



GeneratorJoe®



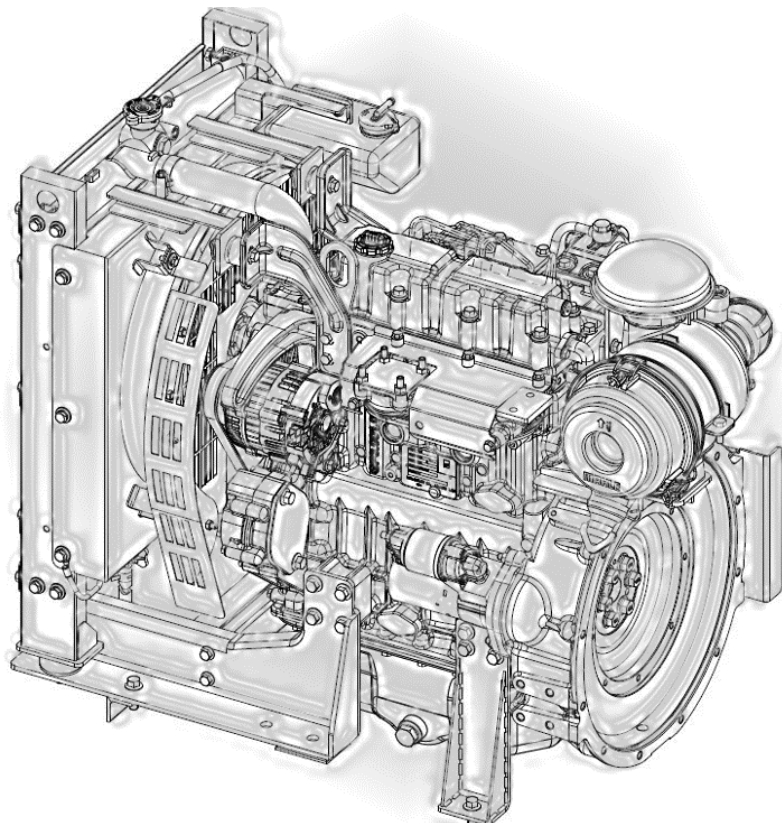
Ranger Generators

featuring

Kirloskar

Americas

ENGINES



G-DRIVE DIESEL ENGINES

OPERATION AND MAINTENANCE MANUAL

ENGINE MODEL: 2R550NA1 & 3R550NA1

California

Proposition 65 Warning

The diesel engine exhaust from this product contains chemicals known to the state of California to cause cancer, birth defects or other reproductive harm.

California

Proposition 65 Warning

Certain components in this product and its related accessories contain chemicals known to the state of California to cause cancer, birth defects or other reproductive harm. Wash hands after handling.

DISCLAIMERS:

All information, illustrations and specifications in this manual are based on the latest information available at the time of publishing. The illustrations used in this manual are intended as representative reference views only. Moreover, because of our continuous product improvement policy, we may modify information, illustrations and/or specifications to explain and/or exemplify a product, service or maintenance improvement. We reserve the right to make any change at any time without notice. Some images may vary depending upon which model is shown.

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NOTES

INTRODUCTION

Congratulations on your purchase of a GeneratorJoe generator with a reliable Kirloskar engine. It is designed and manufactured to provide you years of trouble-free operation.

To help you enjoy your GeneratorJoe generator and Kirloskar engine for many years to come, please follow these recommendations:

- Read and understand this Operation and Maintenance Manual before you operate the engine to ensure that you follow safe operating practices and maintenance procedures.
- Keep this Operation Manual in a convenient place for easy access.
- If this Operation Manual is lost or damaged, order a new one from your authorized Kirloskar engine dealer or distributor.
- Make sure this manual is transferred to subsequent owners. This manual should be considered a permanent part of the engine and remain with it.
- Constant efforts are made to improve the quality and performance of Kirloskar products, so some details included in this Operation and Maintenance Manual may differ slightly from your engine. If you have any questions about these differences, please contact your authorized Kirloskar industrial engine dealer or distributor.
- The specifications and components described in this manual may differ from ones installed on your engine. Please refer to the manual provided by the manufacturer of these components.

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SAFETY

SAFETY STATEMENTS

Kirloskar Americas Corp. is concerned for your safety and your engine's condition. Safety statements are one of the primary ways to call your attention to the potential hazards associated with engine operation. Follow the precautions listed throughout the manual before operation, during operation and during periodic maintenance procedures for your safety, the safety of others and to protect the performance of your engine. Keep the labels from becoming dirty or torn and replace them if they are lost or damaged. Also, if you need to replace a part that has a safety label attached to it, make sure you order the new part and safety label at the same time.

NOTE: Indicates a procedure, practice or condition that should be followed in order for the engine or component to function in the manner intended.

SAFETY PRECAUTION

Before You Operate

DANGER

Indicates a hazardous situation that, if not avoided, *will* result in death or serious injury.

WARNING

Indicates a hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION

Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates a situation that can cause damage to the engine, personal property and/or the environment, or cause the equipment to operate

NOTICE



NEVER permit anyone to operate the engine or driven machine without proper training.

- Read and understand this Operation Manual before you operate or service the machine to ensure that you follow safe operating practices and maintenance procedures.
- Machine safety signs and labels are additional reminders for safe operating and maintenance techniques.
- See your authorized **GeneratorJoe** industrial engine dealer or distributor for additional training.

 **DANGER**



SCALD HAZARD!

- NEVER remove the radiator cap if the engine is hot. Steam and hot engine coolant will spurt out and seriously burn you. Allow the engine to cool down before you attempt to remove the radiator cap.
- Tighten the radiator cap securely after you check the radiator. Steam can spurt out during engine operation if the cap is loose.
- ALWAYS check the level of the engine coolant by observing the reserve tank.
- Failure to comply will result in death or serious injury.

 **DANGER**



EXPLOSION HAZARD!

- Keep the area around the battery well-ventilated. While the
- Engine is running or the battery is charging, hydrogen gas is produced which can be easily ignited.
- Keep sparks, open flame, and any other form of ignition away while the engine is running or battery is charging.
- Failure to comply will result in death or serious injury.
-

 **DANGER**



FIRE AND EXPLOSION HAZARD!

- Diesel fuel is flammable and explosive under certain conditions.
- When you remove any fuel system component to perform maintenance (such as changing the fuel filter) place an approved container under the opening to catch the fuel.
- NEVER use a shop rag to catch the fuel. Vapors from the rag are flammable and explosive.
- Wipe up any spills immediately.
- Wear eye protection. The fuel system is under pressure and fuel could spray out when you remove any fuel system component.
- NEVER jump-start the engine. Sparks caused by shorting the battery to the starter terminals may cause a fire or explosion.
- For mechanical fuel pump, when you prime the fuel system, operate the fuel primer pump located either on fuel injection pump or secondary fuel filter.
- NEVER use diesel fuel as a cleaning agent.
- NEVER remove the fuel cap with the engine running.

 **DANGER**



FIRE AND EXPLOSION HAZARD!

- Only fill the fuel tank with diesel fuel. Filling the fuel tank with gasoline may result in a fire and will damage the engine.
- NEVER refuel with the engine running.
- Keep sparks, open flames, and any other form of ignition (match, cigarette, static electric source) well away when refueling.
- NEVER overfill the fuel tank.
- Fill the fuel tank. Store any containers containing fuel in a well-ventilated area, away from any combustibles or sources of ignition.
- Be sure to place the diesel fuel container on the ground when transferring the diesel fuel from the pump to the container. Hold the hose nozzle firmly against the side of the container while filling it. This prevents static electricity buildup which could cause sparks and ignite fuel vapors.
- NEVER place diesel fuel or other flammable material such as oil, hay, or dried grass close to the engine during engine operation or shortly after shutdown.

 **DANGER**



FIRE AND EXPLOSION HAZARD!

- For mechanical fuel pump, when you prime the fuel system, operate the fuel primer pump located either on fuel injection pump or secondary fuel filter.
- Failure to comply will result in death or serious injury.

 **WARNING**



BURN HAZARD!

- Batteries contain sulfuric acid. NEVER allow battery fluid to come in contact with clothing, skin, or eyes. Severe burns could result. ALWAYS wear safety goggles and protective clothing when servicing the battery. If battery fluid contacts the eyes and/or skin, immediately flush the affected area with a large amount of clean water and obtain prompt medical treatment.
- Failure to comply could result in death or serious injury.

 **WARNING**



ALCOHOL AND DRUG HAZARD!

- NEVER operate the engine while you are under the influence of alcohol or drugs.
- NEVER operate the engine when you are feeling ill.
- Failure to comply could result in death or serious injury.

 **WARNING**



ENTANGLEMENT HAZARD!

- Stop the engine before you begin to service it.
- If you must service the engine while it is operating, remove all jewelry, tie back long hair, and keep your hands, other body parts and clothing away from moving/rotating parts.
- Failure to comply could result in death or serious injury.

 **WARNING**



SEVER HAZARD!

- Keep hands and other body parts away from moving/rotating parts such as the cooling fan or flywheel.
- Wear tight-fitting clothing and keep your hair short or tie it back while the engine is running.
- Remove all jewelry before you operate or service the machine.
- NEVER operate the engine without the guards in place.
- Before you start the engine make sure that all bystanders are clear of the area.
- Keep children and pets away while the engine is operating.
- Check before starting the engine that any tools or shop rags used during maintenance have been removed from the area.
- Failure to comply could result in death or serious injury.

 **WARNING**



EXHAUST HAZARD!

- NEVER operate the engine in an enclosed area such as a garage, tunnel, underground room, manhole or ship's hold without proper ventilation.
- NEVER block windows, vents, or other means of ventilation if the engine is operating in an enclosed area. All internal Combustion engines create carbon monoxide gas during operation. Accumulation of this gas within an enclosure could cause illness or even death.
- Make sure that all connections are tightened to specifications after repair is made to the exhaust system.
- Failure to comply could result in death or serious injury.

 **WARNING**



EXPOSURE HAZARD!

- Wear personal protective equipment such as gloves, work shoes, eye and hearing protection as required by the task at hand.
- NEVER wear jewelry, unbuttoned cuffs, ties, or loose-fitting clothing when you are working near moving/rotating parts such as the cooling fan or flywheel.
- ALWAYS tie back long hair when you are working near moving/ rotating parts such as a cooling fan or flywheel.
- NEVER operate the engine while wearing a headset to listen to music or radio because it will be difficult to hear the alert signals.
- Failure to comply could result in death or serious injury.



WARNING



BURN HAZARD!

- Wait until the engine cools before you drain the engine coolant. Hot engine coolant may splash and burn you.
- If you must drain the engine oil while it is still hot, stay clear of the hot engine oil to avoid being burned.
- ALWAYS wear eye protection.
- Keep your hands and other body parts away from hot engine surfaces such as the muffler, exhaust pipe, turbocharger (if equipped) and engine block during operation and shortly after you shut the engine down. These surfaces are extremely hot while the engine is operating and could seriously burn you.
- Failure to comply could result in death or serious injury.

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WARNING



HIGH-PRESSURE HAZARD!

- Avoid skin contact with the high- pressure diesel fuel spray caused by a fuel system leak such as a broken fuel injection line. High- pressure fuel can penetrate your skin and result in serious injury. If you are exposed to high- pressure fuel spray, obtain prompt medical treatment.
- NEVER check for a fuel leak with your hands. ALWAYS use a piece of wood or cardboard. Have your authorized Kirloskar industrial engine dealer or distributor repair the



CAUTION



COOLANT HAZARD!

- Wear eye protection and rubber gloves when you handle long life or extended life engine coolant.

If contact with the eyes or skin should occur, flush eyes, and wash immediately with clean water.



- Failure to comply may result in minor or moderate injury.

WARNING



SHOCK HAZARD!

- Turn off the battery switch (if equipped) or disconnect the negative battery cable before servicing the electrical system. Always disconnect the negative battery cable first and connect it to the battery last.
- Check the electrical harnesses for cracks, abrasions, and damaged or corroded connectors. ALWAYS keep the connectors and terminals clean.
- Failure to comply could result in death or serious injury.

NOTICE

- Only use recommended diesel fuels for the best engine performance, to prevent engine damage and to comply with EPA warranty requirements.
- Only use clean diesel fuel.
- NEVER remove the primary strainer (if equipped) from the fuel tank filler port. If removed, dirt and debris could get into the fuel system causing it to clog.

CAUTION



FLYING OBJECT HAZARD!

- ALWAYS wear eye protection when servicing the engine and when using compressed air or high-pressure water. Dust, flying debris, compressed air, pressurized water, or steam may injure your eyes.
- Failure to comply may result in minor or moderate injury.

NOTICE

Make sure the engine is installed on a level surface.

NOTICE

Observe the following environmental operating conditions to maintain engine performance and avoid premature engine wear:

- Avoid operating in extremely dusty conditions.
- Avoid operating in the presence of chemical gases or fumes.
- Avoid operating in a corrosive atmosphere such as salt water spray.
- NEVER install the engine in a floodplain unless proper precautions are taken to avoid being subject to a flood.
- NEVER expose the engine to the rain.

NOTICE

If equipped with a key to start, NEVER hold the key in the START position for longer than 15 seconds or the starter motor will overheat.

NOTICE

If any problem is noted during the visual check, the necessary corrective action should be taken before you operate the engine.

NOTICE

- Only use the engine oil specified. Other engine oils may affect warranty coverage, cause internal engine components to seize and/or shorten engine life.
- Prevent dirt and debris from contaminating the engine oil. Carefully clean the oil cap/dipstick and the surrounding area before you remove the cap.
- NEVER mix different types of engine oil. This may adversely affect the lubricating properties of the engine oil.
- NEVER overfill. Overfilling may result in internal damage.
- ALWAYS keep the oil level between the upper and lower lines on the oil cap/dipstick.

NOTICE

When the engine is operated in dusty conditions, clean the air cleaner element more frequently.

NEVER operate the engine with the air cleaner element(s) removed. This may allow foreign material to enter the engine and damage it.

NOTICE

Observe the following environmental operating conditions to maintain engine performance and avoid premature engine wear:

- The standard range of ambient temperatures for the normal operation of the engines is from -4°F (-20°C) to +113°F (+45°C).
- If the ambient temperature exceeds +113°F (+45°C) the engine may overheat and cause the engine oil to break down.
- If the ambient temperature is below -4°F (-20°C) the engine will be hard to start and the engine oil may not flow easily.
- Contact your authorized engine dealer or distributor if the engine is required to be operated outside of this standard temperature range.

