

User and maintenance manual for generating sets



Translation of the original instructions

R220C3

33504017001NE_2_1

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1. Preface

1.1. General recommendations

The information contained in this manual is taken from technical data available at the time of print. In line with our policy of continually improving the quality of our products, this information may be amended without warning.

Read the safety instructions attentively in order to prevent any accident, incident or damage. These instructions must be adhered to constantly.

In order to obtain optimum efficiency and the longest possible service life for the generating sets, maintenance operations must be carried out according to the periods indicated in the attached maintenance tables. If the generating set is used under dusty or unfavourable conditions, some of these periods will be shorter.

Ensure that all adjustments and repairs are carried out by personnel who have received appropriate training. Our agents possess this qualification, and can answer all of your questions. They can also supply you with spare parts and other services and they have qualified staff to carry out preventive and corrective maintenance or even total reconditioning of generating sets.

The left and right sides can be seen from the back of the generating set (the radiator is at the front).


Note: some user and maintenance manuals for engines fitted to generating sets cover control units and include the start-up and shut down procedures for the engines.


As our generating sets are fitted with control units that are specific to the generating sets; only the information that appears in the documentation for the generating set control units should be taken into consideration.

In addition, depending on the manufacturing criteria of the generating sets, some engines may be fitted with specific electrical wiring different to that described in the engine documentation.

1.2. Warnings

In this manual, the warning messages are used as follows:

	<p>Immediate danger.</p> <p>Indicates an imminent danger which may result in death or serious injury. Failure to follow the instruction shown may pose serious risks to the health and life of those concerned.</p>
DANGER	

	<p>Potential danger.</p> <p>Indicates a dangerous situation if the warning is not heeded. Failure to follow the instruction indicated may cause minor injuries to those concerned or damage to equipment.</p>
IMPORTANT	

1.3. Pictograms and their meanings

The aim of the pictograms is as follows:

- To draw the attention of the operator or maintenance technician to the potential dangers.
- To explain how to act in the interest of personal safety and to avoid damaging the equipment.

The safety pictograms present on the equipment are explained below.










	Warning: danger		Important, Electrical risk		Important, risk of explosion
	Important, toxic materials		Important, rotating or moving parts		Important, pressurised fluids
	Important, high temperature		Important, corrosive product		Danger: automatic start-up

Figure 1 : Warning pictograms



	Entry prohibited to unauthorised persons		Jet prohibited washing
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Figure 2 : Pictograms indicating prohibited activities








	Reading manual for the equipment is compulsory		Wearing suitable protective clothing is compulsory		Wearing suitable protective goggles and ear defenders is compulsory
	Lifting point required		Forklift required for lifting		Battery charge must be checked
	Periodic maintenance compulsory				

Figure 3 : Pictograms indicating compulsory operations


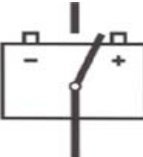









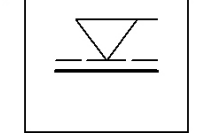

	Earth		Battery switch isolating		External connections fuel
	Diesel fuel		Drain the fuel		Inspection flap
	Fill the coolant		Drain the coolant		Mains supply connection prohibited before filling with water
	Fill the oil		Drain the oil		
	Retention container high level		Drain the retention container		

Figure 4 : Information pictograms



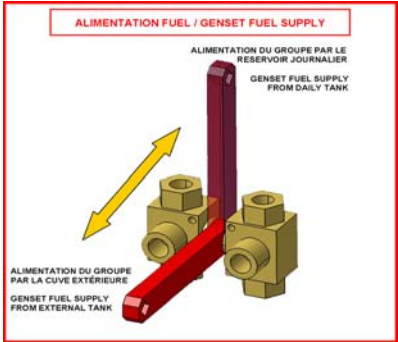
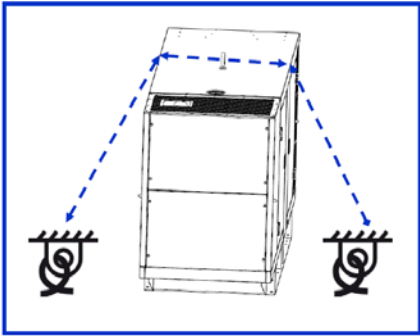
 <p>Flammable product, Do not smoke or create sparks or flames</p>	 <p>Reading the manual for the equipment is compulsory</p>
 <p>Fuel supply - Selection valve -</p>	 <p>Securing straps routing point</p>

Figure 5 : Specific pictograms



 <p>Wearing suitable protective clothing and goggles is compulsory</p>	 <p>Rinse any splashes of acid on the skin or in the eyes using clean water. Consult a doctor immediately. Wash contaminated clothing with water.</p>
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Figure 6 : Pictograms relating to battery operations

1.4. Safety instructions

RETAIN THIS MANUAL

This manual contains important instructions which must be followed when installing or carrying out maintenance on a generating set and batteries.

IMPORTANT - SAFETY ADVICE

If any parts of this manual are not understood, or in case of doubt, contact your nearest agent in order to receive an explanation or demonstration to allow the equipment to be used correctly. The guidelines listed below must always be respected to ensure the safety of personnel and equipment. In addition to this information, it is essential to refer to the local and national regulations applicable according to the jurisdiction.

1.4.1 General guidelines

Installing the equipment

The installer of the equipment must create a document describing any modifications made to the equipment during installation.

Using the equipment

- Before starting any operations on the equipment:
 - Nominate an operations manager.
 - The role of the operations manager is to monitor, either directly or indirectly, any operations performed on the equipment and to ensure that the safety and operating instructions are respected.
 - The operations manager should read and understand all the documentation supplied with the equipment.

- Information for personnel:
 - Regularly reiterate the safety and operating instructions to the operating personnel.
 - Contact your dealer if you have any questions regarding the equipment and any training requests for personnel.
 - Make the manufacturer's instructions available to the users (if possible on site).

- Protection for individuals and equipment:
 - Wear suitable clothing.
 - Move away from equipment in operation.
 - Ensure that persons who are not authorised to intervene as well as animals are kept away from the equipment. Observe this guideline regardless of whether the equipment is in operation or stopped.
 - Protect the equipment from any fluid splashes and bad weather.
 - Before starting the equipment, refit the enclosures and close all the access doors.
 - Before starting the engine, check that the air filter is present and the correct extraction circuit for the exhaust gas.
 - Respect the current regulations relating to fuel use.
 - Under no circumstances use seawater or any other corrosive or electrolytic product in the cooling circuit.
 - Adjust the equipment according to the manufacturer's prescriptions.
 - Check that the equipment operates correctly.
 - Engage the parking brake when the equipment is installed on the operating site on its trailer. When chocking the trailer on a slope, ensure that there is nobody in the path of the trailer.

Maintaining the equipment

- Personnel skills:
 - Ensure that the maintenance operations are performed on the equipment by appropriately trained personnel.

- Personnel protection:
 - Wear suitable clothing and protective goggles.
 - Remove any personal belongings that may hinder the operation: watch, bracelet, etc.
 - Fit a panel over the controls of the equipment to prevent any attempt to start.
 - Disconnect the battery (and pneumatic starter if fitted) before beginning any maintenance operation.
 - Handle the equipment according to best practices, using techniques which do not endanger the personnel.
 - It is essential to wear gloves when detecting leaks.
 - Regularly check that the safety devices are operating correctly.

- Equipment protection:
 - Use tools in good condition and suited to the work to be done. Ensure you have understood the instructions before beginning any operation.
 - Respect the maintenance table and its recommendations. In dusty or unfavourable conditions, certain maintenance intervals will need to be reduced.
 - Check that the spare parts fitted on the equipment are supplied only by the dealer.
 - Handle the equipment according to best practices, using techniques which do not risk damaging the equipment.
 - Replace any safety pictograms that are missing or illegible on the equipment.

Note: the mounting bolts on the protective devices of the rotating parts are captive bolts equipped with retaining washers. Also, in order to ensure the integrity of this assembly, it is prohibited to use electric or pneumatic screwdrivers to undo these mounting bolts.

- Cleaning the equipment:
 - Clean off any trace of oil, fuel or coolant using a clean cloth.
 - Use only approved cleaning solvents.
 - Cleaning products and methods that are strictly prohibited:
 - petrol or other flammable substances;
 - soapy solution containing chlorine or ammonia;
 - high pressure cleaner.

- Additional instruction:
 - If necessary, contact the dealer for the following reasons:
 - answers to any questions relating to the equipment;
 - training requests for personnel;
 - supplying the relevant documentation for maintenance operations;
 - supplying spare parts;
 - corrective or preventive maintenance operations.

Operating site

- Maintenance:
 - Clean the entire operating site regularly with suitable cleaning materials.
 - The presence of dangerous or combustible materials inside premises must be limited to the operating requirements.

- Access:
 - Prohibit free access to persons who are not part of the establishment, except for those designated by the user.

- Respecting the environment:
 - Drain and dispose of engine oil in a specially provided container (fuel distributors can collect your used oil).
 - Burning of waste in the open air is prohibited.
 - Remove waste water, sludge and other waste in a specialised processing centre.

1.4.2 Electrical safety precautions

	<p>ELECTRICAL EQUIPMENT - RISK OF ELECTRIC SHOCKS</p>	
<p>DANGER</p>		

- Read the manufacturer's identification plate carefully. The values for voltage, power, current and frequency are shown. Check that these values match the installation being supplied.
- The electrical connections must be made in accordance with current standards and regulations in the country of use and the neutral system sold.
- Ask a qualified electrician to intervene when there are specific cases requiring equipment to be connected to an existing electrical network.
- Disconnect the power to the equipment (equipment voltage, battery voltage and network voltage) before any installation or maintenance operation is performed.
- Connect the equipment wires by respecting the wiring diagram supplied by the manufacturer.
- Always handle the equipment with dry hands and feet.
- Take all the necessary precautions to avoid touching stripped cables or disconnected connectors.
- Use and maintain the cables in good condition, well insulated and connected correctly and securely.
- Only replace equipment that provides protection against electric shock with identical equipment (specifications and nominal values).
- Only use flexible durable cables with a rubber covering, which conform to ECI 245-4, or equivalent cables.
- Refit the protective plates (blanking covers) after each maintenance operation.

Note: The electrical equipment supplied with the equipment complies with standard NF C15.100 (France), or with the standards of the countries in question.






1.4.3 Safety precautions in case of electrical shock

In the event of an electric shock, observe the following instructions:


1. Avoid direct contact both with the live conductor and the victim's body.
2. Shut off the power immediately and activate the emergency stop for the equipment concerned. *Note: the live wire may be cut with an axe. Take extreme care to avoid the electric arc that will be generated by this.*
3. If it is impossible to access the equipment: move the victim away from the live conductor using a dry piece of wood, dry clothing or other non-conducting material.
4. Move the victim away from any situations where there is a danger of death.
5. Contact the emergency services.
6. If breathing has stopped, begin artificial respiration at once.
7. In the event of cardiac arrest, carry out cardiac massage.



1.4.4 Safety precautions relating to fire, burns and explosions

 DANGER		
 	FUELS / FLAMMABLE PRODUCTS / PRESSURISED FLUID - RISK OF BURNS - - RISK OF FIRE - - RISK OF EXPLOSION -	 

1. Before starting the equipment, move any flammable or explosive products away (petrol, oil, cloth, etc.).
2. It is prohibited to put combustible materials on the hot parts of the equipment (for example: exhaust pipe).
3. Avoid any contact with the hot parts of the equipment (for example: exhaust pipe).
4. Use appropriate ventilation to allow the equipment to cool correctly.
5. Wait for the engine to stop and cool down completely before removing the radiator cap.
6. Wait for the equipment to stop and cool down completely before covering the equipment (if necessary).
7. Depressurise the air, oil and cooling circuits before removing or disconnecting all the fittings, pipes or connected components.
8. Ensure that the equipment in operation is fixed (in a stationary position).

	<p>When installing the equipment on a vehicle or other mobile equipment, a study must be conducted beforehand in order to take into account the various specific uses of the generating set.</p>
IMPORTANT	

Fuels

- Respect current local regulations regarding the equipment and fuel used (petrol, diesel and gas).
- Top up the engine with fuel when the engine has stopped (except for equipment with an automatic filling system).
- Smoking, using a flame or producing sparks are forbidden while the fuel tank is being filled.
- Use protection suitable against fires and explosions.
- Pipes must be replaced as soon as their condition demands it.

**Oils**

1. Check that the system is no longer pressurised before carrying out any procedures.
2. Avoid contact with hot oil.
3. Wait for the engine to stop and cool down completely before topping up the oil.
4. Before starting the engine, refit the oil filler cap.
5. It is prohibited to cover the generating set with a fine layer of oil for anti-rust protection.



Battery

- Smoking, using a flame or producing sparks are forbidden close to batteries (particularly when the batteries are being charged).

Supply gas (concerns generating sets running on gas)

- Request the user technical notes and LPG or NG safety data sheets from your gas supplier.
- For any operation on a gas installation, ask a recognised specialist to intervene.
- Gas supply procedures must be carried out in the open air (outside) in accordance with local regulations, in an area well away from fires, people or animals.
- Check the sealing of the gas supply circuit using soapy water with the circuit pressurised, or using a leak detector.
- It is forbidden to smoke, bring flames near or create sparks when the tank is being filled, and near to the generating set.

1.4.5 Toxic risk safety precautions

 DANGER		
	EXHAUST GAS - TOXIC PRODUCTS - TOXIC RISK -	

Exhaust gas

- Use suitable ventilation to release the exhaust gas outside and prevent it from accumulating.
- Respect current local regulations regarding the equipment and fuel used (petrol, diesel and gas).
- Periodically examine the burnt gas exhaust.
- Pipes must be replaced as soon as their condition demands it.



Note: the carbon monoxide present in the exhaust gas may lead to death by inhalation if the concentration levels in the atmosphere are too high.

Corrosion inhibitor in the coolant (contains alkali)

- Read the instructions on the packaging.
- Keep the product out of the reach of children.
- Do not swallow it.
- Avoid prolonged or repeated contact with the skin.
- Never allow contact with the eyes.

In the event of contact with the eyes:

1. Rinse immediately with plenty of water for at least 15 minutes.
2. Consult a doctor immediately.

In the event of contact with the skin:

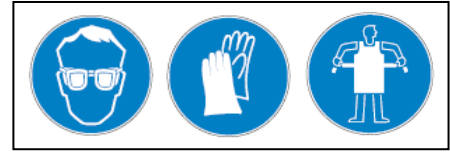
1. Wash thoroughly with water and soap.
2. Consult a doctor immediately.

Fuels and oils

- Do not swallow it.
- Ensure proper ventilation.
- Use a suitable protective mask.

Battery electrolyte




- Avoid all contact with the skin and eyes.
- Wear suitable protective goggles and clothing and strong alkali-resistant gloves for handling the electrolyte .



If splashes get into the eyes:

1. Rinse immediately with running water and/or a 10% diluted boric acid solution.
2. Consult a doctor immediately.



1.4.6 Precautions for risks relating to handling phases

 DANGER		
	HANDLING PHASES - RISK OF DROPPING	

1. Select the appropriate handling equipment and apparatus according to the type of equipment being handled. Check that there is sufficient handling capacity.
2. Check that the handling equipment and apparatus are in good operating condition.
3. Respect the handling instructions described in the present documentation and the pictograms displayed on the equipment to be handled.
4. Be sure never to stand under the load being handled.

Note: the lifting rings provided on the equipment are designed to handle the generating set alone. If additional equipment is fitted to the generating set, a study should be conducted in order to define the centre of gravity of the assembly and to check the correct mechanical performance of the structure and its lifting rings.

1.4.7 Precautions for risks relating to noise

	HIGH SOUND LEVEL - RISK OF HEARING LOSS	
DANGER		

- Always use suitable ear defenders when working in close proximity to a generating set which is in operation.

Note: for generating sets used inside, for which the ambient noise levels are dependent upon the installation conditions, it is not possible to specify these ambient noise levels in the operating instructions. As prolonged exposure to high sound pressure levels can cause permanent damage to hearing, it is necessary to measure the acoustics after installation in order to determine the sound pressure level and, if necessary, to implement the appropriate preventive measures.

2. General description

2.1. Description

Overview

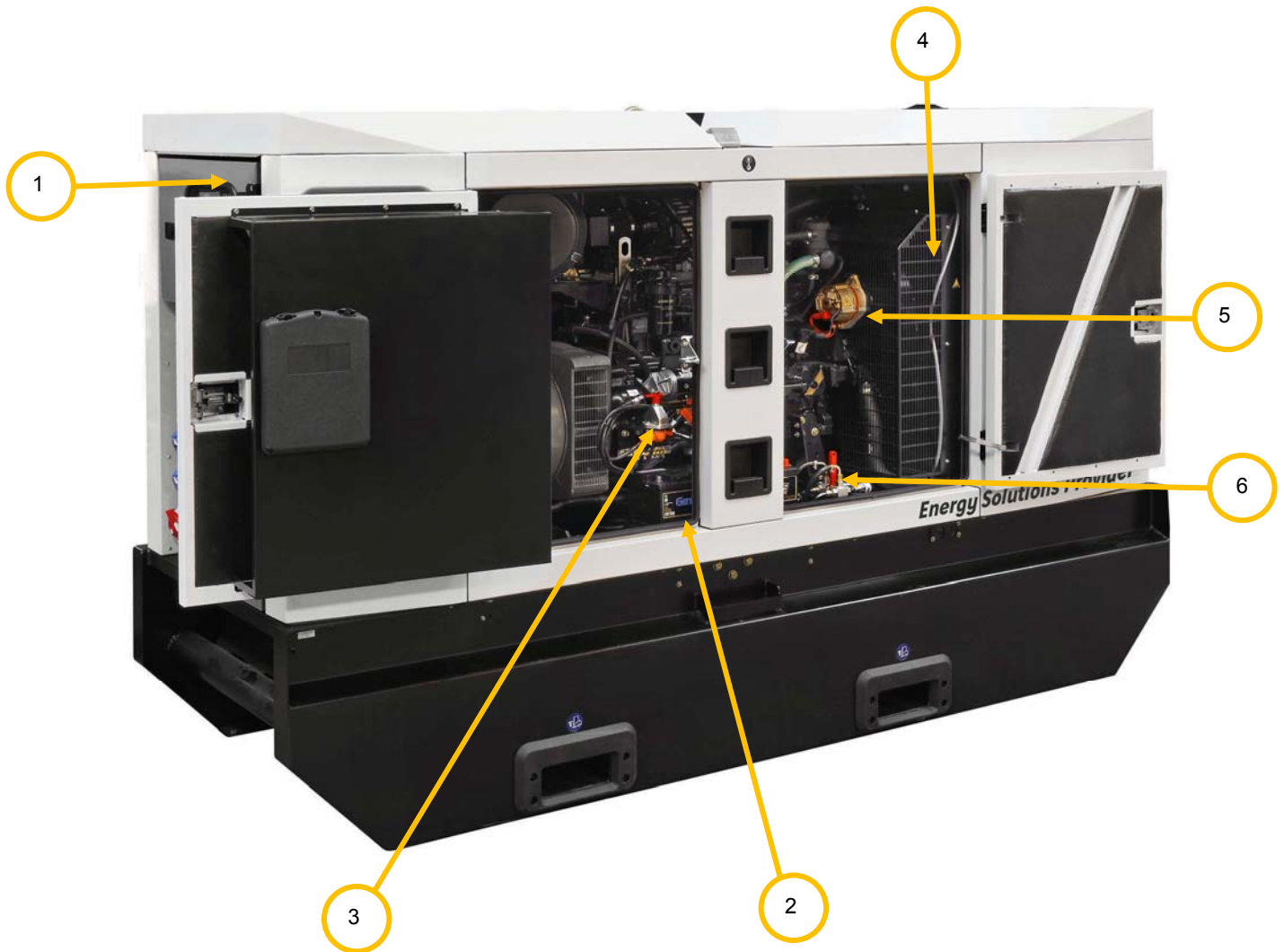


Figure 7 : General description of the generating set

1	Control unit	4	Protective grille
2	Starter battery	5	Charging alternator
3	Battery isolating switch	6	External fuel supply combined tap (optional)

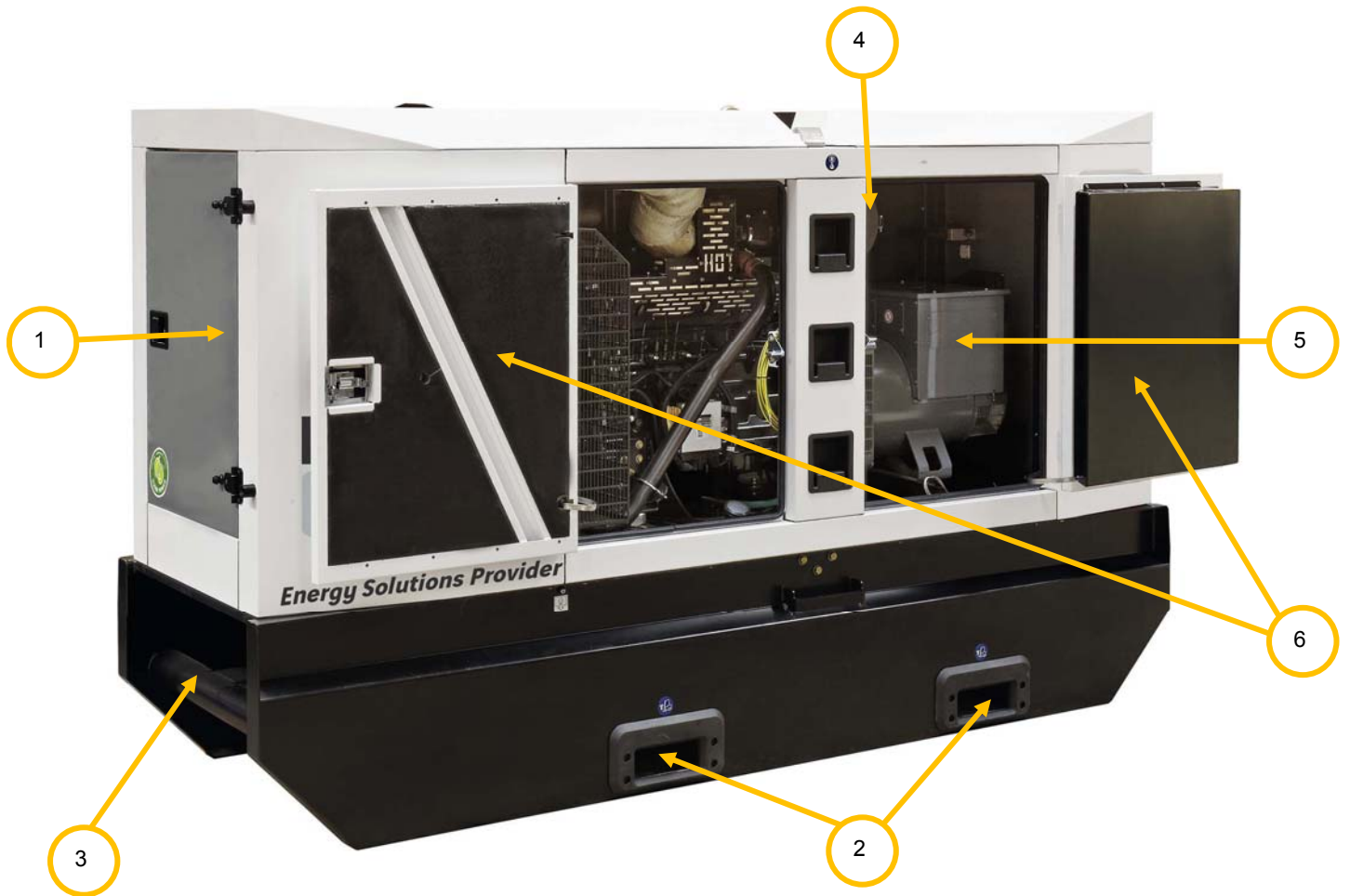


Figure 8 : General description of the generating set

1	Radiator access hatch	4	Air filtration
2	Forklift grooves	5	Alternator
3	Drawbar	6	Access to maintenance area



Figure 9 : General description of the generating set (control)

1	Control unit	4	Working hours counter
2	Emergency stop	5	Power circuit breaker
3	Socket control panel	6	Connection terminal block

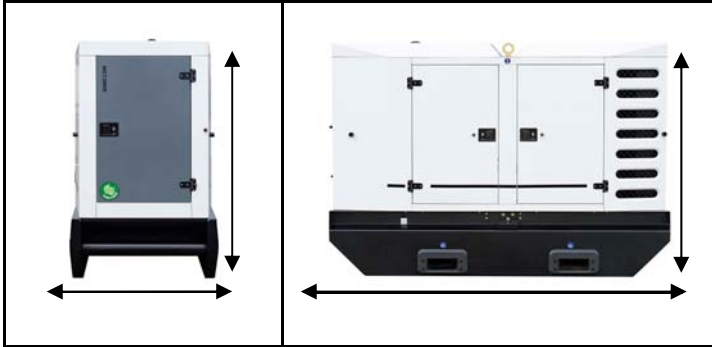
Note: Photo presented with the Nexys control unit.

2.2. Technical specifications

Range / Generating set type	RENTAL POWER / R220C3
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Weights and Dimensions

Dimensions with high autonomy tank



Dimensions l x w x h:
3520 mm x 1190 mm x 2120 mm

Weight:
2810 kg dry weight / 3610 kg in operating configuration

Hood:
M3226

Sound pressure level (LpA) at 1 m : 78 dB(A)
Measurement uncertainty : 0.70

Output

Voltage	Hz	Phase	Load factor	Max current (A)	Emergency power ¹ kW / kVA	Prime power ² kW / kVA
400/230	50	3	0.8	318	176 / 220	160 / 200

(1) ESP: Stand-by output available for emergency use under variable charge up to 200hrs per year as per ISO 8528-1, no overload available under these service conditions.

(2) PRP: Main output available continuously under variable load for an unlimited time period per year as per ISO 8528-1, an overload of 10% one hour every 12 hours is available, as per ISO 3046-1.

- Term of use :

Standard reference conditions ESP/PRP 40° / 40°, Air Intlet Temp, 1000m / 1000m mA.S.L. 60 % relative humidity.

Engine data	
Manufacturer / model	JOHN DEERE 6068HFS86
Type	Turbo
Cylinder configuration	6 X L
Cubic capacity	6.72 L
Rotation speed	1500 Rpm
Max emergency/prime power at nominal speed	202 / 184 kW
Adjustment type	Electronical



Fuel consumption	
110 % (emergency power)	48.60 L/h
100 % main power	46.00 L/h
75 % main power	37.60 L/h
50 % main power	26.10 L/h

Fuel	
Fuel type	Diesel
High autonomy fuel tank	860 L

Lubrication	
Oil capacity	32.00 L
Min. Oil pressure	1.05 bar
Nominal oil pressure	3.75 bar
Oil consumption (100 % load)	0.12 L/h
Type of lubricant	Genlub

Cooling	
Refrigerant type	Gencool
Radiator and engine capacity	27.60 L
Thermostat	82-95 °C
Max Water temperature	110°C

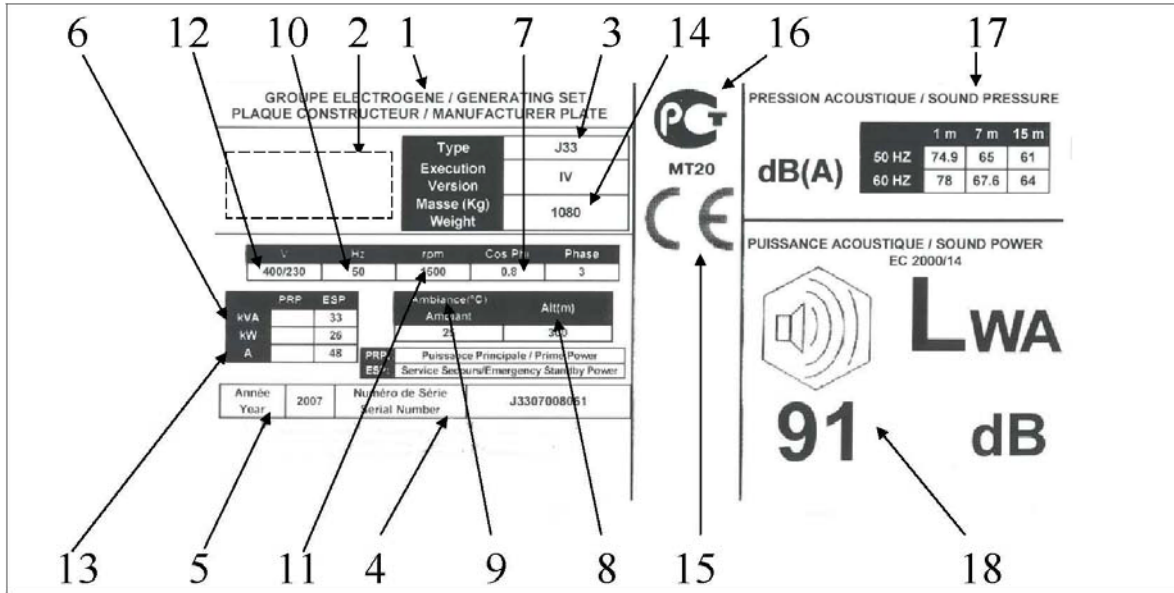
Alternator data	
<ul style="list-style-type: none"> Compliant with NEMA MG21 standards, UTE NF C51 111, VDE 0530, BS 4999, IEC 34.1, CSA 	<ul style="list-style-type: none"> The alternator is protected against short circuits Vacuum impregnation, epoxy winding, IP23 protection rating
Type	LEROY SOMER LSA46.2 M5
Number of phases	3
Power factor (cos Phi)	0.8
Number of poles	4
Excitation type	AREP
Insulation classe	H
Number of bearings	1
Coupling	Direct

Control unit(s)	
<p>NEXYS</p>  <p>The NEXYS control unit is a blue and black rectangular device. It features a central digital display showing '1503', '136', and '48'. To the left of the display is a large red emergency stop button. Below the display are several indicator lights and two buttons labeled 'STOP' (red) and 'START' (green). The brand name 'MICS NEXYS' is printed at the top.</p>	<p><u>Standard specifications:</u> Frequency meter, Voltmeter, Ammeter</p> <p><u>Alarms and faults:</u> Oil pressure, Coolant temperature, Fail to start, Overspeed, Alternator min/max, Fuel level low, Emergency shutdown</p> <p><u>Engine parameters:</u> Working hours counter, Engine speed, Battery voltage, Fuel Level, Air Preheating</p>
<p>TELYS</p>  <p>The TELYS control unit is a black rectangular device. It features a large green monochrome display. To the left is a large red emergency stop button. To the right of the display are several buttons, including a red 'STOP' button and a 'MENU' button. The brand name 'MICS T.E.L.Y.S' is printed on the right side.</p>	<p><u>Standard specifications:</u> Voltmeter, Ammeter, Frequency meter</p> <p><u>Alarms and faults:</u> Oil pressure, Water temperature, Start failure, Overspeed, Alternator min/max, Battery voltage min/max, Emergency stop</p> <p><u>Engine parameters:</u> Timer, Oil pressure, Water temperature, Fuel level, Engine speed, Battery voltage</p>

2.3. Identifying sets

Generating sets and their components are identified by means of identification plates.

The precise rules for identifying each major component (engine, alternator, etc.) are set out in each manufacturer's documentation contained in the appendices of this manual.



1 - Generating set	9 - Maximum ambient temperature for the rated power (°C)
2 - Manufacturer name	10 - Rated frequency (Hz)
3 - Model	11 - Generating set rotation speed (RPM)
4 - Serial number	12- Rated voltage (V)
5 - Year of manufacture	13 - Rated current (A)
6 - Rated output (kVA and kW) according to the ISO 8528-1 standard	14 - Weight (kg)
PRP: main power	15 - CE marking
ESP: emergency power	16 - Non CE standard marking (e.g.: GOSSTANDART)
7 - Rated power factor	17 - Sound pressure
8 - Maximum altitude of the site above sea level (m) for the rated power	18 - Sound power

Figure 10 : Example of a generating set identification plate

2.4. Fluid retention

Any outflow of the fluids contained in the generating sets (fuel, oil and coolant, or rainwater or condensation) will be collected in a retention container.

The containers have a capacity which allows 110% of the fluids contained in the generating set fitted with this option to be collected.

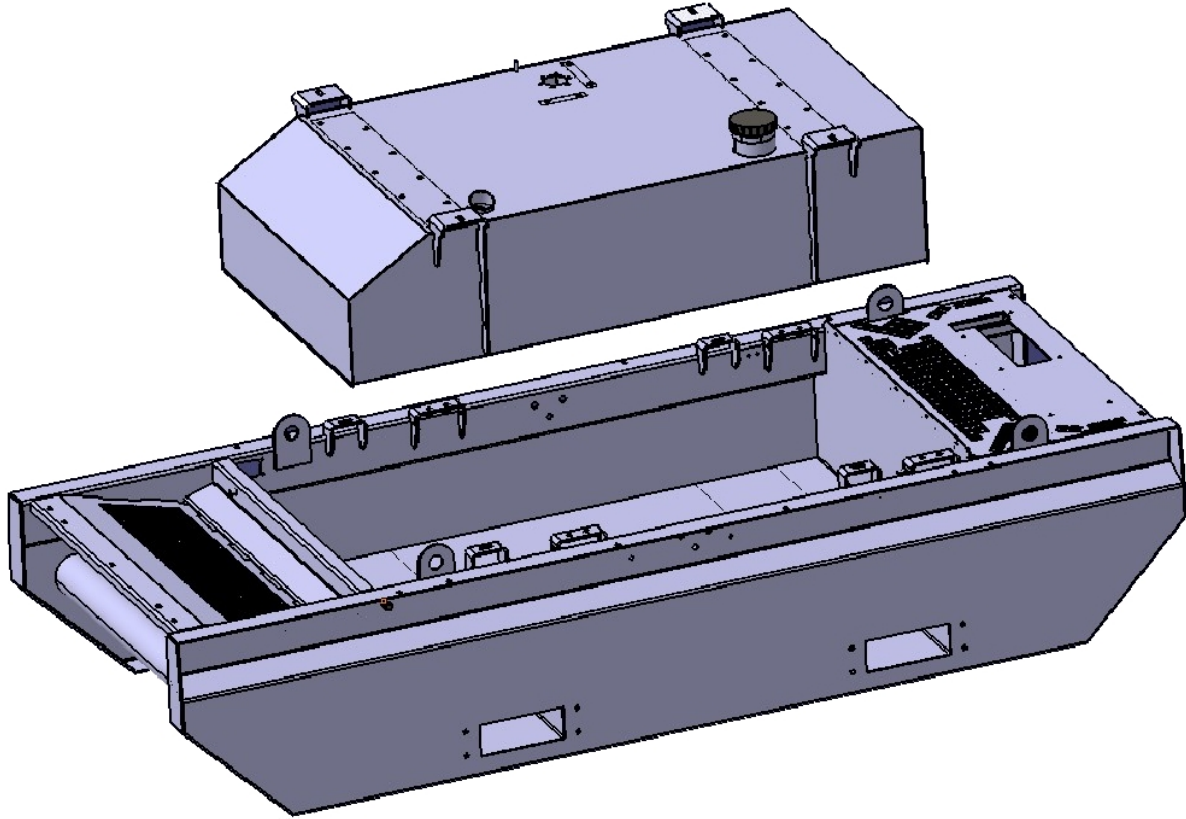


Figure 11 : Fluid retention container

The generating sets are fitted with a visual alarm warning when the upper limit of the retention container has been reached.

In all cases, the retention containers must be regularly checked to ensure they contain no fluid (fuel, oil and coolant, or rainwater or condensation). If necessary, drain the containers via the drain port.

- ✓ **Note:** Never allow these fluids to drain onto the ground; ensure they are collected in a designated container.



2.5. Fuels, lubricants and coolants

All specifications (product features) are given in the engine and alternator maintenance manuals attached to this manual.

In addition to these, we recommend the fuels, lubricants and coolants mentioned in the "Specifications" section.

2.5.1 Fuel specifications

General quality requirements

The quality of the fuel is essential for engine performance. It affects the technical performances such as the service life, power supplied and fuel consumption as well as the ability to respect the requirements issued by authorities relating to pollutant emissions. **Only fuels which conform to the current legal requirements and national and international standards should be used.** Consult the local fuel distributor to find out the characteristics of the diesel fuel available in the area.

Examples of standards and requirements:

EN 590	European standard (CEN) for vehicle fuel - fuels for diesel engines (diesel fuel) - requirements and test methods
ASTM D 975 1-D and 2-D	American Society for Testing and Materials: basic requirement in the United States and Canada
JIS KK 2204	Japanese Industrial Standards: Japanese industrial standards

Respecting pollutant emissions

The certification measures confirming that the legal emission value limits are respected are performed with certified fuels which conform to the standards and requirements stated above.

