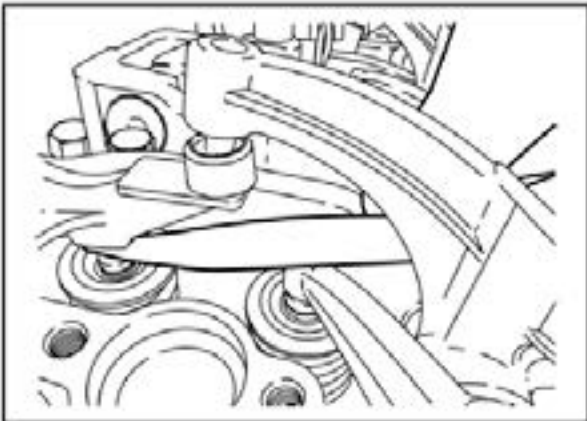
- Using a screwdriver, lean the pivot on its support, eliminating the clearance between the adjusting blade, pivot seat and top of the rocker arm. Continue turning the bolt with a light pressure until the load increases.

NOTE: The same procedure can be used for inlet valve adjustment.



NOTE: The load increase will be sudden but easy to recognize. Repeat this procedure until it is felt.

- Use the adjusting blade to check distance between valve cap and exhaust rocker arm. Target is 0.2 to 0.3 mm.



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Servicing

FUELS - GENERAL

1. Use only clean, high quality fuels of the following specifications, as defined by ASTM designation D975 for diesel fuels:
 - a. Use Grade No. 2 diesel at ambient temperatures above freezing 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

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.

SP-7. CHECK PRIMARY FUEL FILTER

- a. Check the primary fuel filter daily as recommended by the filter manufacturer. Empty the collection bowl as necessary.

SP-8. CHANGE PRIMARY FUEL FILTER ELEMENT

- b. Change the element every 250 hours) or whenever necessary.
- c. If the bowl fills with water, change the primary and secondary elements immediately.

SP-9. FINAL FUEL FILTER

Change fuel filter every 500 hours.

NOTE: The fuel filter on the engine is considered the "final fuel filter". The engine will be fitted with a quick change disposable final fuel filter.

- a. Turn off the fuel.
- b. Remove the final fuel filter by turning the filter counter clockwise until the filter loosens.

*NOTE: Before installing a new filter make sure the surfaces where the filter comes in contact with the mounting plate are absolutely clean. Dirt can be washed into the fuel injection system. This may result in severe damage to the fuel injection pump or nozzles. Your generator set may have two filters, depending on the fuel supply system. **Do not "prefill" the new fuel filter as the fuel used may be contaminated and damage the fuel system components.***

- c. Install new filter.
- d. Turn on the fuel.

Servicing

BLEEDING THE FUEL SYSTEM

DANGER

DANGER: 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. Whenever the fuel system has been opened for service, (lines disconnected, filter changed, etc.) it will be necessary to bleed air from the system.
 - a. To bleed the fuel system, loosen the bleed plug on the fuel filter.

Operate the primer pump lever on fuel/water separator until most of the air bubbles are expelled and clear fuel escapes the bleed plug. Tighten the bleed plug.
 - b. If the engine will not start, it may be necessary to loosen the fuel supply pipe at the pump. Operate primer pump until fuel flow is free from air bubbles. Retighten fuel supply line.
 - c. Crank the engine. If it fails to start after three consecutive attempts, contact an Authorized Northern Lights Dealer.
 - d. Do NOT attempt to disconnect any pipes to the high pressure common rail. This presents a high risk of injury.

SP-10. CRANKSHAFT VIBRATION DAMPER

1. The vibration damper assembly should be replaced every 4500 hours or 60 months, whichever occurs first, as the vibration damper assembly is not repairable.

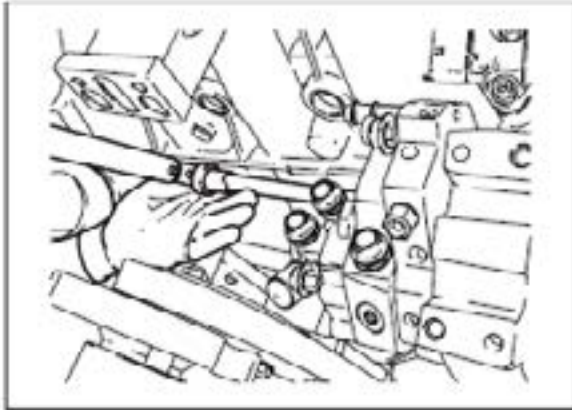
INJECTORS

Fuel injectors are maintenance free. If injector removal should be required, it is to be performed by an Authorized Northern Lights Dealer only.

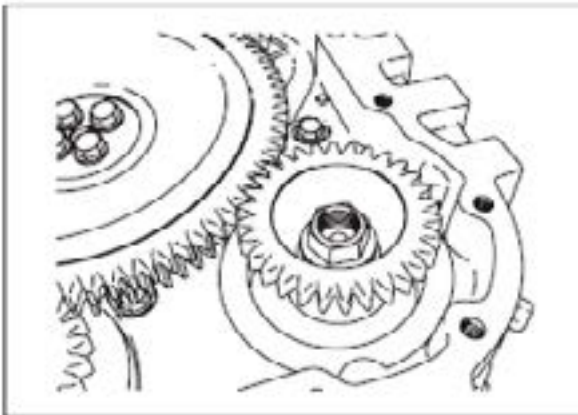
Servicing

HIGH PRESSURE FUEL PUMP

1. Removal
 - a. Loosen and remove the pipes. Then loosen the high pressure pump bolts on the intermediary piece.



- b. Loosen and remove the nut from the high pressure pump gear, located by the side of the gear cover. Then remove the gear.



- c. After removing the gear loosen the bolts and remove the high pressure pump.



CAUTION: The friction between the o-ring and housing of the pump can make it difficult to remove. After removal, put the pump in a safe place to prevent damage.



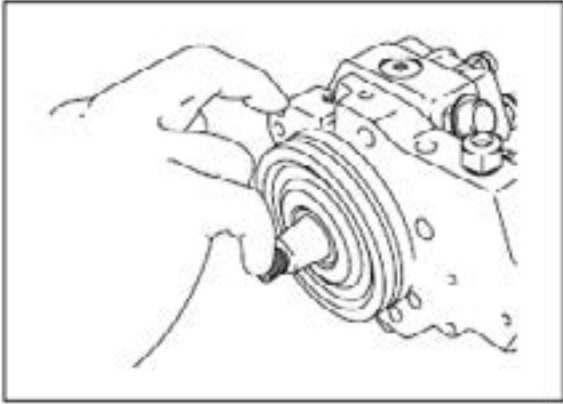
CAUTION: Any disassembly of the high pressure pump will void the warranty. Pump repairs are to be performed ONLY by an authorized Bosch service center.

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Servicing

2. Installation

- a. Install a new o-ring on the high pressure pump. Clean the area and apply a layer of lubricant to the contact area of the o-ring.



- b. Install high pressure pump. Carefully tighten to ensure that the o-ring does not slip or get damaged. Position the pump with the bolts, until it touches the mounting face of the intermediary piece. Then tighten to the specified torque.

TORQUE TO 40+/- 4 Nm.

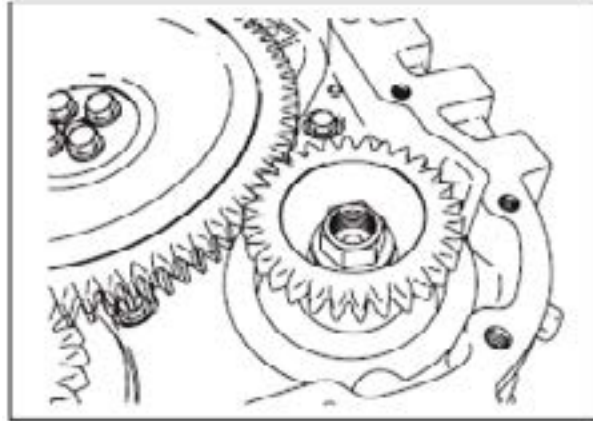
- c. Ensure that there the pump is well seated to the intermediary piece.



- d. After installing the pump, position the gear on the shaft and assembly. Note there is no timing on this gear to the pump, and it does not required a cotter for positioning.

- e. Position gear washer and nut and apply specified torque.

- f. The protective caps must be removed immediately before the piping is installed to avoid contamination.



CAUTION: The cone of the high pressure pump shaft and the gear must be clean and free of oil and grease before installing. Clean using test benzene, ethyl glycol or isopropanol.



CAUTION: The high pressure pump is lubricated by the fuel. Before the first start, fill approximately 60 ml of fuel to lubricate the inner parts. On the first fill, an electric fuel pump can be used with minimum pressure of 2 bar and maximum pressure of 4 bar.

Servicing

SP-11. TURBOCHARGER

1. Check for air leaks every 50 hours. Air leakage will lower engine output and may cause black exhaust smoke and soot.
2. Listen along air line while engine is running. A whistling or hissing sound indicates leakage.
3. Leakage on the pressure side, between turbo and engine, can be found by applying soapy water to the air line.
4. Tighten the hose clamps, replace hose or gaskets as required.
5. Check to see that the lubrication and cooling lines are tight and without leaks.

COOLING REQUIREMENTS

Mixtures of engine coolant and antifreeze include de-mineralised water and inhibitors. The function of coolant and antifreeze is to protect the engine against oxidation and freezing. To assure maximum protection to your engine, pay attention the fluid level on reservoir and use the recommended additives at the correct ratios. Change coolant as specified on Service Chart.

In areas where environmental temperature can fall below freezing (0° C), it is necessary to use an antifreeze additive, which are liquids soluble in water used to prevent water inside the coolant system from freezing.

LINER EROSION (PITTING)

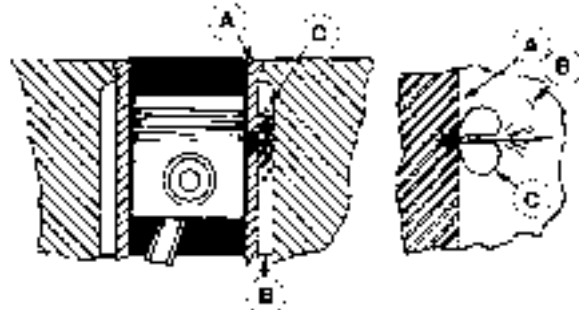
1. Cylinder liner walls (A, right) which are in contact with engine coolant (B, right) can be eroded or pitted unless the proper concentration and type of SCA's are present in the coolant. Water pump impellers are also susceptible to pitting.
2. Vapor bubbles (C, right) are formed when the piston's impact causes the liner walls to vibrate, sending pressure waves into the coolant.
3. These tiny vapor bubbles collect on the surface of metal parts. As the bubbles collapse (pop) a microscopic piece of metal is eroded from the metal part. Over a period of time, this pitting may progress completely through the cylinder liner of a wet-sleeve, heavy-duty diesel engine. This allows coolant to enter the combustion chamber. Engine failure or other serious damage will result.
4. Unprotected engines with low quality water as coolant can have liner failure in as few as 500 hours.

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. Do not use water made by the reverse osmosis method unless it has been PH neutralized.
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.



A - Cylinder Liner Walls B - Engine Coolant C - Vapor Bubbles

Servicing

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 4985P, SAEJ1941, General Motors Performance Specification GM1899M, or formulated to GM6038M.
4. This product is concentrated and should be mixed to the following specification.

	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

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.

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.

SUPPLEMENTAL COOLANT ADDITIVE (SCA)

CAUTION: Supplemental coolant additive contains alkali. 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. Important for heat exchanger cooled engines: Additional SCA's should NOT be added to the mixture of EGC/H₂O on initial fill up of engines with a coolant conditioner-filter. A high SCA concentration will result and can cause silicate-dropout. When this happens, a gel-type deposit is created in the cooling system which retards heat transfer and coolant flow.
2. If additional SCA's are needed, prepare a mixture of 50% quality water and 50%EGC (antifreeze). Add liquid SCA at a rate of 3%, by volume. Example: 30 mL of SCA per liter of H₂O/EGC mixture (1.0 fl oz of SCA per qt of H₂O/EGC). Add the resulting mixture to the cooling system in quart increments. Run the engine for 2 hours and retest the coolant. Continue process until SCA concentration meets recommended levels.
3. SCA is available from your Northern Lights dealer in the following sizes.
Pint - Part Number.....20-00002
1/2 gallon - Part Number.....20-00003
4. DO NOT use any coolant system additives containing soluble oil.

COOLANT TESTING

1. Coolant test kits are available to allow on-site evaluation of the coolant condition.
2. The kits use small strips of paper which are dipped into the coolant. The paper changes color and indicates the SCA concentration. It also indicates the amount of EGC (antifreeze).
3. Test kits are available through your Northern Lights Dealer.

Servicing

SP-12. 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 3/4 in. (4-5 cm) below the filler cap sealing surface when the engine is cold. When filling with coolant, the venting cock on top of the turbocharger (for engines fitted with turbocharger) should be opened to ensure that no air pockets form in the cooling system.
2. The pressure valve in the filler cap releases when the pressure is approximately 10 PSI (0.69 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.

SP-13. FLUSHING THE COOLING SYSTEM

To ensure the longevity of your aftercooler, maintain a clean cooling system according to the recommended maintenance schedule to prevent debris and buildup



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 2000 hours. 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, pages 4 - 6).
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. Close cooling system air vent on turbocharger.
9. Open the seacock.
10. Start the engine. Check hoses and connections and repair any leakage.

SP-14. HEAT EXCHANGER CLEANING

1. Drain the cooling system.
2. Remove the cooling water pipes between the heat exchanger and the water pump inlet.
3. Disconnect hose to seawater pump.
4. Unscrew the attaching bolts holding the heat exchanger to the expansion tank.
5. Remove bolts holding heat exchanger cover.
6. Wash the core inside and out. If necessary, chemical agents can be used. Also clean the accessible parts of the heat exchanger housing.
7. Reassemble, using new gaskets and sealing rings.

Servicing

SP-15. ZINC ANODES

1. Zincs are installed in the cooling system to protect your engine from electrolysis. Check them faithfully every 250 hours. If you are in warm salt water or where electrolysis is a known problem, check them more often.
 - a. Drain the raw water from heat exchanger (see Component Locations).
 - b. Remove zinc holders from side of the heat exchanger (see Component Locations).
2. Scrape or steel brush the zinc electrode clean. If more than 50% of the electrode has eroded away, replace it with a new one. The electrode screws out of the holder.
3. Reinstall the zinc holders. Be sure the threads are clean and have good metal to metal contact.