NOTICE

- Only use the engine coolant specified. Other engine coolants may affect warranty coverage, cause an internal buildup of rust and scale and/or shorten engine life.
- Prevent dirt and debris from contaminating the engine coolant. Carefully clean the radiator cap and the surrounding area before you remove the cap.
- NEVER mix different types of engine coolants. This may adversely affect the properties of the engine coolant.

NOTICE

Protect the air cleaner, turbocharger (if equipped) and electric components from damage when you use steam or high-pressure water to clean the engine.

NOTICE



ALWAYS be environmentally responsible.

Follow the guidelines of the EPA or other governmental agencies for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.

NEVER dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground, or into ground water or waterways.

Failure to follow these procedures may seriously harm the environment

NOTICE

NEVER use an engine starting aid such as ether. Engine damage will result.

NOTICE

For maximum engine life, Kirloskar Americas Corp. recommends that when shutting the engine down, you allow the engine to idle, without load, for five minutes. This will allow the engine components that operate at high temperatures, such as the turbocharger (if equipped) and exhaust system, to cool slightly before the engine itself is shut down.

NOTICE

Establish a periodic maintenance plan according to the engine application and make sure you perform the required periodic maintenance at intervals indicated. Failure to follow these guidelines will impair the engine's safety and performance characteristics, shorten the engine's life, and may affect the warranty coverage on your engine. See Kirloskar Americas Corp. Limited Warranty in the Warranty Section of this manual.

NOTICE

NEVER use high-pressure water or compressed air at greater than 28 psi (193 kPa; 19 686 mmAq) or a wire brush to clean the radiator fins. Radiator fins damage easily.

NOTICE

The tightening torque in the Standard Torque Chart in the Periodic Maintenance Section of this manual should be applied.

NOTICE

If no water drips when the fuel filter/water separator drain valve is opened, loosen the air vent screw on the top of the fuel filter/water separator by using a screwdriver to turn it counterclockwise 2-3 turns.

Be sure to tighten the air vent screw.

NOTICE

- NEVER attempt to modify the engine's design or safety features such as defeating the engine speed limit control or the diesel fuel injection quantity control.
- Modifications may impair the engine's safety and performance characteristics and shorten the engine's life. Any alterations to this engine may void its warranty. Be sure to use Kirloskar genuine replacement

SAFETY LABELS ENGINE MODEL 3R550NA1/2R550NA1

Read and understand all machines' safety decals. Keep safety decals in good condition. Replace all missing or damaged safety decals. Replacement safety decals can be ordered from Kirloskar Americas Corp. or one of their distributors or dealers. Safety decals located on your machine contain important and useful information that will help you operate your engine safely. To ensure that all decals remain in place and in good condition, follow these instructions:

- Keep decals clean. Use soap and water. Abrasive cleaners that may damage the decal are not recommended.
- Replace any damaged or missing decals. When attaching decals, the surface temperature of the metal must be at least 40°F (5°C). The surface must also be clean and dry. When replacing a machine component with a decal attached, replace the decal also.

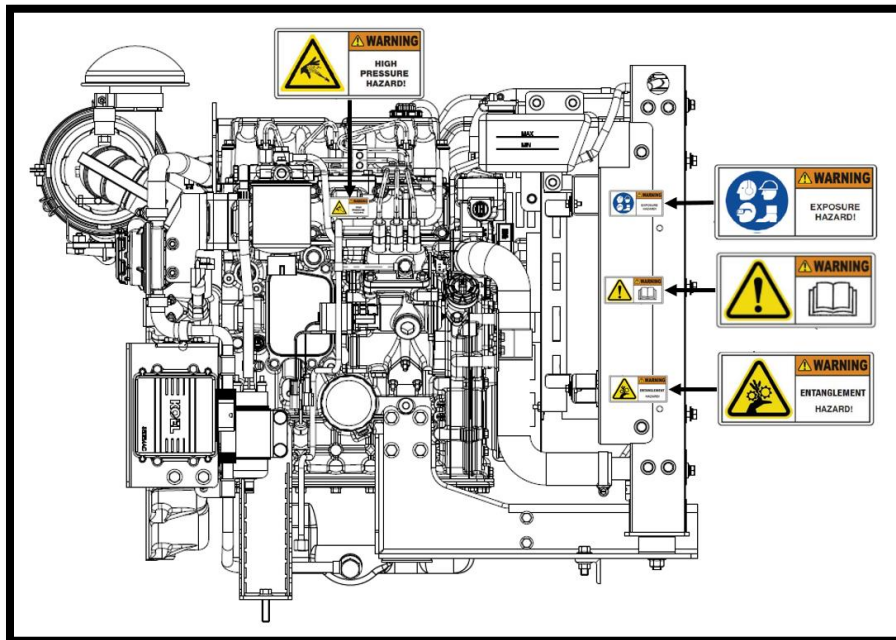


Fig 1- safety labels and location

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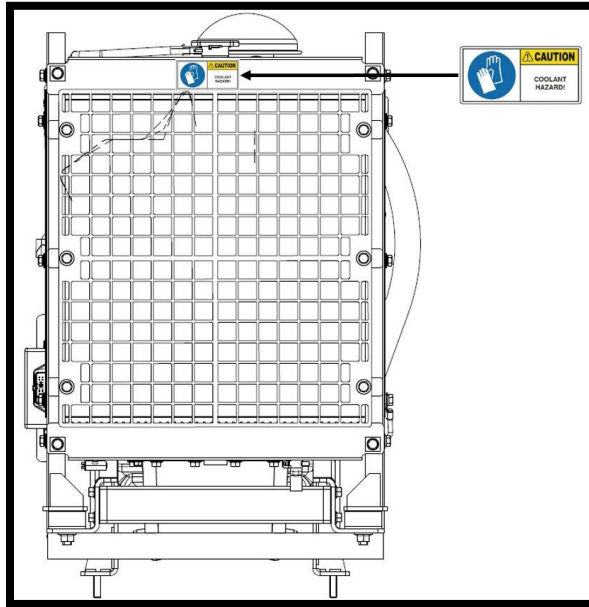


Fig 2- safety labels and location

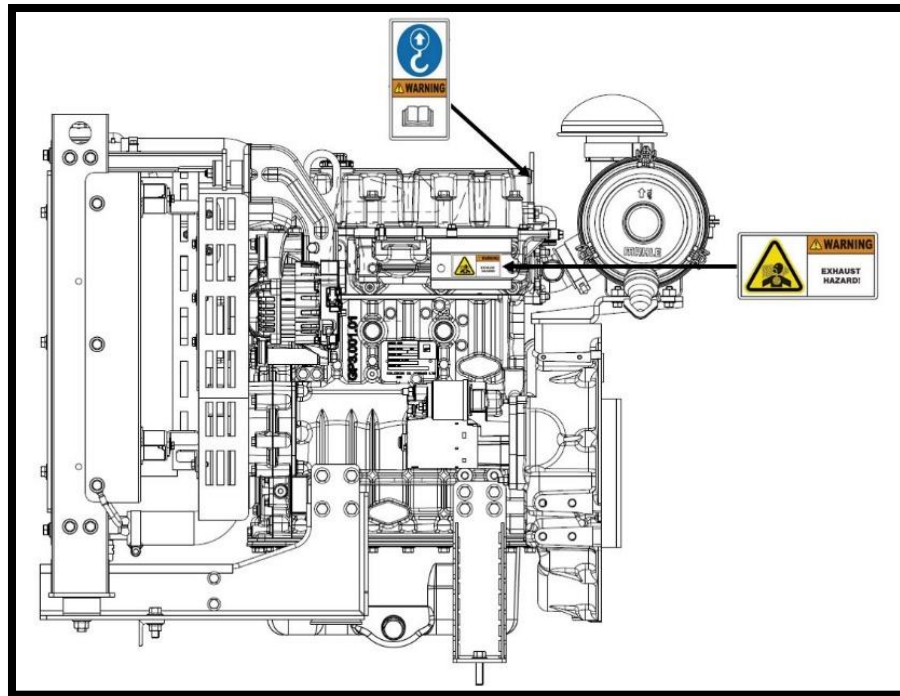


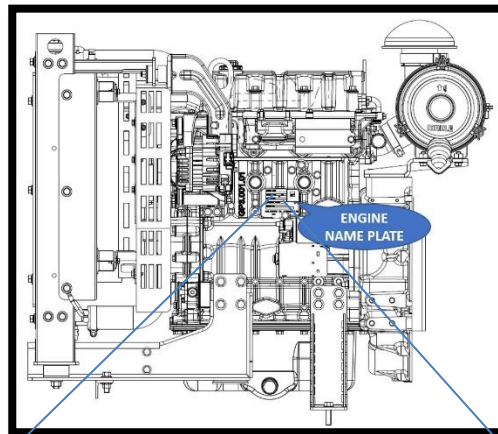
Fig 3- safety labels and location

GENERAL INFORMATION

MODEL AND ENGINE NAME PLATE

ENGINE MODEL 3R550NA1/2R550NA1

The model and serial number tag is located on the engine block. Refer to this tag when needing any warranty or service assistance. Also refer to this tag when ordering any spare parts. This will help ensure that the correct part is ordered.



EMISSION CONTROL INFORMATION	kirloskar Americas
FAMILY – NKOEL1.64NAX	KIRLOSKAR AMERICAS CORPORATION IS A WHOLLY OWNED SUBSIDIARY OF KIRLOSKAR OIL ENGINES LTD,INDIA.
MODEL – 3R550NA1	
ECS – EM, DFI	
RATING – 17.3 kW (23.5HP)/1800RPM (<19kW)	
DISPLACEMENT – 1.64 L.	
CERTIFICATE No. <input type="text"/>	
MONTH/YEAR OF Mfg <input type="text"/> Sr. No. <input type="text"/>	
ULTRA LOW SULFUR DIESEL ONLY	
THIS ENGINE COMPLIES WITH U.S. EPA REGULATIONS FOR 2022 MODEL YEAR NON ROAD DIESEL ENGINES. USE IN CONSTANT –SPEED APPLICATIONS ONLY	
<small>The Mark "Kirloskar" used in Any Form As Suffix Or Prefix Is Owned By Kirloskar Proprietary Limited And Kirloskar Oil Engines Limited Is The Permitted User</small>	

EMISSION CONTROL INFORMATION	kirloskar Americas
FAMILY – NKOEL1.09NAX	KIRLOSKAR AMERICAS CORPORATION IS A WHOLLY OWNED SUBSIDIARY OF KIRLOSKAR OIL ENGINES LTD,INDIA.
MODEL – 2R550NA1	
ECS – EM, DFI	
RATING – 11.5 kW (15.7HP)/1800RPM (<19kW)	
DISPLACEMENT – 1.09 L.	
CERTIFICATE No. <input type="text"/>	
MONTH/YEAR OF Mfg <input type="text"/> Sr. No. <input type="text"/>	
ULTRA LOW SULFUR DIESEL ONLY	
THIS ENGINE COMPLIES WITH U.S. EPA REGULATIONS FOR 2022 MODEL YEAR NON ROAD DIESEL ENGINES. USE IN CONSTANT –SPEED APPLICATIONS ONLY	
<small>The Mark "Kirloskar" used in Any Form As Suffix Or Prefix Is Owned By Kirloskar Proprietary Limited And Kirloskar Oil Engines Limited Is The Permitted User</small>	

Fig 4- Engine name plate and location

ENGINE SPECIFICATIONS

Engine Model Name	3R550NA1	2R550NA1
Engine Family Designation	NKOEL1.64NAX	NKOEL1.09NAX
Engine Model Designation	NKOEL1.64NA1	NKOEL1.09NA1
FUEL	High Speed Diesel	
EPA Category	Non-Road Compression Ignition	
Emission	Tier - IV	
Rated Power (HP/ KW)	23.5 (17.3)	15.7 (11.5)
Rated Speed	1800	
Combustion cycle	4 stroke	
Type of injection	Direct Injection	
No of cylinder	3	2
Cylinder configuration	Inline	
Total displacement (L)	1.64	1.09
Bore (mm)	86	
Stroke (mm)	94	
Aspiration	Naturally Aspirated	
Cooling Medium	Water	
Fuel Injection System Type	Mechanical	
Fuel Injection Pump Type	BOSCH Inline (PF)	
Speed Governor Type	Electronic	
Speed Governing	Isochronous Governing	
Fuel Injector	P Type Multi-hole	
Engine Dimension without Cooling package (LxWxH)	22.2 x 21.2 x 26.4 in. (565 x 539 x 670 mm)	18.4 x 20.4 x 24.9 in. (468 x 518 x 633 mm)
Engine Dry Weight without Cooling package	368 lb (167 kg)	289 lb (130 kg)
Engine Dimension with Cooling package (LxWxH)	36.4 x 21.3 x 30.3 in. (925 x 540 x 770 mm)	32.4 x 21.3 x 30.3 in. (825 x 540 x 770 mm)
Engine Dry Weight with Cooling package	430 lb (195 kg)	331 lb (150 kg)