Resistance to low temperatures

When the external temperature is low, the fluidity of diesel fuel may no longer be sufficient due to paraffin deposits. Also, in the winter in order to avoid malfunctions (for example, clogged filters), use diesel fuels which are fluid enough in cold weather.

The requirements to respect for the various geographical regions and various seasons (winter/summer) are specified in the standards and/or national regulations. Petrol companies should always supply fuels with the correct flow properties regardless of the time of year. In general, diesel fuel is treated with additives so that the fuel can be used at low temperatures in the region where it is marketed.

Treating fuel with additives must respect the engine manufacturer's recommendations and maintain a suitable lubricity for the injection systems. It is recommended to favour fuels whose additives have been added in a refinery over those modified in the storage tank.

General specifications for diesel fuel

The fuel used must have the following characteristics (non-exhaustive list):

Sulphur content	<p>The sulphur content must meet the current emissions regulations in the region where the generating set is used.</p> <p>For the United States and countries respecting the EPA regulation</p> <p>Only use Ultra Low Sulphur Diesel (ULSD) fuel with a maximum sulphur content of 15 mg/kg for Interim Tier 4 and Tier 4 certified engines.</p> <p>For the European Union</p> <p>Directive 2009/30/CE whose aim is to limit atmospheric pollution, imposes the use of a diesel fuel with a very low sulphur content of 10 mg/kg, for <u>non road mobile machinery</u>.</p> <p>In France, this obligation has resulted in the development of a diesel fuel called "off road diesel fuel" or "GNR". The maximum admissible sulphur content is 10 mg/kg. However, member states allow these diesel fuels to contain up to 20 mg/kg of sulphur when they are distributed to the final users. It is recommendable to avoid storing off road diesel fuel for long periods of time (over 6 months).</p>
Viscosity and density	<p>The viscosity and density directly affect the performance (power and fuel consumption), emissions and service life of the engine. A low level of viscosity and density reduces engine power and increases fuel consumption. Too high a level of viscosity and density seriously reduces the service life and operation of the fuel injection system.</p> <p>In order to maintain adequate technical and environmental performance, the viscosity and density must conform to the specifications indicated in the manufacturer's instructions for the engines fitted to our generating sets.</p>
Lubricity capacity lubrication oiliness	<p>(or for or)</p> <p>In order to protect the fuel injection system against excessive wear, the fuel must have satisfactory lubricity (refer to the manufacturer's instructions for the engines fitted to our generating sets).</p>
Cetane index	<p>The ignition behaviour of diesel fuels is described by the cetane index. The cetane index is important for emissions, the ability to start in cold weather and engine noises. The minimum technical requirements are 45.</p>
Water and contaminants	<p>The fuel and tank must not contain any water. Water causes the engine parts to corrode and wear more rapidly, particularly the injection system parts. In addition, water promotes the growth of bacteria and fungi in the tank, which can clog the fuel filter. The fuel must not contain any type of residue. Organic contaminants (bacteria, fungi, etc.) can block the fuel filters; inorganic material in the fuel (dust, sand) can cause serious damage to the injection equipment.</p>

2.5.2 Lubricant specifications

Essential for the correct operation of the engine. The oil should be selected according to its use. Besides the lubrication function, oil should also:

- cool certain parts;
- protect metal parts against corrosion;
- improve the sealing, in particular between pistons, piston rings and cylinders;
- remove impurities (to the filter).

It is recommendable to use a top of the range lubricant for diesel engines. The table below lists the oils recommended for each engine manufacturer.

Engine			
Make	Type	Make	Type
Cummins	All	GenPARTS	GENLUB TDX 15W40
John Deere	All	John Deere	John Deere PLUS-50
		GenPARTS	GENLUB TDX 15W40
MTU	All	GenPARTS	GENLUB TDX 15W40
Mitsubishi	All	GenPARTS	GENLUB TDX 15W40
Perkins	Fuel	GenPARTS	GENLUB TDX 15W40
	Gas	MOBIL	PEGASUS 705
Volvo	All	GenPARTS	GENLUB TDX 15W40
Doosan	All	GenPARTS	GENLUB TDX 15W40
Lombardini Kohler	All	GenPARTS or Kohler	GENLUB TDX 15W40 or Kohler 5W40, according to the model of the engine

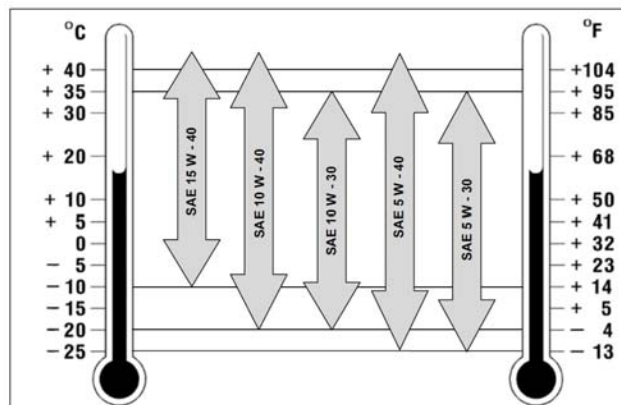
Viscosity

Viscosity is a measure of the flow resistance of a fluid. The viscosity of an engine oil is expressed by 2 SAE (Society of Automotive Engineers) grades. One grade for cold weather and one grade for hot weather. The grade for cold weather appears before the letter W.

The 1st grade represents dynamic viscosity in cold weather, namely the ability to start the engine and to prime the oil pump (and therefore to lubricate the various components quickly). The lower the number, the more fluid the oil.

The 2nd grade represents the kinematic viscosity in hot weather. The higher the number, the thicker the film of oil when hot (which aids protection and sealing). The lower the number, the less friction there will be in hot weather (it helps to save fuel).

In order to ensure immediate protection when starting the engine, the choice of viscosity grade when cold is essential. More fluid oil is quicker to flow when oil begins to circulate through the engine. It should be selected according to the ambient temperature. See the table below.





Characteristics of GENLUB TDX 15W40 oil

Performance

GENLUB TDX oil is a 15W40 multigrade mineral oil which meets the following specifications: ACEA E3 and API CG-4.

ACEA E3: oil with superior viscosity stability, suited to extended oil change intervals and severe conditions of use.

API CG-4: oil particularly effective to meet the emissions requirements.

ACEA = European Automobile Manufacturers' Association

API = American Petroleum Institute

Specifications

Specifications	Units	Grade SAE 15W-40
Density at 15°C	kg/m ³	883
Kinematic viscosity at 100°C	mm ² /s (cSt)	14
Viscosity index	–	130
Flow point	°C	- 27°
Flash point	°C	>200
TBN*	mgKOH/g	9.7

Typical values given for information purposes

* TBN (Total Base Number – degree of alkalinity): a measure of a lubricant's reserve alkalinity according to standard ASTM D 2896. This check makes it possible to assess the ability of the product to remain in service and to check the 'capacity of the lubricant to neutralise the acidity contained in the oil, which may corrode the metallic elements of the lubricated component.

2.5.3 Coolant specifications

The engine's internal cooling system allows the engine to operate at a precise temperature.

The table below lists the coolants recommended for each engine manufacturer.

Engine			
Make	Type	Make	Type
Mitsubishi	All	Mitsubishi	LLC
		GenPARTS	GENCOOL PC -26
MTU	All	GenPARTS	GENCOOL PC -26
John Deere	All	GenPARTS	GENCOOL PC -26
Volvo	All	GenPARTS	GENCOOL PC -26
Doosan	All	GenPARTS	GENCOOL PC -26



Specifications of GENCOOL PC -26 coolant

Performance

GENCOOL PC -26 coolant is a ready-to-use cooling fluid which provides a high level of protection and is produced from an antifreeze approved by the majority of manufacturers (Power Cooling concentrated antifreeze).

It offers the following:

- Improved anticorrosion: improves the effectiveness and service life of the cooling system.
- High temperature feature: promotes heat exchange.
- Long-term protection: against overheating and corrosion under extreme conditions of use.
- Compatible with the original fluid (however, it is recommended to drain the entire cooling system when replacing the fluid).


Specifications

Specifications	Units	Characteristics
Density at 20°C	kg/m ³	1053 ± 3
pH	pH	7.5 to 8.5
Alkalinity reserve	ML	≥ 10
Boiling temperature	°C	105 ± 2
Freezing temperature	°C	-26 ± 2

Typical values given for information purposes

3. Transporting the equipment

3.1. Warnings concerning transport

	It is prohibited to operate generating sets whilst they are being transported.
IMPORTANT	

3.2. Preparing for transport

Before the equipment is transported, perform the following operations:

1. Close the tap on the oil top up tank outlet.
2. Fill up the oil top up tank with oil.
3. Fill up the crankcase with oil.
4. Fill up the on-board tank with fuel.
5. Check that the batteries are fitted and filled with electrolyte.

3.3. Road transport

3.3.1 Generating sets with and without an enclosure

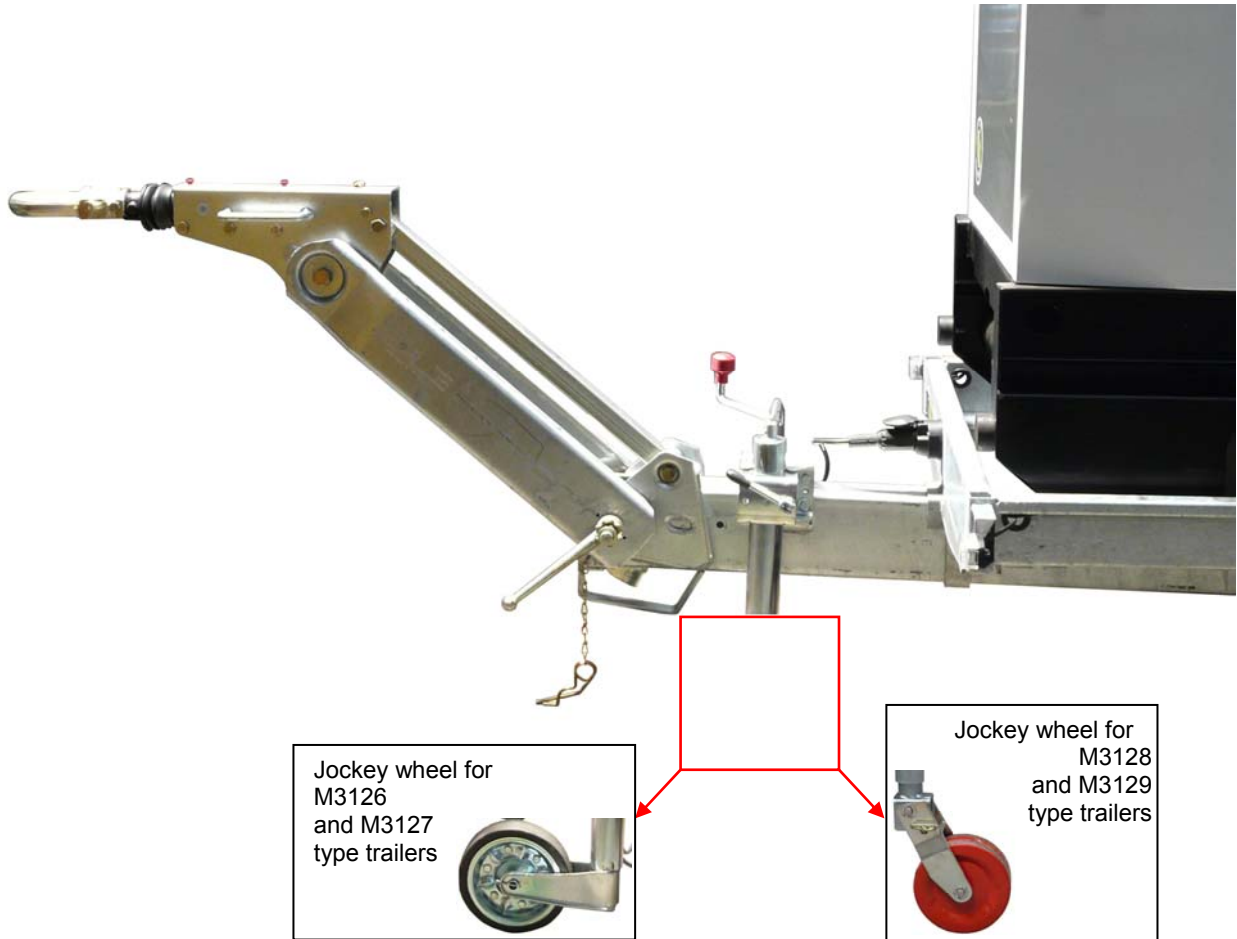
Generating sets must be transported by road in accordance with the regulations of the countries concerned.

When transporting generating sets in containers by road, the following steps must be observed:


1. Put a plastic cover over non-enclosed generating sets during transportation.
2. Select transport equipment (trailer, semi-trailer, etc.) suitable for this usage and having all the safety guarantees in terms of load bearing capacity and of the securing devices.
3. Chock and fix the generating sets to the floor of the transport equipment.
4. Strap the generating sets to the transport equipment.
5. Select a transport route which makes it possible to travel on roads suitable for vehicles, and whose quality will not damage the on-board generating sets.

3.3.2 Generating sets on trailers

3.3.2.1 Hitching and unhitching the trailer

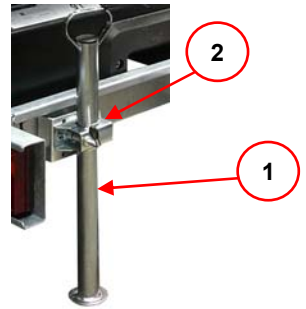


Before hitching the trailer, check the hitching system on the towing vehicle; this must be perfectly compatible with the trailer.

	<p>Towing a trailer with a non-compliant device (bar, cables, lashing, etc.) runs the risk of serious accidents.</p> <p>Also check:</p> <ul style="list-style-type: none"> ✓ That there are no incipient ruptures or significant wear on the hitching system. ✓ That the locking system is working properly.
<p>IMPORTANT</p>	

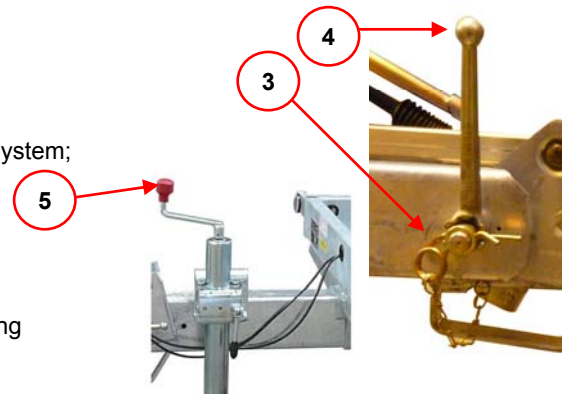
Hitching a trailer fitted with a hitching ring

1. Drive the towing vehicle or bring the trailer up to the hitching point, then:
 - With the jockey wheel touching the ground, place the stabiliser (1) in the top position:
 - Loosen the jaw of the stabiliser (2) with its lever;
 - Raise the stabiliser fully;
 - Tighten the jaw of the stabiliser (2) with its lever.
 - Remove the wheel chocks if necessary and store them.
2. Position the trailer parallel to the ground using the guide wheel handle (jockey wheel).
3. Place the hitching ring above the towing vehicle's hitching system:



!	After this adjustment, the trailer must remain parallel to the ground.
IMPORTANT	Make any necessary height adjustments to the towbar using the jockey wheel to enable hitching.

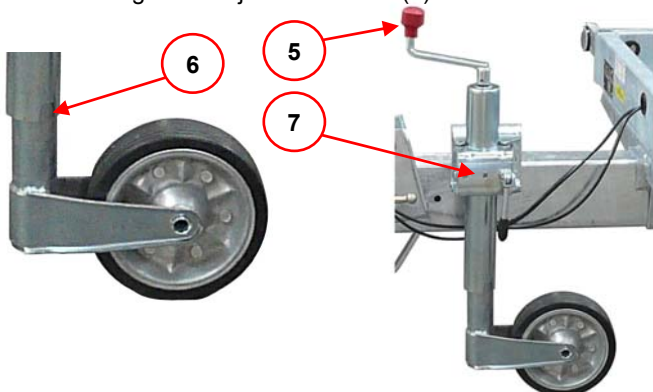
- Remove the safety pin from the towbar (3);
 - Undo the nut with the lever (4);
 - Use the adjustable towbar handle to place the ring above the hitching system;
 - Tighten the nut to lock the towbar;
 - Fit the towbar safety pin.
4. Attach the ring to the hitching system:
 - Lower the trailer by moving the jockey wheel away from the ground using its handle (5).
 5. Lock the jockey wheel in the towing position:



!	When in the towing position, the jockey wheel must not: <ul style="list-style-type: none"> - obstruct the unlocking cable's movement; - trap any electrical cables.
IMPORTANT	

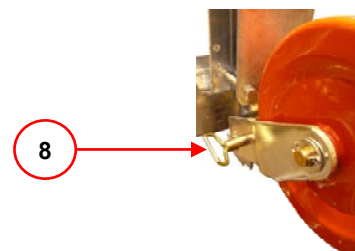
M3126/M3127 type trailers

- Position the jockey wheel at the rear.
- Raise the jockey wheel with its handle (5) into the notches on its tube (6).
- Loosen the jaw of the tube (7) with its lever.
- Raise the tube fully.
- Tighten the jaw of the tube (7) with its lever.

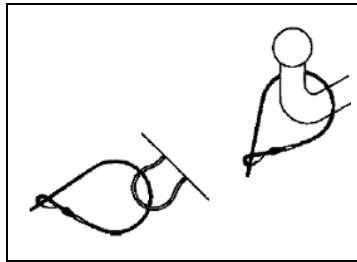


M3128/M3129 type trailers


- Remove the safety pin from the position lock (8).
- Remove the position lock (8).
- Place the jockey wheel in the towing position.
- Fit the position lock (8).
- Fit the safety pin in the position lock (8).
- Raise the jockey wheel with its handle fully and at right angles to the towbar.



6. Attach the unlocking cable to the hitching plate on the towing vehicle.



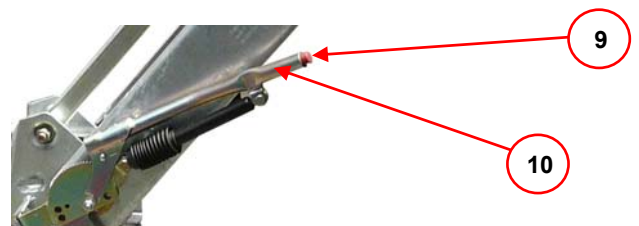
Examples of how to attach the hitching cable

	<p>If the hitching ring is not correctly connected to the hitching hook, the trailer will become separated from the towing vehicle. In this case the unlocking cable actuates the parking brake (which then becomes an emergency brake).</p>
<p>IMPORTANT</p>	<p>To ensure that the device fulfils its function correctly, the unlocking cable:</p> <ul style="list-style-type: none"> - MUST NOT be wound around the jockey wheel, as this will disable emergency braking; - MUST NOT be taut or obstructed, as this could activate emergency braking during towing; - MUST be routed as straight as possible and not be obstructed at any point; - MUST be sufficiently long to allow cornering.

7. Connect the electrical cable plug controlling the lamps, indicators, etc. to the socket on the towing vehicle.

8. Remove the parking brake:

- Remove the wheel chocks if necessary and store them;
- Perform the following operations simultaneously on the parking brake:
 - Press the unlocking button (9);
 - Lower the handle (10) fully.

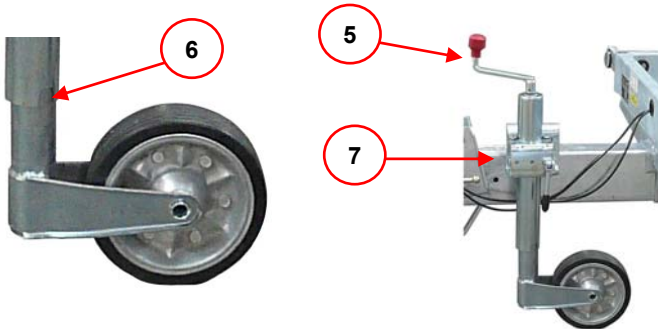


Unhitching a trailer fitted with a hitching ring

1. Immobilise the trailer:
 - Chock the wheels;
 - Apply the parking brake:
 - Raise the parking brake lever (10) fully.
2. Disconnect the electrical cable plug controlling the lights, indicators, etc. from the socket on the towing vehicle.
3. Remove the unlocking cable on the towing vehicle.
4. Release the hitching ring:

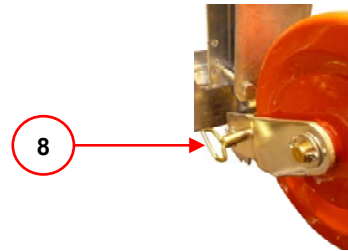
M3126/M3127 type trailers

- Disengage the jockey wheel from the notches in the tube (6) with its handle (5).
- Loosen the jaw of the tube (7) with its lever.
- Lower the tube until the jockey wheel touches the ground.
- Tighten the jaw of the tube (7) with its lever.



M3128/M3129 type trailers

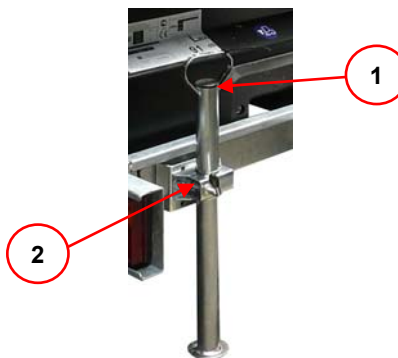
- Remove the safety pin from the position lock (8) on the jockey wheel.
- Remove the position lock (8).
- Place the jockey wheel in the bottom position.
- Fit the position lock (8).
- Fit the position lock pin.
- Lower the jockey wheel to the ground with its handle.



- Support the load on the jockey wheel:
 - Lower the jockey wheel with its handle;
 - When you are sure that the wheel can bear the load (the towbar rises), unhitch the trailer from the vehicle.

5. Fit the stabiliser (1):

- Loosen the jaw of the stabiliser (2) with its lever;
- Place the stabiliser in contact with the ground;
- Tighten the jaw of the stabiliser (2) with its lever.



3.3.2.2. Check before towing

	Before first use, it is essential to check the tightness of the wheel bolts.
IMPORTANT	

Before towing, check the following:

- Wheel tightness.
- Hitching hook locked.
- Tyre pressure.
- Signalling lights working.
- Enclosure doors closed.
- Parking brake released.
- Guide wheels (jockey wheels) and stands lifted and locked.
- Safety cable fitted.

INFLATION PRESSURE (BAR)			
145R13	2.2	185R14C	4.5
155 / 70R13	2.5	195R14C	4.5
185 / 70R13	2.5	215R14C	4.5
175R14C	4.5	215 / 75R14C	4.5


TIGHTENING TORQUE WHEELS	
Axis of 10	60 Nm
Axis of 14 and 16	120 Nm

3.3.2.3. Operation

The driving speed must be suited to the condition of the road and the handling of the trailer.

Maximal speed on road: 140km/h.

Driving at high speed causes the tyres to heat; it is therefore important to stop from time to time and check them. Excessive heating may cause a puncture, and therefore a serious accident. For reversing manoeuvres, remember to lock the inertia brake.

	Particular attention must be paid to the tightness of the wheels on new vehicles. In the first few miles' driving, heating of the brake hubs and drums will actually reduce the wheel tightness. It is therefore essential to check the tightness every 6 miles (10 kilometres) until no further loosening is noted.
IMPORTANT	The tightness check must nonetheless be carried out whenever you have towed the trailer.

Lights / signalling

Warning lights are obligatory for on-road driving. Signalling must comply with regulations in force in the country of use.

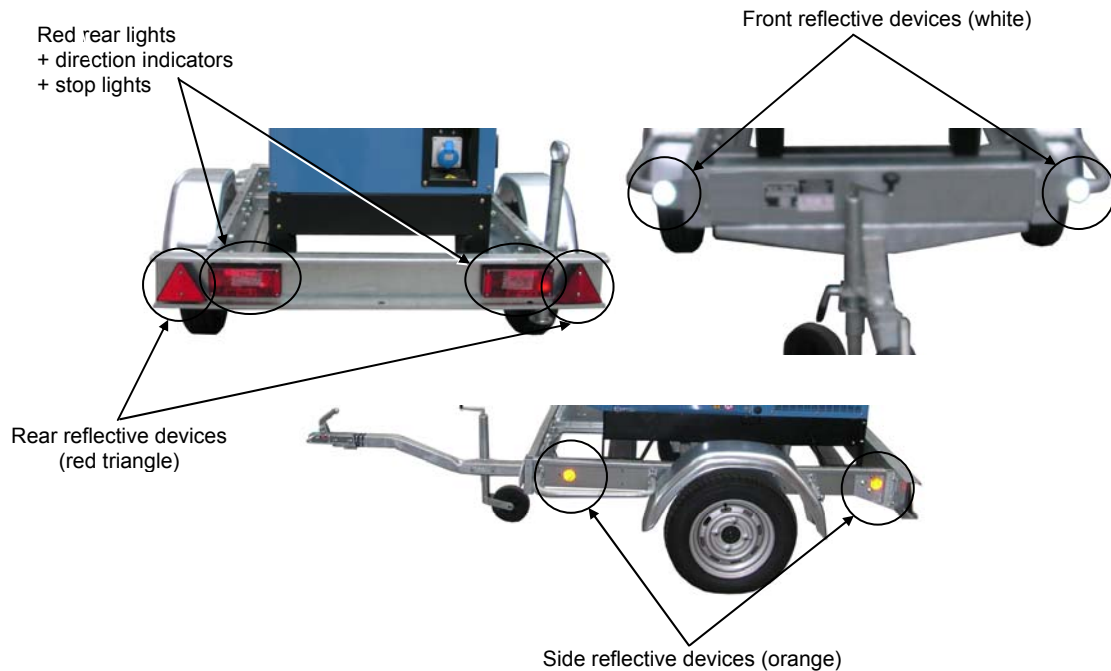


Figure 12 : Example of French signalling

3.4. Rail transport

3.4.1 Generating sets with and without an enclosure

Generating sets must be transported by rail in accordance with the specific rules governing rail transport.

When transporting generating sets in containers by rail, the following steps must be observed:

1. Put a plastic cover over non-enclosed generating sets during transportation.
2. Choose transport equipment appropriate for this usage, and having all the safety guarantees both in terms of load-bearing capacity and securing devices.

3.5. Shipping

3.5.1 Generating sets with and without an enclosure

Transportation must be carried out in accordance with the rules of shipping. Generating sets must be transported in a shipping container.

When shipping generating sets in containers, the following steps must be observed:

1. Choose transport equipment appropriate for this usage, and having all the safety guarantees both in terms of load-bearing capacity and securing devices.
2. In the case of a grouped load container, SEI cases must be used for packing.

3.6. Air transport

Containers must be transported by air in accordance with the specific rules governing air transport.

The UN has classified generating sets as "dangerous goods" listed under UN code 3166 - class 9 - "Engine, internal combustion (flammable liquid powered)".

Any air shipment of generating sets must be subject to prior declaration to the air freight company, in accordance with form MOD3909.

For air transport, observe the following steps:

1. Choose transport equipment appropriate for this usage, and having all the safety guarantees both in terms of load-bearing capacity and securing devices.
2. For control boxes, packing in an SEI 4 C case (solid case with waterproof cover) is obligatory.

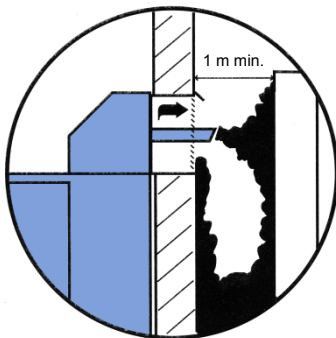
4. Installation - Connections

4.1. Unloading the generating set

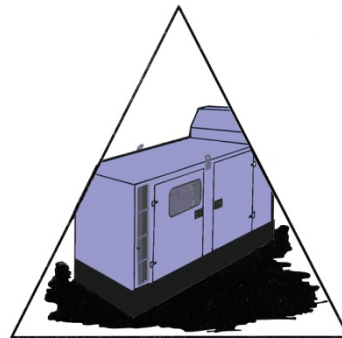
4.1.1 Choosing the location

When choosing where to site the generating set, bear in mind the:

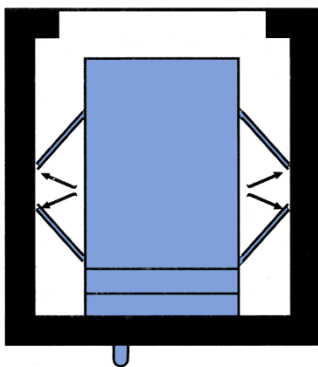
- proximity to the electrical distribution panel;
- nuisance caused by the noise;
- fuel supply;
- burnt gas evacuation;
- direction of these gases and the noise generated.



Incorrect ventilation and exhaust



Building or terrain too rough
Generating set incorrectly seated




Impossible to open enclosure doors



Impossible to fill with fuel

Figure 13 : Examples of problems that may be encountered

4.1.2 Safety during unloading


	Always follow the safety instructions before unloading
IMPORTANT	

- The lifting machinery or equipment is suitable for the work required and the weight of the generating set. This is indicated on the generating set's identification plate.
- The sling is correctly positioned in the central lifting eye or the lifting arms are correctly positioned in the fork-lift pockets intended for this purpose.
- The ground is able to bear the load of the generating set and its lifting machinery without stress (otherwise lay down stabilising beams of sufficient strength).
- The generating set is put down as close as possible to its place of use or transport, in a clear space with free access.

Example of equipment to be used:

- ✓ crane;
- ✓ slings;
- ✓ lifting beam;
- ✓ safety hook;
- ✓ shackles;
- ✓ Forklift truck.

4.1.3 Unloading the generating set

	Before unloading or moving generating set, check that the handling equipment used is able to bear the weight of the generating set (shown on the generating set's identification plate).
IMPORTANT	

4.1.3.1. Slings

1. Attach the sling on the lifting machinery to the ring on the generating set (no.1) by stepping onto the step designed for this purpose.
2. Tension the sling slightly.
3. Check that the sling is correctly attached and the assembly is steady.
4. Lift the generating set carefully.
5. Direct the generating set towards the chosen location and stabilise it.
6. Carefully set down the generating set while continuing to position it.
7. Release the tension on the sling, then remove it.

4.1.3.2. Fork lift truck

1. Adjust the spacing of the forks on the forklift truck to the forklift grooves on the generating set.
2. Position the arms of the forklift truck in the forklift grooves (no. 2).
3. Lift and handle the generating set carefully.
4. Set down the generating set in its unloading position.

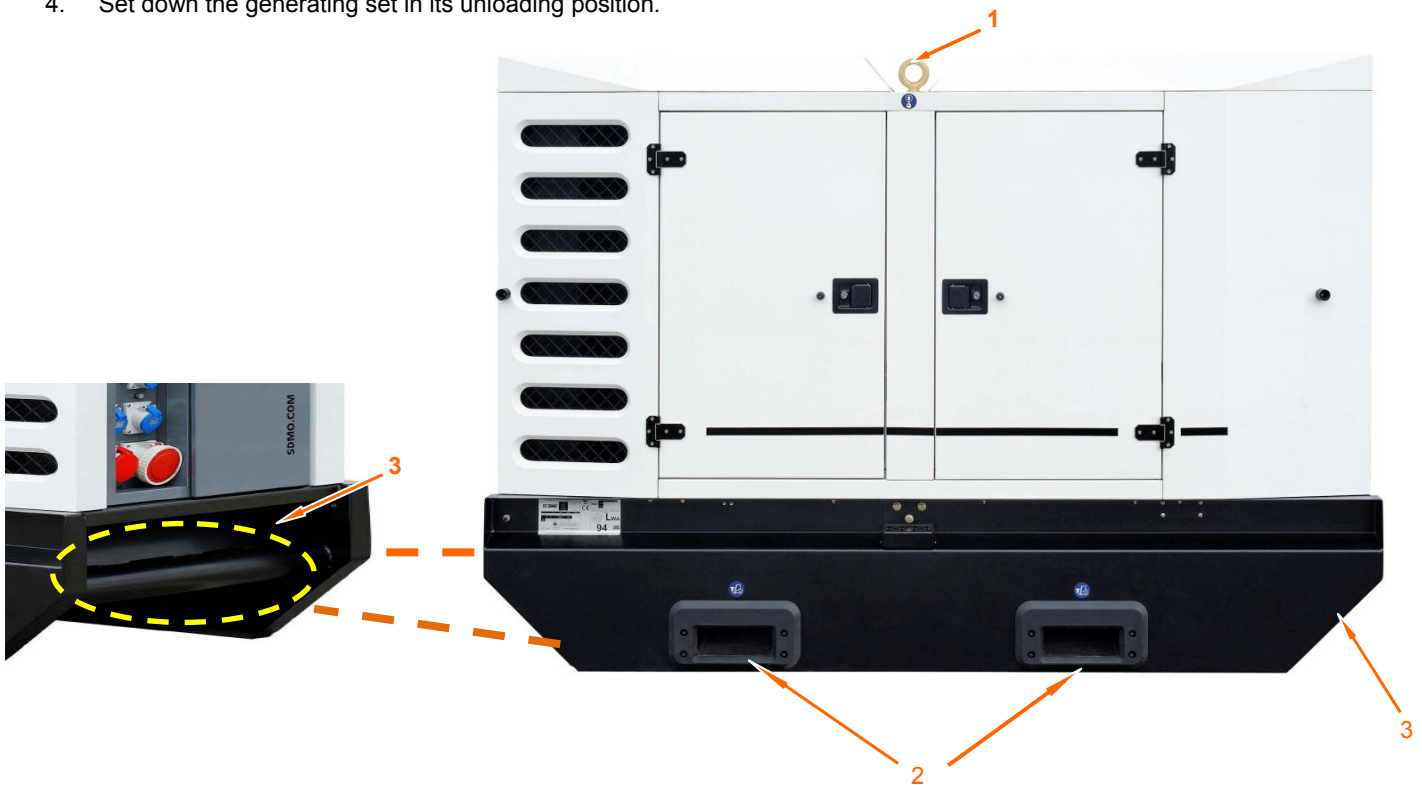


Figure 14 : Points used for lifting and moving

4.1.4 Moving the generating set

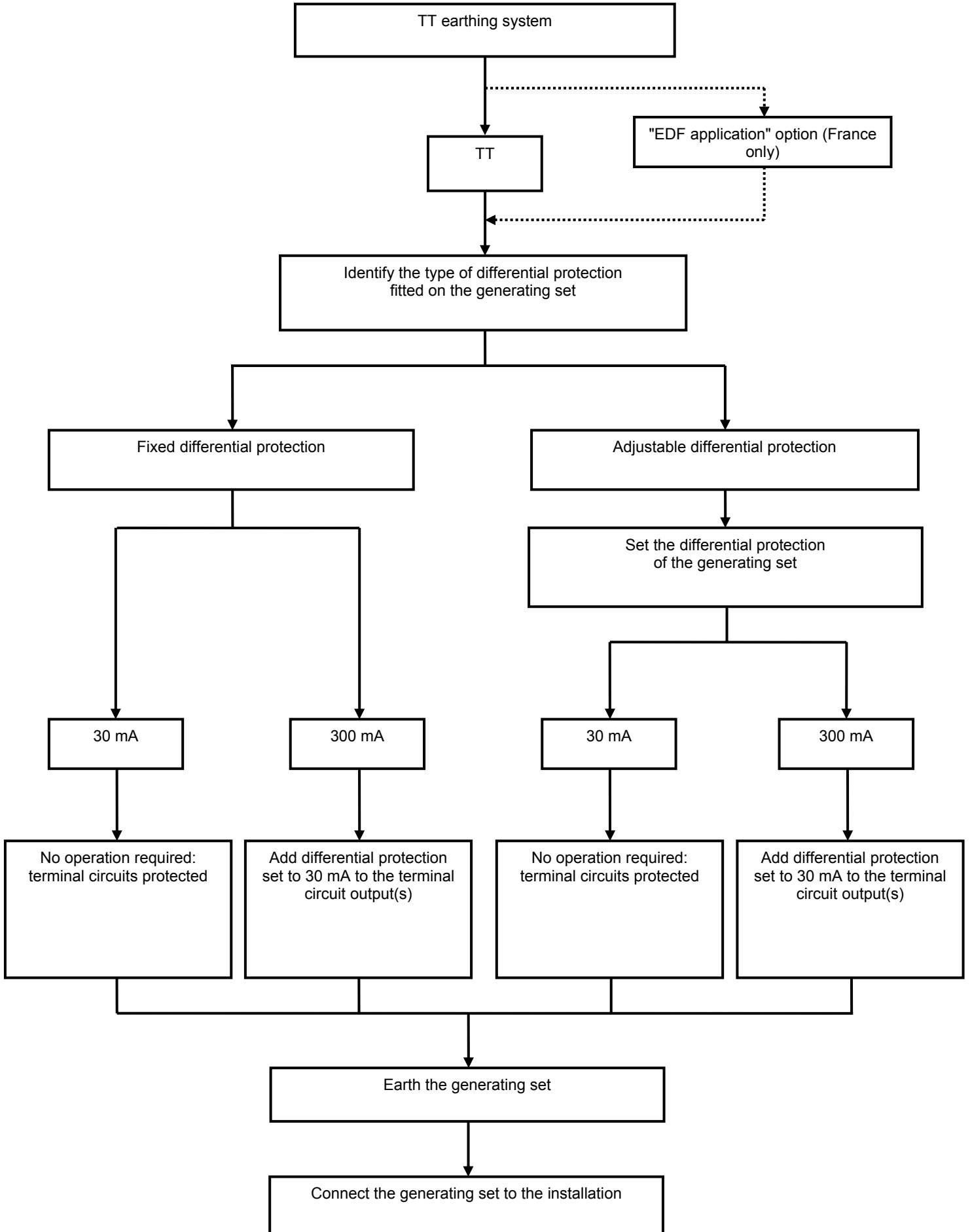
Whenever moving the generating set, ensure suitable equipment is used (e.g. sling, forklift, etc.) and identify those parts on the generating set which can be used to move it:

- lifting eye (no.1);
- forklift grooves (no.2);
- tow bar (no.3).