SP-16. RAW WATER PUMP

Inspect the shaft through the vent holes on the pump for signs of leakage. In case of leaking water pump, the generator should be serviced by an Authorized Northern Lights Dealer.

DRIVEN EQUIPMENT

Generator Ends

1. 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 Northern Lights 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.
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.

Servicing

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.
4. Then, connect negative (-) terminal of booster battery to ground on the engine block (see Figure 26).
5. Remove booster battery after starting engine.
6. Sealed batteries: see manufacturer charging and booster instructions.

SP-17. 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.

SP-18. CHECK BATTERY CONDITION

1. Check the battery condition with a hydrometer every 500 hours.

SP-19. CRANKCASE VENT SYSTEM

1. Check the red filter service indicator button daily - if it pops up the filter element needs to be changed.
2. After changing the element, unscrew the clear plastic cover on the button and push the indicator down to reset it, then replace the cover.
Note: This service should be performed with the engine shut down. The vacuum in the filter canister because of engine operation may make it difficult to take apart.
3. Normally, the filter element should be changed every 250 hours.
4. See Service Point 4 on page 21 for details on servicing the air cleaner

HIGH PRESSURE COMMON RAIL FUEL INJECTORS

Electronic fuel injectors are to be serviced only Authorized Northern Lights dealers. The injectors will not need service unless they show an operational concern or symptom.

Such symptoms may include:

- White smoke in exhaust when cold or lightly loaded.
- Excessive dark exhaust smoke.
- Unusual knocking noises at one cylinder.
- Leakage.

If you notice any of these symptoms, contact a Factory Authorized Northern Lights Dealer.

Do Not Open High-Pressure Fuel System

! DANGER

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

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

Servicing

SP-20. WINTERIZING, OUT-OF-SERVICE

If the generator set will not be used for more than 3 months the following preparations should be taken for long term storage.

- Change engine oil and filter, using 15W-40 oil.
- Run the engine for 15 minutes without load at 2/3 normal speed. Use a small, clean source of fuel dosed with either "Stab-il" brand fuel system stabilizer (diesel engine formula), or Stanadyne Performance fuel system conditioner.
- Completely drain and flush the cooling system.
- Apply protective oil to machined surfaces, and protective grease to linkages.
- Completely seal off intake and exhaust openings.
- Remove belts.
- Cover entire engine in large plastic bag and tape closed at bottom of bag-place several moisture absorbing desiccant packs inside plastic bag Store engine in original shipping crate, if possible, or other suitable storage crate.
- Store engine inside a building (preferably climate controlled) to prevent corrosion.

To Remove Generator Set from Long-Term Storage:

1. Take off all protective coverings and unseal all the openings that were covered up.
2. Clean the generator set exterior
3. Fill the cooling system with pre-mixed, 50/50, conventional ethylene-glycol heavy-duty diesel engine coolant (with SCAs).
4. Change engine oil filter.
5. Fill oil pan with new lubricant oil
6. Install and adjust tension on belt(s)
7. Remove valve covers and lubricate rocker arms with engine oil. Reinstall covers.
8. Drain fuel mixture from reservoir and fill with new fuel.
9. Change fuel filter.
10. Perform all pre-start checks (see Starting and Operating on page 15)
11. Crank the engine for 20 seconds with the starter, without letting the engine start. Wait 2 minutes and crank the engine an additional 20 seconds to make sure all bearing surfaces are well coated.
12. Start the engine and run at no load in a low idle for several minutes. Make sure the engine is warmed up and check gauges before going under load.
13. Check all gauges and check for leaks.

Troubleshooting

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

ENGINE

✓ Engine Hard to Start or Will Not Start

Engine starting under load.

- Disengage PTO if applicable.

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.

Electronic Fuel System problem (if equipped):

- See your dealer.

Injection pump not getting fuel or air in fuel system.

- Check fuel flow at supply pump or bleed fuel system.

✓ 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, bleed fuel system.

Improper type of fuel:

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

✓ Lack of Engine Power

Intake air restriction:

- Service air cleaner.
- Service aftercooler.

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.

Below normal engine temperature:

- Remove and check thermostat.

Electronic fuel system problem.

- See your dealer.

Turbocharger not functioning (if equipped).

- See your dealer.

Leaking exhaust manifold gasket.

- See your dealer.

Restricted fuel hose.

- Clean or replace fuel hose.

Low fast idle speed.

- See your dealer.

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 Knocks

Low oil level:

- Add oil to engine crankcase.

Below normal engine temperature:

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

Engine overheating:

- See "Engine Overheating" section.

Troubleshooting

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

✓ Engine Overheats

Engine overloaded.

- Reduce the 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.

Stretched belt or defective belt tensioner.

- Check automatic belt tensioner and check belts for stretching. Replace as required.

Low engine oil level.

- Check oil level, add oil as needed.

Incorrect grade of fuel.

- Use correct grade of fuel.

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:

- Check impeller and replace if necessary.

✓ High Fuel Consumption

Engine overloaded.

- Reduce load.

Air in fuel system:

- Bleed fuel system.

Improper type of fuel:

- Use correct fuel for temperature.

Clogged or dirty air cleaner:

- Service air cleaner.

Improper valve clearance:

- See your dealer.

Injection nozzles dirty:

- See your dealer.

Electronic fuel system problem.

- 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 Emits Black or Gray Exhaust Smoke

Clogged or dirty air cleaner:

- Service air cleaner.

Clogged aftercooler:

- Service aftercooler.

Defective muffler (back pressure too high):

- Have dealer check back pressure.

Improper fuel:

- Use correct fuel for temperature.

Engine overloaded.

- Reduce load.

Electronic fuel system problem.

- See your dealer.

Turbocharger not functioning.

- See your dealer.

Injection nozzles dirty:

- 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.

Defective injection nozzles.

- See your dealer.

Troubleshooting

If you cannot correct problems with these procedures, see your **Lugger or 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 cell.
- Check electrolyte level of each battery cell.

Loose or defective alternator belt:

- Adjust belt tension.
- Replace belt.

✓ Undercharged Electrical System

Excessive electrical load from added accessories:

- Take off accessories or install higher output alternator.

Engine idling excessively.

- Increase the engine RPM when there is a heavy electrical load.

Poor electrical connections on battery, ground strap, starter, or alternator.

- Inspect connections and clean if necessary.

Defective battery.

- Test battery.

Battery charging rate too high.

- Test charging system.

✓ Starter Inoperative

PTO engaged.

- Disengage PTO.

Check DC circuit breaker:

- If the breaker is tripped, reset it.

Faulty start circuit relay.

- See dealer.

Blown main system fuse.

- Replace fuse.

Loose or corroded connections:

- Clean and tighten loose battery and harness plug connection.

Low battery output:

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

Defective electrical system ground wire:

- Repair or replace.

✓ Starter Cranks Slowly

Low battery output:

- Battery is too small.
- Battery cables are too small.

Check specific gravity of each battery cell:

- Replace battery if necessary.

Check electrolyte level of each battery cell:

- 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.

✓ Starter and Hour Meter Function but rest of Electrical System Does Not Function

Blown fuse on magnetic switch.

- Replace fuse.

✓ 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 cell.

Model Specifications

	M4105A1	M4105A2	M4105A3	M4105A4
	90 KW, 50 Hz	105 KW, 50 Hz	116 KW, 50 Hz	127 KW, 50 Hz
Dimensions and Weight				
Length - in (mm)	73.9 (1878)	73.9 (1878)	73.9 (1878)	73.9 (1878)
Width - in (mm)	36.17 (919)	36.17 (919)	36.17 (919)	36.17 (919)
Height - in (mm)	43.2 (1096)	43.2 (1096)	43.2 (1096)	43.2 (1096)
Weight - lbs (kg)	2604 (1181)	2604 (1181)	2604 (1181)	2888 (1310)
Dimensions and Weight with Optional Sound Enclosure				
Length - in (mm)	75.4 (1916)	75.4 (1916)	75.4 (1916)	75.4 (1916)
Width - in (mm)	42.0 (1067)	42.0 (1067)	42.0 (1067)	42.0 (1067)
Height - in (mm)	45.0 (1143)	45.0 (1143)	45.0 (1143)	45.0 (1143)
Weight - lbs (kg)	3162 (1421)	3162 (1421)	3162 (1421)	3753 (1706)
Generator Data				
Voltage Regulation	+/-0.5%	+/-0.5%	+/-0.5%	+/-0.5%
Frequency Control	Isochronous/Droop	Isochronous/Droop	Isochronous/Droop	Isochronous/Droop
Phase and Power Factor - Standard	Three phase 0.8	Three phase 0.8	Three phase 0.8	Three phase 0.8
Generator Full Load Temp. Rise at 45°C Ambient	110°	110°	110°	110°
Lugger Diesel Engine Data				
Inline Cylinder / Aspiration	I-4/Turbo-Aftercooled	I-4/Turbo-Aftercooled	I-4/Turbo-Aftercooled	I-4/Turbo-Aftercooled
Displacement - in ³ (ltr)	293 (4.8)	293 (4.8)	293 (4.8)	293 (4.8)
Bore / Stroke - in (mm)	4.13/5.39 (105/137)	4.13/5.39 (105/137)	4.13/5.39 (105/137)	4.13/5.39 (105/137)
Cooling System (Heat Exchanger Standard, Keel-Cooling Optional)				
Heat Rejection to Jacket-Water - BTU min	2342	2908	3090	C/F
Freshwater Pump Capacity - gpm (lpm)	50 (190)	50 (190)	50 (190)	50 (190)
Heat Exchanger Approx. Cooling Capacity - gal (ltr)	9.7 (37)	9.7 (37)	9.7 (37)	9.7 (37)
Engine Only Approx. Cooling Capacity - gal (ltr)	8.2 (31)	8.2 (31)	8.2 (31)	8.2 (31)
Raw Water Pump Capacity - gpm (lpm)	40 (151)	40 (151)	40 (151)	40 (151)
Max. Raw Water Pump Suction Head Lift - in (mm)	39 (1000)	39 (1000)	39 (1000)	39 (1000)
Raw Water Pump Inlet Hose ID - in (mm)	2 (51)	2 (51)	2 (51)	2 (51)
Min. Raw Water Inlet/ Discharge Thru-Hull - in (mm)	2 (51)	2 (51)	2 (51)	2 (51)
DC Electrical				
DC Starting Voltage - Standard (Optional)	12 (24)	12 (24)	12 (24)	12 (24)
Min. Battery Capacity - amp hr	90	90	90	90
Min. Battery Size - CCA	750	750	750	750
Starter Rolling Amps at 0°C - 12V (24V)	420 (225)	420 (225)	420 (225)	420 (225)
12 Volt Battery Cable Size Up to 5ft (1.5m) - mm ²	50	50	50	50
Air				
Air Consumption - m ³ /m (cfm)	4.1 (146)	4.4 (157)	4.6 (162)	4.8 (169.8)
Approx. Heat Radiated to Air; Engine & Gen. - BTU/min	1304	1529	1655	1799
Generator Cooling Air Flow 1&3Ø - m ³ /m (cfm)	15 (528)	15 (528)	15 (528)	17.4 (614)
Exhaust Gas Volume - kg/hr (lbs/min)	431 (15.8)	473 (17.4)	507 (18.6)	540 (19.8)
Exhaust Gas Temp. - C°(F°)	462° (864°)	482° (899°)	499° (930.2°)	524° (975.2°)
Max. Exhaust Back Pressure - in H ² O (mm H ² O)	30 (762)	30 (762)	30 (762)	30 (762)
Wet Exhaust Elbow OD - in (mm)	5 (127)	5 (127)	5 (127)	5 (127)
Dry Exhaust Elbow - in (mm)	4 (102)	4 (102)	4 (102)	4 (102)
Fuel				
Fuel Injection Pump Type and Control	Electronic (HPCR)	Electronic (HPCR)	Electronic (HPCR)	Electronic (HPCR)
Min. Suction Line Size - in (mm)	0.375 (10)	0.375 (10)	0.375 (10)	0.375 (10)
Min. Return Line Size - in (mm)	0.375 (10)	0.375 (10)	0.375 (10)	0.375 (10)
Max. Fuel Transfer Pump Suction Lift - ft (m)	3.28 (1)	3.28 (1)	3.28 (1)	3.28 (1)
Max. Fuel Flow to Transfer Pump - gph	23.8	25.3	25.8	C/F
Max. Fuel Return Line - psi	5	5	5	5
Approx. Fuel Rate at Full Load - gph (lph)	7.5 (28.35)	8.73 (30.3)	9.62 (36.4)	10.64 (48)
Max Engine Operating Angle				
Continuous - Fore/Aft	10° (22.5°)	10° (22.5°)	10° (22.5°)	10° (22.5°)