COMPONENT LOCATION ENGINE MODEL 2R550NA1/3R550NA1

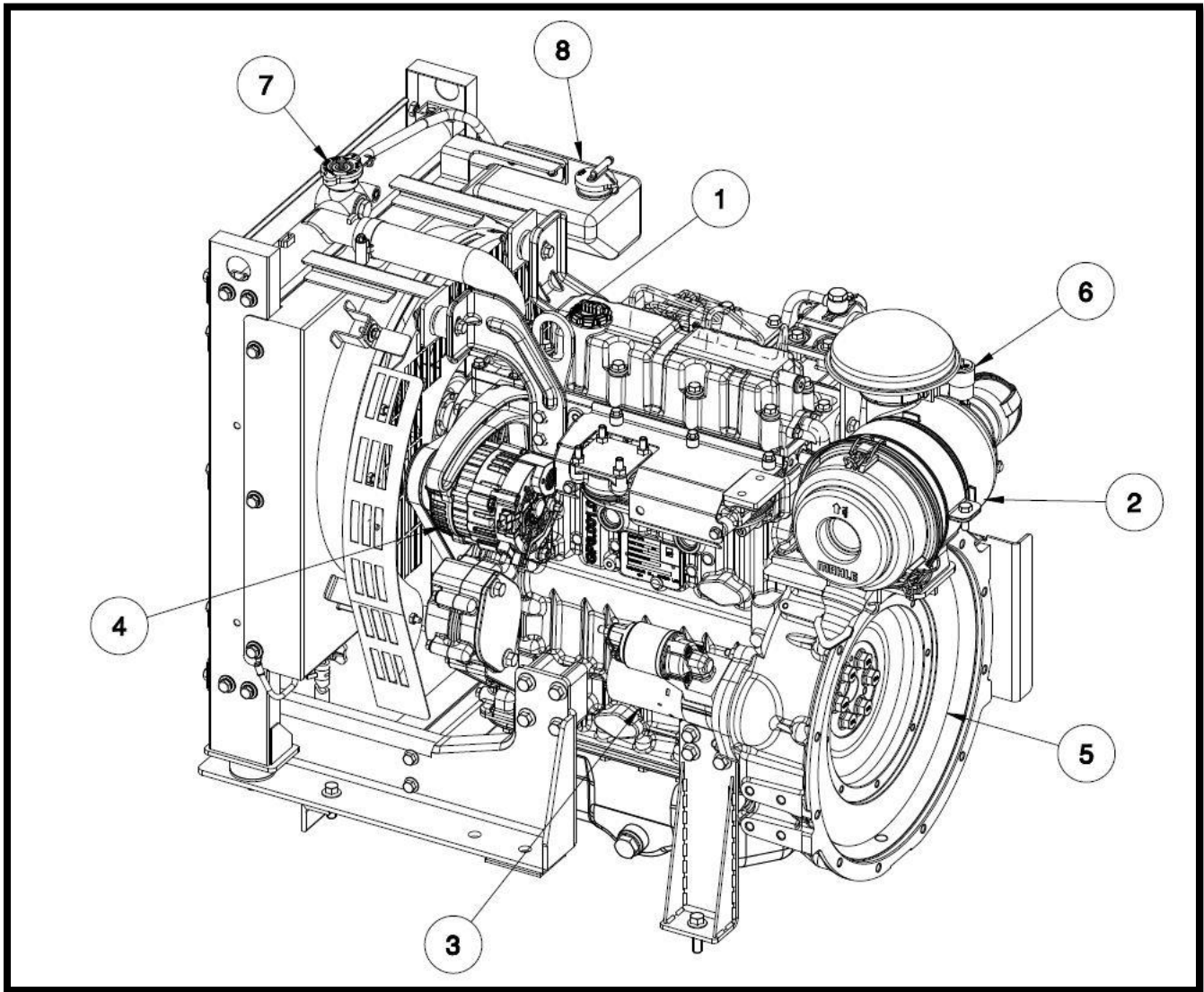


Fig 5- Component and location

- | | |
|-------------------------|-------------------------------------|
| 1. Front Lifting Eye | 5. Flywheel |
| 2. Air Cleaner Assembly | 6. Air Filter Restriction Indicator |
| 3. Starter Motor | 7. Radiator Cap |
| 4. Charging Alternator | 8. Coolant Recovery Tank |

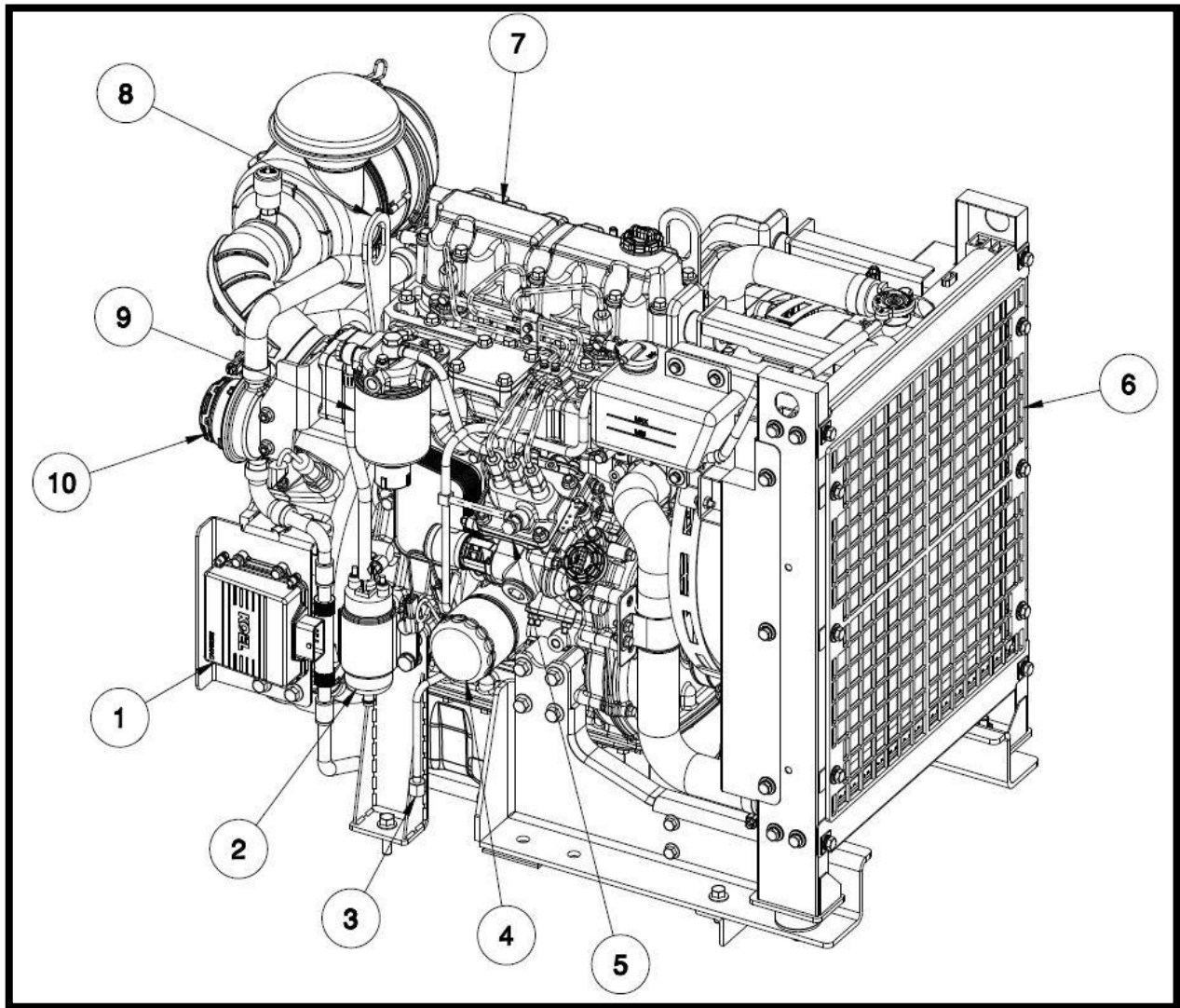


Fig 6- Component and location

- | | |
|---------------------------------|-------------------------|
| 1. Engine ECU | 6. Radiator Screen |
| 2. Electric Fuel Pump | 7. Rocker Cover |
| 3. Fuel Return Line Connection. | 8. Rear Eye Lifting |
| 4. Lube Oil Filter Assembly | 9. Fuel Filter Assembly |
| 5. Fuel Injection Pump | 10. CCV Assembly |

SPECIFICATIONS

ENGINE OIL

QUALITY

Any globally acceptable oil with specifications as provided on Figure may be used.

For normal operating conditions use of

SAE 15W40 API CI4

or higher grade is recommended.

NOTICE

Use of improper oil or oil of the incorrect viscosity may cause premature engine wear and can void your warranty.

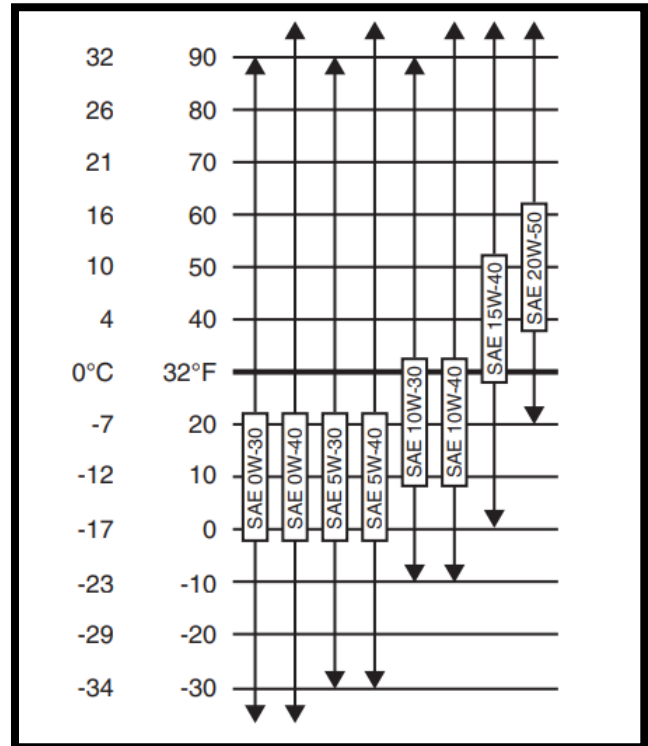


Fig 7- Component and location

VISCOSITY

Multi-grade oil should be used. The viscosity of engine lube oil is dependent on the ambient temperature. The use of an SAE grade oil should be governed by the ambient temperature at the engine operating site. Optimum operating performance will be achieved by using the correct viscosity oil. Use the following chart to determine the correct viscosity of oil to use for the temperature the engine will be operating in.

DIESEL FUEL

Diesel fuel for North America should have the specifications No. 2-D-S15, 1-D-15 ultra-low Sulphur diesel.

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ADDITIONAL DIESEL FUEL REQUIREMENTS

ITEM	UNITS	LIMITS		METHOD
		MINIMUM	MAXIMUM	
Cetane Number (tested by subcontractor)		45	50	ASTM D613
Cetane Index		40	50	ASTM D976
Density @ 15°C	kg/m3	839.8	864.6	ASTM D4052
Gravity, API (not accredited)		32	37	ASTM D287
Distillation IBP	oc	171.1	204.4	ASTM D86
Dist. 10% v/v	oc	204.4	237.8	ASTM D86
Dist. 50% v/v	oc	243.3	282.2	ASTM D86
Dist. 90% v/v	oc	293.3	332.2	ASTM D86
Distillation FBP	oc	321.1	365.6	ASTM D86
Flash Point	oc	54	-	ASTM D93
Viscosity @ 40°C	mm ² /s	2	3.2	ASTM D445
Sulfur	mg/kg	7	15	EN ISO 20846
Total Aromatics	%M	27	-	EN 12916
Non-aromatics	%M	-	-	EN 12916
Carbon	% w	-	-	ASTM D3343
Hydrogen	% w	-	-	ASTM D3343
C:H Ratio (H=1)		-	-	ASTM D3343
H:C Ratio (C=1)		-	-	ASTM D3343
Net Heating Value	MJ/kg	-	-	ASTM D3338
Net Heating Value	Btu/lb	-	-	ASTM D3338
HFRR (wsd 1,4)	µm	-	-	ISO 12156-1

WINTER GRADE FUEL

At low temperatures, fuel jelling or waxing may occur and clog the fuel system, make the engine start or operate poorly, or prevent the engine from starting at all. Use a winter grade, blended fuel from a reputable supplier when operating in cold weather.

ENGINE COOLANT

Use a Long Life Coolant (LLC) or an Extended Life Coolant (ELC). If an Extended or Long Life Coolant is not available, alternatively, you may use an ethylene glycol or propylene glycol based conventional coolant (green).

NOTES:

1. ALWAYS use a 50/50 mix of coolant and water. NEVER use water only.
2. Water quality is important to coolant performance. Kirloskar recommends demineralized Water be used to mix with coolant.
3. Do not mix Extended or Long Life Coolants and conventional (green) coolants.

LIFTING THE ENGINE

ENGINE MODEL 3R550NA1/2R550NA1

The engine should only be lifted using approved chains or slings and using a suitable lifting device that exceeds the lifting capacity weight of the engine. See Engine Specifications on page 2-2 for engine weights.



! WARNING

○ Only use approved lifting devices attached only to the factory-installed engine lifting eyes. Attaching anywhere else or using unapproved equipment could cause the engine to drop while being lifted.

Attach the chains or slings only to the factory-installed lifting eyes on the engine. Attaching the chains or slings anywhere else on the engine can damage the engine and/or void the warranty.

1. Engine Lifting Eye

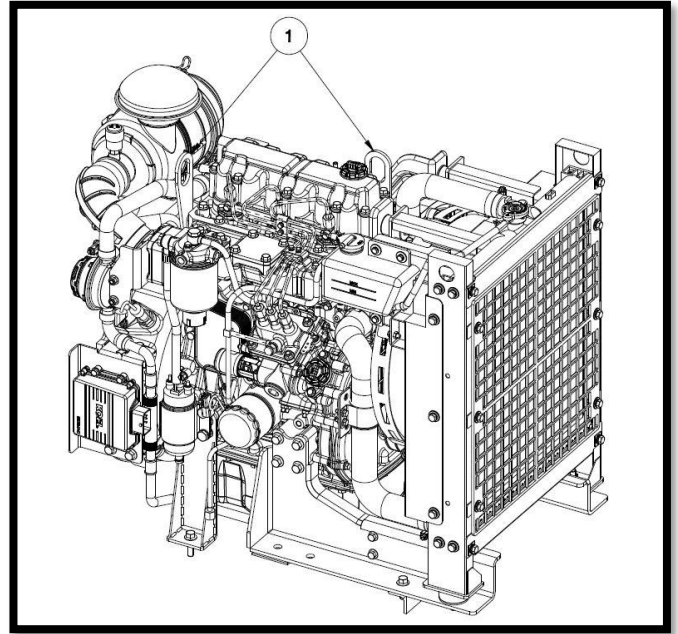


Fig8- Component and location

Ranger models come equipped with a fold down single point swivel loop to hoist the generator with. The fold down hoist ring replaces the two lifting eyes on the engine.

ELECTRICAL SYSTEM

The engine comes equipped with 12-volt DC negative ground system. Do not use any other type of voltage system with this engine. AWG 1 type cables should be used for the battery to the starting motor connections. Refer to the battery requirements table for the recommended battery for your temperature.

CCA	Temperature
500	32°F (0°C)
780	32 to -5°F (0 to -20°C)
910	-6 to -13°F (-20 to -25°C)

BATTERY CABLES

The recommended battery cable size should be no less than 2 AWG (35 sq. mm) and a maximum allowable resistance of 0.0004 ohms.

BATTERY REQUIREMENTS

The recommended battery size should be no less than :

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BEFORE YOU OPERATE

FILLING THE FUEL TANK

DANGER



FIRE AND EXPLOSION HAZARD!