4.2. Connecting the generating set

4.2.1 Connection summary

This diagram can be used to retrace the different steps enabling the generating set to be correctly connected.



4.2.2 Protecting people and equipment

4.2.2.1. Earthing system principle

The **Earthing system**, or **SLT** (formerly **Neutral system**) of the electrical installation defines the situation of the generating set neutral in relation to earth and the grounds of the electrical installation at the user end.

Our generating sets are designed to operate with the TT system (or EDF application depending on the option, for France only).

4.2.2.2. TT system

In the TT earthing system, automatic power cut-off via a Residual Current Device (RCD) is obligatory at the upstream part of the installation, to ensure that personnel are protected (additionally, a maximum 30 mA device must be installed on outlet circuits).

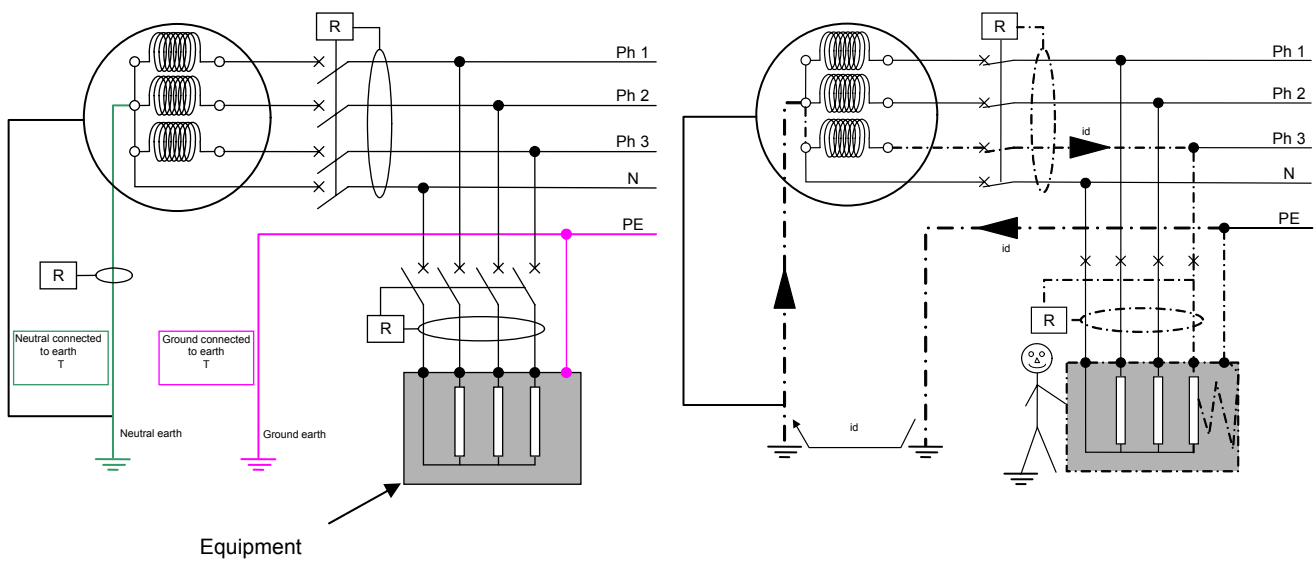


Figure 15 : TT earthing system

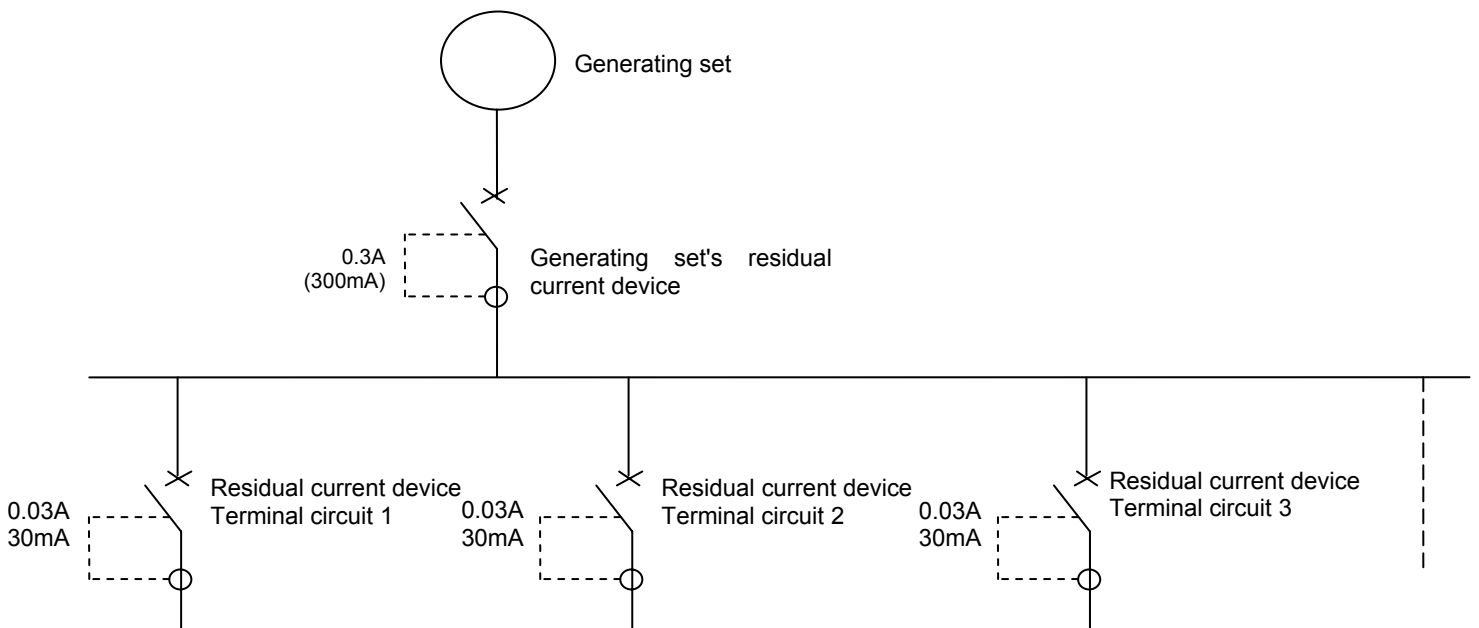
The alternator neutral is earthed, the grounds of the user equipment have their own earth connection.

4.2.2.3. Installing the differential protection

The generating set is equipped with a residual current device in order to guarantee individuals are protected from electric shocks with the TT system. This may be fixed ("vigi" unit) or adjustable (Resys) depending on the option chosen.

- If the generating set's residual current device is fixed and the activation threshold is set to 30 mA, it is guaranteed to protect people.
- If the generating set's residual current device is fixed and the activation threshold has been set at 300 mA, a 30mA residual current device must be added to each of the circuit outlets in use.
- If the generating set's residual current device is adjustable, (located upstream) this must be above those devices located downstream (terminal circuits); this means that continuity on clean circuits will be maintained in the event of a fault on one of the terminal circuits (see the following point on setting the residual current device).

Example:



	<p>Risk of electric shock. The generating set's differential relay is factory-set with a current threshold of 0.03 A (30 mA) and with an automatic time delay (0 s). Any change to the setting on the residual current device could pose a risk to personal safety. The user will be held liable - any changes must only be made by trained, qualified engineers. If the setting is modified, it is essential to restore the original settings after use.</p>
--	---

4.2.2.4. Setting the generating set differential protection

The setting of the generating set's residual current device is guaranteed by a differential relay fitted near the control unit (type A / AC or B depending on the generating sets). As a result, two parameters relating to the downstream device (terminal circuit) must be set:

- Current threshold: the generating set's differential relay must be three times more sensitive than that of the terminal circuit.
- Time delay: the cut-off of the generating set's differential relay must be longer than that of the terminal circuit.

- Type A / AC differential relay:

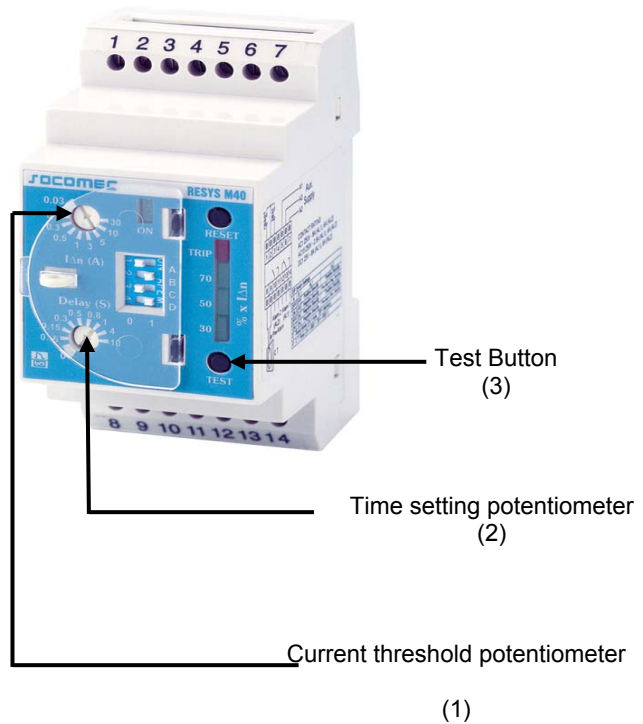
➤ Use:

Differential relay for which operation is guaranteed:

- for residual sinusoidal alternating currents;
- for continuous pulsed residual currents;
- for continuous pulsed residual currents with a continuous component of 0.006 A with or without phase check, independent of the polarity.

➤ Setting:

1. Use a screwdriver to set the current threshold potentiometer (1) to 0.03 A (30 mA).
2. Use a screwdriver to set the time delay potentiometer (2) to 0s (automatic).
3. Test the residual current device using the "Test" button on the relay (3).



- Type B differential relay:

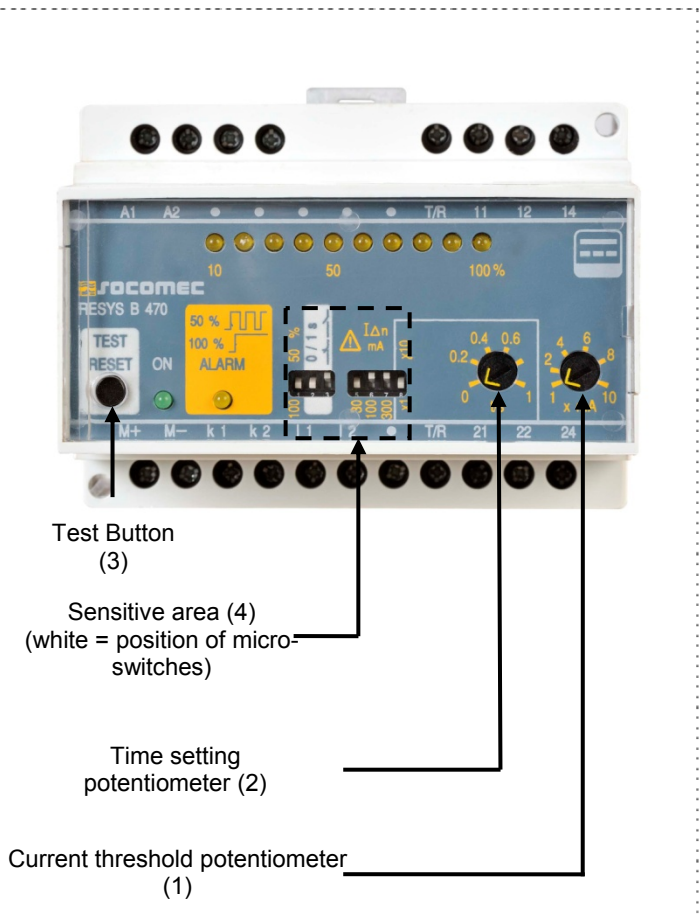
➤ Use:

Differential relay for which operation is guaranteed:

- as in the case of type A;
- for residual sinusoidal currents up to 1000 Hz;
- for residual sinusoidal currents superimposed on a pure continuous current;
- for continuous pulsed currents superimposed on a pure continuous current;
- for residual currents which could come from rectifier circuits i.e.: three phase half-wave rectifier or a three-phase full-wave bridge rectifier, full-wave bridge rectifier between phases, with or without phase angle check, independent of the polarity.


➤ Setting:

1. Use a screwdriver to adjust the current threshold using the setting potentiometer (1) and the micro-switches (4) to 0.03 A (30 mA).
2. Use a screwdriver to adjust the time delay using the setting potentiometer (2) and the micro-switches (4) to 0s (automatic).
3. Test the residual current device using the "Test" button on the relay.



	<p>Risk of electric shock. The generating set's differential relay is factory-set with a current threshold of 0.03 A (30 mA) and with an automatic time delay (0 s). Any change to the setting on the residual current device could pose a risk to personal safety. The user will be held liable - any changes must only be made by trained, qualified engineers. If the setting is modified, it is essential to restore the original settings after use.</p>
<p>DANGER</p>	

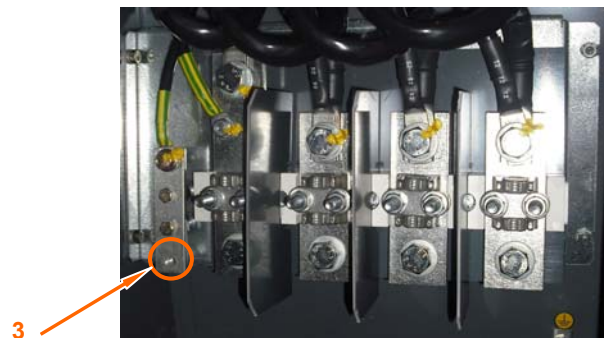
4.2.2.5. Earthing the generating set

	RISK OF ELECTRIC SHOCK. Before use, the generating set must always be earthed. Protection against electric shocks is only effective once the earthing connection has been made.
DANGER	Disconnect the battery leads, starting with the negative lead (-), or use the battery isolating switch before carrying out any operations on the generating set.

1. Open the door to the power section (no.1) then the access door to the cable router flap and to the connection terminal box (no.2).



2. Connect the earth cable (supplied) to the terminal (rep.3) on the generating set located on the connection terminal box.

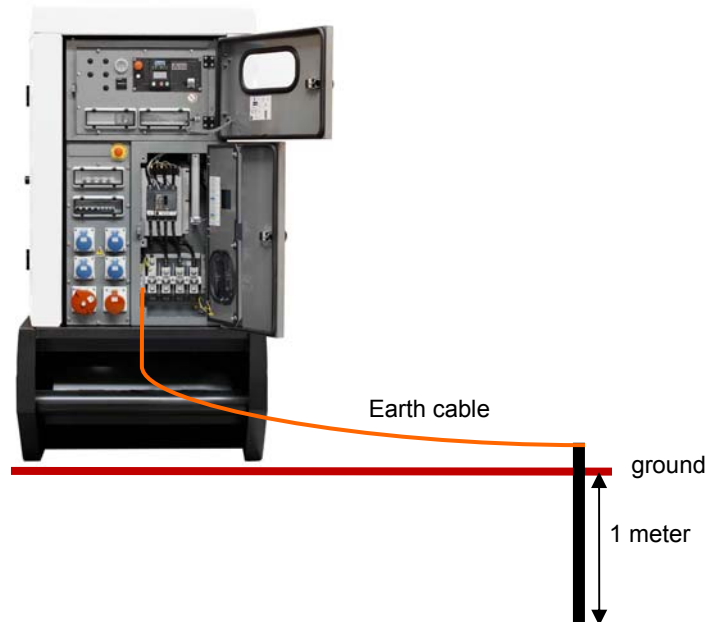


3. Check the length of the earthing rod depending on the nature of the ground and adapt if necessary.

!	The equipment supplied is not suitable for bare stony soils, dry sand or impermeable rock.
IMPORTANT	

Nature of ground	Length of earthing rod (in metres)
Thick arable land, damp compact backfill	1
Thin arable land, gravel, rough backfill	1
Bare stony soils, dry sand, impermeable rock	4 or 4 x 1

4. Plant the earthing rod in the ground and connect it to the earth cable.



Note: For the United States (National Electrical Code ref. NFPA-70), use a copper wire with a minimum cross-section of 13.3 mm² (or AWG 6 at most) connected to the generating set's earth connection and a galvanised steel earthing rod completely buried in the ground in an upright position. This earthing rod must be at least 2.5 m long (of which at least 1 m must be in the ground).

4.2.3 Making the connections

4.2.3.1. Connections - general information

When connecting, always comply with standard NFC 15-100 and the application guide NFC 15-401 (in France) or follow standards based on the international standard IEC 60364 (countries outside France).

The cable cross-section and number of connection cables should be determined according to the type of connection cable and the current standards to be observed in the country of installation. The choice of connection cables must comply with international standard IEC 60364-5-52.

4.2.3.2. Selecting the power cables

The calculation rules used to choose the power connection cable size are defined below:


- Identify the current shown on the generating set's identification plate.
- From the table below, select the circuit breaker rating directly above the current shown on the generating set's identification plate.
- Choose the corresponding cable size.

Three-phase				
Permitted drop in voltage = 5% / Multi-core conductors or connected single-core conductors where rating = 4X...(1) / Cable type PVC 70°C (e.g. H07RNF) / Ambient temperature = 30°C.				
Circuit breaker rating (A)	Cable sizes			
	0 - 50m	51 - 100m	101 - 150m	
	mm ² /AWG*	mm ² /AWG*	mm ² /AWG*	
10	1.5 / 14	2.5 / 12	4 / 10	
16	2.5 / 12	4 / 10	6 / 9	
20	2.5 / 12	4 / 10	6 / 9	
25	4 / 10	6 / 9	10 / 7	
32	6 / 9	6 / 9	10 / 7	
40	10 / 7	10 / 7	16 / 5	
50	10 / 7	10 / 7	16 / 5	
63	16 / 5	16 / 5	25 / 3	
80	25 / 3	25 / 3	35 / 2	
100	35 / 2	35 / 2	4X(1X50) / 0	
125	(1) 4X(1X50) / 0	4X(1X50) / 0	4X(1X70) / 2/0	
160	(1) 4X(1X70) / 2/0	4X(1X70) / 2/0	4X(1X95) / 4/0	
250	(1) 4X(1X95) / 4/0	4X(1X150) / 2350MCM	4X(1X150) / 2350MCM	
400	(1) 4X(1X185) / 0400MCM	4X(1X185) / 0400MCM	4X(1X185) / 0400MCM	
630	(1) 4X(2X1X150) / 2x 2350MCM	4X(2X1X150) / 2x 2350MCM	4X(2X1X150) / 2x 2350MCM	

Single phase				
Permitted drop in voltage = 5% / Multi-core conductors / Cable type PVC 70°C (e.g. H07RNF) / Ambient temperature = 30°C.				
Circuit breaker rating (A)	Cable sizes			
	0 - 50m	51 - 100m	101 - 150m	
	mm ² /AWG*	mm ² /AWG*	mm ² /AWG*	
10	4 / 10	10 / 7	10 / 7	
16	6 / 9	10 / 7	16 / 5	
20	10 / 7	16 / 5	25 / 3	
25	10 / 7	16 / 5	25 / 3	
32	10 / 7	25 / 3	35 / 2	
40	16 / 5	35 / 2	50 / 0	
50	16 / 5	35 / 2	50 / 0	
63	25 / 3	50 / 0	70 / 2/0	
80	35 / 2	50 / 0	95 / 4/0	
100	35 / 2	70 / 2/0	95 / 4/0	
125	50 / 0	95 / 4/0	120 / 2250MCM	

* : AWG. American Wire Gauge, American standard for electrical cables.

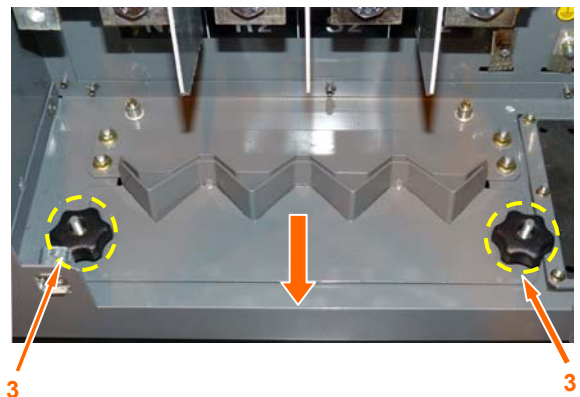
4.2.3.3. Connecting the generating set to the installation

	<p>RISK OF ELECTRIC SHOCK. Before use, the generating set must always be earthed. Protection against electric shocks is only effective once the earthing connection has been made.</p>
<p>DANGER</p>	<p>Disconnect the battery leads, starting with the negative lead (-), or use the battery isolating switch before carrying out any operations on the generating set.</p>

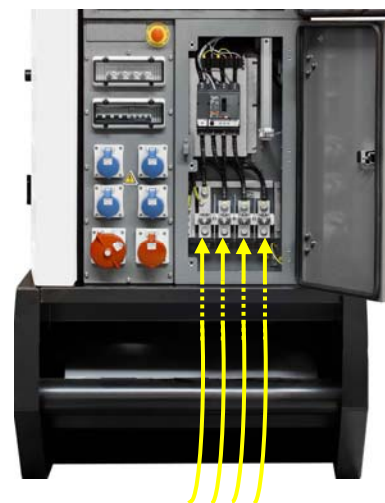
1. Open the door to the power section (no.1) then the access door to the power connection cable router flap and to the connection terminal box (no.2).



2. Loosen the two knobs (no.3) on either side of the power connection cable router flap then slide the flap towards the outside of the generating set.

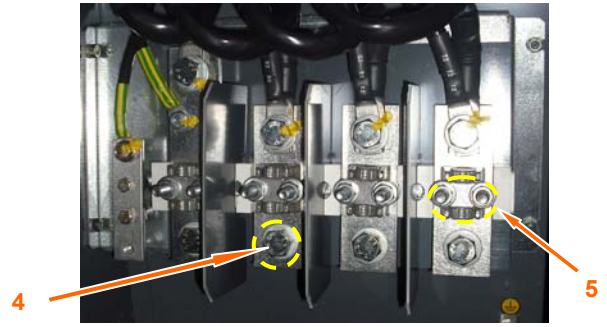


3. Feed the power connection cables through the cable router flap.

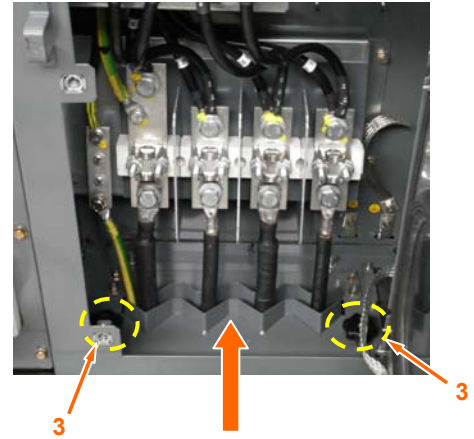


Power cables

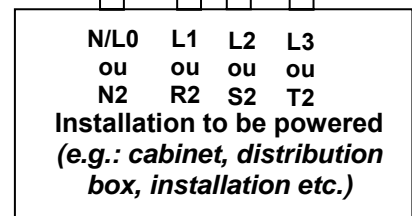
4. Connect the power connection cables onto the bars (N/L0-L1-L2-L3 or N2-R2-S2-T2) using the terminals (no.4) or clamps (no.5).





5. Slide the cable router flap towards the inside of the generating set until it makes contact with the power connection cables then retighten the two knobs; close the access door to the power section back up again.




6. Connect the power connection cables to the installation to be powered ensuring the live and neutral wires are correctly connected.

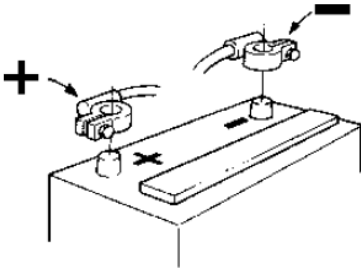


	<p>Our generating sets are factory-set with a conventional direction of phase rotation. A phase converter (not supplied) can be used to ensure correspondence of phases between the generating set and the installation..</p>
IMPORTANT	

	<p>To limit the risk of falls caused by obstacles on the floor, it is recommended to suspend cables and ventilation ducts. As necessary, ensure that cables which remain on the floor are protected by burying or covering them.</p>
IMPORTANT	

4.2.3.4. Connecting the battery or batteries to the generating set

	<p>Always ensure that the polarities of the battery and starter motor correspond. Never swap the positive and negative battery terminals when connecting them. This could cause severe damage to the electrical equipment.</p>
<p>IMPORTANT</p>	



To connect the battery:

1. Connect the red connecting cable (+) to the positive battery terminal.
2. Then connect the black cable (-) to the negative battery terminal.

To disconnect the battery:

1. First disconnect the black cable (-)
2. Then disconnect the red cable (+).

4.2.4 Overvoltage


Generating sets are not equipped with devices that protect against voltage surges from atmospheric discharges or due to handling operations.

The company disclaims all liability for any accidents caused by these phenomena.

However, it is possible to install surge protectors considering that this assembly does not provide complete protection.

5. Installation

5.1. Warnings concerning commissioning

	<p>The inspections referred to in this section enable the electrical generator set to operate. Specific skills are required to carry out these operations.</p>
<p>IMPORTANT</p>	<p>They must only be entrusted to personnel with the necessary skills.</p> <p>Failure to follow these instructions in any way could result in malfunction or very serious accidents.</p>

5.2. Checking the generating set installation

- Check the position of the generating set (stability, mounting, available space, ventilation, exhaust, etc.).
- Check the electrical connections :
 - earthing;
 - electrical control connections;
 - electrical power connections;
 - starter battery charging system (rating and voltage) if fitted to the generating set.

5.3. Preparing for operation of the generating set

- Become familiar with the controls useful to operate the generating set.
- Read and understand the "user" menus of the control unit.
- Become familiar with the maintenance plans for the generating set .
- Become familiar with the operation of the generating set at no load or under load.
- Become familiar with the fluid specifications (fuel, lubricant and coolant).

5.4. Checking the generating set before startup

- Check that the plugs, blanking covers and protective adhesive strips have been removed.
- Ensure that the anti-humidity bags have been removed from the electrical sections (cabinet or control console, alternator, etc.).
- Check the insulation of the alternator *see the alternator's maintenance manual*.
- Check the levels *see the engine's maintenance manual*:
 - coolant;
 - oil;
 - fuel.
- Open the oil filler tap (if fitted to the generating set).
- Check the starter battery or batteries (connecting and charge) *see the paragraph entitled "Starter batteries"*.
- Check the starter battery charging system (if fitted to the generating set).

5.5. Checking the generating set after startup

Off-load tests

- Carry out the safety checks (emergency shutdown, oil pressure, coolant temperature, etc.).
- Check the mechanical parameters:
 - engine parameters (oil pressure, coolant temperature);
 - absence of abnormal vibrations;
 - absence of abnormal noises;
 - absence of leaks.
- Check the electrical parameters:
 - voltage, frequency, current;
 - rotating field.

On-load tests

- Check the mechanical parameters:
 - engine parameters (oil pressure, coolant temperature);
 - absence of abnormal vibrations;
 - absence of abnormal noises;
 - absence of leaks.
- Check the electrical parameters:
 - voltage, frequency, current;
 - rotating field.

6. Using the generator set


6.1. Pre-Start Inspection

Inspecting the engine compartment

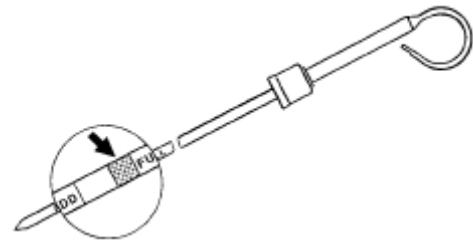
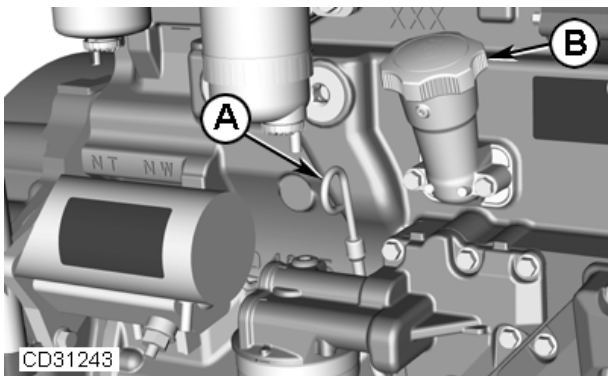
Inspect the engine carefully.

Wipe all the grease fittings and caps before carrying out any maintenance in order to reduce the risk of contaminating the circuits.


Checking the engine oil level

	<p>- Do not top up the oil if the oil level is not below the low level marker.</p> <p>- Do not exceed the hatched area</p> <p>The oil level is correct if it is within the hatched area.</p>
Important	

- ❶ Check the oil level using the dipstick (A).
- ❷ Top up the oil as required.
Use an oil whose viscosity is suited to the seasonal conditions.
- ❸ Pour the oil through the rocker cover filling port (B).




Checking the coolant level

	<p>Fluid may abruptly exit the cooling circuit and cause serious burns.</p> <p>Only remove the filler cap once the engine and cap have cooled sufficiently to enable them to be handled with bare hands. Firstly, loosen the cap slightly by one notch to eliminate any pressure, then remove it.</p>
Warning	



- ❶ Remove the cap from the radiator (E) and check the coolant level.
The level should reach the lower section of the filler neck.
- ❷ Fill the radiator with the appropriate coolant if the level is too low.
- ❸ Check for leaks in the cooling circuit.

Checking the air filter

	A clogged filter element limits the engine's air intake and a reduced air supply to the engine.
Important	

If the air filter is fitted with a dust control valve (A), press the tip of the valve to evacuate any accumulated dust particles.

Check the air filter clogging indicator (B). If the indicator is red, clean the air filter.



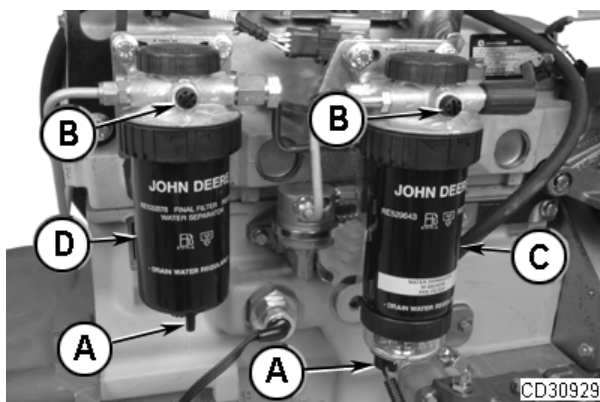
Checking the fuel filters

	Drain water into a suitable container and dispose of properly.
Danger	

Note: Engines have two fuel filters (primary and final) equipped with a water sensor. Depending on application, an indicator light on the instrument panel signal the operator that water should be drained from filter bowls.

Check fuel filters (C) and (D) daily for water or debris and drain as necessary.

- 1 Loosen drain plugs (A) at bottom of both fuel filters two or three turns.
- 2 Loosen air bleed plugs (B) two full turns and drain water into a suitable container.
- 3 When fuel starts to drain out, tighten drain plugs securely.
- 4 Bleed fuel system.



A – Drain Plug
 B – Air Bleed Plug
 C - Primary Fuel Filter
 D - Final Fuel Filter

6.2. Generator set with NEXYS control panel

6.2.1 Control panel presentation

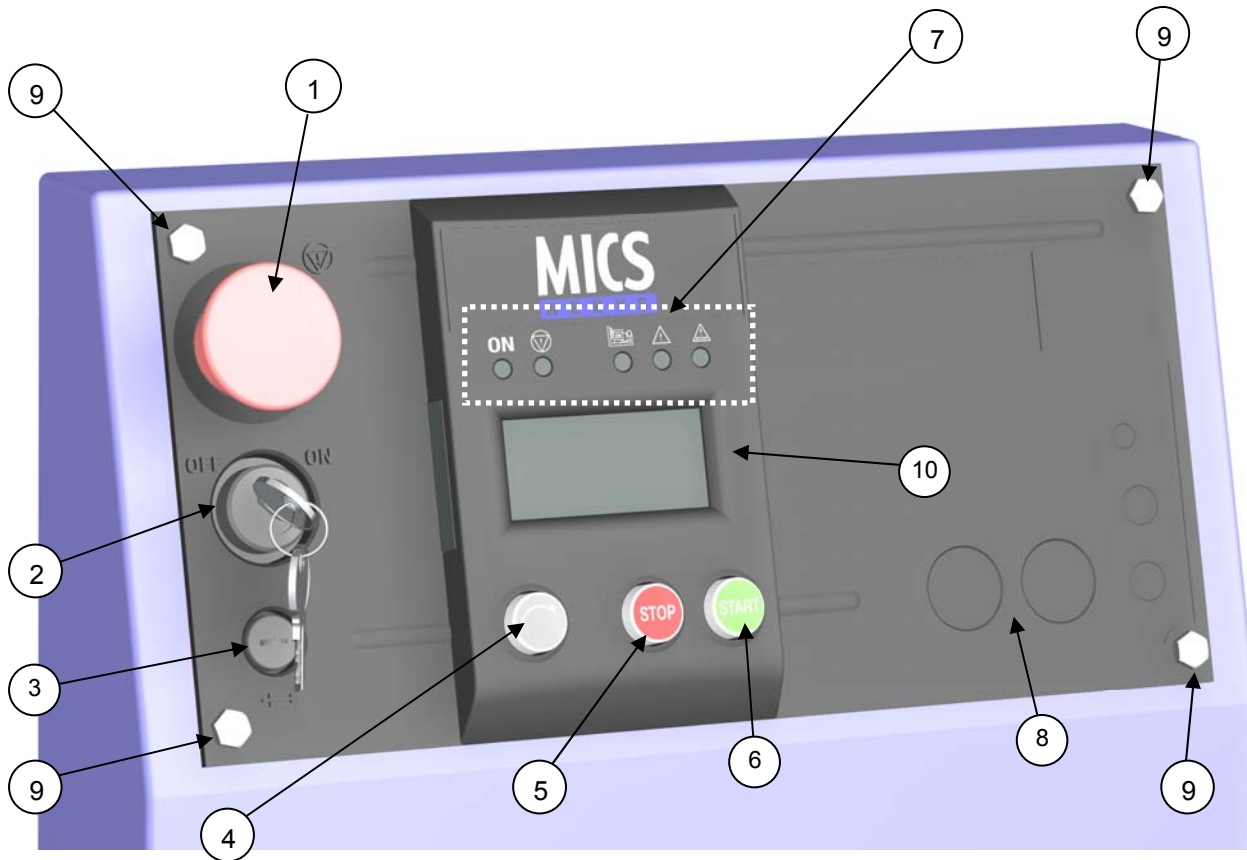


Figure 16 : View of the front side

- ① Emergency stop button for switching off the generating set in the event of a fault which could endanger personnel or damage equipment
- ② Key switch for starting up/shutting down the module and RESET function
- ③ Electronic card protection fuse
- ④ Screen-scroll button, press successively to access the various screens which are available
- ⑤ STOP button, press to switch off the generating set
- ⑥ START button, press to switch on the generating set
- ⑦ Normal operation LEDs and alarm and fault warning LEDs
- ⑧ Slot reserved for panel fascia options
- ⑨ Mounting bolt.
- ⑩ LCD for displaying alarms and faults, operating states, electrical and mechanical quantities

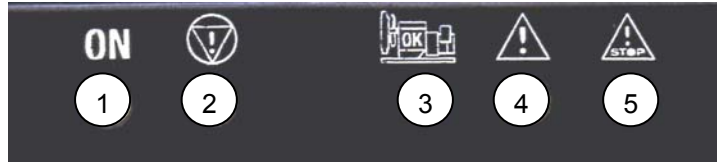


Figure 17 : Description of the LEDs

A lit LED indicates:

- ① Module being supplied (green, lights up and remains lit)
- ② Emergency stop activated (control panel or external emergency stop) (red, lights up and remains lit)
- ③ Visualisation of starting phase and speed/voltage stabilisation (flashing) and generating set operating OK or set ready to generate (green, lights up and remains lit)
- ④ General alarm (orange, flashing)
- ⑤ General fault (red, flashing).