Model Specifications

	M4105A5	M4105A6	M4105H1
	126 KW, 60 Hz	145 KW, 60 Hz	160 KW, 60 Hz
Dimensions and Weight			
Length - in (mm)	73.9 (1878)	73.9 (1878)	73.9 (1878)
Width - in (mm)	37.6 (955)	37.6 (955)	37.6 (955)
Height - in (mm)	43.2 (1096)	43.2 (1096)	43.2 (1096)
Weight - lbs (kg)	2636 (1195)	2901 (1316)	3148 (1428)
Dimensions and Weight with Optional Sound Enclosure			
Length - in (mm)	75.4 (1916)	75.4 (1916)	75.4 (1916)
Width - in (mm)	42.0 (1067)	42.0 (1067)	42.0 (1067)
Height - in (mm)	45.0 (1143)	45.0 (1143)	45.0 (1143)
Weight - lbs (kg)	3507 (1591)	3774 (1712)	4021 (1824)
Generator Data			
Voltage Regulation	+/-0.5%	+/-0.5%	+/-0.5%
Frequency Control	Isochronous/Droop	Isochronous/Droop	Isochronous/Droop
Phase and Power Factor - Standard	Three phase 0.8	Three phase 0.8	Three phase 0.8
Generator Full Load Temp. Rise at 45°C Ambient	110°	110°	110°
Lugger Diesel Engine Data			
Inline Cylinder / Aspiration	I-4/Turbo-Aftercooled	I-4/Turbo-Aftercooled	I-4/Turbo-Aftercooled
Displacement - in ³ (ltr)	293 (4.8)	293 (4.8)	293 (4.8)
Bore / Stroke - in (mm)	4.13/5.39 (105/137)	4.13/5.39 (105/137)	4.13/5.39 (105/137)
Cooling System (Heat Exchanger Standard, Keel-Cooling Optional)			
Heat Rejection to Jacket-Water - BTU min	C/F	C/F	C/F
Freshwater Pump Capacity - gpm (lpm)	55 (210)	55 (210)	55 (210)
Heat Exchanger Approx. Cooling Capacity - gal (ltr)	9.7 (37)	9.7 (37)	9.7 (37)
Engine Only Approx. Cooling Capacity - gal (ltr)	8.2 (31)	8.2 (31)	8.2 (31)
Raw Water Pump Capacity - gpm (lpm)	47 (177)	47 (177)	47 (177)
Max. Raw Water Pump Suction Head Lift - in (mm)	39 (1000)	39 (1000)	39 (1000)
Raw Water Pump Inlet Hose ID - in (mm)	2 (51)	2 (51)	2 (51)
Min. Raw Water Inlet/ Discharge Thru-Hull - in (mm)	2 (51)	2 (51)	2 (51)
DC Electrical			
DC Starting Voltage - Standard (Optional)	12 (24)	12 (24)	12 (24)
Min. Battery Capacity - amp hr	90	90	90
Min. Battery Size - CCA	750	750	750
Starter Rolling Amps at 0°C - 12V (24V)	420 (225)	420 (225)	420 (225)
12 Volt Battery Cable Size Up to 5ft (1.5m) - mm ²	50	50	50
Air			
Air Consumption - m ³ /m (cfm)	6.4 (226)	7.4 (260)	7.6 (267)
Approx. Heat Radiated to Air; Engine & Generator - BTU/min	1844	2069	2338
Generator Cooling Air Flow 1&3Ø - m ³ /m (cfm)	18 (635)	20.4 (720)	34.8 (1228)
Exhaust Gas Volume - kg/hr (lbs/min)	734 (27)	870 (32)	942 (34.6)
Exhaust Gas Temp. - C°(F°)	480° (896°)	459° (858.2°)	469° (876.2°)
Max. Exhaust Back Pressure - in H ² O (mm H ² O)	30 (762)	30 (762)	30 (762)
Wet Exhaust Elbow OD - in (mm)	5 (127)	5 (127)	5 (127)
Dry Exhaust Elbow - in (mm)	4 (102)	4 (102)	4 (102)
Fuel			
Fuel Injection Pump Type and Control	Electronic (HPCR)	Electronic (HPCR)	Electronic (HPCR)
Min. Suction Line Size - in (mm)	0.375 (10)	0.375 (10)	0.375 (10)
Min. Return Line Size - in (mm)	0.375 (10)	0.375 (10)	0.375 (10)
Max. Fuel Transfer Pump Suction Lift - ft (m)	3.28 (1)	3.28 (1)	3.28 (1)
Max. Fuel Flow to Transfer Pump - gph	C/F	C/F	C/F
Max. Fuel Return Line - psi	5	5	5
Approx. Fuel Rate at Full Load - gph (lph)	11.9 (45.05)	13.62 (51.56)	14.9 (56.4)
Max Engine Operating Angle			
Continuous - Fore/Aft (side to side)	10° (22.5°)	10° (22.5°)	10° (22.5°)

Model Specifications

	M6105A1	M6105A2	M6105A3
	150 KW, 50 Hz	170 KW, 50 Hz	188 KW, 50 Hz
Dimensions and Weight			
Length - in (mm)	90.0 (2285)	90.0 (2285)	90.0 (2285)
Width - in (mm)	37.6 (955)	37.6 (955)	37.6 (955)
Height - in (mm)	43.0 (1092)	43.0 (1092)	43.0 (1092)
Weight - lbs (kg)	3545 (1608)	3700 (1678)	3700 (1678)
Dimensions and Weight with Optional Sound Enclosure			
Length - in (mm)	91.4 (2321)	91.4 (2321)	91.4 (2321)
Width - in (mm)	42.0 (1067)	42.0 (1067)	42.0 (1067)
Height - in (mm)	45.0 (1143)	45.0 (1143)	45.0 (1143)
Weight - lbs (kg)	4225 (1917)	4380 (1987)	4380 (1987)
Generator Data			
Voltage Regulation	+/-0.5%	+/-0.5%	+/-0.5%
Frequency Control	Isochronous/Droop	Isochronous/Droop	Isochronous/Droop
Phase and Power Factor - Standard	Three phase 0.8	Three phase 0.8	Three phase 0.8
Generator Full Load Temp. Rise at 45°C Ambient	110°	110°	110°
Lugger Diesel Engine Data			
Inline Cylinder / Aspiration	I-6/Turbo-Aftercooled	I-6/Turbo-Aftercooled	I-6/Turbo-Aftercooled
Displacement - in ³ (ltr)	439 (7.2)	439 (7.2)	439 (7.2)
Bore / Stroke - in (mm)	4.13/5.39 (105/137)	4.13/5.39 (105/137)	4.13/5.39 (105/137)
Cooling System (Heat Exchanger Standard, Keel-Cooling Optional)			
Heat Rejection to Jacket-Water - BTU min	C/F	C/F	C/F
Freshwater Pump Capacity - gpm (lpm)	50 (190)	50 (190)	50 (190)
Heat Exchanger Approx. Cooling Capacity - gal (ltr)	11.4 (43)	11.4 (43)	11.4 (43)
Engine Only Approx. Cooling Capacity - gal (ltr)	9.9 (37.5)	9.9 (37.5)	9.9 (37.5)
Raw Water Pump Capacity - gpm (lpm)	40 (151)	40 (151)	40 (151)
Max. Raw Water Pump Suction Head Lift - in (mm)	39 (1000)	39 (1000)	39 (1000)
Raw Water Pump Inlet Hose ID - in (mm)	2 (51)	2 (51)	2 (51)
Min. Raw Water Inlet/ Discharge Thru-Hull - in (mm)	2 (51)	2 (51)	2 (51)
DC Electrical			
DC Starting Voltage - Standard (Optional)	12 (24)	12 (24)	12 (24)
Min. Battery Capacity - amp hr	150	150	150
Min. Battery Size - CCA	900	900	900
Starter Rolling Amps at 0°C - 12V (24V)	C/F	C/F	C/F
12 Volt Battery Cable Size Up to 5ft (1.5m) - mm ²	50	50	50
Air			
Air Consumption - m ³ /m (cfm)	12.1 (429)	10.3 (362)	11.4 (402)
Approx. Heat Radiated to Air; Engine & Generator- BTU/min	2159	2429	2699
Generator Cooling Air Flow 1&3Ø - m ³ /m (cfm)	29 (1017)	29 (1017)	29 (1017)
Exhaust Gas Volume - kg/hr (lbs/min)	886 (33)	759 (28)	843 (31)
Exhaust Gas Temp. - C°(F°)	347° (657°)	514° (957°)	523° (973°)
Max. Exhaust Back Pressure - in H ² O (mm H ² O)	30 (762)	30 (762)	30 (762)
Wet Exhaust Elbow OD - in (mm)	5 (127)	5 (127)	5 (127)
Dry Exhaust Elbow - in (mm)	4 (102)	4 (102)	4 (102)
Fuel			
Fuel Injection Pump Type and Control	Electronic (HPCR)	Electronic (HPCR)	Electronic (HPCR)
Min. Suction Line Size - in (mm)	0.375 (10)	0.375 (10)	0.375 (10)
Min. Return Line Size - in (mm)	0.375 (10)	0.375 (10)	0.375 (10)
Max. Fuel Transfer Pump Suction Lift - ft (m)	3.28 (1)	3.28 (1)	3.28 (1)
Max. Fuel Flow to Transfer Pump - gph	C/F	C/F	C/F
Max. Fuel Return Line - psi	5	5	5
Approx. Fuel Rate at Full Load - gph (lph)	11.48 (43.46)	13.27 (50.23)	15.02 (56.86)
Max Engine Operating Angle			
Continuous - Fore/Aft (side to side)	10° (22.5°)	10° (22.5°)	10° (22.5°)

Model Specifications

	M6105A4	M6105A5	M6105H1
	195 kW, 60 Hz	223 kW, 60 Hz	245 kW, 60 Hz
Dimensions and Weight			
Length - in (mm)	90.0 (2285)	90.0 (2285)	90.0 (2285)
Width - in (mm)	37.6 (955)	37.6 (955)	37.6 (955)
Height - in (mm)	43.0 (1092)	43.0 (1092)	43.0 (1092)
Weight - lbs (kg)	3700 (1678)	3700 (1678)	3999 (1814)
Dimensions and Weight with Optional Sound Enclosure			
Length - in (mm)	91.4 (2321)	91.4 (2321)	91.4 (2321)
Width - in (mm)	42.0 (1067)	42.0 (1067)	42.0 (1067)
Height - in (mm)	45.0 (1143)	45.0 (1143)	45.0 (1143)
Weight - lbs (kg)	4380 (1987)	4380 (1987)	4679 (2122)
Generator Data			
Voltage Regulation	+/-0.5%	+/-0.5%	+/-0.5%
Frequency Control	Isochronous/Droop	Isochronous/Droop	Isochronous/Droop
Phase and Power Factor - Standard	Three phase 0.8	Three phase 0.8	Three phase 0.8
Generator Full Load Temp. Rise at 45°C Ambient	110°	110°	110°
Lugger Diesel Engine Data			
Inline Cylinder / Aspiration	I-6/Turbo-Aftercooled	I-6/Turbo-Aftercooled	I-6/Turbo-Aftercooled
Displacement - in ³ (ltr)	439 (7.2)	439 (7.2)	439 (7.2)
Bore / Stroke - in (mm)	4.13/5.39 (105/137)	4.13/5.39 (105/137)	4.13/5.39 (105/137)
Cooling System (Heat Exchanger Standard, Keel-Cooling Optional)			
Heat Rejection to Jacket-Water - BTU min	C/F	C/F	C/F
Freshwater Pump Capacity - gpm (lpm)	55 (210)	55 (210)	55 (210)
Heat Exchanger Approx. Cooling Capacity - gal (ltr)	11.4 (43)	11.4 (43)	11.4 (43)
Engine Only Approx. Cooling Capacity - gal (ltr)	9.9 (37.5)	9.9 (37.5)	9.9 (37.5)
Raw Water Pump Capacity - gpm (lpm)	47 (177)	47 (177)	47 (177)
Max. Raw Water Pump Suction Head Lift - in (mm)	39 (1000)	39 (1000)	39 (1000)
Raw Water Pump Inlet Hose ID - in (mm)	2 (51)	2 (51)	2 (51)
Min. Raw Water Inlet/ Discharge Thru-Hull - in (mm)	2 (51)	2 (51)	2 (51)
DC Electrical			
DC Starting Voltage - Standard (Optional)	12 (24)	12 (24)	12 (24)
Min. Battery Capacity - amp hr	150	150	150
Min. Battery Size - CCA	900	900	900
Starter Rolling Amps at 0°C - 12V (24V)	C/F	C/F	C/F
12 Volt Battery Cable Size Up to 5ft (1.5m) - mm ²	50	50	50
Air			
Air Consumption - m ³ /m (cfm)	15.8 (559)	16.8 (593)	15.8 (559)
Approx. Heat Radiated to Air; Engine & Generator - BTU/min	2789	3148	3508
Generator Cooling Air Flow 1&3Ø - m ³ /m (cfm)	34.8 (1228)	34.8 (1228)	34.8 (1228)
Exhaust Gas Volume - kg/hr (lbs/min)	1161 (43)	1235 (45)	1167 (43)
Exhaust Gas Temp. - C°(F°)	450° (842°)	483° (901°)	495° (923°)
Max. Exhaust Back Pressure - in H ² O (mm H ² O)	30 (762)	30 (762)	30 (762)
Wet Exhaust Elbow OD - in (mm)	5 (127)	5 (127)	5 (127)
Dry Exhaust Elbow - in (mm)	4 (102)	4 (102)	4 (102)
Fuel			
Fuel Injection Pump Type and Control	Electronic (HPCR)	Electronic (HPCR)	Electronic (HPCR)
Min. Suction Line Size - in (mm)	0.375 (10)	0.375 (10)	0.375 (10)
Min. Return Line Size - in (mm)	0.375 (10)	0.375 (10)	0.375 (10)
Max. Fuel Transfer Pump Suction Lift - ft (m)	3.28 (1)	3.28 (1)	3.28 (1)
Max. Fuel Flow to Transfer Pump - gph	C/F	C/F	C/F
Max. Fuel Return Line - psi	5	5	5
Approx. Fuel Rate at Full Load - gph (lph)	16.61 (62.88)	17.92 (67.83)	19.3 (73.1)
Max Engine Operating Angle			
Continuous - Fore/Aft (side to side)	10° (22.5°)	10° (22.5°)	10° (22.5°)