- Diesel fuel is flammable and explosive under certain conditions.
- When you remove any fuel system component to perform maintenance (such as changing the fuel filter) place an approved container under the opening to catch the fuel.
- NEVER use a shop rag to catch the fuel. Vapors from the rag are flammable and explosive.
- Wipe up any spills immediately.
- Wear eye protection. The fuel system is under pressure and fuel could spray out when you remove any fuel system component.
- NEVER jump-start the engine. Sparks caused by shorting the battery to the starter terminals may cause a fire or explosion.
- For mechanical fuel pump, when you prime the fuel system, operate the fuel primer pump located either on fuel injection pump or secondary fuel filter.
- NEVER use diesel fuel as a cleaning agent.
- NEVER remove the fuel cap with the engine running.

1. Clean the area around the fuel cap before removing the cap.
2. Remove the fuel cap from the fuel tank.
3. Observe the fuel level sight gauge or indicator and stop filling when gauge or indicator shows the fuel tank is full. NEVER overfill the fuel tank.
4. Replace the fuel cap and hand-tighten. Over-tightening the fuel cap will damage it.

CAUTION

- Only use diesel fuels recommended by Kirloskar for the best engine performance, to prevent engine damage and to comply with EPA warranty Requirements.
- Only use clean diesel fuel.
- NEVER remove the primary strainer (if equipped) from the fuel tank filler port. If dirt is not removed, dirt and debris could get into the fuel system causing it to clog.

FUEL SYSTEM

ENGINE MODEL 3R550NA1/2R550NA1

Fuel is supplied to the mechanical fuel pump by electric feed pump. Fuel filter is integrated with water separator ensure the supply of clean fuel to the fuel pump.

1. Electric Feed Pump
2. Fuel Filter & Water Separator.
3. Fuel Pump
4. Fuel Return Line Connection.

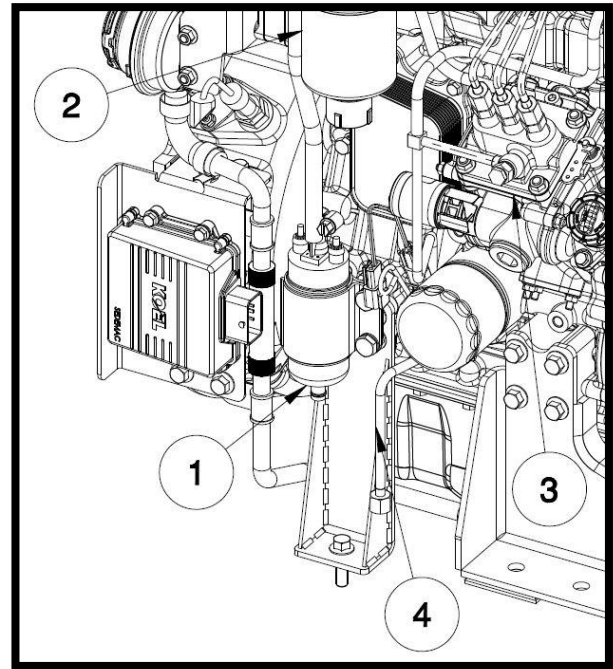


Fig 9- Component and location

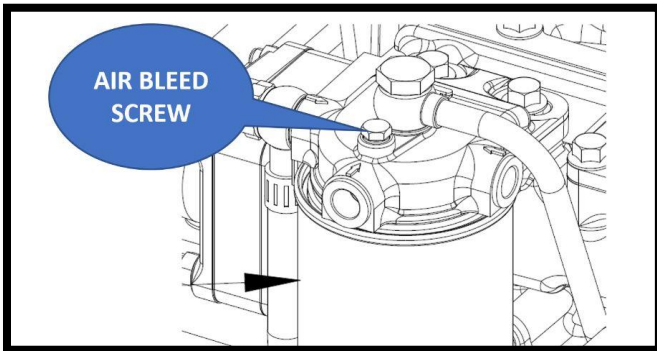


Fig 10- Component and location

1. Loosen the bleed screw on the fuel filter
2. After ensuring no bubbles are present, tighten the bleed screw

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CHECKING ENGINE OIL

ENGINE MODEL 3R550NA1/2R550NA1

1. Make sure engine is level.
2. Remove dipstick and wipe with clean cloth.
3. Fully reinsert dipstick.
4. Remove dipstick. The oil level should be between minimum and maximum level lines on the dipstick.
5. Add oil if required.
6. Recheck engine oil level

1. Engine Oil Dipstick
2. Engine Oil Fill Cap
3. Oil Filter

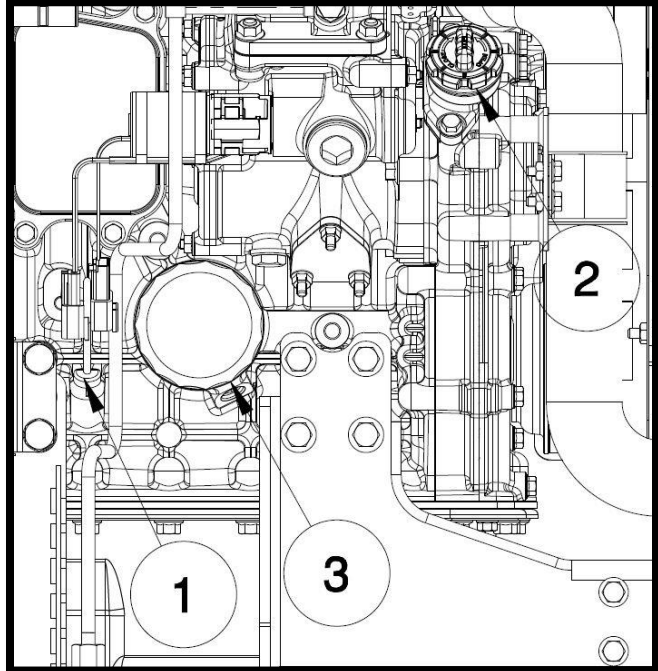


Fig 11- Component and location

OIL DIPSTICK

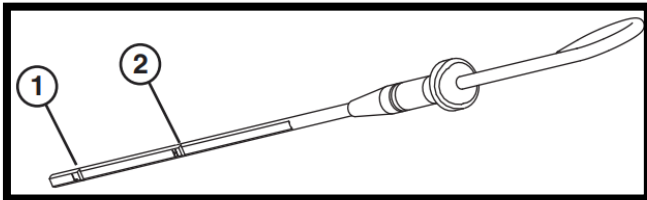


Fig 12- Component and location

1. Minimum/Low Level
2. Maximum/High Level

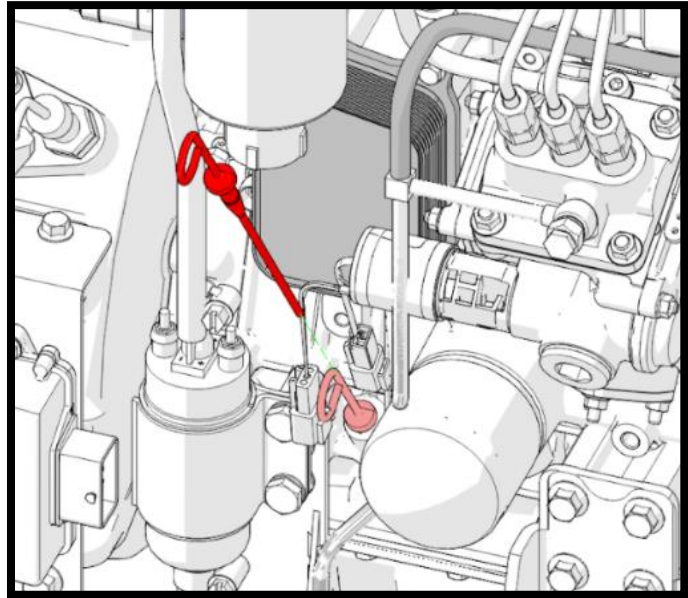


Fig 13- Component and location

ADDING ENGINE OIL

ENGINE MODEL 3R550NA1/2R550NA1

1. Make sure engine is level.
2. Remove oil fill cap.
3. Add the required amount of engine oil through the engine oil filler port.
4. Wait three minutes to allow the oil to drain to the oil pan and then check oil level again.
5. Add more oil if necessary.
6. Install the oil fill cap and hand-tighten.
Over-tightening may damage the oil fill cap.

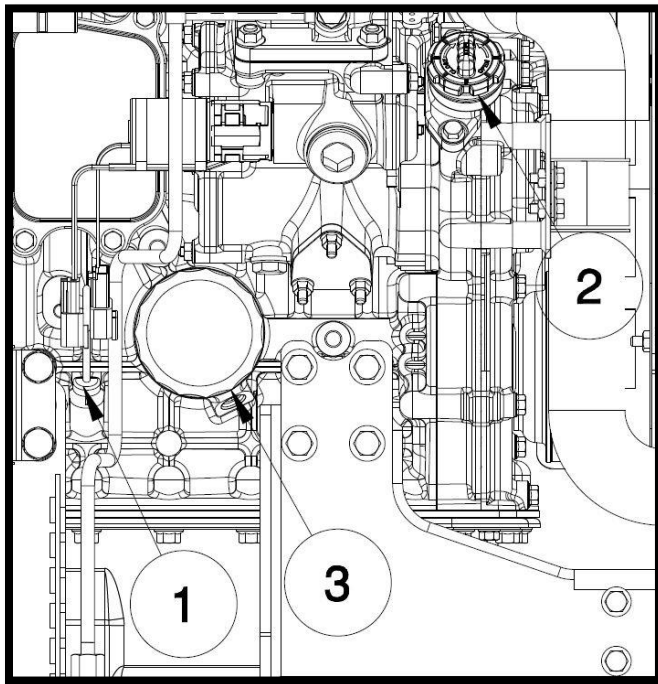


Fig 14- Component and location

⚠ CAUTION

- Only use the engine oil specified. Other engine oils may affect warranty coverage, cause internal engine components to seize and/or shorten engine life.
- Prevent dirt and debris from contaminating the engine oil. Carefully clean the oil cap/dipstick and the surrounding area before you remove the cap.
- NEVER mix different types of engine oil. This may adversely affect the lubricating properties of the engine oil.
- NEVER overfill. Overfilling may result in internal engine damage..

1. Engine Oil Dipstick
2. Engine Oil Fill Cap
3. Oil Filter

Oil Capacity in litres		
Engine model	First fill	Refill
3R550NA1	6.45	5.95
2R550NA1	3.8	3.3

NOTICE

Never check oil level when engine is running or immediately after stopping the engine, Oil level is to be checked in cold condition or at least after 15 mins after stopping the engine to ensure the oil circulated in the system while running will get accumulated in the sump. Ignoring this notice may affect the warranty coverage on your engine.

COOLING SYSTEM

ENGINE MODEL 3R550NA1/2R550NA1

Checking the Coolant Level

1. Make sure the engine is level
2. Check the fluid level in the recovery tank.
3. On a cold engine the coolant should be at the minimum level line or slightly above it.
4. Remove the cap and add coolant if required. If there is no coolant in the recovery tank, remove the radiator cap and add coolant to the bottom of the radiator filler neck and then add coolant to the recovery tank

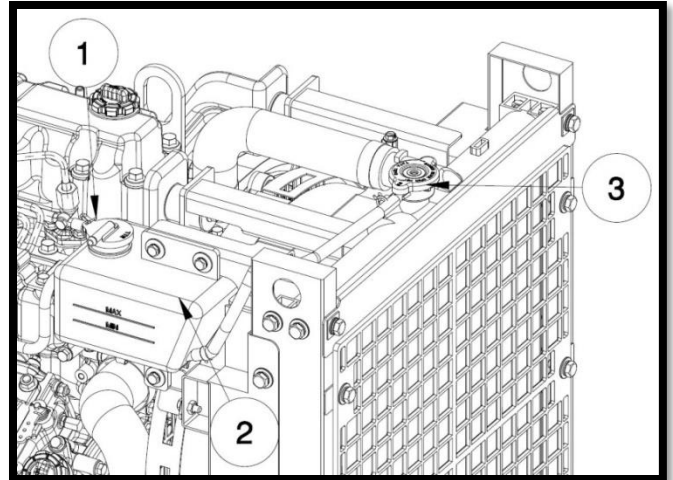


Fig 15- Component and location

1. Recovery Tank Cap
2. Recovery Tank
3. Radiator Cap

DANGER



SCALD HAZARD!

- NEVER remove the radiator cap if the engine is hot. Steam and hot engine coolant will spurt out and seriously burn you. Allow the engine to cool down before you attempt to remove the radiator cap.
- Tighten the radiator cap securely after you check the radiator. Steam can spurt out during engine operation if the cap is loose.
- ALWAYS check the level of the engine coolant by observing the reserve tank.
- Failure to comply will result in death or serious injury.

Coolant Capacity in litres

Engine model	First fill
3R550NA1	5
2R550NA1	4

NOTICE

- Only use the engine coolant specified. Other engine coolants may affect warranty coverage, cause an internal buildup of rust and scale and/or shorten engine life.
- Prevent dirt and debris from contaminating the engine coolant. Carefully clean the radiator cap and the surrounding area before you remove the cap.
- NEVER mix different types of engine coolants. This may adversely affect the properties of the engine coolant.

Maintenance and Service Schedule

A well planned program of preventative maintenance and service should be integral to the design of an onsite power system. Failure of a standby generator set to start and run could lead to loss of life, personal injury, property damage, and loss of business income. Failure to start and run due to low battery charge because of improper maintenance is the most common type of failure.

A comprehensive program carried out on a scheduled basis by qualified persons can prevent such failures and their possible consequences. The maintenance and service programs most generator set distributors offer on a contract basis should be considered. Typically, they include performance of scheduled maintenance, repairs, parts replacement, and service documentation.

The maintenance schedule for prime power sets should be on the basis of running time, as published by the manufacturer. Since standby sets run infrequently, the maintenance schedule is usually in terms of daily, weekly, monthly, or longer term tasks. See the manufacturer's instructions for details. In any case, scheduled maintenance should include:

Daily:

- Check for oil, coolant, and fuel leaks.
- Check operation of the engine coolant heater(s). If the block is not warm, the heaters are not working and the engine might not start.
- Check to see that the switchgear is in the AUTOMATIC position and the generator circuit breaker, if used, is closed.

Monthly:

- Check for air cleaner restrictions.
- Exercise the generator set by starting and running it for at least 30 minutes under not less than 30% rated load. Lower load levels are acceptable if the exhaust gas temperature reaches a level sufficient to prevent engine damage. Check for unusual vibrations, noises, and exhaust, coolant, and fuel leaks while the set is running. (Regular exercising keeps engine parts lubricated, improves starting reliability, prevents oxidation of electrical contacts, and consumes fuel before it deteriorates and has to be discarded.
- Check for radiator restrictions, coolant leaks, deteriorated hoses, loose and deteriorated fan belts, non-functioning motorized louvers, and proper concentration of engine coolant additives.
- Check for holes, leaks, and loose connections in the air cleaner system.
- Check fuel level and fuel transfer pump operation.
- Check for exhaust system leaks and restrictions, and drain the condensate trap.