6.2.1.1. Introduction to pictograms

The pictograms are as follows:

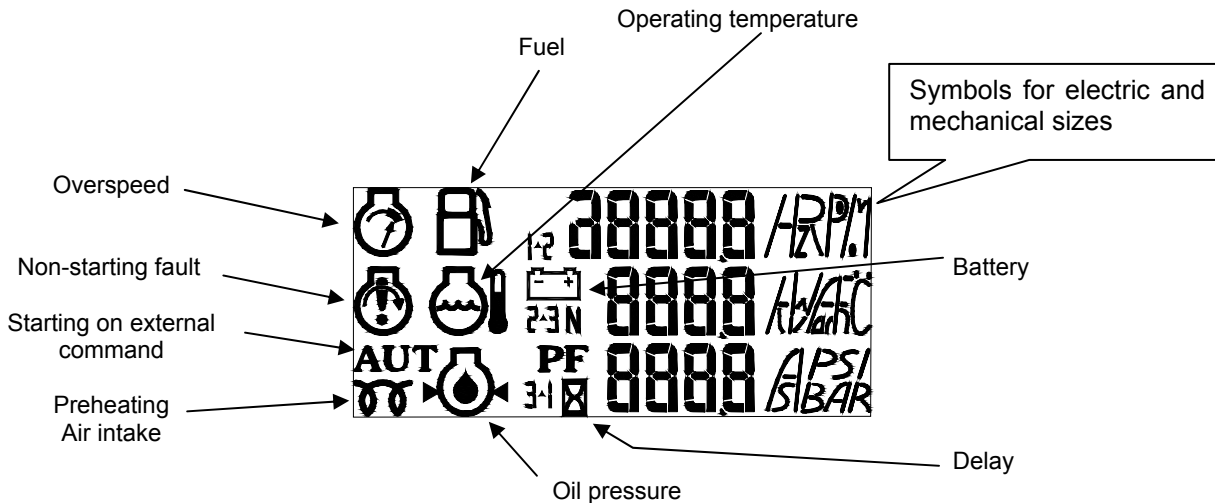



Figure 18 : View of pictograms

- The "fuel level" pictogram is used to display the fault, the alarm and the fuel level.
- The "operating temperature" and "oil pressure" pictograms are used to display the fault and analog value
- The "overspeed" and "non-starting fault" pictograms are used to display the fault.
- The "battery" pictogram is used to display the "alternator charge" fault and to indicate the battery voltage.

6.2.2 Manual starting

	<p>Check that the generating set circuit breaker has triggered.</p>
<p>Danger</p>	

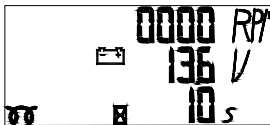
- ❶ connect the generating set battery.
- ❷ turn the key switch to the ON position (without forcing it)
 - ✓ All of the LEDs light up for 2 seconds, to confirm that they are operating correctly.
 - ✓ If the LEDs do not light up, check the protection fuse and replace it if necessary.
 - ✓ All the items on the screen are displayed for 2 seconds.
 - ✓ Only the "ON" LED remains lit to indicate that the module is powered up.
 - ✓ The following screen appears.



The first line displays the motor speed in RPM.
The second line displays the battery voltage in volts (V).

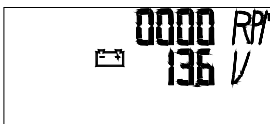
- ✓ Check the battery voltage (min. 12 V)


- ❸ Press (once briefly) the green "START" button.
 - ✓ If the motor is equipped with an air preheating system, there is a 10-second delay before the motor starts (preheating activation period).
 - ✓ The following screen appears



The third line displays the air preheating time remaining (with pictograms representing a resistor and an hourglass).

- ✓ If the motor is not fitted with an air preheating system or once the preheating delay has elapsed, the engine starts up (start of a cycle comprising 3 attempts to start up the engine).
- ✓ The following screen appears.



	<p>The number of successive and automatic starting attempts is limited to 3.</p>
<p>Warning</p>	



Note: the LED flashes as soon as the START button is pressed and continues to flash until the frequency stabilises if a "measurements" card has not been inserted and until the frequency and voltage stabilise if a "measurements" card has been inserted.

Following stabilisation, the LED light comes on continuously.

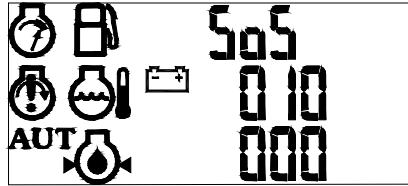


6.2.3 Switching off

- ❶ trigger the circuit breaker located at the base of the centre console
- ❷ Let the motor run under no load for 1 to 2 minutes to allow it to cool.
- ❸ press the "STOP" button to stop the generating set.
- ❹ switch off the MICS Nexys module by switching the key to "OFF" (without forcing it).

6.2.4 Alarms and faults

The appearance of a fault or an alarm causes the following screen to be displayed (one or more pictograms or a fault code along with the SOS message are displayed).



The user can access the following screens by pressing the key



The fault or alarm screen will disappear once the fault or alarm has been removed.






Only one fault is displayed on this screen (the fault which caused the generating set to stop).

If one or more faults have appeared after the first fault, they can only be displayed after the first fault has been reset (press "Reset" as many times as the number of faults present).

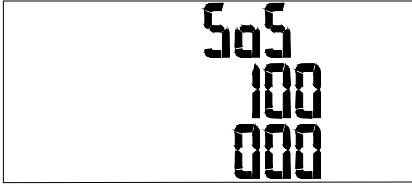
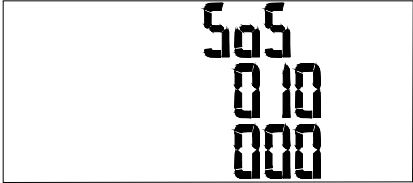
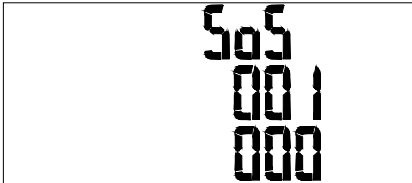
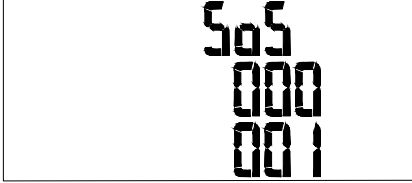
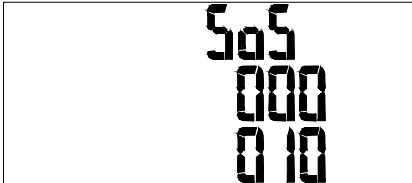
Note: an alarm can appear at the same time as a fault.

6.2.5 Faults and alarms - Details



List of faults which will cause the generating set to stop and generate a pictogram

<p>Oil pressure fault: Indicates that the oil pressure is incorrect</p>	<p>Associated pictogram</p> 
<p>Engine temperature fault: Indicates that the engine temperature is too high.</p>	<p>Associated pictogram</p> 
<p>Non-starting fault: Indicates that there have been three consecutive unsuccessful starting attempts.</p>	<p>Associated pictogram</p> 
<p>Overspeed fault: Indicates an excessive generating set running speed.</p>	<p>Associated pictogram</p> 
<p>Low fuel level fault: Indicates the need to top up the fuel.</p>	<p>Associated pictogram</p> 

List of faults which will cause the generating set to stop and generate a fault code

<p>Low coolant level fault: indicates that the level of coolant is low in the radiator (linked to a two second time delay). Or Overload or short-circuit fault (optional): with the circuit breaker SD contact closing (overload or short-circuit), the generating set switches off immediately also causing the main circuit breaker to be triggered.</p>	<p>Associated message</p> 
<p>Additional fault linked to message opposite: is displayed in the following two cases: > Differential fault (1) > insulation fault (2) (1) Differential fault (optional): with a differential fault causing the activation of the differential relay, the generating set stops immediately also causing the main circuit breaker to be tripped. (2) Insulation fault (optional): with an insulation fault causing the activation of the control unit performing insulation, the generating set stops immediately.</p>	<p>Associated message</p> 
<p>Underspeed fault: indicates an incorrect rotation speed (below 1000 rpm).</p>	<p>Associated message</p> 
<p>Emergency stop or external emergency stop fault</p>	<p>Associated message</p> 
<p>"STOP" fault activated if the "STOP" button is pressed whilst the "AUT" LED is flashing to indicate that the generating set is operating in automatic mode.</p>	<p>Associated message</p> 

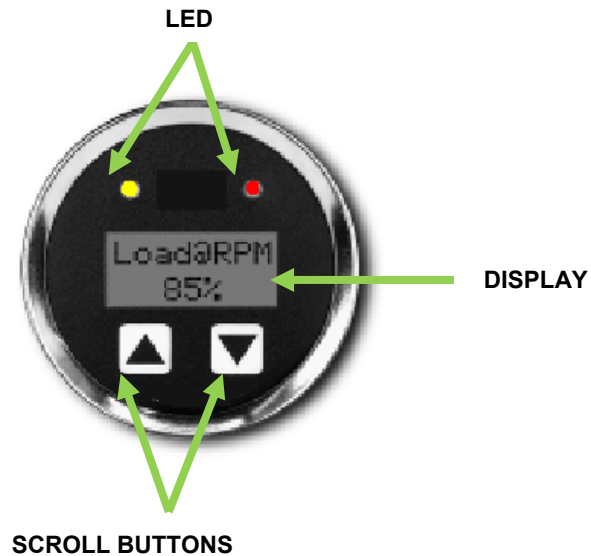
List of alarms associated with a pictogram

<p>Low fuel level alarm: Indicates the need to fill up with fuel.</p>	<p>Associated pictogram</p> 
<p>"Alternator charging fault" alarm indicates a problem affecting the alternator charging rate.</p>	<p>Associated pictogram</p> 

6.2.6 MURPHY diagnostic module

The fault finding module (MDDM) is an indicator for analysis and fault finding designed and manufactured for reading information available on the J1939 CAN Bus. The fault finding module is easy to use and will enable you to view the values of the various engine parameters and engine operating status codes.

It shows two lines, each of 8 characters, on a backlit LCD display. Two scroll buttons enable you to navigate in the menus and parameters. Two LEDs, one red and one orange, indicate the fault or alarm status of the engine or ECU.



A- Machine Parameters

The following parameters are available on the Murphy fault finding module:

- working hours counter
- engine speed
- battery voltage
- engine speed
- coolant temperature
- oil pressure
- fuel economy
- air manifold temperature
- actual consumption
- active status codes
- status codes recorded coming from the engine
- MDDM20 parameter configuration for display
- display of the engine configuration parameters
- etc. depending on the type of engine.

B-Use

The Murphy module (MDDM) offers simple menu navigation:

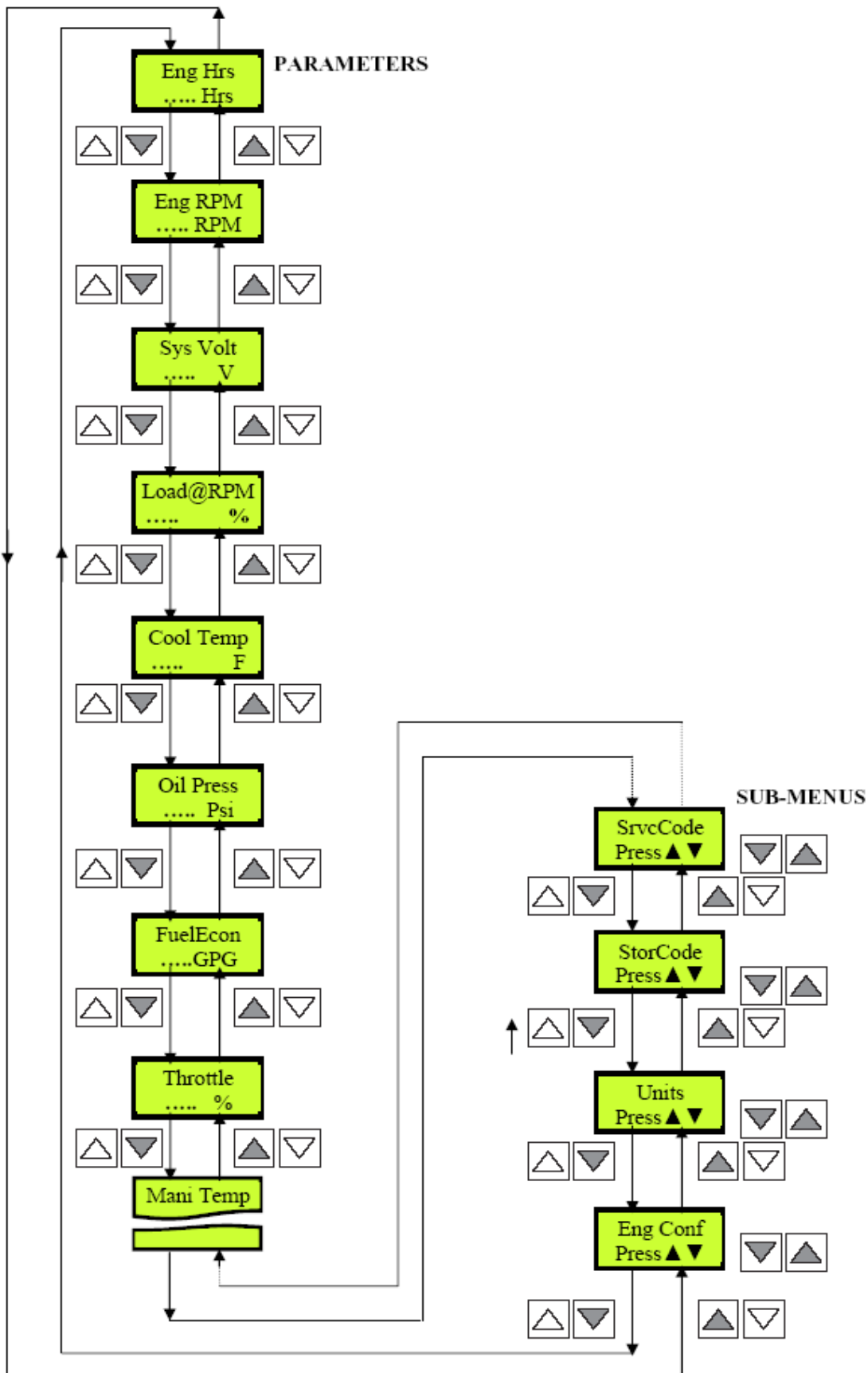
1. To browse the list of parameters, press the Up and Down buttons.



2. To enter or exit a sub-menu, press both arrows simultaneously.



The following diagram shows the structure of the main menu and how to go to each parameter:



The Parameter menu: to navigate in this menu simply use the arrow buttons separately.

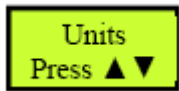
The sub-menus: The sub-menus are available at the end of the parameter menu. To go to these sub-menus, scroll through the parameters using the ▲ and ▼ buttons until you reach the required sub-menu.

C- The Sub-menus.

The sub-menus enable certain aspects of the fault finding module display to be modified.

Changing the unit of measurement:

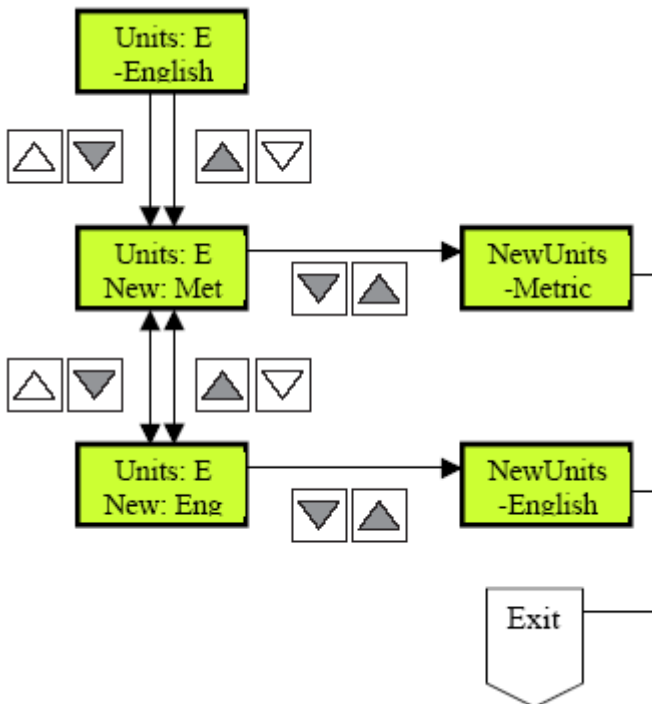
There are two display modes available for units: English or metric. To change your units of measurement, use the ▲ and ▼ scroll buttons until you get to the sub-menu:



Press the ▲ and ▼ arrows simultaneously if you want to retain the current designation.



Press one of the scroll buttons to show the second mode for displaying units. If you want to retain the second display mode, confirm this by pressing the ▲ and ▼ buttons simultaneously.



D-Displaying the active service codes:

The fault finding module enables the machine faults and alarms to be displayed in real time. When a fault appears, the display shows the message "SrvcCode" every five seconds between displaying the current parameters.

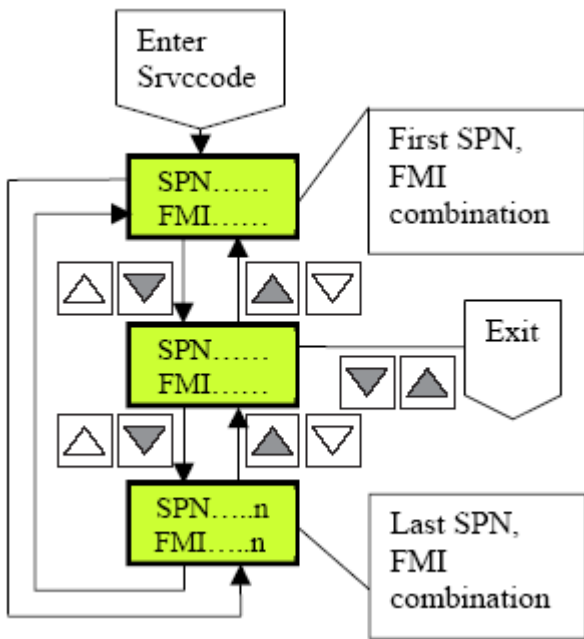


The orange LED will light up when an alarm code is displayed (engine does not stop), the red LED will light up when a fault code is displayed.

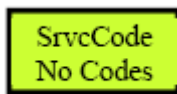
SPN and FMI codes are used in standard J1939 to identify faulty equipment

SPN: Suspect Parameter Number.

FMI: Failure Mode Indicator.



In the event that there are no active fault codes, the following screen will appear:



Depending on the SPN/FMI code, refer to the attached "List of engine fault codes" and "Engine user and maintenance manual" for help on fault finding and maintenance.

Note that the manufacturer documents do not always stipulate the SPN used, for example:

- Volvo uses a set of codes called PID (Parameter Identifier) or SID (System Identifier); these two names relate to standards J1587 or J1979, but in the case of VOLVO engines they relate to standard J1587. These two codes find their equivalent in standard J1939 (SPN). The attached "List of engine fault codes" indicates the SPN equivalent to Volvo's SID and PID.
- John DEERE complies with standard J1939 and uses SPN codes.

E-display of machine codes programmed:

The MDDM can display the codes of services programmed in the ECU memory. These programmed service codes are useful for generating set fault finding and maintenance.

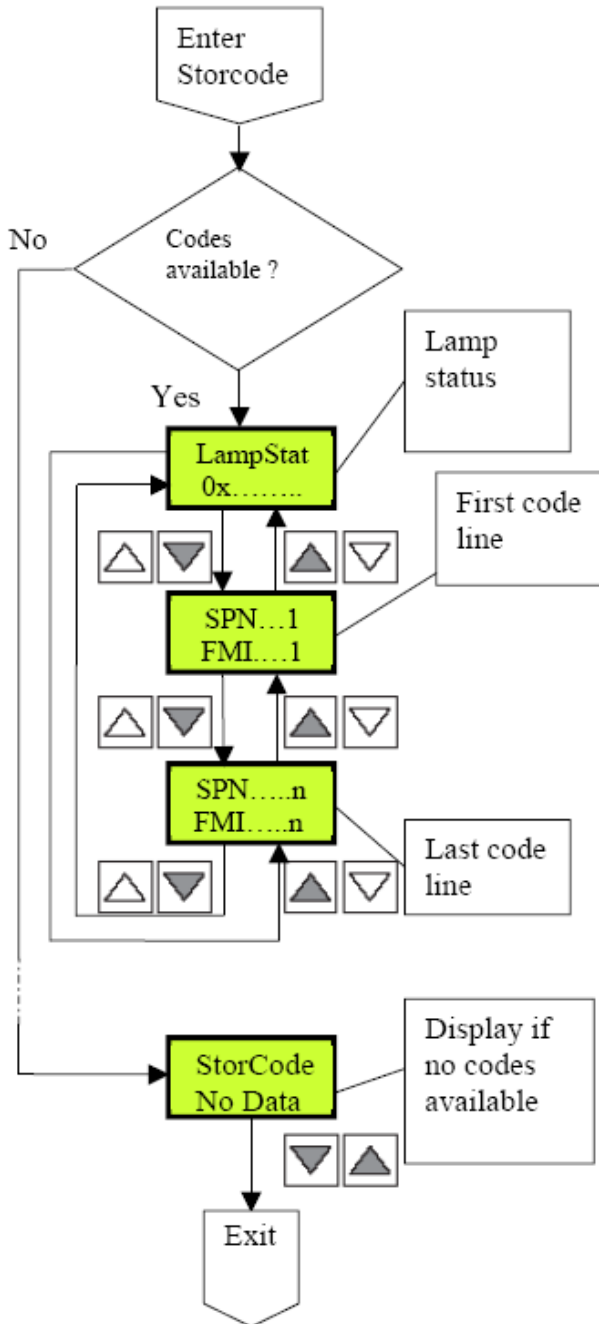
To display the programmed codes, scroll through the parameters until you reach the following sub-menus:



In the event that there are no programmed codes to display, the following screen will appear:



The purpose of programmed codes is to create a fault log, which is used to determine recurrent faults and thereby carry out effective corrective and preventive maintenance on the engine; also it not desirable to delete these when the generating set is in operation onsite. Note that at the test bench outlets the EEPROM memory, in which the programmed codes are stored, is reset to zero. The following diagram shows the structure of the STORCODE (programmed code) menu and how to go to each parameter:



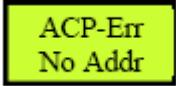
F)-Fault finding module internal errors.

Like any equipment using internal memory and a program, the fault finding module generates fault codes. Two types of code can be recognised:

- Address Claim Procedure Errors
- Run Time Bus Errors.

Address Claim Procedure Errors (ACP-Err):

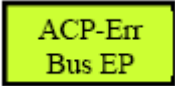
The following fault codes relate to the switching on of the fault finding module.

Error Code 1:


ACP-Err
No Addr

When switched on, the fault finding module must issue a request to the ECU for the network addresses used in order to exploit them; this screen appears when:

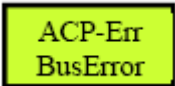
- an address cannot be used.
- the fault finding module cannot find the default addresses.
- an address cannot be found in the correct register.

Error Code 2:


ACP-Err
Bus EP

Passive Bus Error: this code appears when:

- the fault finding module cannot detect the ECU: in this case the CAN Bus is open.
- the CAN_hi and CAN_lo run time bus connection is reversed between the source (ECU) and the fault finding module.

Error Code 3:


ACP-Err
BusError

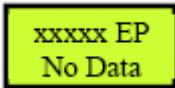
This code is the result of the following problems:

- the CAN_Hi or CAN_lo bus, or both, are connected to an electrical ground or an external source of current.
- data is being not transmitted at a standard baud rate.

This type of fault generally requires repairs to be carried out on the CAN BUS connection and therefore involves work on the engine wiring harness, i.e. on the fault finding module extension.

Run Time Bus Errors:

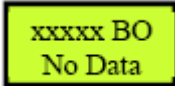
Fault codes can only be active if the fault finding module has been able to obtain the network addresses when it was switched on, see Address Claim Procedure Errors (ACP-err).

Error Code 1:


xxxxx EP
No Data

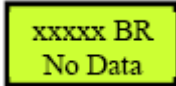
EP=Passive Error, this screen appears when the fault finding module loses contact with the ECU, there may be two causes of this:

- one connector on the bus connection is disconnected.
- the CAN Bus is open.

Error Code 2:


xxxxx BO
No Data

BO=Bus Off, in this case, the case is identical to Error code 3 of the ACP.

Error Code 3:


xxxxx BR
No Data

BR=Bus Reset, this error code is similar to Error code 3 of the ACP, as are its causes. In this case the fault finding module has encountered problems on the CAN Bus and it tries to automatically re-establish the network connection.

6.3. Generator set with TELYS control panel

6.3.1 Control panel presentation

6.3.1.1. View of the front panel

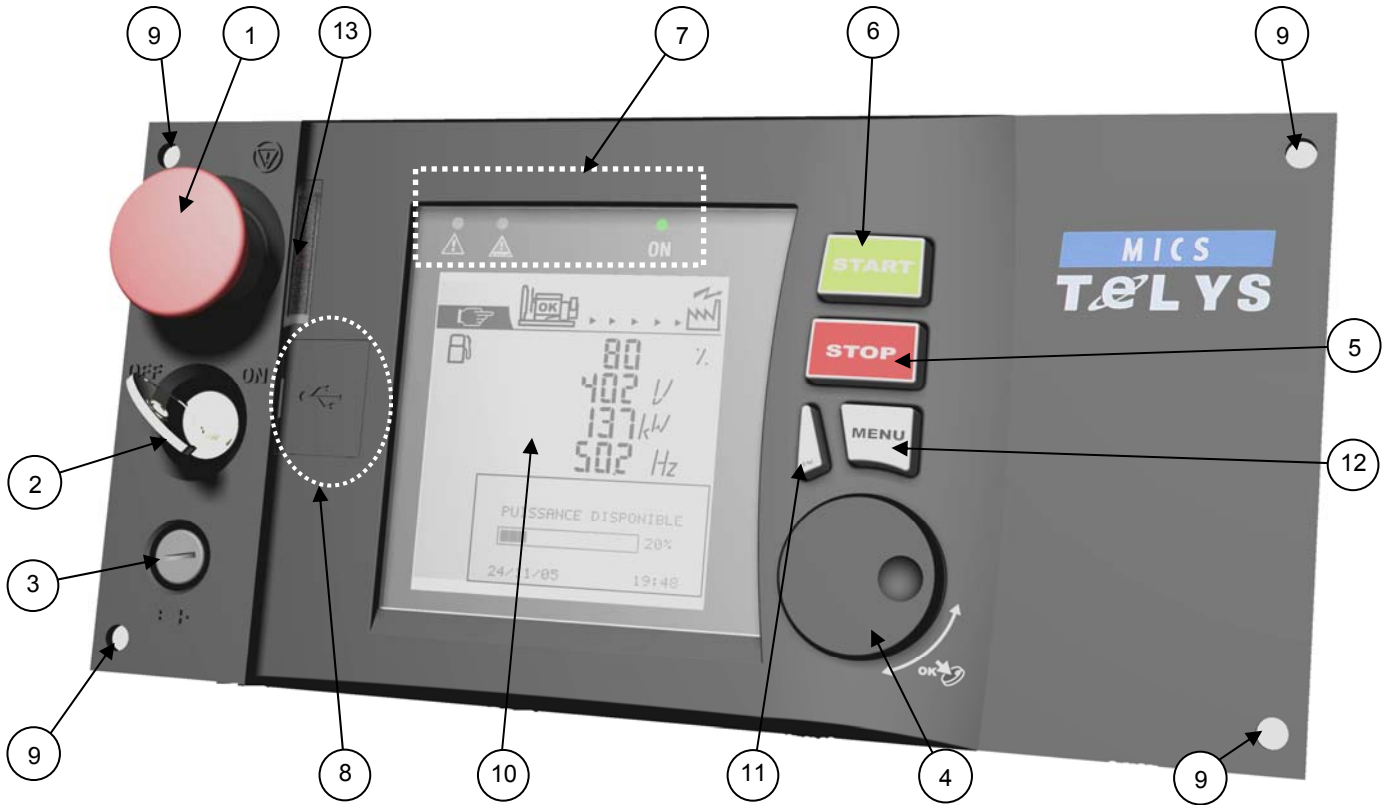


Figure 19 : View of the front panel

- 1 Emergency stop button (AU) for switching off the generating set in the event of a fault which could endanger personnel or damage equipment.
- 2 Key switch for switching the module on/off.
- 3 Electronic board protection fuse.
- 4 Scrolling and selection wheel for scrolling through the menus and screens and selecting items simply by pressing the wheel.
- 5 STOP button, press to switch off the generating set.
- 6 START button, press to switch on the generating set.
- 7 Power ON LEDs and alarm/fault warning LEDs.
- 8 Location of USB ports.
- 9 Mounting bolt.
- 10 LCD for displaying alarms and faults, operating statuses, electrical and mechanical quantities.
- 11 ESC button: for returning to the previous selection and for default RESET function.
- 12 MENU button for accessing the menus.
- 13 Lighting for the emergency stop button.



Figure 20 : Description of the LEDs

A lit LED indicates:

- 1 Alarm activated (flashing yellow).
- 2 Fault found (flashing red).
- 3 Module on (green, on continuously).

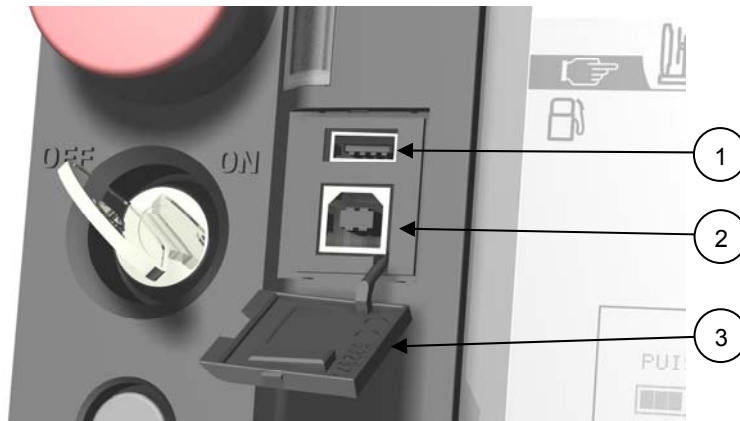


Figure 21 : Close-up of USB ports

- 1 USB key connection (HOST): file transfer between USB key and TELYS and vice versa.
- 2 Connection for microcomputer (DEVICE):
 - file transfer between PC and TELYS and vice versa,
 - main module power supply.
- 3 Protective cover.

6.3.1.2. Description of the screen

The screen is backlit and requires no contrast adjustments. This screen is divided into 4 zones.

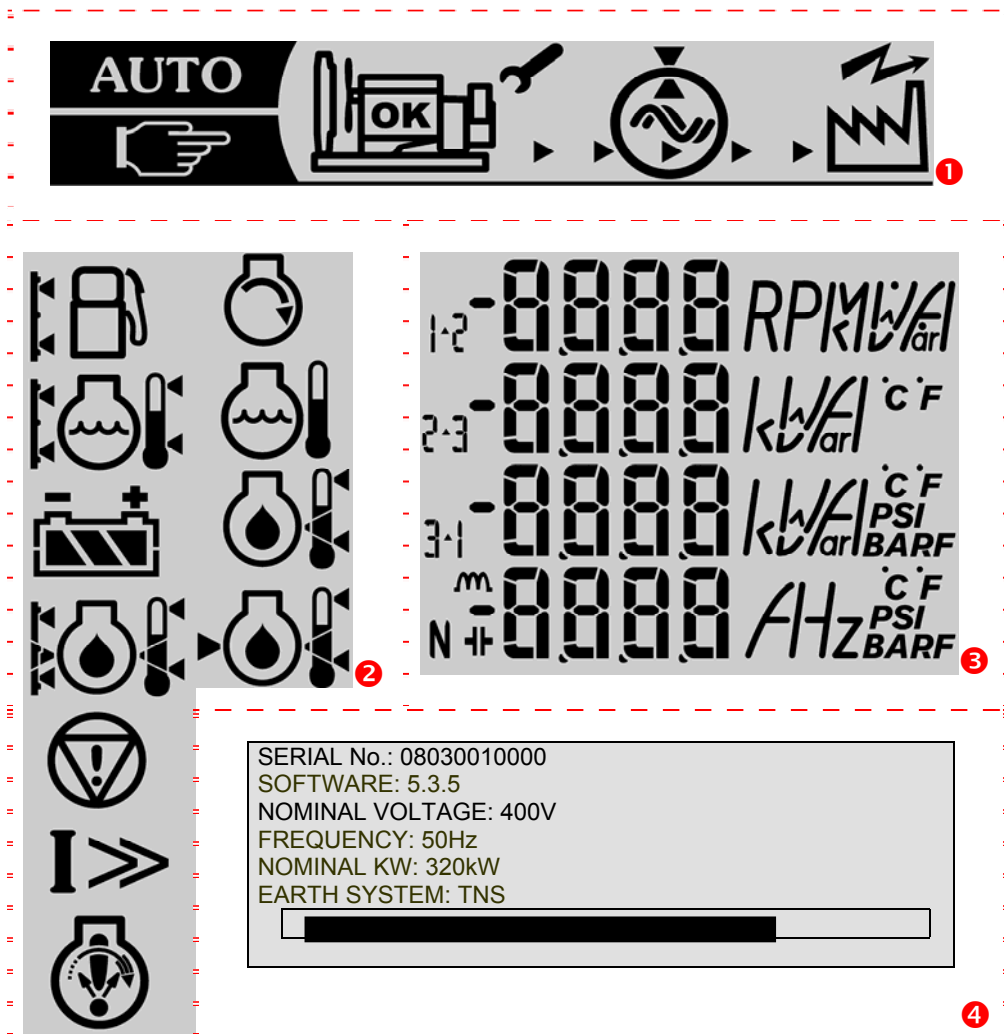












Figure 22 : Description of the screen (example)

- ① Zone 1: in this zone, the status of the generating set is displayed
- ② Zone 2: in this zone, pictograms relating to dimensions measured are displayed, as well as Alarm and Fault pictograms
- ③ Zone 3: in this zone, the measured values corresponding to the measured dimensions are displayed with the corresponding units of measurement
- ④ Zone 4: in this zone, messages relating to the control of the generating set and the menus are displayed.

Note: the information displayed on measurements, alarms and faults as well as messages and menus relating to control of the generating set will depend on the equipment level of each generating set. Certain screens may therefore not be present.

6.3.1.3. Description of the pictograms in zone 1


















Zone 1 pictograms

Pictograms	Display	Activation conditions
 "MAN" mode	Fixed	TELYS in manual mode (MAN)
	Flashing	For 5 seconds when switching from AUTO to MAN mode
 "AUTO" mode	Fixed	TELYS in automatic mode (AUTO)
	Flashing	For 5 seconds when switching from MAN to AUTO mode
	Flashing	Genset starting
	Fixed	Genset started
	Fixed	Genset stabilised (voltage and frequency)
	Flashing (impression of constant movement from left to right)	The genset is generating and in use
	Fixed	Usage supplied
	Not used	
	Fixed	Synchronisation
	Flashing	
	Fixed	Genset synchronised or coupled

6.3.1.4. Description of the pictograms in zone 2

Alarm and fault pictograms in zone 2

All the pictograms in this zone are activated when TELYS is initialised.