Model Specifications

	C4105A1	C4105A2	C4105A3	C4105A4
	85 KW, 50 Hz	100 KW, 50 Hz	108 KW, 50 Hz	117 KW, 50 Hz
Dimensions and Weight				
Length - in (mm)	71.0 (1804)	71.0 (1804)	71.0 (1804)	71.0 (1804)
Width - in (mm)	38.12 (968)	38.12 (968)	38.12 (968)	38.12 (968)
Height - in (mm)	44.8 (1139)	44.8 (1139)	44.8 (1139)	44.8 (1139)
Weight - lbs (kg)	2400 (1090)	2400 (1090)	2400 (1090)	2478 (1126)
Generator Data				
Voltage Regulation	+/-0.5%	+/-0.5%	+/-0.5%	+/-0.5%
Frequency Control	Isochronous/Droop	Isochronous/Droop	Isochronous/Droop	Isochronous/Droop
Phase and Power Factor - Standard	Three phase 0.8	Three phase 0.8	Three phase 0.8	Three phase 0.8
Generator Full Load Temp. Rise at 40°C Ambient	125°	125°	125°	125°
Lugger Diesel Engine Data				
Inline Cylinder / Aspiration	I-4/Turbo-Aftercooled	I-4/Turbo-Aftercooled	I-4/Turbo-Aftercooled	I-4/Turbo-Aftercooled
Displacement - in ³ (ltr)	293 (4.8)	293 (4.8)	293 (4.8)	293 (4.8)
Bore / Stroke - in (mm)	4.13/5.39 (105/137)	4.13/5.39 (105/137)	4.13/5.39 (105/137)	4.13/5.39 (105/137)
Cooling System (Keel-Cooling Standard, Heat Exchanger Optional)				
Heat Rejection to Jacket-Water - BTU min	2343	2908	3090	C/F
Freshwater Pump Capacity - gpm (lpm)	50 (190)	50 (190)	50 (190)	50 (190)
Engine Only Approx. Cooling Capacity - gal (ltr)	9.7 (37)	9.7 (37)	9.7 (37)	9.7 (37)
Heat Exchanger Approx. Cooling Capacity - gal (ltr)	8.2 (31)	8.2 (31)	8.2 (31)	8.2 (31)
Raw Water Pump Capacity - gpm (lpm)	40 (151)	40(151)	40 (151)	40 (151)
Max. Raw Water Pump Suction Head Lift - in (mm)	39 (1000)	39 (1000)	39 (1000)	39 (1000)
Raw Water Pump Inlet Hose ID - in (mm)	2 (51)	2 (51)	2 (51)	2 (51)
Min. Raw Water Inlet/ Discharge Thru-Hull - in (mm)	2 (51)	2 (51)	2 (51)	2 (51)
DC Electrical				
DC Starting Voltage - Standard (Optional)	12 (24)	12 (24)	12 (24)	12 (24)
Min. Battery Capacity - amp hr	90	90	90	90
Min. Battery Size - CCA	750	750	750	750
Starter Rolling Amps at 0°C - 12V (24V)	420 (225)	420 (225)	420 (225)	420 (225)
12 Volt Battery Cable Size Up to 5ft (1.5m) - mm ²	50	50	50	50
Air				
Air Consumption - m ³ /m (cfm)	4.1 (146)	4.4 (157)	4.6 (162)	4.8 (169.8)
Approx. Heat Radiated to Air; Engine & Gen. - BTU/min	1304	1529	1655	1799
Generator Cooling Air Flow 1&3Ø - m ³ /m (cfm)	72 (2542)	72 (2542)	72 (2542)	84 (2966)
Exhaust Gas Volume - kg/hr (lbs/min)	431 (15.8)	473 (17.4)	507 (18.6)	540 (19.8)
Exhaust Gas Temp. - C°(F°)	462° (834°)	482° (899°)	499° (930.2°)	524° (975.2°)
Max. Exhaust Back Pressure - in H ² O (mm H ² O)	30 (762)	30 (762)	30 (762)	30 (762)
Dry Exhaust Elbow - in (mm)	4 (102)	4 (102)	4 (102)	4 (102)
Wet Exhaust Elbow OD - in (mm)	5 (127)	5 (127)	5 (127)	5 (127)
Fuel				
Fuel Injection Pump Type and Control	Electronic (HPCR)	Electronic (HPCR)	Electronic (HPCR)	Electronic (HPCR)
Min. Suction Line Size - in (mm)	0.375 (10)	0.375 (10)	0.375 (10)	0.375 (10)
Min. Return Line Size - in (mm)	0.375 (10)	0.375 (10)	0.375 (10)	0.375 (10)
Max. Fuel Transfer Pump Suction Lift - ft(m)	3.28 (1)	3.28 (1)	3.28 (1)	3.28 (1)
Max. Fuel Flow to Transfer Pump - gph	23.8	25.3	25.8	C/F
Max. Fuel Return Line - psi	5	5	5	5
Approx. Fuel Rate at Full Load - gph (lph)	7.49 (28.35)	8.73 (30.3)	9.62 (36.4)	12.69 (48)
Max Engine Operating Angle				
Continuous - Fore/Aft	10°	10°	10°	10°
Continuous - Side to Side	22.5°	22.5°	22.5°	22.5°

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Model Specifications

	C4105A5	C4105A6
	122 KW, 60 Hz	135 KW, 60 Hz
Dimensions and Weight		
Length - in (mm)	71.0 (1804)	71.0 (1804)
Width - in (mm)	39.35 (999)	39.35 (999)
Height - in (mm)	44.8 (1139)	44.8 (1139)
Weight - lbs (kg)	2762 (1119)	2762 (1119)
Generator Data		
Voltage Regulation	+/-0.5%	+/-0.5%
Frequency Control	Isochronous / Droop	Isochronous/Droop
Phase and Power Factor - Standard (Optional)	Three phase 0.8	Three phase 0.8
Generator Full Load Temp. Rise at 40°C Ambient	125°	125°
Lugger Diesel Engine Data		
Inline Cylinder / Aspiration	I-4/Turbo-Aftercooled	I-4/Turbo-Aftercooled
Displacement - in ³ (ltr)	293 (4.8)	293 (4.8)
Bore / Stroke - in (mm)	4.13/5.39 (105/137)	4.13/5.39 (105/137)
Cooling System (Keel-Cooling Standard, Heat Exchanger Optional)		
Heat Rejection to Jacket-Water - BTU min	C/F	C/F
Freshwater Pump Capacity - gpm (lpm)	55 (210)	55 (210)
Engine Only Approx. Cooling Capacity - gal (ltr)	8.2 (31)	8.2 (31)
Heat Exchanger Approx. Cooling Capacity - gal (ltr)	9.7 (37)	9.77 (37)
Raw Water Pump Capacity - gpm (lpm)	47 (177)	47 (177)
Max. Raw Water Pump Suction Head Lift - in (mm)	39 (1000)	39 (1000)
Raw Water Pump Inlet Hose ID - in (mm)	2 (51)	2 (51)
Min. Raw Water Inlet/ Discharge Thru-Hull - in (mm)	2 (51)	2 (51)
DC Electrical		
DC Starting Voltage - Standard (Optional)	12 (24)	12 (24)
Min. Battery Capacity - amp hr	90	90
Min. Battery Size - CCA	750	750
Starter Rolling Amps at 0°C - 12V (24V)	420 (225)	420 (225)
12 Volt Battery Cable Size Up to 5ft (1.5m) - mm ²	50	50
Air		
Air Consumption - m ³ /m (cfm)	6.4 (226)	7.4 (260)
Approx. Heat Radiated to Air; Engine & Generator - BTU/min	1844	2069
Generator Cooling Air Flow 1&3Ø - m ³ /m (cfm)	72 (2542)	84 (2966)
Exhaust Gas Volume - kg/hr (lbs/min)	734 (27)	870 (32)
Exhaust Gas Temp. - C°(F°)	480° (896°)	459° (858°)
Max. Exhaust Back Pressure - in H ² O (mm H ² O)	30 (762)	30 (762)
Dry Exhaust Elbow - in (mm)	4 (102)	4 (102)
Wet Exhaust Elbow OD - in (mm)	5 (127)	5 (127)
Fuel		
Fuel Injection Pump Type and Control	Electronic (HPCR)	Electronic (HPCR)
Min. Suction Line Size - in (mm)	0.375 (10)	0.375 (10)
Min. Return Line Size - in (mm)	0.375 (10)	0.375 (10)
Max. Fuel Transfer Pump Suction Lift - ft (m)	3.28 (1)	3.28 (1)
Max. Fuel Flow to Transfer Pump - gph	C/F	C/F
Max. Fuel Return Line - psi	5	5
Approx. Fuel Rate at Full Load - gph (lph)	11.87 (44.93)	13.62 (51.56)
Max Engine Operating Angle		
Continuous - Fore/Aft	10°	10°
Continuous - Side to Side	22.5°	22.5°

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Model Specifications

	C6105A1	C6105A2	C6105A3
	147 KW, 50 Hz	166 KW, 50 Hz	185 KW, 50 Hz
Dimensions and Weight			
Length - in (mm)	84.3 (2141)	84.3 (2141)	90.0 (2285)
Width - in (mm)	39.35 (999)	39.35 (999)	39.35 (999)
Height - in (mm)	45.1 (1146)	45.1 (1146)	45.1 (1146)
Weight - lbs (kg)	3366 (1527)	3366 (1527)	3609 (1637)
Generator Data			
Voltage Regulation	+/-0.5%	+/-0.5%	+/-0.5%
Frequency Control	Isochronous / Droop	Isochronous/Droop	Isochronous/Droop
Phase and Power Factor - Standard	Three phase 0.8	Three phase 0.8	Three phase 0.8
Generator Full Load Temp. Rise at 450C Ambient	125°	125°	125°
Lugger Diesel Engine Data			
Inline Cylinder / Aspiration	I-6/Turbo-Aftercooled	I-6/Turbo-Aftercooled	I-6/Turbo-Aftercooled
Displacement - in ³ (ltr)	439 (7.2)	439 (7.2)	439 (7.2)
Bore / Stroke - in (mm)	4.13/5.39 (105/137)	4.13/5.39 (105/137)	4.13/5.39 (105/137)
Cooling System (Keel-Cooling Standard, Heat Exchanger Optional)			
Heat Rejection to Jacket-Water - BTU min	C/F	C/F	C/F
Freshwater Pump Capacity - gpm (lpm)	50 (190)	50 (190)	50 (190)
Engine Only Approx. Cooling Capacity - gal (ltr)	9.9 (37.5)	9.9 (37.5)	9.9 (37.5)
Heat Exchanger Approx. Cooling Capacity - gal (ltr)	11.4 (43)	11.4 (43)	11.4 (43)
Raw Water Pump Capacity - gpm (lpm)	40 (151)	40(151)	40 (151)
Max. Raw Water Pump Suction Head Lift - in (mm)	39 (1000)	39 (1000)	39 (1000)
Raw Water Pump Inlet Hose ID - in (mm)	2 (51)	2 (51)	2 (51)
Min. Raw Water Inlet/ Discharge Thru-Hull - in (mm)	2 (51)	2 (51)	2 (51)
DC Electrical			
DC Starting Voltage - Standard (Optional)	12 (24)	12 (24)	12 (24)
Min. Battery Capacity - amp hr	150	150	150
Min. Battery Size - CCA	900	900	900
Starter Rolling Amps at 0°C - 12V DC (24V DC)	500 (C/F)	500 (C/F)	500 (C/F)
12 Volt Battery Cable Size Up to 5ft (1.5m) - mm ²	50	50	50
Air			
Air Consumption - m ³ /m (cfm)	12.1 (429)	10.3 (362)	11.4 (402)
Approx. Heat Radiated to Air; Engine & Generator - BTU/min	2529	2845	3161
Generator Cooling Air Flow 1&3Ø - m ³ /m (cfm)	82.8 (2924)	82.8 (2924)	93 (3284)
Exhaust Gas Volume - kg/hr (lbs/min)	886 (33)	759 (28)	843 (31)
Exhaust Gas Temp. - C°(F°)	347° (657°)	514° (957°)	523° (973°)
Max. Exhaust Back Pressure - in H ² O (mm H ² O)	30 (762)	30 (762)	30 (762)
Wet Exhaust Elbow OD - in (mm)	5 (127)	5 (127)	5 (127)
Dry Exhaust Elbow - in (mm)	4 (102)	4 (102)	4 (102)
Fuel			
Fuel Injection Pump Type and Control	Electronic (HPCR)	Electronic (HPCR)	Electronic (HPCR)
Min. Suction Line Size - in (mm)	0.375 (10)	0.375 (10)	0.375 (10)
Min. Return Line Size - in (mm)	0.375 (10)	0.375 (10)	0.375 (10)
Max. Fuel Transfer Pump Suction Lift - ft(m)	3.28 (1)	3.28 (1)	3.28 (1)
Max. Fuel Flow to Transfer Pump - gph	C/F	C/F	C/F
Max. Fuel Return Line - psi	5	5	5
Approx. Fuel Rate at Full Load - gph (lph)	11.47 (43.5)	13.27 (50.23)	15.02 (56.86)
Max Engine Operating Angle			
Continuous - Fore/Aft	10°	10°	10°
Continuous - Side to Side	22.5°	22.5°	22.5°

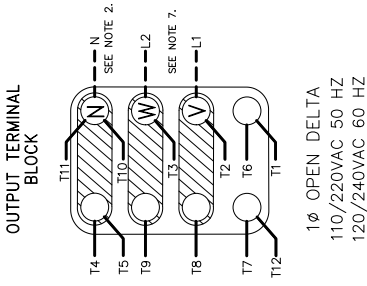
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Model Specifications

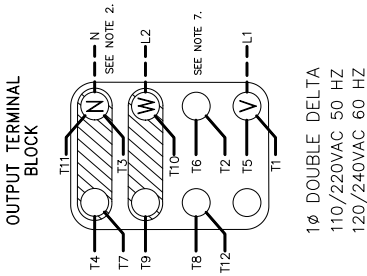
	C6105A4	C6105A5
	193 KW, 60 Hz	218 KW, 60 Hz
Dimensions and Weight		
Length - in (mm)	90.0 (2285)	90.0 (2285)
Width - in (mm)	39.35 (999)	39.35 (999)
Height - in (mm)	45.1 (1146)	45.1 (1146)
Weight - lbs (kg)	3609 (1637)	3609 (1637)
Generator Data		
Voltage Regulation	+/-0.5%	+/-0.5%
Frequency Control	Isochronous / Droop	Isochronous/Droop
Phase and Power Factor - Standard	Three phase 0.8	Three phase 0.8
Generator Full Load Temp. Rise at 40°C Ambient	125°	125°
Lugger Diesel Engine Data		
Inline Cylinder / Aspiration	I-6/Turbo-Aftercooled	I-6/Turbo-Aftercooled
Displacement - in ³ (ltr)	439 (7.2)	439 (7.2)
Bore / Stroke - in (mm)	4.13/5.39 (105/137)	4.13/5.39 (105/137)
Cooling System (Keel-Cooling Standard, Heat Exchanger Optional)		
Heat Rejection to Jacket-Water - BTU min	C/F	C/F
Freshwater Pump Capacity - gpm (lpm)	55 (210)	55 (210)
Engine Only Approx. Cooling Capacity - gal (ltr)	9.9 (37.5)	9.9 (37.5)
Heat Exchanger Approx. Cooling Capacity - gal (ltr)	11.4 (43)	11.4 (43)
Raw Water Pump Capacity - gpm (lpm)	47 (177)	47 (177)
Max. Raw Water Pump Suction Head Lift - in (mm)	39 (1000)	39 (1000)
Raw Water Pump Inlet Hose ID - in (mm)	2 (51)	2 (51)
Min. Raw Water Inlet/ Discharge Thru-Hull - in (mm)	2 (51)	2 (51)
DC Electrical		
DC Starting Voltage - Standard (Optional)	12 (24)	12 (24)
Min. Battery Capacity - amp hr	150	150
Min. Battery Size - CCA	900	900
Starter Rolling Amps at 0°C - 12V (24V)	500 (C/F)	500 (C/F)
12 Volt Battery Cable Size Up to 5ft (1.5m) - mm ²	50	50
Air		
Air Consumption - m ³ /m (cfm)	15.8 (559)	16.8 (592)
Approx. Heat Radiated to Air; Engine & Generator - BTU/min	2789	3148
Generator Cooling Air Flow 1&3Ø - m ³ /m (cfm)	93 (3284)	93 (3284)
Exhaust Gas Volume - kg/hr (lb/min)	1161 (43)	1235 (45)
Exhaust Gas Temp. - C°(F°)	450° (842°)	483° (901°)
Max. Exhaust Back Pressure - in H ² O (mm H ² O)	30 (762)	30 (762)
Wet Exhaust Elbow OD - in (mm)	5 (127)	5 (127)
Dry Exhaust Elbow - in (mm)	4 (102)	4 (102)
Fuel		
Fuel Injection Pump Type and Control	Electronic (HPCR)	Electronic (HPCR)
Min. Suction Line Size - in (mm)	0.375 (10)	0.375 (10)
Min. Return Line Size - in (mm)	0.375 (10)	0.375 (10)
Max. Fuel Transfer Pump Suction Lift - ft (m)	3.28 (1)	3.28 (1)
Max. Fuel Flow to Transfer Pump - gph	C/F	C/F
Max. Fuel Return Line - psi	5	5
Approx. Fuel Rate at Full Load - gph (lph)	16.61 (62.88)	17.92 (67.83)
Max Engine Operating Angle		
Continuous - Fore/Aft	10°	10°
Continuous - Side to Side	22.5°	22.5°