- Check all meters, gauges, and indicator lamps for proper operation.
- Check the battery cable connections and battery fluid level and recharge the batteries if specific gravity is less than 1.260.
- Check for ventilation restrictions in the inlet and outlet openings of the generator.
- Check that all required service tools are readily available.

Annually:

- Change engine oil.
- Change engine oil filters.
- Change the filter(s) in the coolant conditioner circuit if applicable.
- Clean or replace the crankcase breather filter(s).
- Change the fuel filter(s), drain sediment from fuel tanks, check flexible fuel hoses for cuts and abrasions.
- Check electrical safety controls and alarms.
- Clean up accumulations of grease, oil, and dirt on the generator set.
- Check power distribution wiring, connections, circuit breakers, and transfer switches.
- Simulate a utility power outage. This will test the ability of the set to start and assume the rated load. Check the operation of the automatic transfer switches, related switchgear and controls, and all other components in the standby power system.
- Check the fan hub, pulleys, and water pump
- Check the fuel tank breather.
- Check and torque the exhaust manifold and turbocharger fasteners.
- Tighten the generator set mounting hardware.
- Clean the generator power output and control boxes. Check for and tighten all loose wiring connectors. Check the operation of the generator heater strips and grease the bearings if applicable.
- Check the operation of the main generator circuit breaker (if used) by manually operating it. Test the trip unit according to the manufacturer's instructions.
- If the set is normally exercised at no-load or carries only light loads, run the generator set for at least three hours, including one hour at near rated load.

COOLANT SPECIFICATION RECOMMENDATIONS (ANTIFREEZE)

Coolant is a mixture of antifreeze (ethylene glycol) and water. Antifreeze lowers the freezing point and raises the boiling point. Coolant also protects the system from rust and corrosion.

Antifreeze contains:

Corrosion inhibitors	Silicates, Phosphates, Borates
pH buffers	Maintain acid-alkaline balance, prevent electrolytic corrosion
EG or PG base	To reduce freezing point and increase boiling point
Dye	To distinguish anti-freeze and type

The coolant used in the cooling system meets the requirements of LLC (Long life Coolant Class 2 as specified in JIS K 2234).

Only ethylene glycol-based and non-amine-type coolants are recommended.

Water Quality Guidelines (used for mixing with coolant): It is recommended that demineralized water be used for mixing with coolant. The following table shows the quality level of water:

Sr.No.	Parameter	Unit of measurement	Specifications
1	pH Value	pH	6 to 8
2	Conductivity	µS/cm	100
3	Chloride	mg/l	< 20 mg/l
4	Sulphate	mg/l	< 50 mg/l
5	Iron	mg/l	< 0.30
6	Copper	mg/l	<1
7	Silicate	mg/l	<50
8	Hardness (CaCO ₃)	mg/l	200 max
9	M-Alkalinity (CaCO ₃)	mg/l	100 max
10	Remainants after evaporation	mg/l	500

COOLANT FILLING:

- Before and after adding coolant to the engine cooling system, follow the instructions below. Engine coolant galleries shall be free from rust, dust, and free particles.
- If rust appears at the engine inlet and outlet, completely flush the engine with demineralized water to ensure that it is rust-free.
- Properly remove the engine rust prevention chemical to avoid loss of rust prevention properties of the coolant.
- De-aerate the system to ensure that no air pockets are present.
- Measure concentration at the genset level using a refractometer. Verify pH after filling the system with coolant.

CHECKS BEFORE AND AFTER INITIAL OPERATION OF THE GENSET:

Perform the following checks and verify parameters before and after initial operation of the genset:

- Check coolant level at pressure cap mounting filler neck. Ensure that coolant is full at the filler neck area.
- Check coolant leakage from all connections of the engine cooling system:
 - Radiator inlet and outlet hose
 - Water pump connections
 - Engine coolant in and out port
 - Thermostat mounting
 - Other connections such as metallic hose joints

CHECK FOR STRAY CURRENT USING THE FOLLOWING METHOD:

- Attach the negative probe of a multimeter to the battery negative terminal and submerge the positive probe into the coolant without touching any metal part.
- Read the DC charge (voltage) with all systems off. If a block heater is present, take a reading with the heater turned on. If an automatic battery charger is present as a standby system, take a reading with this system running.
- Read the DC charge (voltage) with the motor starter engaged.
- Read the DC charge (voltage) with the engine running and all systems turned on: lights, coolers, fans, heaters.
- A voltage reading of 0 to 0.05 is normal. A higher reading is detrimental for radiator tubes.
- If the reading is higher than 0.05 with all the equipment turned on, turn off one component at a time until you finally turn off the component that lowers the reading to normal. This will indicate the component causing the problem.
- Use caution with starters, as they can cause as much damage to a cooling system as a direct connection to an arc welder. This is due to the amperage present.
- Always change the coolant when detecting a high reading. The electrical current will destroy the protecting chemicals in a properly inhibited coolant.

ENGINE OPERATION

STARTING THE ENGINE

The engine is integrated with an Engine Control Unit (ECU) and an Electric Starter mechanism.

1. Activate the ECU with a 12V DC power supply.
2. Figure 4-1 illustrates an ECU basic wiring diagram. See the product-specific installation guidelines for technical details.
3. The engine starter solenoid and starter motor power terminals need to be provided with 12 volts DC power to engage the starter motor in order to crank the engine to provide the initial engine RPM as indicated in Figure
4. When the ECU detects the initial engine RPM provided by the starter motor, it increases the fuel supply to the engine in order to reach the rated 1800 RPM.
5. If the engine fails to start:
 - a. Wait until the engine comes to a complete stop before you attempt to start it again. Engaging the starter while the engine is still rotating will result in damage to the starter and flywheel.
 - b. Wait at least 15 seconds before you attempt to start the engine again. This procedure will allow the battery voltage to recover and prevent damage to the starter motor due to low battery voltage.

NOTICE

NEVER hold the key in the START position for longer than 15 seconds or the starter motor will overheat.

NOTICE

NEVER use an engine starting aid such as ether. Engine damage will result.

NOTICE

The starter needs to be disengaged before the engine reaches 300 RPM. Engagement of the starter with the engine at higher RPMs will result in damage to the starter and flywheel.

COLD STARTING AIDS AND PROCEDURE

1. It is recommended that the cold starting aids and the cold starting procedure be used when the temperature is 32°F (0°C) or below.
2. The engine is equipped with a plug-in coolant heater with 400W heating output. This coolant heater will maintain healthy core temperature of the engine during non-operational period when kept plugged in.
3. It is recommended to keep this coolant heater plugged in at all times in order to maintain the proper engine core temperature. The coolant heater is equipped with a 110/120V AC 3 prong NEMA 5-15P plug.
4. Only plug the coolant heater into a 110/120-volt AC rated power outlet.
5. The engine is also equipped with an integrated flange heater which heats the incoming air for the intake manifold.
6. The flange heater specifications are listed in the table below.
7. The wiring schematic for the flange heater is shown in Figure.
8. The flange heater should be used whenever the coolant temperature drops below 32°F (0°C).
9. The flange heater should not be operated for more than 30 seconds before cranking the engine.
10. The heater can be kept on until the engine RPM reaches the rated value. It is recommended that the flange heater be shut off 20 seconds after reaching the rated RPM or after a maximum total operation of 90 seconds.
11. In the case of a flange heater failure, engine starting ability in sub-zero temperatures may be affected.

Flange Heater Specifications

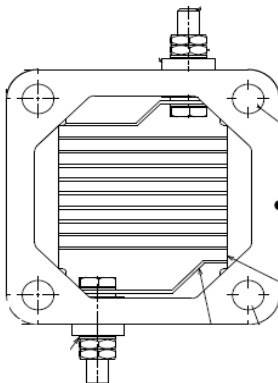


Fig 16- Component and location

Parameter	Specification
Type	Resistive
Input voltage	12V DC
Power consumption	1 kW
Permissible maximum continuous operation	60 sec (with airflow) 30 sec (without airflow)

CHECKING THE ENGINE DURING OPERATION

NOTE:

Depending on the Original Equipment Manufacturer (OEM), the method of monitoring the engine during operation and displaying fault codes may vary. See the operating instructions that were supplied from the OEM.

NOTICE

New Engine Break-in:

- On the initial engine start-up, allow the engine to idle for approximately 15 minutes while you check for proper engine oil pressure, diesel fuel leaks, engine oil leaks, coolant leaks, and for proper operation of the indicators and/or gauges.
- During the first hour of operation, vary the engine speed and the load on the engine. Short periods of maximum engine speed and load are desirable. Avoid prolonged operation at minimum or maximum engine speeds and loads for the next four to five hours.
- During the break-in period, carefully observe the engine oil pressure and engine temperature.
- During the break-in period, check the engine oil and coolant levels frequently.

NOTICE

Continuous use of the flange can result in damage to the heater coils and flywheel.

NOTICE

NEVER engage the starter motor while the engine is running. This may damage the starter motor pinion and/or ring gear.

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SAFE OPERATING PARAMETERS

- a. The engine is equipped with an electronic control unit that governs the engine speed to operate at fixed 1800 RPM. 1800 is the rated RPM of the engine.
- b. 1800 RPM fixed-speed engines are recommended for power generation applications equipped with 60 Hz power output alternators.
- c. At steady-state load conditions, the engine RPM will remain within the bandwidth of 1800 ± 10 RPM to ensure power frequency stability.
- d. The engine speed may deviate from its fixed-speed band during transient loading conditions. The electronic governor will constantly attempt to restore the engine RPM back to 1800 during the transient loading phase.
- e. Depending on application and power output requirements, the limits of the deviation of the engine speed (RPM higher or lower fixed speed), as well as duration of deviation during transient operations, will need to be defined by the Original Equipment Manufacturer (OEM) of the generator.
- f. The electronic governor ignition supply should be controlled by the generator control system, consequently stopping the engine once the engine crosses the above-mentioned speed limits.
- g. For additional safety, the Oil-pressure sensor (0-5V output), Coolant temperature sensor (Resistive negative thermal coefficient output) and engine speed sensor (Magnetic pick-up unit) are connected to the ECU.
- h. The minimum oil pressure limit for the safe operation of engine is 2 bar, therefore ECU will shut down the engine if the engine oil pressure falls below 2 bars during running conditions.
- i. The maximum coolant temperature limit for the safe operation of engine is 219°F (104°C) therefore ECU will shut down the engine if the engine coolant temperature rises above 219°F (104°C) during running conditions.

SHUTTING DOWN THE ENGINE

1. Remove all the external load from the engine.
2. Run the engine without load for approximately 2 minutes before shutting down the engine. This will give the engine time to cool down.
3. Turn the key to the OFF position and remove it from the key switch.

For maximum engine life, when shutting the engine down, allow the engine to idle, without load, for two minutes. This will allow the engine components that operate at high temperatures, such as the turbocharger (if equipped) and exhaust system, to cool slightly before the engine is shut down.

PERIODIC MAINTENANCE

THE IMPORTANCE OF PERIODIC MAINTENANCE

Engine deterioration and wear occur in proportion to length of time the engine has been in service and the conditions the engine is subject to during operation. Periodic maintenance prevents unexpected downtime, reduces the number of accidents due to poor genset performance and helps extend the life of the engine.

PERFORMING PERIODIC MAINTENANCE

WARNING



EXHAUST HAZARD!

- **NEVER** operate the engine in an enclosed area such as a garage, tunnel, underground room, manhole or ship's hold without proper ventilation.
- **NEVER** block windows, vents, or other means of ventilation if the engine is operating in an enclosed area. All internal combustion engines create carbon monoxide gas during operation. Accumulation of this gas within an enclosure could cause illness or even death.
- **Make sure that all connections are tightened to specifications after repair is made to the exhaust system.**
- **Failure to comply could result in death or serious injury.**

NOTICE



ALWAYS be environmentally responsible.

Follow the guidelines of the EPA or other governmental agencies for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.

NEVER dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground, or into ground water or waterways.

Failure to follow these procedures may seriously harm the environment.

Perform periodic maintenance procedures in an open, level area away from obstacles and congested areas. If possible, perform the procedures indoors out of the elements to prevent environmental conditions, such as rain, wind, or snow, from damaging the machine.

THE IMPORTANCE OF DAILY CHECKS

Periodic maintenance schedules are based on the assumption that the daily checks are performed on a regular basis. If the engine is operated in extreme conditions or in harsh elements, the maintenance intervals should be performed more frequently.

REQUIRED EPA MAINTENANCE

To maintain optimum engine performance and compliance with the Environmental Protection Agency (EPA) Regulations Off-Road Engines, it is essential that you follow the Periodic Maintenance Chart and the procedures in this manual.

WARNING

SEVER HAZARD!



- Keep hands and other body parts away from moving/rotating parts such as the cooling fan, flywheel, or PTO shaft.
- Wear tight-fitting clothing and keep your hair short or tie it back while the engine is running.
- Remove all jewelry before you operate or service the machine.
- NEVER operate the engine without the guards in place.
- Before you start the engine make sure that all bystanders are clear of the area.
- Keep children and pets away while the engine is operating.
- Check before starting the engine that any tools or shop rags used during maintenance have been removed from the area.