Data displayed			
Fuel level indicator			
Alarm / Fault low fuel level		Alarm / Fault high fuel level	
Coolant level / temperature indicator			
Alarm Low level fault		High level fault alarm	
		Alarm High temperature fault	
		No preheating fault alarm	
Battery			
Min battery voltage (flashing)		Max battery voltage (flashing)	
		Battery charge indicator (flashing bars)	
Oil pressure / temperature indicator			
Oil pressure Alarm / Fault		High or low oil level Alarm / Fault	
		High or low oil temperature Alarm / Fault	
Emergency stop			
Emergency stop fault			
Overload or short circuit			
Tripping of circuit breaker following an overload or short circuit			
Engine speed			
Underspeed fault		Overspeed fault	
		Non-starting fault	

6.3.1.5. Description of the pictograms in zone 3

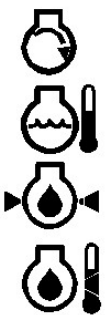
Zone 3 pictograms

All the pictograms for these zones are activated when the TELYS is initialised. The pictograms below are shown for information only.


Generating set stopped

Screen No.	Pictograms	Data displayed
P1	 80 % 11 °C 25.2 V 12 °C	Fuel Level Indication High-temperature (HT) coolant temperature indication (units as per settings menu) Battery Voltage indication Oil Temperature Indication (units as per settings menu)



Genset start-up or genset started or genset stoppage in progress

Screen No.	Pictograms	Data displayed
P2	 600 RPM 48 °C 1.7 BAR 43 °C	Engine Speed Indication High-temperature (HT) coolant temperature indication (units as per settings menu) Oil Pressure Indication (units as per settings menu) Oil Temperature Indication (units as per settings menu)

Genset started

Screen No.	Pictograms	Data displayed
P3 Operation default screen	 80 % 40.2 V 0 kW 50.2 Hz	Fuel Level Indication Alternator Compound Voltage Indication Total Active Power Indication Alternator Frequency Indication
P4	1-2 40.4 2-3 40.3 V 3-1 40.3 50.2 Hz	Alternator U12 compound Voltage Indication Alternator U23 compound Voltage Indication Alternator U31 compound Voltage Indication Alternator Frequency Indication

Screen No.	Pictograms	Data displayed
P5		<p>Alternator V1 single Voltage Indication</p> <p>Alternator V2 single Voltage Indication</p> <p>Alternator V3 single Voltage Indication</p> <p>Alternator Frequency Indication</p>
P6		<p>Alternator U12 compound Voltage Indication</p> <p>Alternator V2 single Voltage Indication</p> <p>Alternator V1 single Voltage Indication</p> <p>Alternator Frequency Indication</p>
P7		<p>Alternator V1 single Voltage Indication</p> <p>Alternator phase 1 Current Indication</p> <p>Alternator Frequency Indication</p>
P8		<p>Alternator phase 1 Current Indication</p> <p>Alternator phase 2 Current Indication</p> <p>Alternator phase 3 Current Indication</p> <p>Alternator Neutral Current Indication</p>
P9		<p>Total Active Power Indication</p> <p>Total Reactive Power Indication</p> <p>Total Apparent Power Indication</p> <p>Total Output Factor Indication (inductive or capacitive)</p>

Screen No.	Pictograms	Data displayed
P10	 80 %  142 V 20 A	Fuel Level Indication Battery Voltage indication Battery Ammeter Indication
P11	90 kVar 400 V 318 kW 50.1 Hz	Total Reactive Power Indication Alternator U12 compound Voltage Indication Total Active Power Indication Alternator Frequency Indication

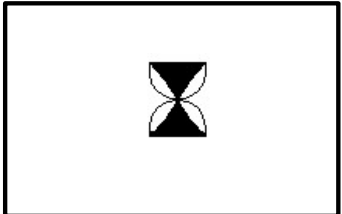

Order of appearance of screens based on the type of network with the genset started.

Order of appearance	Type of line			
	3P+N	3P	2P+N	1P+N
1	P3 if genset started P11 if genset coupled	P3 if genset started P11 if genset coupled	P3 if genset started P11 if genset coupled	P3 if genset started P11 if genset coupled
2	P4	P4	P6	P7
3	P5	P8	P8	P9
4	P8	P9	P9	P2
5	P9	P2	P2	P10
6	P2	P10	P10	
7	P10			

The screen is changed using the scrolling and validation wheel.
 When the wheel is turned clockwise, the screens scroll upwards and backwards.
 The screens scroll in a loop.
 Example: in a 3P+N network after screen 7, then screen 1 and in reverse.

6.3.1.6. Display of messages in zone 4

The graphic zone (zone 4) is used to display messages relating to the generating set's operation. These messages are as follows:
Initialisation of the TELYS

Screen No.	Screen	Data displayed
G 1		Initialisation of the TELYS when switching on and/or when loading a configuration
G 2	<div style="border: 1px solid black; padding: 5px;"> SERIAL No.: 08030010000 SOFTWARE: 6.1.0 NOMINAL VOLTAGE: 400V FREQUENCY: 50Hz NOMINAL KW: 320kW EARTH SYSTEM: TNS  </div>	Generating set serial number TELYS software version Alternator nominal voltage Alternator nominal frequency Nominal active power Neutral speed Bar graph indicating the screen display time

Generating set stopped

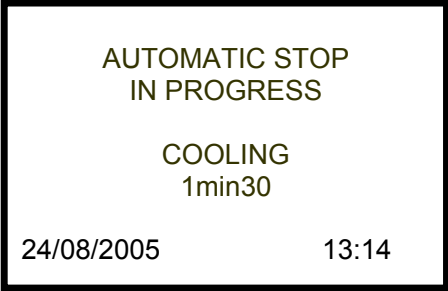
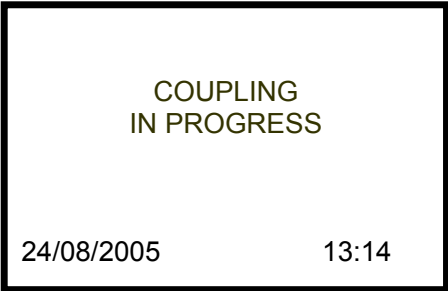
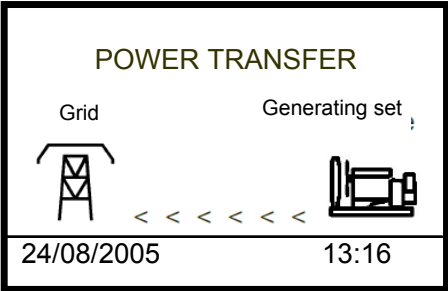
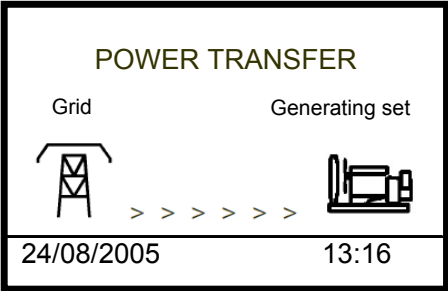
Screen No.	Screen	Data displayed
G 3	<div style="border: 2px solid black; padding: 10px; text-align: center;"> <p>MANUAL OPERATION</p> <p>Press START to start</p> <p>24/08/2005 13:12</p> </div>	<p>Operation mode - genset in MAN mode ready to start Date and time (depending on settings)</p>
G 4	<div style="border: 2px solid black; padding: 10px; text-align: center;"> <p>AUTOMATIC OPERATION</p> <p>IMPORTANT IMMEDIATE START-UP POSSIBLE</p> <p>24/08/2005 13:12</p> </div>	<p>Operation mode - genset in AUTO mode ready to start Date and time (depending on settings)</p>
G 5	<div style="border: 2px solid black; padding: 10px; text-align: center;"> <p>IMPORTANT</p> <p>AUTOMATIC starting 19min30</p> <p>24/08/2005 13:12</p> </div>	<p>Operation mode - genset in AUTO mode with programmed start Countdown of micro disconnection delay OR EJP (for France only) Date and time (depending on settings)</p>

Generating set start-up

Screen No.	Screen	Data displayed
G 6	<p>STARTING IN PROGRESS</p> <p>24/08/2005 13:12</p>	<p>Operating phase - genset starting Date and time (depending on settings)</p>
G 7	<p>AIR PREHEATING</p> <p>10sec</p> <p>24/08/2005 13:12</p>	<p>Operating phase - air preheating prior to genset starting Countdown of the air preheating delay Date and time (depending on settings)</p>

Generating set started

Screen No.	Screen	Data displayed
G 8 Default screen	<p>AVAILABLE POWER</p> <p>75%</p> <p>24/08/2005 13:12</p>	<p>Operating phase – genset operating – stable voltage and frequency Available power Date and time (depending on settings)</p>
G 9	<p>AUTOMATIC STOP IN PROGRESS</p> <p>LOAD SUPPRESSION 1min30</p> <p>24/08/2005 13:12</p>	<p>Operation mode - operation in AUTO mode Power supply device opens (motorised circuit breaker or changeover switch controlled by the TELYs) Countdown of the Mains Return delay OR Test on load delay Date and time (depending on settings)</p>

Screen No.	Screen	Data displayed
G 10		<p>Operation mode - operation in AUTO mode Genset cooling in progress Countdown of the Engine Stop delay (cooling) OR Gradual Stop delay (Water temperature) OR Overload Gradual Stop delay OR No Load Test delay Date and time (depending on settings)</p>
G-10/1		<p>Operation mode - operation in AUTO mode Synchronisation of the genset with the grid or another genset Date and time (depending on settings)</p>
G-10/2		<p>Operation mode - operation in AUTO mode Transfer of power from the generating set to the grid Date and time (depending on settings)</p>
G-10/3		<p>Operation mode - operation in AUTO mode Transfer of power from the grid to the generating set Date and time (depending on settings)</p>

Generating set stoppage

Screen No.	Screen	Data displayed
G 11	<div style="border: 2px solid black; padding: 10px; text-align: center;"> <p>STOPPAGE IN PROGRESS</p> <p>24/08/2005 13:16</p> </div>	<p>Genset stoppage Date and time (depending on settings)</p>


Change of operation mode (switch from MAN mode to AUTO mode when an automatic start demand is issued)

Screen No.	Screen	Data displayed
G 12	<div style="border: 2px solid black; padding: 10px; text-align: center;"> <p>AUTOMATIC start demand Do you want to switch to AUTO mode? IMPORTANT Immediate start</p> <p>OK Esc</p> </div>	<p>Operation mode - operation in MAN mode AUTOMATIC start demand</p>

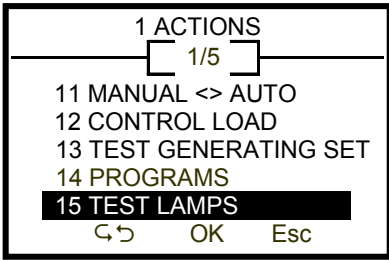
Generating set stop demand if a fault occurs or if STOP is pressed in AUTO mode

Screen No.	Screen	Data displayed
G 13	<div style="border: 2px solid black; padding: 10px; text-align: center;"> <p>MAN mode activated</p> <p>Do you want to switch to AUTOMATIC mode?</p> <p>OK Esc</p> </div>	<p>Operation mode - operation in AUTO mode (genset running) Warning message for switch to MAN mode if STOP is pressed or if a fault occurs</p>
G 13/1	<div style="border: 2px solid black; padding: 10px; text-align: center;"> <p>The "51 Hz" offset must be applied to all of the power plant's gensets</p> <p>Esc</p> </div>	<p>Operating phase – genset operating – stable voltage and frequency Warning message for setting offset on all of the power plant's generating sets</p>

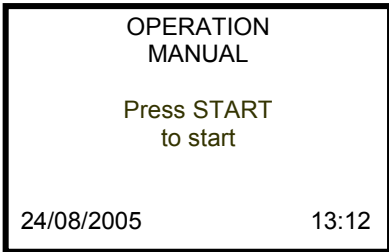
6.3.2 Starting

	Check that the generating set circuit breaker has triggered.
Danger	

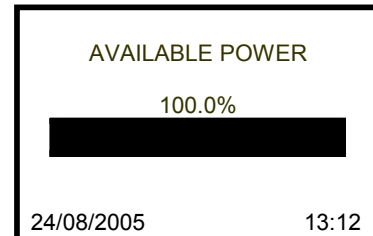
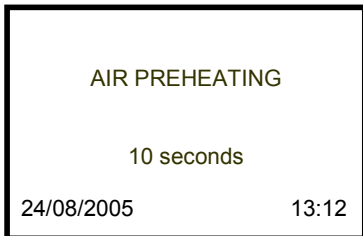
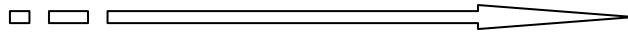
- ❶ Connect the generating set battery
- ❷ Turn the key switch to the ON position (without forcing it to the ON position), the ON lamp will light up (if the lamp does not light up, check and replace the fuse if necessary)
- ❸ Test the Alarm and Fault LEDs (menu 15 – TEST LAMPS)



- ❹ Press "Esc" several times to return to the following home menu



- ❺ Check the battery voltage
- ❻ Press START:



The following pictogram is displayed







- If the engine is equipped with an air preheating system, there is a delay (adjustable) before the engine starts (preheating activation period).
- If the motor is not fitted with an air preheating system or once the preheating delay has elapsed, the engine starts up (start of a cycle comprising 3 attempts to start up the engine).

Warning: the number of successive and automatic starting attempts is limited to 3.

The following pictogram will flash



The following information is displayed

	Speed of rotation	Options
	Coolant temperature	
	Oil pressure	
	Oil Temperature	

6.3.3 Switching off

- ❶ Open the circuit breaker
 - manually
 - OR
 - by selecting menu 12 "CONTROL LOAD"

The following display will disappear (supply stopped)



- ❷ Press the STOP button
- ❸ The following screen is displayed and the generating set will stop



- ❹ Switch TELYS off by turning the key to "OFF" (without forcing it to the "OFF" position).

6.3.4 Alarms and faults

6.3.4.1. Viewing alarms and faults

Alarms and faults are displayed as follows:

- ❶ Alarms

All alarms will cause:

- the yellow LED to flash "General alarm".

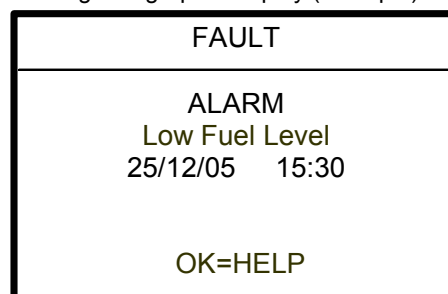


In conjunction with this LED:

- a flashing pictogram appears on the LCD screen representing the circuit affected by the alarm and the associated indicator, if present (example)



- message on graphic display (example)



② Faults

All faults will cause:

- the generating set to stop: immediate or gradual stop (coolant temperature and overload or short circuit)

- the red LED to flash "General fault".

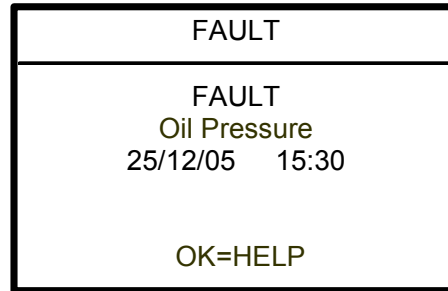


In conjunction with this LED:

- a flashing pictogram appears on the LCD screen representing the circuit affected by the fault and the associated indicator, if present (example)



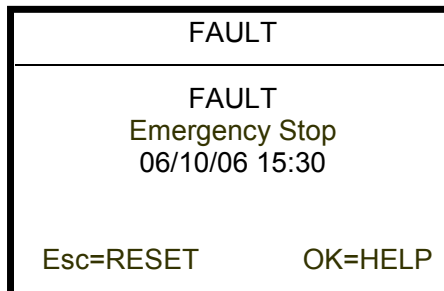
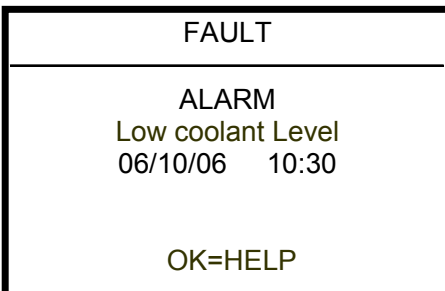
- message on graphic display (example)



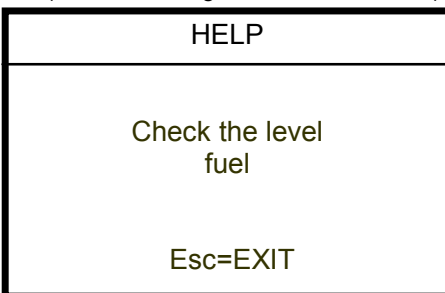
Faults have priority over alarms. Faults are displayed in the descending order of their appearance (from the most recent to the oldest).

6.3.4.2. Activation of an alarm or fault

The appearance of an alarm or a fault causes the corresponding screen to be displayed (examples below)



Press OK (on the scrolling and selection wheel) to access the help message if it is available (example below)



If the alarm is no longer active, it is reset automatically (cause disappears).

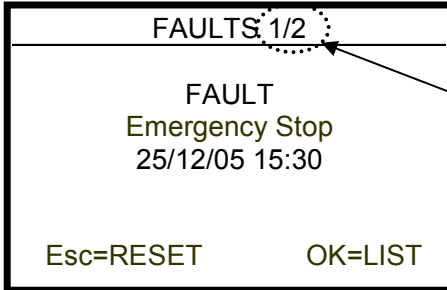
Press Esc to reset a fault:

- reset acknowledged if the cause of the fault has been removed
- reset not performed if the cause of the fault is still present.

6.3.4.3. Activation of an alarm and a fault

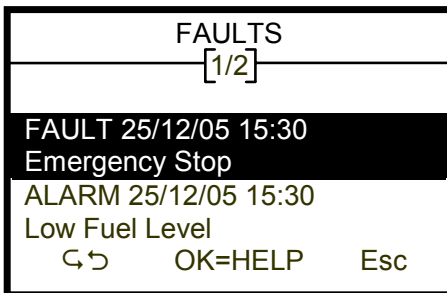
The appearance of an alarm **and** a fault causes:

- The yellow and red LEDs to flash
- the related screen to be displayed (example below)

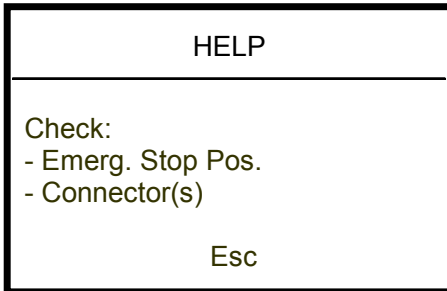


If several faults are present, the number of faults is displayed at the top of the screen.

The faults list can be accessed by pressing OK (of the scrolling and selection wheel) (examples below)



Press Esc to return to the previous screen.
 Press OK to go to the HELP screen (help on the highlighted fault)
 Use the scrolling and selection wheel to scroll through the list of faults.



If the alarm is no longer active, it is reset automatically (cause disappears).

Press Esc to reset a fault:

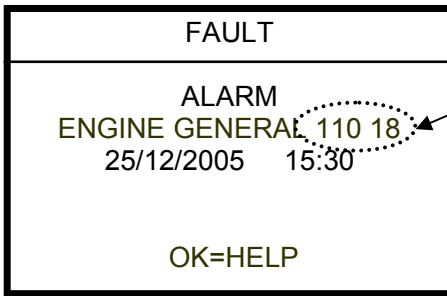
- reset acknowledged if the cause of the fault has been removed
- reset not performed if the cause of the fault is still present.

6.3.4.4. Engine fault codes display

Certain alarms and engine faults generate specific fault codes. These codes are standardised according to the J1939 and/or J1587 standards.

Terminology used by the SAE CAN J1939 standard	
SPN: Suspect Parameter Number	This represents the system or component at fault, for example: SPN 100, indicates an oil pressure problem or a problem with the oil pressure sensor.
FMI: Failure Mode identifier	This represents the type of fault that has occurred. This may be an electrical, mechanical or equipment fault.
Terminology used by VOLVO	
SID: System Identifier	This term, used in the J1587 standard, has an equivalent in the J1939 standard (SPN). However, this term corresponds, more particularly, to an assembly of components, for example, the injection system.
PID: Parameter Identifier	This term, used in the J1587 standard, has an equivalent in the J1939 standard (SPN). However, this term corresponds, more particularly, to a specific component, for example, a sensor.
PPID: Parameter Identifier	This term, used in the J1587 standard, has an equivalent in the J1939 standard (SPN). PPID corresponds to PID, but is only used by VOLVO.
FMI: Failure Mode identifier	This represents the type of fault that has occurred. This may be an electrical, mechanical or equipment fault. VOLVO uses a SID-FMI or PID-FMI or PPID-FMI combination.
Terminology used by JOHN DEERE	
SPN: Suspect Parameter Number	This represents the system or component at fault, for example: SPN 100, indicates an oil pressure problem or a problem with the oil pressure sensor.
FMI: Failure Mode identifier	This represents the type of fault that has occurred. This may be an electrical, mechanical or equipment fault.

In the event of a fault, the screen will display the following message:



Engine fault code.

Pressing OK will display fault finding information.

In addition, appendix D indicate the meaning of the code. The checking and maintenance operations to carry out in order to solve the fault are included in the user and maintenance manuals of the engines supplied with the generating set documentation.

For JOHN DEERE (JD) and VOLVO (VO) engines, the codes displayed are SPN and FMI codes.

6.3.4.5. Horn reset

Depending on the settings made (menu 363 - HORN), the activation of an alarm and/or a fault leads to the horn sounding and the following screen appearing:



This screen will display first any messages relating to the alarms and faults that appear as soon as OK is pressed.

7. Maintenance schedule

7.1. Reminder of use

The maintenance interval frequency and the operations to be carried out are outlined in the maintenance schedule, given as a guideline.

N.B. the environment in which the generating set is operating determines this schedule.

If the generating set is used in extreme conditions, shorter intervals between maintenance procedures should be observed

These maintenance intervals only apply to generating sets running on fuel, oil and coolant which conform to the specifications given in this manual.

7.2. Maintenance safety instructions

Before each operation, please observe the following maintenance safety instructions:

- ✓ read the safety instructions carefully (chapter 1),
- ✓ refer systematically to the maintenance instructions,
- ✓ the battery isolating switch must be in the open position,
- ✓ no operations must be carried out while the motor is running,
- ✓ wear protective equipment (gloves, goggles, safety shoes etc.),
- ✓ before operating on a pressurised circuit, ensure that the circuit pressure has been reduced (atmospheric pressure),
- ✓ after the operations, ensure that the equipment is clean, or clean it if necessary.

7.3. Table of maintenance operations

OPERATIONS	10 h Daily	Every 2 weeks	500 h	1000 h 1 years	2000 h 2 years	4500 h	5000 h	10 000 h	20 000 h 3 years
Generator set									
• Check the general condition				•					
• Check the tightening torques				•					
• Check the absence of leaks			•						
• Check the condition of battery charge			•						
• Clean the battery terminals			•						
• Check condition and connections of electrical equipment			•						
• Clean with compressed air the relays and contactors			•						
Engine									
• Check engine oil and coolant level	•								
• Check air filter restriction indicator ^a	•								
• Check fuel filter / Water bowl	•								
• Operate engine at rated speed and 50-70% load a minimum of 30 minutes ^b		•							
• Change engine oil and filter ^c			•						
• Replace fuel filter element(s)			•						
• Check crankcase vent system			•						
• Check engine mounts			•						
• Check engine ground connection			•						
• Check belt tension and automatic tensioner				•					
• Check cooling system				•					
• Check air intake system				•					
• Replace crankcase vent filter (Optional)				•					
• Check crankshaft vibration damper (6cyl.) ^d				•					
• Check and adjust engine speed				•					
• Drain and flush cooling system ^e					•				
• Adjust valve clearance					•				
• Replace crankshaft vibration damper (6cyl.)						•			
• Replace injection nozzles							•		
• Replace thermostat								•	
Alternator									
• Check the tightening torques	After the first 20 hours								
• Check the general condition									
• Check the various electrical connections of the installation									
• Grease the bearings									
									•

^a Clean air filter element when restriction indicator is red. Replace filter element after 6 cleanings or once a year.
^b For standby generator set only.
^c Change oil and filter after the first 100 hours of operation, then every 500 hours maximum thereafter. Change oil and filter at least once a year.
^d Have your authorized dealer or engine distributor replace the vibration damper every 4500 hours / 5 years.
^e Drain and flush cooling system every 3000 hours / 3 years when John Deere COOL-GARD II coolant is used. Otherwise every 2000 hours / 2 years.

7.4. Cover maintenance

!	The sealing between the cover and the frame and between the frame and the retention tank is ensured by a gasket. It is essential to replace the gasket if the cover has been removed.
IMPORTANT	

Users must maintain the enclosures and base frames to ensure that the paintwork retains all its protective properties.

7.5. Trailer maintenance

Operations \ Frequency		When commissioning and before towing	Every 6 months	Every year
Check	General condition of the vehicle	●		
	Tyre pressure	●		
	Tighten the wheel nuts	●		
	Efficiency of the automatic brake		●	●
	Efficiency of the parking brake		●	●
	Braking adjustment and distribution across all wheels		●	●
	Wear on brake linings and drums			●
	No play in the hubs			●
	Play in the clamping tube			●
	Play in the ball socket or ring			●
Lubricate	Braking control hinges and joints		●	●
	Stabilising		●	●

Lubricate or grease the moving parts on the coupling device (see lubrication point examples in the Figure 23).

- ✓ Recommended lubricant: general purpose grease compliant with DIN 51825 KTA 3KA.

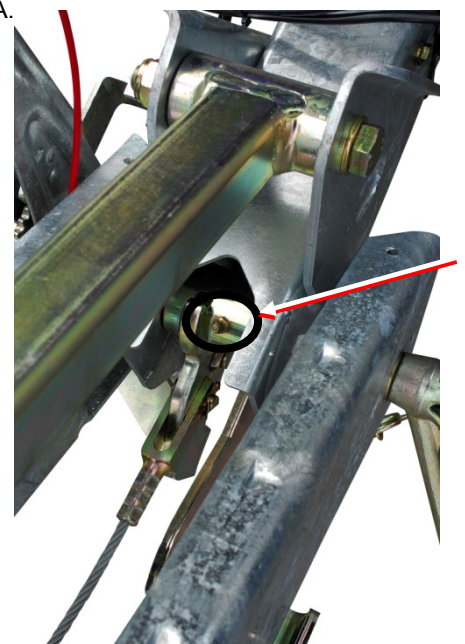
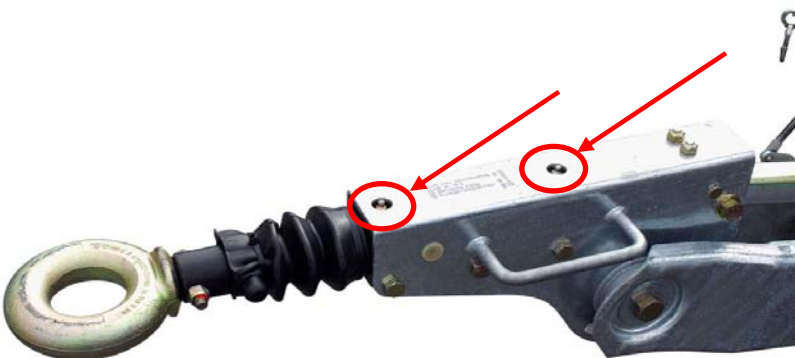


Figure 23 : Trailer lubrication/greasing points

7.6. Common Spare Parts

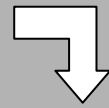
GenPARTS




R220C3
Rental Power







JOHN DEERE
6068HFS86



ENGINE	Rocker cover gasket	330362904	x 1
	Belt	330360183	x 1
	Thermostat	330364770	x 1
	Thermostat Gasket	330361286	x 1

GENLUB		x 20 L	330910115	x 1
		x 208 L	330910095	

GENCOOL		x 20 L	330910098	x 1
		x 60 L	330910099	
		x 210 L	330910100	

	<p>330570108+330570107</p>	<p>x 1</p>
	<p>330362912 + 330362934</p>	<p>x 1</p>
	<p>330560661</p>	<p>x 1</p>

	<p>LEROY-SOMER LSA462M5</p>	
---	---	---

ALTERNATOR	<p>Bearing grease</p>	<p>330411113</p>	<p>x 1</p>
	<p>Bearing</p>	<p>330810047</p>	<p>x 1</p>

For any need of spare parts, please contact:

Spare Parts department
☎ : +33(0)02.98.41.13.07
e-mail :genparts@sdmo.com

To find your nearest center service, please consult our website:

www.sdmo.com

7.7. Fault finding

Refer to the user manual and engine and alternator maintenance manuals appended.
Additionally, in the event of an abnormal rise in engine temperature, check that the radiator is clean.

7.8. No load and under load tests

Notes on operation at no load and under load:

When operating at no load or low load (< 30% of nominal power), the operating conditions do not allow optimum running of the engine.

The main causes are as follows:

- ✓ The low volume of fuel burned in the combustion chamber leads to incomplete combustion; the resulting thermal energy means that the optimum engine operating temperature cannot be reached.
- ✓ Overheated engines have lower compression ratios (low compression ratio without turbocharging), which are defined for full load and not suitable for good combustion at low load.

All of these factors lead to choking of the engine, in particular the piston rings and valves, which leads to:

- ✓ Accelerated wear and glazing of the cylinder liners
- ✓ Loss of sealing of seats, and sometimes sticking of valve stems.

Consequently, operating any turbocharged engine at low load (< 30%) can only have adverse repercussions on an engine's operation and its service life. Maintenance intervals will have to be shortened to accompany harsh operating conditions. Shortening draining intervals, among other things, will enable you to change the oil more frequently, which will tend to be choked with unburnt particles and contaminated with fuel. Adding a load bench is generally used to limit low load phases, and obtain the periodic full loads necessary to unchoke the engine.

Finally, when operating under load, we advise vigilance towards the oil breather circuit, and more particularly towards engines which have the crankcase vent connected to the turbocharger inlet (risk of oil or oil vapour absorption and accelerated engine speed).

On load tests:




It is recommended to conduct an on load test on the generating set monthly, for a period of around 1 hour after stabilisation of the parameters.

The load must be greater than 50% of nominal power (ideally 80%), to ensure unchoking of the engine and to obtain a decent picture of the generating set operation.

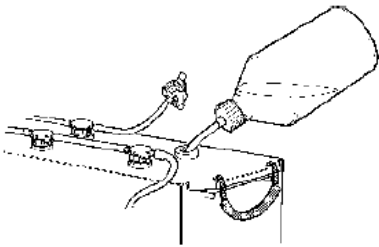
Off load test (no load):

This test is not recommended; it must not exceed 10 minutes, and must not be repeated without a monthly on load test. This test only allows you to check for correct engine start-up. It does not allow you to check that the generating set is working properly.

8. Starter batteries

 DANGER		
	<p>Risk of explosion or fire (oxygen and hydrogen present). The battery must never be exposed to any naked flames or sparks.</p> <p>Risk of sparks forming and an explosion. When fitting the battery, never invert the polarities. Do not short the battery terminals with a tool or other metal object.</p> <p>Risk of injury. Battery electrolyte is extremely corrosive. Always protect your eyes, skin and clothing when handling batteries. Always wear protective goggles and gloves. In the event of contact with the skin, wash thoroughly with water and soap. If the eyes are splashed, rinse thoroughly with water and consult a doctor immediately.</p>	

8.1. Checking the electrolyte level



The electrolyte level must be approximately 10 mm above the battery plates.

1. Top up with distilled water if necessary.
2. Pour the distilled water carefully to avoid any splashes.

Wear protective goggles and rubber gloves when handling the battery (adding water, charging, etc.).

Note: some batteries requiring no maintenance form the subject of specific instructions which must be respected.

After the battery has been topped up, it must be recharged for at least 30 minutes.

8.2. Checking the voltage/acid density

Every 2 months, the following checks must be performed:

1. Check the density of the acid contained in the cells (all the battery cells must have the same density; if this is not the case, the battery must be replaced)
2. Check the voltage when idle.

Acid density	Charge status	Voltage when idle	Observation / action
1.27	100%	Above 12.60 V	
1.25	80%	12.54 V	
1.20	60%	12.36 V	From 60% recharge
1.19	40%	12.18 V	Risk of sulphation
1.13	20%	Below 11.88 V	Unusable

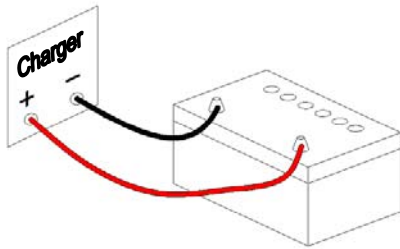
The results of the density and voltage measurements make it possible to define the charge status of the battery. If the charge status is less than 60%, the battery must be recharged.

8.3. Charging the battery

Highly discharged or sulphated batteries (formation of whitish lead sulphate deposit on the plates, which becomes hard) can no longer regenerate or be charged in a generating set.

!	A discharged battery should be recharged immediately, or else it will suffer irreparable damage.
IMPORTANT	

Battery charge



Example of charge:

- 12V 60 Ah battery = 6 A charging current;
- Charge status: 50% (acid density 1.19 and voltage when idle 12.30V);
- The battery is short 30 Ah, and this must be recharged.
- Charge factor: 1.2;
- $30 \text{ Ah} \times 1.2 = 36 \text{ Ah}$ to be charged;
- Charging current: 6A, approximately 6 hours charging required; the charging current must always be $1/10^{\text{th}}$ of the nominal capacity of the battery.

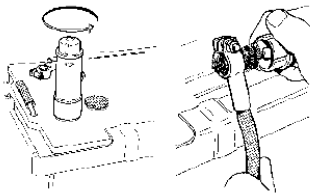
Recharging is complete when the battery voltage and the acid density stop increasing.

The power of the charger must be suitable for the battery to be charged and the charging time available.

Note: if several batteries connected together are being recharged, the following points must be checked:

- Are the batteries connected in series?
- Is the voltage chosen exact? 1 battery x 12 V, 3 x 36V batteries.
- Adjust the charge current to the lowest battery.
- The power difference between the batteries must be as low as possible.

8.4. Cleaning the battery



Keep the batteries clean and dry. The presence of impurities and rust on the battery and terminals may cause the current jumps, voltage drops and the battery to discharge, particularly in humid weather.


1. Clean any signs of oxidation on the battery terminals and the cable terminals using a brass brush.
2. Fully tighten the cable terminals and lubricate them with grease for battery terminals or vaseline. A terminal which is not secured correctly may cause sparks and therefore lead to an explosion.

8.5. Fault finding

Fault observed	Probable origin	Measures or observations
The acid heats up when a new battery is filled	Incorrect composition Incorrect storage Prolonged storage in a damp place	Cool Charge the battery Check the acid density
The acid escapes through the filler holes	The battery is too full	Reduce the battery fluid level
Acid level too low	Battery tray not leaktight Considerable formation of gas due to a very high charging voltage	Replace the battery Check the charger and repair if necessary
Acid level too low Incorrect operation from start-up	Insufficient charge Short circuit in the power circuit Consumption fault	Recharge the battery Check the electrical installation
Acid density too high	The battery has been filled with acid instead of water	Reduce the acid level and fill with distilled water. Repeat the operation if necessary
Starting problems Starting test incorrect	Battery empty Battery exhausted or faulty Capacity too low Battery sulphated	Recharge the battery Replace the battery
Battery terminals melted	Incorrect electrical connection Battery cabling incorrect	Tighten the ends of the battery cables or replace them if necessary and replace the battery
One or two cells release a lot of gas at high charge	Faulty cell(s)	Replace the battery
The battery discharges very quickly	Charge status too low Short circuit in the power circuit High self-discharge (for example: through electrolyte contamination) Sulphation (storage of discharged battery)	Check the load Replace the battery
Short service life	Incorrect battery part no Repeated deep discharging Battery stored too long without charge	Define the correct battery part no. for the recommended use It is recommended to charge the battery using a regulator
High water consumption	Overload Charging voltage too high	Check the charger (voltage regulator).
The battery explodes	Sparks after battery charging Short circuit Connection or disconnection during charging Internal fault (for example: interruption) and low electrolyte level	Replace the battery

9. Options

9.1. Dual frequency

	<p>This operation must be carried out by a qualified electrician. These operations must only be carried out when the generating set is stopped, until you are instructed to start up the generating set.</p>
IMPORTANT	

- Close the battery isolating switch to turn on the TELYS 2.



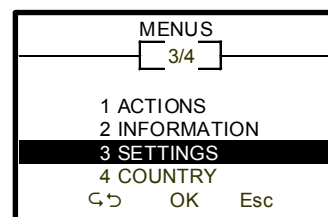
- Turn the supply switch of the TELYS 2 to the "ON" position.