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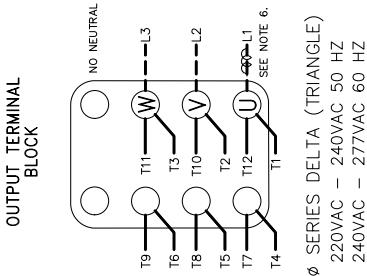
AC Wiring Diagram



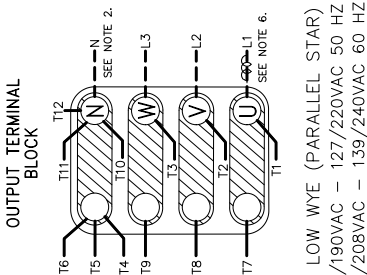
1Ø OPEN DELTA
110/220VAC 50 HZ
120/240VAC 60 HZ



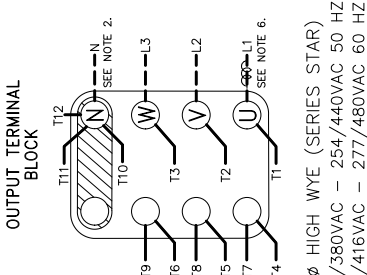
1Ø DOUBLE DELTA
110/220VAC 50 HZ
120/240VAC 60 HZ



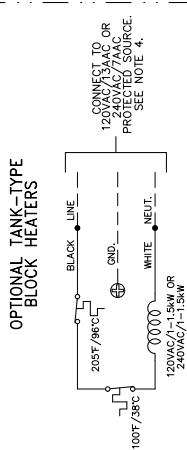
3Ø SERIES DELTA (TRIANGLE)
220VAC - 240VAC 50 HZ
240VAC - 277VAC 60 HZ



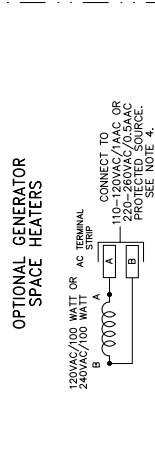
3Ø LOW WYE (PARALLEL STAR)
110/190VAC - 127/220VAC 50 HZ
120/208VAC - 139/240VAC 60 HZ



3Ø HIGH WYE (SERIES STAR)
220/380VAC - 254/440VAC 50 HZ
240/416VAC - 277/480VAC 60 HZ

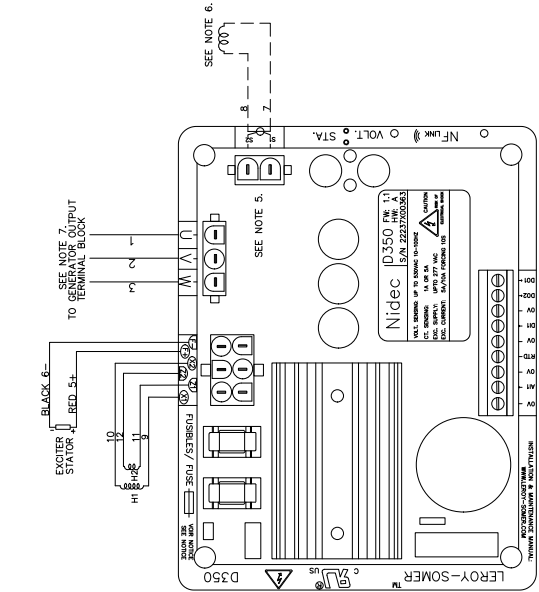


OPTIONAL TANK-TYPE BLOCK HEATERS



OPTIONAL GENERATOR SPACE HEATERS

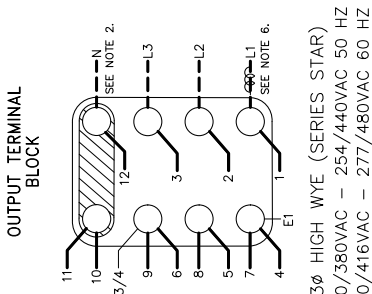
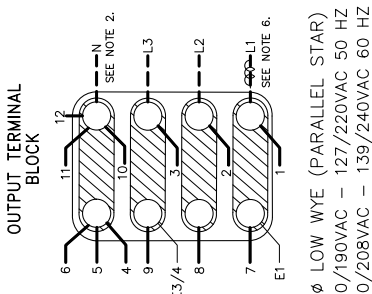
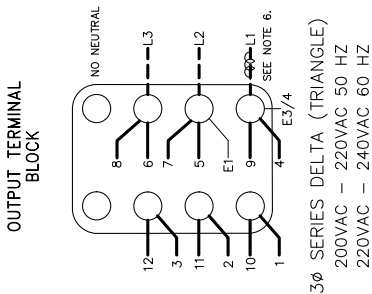
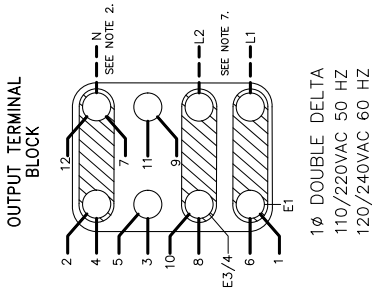
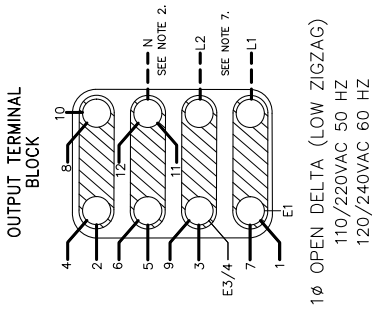
3Ø CT CHART			
VAC	90KW	105KW	116KW 127KW 145KW
110/190	400:5	500:5	600:5 700:5
115/200	400:5	500:5	600:5 600:5
120/208	400:5	500:5	500:5 600:5
127/220	400:5	500:5	500:5 600:5
133/230	400:5	400:5	500:5 500:5
139/240	300:5	400:5	400:5 500:5
219/380	200:5	250:5	300:5 400:5
231/400	200:5	250:5	250:5 300:5
240/416	200:5	250:5	250:5 300:5
254/440	200:5	200:5	250:5 250:5
266/460	200:5	200:5	250:5 300:5
277/480	150:5	200:5	200:5 250:5



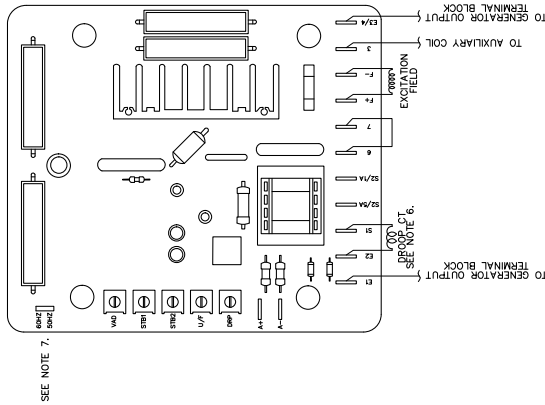
- NOTES:
- ALL INSULATION CONDUCTORS ARE TO BE 14AWG/2.5MM², TYPE THHN, UNLESS OTHERWISE SPECIFIED.
 - ALL WIRING IS TO BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC) AND THE MARINE GENSETS ARE TO BE GROUNDED BY CUSTOMER ONLY, AT CUSTOMER'S DISCRETION. WIRE SIZE TO BE SAME AS CURRENT CARRYING CONDUCTORS.
 - DASHED LINES INDICATE CUSTOMER SUPPLIED AND CONNECTED MAIN OUTPUT CONDUCTORS. SIZING DETERMINED PER INSTALLATION. DO NOT ENERGIZE HEATERS WHEN UNIT IS IN OPERATION.
 - IF USING PROOP CT, SEE CT CHART AND PLACE CT ON PHASE U. GENERATOR OUTPUT LEAD IS TO ENTER CT THROUGH SIDE MARKED "HI".
 - FOR 1Ø USE ONLY V & W FOR AVR CONNECTIONS.

AC Wiring Diagram
M4105, M6105
LSA 44.3
B-12568
Drawings subject to change without notice.

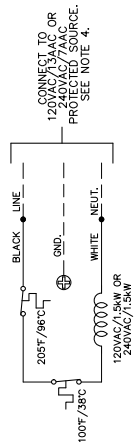
A.C. Wiring Diagram



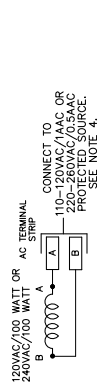
VAC	3Ø CT CHART					
	85KW	100KW	108KW	117KW	122KW	135KW
110/190	400:5	500:5	500:5	500:5	600:5	600:5
115/200	400:5	400:5	500:5	500:5	600:5	600:5
120/208	400:5	400:5	500:5	500:5	500:5	500:5
127/220	400:5	400:5	400:5	500:5	500:5	500:5
133/230	300:5	400:5	400:5	500:5	500:5	500:5
139/240	300:5	400:5	400:5	400:5	500:5	500:5
219/380	200:5	250:5	250:5	250:5	300:5	300:5
231/400	200:5	200:5	250:5	250:5	250:5	300:5
240/416	200:5	200:5	200:5	250:5	250:5	300:5
254/440	200:5	200:5	200:5	250:5	250:5	250:5
266/460	150:5	200:5	200:5	200:5	250:5	250:5
277/480	150:5	200:5	200:5	200:5	200:5	250:5



OPTIONAL TANK-TYPE BLOCK HEATERS



OPTIONAL GENERATOR SPACE HEATERS

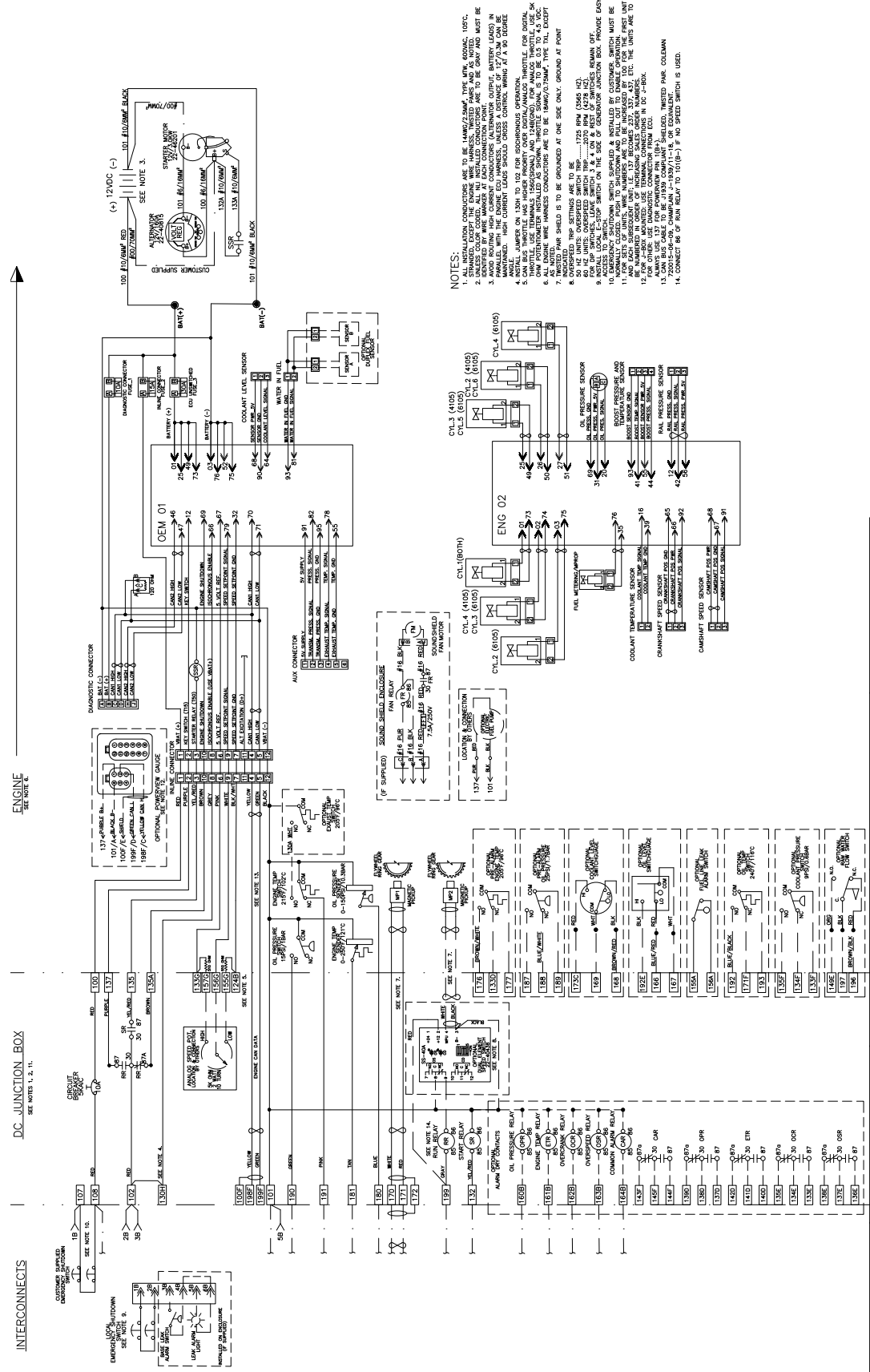


- NOTES:
- ALL INSTALLATION CONDUCTORS ARE TO BE 14AWG/2.5MM² TYPE MTW 105°C, 60DQAC, STRANDED, EXCEPT AS NOTED.
 - MARINE GENSSETS ARE TO BE GROUNDED BY CUSTOMER ONLY, AT CUSTOMER'S DISCRETION. WIRE SIZE TO BE SAME AS CURRENT CARRYING CONDUCTORS.
 - DASHED LINES INDICATE CUSTOMER SUPPLIED AND CONNECTED MAIN OUTPUT CONDUCTORS. SIZING DETERMINED PER INSTALLATION. WIRE SIZE TO BE SAME AS CURRENT CARRYING CONDUCTORS.
 - USE 1505536-1 TERMINAL TO TERMINATE CT LEADS.
 - IF USING PROOP CT SEE CT CHART AND PLACE CT ON PHASE U. GENERATOR OUTPUT LEAD IS TO ENTER CT THROUGH SIDE MARKED "H1".
 - ADJUST JUMPER FOR EITHER 50HZ OR 60HZ OPERATION.