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TIGHTENING FASTENERS

GENERAL TORQUE VALUES

Please Use the correct amount of torque when you tighten fasteners on the machine. Applying

TIGHTENING TORQUE					
SR NO	PARAMETERS	BOLT SIZE	INITIAL TORQUE	TIGHTENING TORQUE/ANGLE	TOTAL TORQUE/ANGLE
			Kg.m	-	-
1	Bolt for Main bearing cap	M12 X 1.5 X 100 mm long	3 kg.m	90°	90°
2	Bolt for Connecting rod	M9 X 1 X 51 mm long	3 kg.m	60°	60°
3	Bolt for cylinder head	M8 X 1 X 128mm long	2.5 kg.m	90°	90°
4	Bolt for crank pulley	M12 X 1.75 X 30 mm long	-	-	6 kg.m
5	Bolt for flywheel housing	M10 X 1.5 X 30 mm long	-	-	4.5 kg.m
6	Injector clamping bolt	M6 X 1 X 16mm long	-	-	14 Nm
7	Bolt for flywheel	M12x1.5x30 mm long	16 kg.m	-	16 kg.m
8	Alternator pulley nut	M14x1.5	6 kg.m	-	6 kg.m
9	High pressure pipe nuts	M12x1.5	2.5 kg.m	-	2.5 kg.m
10	Nut for Starter motor mounting	M8 X 1.25	2.5 kg.m	-	2.5kg.m
11	Exhaust manifold Hexagonal socket cap screw	M8 X 50 mm	4 kg.m	-	4 kg.m
12	Alternator support bracket bolt nut	M8 X 1.25 X 115mm long	2.5 kg.m	-	2.5 kg.m
13	FIP banjo bolt (Fuel supply pipe)	M12 X 1.5	2.5 kg.m	-	2.5 kg.m
14	Bolt for Sump mounting	M8 X 1.25 X 25mm	2.5 kg.m	-	2.5 kg.m
15	Bolt for Sump mounting	M8 X 1.25 X 28mm	2 kg.m	-	2 kg.m
16	FIP banjo bolt (leak off pipe)	M12 X 1.5	2.5 kg.m	-	2.5 kg.m
17	Oil filter adaptor	M16x 1.5	2.5 kg.m	-	2.5 kg.m
18	All M6x1mm Aluminum mounting	M6 X 1	1.1 kg.m	-	1.1 kg.m
19	All M6x1mm Casting mounting	M6 X 1	1.4 kg.m	-	1.4 kg.m
20	Nut for FIP Adaptor	M14 X 1.5	8 kg.m	-	8 kg.m
21	Bolt for Rocker Lever support	M8 X 1.25 X 60 (10.9 Grade)	3.5 kg.m	-	3.5 kg.m
22	Bolt for Rocker cover	M6 X 1	0.5 kg.m	-	0.5 kg.m
23	Tappet lever nut	M6 x 0.75	1 kg.m	-	1 kg.m
24	Coolant temperature sensor		1.5 kg.m		1.5 kg.m
25	Lub oil sensor		Hand tight (2 to 3 turns)		Hand tight (2 to 3 turns)
26	Breather plate	M5x 0.75	0.9 kg.m		0.9 kg.m
27	All M8 Nut Aluminum Mtg.	M8 X 1.25	2 kg.m	-	2 kg.m
28	All M8 Nut Casting Mtg.	M8 X 1.25	2.5 kg.m	-	2.5 kg.m

1 Nm = 0.102 Kgm = 0.74 lb. ft.

excessive torque may damage the fastener or component and inadequate torque may cause a leak or component failure.

EXHAUST SYSTEM TORQUE

FOR ENGINE MODEL 3R550NA1/2R550NA1

SR. NO.	EXHAUST SYSTEM FASTENER SIZE	TORQUE (Kgm)
1	M8	4

Torque Chart for ENGINE MODEL 3R550NA1/2R550NA1

1 Nm = 0.102 Kgm = 0.74 lb.ft.

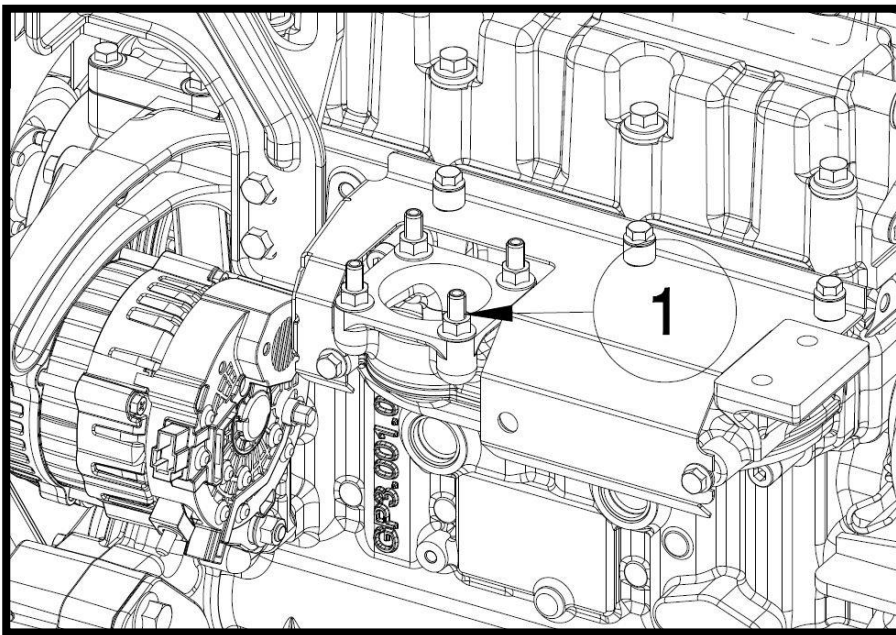


Fig 17- Component and location

1. Exhaust Manifold Studs 4 Kgm

CYLINDER HEAD TORQUE

FOR ENGINE MODEL 3R550NA1/2R550NA1

The cylinder head must be torqued in the proper sequence to prevent warping of the cylinder head.

Starting in the center of the head with the number 1 bolt, tighten all the bolts in sequence up to bolt number 10 for 2 cylinder & number 14 for 3 cylinder respectively. Refer to the torque chart for the correct torque value and the torquing increments

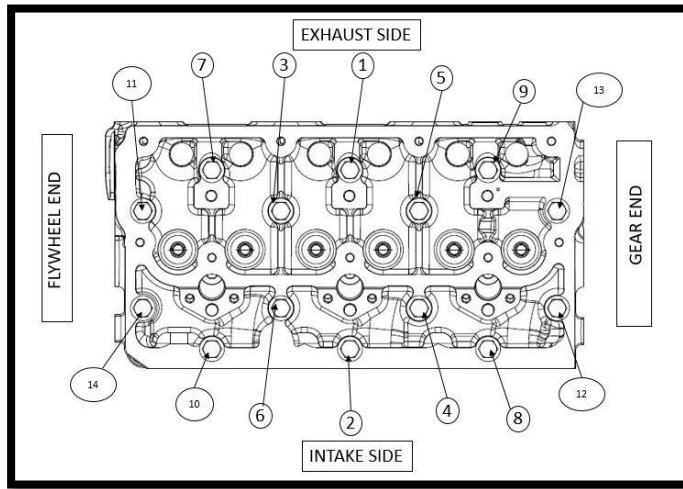
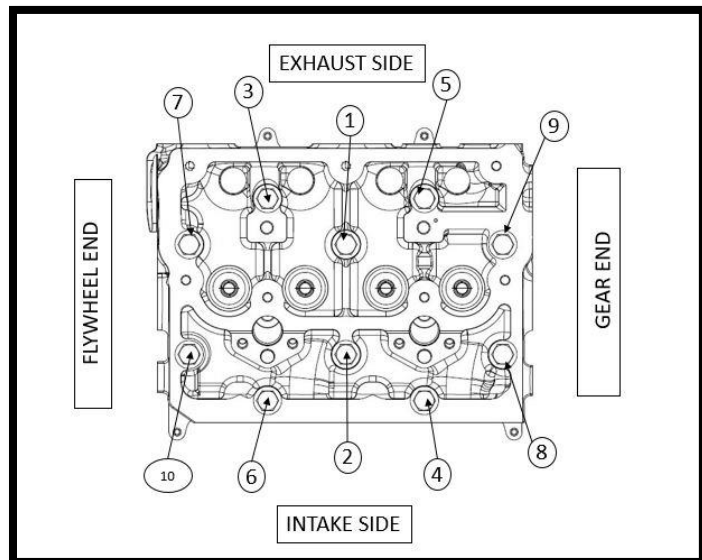


Fig18- 3R550NA1 Cylinder Head



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PERIODIC MAINTENANCE CHART

FOR ENGINE MODEL 3R550NA1/2R550NA1

Periodic maintenance intervals vary depending on engine application, loads, operating conditions, outside elements, fuel and engine oil used and are hard to establish definitively. The following should be treated only as a general guideline.

NOTICE

Establish a periodic maintenance plan according to the engine application and operating conditions and make sure the required periodic maintenance is performed at the intervals indicated in the chart. Failure to follow these guidelines will affect the engine's safety and performance characteristics, cause premature wear, shorten the engine's life, and may affect the warranty coverage on your engine.

Service Item	Activity	Maintenance Schedule				
		Frequency	Engine running hrs.			
		Daily	1 st 50 Hrs.	Every 250 Hrs. / 1Year* After 1 st 50 Hrs.	Every 500 Hrs. / 2 Year* After 1 st 50 Hrs.	Every 1500 Hrs.
Walk Around Inspection	--	✓				
Engine Air Cleaner Service Indicator	Inspect	✓				
Engine Oil Level	Check	✓				
Fuel System Water Separator	Drain	✓				
Hoses and clamps	Inspect	✓				
Fuel System Primary Filter	Replace		✓	✓		
Charging Alternator and Fan Belt	Check / Adjust		✓	✓		
Engine Lubricating Oil	Change		✓	✓		
Lubricating Oil Filter	Change		✓	✓		
Engine Air Cleaner Element	Replace		✓	✓		
Charging Alternator and Fan Belt	Check / Adjust				✓	
Engine Valve lash	Check / Adjust			✓		
Fasteners	Check / Adjust				✓	
Engine Mounts	Inspect				✓	
Starting Motor	Inspect				✓	
Charging Alternator	Inspect				✓	
Water Pump	Inspect				✓	
Thermostat Element	Check				✓	
Fuel Injector Tips	Clean					✓

* **Whichever occurs first**

MAINTENANCE LOG

HOUR	DATE	COMMENTS	PERFORMED BY
50			
250			
500			
750			
1000			
1250			
1500			
1750			
2000			
2250			
2500			
2750			
3000			

WALK AROUND INSPECTION

1. Check for any engine oil, fuel, or engine coolant leaks.
2. Check for loose, missing, or damaged fasteners.
3. Check for damaged or missing parts.
4. Check the air filter restriction indicator.
5. Check electrical harnesses for any cracked, loose or corroded wires.
6. Check the hoses for cracks, damage and loose or corroded clamps.
7. Check the water separator for any signs of water.

1. Electric Feed Pump
2. Fuel Filter & Water Separator.
3. Fuel Pump
4. Fuel Return Line Connection.

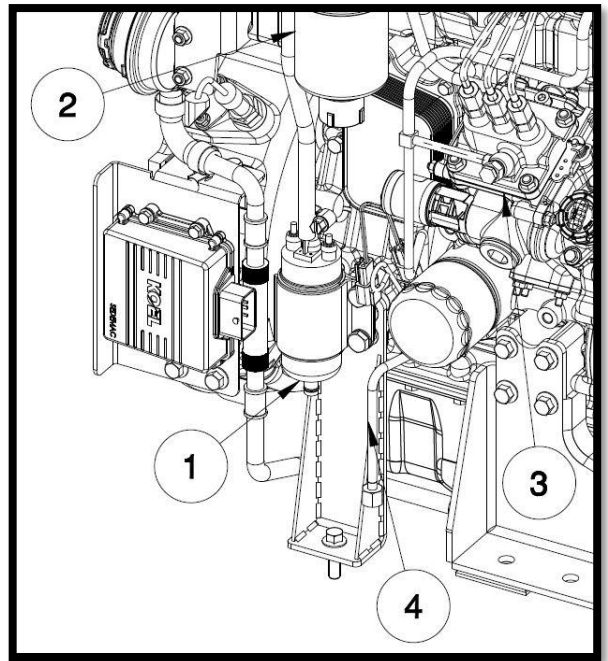


Fig 20- Component and location

CHECK ENGINE OIL LEVEL

See Checking Engine Oil on page 32.

DRAIN THE FUEL FILTER/WATER SEPARATOR

1. Make sure the engine is on a level surface.
2. Position an approved container under the fuel filter/water separator to collect the contaminants.
3. Open the drain plug by turning it counter clockwise and drain the sediment into the container.
4. When only clean diesel fuel is draining, close the drain plug.

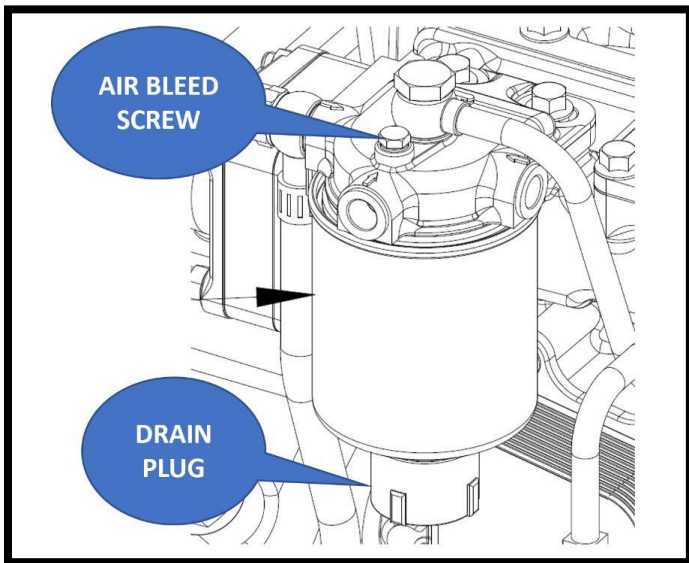


Fig21- Component and location

NOTICE

Use a suitable container to drain fuel into.
Always dispose of old fuel properly.

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HOSES AND CLAMPS

1. Inspect the hoses and clamps for the lubrication system, the fuel system, and the cooling system.
2. Inspect for any leaks, cuts, cracks, abrasions, or corrosion.
3. Make sure all clamps and fittings are tight and not corroded.

FUEL SYSTEM FUEL FILTER

Using a suitable container under the filter, turn the filter clockwise to remove.

2. Inspect all gaskets and O-rings and replace if necessary.
3. Install the filter by turning them counter clockwise until the rubber gasket touches the filter housing surface.
4. Tighten the filter an additional 1/2 to 3/4 turn using a filter wrench.
6. Dispose of any drained fuel properly.

NOTICE



ALWAYS be environmentally responsible.

Follow the guidelines of the EPA or other governmental agencies for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.

NEVER dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground, or into ground water or waterways.

Failure to follow these procedures may seriously harm the environment.

NOTICE



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Follow the guidelines of the EPA or other governmental agencies for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.

NEVER dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground, or into ground water or waterways.

Failure to follow these procedures may seriously harm the environment.

FUEL FILTER

FOR ENGINE MODEL 2R550NA1/3R550NA1

Filter Numbers here

CHECK/ADJUST ALTERNATOR/FAN BELT

1. Remove fan shroud if required to gain access to the belt.
2. Inspect the belt for any cracking or fraying.
3. Check the belt for proper tension.
4. If the belt needs to be tightened, loosen the alternator bracket bolts, and turn the adjustment bolt and nuts until the belt is properly tensioned.
5. Tighten the alternator bracket bolts.