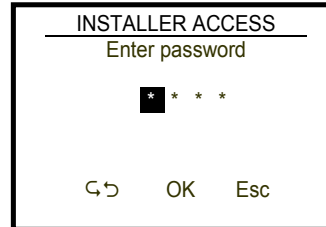
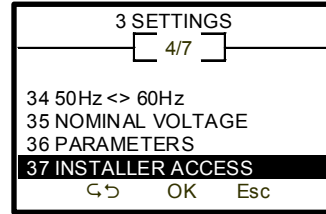
- Press the "MENU" key.



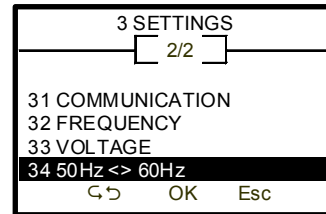
- Using the knob, select "3 SETTINGS" and press the knob to confirm.



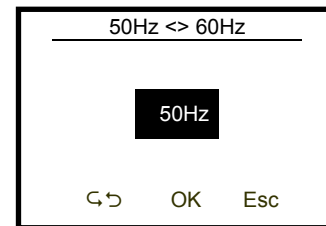
- As not all the settings are available, go to the "37 INSTALLER ACCESS" menu to enter the code "1966" using the knob to call up the desired menus.



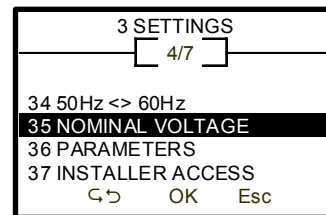
- Using the knob, select "34 50Hz<=>60Hz" and press the knob to confirm.



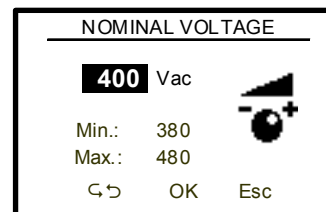
- Select and confirm the desired frequency using the knob to scroll and confirm (50 Hz or 60 Hz).



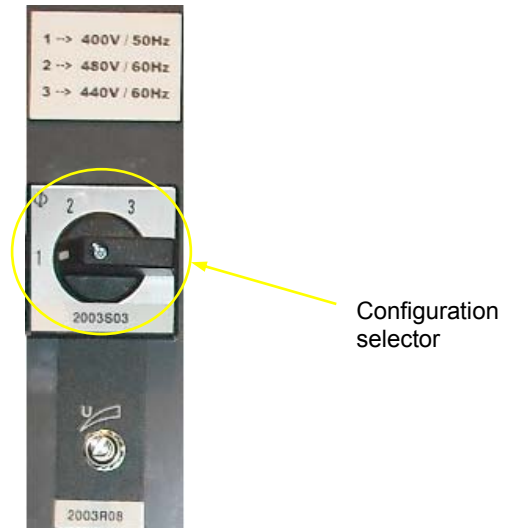
- Return to the "3 SETTINGS" screen and use the knob to select "35 NOMINAL VOLTAGE" then press the knob to confirm.



- Set the desired voltage then confirm using the scroll and confirm knob.



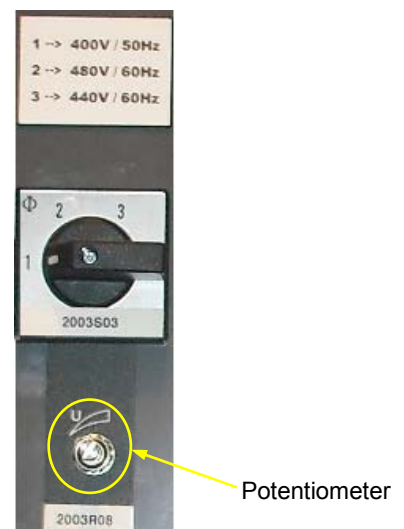
- Select the desired configuration using the configuration option selector located next to the TELYS 2 control unit.



- Start up the generating set by pressing the "START" button.



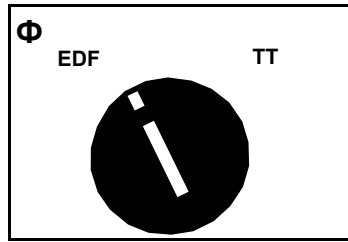
- Adjust the voltage after starting up the generating set using the 2003R08 potentiometer.



Warning: when switching to 60Hz, do not use sockets if fitted to the generating set.

9.2. Neutral system

Turn the switch to the desired neutral system.

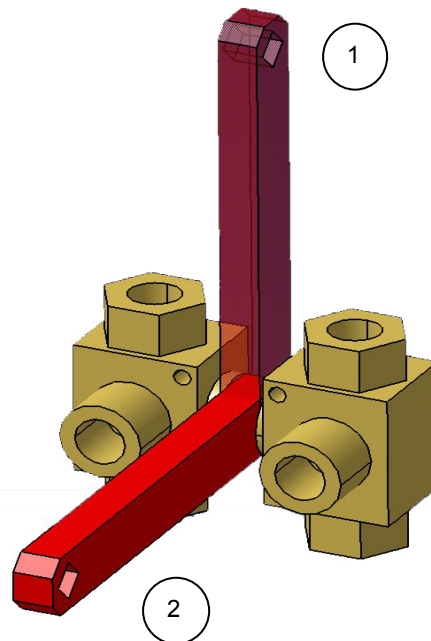


Important

Select the neutral system with the generating set switched off.

9.3. Fuel supply valve

The 3-way valve is used to select between the generating set fuel tank and an external fuel supply.



Valve in vertical position (no. 1): generating set supplied by the daily service tank.

Valve in horizontal position (no. 2): generating set supplied by the external tank.

10. Appendix

10.1. Appendix A – Engine user and maintenance manual

User guide and maintenance manual

JOHN DEERE

Engine

4045HFS86

4045HFS87

4045HFS88

4045HFS85

6068HFS85

6068HFS86

6090HFS85

6090HFS86

Engines & Power Units for Generator Sets Stage III A (Saran-Built)

OPERATOR'S MANUAL

Engines & Power Units for Generator Sets Stage III A (Saran-Built)

OMCD16510 ISSUE L0 (ANGLAIS)

CALIFORNIA

Proposition 65 Warning

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

If this product contains a gasoline engine:

WARNING

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

The State of California requires the above two warnings.

Additional Proposition 65 Warnings can be found in this manual.

John Deere Usine De Saran

European Edition
PRINTED IN GERMANY

Introduction

Foreword

THIS MANUAL COVERS the following Stage III A engines for generator sets:

Engine Pack

CD3029TFU80 (Mechanical Fuel System)
CD4045HFU82 (HPCR System, 2-Valve Head)
CD6068HFU82 (HPCR System, 2-Valve Head)
RG6090HFU84 (HPCR System, 4-Valve Head)

Bare Engine

CD4045HFS86 (HPCR System, 2-Valve Head)
CD4045HFS87 (HPCR System, 2-Valve Head)
CD4045HFS88 (HPCR System, 2-Valve Head)
CD6068HFS85 (HPCR System, 2-Valve Head)
CD6068HFS86 (HPCR System, 2-Valve Head)

READ THIS MANUAL carefully to learn how to operate and service your engine correctly. Failure to do so could result in personal injury or equipment damage.

THIS MANUAL SHOULD BE CONSIDERED a permanent part of your engine and should remain with the engine when you sell it.

MEASUREMENTS IN THIS MANUAL are given in metric. Use only correct replacement parts and fasteners. Metric and inch fasteners may require a specific metric or inch wrench.

WRITE ENGINE SERIAL NUMBERS and option codes in the spaces indicated in the Serial Number Section. Accurately record all the numbers. Your dealer also needs these numbers when you order parts. File the identification numbers in a secure place off the engine or machine.

RIGHT-HAND AND LEFT-HAND sides are determined by standing at the drive or flywheel end (rear) of the engine and facing toward the front of the engine.

SETTING FUEL DELIVERY beyond published factory specifications or otherwise overpowering will result in loss of warranty protection for this engine.

Information relative to emissions regulations

Depending on final destination, this engine can meet the emissions regulations according to the US Environmental Protection Agency (EPA), California Air Resources Board (CARB) and for Europe, the Directive 97/68/EC relating the measures against the emissions of gaseous and particulates pollutants from internal combustion engines. In this case an emission label is stuck on the engine.

Emission regulations prohibit tampering with the emission-related components listed below which would render that component inoperative or to make any adjustment on the engine beyond published specifications. It is also illegal to install a part or component where the principal effect of that component is to bypass, defeat, or render inoperative any engine component or device which would affect the engine conformance to the emissions regulations. To summarize, it is illegal to do anything except return the engine to its original published specifications.

List of emission-related components:

- Fuel injection pump
- Intake manifold
- Turbocharger
- Charge air cooling system
- Piston

CALIFORNIA PROPOSITION 65 WARNING

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

CD03523,0000293 -19-23DEC10-1/1

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Original Instructions. All information, illustrations and specifications in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

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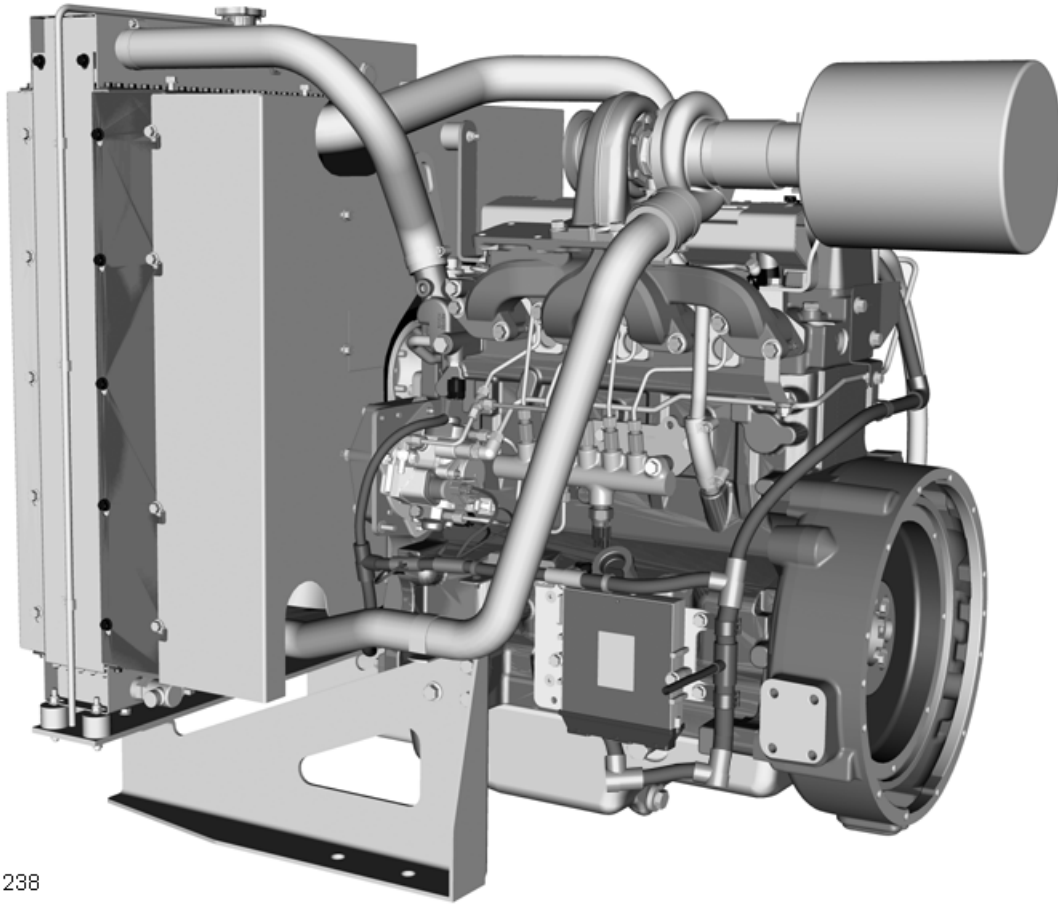
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Identification Views



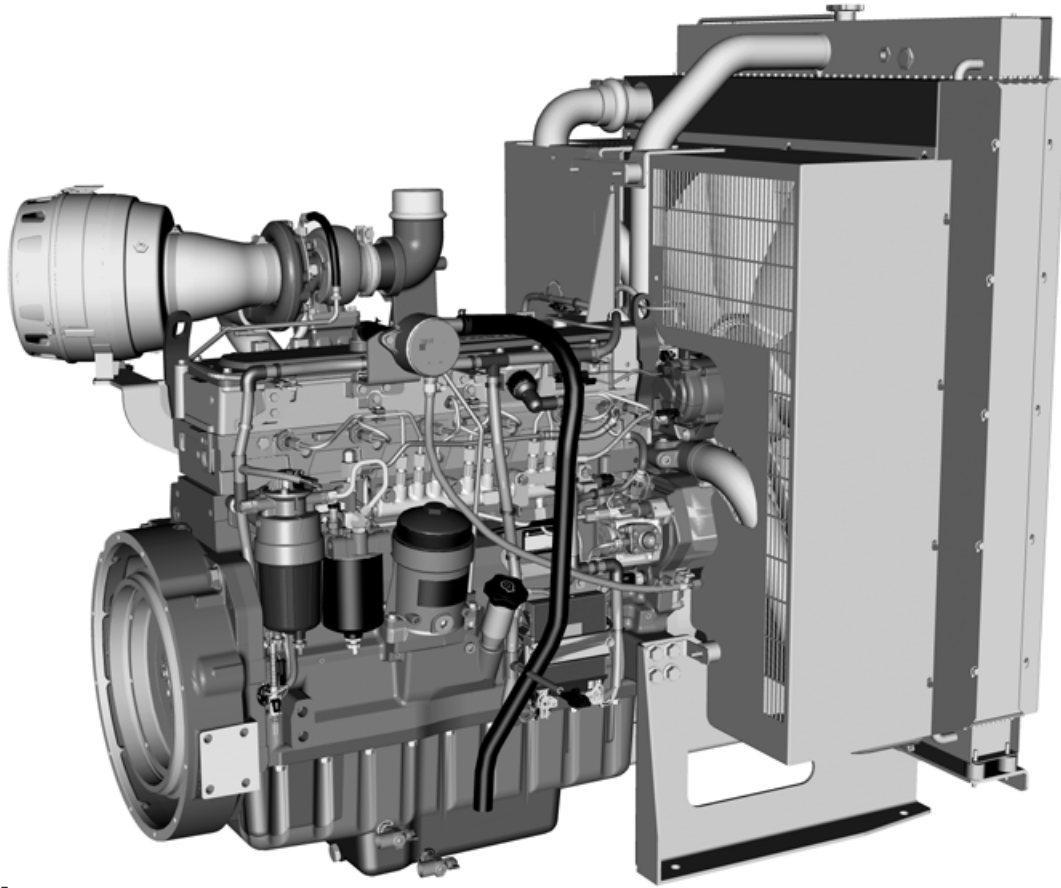
CD31238

4045HFU82

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CD03523,0000294 -19-04NOV10-1/2

CD31238 —UN—04NOV10



CD31239

6090HFU84

CD03523,0000294 -19-04NOV10-2/2

CD31239—UN—04NOV10

Maintenance Records

Using maintenance records

To obtain the best performance, economy and service life from your engine, ensure service is carried out according to this present manual and recorded in the following pages. It is recommended that your engine Distributor or your Dealer carry out this service work and stamp the appropriate case.

Keeping an accurate account of all service performed on your engine will give more value to the machine when resell it.

John Deere oils and coolants have been formulated to give maximum protection and performance to your engine. We recommend only genuine John Deere service products and replacement parts.

To protect your rights under the warranty ensure all scheduled services are carried out and recorded. If your engine is covered by extended warranty, it is important to maintain this record for the duration of the warranty.

DPSG,CD03523,6 -19-22JAN07-1/1

100 Hours of operation

- Engine oil, drain
- Engine oil filter, replace
- Hose connections, check

Number of hours:	Observation:	Dealer or distributor stamp
Date:		
Job done by:		

DPSG,CD03523,7 -19-22JAN07-1/1

500 Hours of operation

- Engine oil, drain
- Engine oil filter, replace
- Fuel filter elements, replace
- Crankcase vent system, clean
- Engine mounts, check
- Engine ground connection, check

Number of hours:	Observation:	Dealer or distributor stamp
Date:		
Job done by:		

CD03523,0000295 -19-22DEC10-1/1

1000 Hours of operation

- | | |
|--|---|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Air intake system, check |
| <input type="checkbox"/> Engine oil filter, replace | <input type="checkbox"/> Crankshaft vibration damper, check |
| <input type="checkbox"/> Fuel filter elements, replace | <input type="checkbox"/> Engine mounts, check |
| <input type="checkbox"/> Belt, check tension and wear | <input type="checkbox"/> Engine ground connection, check |
| <input type="checkbox"/> Cooling system, check | <input type="checkbox"/> Engine speed, check and adjust |
| <input type="checkbox"/> Crankcase vent system, clean or replace filter (optional) | |

Number of hours:	Observation:	Dealer or distributor stamp
Date:		
Job done by:		

CD03523,0000296 -19-03JAN11-1/1

1500 Hours of operation

- | | |
|--|--|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Crankcase vent system, clean |
| <input type="checkbox"/> Engine oil filter, replace | <input type="checkbox"/> Engine mounts, check |
| <input type="checkbox"/> Fuel filter elements, replace | <input type="checkbox"/> Engine ground connection, check |

Number of hours:	Observation:	Dealer or distributor stamp
Date:		
Job done by:		

CD03523,0000297 -19-22DEC10-1/1

2000 Hours of operation

- | | |
|---|---|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Air intake system, check |
| <input type="checkbox"/> Engine oil filter, replace | <input type="checkbox"/> Crankshaft vibration damper, check |
| <input type="checkbox"/> Fuel filter elements, replace | <input type="checkbox"/> Engine mounts, check |
| <input type="checkbox"/> Belt, check tension and wear | <input type="checkbox"/> Engine ground connection, check |
| <input type="checkbox"/> Cooling system, check or drain and flush (if COOL-GARD II is not used) | <input type="checkbox"/> Engine speed, check and adjust |
| <input type="checkbox"/> Crankcase vent system, clean or replace filter (optional) | <input type="checkbox"/> Valve clearance, adjust |

Number of hours:	Observation:	Dealer or distributor stamp
Date:		
Job done by:		

CD03523,0000298 -19-03JAN11-1/1

2500 Hours of operation

- | | |
|--|--|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Crankcase vent system, clean |
| <input type="checkbox"/> Engine oil filter, replace | <input type="checkbox"/> Engine mounts, check |
| <input type="checkbox"/> Fuel filter elements, replace | <input type="checkbox"/> Engine ground connection, check |

Number of hours:	Observation:	Dealer or distributor stamp
Date:		
Job done by:		

CD03523,0000299 -19-22DEC10-1/1

3000 Hours of operation

- | | |
|---|---|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Air intake system, check |
| <input type="checkbox"/> Engine oil filter, replace | <input type="checkbox"/> Crankshaft vibration damper, check |
| <input type="checkbox"/> Fuel filter elements, replace | <input type="checkbox"/> Engine mounts, check |
| <input type="checkbox"/> Belt, check tension and wear | <input type="checkbox"/> Engine ground connection, check |
| <input type="checkbox"/> Cooling system, check or drain and flush (if COOL-GARD II is used) | <input type="checkbox"/> Engine speed, check and adjust |
| <input type="checkbox"/> Crankcase vent system, clean or replace filter (optional) | |

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp
---	--------------	-----------------------------

CD03523,000029A -19-03JAN11-1/1

3500 Hours of operation

- | | |
|--|--|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Crankcase vent system, clean |
| <input type="checkbox"/> Engine oil filter, replace | <input type="checkbox"/> Engine mounts, check |
| <input type="checkbox"/> Fuel filter elements, replace | <input type="checkbox"/> Engine ground connection, check |

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp
---	--------------	-----------------------------

CD03523,000029B -19-22DEC10-1/1

4000 Hours of operation

- | | |
|---|---|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Air intake system, check |
| <input type="checkbox"/> Engine oil filter, replace | <input type="checkbox"/> Crankshaft vibration damper, check |
| <input type="checkbox"/> Fuel filter elements, replace | <input type="checkbox"/> Engine mounts, check |
| <input type="checkbox"/> Belt, check tension and wear | <input type="checkbox"/> Engine ground connection, check |
| <input type="checkbox"/> Cooling system, check or drain and flush (if COOL-GARD II is not used) | <input type="checkbox"/> Engine speed, check and adjust |
| <input type="checkbox"/> Crankcase vent system, clean or replace filter (optional) | <input type="checkbox"/> Valve clearance, adjust |

Number of hours:	Observation:	Dealer or distributor stamp
Date:		
Job done by:		

CD03523,000029D -19-03JAN11-1/1

4500 Hours of operation

- | | |
|--|--|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Crankcase vent system, clean |
| <input type="checkbox"/> Engine oil filter, replace | <input type="checkbox"/> Engine mounts, check |
| <input type="checkbox"/> Fuel filter elements, replace | <input type="checkbox"/> Engine ground connection, check |

Number of hours:	Observation:	Dealer or distributor stamp
Date:		
Job done by:		

CD03523,000029E -19-22DEC10-1/1

5000 Hours of operation

- | | |
|--|---|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Air intake system, check |
| <input type="checkbox"/> Engine oil filter, replace | <input type="checkbox"/> Crankshaft vibration damper, check |
| <input type="checkbox"/> Fuel filter elements, replace | <input type="checkbox"/> Engine mounts, check |
| <input type="checkbox"/> Belt, check tension and wear | <input type="checkbox"/> Engine ground connection, check |
| <input type="checkbox"/> Cooling system, check | <input type="checkbox"/> Engine speed, check and adjust |
| <input type="checkbox"/> Crankcase vent system, clean or replace filter (optional) | |

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp
---	--------------	-----------------------------

CD03523,000029F -19-03JAN11-1/1

5500 Hours of operation

- | | |
|--|--|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Crankcase vent system, clean |
| <input type="checkbox"/> Engine oil filter, replace | <input type="checkbox"/> Engine mounts, check |
| <input type="checkbox"/> Fuel filter elements, replace | <input type="checkbox"/> Engine ground connection, check |

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp
---	--------------	-----------------------------

CD03523,00002A0 -19-22DEC10-1/1

6000 Hours of operation

- | | |
|--|---|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Air intake system, check |
| <input type="checkbox"/> Engine oil filter, replace | <input type="checkbox"/> Crankshaft vibration damper, check |
| <input type="checkbox"/> Fuel filter elements, replace | <input type="checkbox"/> Engine mounts, check |
| <input type="checkbox"/> Belt, check tension and wear | <input type="checkbox"/> Engine ground connection, check |
| <input type="checkbox"/> Cooling system, drain and flush | <input type="checkbox"/> Engine speed, check and adjust |
| <input type="checkbox"/> Crankcase vent system, clean or replace filter (optional) | <input type="checkbox"/> Valve clearance, adjust |

Number of hours:	Observation:	Dealer or distributor stamp
Date:		
Job done by:		

CD03523,00002A1 -19-03JAN11-1/1

6500 Hours of operation

- | | |
|--|--|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Crankcase vent system, clean |
| <input type="checkbox"/> Engine oil filter, replace | <input type="checkbox"/> Engine mounts, check |
| <input type="checkbox"/> Fuel filter elements, replace | <input type="checkbox"/> Engine ground connection, check |

Number of hours:	Observation:	Dealer or distributor stamp
Date:		
Job done by:		

CD03523,00002A2 -19-22DEC10-1/1

7000 Hours of operation

- | | |
|--|---|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Air intake system, check |
| <input type="checkbox"/> Engine oil filter, replace | <input type="checkbox"/> Crankshaft vibration damper, check |
| <input type="checkbox"/> Fuel filter elements, replace | <input type="checkbox"/> Engine mounts, check |
| <input type="checkbox"/> Belt, check tension and wear | <input type="checkbox"/> Engine ground connection, check |
| <input type="checkbox"/> Cooling system, check | <input type="checkbox"/> Engine speed, check and adjust |
| <input type="checkbox"/> Crankcase vent system, clean or replace filter (optional) | |

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp
---	--------------	-----------------------------

CD03523,00002A3 -19-03JAN11-1/1

7500 Hours of operation

- | | |
|--|--|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Crankcase vent system, clean |
| <input type="checkbox"/> Engine oil filter, replace | <input type="checkbox"/> Engine mounts, check |
| <input type="checkbox"/> Fuel filter elements, replace | <input type="checkbox"/> Engine ground connection, check |

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp
---	--------------	-----------------------------

CD03523,00002A4 -19-22DEC10-1/1

8000 Hours of operation

- | | |
|---|---|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Air intake system, check |
| <input type="checkbox"/> Engine oil filter, replace | <input type="checkbox"/> Crankshaft vibration damper, check |
| <input type="checkbox"/> Fuel filter elements, replace | <input type="checkbox"/> Engine mounts, check |
| <input type="checkbox"/> Belt, check tension and wear | <input type="checkbox"/> Engine ground connection, check |
| <input type="checkbox"/> Cooling system, check or drain and flush (if COOL-GARD II is not used) | <input type="checkbox"/> Engine speed, check and adjust |
| <input type="checkbox"/> Crankcase vent system, clean or replace filter (optional) | <input type="checkbox"/> Valve clearance, adjust |

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp
---	--------------	-----------------------------

CD03523,00002A5 -19-03JAN11-1/1

8500 Hours of operation

- | | |
|--|--|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Crankcase vent system, clean |
| <input type="checkbox"/> Engine oil filter, replace | <input type="checkbox"/> Engine mounts, check |
| <input type="checkbox"/> Fuel filter elements, replace | <input type="checkbox"/> Engine ground connection, check |

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp
---	--------------	-----------------------------

CD03523,00002A6 -19-22DEC10-1/1

9000 Hours of operation

- | | |
|---|---|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Air intake system, check |
| <input type="checkbox"/> Engine oil filter, replace | <input type="checkbox"/> Crankshaft vibration damper, replace |
| <input type="checkbox"/> Fuel filter elements, replace | <input type="checkbox"/> Engine mounts, check |
| <input type="checkbox"/> Belt, check tension and wear | <input type="checkbox"/> Engine ground connection, check |
| <input type="checkbox"/> Cooling system, check or drain and flush (if COOL-GARD II is used) | <input type="checkbox"/> Engine speed, check and adjust |
| <input type="checkbox"/> Crankcase vent system, clean or replace filter (optional) | |

Number of hours:	Observation:	Dealer or distributor stamp
Date:		
Job done by:		

CD03523,00002A7 -19-03JAN11-1/1

9500 Hours of operation

- | | |
|--|--|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Crankcase vent system, clean |
| <input type="checkbox"/> Engine oil filter, replace | <input type="checkbox"/> Engine mounts, check |
| <input type="checkbox"/> Fuel filter elements, replace | <input type="checkbox"/> Engine ground connection, check |

Number of hours:	Observation:	Dealer or distributor stamp
Date:		
Job done by:		

CD03523,00002A8 -19-22DEC10-1/1

10000 Hours of operation

- | | |
|---|---|
| <input type="checkbox"/> Engine oil, drain | <input type="checkbox"/> Air intake system, check |
| <input type="checkbox"/> Engine oil filter, replace | <input type="checkbox"/> Crankshaft vibration damper, check |
| <input type="checkbox"/> Fuel filter elements, replace | <input type="checkbox"/> Engine mounts, check |
| <input type="checkbox"/> Belt, check tension and wear | <input type="checkbox"/> Engine ground connection, check |
| <input type="checkbox"/> Cooling system, check or drain and flush (if COOL-GARD II is not used) | <input type="checkbox"/> Engine speed, check and adjust |
| <input type="checkbox"/> Crankcase vent system, clean or replace filter (optional) | <input type="checkbox"/> Valve clearance, adjust |
| <input type="checkbox"/> Thermostats, replace | <input type="checkbox"/> Fuel injectors, replace |

Number of hours:

Observation:

Dealer or distributor stamp

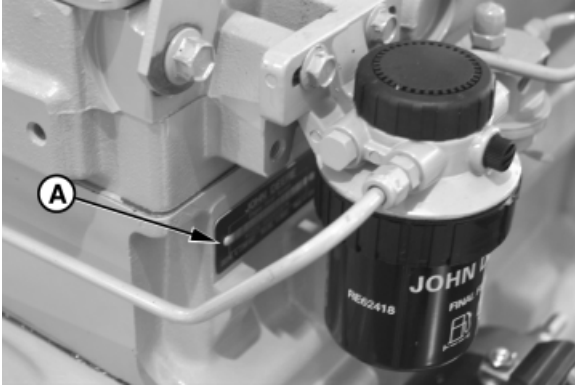
Date:

Job done by:

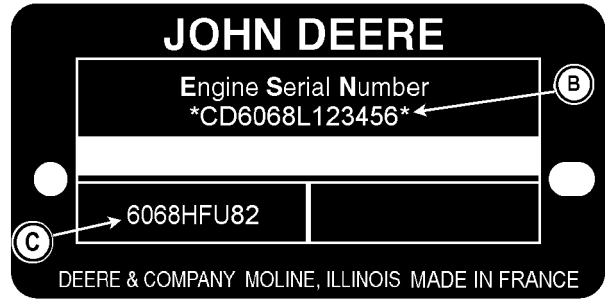
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Serial Numbers

Record Engine Serial Number (3029, 4045 and 6068 Engines)



Engine Serial Number Plate



3029, 4045 and 6068 Engine Serial Number Plate

A—Engine Serial Number Plate **B**—Engine Serial Number

C—Engine Model Number

The engine serial number plate (A) is located on the right-hand side of engine block behind the fuel filter.

Engine Model Number (C)

Record all of the numbers and letters found on your engine serial number plate in the spaces provided below.

This information is very important for repair parts or warranty information.

Engine Serial Number (B)

RG8007 —UN—15JAN99

CD31240 —UN—24NOV10

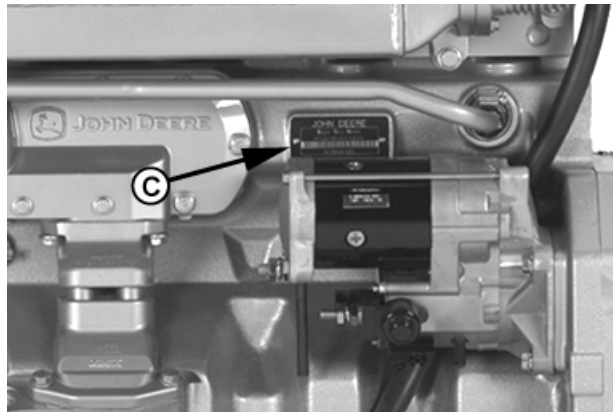
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Record Engine Serial Number (6090 Engines)



6090 Engine Serial Number Plate

CD31241 —UN—24NOV10



Location of Engine Serial Number Plate

RG13813 —UN—11JAN05

A—Engine Serial Number **B**—Engine Model Number

C—Engine Serial Number Plate

The engine serial number plate (C) is located on the left-hand side of engine block between intake manifold and starter motor.

Engine Model Number (B)

Record all of the numbers and letters found on your engine serial number plate in the spaces provided below.

This information is very important for repair parts or warranty information.

Engine Serial Number (A)

CD03523.00002AB -19-23NOV10-1/1

Engine Option Codes



CD31242—UN—24NOV10

A—Engine Base Code

In addition to the serial number plate, OEM engines have an engine option code label affixed to the rocker arm cover. These codes indicate which of the engine options were installed on your engine at the factory. When in need of parts or service, furnish your authorized servicing dealer or engine distributor with these numbers.

An additional sticker may be also delivered (in a plastic bag attached to the engine or inserted in the machine documentation). It is recommended to stick this option code list sticker either:

- On this page of your Operator’s manual below this section.
- or
- On the "Engine Owner’s Warranty" booklet under the title Option Codes (Engine manufacturing configuration).

NOTE: The Machine Manufacturer may have already stuck it at a specific accessible place (inside the enclosure or close to a maintenance area).

The engine option code label includes an engine base code (A). This base code must also be recorded along with the option codes. At times it will be necessary to furnish this base code to differentiate two identical option codes for the same engine model.

The first two digits of each code identify a specific group, such as alternators. The last two digits of each code identify one specific option provided on your engine, such as a 12-volt, 55-amp alternator.

NOTE: These option codes are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

If an engine is ordered without a particular component, the last two digits of that functional group option code will be 99, 00, or XX. The list on the next page shows only the first two digits of the code numbers. For future reference such as ordering repair parts, it is important to have these code numbers available. To ensure this availability, enter the third and fourth digits shown on your engine option code label in the spaces provided on the following page.

NOTE: NOTE: Your engine option code label may not contain all option codes if an option has been added after the engine left the producing factory.

If option code label is lost or destroyed, consult your servicing dealer or engine distributor selling the engine for a replacement.

Option Codes	Description	Option Codes	Description
Engine Base Code: _____			
11___	Rocker Arm Cover	50___	Oil Pump
12___	Oil Filler Neck	51___	Cylinder Head With Valves
13___	Crankshaft Pulley	52___	Auxiliary Gear Drive
14___	Flywheel Housing	53___	Fuel Heater
15___	Flywheel	54___	Oil Heater
16___	Fuel Injection Pump	55___	Shipping Stand
17___	Air Inlet	56___	Paint Option
18___	Air Cleaner	57___	Coolant Inlet
19___	Oil Pan	59___	Oil Cooler
20___	Coolant Pump	60___	Add-on Auxiliary Drive Pulley
21___	Thermostat Cover	62___	Alternator Mounting

Continued on next page

CD03523,00002AC -19-03JAN11-1/2

Serial Numbers

Option Codes	Description	Option Codes	Description
22__	Thermostat	63__	Low Pressure Fuel Line
23__	Fan Drive	64__	Exhaust Elbow
24__	Fan Belt	65__	Turbocharger
25__	Fan	66__	Coolant Temperature Switch
26__	Engine Coolant Heater	67__	Electronic Tachometer Sensor
27__	Radiator	68__	Damper
28__	Exhaust Manifold	69__	Engine Serial Number Plate
29__	Ventilator System	72__	ECU Electronic Software Option
30__	Starting Motor	74__	Air Conditioner Compressor Mounting
31__	Alternator	75__	Air Restriction Indicator
32__	Instrument Panel	76__	Oil Pressure Switch
35__	Fuel Filter	81__	Primary Fuel Filter
36__	Front Plate	83__	Electronic Software
37__	Fuel Transfer Pump	84__	Electrical Wiring Harness
39__	Thermostat Housing	86__	Fan Pulley
40__	Oil Dipstick	87__	Belt Tensioner
41__	Belt Driven Front Auxiliary Drive	88__	Oil Filter
43__	Starting Aid	91__	Special Equipment (Factory Installed)
44__	Timing Gear Cover with Gears	93__	Emission Label
45__	Balancer Shaft	98__	Shipping
46__	Cylinder Block With Liners and Camshaft		
47__	Crankshaft and Bearings		
48__	Connecting Rods and Pistons		
49__	Valve Actuating Mechanisms		

CD03523,00002AC -19-03JAN11-2/2

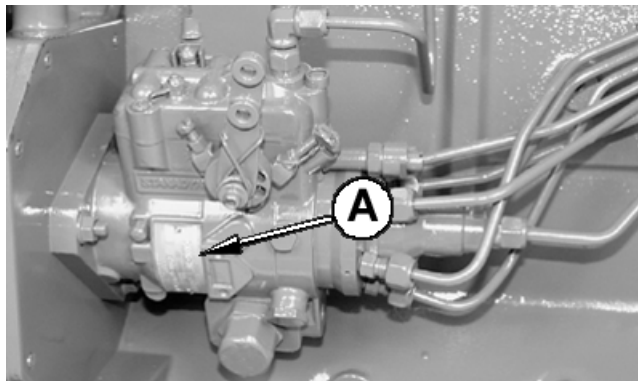
Record fuel injection pump model number

Record the fuel injection pump model and serial information found on the serial number plate (A).

Model No. _____ RPM _____

Manufacturer's No. _____

Serial No. _____



CD030749 -UN-24SEP99

DPSG,CD03523,15 -19-22JAN07-1/1

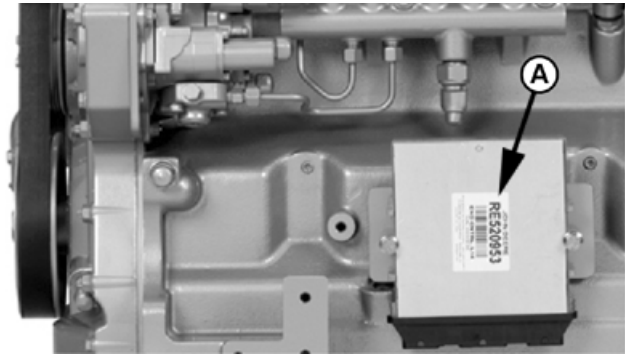
Record Engine Control Unit (ECU) Serial Number

Record the part number and serial number information found on the serial number label (A) on the Engine Control Unit (ECU) mounted on or near the engine.