AC Wiring Diagram C4105, C6105 B-12567

Drawings subject to change without notice.

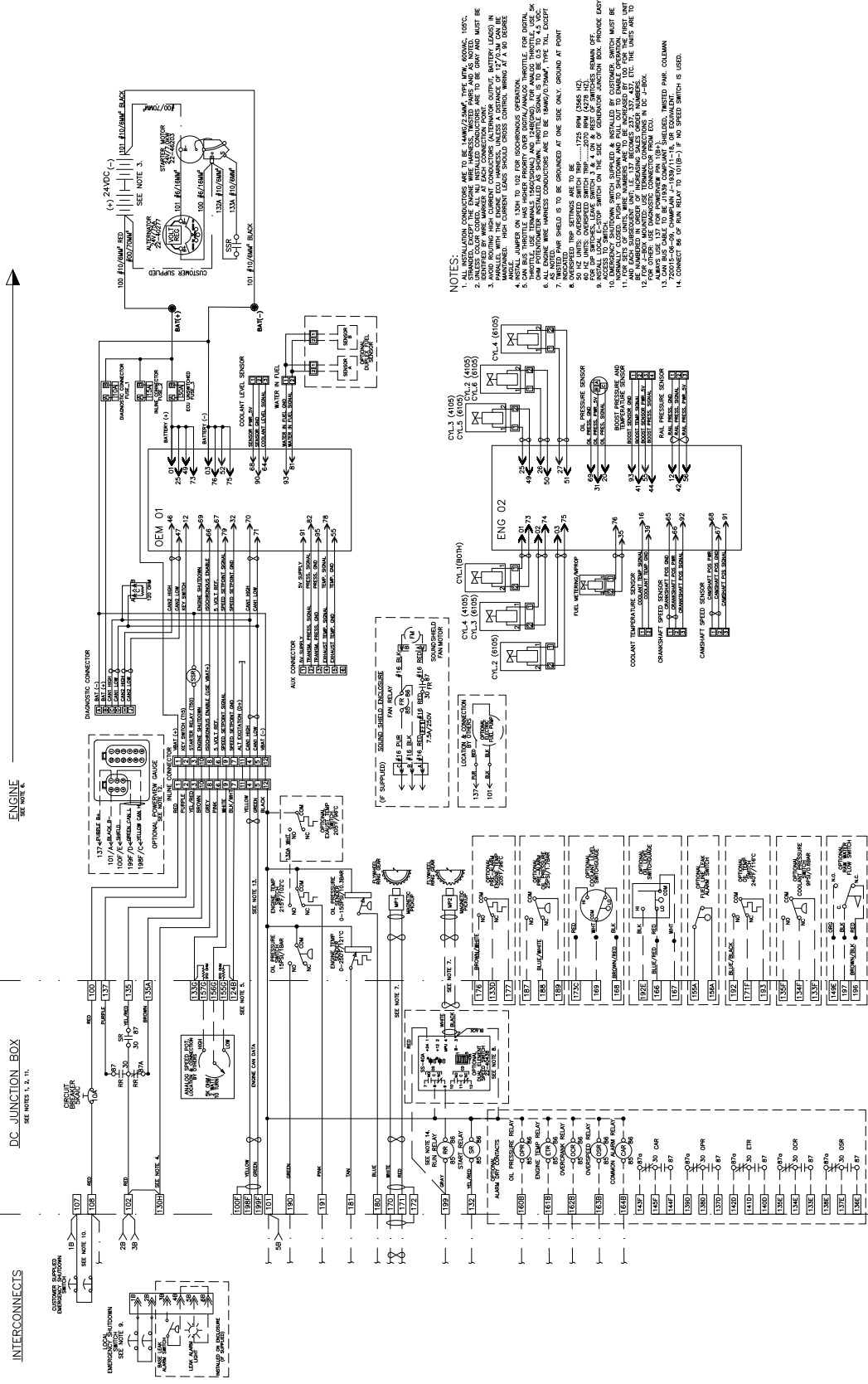
D.C. Wiring Diagram



- NOTES:**
1. STRANDED CONDUCTORS ARE TO BE 14AWG/25MM² TYPE UPR. MONROE. USE.
 2. IDENTIFY BY WIRE MARKER, WIRE HARNESS, WIRE HARNESS PARS AND AS NOTED.
 3. IDENTIFY BY WIRE MARKER AT EACH CONNECTION POINT.
 4. PARALLEL WITH THE WIRE HARNESS, UNLESS A DISTANCE OF 17/32" CAN BE MAINTAINED. HIGH CURRENT LEADS SHOULD CROSS CORNERS, WRING AT A 90 DEGREE ANGLE.
 5. CAN BUS THROTTLE HAS HIGHER PRIORITY OVER DIGITAL/ANALOG THROTTLE FOR DIGITAL THROTTLE. THE CAN BUS THROTTLE SHOULD BE INSTALLED AS SHOWN. THE CAN BUS THROTTLE SHOULD BE INSTALLED AS SHOWN. THE CAN BUS THROTTLE SHOULD BE INSTALLED AS SHOWN.
 6. ALL WIRE HARNESS CONDUCTORS ARE TO BE 14AWG/25MM² TYPE T1L, EXCEPT AS NOTED.
 7. INSTALLED PINK SHIELD IS TO BE GROUND AT ONE SIDE ONLY. GROUND AT POINT AS NOTED.
 8. OVERSPEED TRIP SETTINGS ARE TO BE 1725 RPM (2540 U/S).
 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100.

DC Wiring Diagram
M4105, M6105
12 VDC Isolated Ground autostart (S-3A)
Drawing D-12554
Drawings subject to change without notice.

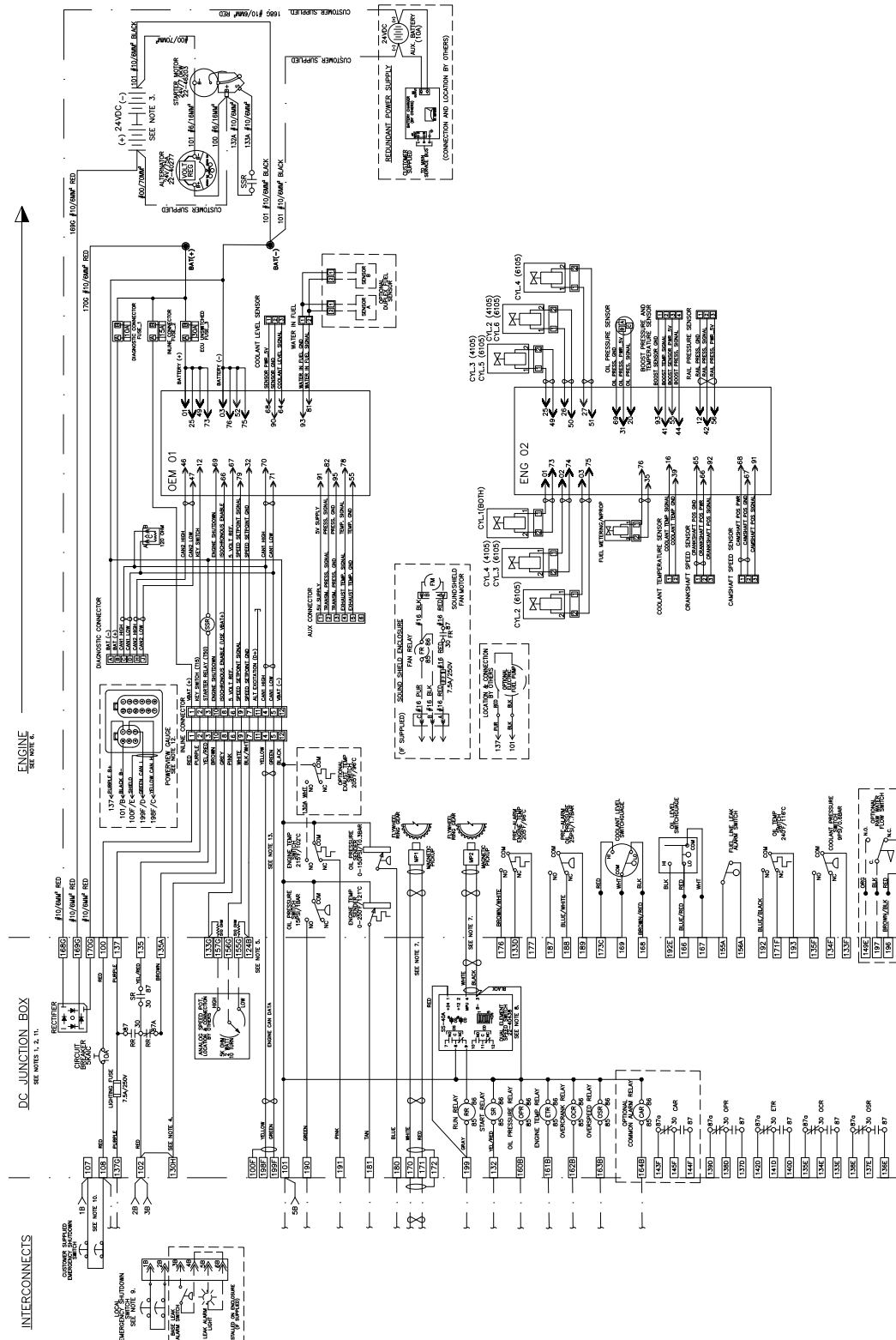
D.C. Wiring Diagram



- NOTES:**
1. ALL INSTALLATION CONDUCTORS ARE TO BE 14AWG/25MM² TYPE WFM 600VAC, 105°C, UNLESS COLOR CODED. ALL UNINSTALLED CONDUCTORS ARE TO BE GRAY AND MUST BE PROTECTED BY A CONDUCTOR PROTECTIVE COVER.
 2. ALL CONDUCTORS ARE TO BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. HIGH CURRENT LEADS SHOULD BESS CRITICAL WIRING AT A DISCREET INTERVALS.
 3. AVOID ROUTING HIGH CURRENT CONDUCTORS ALTERNATOR OUTPUT, BATTERY LEADS IN PARALLEL WITH OTHER CONDUCTORS. THIS WILL REDUCE THE EFFICIENCY OF THE ALTERNATOR.
 4. INSTALL JUMPER ON 130H TO 102 FOR ISOBANDS OPERATION.
 5. THROTTLE USE TERMINALS (RESERVOIR) AND (2) (GROUND) FOR AWARD THROTTLE USE ONLY. THROTTLE USE TERMINALS (RESERVOIR) AND (2) (GROUND) FOR AWARD THROTTLE USE ONLY.
 6. ALL ENGINE WIRE HARNESS CONDUCTORS ARE TO BE 14AWG/25MM² TYPE WFM 600VAC, 105°C.
 7. TWISTED PAIR SHIELD IS TO BE GROUND AT ONE END ONLY. GROUND AT POINT OF INSTALLATION.
 8. EXPANDED TRAP SETTINGS ARE TO BE:
 - 50 Hz UNITS: COMPANION SWITCH TRIP — 200 RPM (1275 Hz)
 - 60 Hz UNITS: COMPANION SWITCH TRIP — 200 RPM (1275 Hz)
 9. ALL CONDUCTORS ARE TO BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. HIGH CURRENT LEADS SHOULD BESS CRITICAL WIRING AT A DISCREET INTERVALS.
 10. ALL CONDUCTORS ARE TO BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. HIGH CURRENT LEADS SHOULD BESS CRITICAL WIRING AT A DISCREET INTERVALS.
 11. FOR SETS OF UNITS, WIRE HARNESS ARE TO BE IDENTIFIED BY TAG FOR THE FIRST UNIT AND IDENTIFIED BY TAG FOR THE SECOND UNIT. THE TAGS ARE TO BE IDENTIFIED BY TAG FOR THE FIRST UNIT AND IDENTIFIED BY TAG FOR THE SECOND UNIT.
 12. ALL CONDUCTORS ARE TO BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. HIGH CURRENT LEADS SHOULD BESS CRITICAL WIRING AT A DISCREET INTERVALS.
 13. ALL CONDUCTORS ARE TO BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. HIGH CURRENT LEADS SHOULD BESS CRITICAL WIRING AT A DISCREET INTERVALS.
 14. CONNECT BE OF MAIN RELAY TO 101/102-1 NO SPEED SWITCH IS USED.

DC Wiring Diagram
M4105, M6105
24 VDC Isolated Ground autostart (S-3A)
Drawing D-12555
Drawings subject to change without notice.