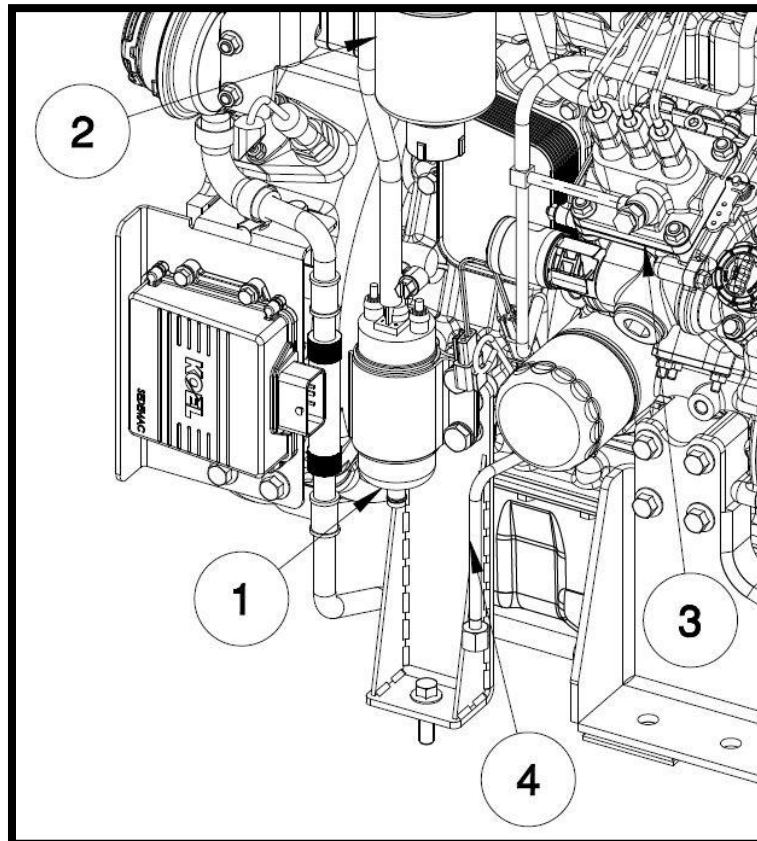
3R550NA1 and 2R550NA1		
The belt tension should be measured at 9.8 in. (186.9mm) between the water pump and the alternator	New Belt installation Tension	76 +- 5 lbf 340 +-20 N
	Frequency	174 Hz
	Service Limit - Minimum tension allowed	40 +- 5 lbf 180 +-20 N
	Frequency	126Hz
	Normal Operating Tension	58 +- 5 lbf 260 +- 20 N
	Frequency	152 Hz

FUEL FILTER

FOR ENGINE MODEL

3R550NA1/2R550NA1

- 5. Electric Feed Pump
- 6. Fuel Filter & Water Separator.
- 7. Fuel Pump
- 8. Fuel Return Line Connection.



CHECK/ADJUST ALTERNATOR/FAN BELT

6. Remove fan shroud if required to gain access to the belt.
7. Inspect the belt for any cracking or fraying.
8. Check the belt for proper tension.
9. If the belt needs to be tightened, loosen the alternator bracket bolts and turn the adjustment bolt and nuts until the belt is properly tensioned.
10. Tighten the alternator bracket bolts.

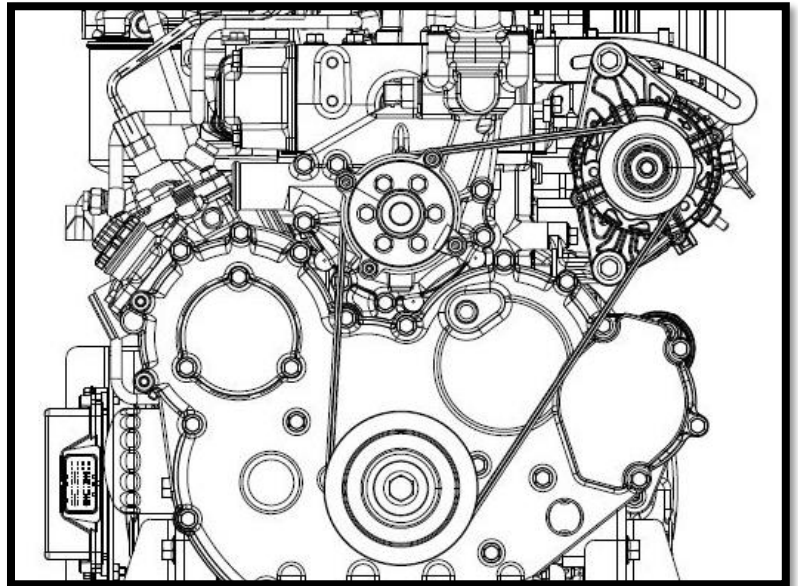


Fig23- Component and location

3R550NA1 and 2R550NA1		
The belt tension should be measured at 9.8 in. (186.9mm) between the water pump and the alternator	New Belt installation Tension	76 +- 5 lbf 340 +-20 N
	Frequency	174 Hz
	Service Limit - Minimum tension allowed	40 +- 5 lbf 180 +-20 N
	Frequency	126Hz
	Normal Operating Tension	58 +- 5 lbf 260 +- 20 N
	Frequency	152 Hz

CHANGE THE ENGINE OIL

1. Make sure the engine is on a flat, level surface.
2. Run the engine for several minutes to warm up the engine oil and then turn the engine off.
3. Position an approved container under the oil drain plug and the oil filter to collect the drain oil.
4. Remove the drain plug and turn the oil drain valve (if equipped) one-fourth turn to open the drain petcock. Allow the oil to fully drain.
5. Using a suitable filter wrench, turn the oil filter clockwise to remove the filter.
6. Dispose of drained oil and filter properly.
7. Apply a light film of clean engine oil to the rubber gasket on the filter.
8. Fill the new oil filter(s) with clean engine oil before installing onto the engine.
9. Tighten the filter by turning counter clockwise until the filter contacts the mounting surface. Tighten the filter an additional 1/2 to 3/4 turn using a filter wrench.
10. Shut the oil drain valve and install the oil drain plug.
11. Add engine oil to the correct level. and Checking Engine Oil.

NOTICE

Always fill the new oil filter with clean engine oil before installing on the engine. Never install the oil filter when empty. Installing an empty oil filter on the engine could allow contaminants to enter the new filter that might cause premature wear of engine components.

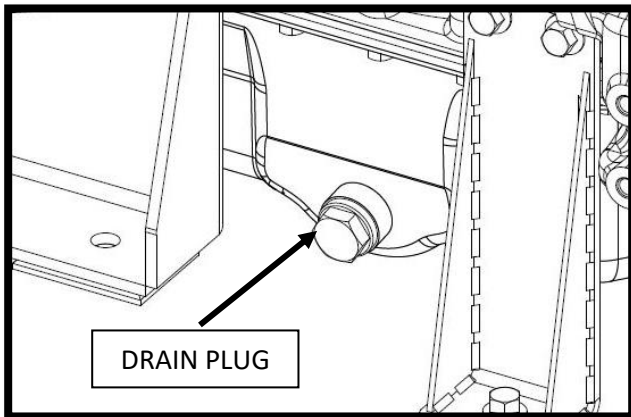


Fig 25- Component and location

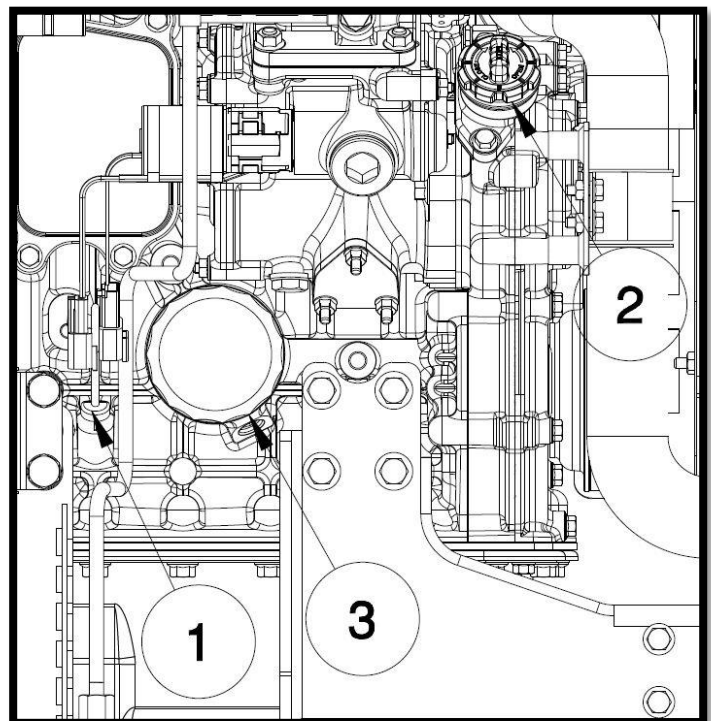


Fig 24- Component and location

1. Engine Oil Dipstick (Yellow)
2. Engine Oil Fill Cap
3. Oil Filter, (Yellow)

CHECKING/CHANGING AIR CLEANER ELEMENT

1. Check to make sure the air filter restriction indicator is in the green operating range.
2. Unlatch the air cleaner cover clips and remove the air cleaner cover.
3. Remove the element and inspect it for any rips or tears in the paper pleat or for a dirty filter.
4. Install filter element and install air cleaner cover.
5. Reset air filter restriction indicator if needed by pushing on the button on the indicator.

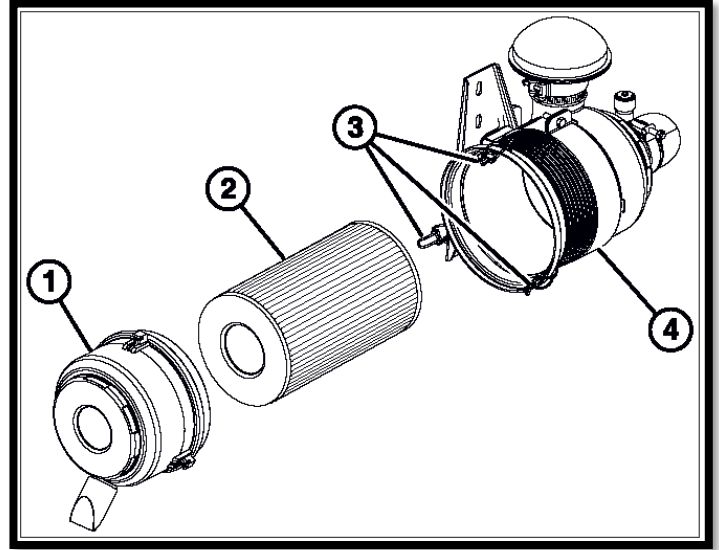


Fig 26- Component and location

INSPECT THE COOLING SYSTEM

1. Allow the engine to cool down if it has been recently run.
2. Make sure the engine is level.
3. Check the coolant level in the recovery tank and add coolant if required.
4. Inspect all hoses and clamps to make sure they are in good condition.
5. Remove the guards and screens and inspect the radiator fins. Clean any dust or dirt and debris from the radiator fins.
6. Straighten any bent fins.
7. Inspect the fan belt for any cracks or fraying.

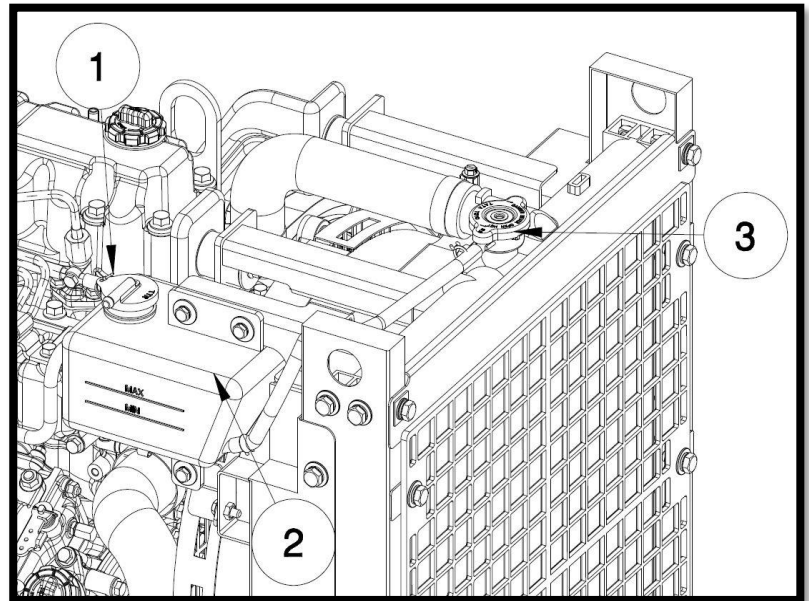


Fig 27- Component and location

1. Recovery Tank Cap
2. Recovery Tank
3. Radiator Cap

CHECK AND ADJUST VALVE CLEARANCE

The valve clearance is the gap (clearance) between the rocker arm toe and valve stem end. Engine performance and power output depend on its correct adjustment, which should be completed by a skilled, knowledgeable diesel engine mechanic.

1. Only check the valve clearance when the engine is cold, at ambient temperature.
2. Remove the rocker arm cover.
3. Rotate the crankshaft pulley clockwise until the pointer aligns with TDC mark on the crankshaft pulley.
4. Try to rotate push rods of No. 1 cylinder. If push rods are not loose, rotate flywheel one revolution (360°). If both push rods are loose, the piston for No. 1 cylinder is at TDC on compression stroke.
5. To check and adjust the valve clearance for No.1, loosen the jam nut one or two turns.

NOTE: "Top Dead Center" (TDC) is the piston at its highest point.

NOTE: No. 1 cylinder is the closest to the flywheel.