Part No. _____

Serial No. _____

A—Serial Number Label



RG14635 —UN—13APR06

Record Engine Control Unit (ECU) Serial Number

CD03523,0000189 -19-06FEB07-1/1

Record High-Pressure Fuel Pump Model Number

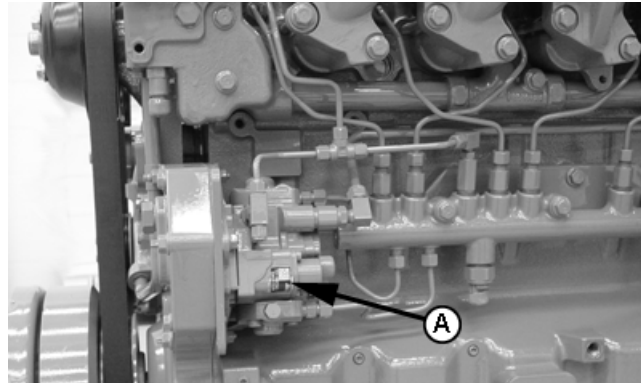
Record the high-pressure fuel pump model and serial number information found on the serial number plate (A).

Model No. _____ RPM _____

Manufacturer's No. _____

Serial No. _____

A—Serial Number Plate



RG13718 —UN—11NOV04

Record High-Pressure Fuel Pump Serial Number

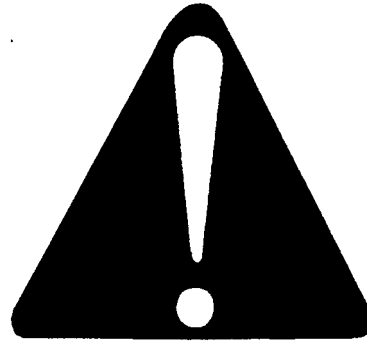
CD03523,000018A -19-06FEB07-1/1

Safety

Recognize Safety Information

This is a safety-alert symbol. When you see this symbol on your machine or in this manual, be alert to the potential for personal injury.

Follow recommended precautions and safe operating practices.



T81389 —UN—07DEC88

DX,ALERT -19-29SEP98-1/1

Understand Signal Words

A signal word—DANGER, WARNING, or CAUTION—is used with the safety-alert symbol. DANGER identifies the most serious hazards.

DANGER or WARNING safety signs are located near specific hazards. General precautions are listed on CAUTION safety signs. CAUTION also calls attention to safety messages in this manual.



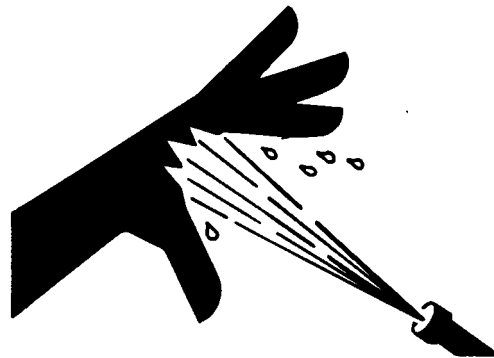
TS187 —19—30SEP88

DX,SIGNAL -19-03MAR93-1/1

Do Not Open High-Pressure Fuel System

High-pressure fluid remaining in fuel lines can cause serious injury. Do not disconnect or attempt repair of fuel lines, sensors, or any other components between the high-pressure fuel pump and nozzles on engines with High Pressure Common Rail (HPCR) fuel system.

Only technicians familiar with this type of system can perform repairs. (See your John Deere dealer.)



TS1343 —UN—18MAR92

DX,WW,HPCR1 -19-07JAN03-1/1

Engine lifting procedure

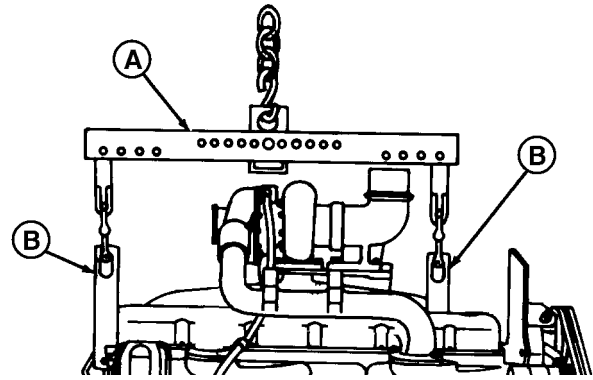
CAUTION: The only recommended method for lifting the engine is with JDG23 Engine Lifting Sling (A) and safety approved lifting straps (B) that come with engine. Use extreme caution when lifting and **NEVER** permit any part of the body to be positioned under an engine being lifted or suspended.

Lift engine with longitudinal loading on lifting sling and lifting straps only. Angular loading greatly reduces lifting capacity of sling and straps.

NOTE: If engine does not have lifting straps, universal straps can be procured through service parts under part numbers JD-244-1 and JD-244-2.

1. If not equipped, install lifting straps and torque to 200 N·m (145 lb-ft).
2. Attach JDG23 Engine Lifting Sling (A) to engine lifting straps (B) and overhead hoist.

IMPORTANT: Lifting straps are designed to lift the engine and accessories such as radiator, air filter and other small components. If



RG7784—UN—11NOV97

larger components, such as power take-off, transmission, generator air compressor... etc, are attached to engine, the lifting straps provided with engine or through parts channel are not intended for this purpose. Technician is responsible for providing adequate lifting devices under these situations. See machine manuals for additional information on removing engine from machine.

3. Carefully move engine to desired location.

DPSG,CD03523,95 -19-22JAN07-1/1

Follow Safety Instructions

Carefully read all safety messages in this manual and on your machine safety signs. Keep safety signs in good condition. Replace missing or damaged safety signs. Be sure new equipment components and repair parts include the current safety signs. Replacement safety signs are available from your John Deere dealer.

There can be additional safety information contained on parts and components sourced from suppliers that is not reproduced in this operator's manual.

Learn how to operate the machine and how to use controls properly. Do not let anyone operate without instruction.

Keep your machine in proper working condition. Unauthorized modifications to the machine may impair the function and/or safety and affect machine life.



TS201—UN—23AUG88

If you do not understand any part of this manual and need assistance, contact your John Deere dealer.

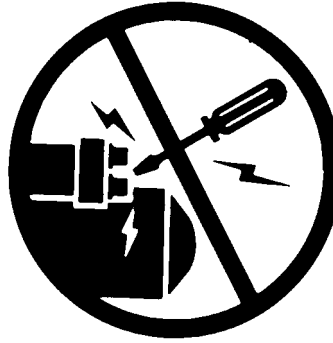
DX,READ -19-16JUN09-1/1

Prevent Machine Runaway

Avoid possible injury or death from machinery runaway.

Do not start engine by shorting across starter terminals. Machine will start in gear if normal circuitry is bypassed.

NEVER start engine while standing on ground. Start engine only from operator's seat, with transmission in neutral or park.



TS177 —UN—11JAN89

DX,BYPAS1 -19-29SEP98-1/1

Handle Fuel Safely—Avoid Fires

Handle fuel with care: it is highly flammable. Do not refuel the machine while smoking or when near open flame or sparks.

Always stop engine before refueling machine. Fill fuel tank outdoors.

Prevent fires by keeping machine clean of accumulated trash, grease, and debris. Always clean up spilled fuel.



TS202 —UN—23AUG88

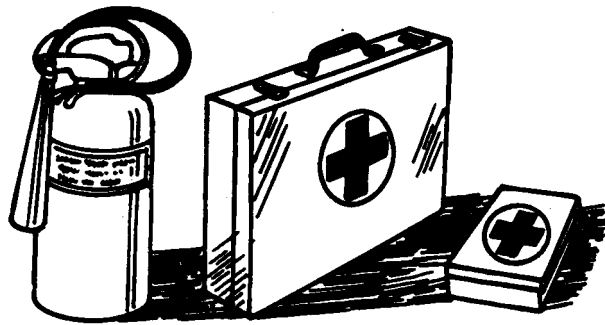
DX,FIRE1 -19-03MAR93-1/1

Prepare for Emergencies

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



TS291 —UN—23AUG88

DX,FIRE2 -19-03MAR93-1/1

Handle Starting Fluid Safely

Starting fluid is highly flammable.

Keep all sparks and flame away when using it. Keep starting fluid away from batteries and cables.

To prevent accidental discharge when storing the pressurized can, keep the cap on the container, and store in a cool, protected location.

Do not incinerate or puncture a starting fluid container.



TS1356 —UN—18MAR92

DX,FIRE3 -19-16APR92-1/1

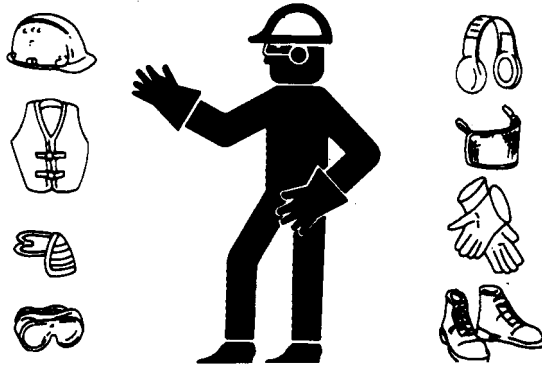
Wear Protective Clothing

Wear close fitting clothing and safety equipment appropriate to the job.

Prolonged exposure to loud noise can cause impairment or loss of hearing.

Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating machine.



TS206 —UN—23AUG88

DX,WEAR -19-10SEP90-1/1

Protect Against Noise

Prolonged exposure to loud noise can cause impairment or loss of hearing.

Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.



TS207 —UN—23AUG88

DX,NOISE -19-03MAR93-1/1

Handle Chemical Products Safely

Direct exposure to hazardous chemicals can cause serious injury. Potentially hazardous chemicals used with John Deere equipment include such items as lubricants, coolants, paints, and adhesives.

A Material Safety Data Sheet (MSDS) provides specific details on chemical products: physical and health hazards, safety procedures, and emergency response techniques.

Check the MSDS before you start any job using a hazardous chemical. That way you will know exactly what the risks are and how to do the job safely. Then follow procedures and recommended equipment.

(See your John Deere dealer for MSDS's on chemical products used with John Deere equipment.)



TS11132 —JUN—26NOV09

DX,MSDS,NA -19-03MAR93-1/1

Stay Clear of Rotating Drivelines

Entanglement in rotating driveline can cause serious injury or death.

Keep master shield and driveline shields in place at all times. Make sure rotating shields turn freely.

Wear close fitting clothing. Stop the engine and be sure the PTO driveline is stopped before making adjustments or performing any type service on the engine or PTO-driven equipment.



TS1644 —JUN—22AUG95

CD,PTO -19-22JAN07-1/1

Practice Safe Maintenance

Understand service procedure before doing work. Keep area clean and dry.

Never lubricate, service, or adjust machine while it is moving. Keep hands, feet, and clothing from power-driven parts. Disengage all power and operate controls to relieve pressure. Lower equipment to the ground. Stop the engine. Remove the key. Allow machine to cool.

Securely support any machine elements that must be raised for service work.

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

On self-propelled equipment, disconnect battery ground cable (-) before making adjustments on electrical systems or welding on machine.

On towed implements, disconnect wiring harnesses from tractor before servicing electrical system components or welding on machine.



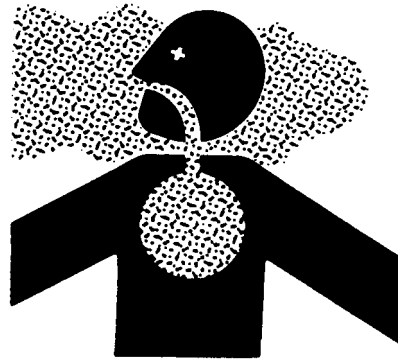
TS218 —UN—23AUG88

DX,SERV -19-17FEB99-1/1

Work In Ventilated Area

Engine exhaust fumes can cause sickness or death. If it is necessary to run an engine in an enclosed area, remove the exhaust fumes from the area with an exhaust pipe extension.

If you do not have an exhaust pipe extension, open the doors and get outside air into the area.



TS220 —UN—23AUG88

DX,AIR -19-17FEB99-1/1

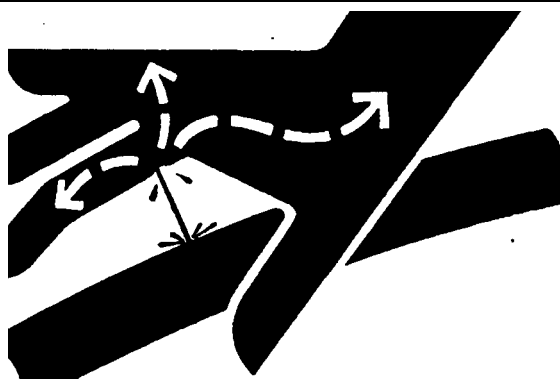
Avoid High-Pressure Fluids

Escaping fluid under pressure can penetrate the skin causing serious injury.

Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available in English from Deere & Company Medical Department in



X9811 —UN—23AUG88

Moline, Illinois, U.S.A., by calling 1-800-822-8262 or +1 309-748-5636.

DX,FLUID -19-20AUG09-1/1

Avoid Heating Near Pressurized Fluid Lines

Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials. Pressurized lines can accidentally burst when heat goes beyond the immediate flame area.



TS963 —UN—15MAY90

DX,TORCH -19-10DEC04-1/1

Remove Paint Before Welding or Heating

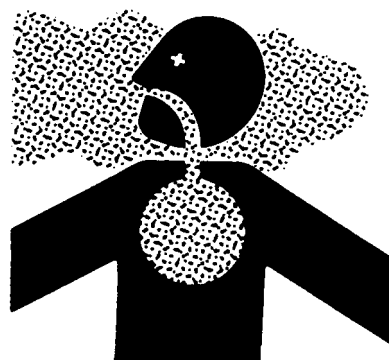
Avoid potentially toxic fumes and dust.

Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch.

Remove paint before heating:

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

Do not use a chlorinated solvent in areas where welding will take place.



TS220 —UN—23AUG88

Do all work in an area that is well ventilated to carry toxic fumes and dust away.

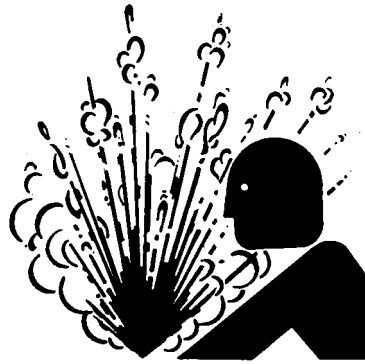
Dispose of paint and solvent properly.

DX,PAINT -19-24JUL02-1/1

Service Cooling System Safely

Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.



TS281 —UN—23AUG88

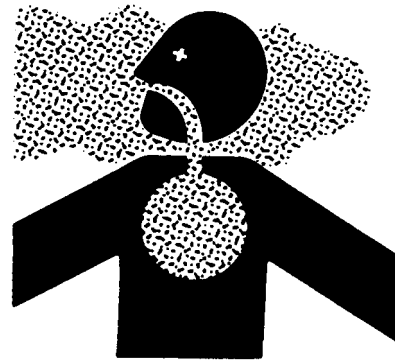
DX,RCAP -19-04JUN90-1/1

Avoid Harmful Asbestos Dust

Avoid breathing dust that may be generated when handling components containing asbestos fibers. Inhaled asbestos fibers may cause lung cancer.

Components in products that may contain asbestos fibers are brake pads, brake band and lining assemblies, clutch plates, and some gaskets. The asbestos used in these components is usually found in a resin or sealed in some way. Normal handling is not hazardous as long as airborne dust containing asbestos is not generated.

Avoid creating dust. Never use compressed air for cleaning. Avoid brushing or grinding material containing asbestos. When servicing, wear an approved respirator. A special vacuum cleaner is recommended to clean asbestos. If not available, apply a mist of oil or water on the material containing asbestos.



TS220 —UN—23AUG88

Keep bystanders away from the area.

DX,DUST -19-15MAR91-1/1

Dispose of Waste Properly

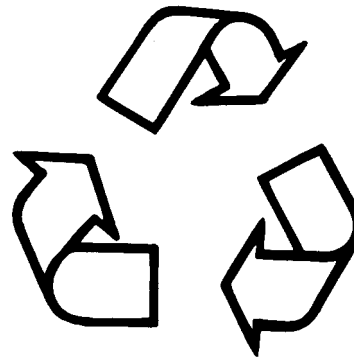
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

Do not pour waste onto the ground, down a drain, or into any water source.

Air conditioning refrigerants escaping into the air can damage the Earth's atmosphere. Government regulations may require a certified air conditioning service center to recover and recycle used air conditioning refrigerants.

Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center, or from your John Deere dealer.



TS1133 —UN—26NOV90

DX,DRAIN -19-03MAR93-1/1

Fuels, Lubricants and Coolant

Diesel Fuel

Consult your local fuel distributor for properties of the diesel fuel available in your area.

In general, diesel fuels are blended to satisfy the low temperature requirements of the geographical area in which they are marketed.

Diesel fuels specified to EN 590 or ASTM D975 are recommended. Renewable diesel fuel produced by hydrotreating animal fats and vegetable oils is basically identical to petroleum diesel fuel. Renewable diesel that meets EN 590 or ASTM D975 is acceptable for use at all percentage mixture levels.

Required Fuel Properties

In all cases, the fuel shall meet the following properties:

Cetane number of 43 minimum. Cetane number greater than 47 is preferred, especially for temperatures below -20°C (-4°F) or elevations above 1500 m (5000 ft).

Cold Filter Plugging Point (CFPP) should be at least 5°C (9°F) below the expected lowest temperature or **Cloud Point** below the expected lowest ambient temperature.

Fuel lubricity should pass a maximum scar diameter of 0.45 mm as measured by ASTM D6079 or ISO 12156-1.

Sulfur Content for Interim Tier 4 and EU Stage IIIB Engines

- Diesel fuel quality and fuel sulfur content must comply with all existing emissions regulations for the area in which the engine operates.
- Use **ONLY** ultra low sulfur diesel (ULSD) fuel with a maximum of 0.0015% (15 mg/kg) sulfur content.

Sulfur Content for Other Engines

- Diesel fuel quality and fuel sulfur content must comply with all existing emissions regulations for the area in which the engine operates.
- Use of diesel fuel with sulfur content less than 0.10% (1000 mg/kg) is **STRONGLY** recommended.
- Use of diesel fuel with sulfur content 0.10% (1000 mg/kg) to 0.50% (5000 mg/kg) may result in **REDUCED** oil and filter change intervals. Refer to table in Diesel Engine Oil and Filter Service Intervals.
- **BEFORE** using diesel fuel with sulfur content greater than 0.50% (5000 mg/kg), contact your John Deere dealer.

IMPORTANT: Do not mix used diesel engine oil or any other type of lubricating oil with diesel fuel.

Improper fuel additive usage may cause damage on fuel injection equipment of diesel engines.

DX,FUEL1 -19-03AUG09-1/1

Handling and Storing Diesel Fuel

⚠ CAUTION: Handle fuel carefully. Do not fill the fuel tank when engine is running.

DO NOT smoke while you fill the fuel tank or service the fuel system.

Fill the fuel tank at the end of each day's operation to prevent water condensation and freezing during cold weather.

Keep all storage tanks as full as practicable to minimize condensation.

Ensure that all fuel tank caps and covers are installed properly to prevent moisture from entering.

Monitor water content of the fuel regularly.

When using bio-diesel fuel, the fuel filter may require more frequent replacement due to premature plugging.

Check engine oil level daily prior to starting engine. A rising oil level may indicate fuel dilution of the engine oil.

IMPORTANT: The fuel tank is vented through the filler cap. If a new filler cap is required, always replace it with an original vented cap.

When fuel is stored for an extended period or if there is a slow turnover of fuel, add a fuel conditioner to stabilize the fuel and prevent water condensation. Contact your fuel supplier for recommendations.

DX,FUEL4 -19-19DEC03-1/1

Diesel Engine Break-In Oil

New engines are filled at the factory with either John Deere Break-In™ or Break-In™ Plus Engine Oil. During the break-in period, add John Deere Break-In™ or Break-In™ Plus Engine Oil, respectively, as needed to maintain the specified oil level.

Operate the engine under various conditions, particularly heavy loads with minimal idling, to help seat engine components properly.

Change the oil and filter at 100 hours maximum for Break-In™ Oil or 500 hours maximum for Break-In™ Plus Oil during the initial operation of a new or rebuilt engine.

After engine overhaul, fill the engine with either John Deere Break-In™ or Break-In™ Plus Engine Oil.

If John Deere Break-In™ or Break-In™ Plus Engine Oil is not available, use a 10W-30 diesel engine oil meeting one of the following during the first 100 hours of operation:

- API Service Classification CE
- API Service Classification CD
- API Service Classification CC
- ACEA Oil Sequence E2
- ACEA Oil Sequence E1

*Break-In is a trademark of Deere & Company.
Plus-50 is a trademark of Deere & Company.*

IMPORTANT: Do not use Plus-50™ II, Plus-50 or engine oils meeting any of the following for the initial break-in of a new or rebuilt engine:

API CJ-4	ACEA E9
API CI-4 PLUS	ACEA E7
API CI-4	ACEA E6
API CH-4	ACEA E5
API CG-4	ACEA E4
API CF-4	ACEA E3
API CF-2	
API CF	

These oils will not allow the engine to break in properly.

John Deere Break-In™ Plus Engine Oil can be used for all John Deere diesel engines at all emission certification levels.

After the break-in period, use John Deere Plus-50™ II, John Deere Plus-50, or other diesel engine oil as recommended in this manual.

DX,ENOIL4 -19-03AUG09-1/1

Engine Oil and Filter Service Intervals—Tier 3 and Stage III A Engines

Recommended oil and filter service intervals are based on a combination of oil pan capacity, type of engine oil and filter used, and sulfur content of diesel fuel. Actual service intervals also depend on operation and maintenance practices.

Use oil analysis to evaluate the condition of the oil and to aid in selection of the proper oil and filter service interval. Contact your John Deere dealer for more information on engine oil analysis.

Change the oil and oil filter at least once every 12 months even if the hours of operation are fewer than the otherwise recommended service interval.

Diesel fuel sulfur content affects engine oil and filter service intervals.

- Use of diesel fuel with sulfur content less than 1000 mg/kg (1000 ppm) is **RECOMMENDED**.
- Use of diesel fuel with sulfur content 1000—5000 mg/kg (1000—5000 ppm) **REDUCES** the oil and filter change interval.
- **BEFORE** using diesel fuel with sulfur content greater than 5000 mg/kg (5000 ppm), contact your John Deere dealer.
- **DO NOT** use diesel fuel with sulfur content greater than 10 000 mg/kg (10 000 ppm).

IMPORTANT: To avoid engine damage:

- **Reduce oil and filter service intervals by 50% when using biodiesel blends greater than B20. Oil analysis may allow longer service intervals.**
- **Use only approved oil types.**

Approved Oil Types:

- “Plus-50 Oils” include John Deere Plus-50™ II and John Deere Plus-50.
- “Other Oils” include John Deere Torq-Gard™, API CJ-4, API CI-4 PLUS, API CI-4, ACEA E9, ACEA E7, ACEA E6, ACEA E5, and ACEA E4.

NOTE: The 500 hour extended oil and filter change interval is only allowed if all of the following conditions are met:

- *Use of diesel fuel with sulfur content less than 5000 mg/kg (5000 ppm).*
- *Use of John Deere Plus-50™ II or Plus-50 Oil.*
- *Use of an approved John Deere oil filter.*

Engine Oil and Filter Service Intervals	
Fuel Sulfur	Less than 1000 mg/kg (1000 ppm)
Plus-50 Oils	500 hours
Other Oils	250 hours
Fuel Sulfur	1000—2000 mg/kg (1000—2000 ppm)
Plus-50 Oils	500 hours
Other Oils	250 hours
Fuel Sulfur	2000—5000 mg/kg (2000—5000 ppm)
Plus-50 Oils	500 hours
Other Oils	250 hours
Fuel Sulfur	5000—10 000 mg/kg (5000—10 000 ppm)
Plus-50 Oils	Contact John Deere dealer
Other Oils	Contact John Deere dealer
Oil analysis may extend the service interval of “Other Oils”, to a maximum not to exceed the interval of Plus-50 Oils.	

*Plus-50 is a trademark of Deere & Company
Torq-Gard is a trademark of Deere & Company*

DX,ENOIL13,T3,PTP,220toMAX -19-21JUN10-1/1

Lubricant Storage

Your equipment can operate at top efficiency only when clean lubricants are used.

Use clean containers to handle all lubricants.

Whenever possible, store lubricants and containers in an area protected from dust, moisture, and other contamination. Store containers on their side to avoid water and dirt accumulation.

Make certain that all containers are properly marked to identify their contents.

Properly dispose of all old containers and any residual lubricant they may contain.

DX,LUBST -19-18MAR96-1/1

Mixing of Lubricants

In general, avoid mixing different brands or types of oil. Oil manufacturers blend additives in their oils to meet certain specifications and performance requirements.

Mixing different oils can interfere with the proper functioning of these additives and degrade lubricant performance.

Consult your John Deere dealer to obtain specific information and recommendations.

DX,LUBMIX -19-18MAR96-1/1

Diesel Engine Coolant

The engine cooling system is filled to provide year-round protection against corrosion and cylinder liner pitting, and winter freeze protection to -37°C (-34°F).

John Deere COOL-GARD is preferred for service.

If John Deere COOL-GARD is not available, use a low silicate ethylene glycol or propylene glycol base coolant concentrate in a 50% mixture of concentrate with quality water.

The coolant concentrate shall be of a quality that provides cavitation protection to cast iron and aluminum parts in the cooling system. John Deere COOL-GARD meets this requirement.

Freeze protection

A 50% mixture of ethylene glycol engine coolant in water provides freeze protection to -37°C (-34°F).

A 50% mixture of propylene glycol engine coolant in water provides freeze protection to -33°C (-27°F).

If protection at lower temperatures is required, consult your John Deere dealer for recommendations.

Water quality

Water quality is important to the performance of the cooling system. Distilled, deionized, or demineralized water is recommended for mixing with ethylene glycol and propylene glycol base engine coolant concentrate.

IMPORTANT: Do not use cooling system sealing additives or antifreeze that contains sealing additives.

IMPORTANT: Do not mix ethylene glycol and propylene glycol base coolants.

DX,COOL8 -19-16NOV01-1/1

Operating in Warm Temperature Climates

John Deere engines are designed to operate using glycol base engine coolants.

Always use a recommended glycol base engine coolant, even when operating in geographical areas where freeze protection is not required.

John Deere COOL-GARD™ II Premix is available in a concentration of 50% ethylene glycol. However, there are situations in warm temperature climates where a coolant with lower glycol concentration (approximately 20% ethylene glycol) has been approved. In these cases, the low glycol formulation has been modified to provide the same level of corrosion inhibitor as John Deere COOL-GARD II Premix (50/50).

COOL-GARD is a trademark of Deere & Company

IMPORTANT: Water may be used as coolant *in emergency situations only.*

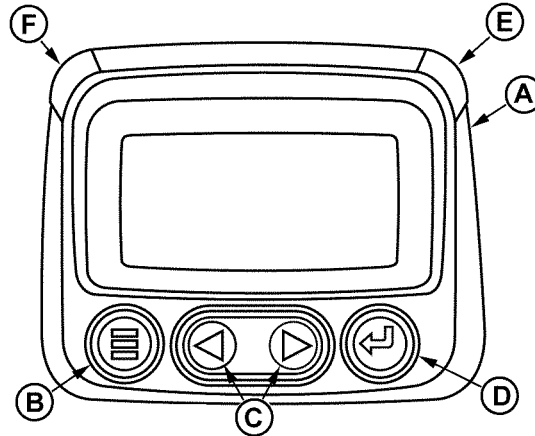
Foaming, hot surface aluminum and iron corrosion, scaling, and cavitation will occur when water is used as the coolant, even when coolant conditioners are added.

Drain cooling system and refill with recommended glycol base engine coolant as soon as possible.

DX,COOL6 -19-03NOV08-1/1

Operating the Engine

Using Diagnostic Gauge to Access Engine Information (Optional equipment)



Diagnostic Gauge

A—Diagnostic Gauge
B—Menu Key

C—Arrow Keys
D—Enter Key

E—Red "STOP ENGINE"
Indicator Light
F—Amber "WARNING" Indicator
Light

NOTE: Generator sets powered by an electronically controlled engine (DE10 or HPCR fuel system) can be optionally equipped with the diagnostic gauge shown. Depending on the generator set manufacturer, other instrumentations can be used. Refer to the generator set documentation for more information.

The diagnostic gauge (A) allows the operator to view many readouts of engine functions and trouble codes (DTCs). The gauge is linked to the electronic control system and its sensors. This allows the operator to monitor engine functions and to troubleshoot the engine systems when needed.

Press the menu key (B) to access the various engine functions in sequence. The displays can be selected as either customary English or metric units. The following menu of engine parameters can be displayed on the diagnostic gauge window:

- Engine hours
- Engine rpm
- System voltage
- Percent engine load at the current rpm

- Coolant temperature
- Oil pressure
- Throttle position
- Intake manifold temperature
- Current fuel consumption
- Active service (diagnostic) codes
- Stored service (diagnostic) codes from the engine
- Set the units for display
- View the engine configuration parameters

NOTE: Engine parameters which can be accessed will vary with the engine application. Six languages for readouts are available and can be selected during setup of gauge.

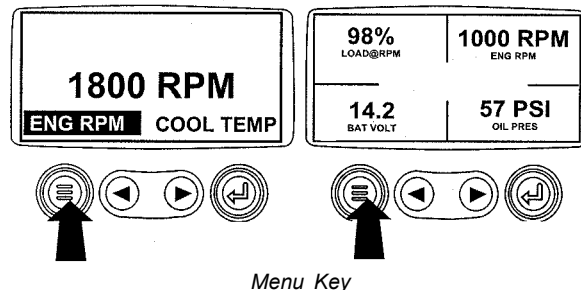
The diagnostic gauge includes a graphical backlit Liquid Crystal Display (LCD) screen. The display can show either a single parameter or a quadrant display showing four parameters simultaneously. The diagnostic gauge uses two arrow keys (C) for scrolling through the engine parameter list and viewing the menu list and an enter key (D) for selecting highlighted items. The red (E) and amber (F) lights are used to signal active trouble code received by the diagnostic gauge.

CD03523,000018B -19-22JAN07-1/1

Main Menu Navigation

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, See *Starting The Engine*. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.



Menu Key

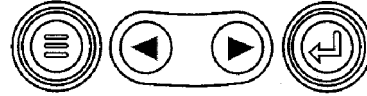
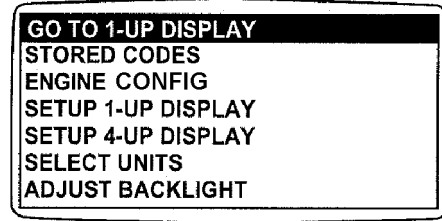
Continued on next page

OURGP11,00000A9 -19-03SEP03-1/5

RG13132—UN—09SEP03

RG13159—UN—26SEP03

2. The first seven items of the "Main Menu" will be displayed.

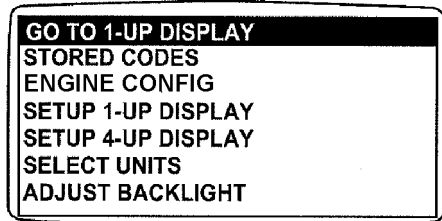


Menu Display

RG13160 —JUN—02OCT03

OURGP11,00000A9 -19-03SEP03-2/5

3. Pressing the "Arrow" keys will scroll through the menu selections.

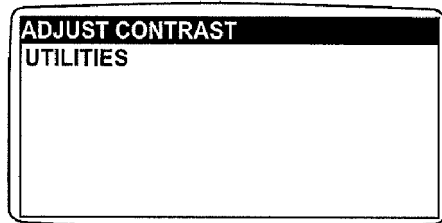


Main Menu Items

RG13161 —JUN—02OCT03

OURGP11,00000A9 -19-03SEP03-3/5

4. Pressing the right arrow key will scroll down to reveal the last items of "Main Menu" screen, highlighting the next item down.



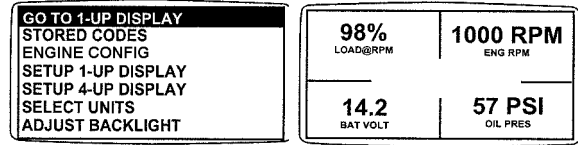
Last Items On Main Menu

RG13162 —JUN—26SEP03

Continued on next page

OURGP11,00000A9 -19-03SEP03-4/5

- Use the arrow keys to scroll to the desired menu item or press the "Menu Button" to exit the main menu and return to the engine parameter display.



Use Arrow Buttons To Scroll / Quadrant Display

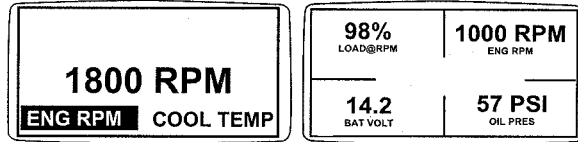
OURGP11,00000A9 -19-03SEP03-5/5

RG13163—UN—02OCT03

Engine Configuration Data

NOTE: The engine configuration data is a read only function.

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, See Starting The Engine. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.



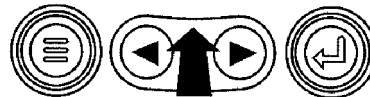
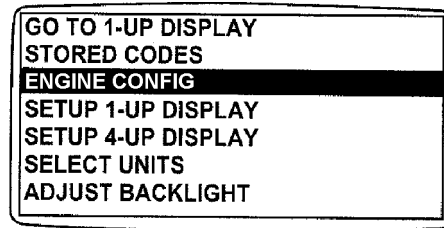
Menu Key

- Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.

OURGP11,00000AB -19-03SEP03-1/6

RG13159—UN—26SEP03

- The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Engine Config" is highlighted.



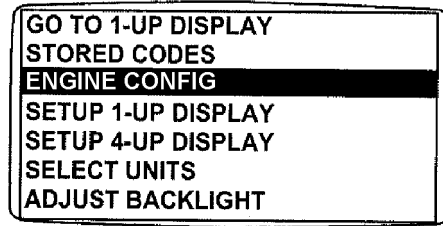
Select Engine Configuration

Continued on next page

OURGP11,00000AB -19-03SEP03-2/6

RG13164—UN—07OCT03

3. Once "Engine Config" menu item has been highlighted, press the "Enter" key to view the engine configuration data.

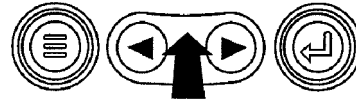
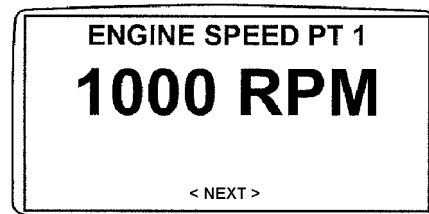


Enter Key

RG13165 —UN—02OCT03

OURGP11,00000AB -19-03SEP03-3/6

4. Use the "Arrow" keys to scroll through the engine configuration data.

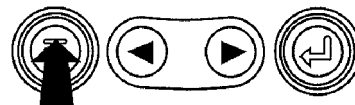
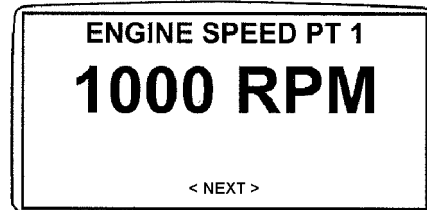


Use Arrow Keys To Scroll

RG13166 —UN—29SEP03

OURGP11,00000AB -19-03SEP03-4/6

5. Press the "Menu" key to return to the main menu.



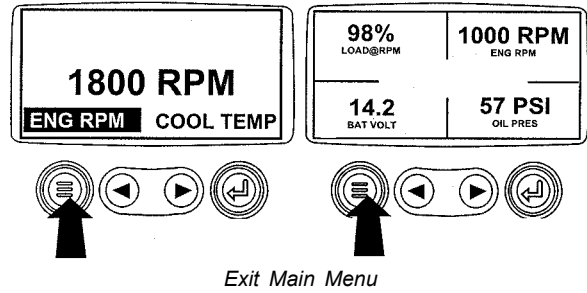
Return To Main Menu

RG13167 —UN—29SEP03

Continued on next page

OURGP11,00000AB -19-03SEP03-5/6

- Press the "Menu" key to exit the main menu and return to the engine parameter display.