D.C. Wiring Diagram



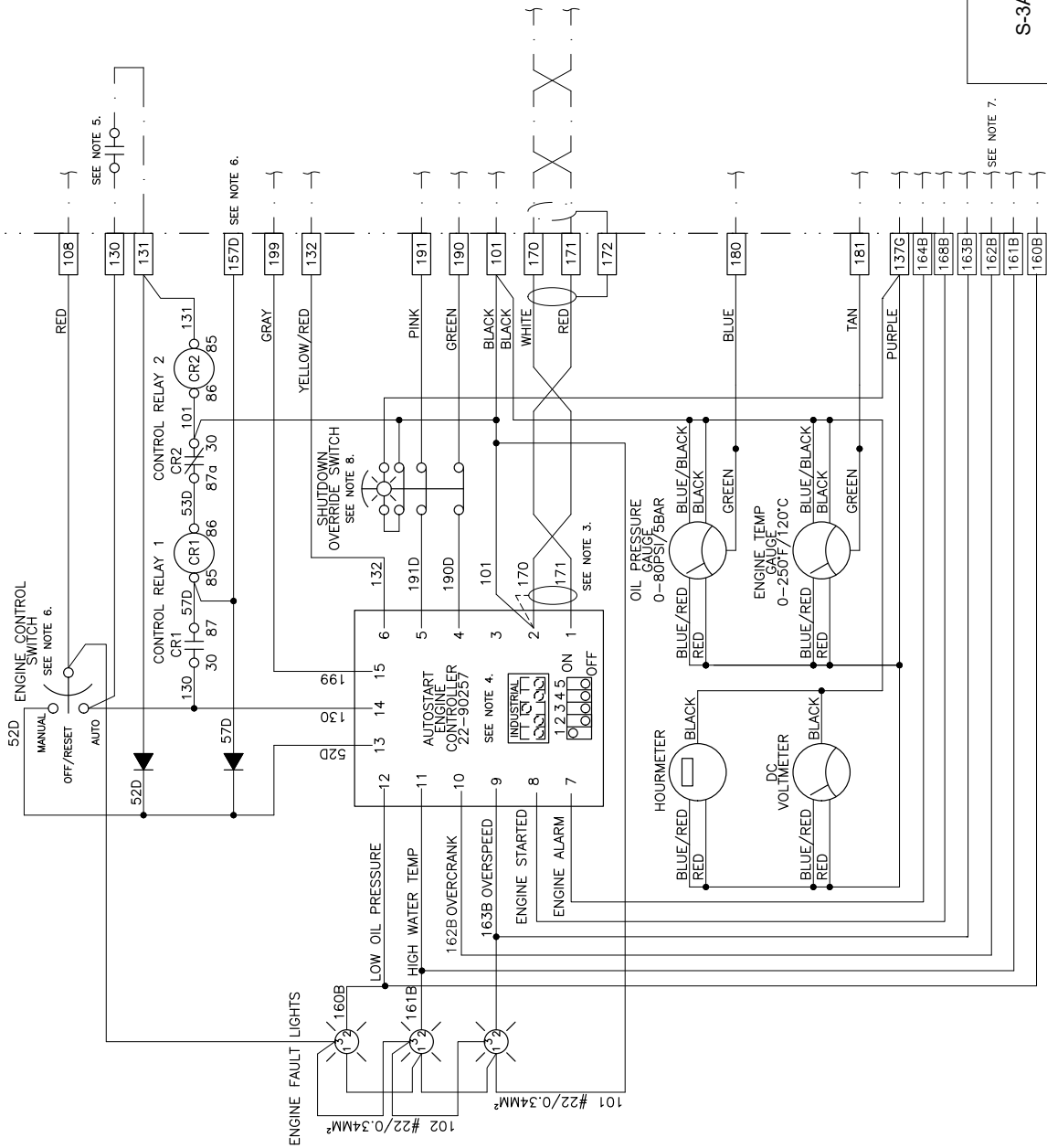
DC Wiring Diagram
M4105, M6105
24 VDC Isolated Ground autostart
Drawing D-5654 (for classed applications)
Drawings subject to change without notice.

Panel Wiring Diagram

CONTROL PANEL

SEE NOTES 1 & 2.

INTERCONNECTS



Panel Wiring Diagram
S-3A MCA Emergency Set Control Panel
(for emergency sets)
B-12520B

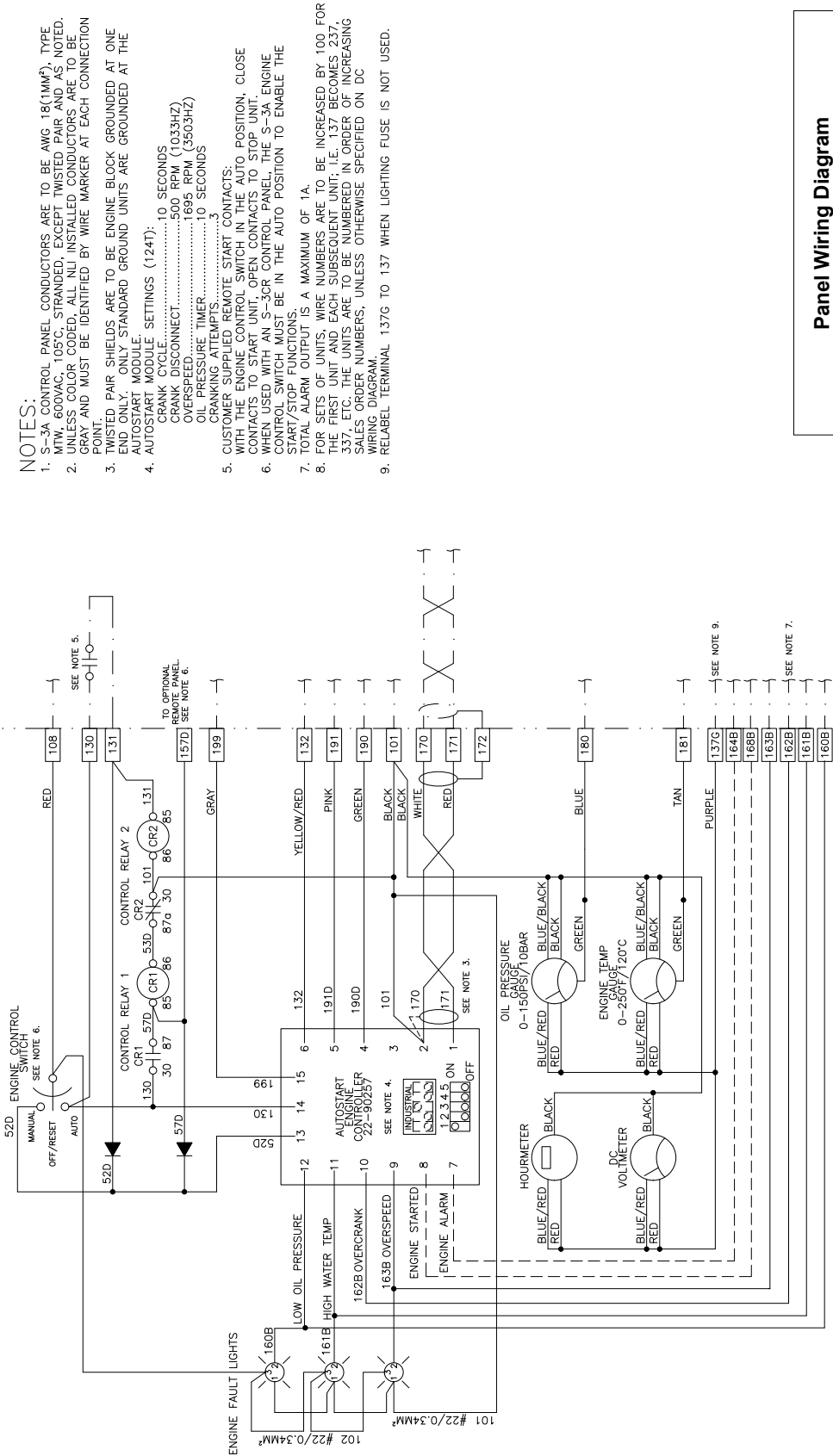
Drawings subject to change without notice.

Panel Wiring Diagram

CONTROL PANEL

SEE NOTES 1, 2, & 8.

INTERCONNECTS

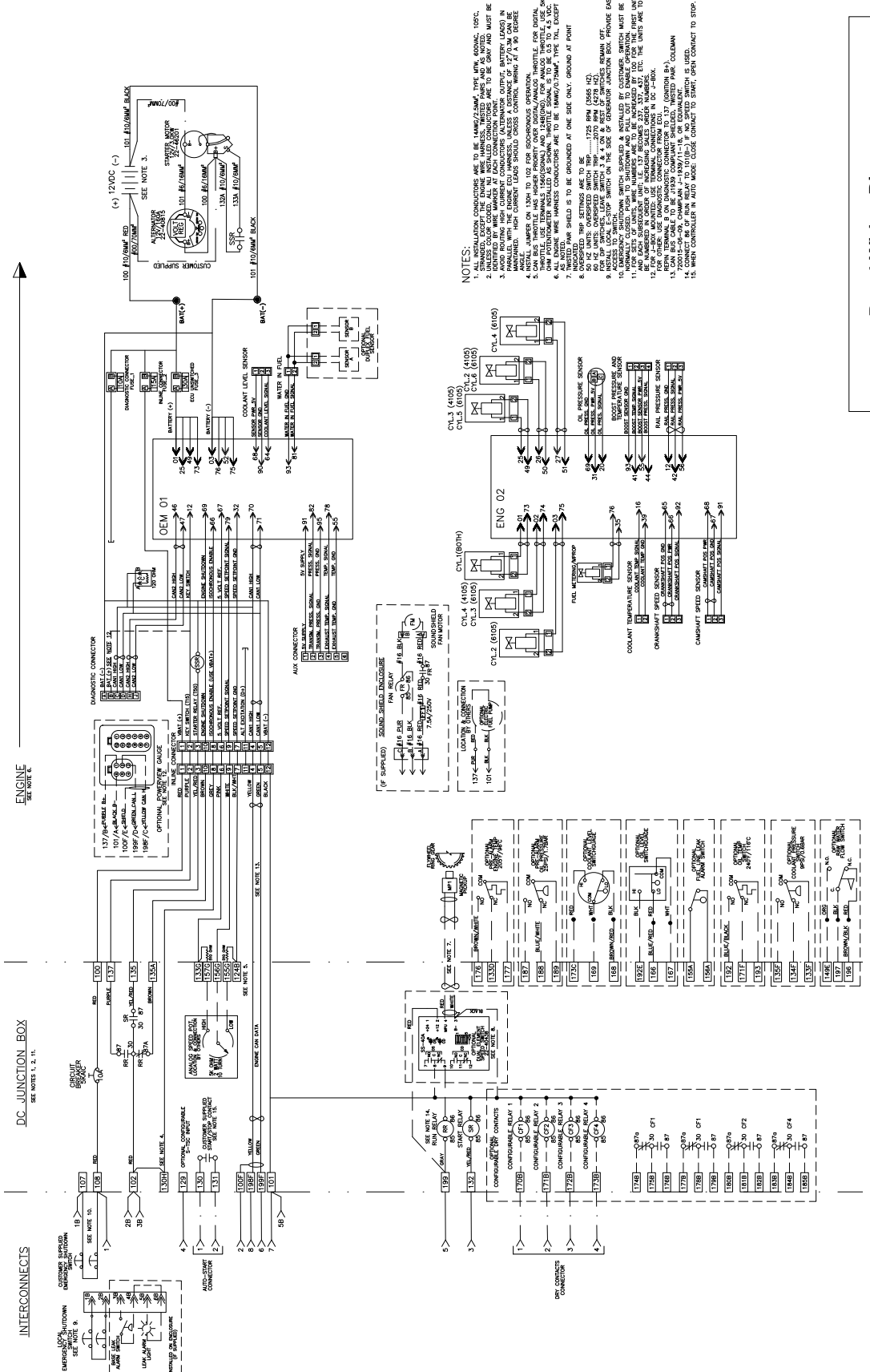


NOTES:

- S-3A CONTROL PANEL CONDUCTORS ARE TO BE AWG 18(1MM²), TYPE MTW, 600VAC, 105°C, STRANDED, EXCEPT TWISTED PAIR AND AS NOTED.
- UNLESS COLOR CODED, ALL NLI INSTALLED CONDUCTORS ARE TO BE GRAY AND MUST BE IDENTIFIED BY WIRE MARKER AT EACH CONNECTION POINT.
- TWISTED PAIR SHIELDS ARE TO BE ENGINE BLOCK GROUNDED AT ONE END ONLY. ONLY STANDARD GROUND UNITS ARE GROUNDED AT THE AUTOSTART MODULE.
- AUTOSTART MODULE SETTINGS (1247):
 CRANK PULSE..... 10 SECONDS
 CRANK DISCONNECT..... 500 RPM (1033HZ)
 OVERSPEED..... 1695 RPM (3503HZ)
 OIL PRESSURE TIMER..... 10 SECONDS
 CRANKING ATTEMPTS..... 3
- CUSTOMER SUPPLIED REMOTE START CONTACTS: WITH THE ENGINE CONTROL SWITCH IN THE AUTO POSITION, CLOSE CONTACTS TO START UNIT, OPEN CONTACTS TO STOP UNIT.
- WHEN USED WITH AN S-3OR CONTROL PANEL, THE S-3A ENGINE CONTROL SWITCH MUST BE IN THE AUTO POSITION TO ENABLE THE START/STOP FUNCTIONS.
- TOTAL ALARM OUTPUT IS A MAXIMUM OF 1A.
- FOR SETS OF UNITS, WIRE NUMBERS ARE TO BE INCREASED BY 100 FOR THE FIRST UNIT AND EACH SUBSEQUENT UNIT; I.E. 137 BECOMES 237, 337, ETC. THE UNITS ARE TO BE NUMBERED IN ORDER OF INCREASING SALES ORDER NUMBERS, UNLESS OTHERWISE SPECIFIED ON DC WIRING DIAGRAM.
- RELABEL TERMINAL 137G TO 137 WHEN LIGHTING FUSE IS NOT USED.

Panel Wiring Diagram
 M4105, M6105
 S-3A Control Panel
B-12564
Drawings subject to change without notice.