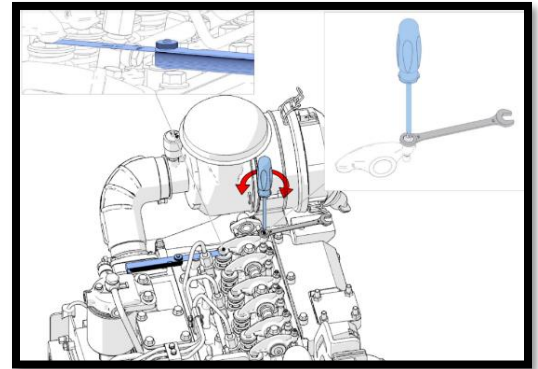


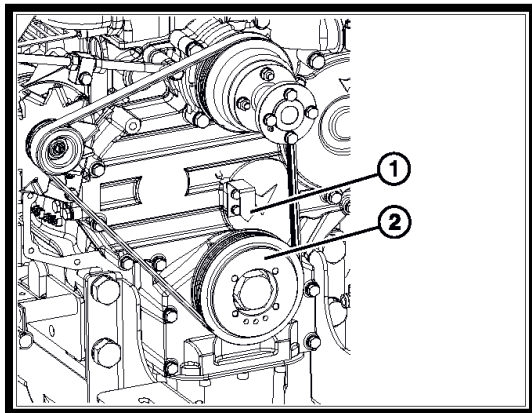
Fig 28- Component and location

6. Turn the adjusting screw for the intake valve so that when jam nut is retightened, the feeler gauge of 0.010 in. (0.25 mm) can be inserted and withdrawn with slight drag on feeler gauge.
7. Check and adjust the valve clearance of exhaust valve with 0.012 in. (0.3 mm) feeler gauge.

Specification

Valve – Intake

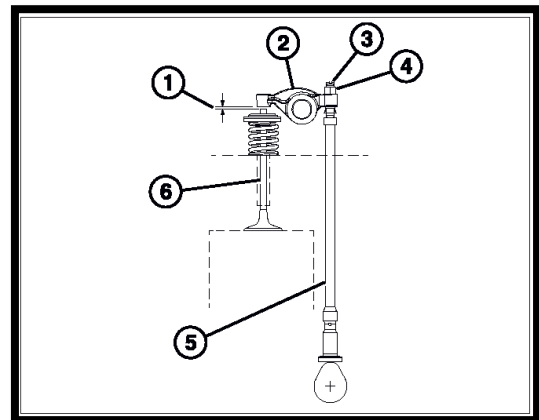
Clearance.....0.010 in. (0.2 mm)



Specification

Valve – Exhaust

Clearance.....0.012 in. (0.3 mm)



8. Rotate the crankshaft 180 degrees to get to the compression TDC of Cylinder No. 3. Confirm TDC as per step 4, and check and adjust the valve clearance on the intake and exhaust valves for No. 3.

9. Do not change the setting of oil metering screw (if applicable) unless required.
10. With a hot engine running at idling, oil flow to rocker at the push rod must be just noticeable. Excess oil flow can lead to higher oil consumption.

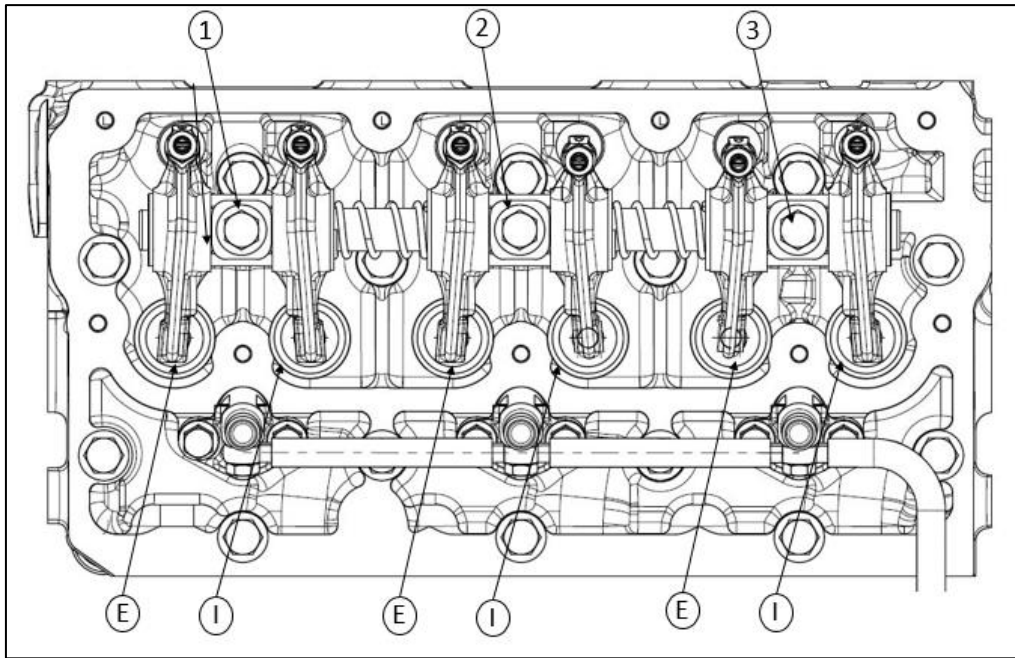


Fig 30- Component and location

1. Valves for No.1 Cylinder
2. Valves for No.2 Cylinder
3. Valves for No.3 Cylinder
- E. Exhaust Valve
- I. Intake Valve

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DRAIN CCV (CLOSED CRANKCASE VENTILATION) VALVE

1. Loosen both hose clamps on drain hose.
2. Remove drain hose and drain any accumulated oil into a suitable container. Dispose of oil properly.
3. Install the drain hose and tighten the two hose clamps.

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TROUBLESHOOTING

If a problem occurs during engine operation, stop the engine immediately. Refer to the SYMPTOM column in the Troubleshooting Chart to identify the problem.

TROUBLESHOOTING CHART

SYMPTOM	PROBABLE CAUSE	ACTION	REFER TO
INDICATOR TURNS ON - ENGINE RUNNING			
Engine oil pressure indicator	Low level of engine oil	Check and adjust oil level as necessary	<i>See Checking Engine Oil on page 32</i>
	Too high an oil level		
	Clogged engine oil filter	Replace engine oil filter	<i>See Change the Engine Oil on page 32</i>
Engine coolant indicator	Low engine coolant level	Add engine coolant	<i>See Checking the Cooling System on page 34</i>
	Dirty radiator fins	Clean the radiator fins	<i>See Checking the Coolant Level on page 34</i>
	Engine coolant leaking	See authorized cooling system KOEL engine dealer or distributor	-
	V-belt loose or damaged	Adjust V-belt or replace	<i>See Check/Adjust Alternator/ Fan Belt on page 57</i>
	Contaminated engine coolant	See authorized KOEL industrial engine dealer or distributor	-
	Faulty engine coolant pump		-
Battery indicator	V-belt loose or damaged	Adjust V-belt or replace	<i>See Check/Adjust Alternator/ Fan Belt on page 57</i>
	Battery failure	Check battery condition	-
	Faulty alternator	See authorized KOEL industrial engine dealer or distributor	-
INDICATOR DOES NOT TURN ON - KEY SWITCH IS TURNED TO ON (OFF → ON) - ENGINE NOT RUNNING			
Engine coolant indicator	Faulty electrical wiring or faulty indicator	See authorized KOEL industrial engine dealer or distributor	-

SYMPTOM	PROBABLE CAUSE	ACTION	REFER TO
INDICATOR DOES NOT TURN ON - KEY SWITCH IS TURNED TO ON (OFF→ON) - ENGINE NOT RUNNING			
Battery indicator stays ON	Faulty alternator	See authorized KOEL industrial engine dealer or distributor	-
Engine oil pressure indicator stays ON	Faulty engine oil pressure switch		-
	No or low level of engine oil	Check and adjust oil level as necessary	<i>See Checking Engine Oil on page 32</i>
	Clogged engine oil filter	Replace engine oil filter	<i>See Change the Engine Oil on page 33</i>
ENGINE DOES NOT START			
Starter motor operates but engine does not start	No diesel fuel	Refuel and prime fuel system	<i>See Filling the Fuel Tank on page 30.</i>
	Improper diesel fuel	Replace with recommended diesel fuel	<i>See Diesel Fuel on page 24</i>
	Clogged fuel filter	Replace fuel filter	-
	Poor fuel injection	See authorized KOEL industrial engine dealer or distributor	-
	Compressed air leakage from intake/exhaust valves		-
	Faulty engine stop solenoid/ Engine control unit		-
Starter motor does not operate or rotates too slowly (engine can be turned manually)	Battery needs charging	Check electrolyte, recharge	-
	Faulty cable connection at battery terminals	Clean terminals, retighten	-
	Faulty starter switch		-
	Faulty starter motor	See authorized KOEL industrial engine dealer or distributor	-
Engine cannot be manually turned	Inner parts seized or damaged		-
WHITE OR BLACK EXHAUST SMOKE			
Black exhaust smoke	Engine overloaded	Reduce load	-
	Clogged air cleaner element	Clean element or replace	<i>See Checking/Changing Air Cleaner Element on page 59</i>
	Improper diesel fuel	Replace with recommended diesel fuel	<i>See Diesel Fuel on page 24</i>
	Faulty spraying of fuel injection	See authorized KOEL industrial engine dealer or distributor	-
	Excessive intake/exhaust valve clearance		-

SYMPTOM	PROBABLE CAUSE	ACTION	REFER TO
White exhaust smoke	Improper diesel fuel	Replace with recommended	See Diesel Fuel on page 24
	Faulty spray pattern of fuel	See authorized KOEL industrial engine dealer or distributor	-
	Fuel injection timing delay		-
	Engine burning oil		-
Engine knocks	Low engine oil level	Add oil to engine crankcase	See Adding Engine Oil on page 33
	Low coolant temperature	Remove and check thermostat	-
	Engine overheating	Replace with recommended diesel fuel	-
	Engine cold	Incorrect or defective thermostat. Remove and check thermostat	-
High oil consumption	Improper type of oil	Drain, fill crankcase with oil of proper viscosity and quality	See Change the Engine Oil on page 33
	Crankcase oil too light	Use proper viscosity oil	-
	Oil leaks	Check for leaks in lines, gaskets, and drain plug	-
	Restricted crankcase vent tube	Clean vent tube	-
	Defective turbocharger	See your authorized servicing dealer or engine distributor	-
Engine overheats	Engine overloaded	Reduce load	-
	Low coolant level	Clean element or replace	See Inspect the Cooling System on page 59
	Faulty radiator cap	Replace with recommended diesel fuel	-
	Worn V-belt or defective belt tensioner	Check automatic belt tensioner and check belts for wear and cracking. Replace as required	See Check/Adjust Alternator/ Fan Belt on page 57.
	Low engine oil level	Check oil level. Add oil as required	See Adding Engine Oil on page 33
	Cooling system needs flushing	Flush cooling system	-
	Defective thermostat	Remove and check thermostat	-
	Defective temperature gauge	Check coolant temperature with thermometer and replace gauge, if necessary	-
	Incorrect grade of fuel	Use correct grade of fuel	See Diesel Fuel on page 24

SYMPTOM	PROBABLE CAUSE	ACTION	REFER TO
High fuel consumption	Improper type of fuel	Use proper type of fuel	<i>See Diesel Fuel on page 24</i>
	Clogged or dirty air cleaner	Service air cleaner	<i>See Checking/Changing Air Cleaner Element on page 59</i>
	Engine overloaded	Reduce load	-
	Incorrect valve clearance	See your authorized servicing dealer or engine distributor	-
	Injection nozzles dirty	See your authorized servicing dealer or engine distributor	-
	Electronic fuel system problem	See your authorized servicing dealer or engine distributor	-
	Defective turbocharger	See your authorized servicing dealer or engine distributor	-
	Low engine temperature	Check thermostat	-

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WARRANTY INFORMATION

For all Warranty-related information, including the Emissions Warranty, refer to the Warranty Documents

GENERATORJOE LIMITED WARRANTY RANGER GENERATOR SETS

GeneratorJoe or its supplier, that builds equipment for GeneratorJoe on an OEM basis warrants to the purchaser; each product of its sale or manufacturer is free from defects in materials and workmanship that its products will work properly when properly installed, serviced & operated under normal conditions and in accordance with the instruction manual.

This warranty shall be in effect on New Product for one (1) year or from the date the retail customer takes ownership or 180 days from the date the unit left the GeneratorJoe facility, whichever occurs first, and shall cover product built exclusively by GeneratorJoe and also applies to only parts installed on our product for that product at the time of the sale. Otherwise, the standard new parts warranty is ninety (90) days from date of sale. The GeneratorJoe must be notified within five (5) business days, in writing, of any product failure.

GeneratorJoe liability shall be limited to the cost of repairing or replacing such defective or failed part(s), based on vendor warranty only, provided the cost of such repair does not exceed the original unit cost of the part. Within the continental United States GeneratorJoe shall pay reasonable labor rates for repairs and for replacement parts within the warranty period. Outside of the Continental United States GeneratorJoe shall pay for replacement parts only within the warranty period. GeneratorJoe will not assume any expense or liability for repairs made outside its facility without prior written consent. Warranty coverage for removal and replacement of an engine is that which the OE engine manufacturer dictates; the customer will be responsible for additional labor for difficulty of access to, removal of or installation of said engine. Use of replacement parts not supplied or specified by GeneratorJoe will invalidate the limited warranty. Limits of mileage, travel time & labor exist and are applicable to vendor warranty coverage. Shipping costs will not be reimbursed. There is no coverage for airfare for any type of warranty repair or replacement services.

GeneratorJoe warranty does not cover troubleshooting expense, customer down time, labor charges associated with general service calls, i.e., disassembly, reassembly, transportation to or from a service facility or job site, malfunctions resulting from improper installation or alignment, lack of performance made in connection with normal maintenance services or the replacement of normal maintenance items, or stress caused by add-on components unknown to us.

GeneratorJoe will reimburse or credit the Distributor/Dealer for the repair or replacement under this warranty for any part found to be defective or the cause of a malfunction. Such reimbursement or credit will be based on current distributor/dealer cost of the parts. Warranty labor will be paid 100% up to \$50.00 per hour; anything over \$50.00 per hour will be paid at 50% of the Distributor/Dealer's published Customer Labor Rate that's on file with GeneratorJoe.

This warranty shall not apply to any product or parts which have been damaged or rendered defective by misuse, negligence, mechanic or installer error, Act of God, or accident outside of GeneratorJoe facility. Abuse by the customer or damage to the product by outside forces or war damage are explicitly not covered by the factory warranty under any circumstances.

Electrolysis is not covered by any warranty.

GeneratorJoe shall not be liable for consequential and incidental damages, loss or expense, directly or indirectly, from the use of its product or parts or any other cause. We disclaim any warranty of merchantability or fitness for a particular purpose.

The above warranty supersedes and is in lieu of all other warranties, expressed or implied, and of all other liabilities or obligations on the part of GeneratorJoe. No person, agent or dealer is authorized to give any warranties on the behalf of GeneratorJoe, nor is to assume for this GeneratorJoe any other liability in connection with any of its products unless made in writing and signed by an officer of GeneratorJoe.

GeneratorJoe shall be the warranty administrator and final and sole decision maker on all warranty issues on your purchase.

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