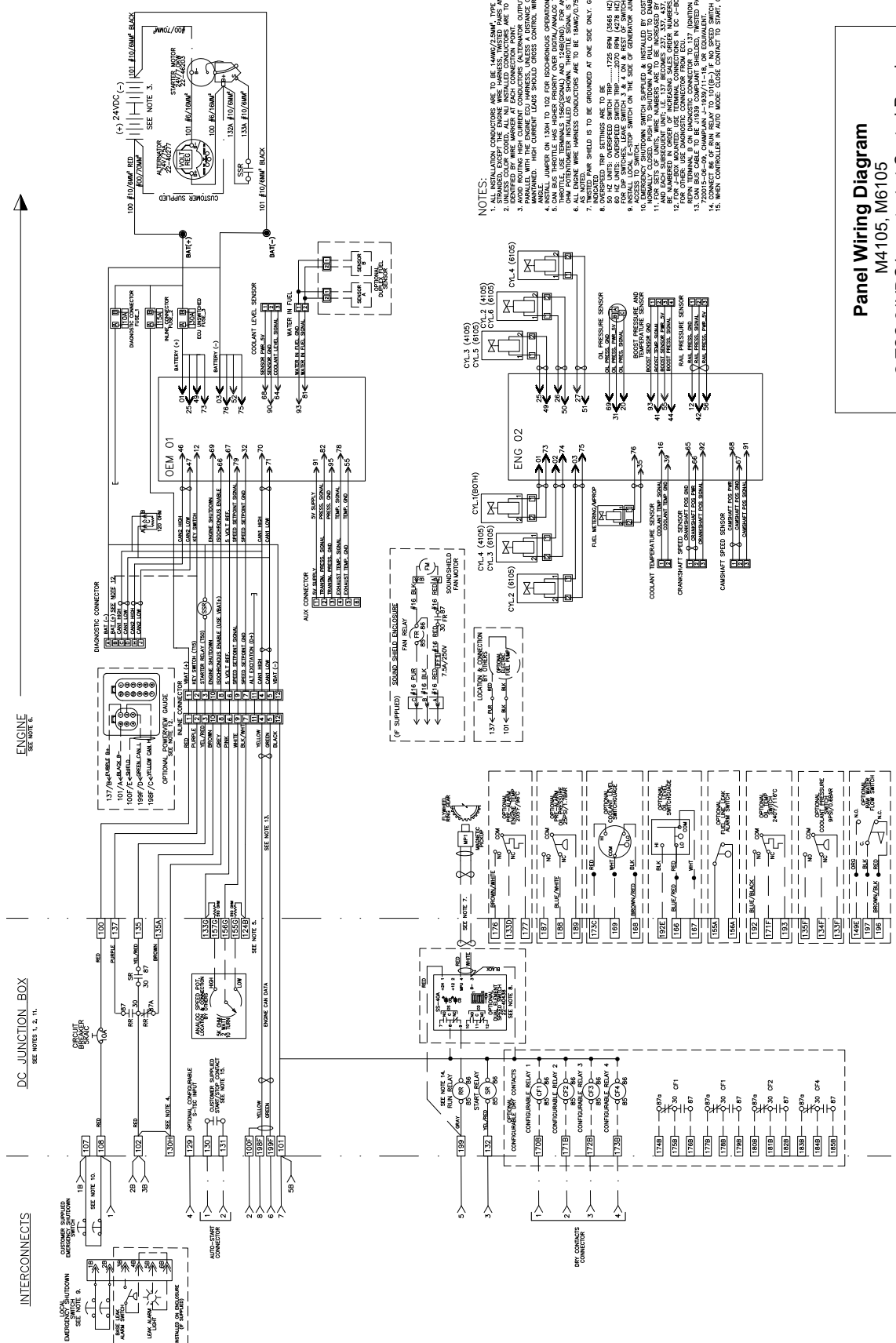
Panel Wiring Diagram



- NOTES:**
1. ALL SIGNALER CONDUCTORS ARE TO BE 14AWG/2.0MM² TYPE MFM 600MC 100C.
 2. STRANDED, EXCEPT THE ENGINE WIRE HARNESS, WHEATED PAPER AND AS NOTED 100C.
 3. IDENTIFIED BY WIRE MARKER AT EACH CONNECTION POINT.
 4. PARALLEL WITH THE ENGINE ECU HARNESS, UNLESS A DISTANCE OF 177.0 MM CAN BE MAINTAINED. THE WIRE HARNESS CONDUCTORS ARE TO BE 14AWG/2.0MM² TYPE MFM 600MC 100C.
 5. CAN BUS HARNESS IS TO BE USED FOR DIGITAL/ANALOG WIRE HARNESS.
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Panel Wiring Diagram
M4105, M6105
S-TSC 12VDC iso autostart Control Panel
B-125556
Drawings subject to change without notice.

Panel Wiring Diagram



- NOTES:**
1. ALL INSULATION CONDUCTORS ARE TO BE 14AWG/25MM² TYPE.
 2. WIRE COLOR CODED. ALL INSTALLED CONDUCTORS ARE TO BE COLOR CODED TO MATCH THE PANEL WIRING DIAGRAM.
 3. AVOID ROUTING HIGH CURRENT CONDUCTORS (ALTERNATOR OUTPUT) PARALLEL WITH THE EXISTING LOW CURRENT CONDUCTORS. UNLESS A DISTANCE OF 100MM (4") IS MAINTAINED.
 4. ALL WIRE JUNCTIONS ON 130M TO 100 FOR ISOCHEMICAL OPERATION.
 5. CAN BITE THROTTLE HAS HIGHER PRIORITY OVER DIGITAL/ANALOG.
 6. CAN BITE THROTTLE IS TO BE INSTALLED AS SHOWN. THROTTLE SIGNAL IS TO BE INSTALLED AS SHOWN.
 7. INSTALLED PWR SHIELD IS TO BE GROUND AT ONE SIDE ONLY.
 8. OVERSEEN TYP SETTINGS ARE TO BE: 1255 RPM (2565 HD), 1255 RPM (2565 LD), 1255 RPM (2565 MD), 1255 RPM (2565 PD), 1255 RPM (2565 RD), 1255 RPM (2565 SD), 1255 RPM (2565 TD), 1255 RPM (2565 UD), 1255 RPM (2565 VD), 1255 RPM (2565 WD), 1255 RPM (2565 XD), 1255 RPM (2565 YD), 1255 RPM (2565 ZD).
 9. INSTALL LOCAL STOP SWITCH ON THE SIDE OF GENERATOR JUNCTION.
 10. EMERGENCY STOP SWITCH SUPPLIER & INSTALLED BY CUSTOMER.
 11. TYP SETTINGS OF TYP, WIRE NUMBERS ARE TO BE INDICATED BY THE SUPPLIER.
 12. FOR OTHER USE, DIAGNOSTIC CONDUCTORS FROM ECU IN DC 4-80.
 13. CAN BUS CABLE OF 1000 CONDUCTORS FROM ECU IN DC 4-80.
 14. WHEN CONTROLLER IN AUTO MODE, CLOSE CONTACT TO START.

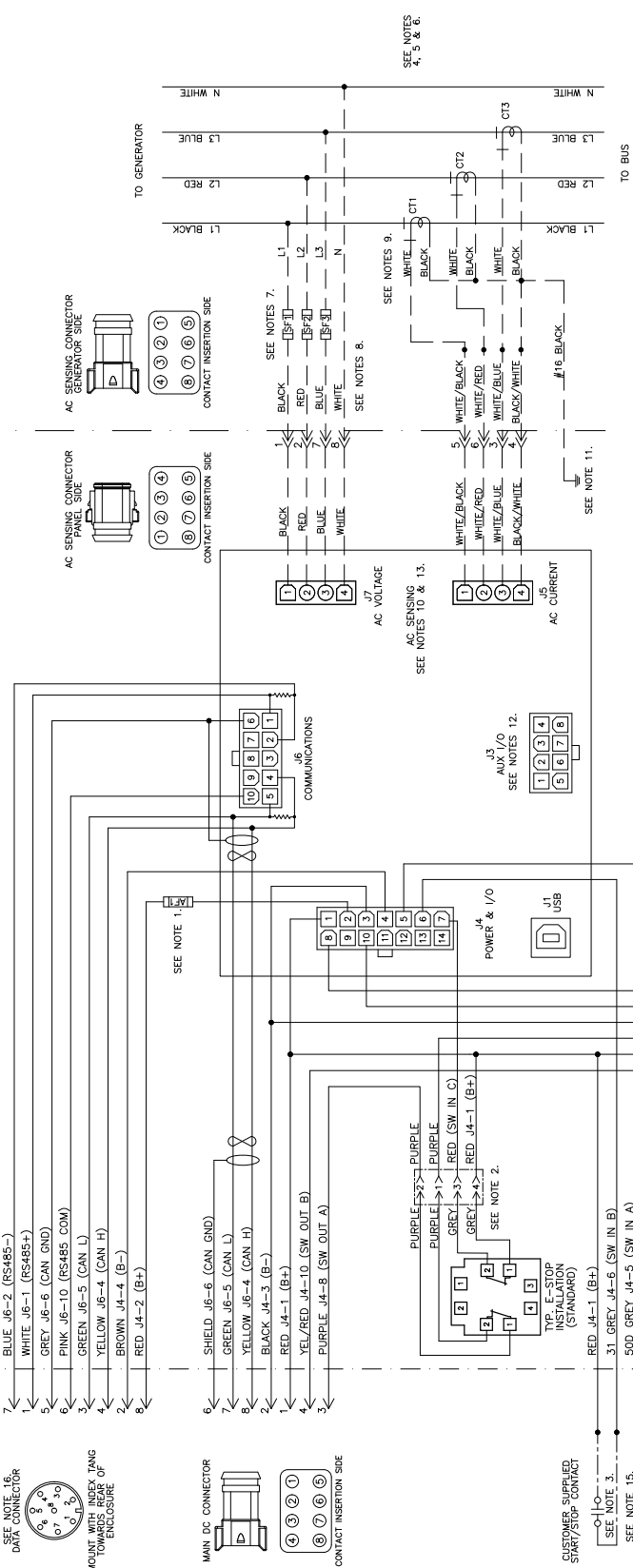
Panel Wiring Diagram
M4105, M6105
S-TSC 24VDC iso autostart Control Panel
B-12557
Drawings subject to change without notice.

INTERCONNECTS

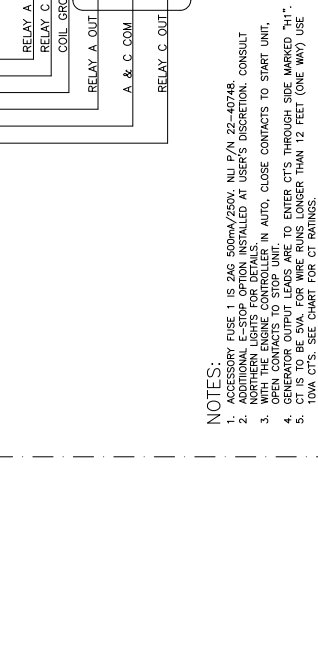
S-TSC CONTROL PANEL

GENERATOR J-BOX

| PANEL | P/N |
|-------------------|----------|
| 12V NO AC SENSING | 22-90027 |
| 24V NO AC SENSING | 22-90028 |
| 12V W/ AC SENSING | 22-90033 |
| 24V W/ AC SENSING | 22-90034 |



| VAC | 30 CT CHART | | | | | | | | | | 10 CT CHART | | | | | | | | | |
|---------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------------|------|------|------|------|------|------|--|--|--|
| | 85KW | 100KW | 108KW | 117KW | 122KW | 135KW | 147KW | 166KW | 185KW | 193KW | 218KW | 220 | 230 | 240 | 220 | 230 | 240 | | | |
| 110/198 | 400S | 500S | 500S | 500S | 500S | 500S | 500S | 500S | 500S | 500S | 500S | 750S | 750S | 750S | 750S | 750S | 750S | | | |
| 120/248 | 400S | 400S | 400S | 400S | 400S | 400S | 400S | 400S | 400S | 400S | 400S | 750S | 750S | 750S | 750S | 750S | 750S | | | |
| 127/220 | 400S | 400S | 400S | 400S | 400S | 400S | 400S | 400S | 400S | 400S | 400S | 750S | 750S | 750S | 750S | 750S | 750S | | | |
| 220/380 | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 300S | 300S | 300S | 300S | 300S | 300S | | | |
| 231/400 | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 300S | 300S | 300S | 300S | 300S | 300S | | | |
| 240/416 | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 300S | 300S | 300S | 300S | 300S | 300S | | | |
| 254/440 | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 300S | 300S | 300S | 300S | 300S | 300S | | | |
| 277/480 | 150S | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 200S | 250S | 250S | 250S | 250S | 250S | 250S | | | |



- NOTES:**
- ACCESSORY FUSE 1 IS 24G 500mA/250V. NLI P/N 22-40748.
 - ADDITIONAL L-TSC OPTION, INSTALLED AT USER'S DISCRETION. CONSULT FACTORY FOR DETAILS.
 - WITH THE ENGINE CONTROLLER IN AUTO, CLOSE CONTACTS TO START UNIT. OPEN CONTACTS TO STOP UNIT. DO NOT ENTER CT'S THROUGH SIDE MARKED "H".
 - CT IS TO BE SWA FOR WIRE RUNS LONGER THAN 12 FEET (ONE WAY) USE 10VA CT'S. SEE CHART FOR CT RATINGS.
 - FACTORY INSTALLATIONS: INSTALLED ON GENERATOR SIDE OF OUTPUT TERMINALS. CUSTOMER-SUPPLIED OUTPUT LEADS AT TIME OF GENSET INSTALLATION.
 - SENSING FUSES 1, 2 & 3 ARE TO BE 1A/250V, TYPE ABC-1, INSTALLED ON OUTPUT TERMINALS WITH PANEL MOUNTED DIRECTLY ON GENERATOR JUNCTION BOX. USED ON UNITS WITH PANEL MOUNTED DIRECTLY ON GENERATOR JUNCTION BOX.
 - OMIT UNUSED VOLTAGE AND CURRENT SENSING INPUTS AS DETERMINED BY TRIM CT AND CT HARNESS WIRES TO SUITABLE LENGTH FOR INSTALLATION & REPAIR. DO NOT COIL EXCESS WIRE IN J-BOX. FOR SCALING FACTOR = MULTIMETER READINGS DIVIDED BY 3-TSC READINGS.
 - GROUND UNITS GROUND CT'S ON STARTER. I NORTHERN LIGHTS FOR DETAILS.
 - POWER RELAYS TO BE RATED FOR GENSET CHARGING SYSTEM VOLTAGE. CONTACTS TO BE RATED FOR 100% IN-RUSH CURRENT. SHUTDOWN.
 - NO MODERN RS485 COMMUNICATION ON NO AC SENSING PANELS.

Panel Wiring Diagram
C4105, C6105
S-TSC Control Panel
C-7682

Drawings subject to change without notice.

On Board Spare Parts

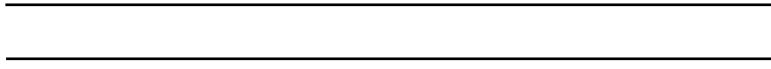
Safety at sea depends on careful preparation, product knowledge, and having the right tools and parts. Below is a list of parts Northern Lights, Inc. recommends you carry onboard at all times.

Onboard Parts Kits are available from your dealer.

We consider these minimum quantities. Your vessel's operating conditions may require more of a given part. Consult your dealer. The example below lists typical items for either heat exchanged or keel cooled engines (except where noted).

| Item | Description | Qty | |
|------|------------------------------|--------------|--------------|
| | | M4105 Series | M6105 Series |
| 1 | Fuel injector (full set) | 4 | 6 |
| 2 | Valve cover gasket | 4 | 6 |
| 3 | Aftercooler o-ring | 1 | 1 |
| 4 | Kit, cooling system gaskets* | 1 | 1 |
| 5 | Thermostat, 169 degree | 1 | 1 |
| 6 | Thermostat, 180 degree | 1 | 1 |
| 7 | Exhaust manifold gasket | 4 | 6 |
| 8 | Turbocharger mounting gasket | 2 | 2 |
| 9 | Intake gaskets | 4 | 6 |
| 10 | Oil pan gasket | 1 | 1 |
| 11 | Alternator belt | 1 | 1 |
| 12 | M-prop | 1 | 1 |
| 13 | Raw water pump | 1 | 1 |
| 14 | Impeller kit | 1 | 1 |
| 15 | Cooling system hose coupler | 3 | 3 |
| 16 | Oil filter | 2 | 2 |
| 17 | Air filter | 1 | 1 |
| 18 | Coalescing filter | 1 | 1 |
| 19 | Fuel filter | 2 | 2 |
| 20 | Fuel/water separator | 2 | 2 |
| 21 | Zinc anode | 4 | 4 |
| 22 | Filler cap, 10 psi | 1 | 1 |

* - keel cooled only





4420 14th Ave. NW., Seattle WA 98107

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

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