RG13159—UN—26SEP03

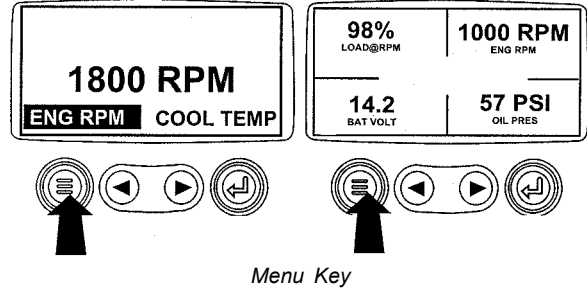
OURGP11.00000AB -19-03SEP03-6/6

Accessing Stored Trouble Codes

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, See Starting The Engine. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

For description of trouble codes, see chart in Troubleshooting Section.

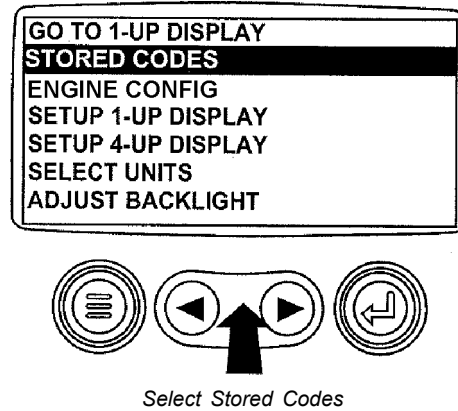
- Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.



RG13159—UN—26SEP03

OURGP11.00000AC -19-03SEP03-1/6

- The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Stored Codes" is highlighted.

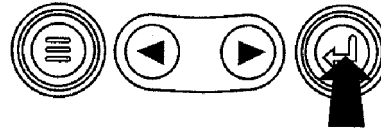
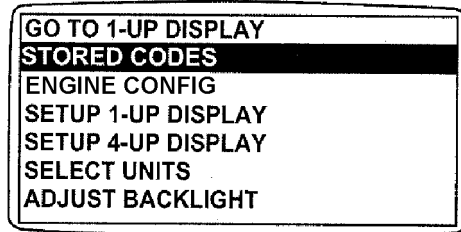


RG13168—UN—02OCT03

Continued on next page

OURGP11.00000AC -19-03SEP03-2/6

- Once the "Stored Codes" menu item has been highlighted press the "Enter" key to view the stored codes.

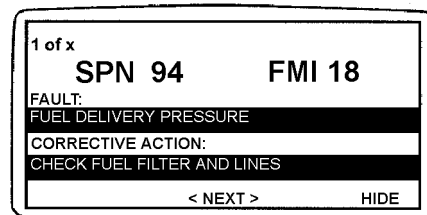


Enter Key

OURGP11.00000AC -19-03SEP03-3/6

RG13169 —UN—02OCT03

- If the word "Next" appears above the "Arrow" keys, there are more stored codes that may be viewed. Use the "Arrow" key to scroll to the next stored code.

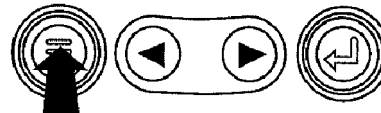
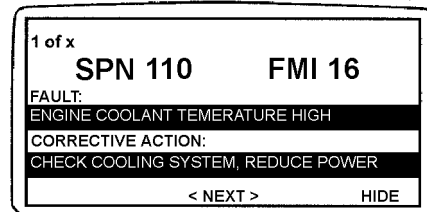


Use Arrow Keys To Scroll

OURGP11.00000AC -19-03SEP03-4/6

RG13245 —UN—02OCT03

- Press the "Menu" key to return to the main menu.



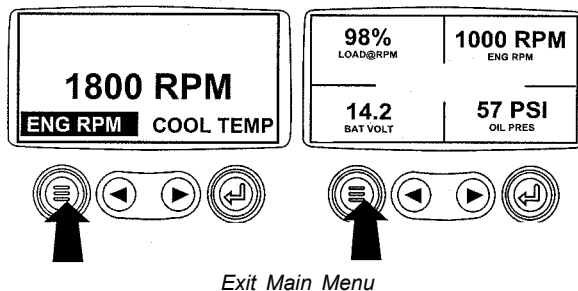
Return To Main Menu

Continued on next page

OURGP11.00000AC -19-03SEP03-5/6

RG13246 —UN—02OCT03

- Press the "Menu" key to exit the main menu and return to the engine parameter display.



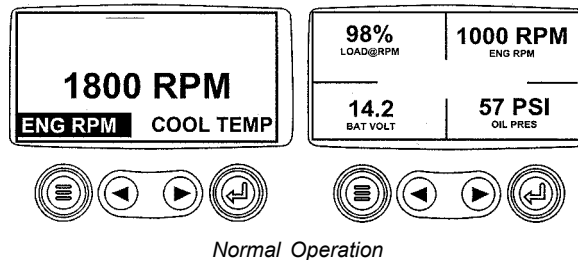
RG13159—UN—26SEP03

OURGP11.00000AC -19-03SEP03-6/6

Accessing Active Trouble Codes

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, See Starting The Engine. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

For description of trouble codes, see chart in Troubleshooting Section.



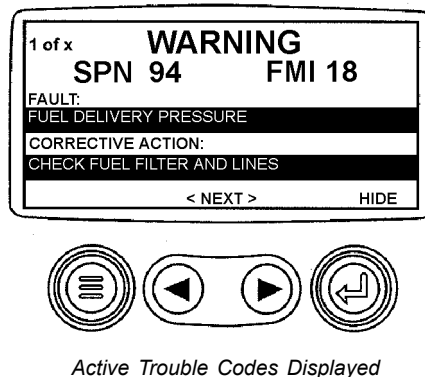
RG13172—UN—26SEP03

- During normal operation the single or four parameter screen will be displayed.

OURGP11.00000AD -19-03SEP03-1/7

- When the diagnostic gauge receives a trouble code from an engine control unit, the single or four parameter screen will be replaced with the "Warning" message. The SPN and FMI number will be displayed along with a description of the problem and the corrective action needed.

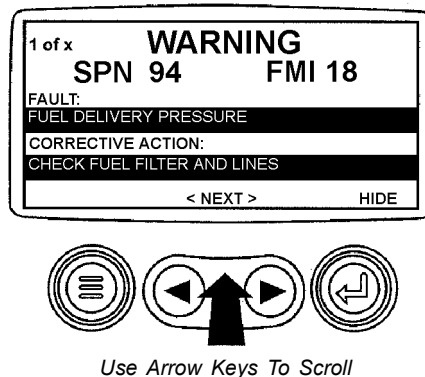
IMPORTANT: Ignoring active trouble codes can result in severe engine damage.



RG13240—UN—30SEP03

OURGP11.00000AD -19-03SEP03-2/7

- If the word "Next" appears above the arrow keys, there are more trouble codes that can be viewed by using the arrow keys to scroll to the next trouble code.



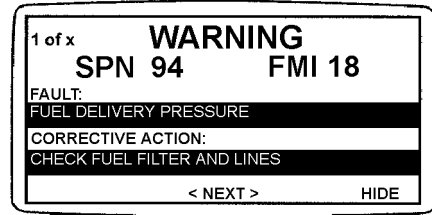
RG13241—UN—30SEP03

Continued on next page

OURGP11.00000AD -19-03SEP03-3/7

IMPORTANT: Ignoring active trouble codes can result in severe engine damage.

- To acknowledge and hide the code and return to the single or four parameter display, press the "Enter" Key.

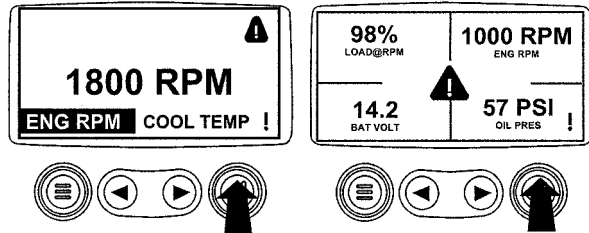


Hide Trouble Codes

OURGP11.00000AD -19-03SEP03-4/7

RG13242 —UN—30SEP03

- The display will return to the single or four parameter display, but the display will contain the warning icon. Pressing the "Enter" key will redisplay the hidden trouble code.



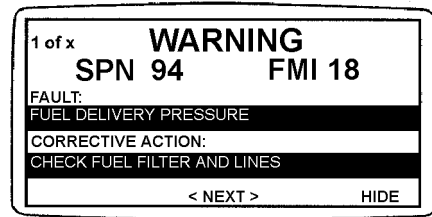
Active Trouble Code Icon

OURGP11.00000AD -19-03SEP03-5/7

RG13176 —UN—26SEP03

IMPORTANT: Ignoring active trouble codes can result in severe engine damage.

- Pressing the "Enter" key once again will hide the trouble code and return the screen to the single or four parameter display.

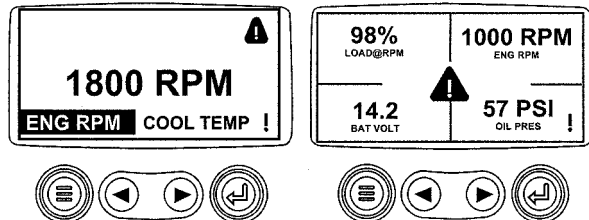


Enter Key

OURGP11.00000AD -19-03SEP03-6/7

RG13242 —UN—30SEP03

- The single or four parameter screen will display the warning icon until the trouble code condition is corrected.



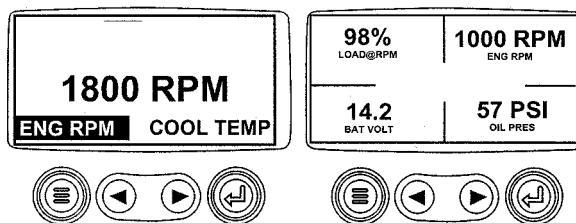
Active Trouble Code Condition

OURGP11.00000AD -19-03SEP03-7/7

RG13243 —UN—01OCT03

Engine Shutdown Codes

1. During normal operation the single or four parameter screen will be displayed.



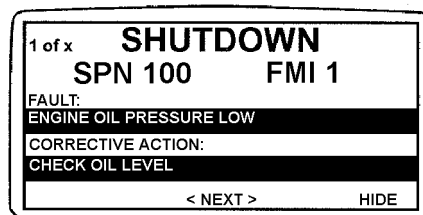
Normal Operation

OURGP11,00000AE -19-03SEP03-1/6

RG13172 —UN—26SEP03

2. When the diagnostic gauge receives a severe trouble code from an engine control unit, the single or four parameter screen will be replaced with the "Shutdown" message. The SPN and FMI number will be displayed along with a description of the problem and the corrective action needed.

If the word "Next" appears above the arrow keys, there are more trouble codes that can be viewed by using the arrow keys to scroll to the next trouble code.



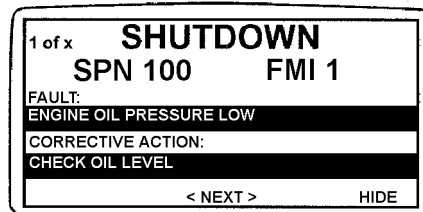
Shutdown Message

OURGP11,00000AE -19-03SEP03-2/6

RG13238 —UN—29SEP03

3. To acknowledge and hide the trouble code and return to the single or four parameter display, press the "Enter" key".

IMPORTANT: Ignoring the shutdown message can result in severe engine damage.



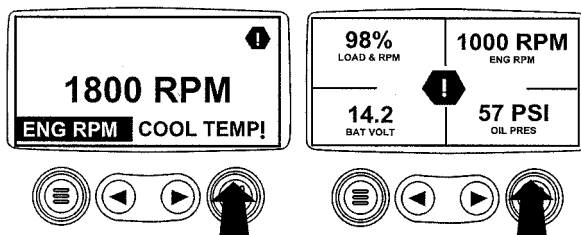
Hide Trouble Code

OURGP11,00000AE -19-03SEP03-3/6

RG13239 —UN—29SEP03

4. The display will return to the single or four parameter display, but the display will contain the "Shutdown" icon. Pressing the "Enter" key will redisplay the hidden trouble code.

IMPORTANT: Ignoring the shutdown message can result in severe engine damage.



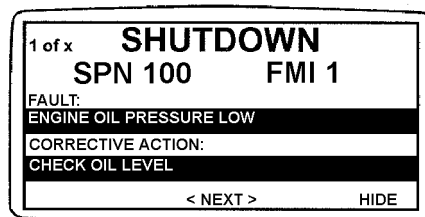
Flashing Shutdown Icon

OURGP11,00000AE -19-03SEP03-4/6

RG13179 —UN—26SEP03

Continued on next page

- Pressing the "Enter" key once again will hide the trouble code and return the screen to the single or four parameter display.



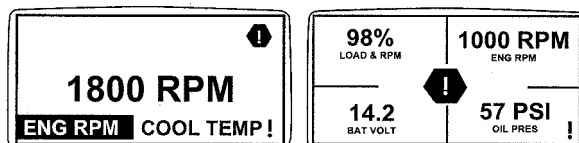
Redisplay Trouble Code

OURGP11,00000AE -19-03SEP03-5/6

RG13239 —UN—29SEP03

- The single or four parameter screen will display the shutdown icon until the trouble code condition is corrected.

IMPORTANT: Ignoring the shutdown message can result in severe engine damage.



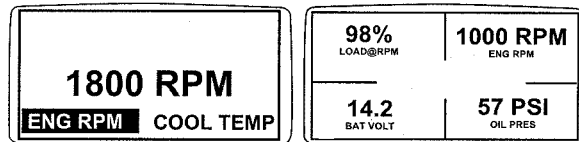
Shutdown Icon

OURGP11,00000AE -19-03SEP03-6/6

RG13180 —UN—26SEP03

Adjusting Backlighting

- Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.

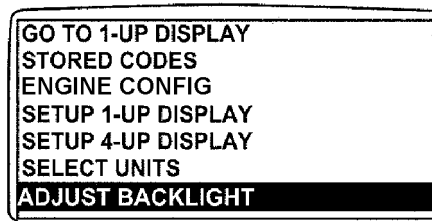


Menu Key

OURGP11,0000237 -19-21OCT03-1/6

RG13159 —UN—26SEP03

- The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Adjust Backlight" is highlighted.



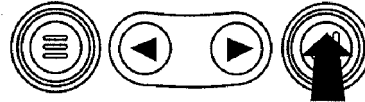
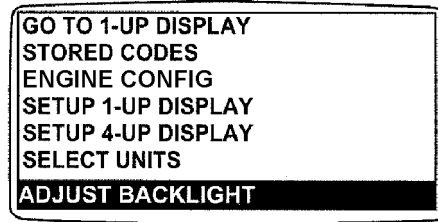
Select Adjust Backlight

Continued on next page

OURGP11,0000237 -19-21OCT03-2/6

RG13181 —UN—02OCT03

3. Once the "Adjust Backlight" menu item has been highlighted, press the "Enter" key to activate the "Adjust Backlight" function.

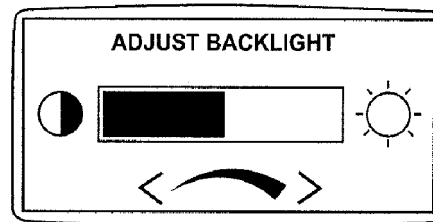


Press Enter Key

OURGP11.0000237 -19-21OCT03-3/6

RG13182 —UN—02OCT03

4. Use the "Arrow" keys to select the desired backlight intensity.

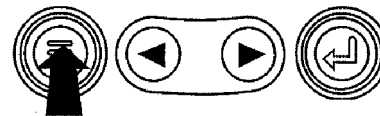
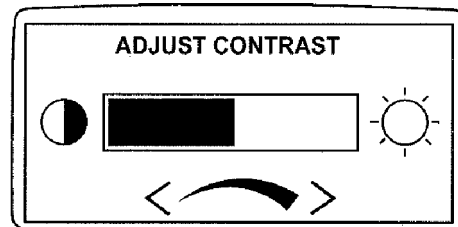


Adjust Backlight Intensity

OURGP11.0000237 -19-21OCT03-4/6

RG13183 —UN—29SEP03

5. Press the "Menu" key to return to the main menu.



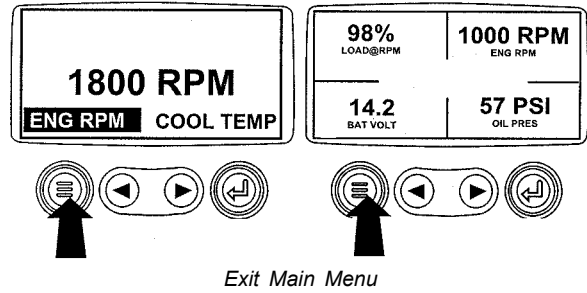
Return To Main Menu

Continued on next page

OURGP11.0000237 -19-21OCT03-5/6

RG13184 —UN—26SEP03

- Press the "Menu" key to exit the main menu and return to the engine parameter display.

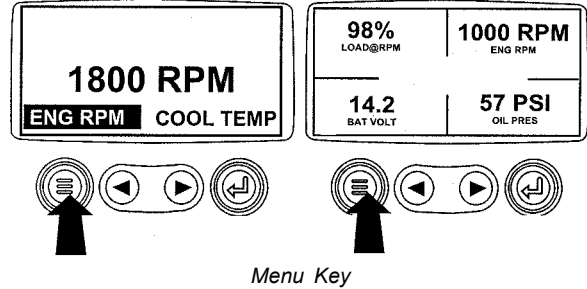


OURGP11,0000237 -19-21OCT03-6/6

RG13159—UN—26SEP03

Adjusting Contrast

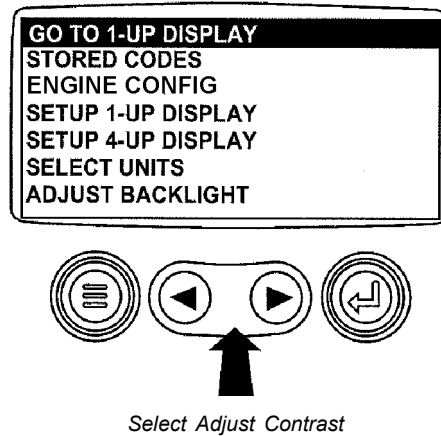
- Turn the key switch to the ON position. Starting at the single or four engine parameter display press the "Menu" key.



OURGP11,00000AF -19-03SEP03-1/6

RG13159—UN—26SEP03

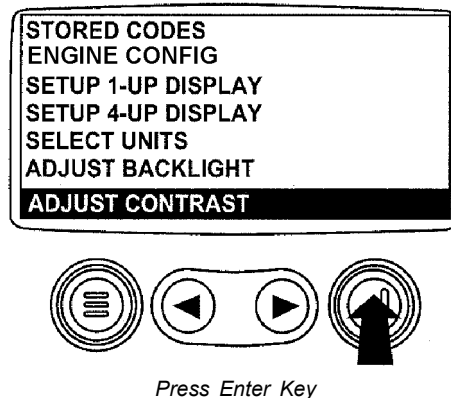
- The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Adjust Contrast" is highlighted.



OURGP11,00000AF -19-03SEP03-2/6

RG13161—UN—02OCT03

- Once the "Adjust Contrast" menu item has been highlighted, press the "Enter" key to activate the "Adjust Contrast" function.

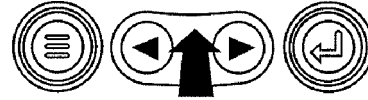
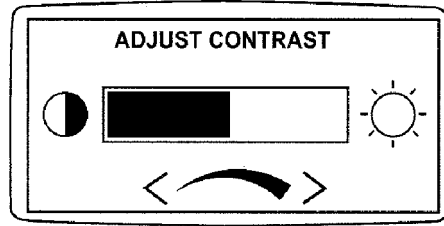


OURGP11,00000AF -19-03SEP03-3/6

RG13185—UN—02OCT03

Continued on next page

- Use the "Arrow" keys to select the desired contrast intensity.

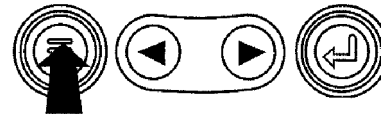
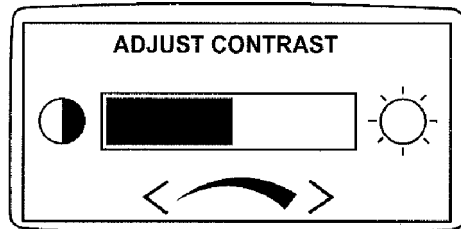


Adjust Contrast Intensity

RG13186 —UN—29SEP03

OURGP11,00000AF -19-03SEP03-4/6

- Press the "Menu" key to return to the main menu.

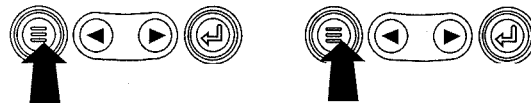
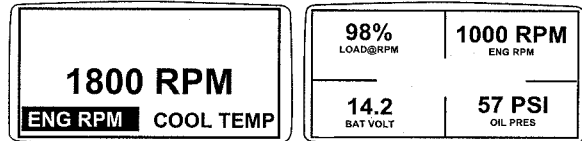


Return To Main Menu

RG13187 —UN—26SEP03

OURGP11,00000AF -19-03SEP03-5/6

- Press the "Menu" key to exit the main menu and return to the engine parameter display.



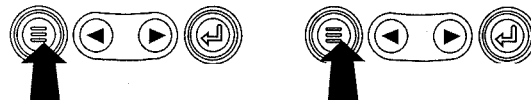
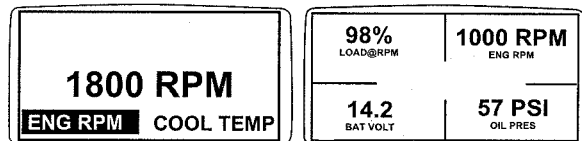
Exit Main Menu

RG13159 —UN—26SEP03

OURGP11,00000AF -19-03SEP03-6/6

Selecting Units Of Measurement

- Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.



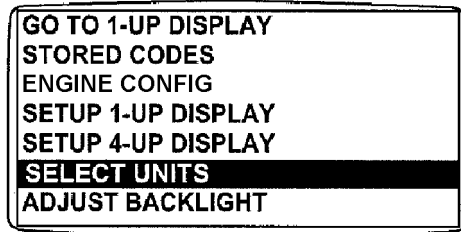
Menu Key

RG13159 —UN—26SEP03

Continued on next page

OURGP11,00000B0 -19-03SEP03-1/7

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Select Units" is highlighted.

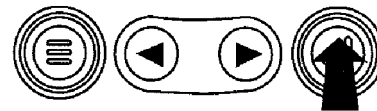
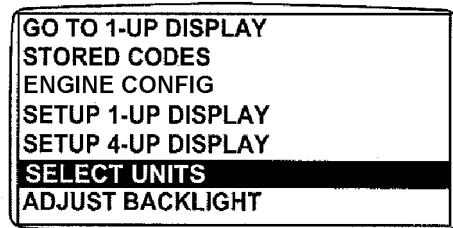


Select Units

RG13188 —UN—02OCT03

OURGP11,0000B0 -19-03SEP03-2/7

3. Once the "Select Units" menu item has been highlighted press the "Enter" key to access the "Select Units" function.



Press Enter Key

RG13188 —UN—02OCT03

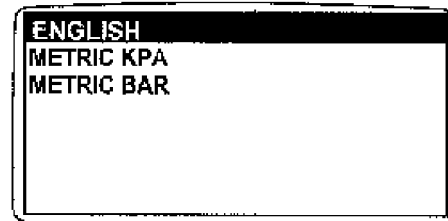
OURGP11,0000B0 -19-03SEP03-3/7

4. There are three choices for units of measurement, English, Metric kPa or Metric Bar.

English is for Imperial units, with pressures displayed in PSI and temperatures in °F.

Metric kPa and Metric bar are for IS units, with pressures displayed in kPa and bar respectively, and temperatures in °C.

Use the "Arrow" keys to highlight the desired units of measurement.



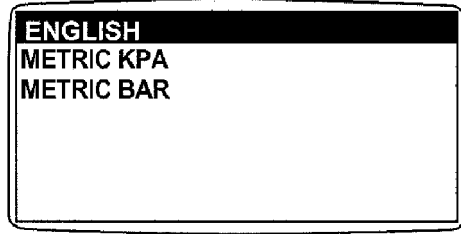
Select Desired Units

RG13190 —UN—26SEP03

Continued on next page

OURGP11,0000B0 -19-03SEP03-4/7

5. Press the "Enter" key to select the highlighted units.

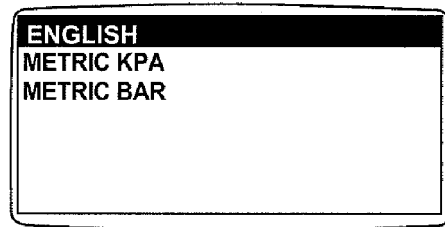


Press Enter Key to Select

OURGP11,00000B0 -19-03SEP03-5/7

RG13191 —UN—30SEP03

6. Press the "Menu" key to return to the main menu.

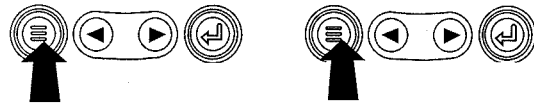
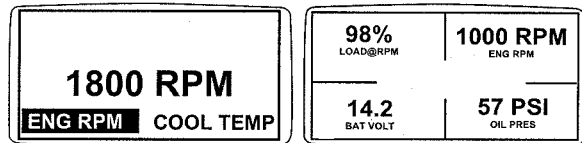


Return To Main Menu

OURGP11,00000B0 -19-03SEP03-6/7

RG13192 —UN—26SEP03

7. Press the "Menu" key to return to the engine parameter display.



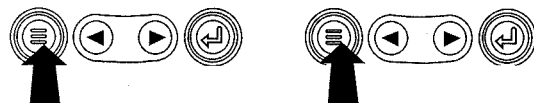
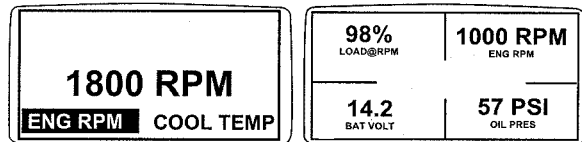
Press Menu Key

OURGP11,00000B0 -19-03SEP03-7/7

RG13159 —UN—26SEP03

Setup 1-Up Display

1. Turn the key switch to the ON position. Starting at the single engine parameter display, press the "Menu" key.



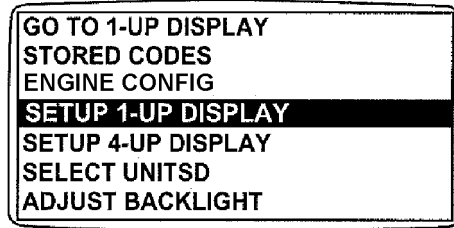
Menu Key

Continued on next page

OURGP11,00000B1 -19-03SEP03-1/18

RG13159 —UN—26SEP03

2. Use the "Arrow" keys to scroll through the menu until "Setup 1-Up Display" is highlighted.

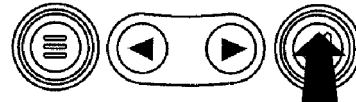
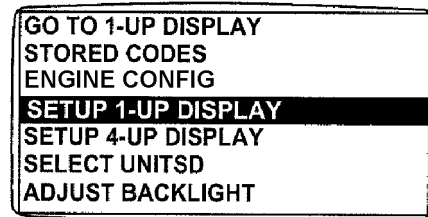


Setup 1-Up Display

OURGP11,00000B1 -19-03SEP03-2/18

RG13193 —UN—02OCT03

3. Once "Setup 1-Up Display" menu item has been highlighted press the "Enter" key to access the "Setup 1-Up Display" function.

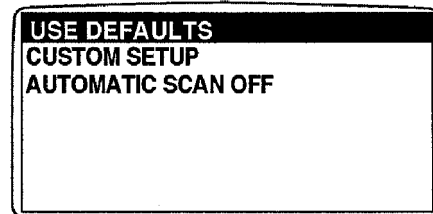


Press Enter Key

OURGP11,00000B1 -19-03SEP03-3/18

RG13194 —UN—02OCT03

4. Three options are available for modification of the 1-Up Display.
- Use Defaults** – This option contains the following engine parameters for display: Engine Hours, Engine Speed, Battery Voltage, % Load, Coolant Temperature and Oil Pressure.
 - Custom Setup** – This option contains a list of engine parameters. Engine parameters from this list can be selected to replace any or all of the default parameters. This option can be used to add parameters available for scrolling in the 1-Up Display.
 - Automatic Scan** – Selecting the scan function will allow the 1-Up Display to scroll through the selected set of parameters one at a time, momentarily pausing at each.



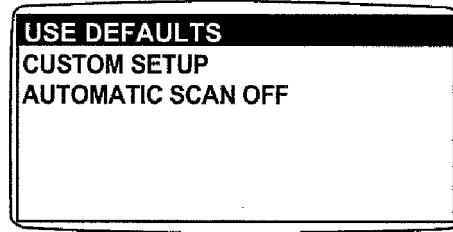
1-Up Display Options

Continued on next page

OURGP11,00000B1 -19-03SEP03-4/18

RG13196 —UN—26SEP03

5. **Use Defaults** - To select "Use Defaults" use the Arrow keys to scroll to and highlight "Use Defaults" in the menu display.

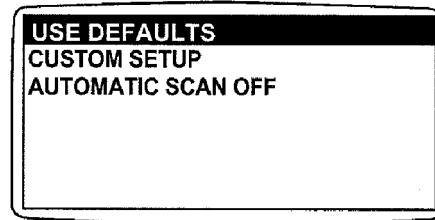


Select Defaults

OURGP11,00000B1 -19-03SEP03-5/18

RG13195 —UN—26SEP03

6. Press the "Enter" key to activate the "Use Defaults" function.

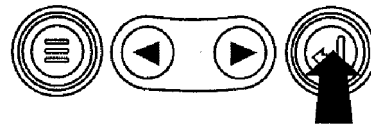
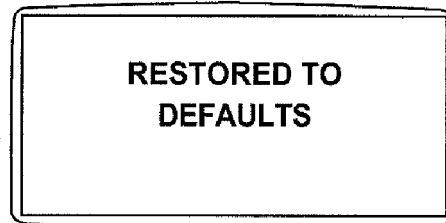


Defaults Selected

OURGP11,00000B1 -19-03SEP03-6/18

RG13197 —UN—29SEP03

7. The display parameters are reset to the factory defaults, then the display will return to the "Setup 1-Up Display" menu.



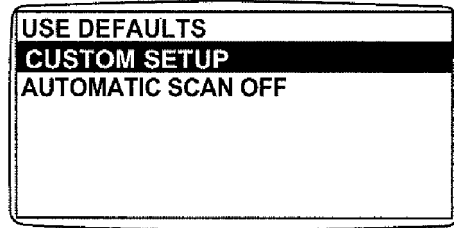
Restored To Defaults

Continued on next page

OURGP11,00000B1 -19-03SEP03-7/18

RG13149 —UN—24SEP03

8. **Custom Setup** - To perform a custom setup of the 1-Up Display, use the arrow buttons to scroll to and highlight "Custom Setup" on the display.

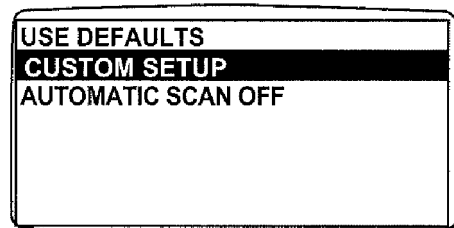


Select Custom Setup

OURGP11,00000B1 -19-03SEP03-8/18

RG13198 —UN—26SEP03

9. Press the "Enter" key to display a list of engine parameters.

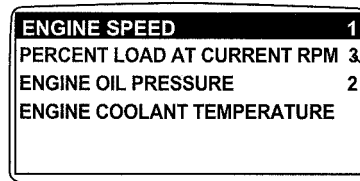


Engine Parameters

OURGP11,00000B1 -19-03SEP03-9/18

RG13199 —UN—26SEP03

10. Use the "Arrow" keys to scroll to and highlight a selected parameter (parameter with a number to right of it).



This number indicates the order of display for the parameters and that the parameter is selected for display.



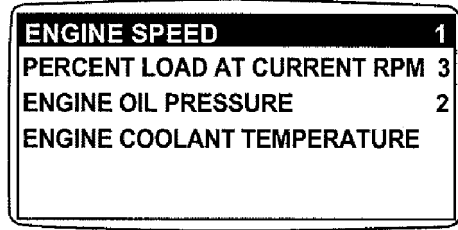
Select Parameters

Continued on next page

OURGP11,00000B1 -19-03SEP03-10/18

RG13150 —UN—24SEP03

11. Press the "Enter" key to deselect the selected parameter, removing it from the list of parameters being displayed on the 1-Up Display.

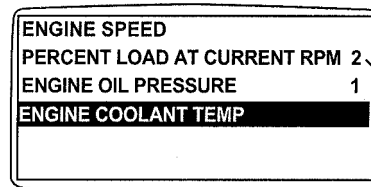


Deselect Parameters

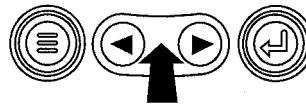
OURGP11,00000B1 -19-03SEP03-11/18

RG13219 —UN—26SEP03

12. Use the "Arrow" keys to scroll and highlight the desired parameter that has not been selected for display (parameter without a number to right of it).



Note that the numbers now indicate the new order of display for the parameters.

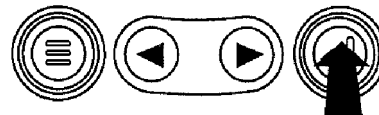
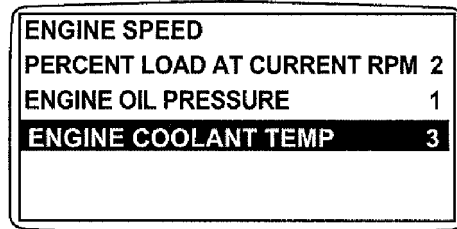


Select Desired Parameters

OURGP11,00000B1 -19-03SEP03-12/18

RG13151 —UN—24SEP03

13. Press the "Enter" key to select the parameter for inclusion in the Single Engine Parameter Display.
14. Continue to scroll through and select additional parameters for the custom 1-Up Display. Press the "Menu" key at any time to return to the "Custom Setup" menu.



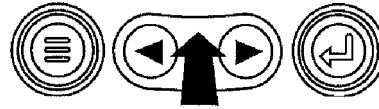
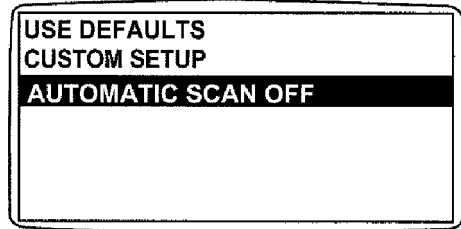
Select Parameters For Display

Continued on next page

OURGP11,00000B1 -19-03SEP03-13/18

RG13220 —UN—26SEP03

15. **Automatic Scan** - Selecting the scan function will allow the 1- Up Display to scroll through the selected set of parameters one at a time. Use the "Arrow" keys to scroll to the "Automatic Scan" function.

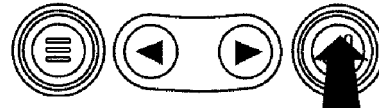
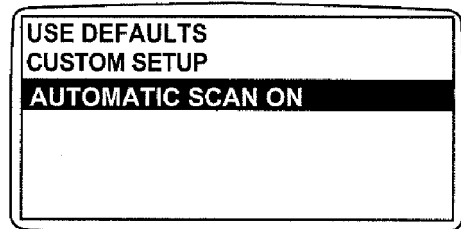


Automatic Scan Off

OURGP11,00000B1 -19-03SEP03-14/18

RG13221 —UN—26SEP03

16. Press the "Enter" key to toggle the "Automatic Scan" function on.

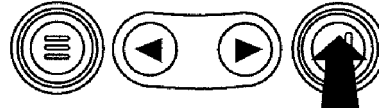
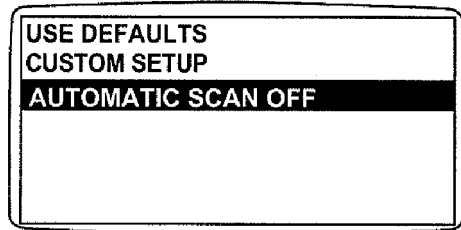


Automatic Scan On

OURGP11,00000B1 -19-03SEP03-15/18

RG13222 —UN—26SEP03

17. Press the "Enter" key again to toggle the "Automatic Scan" function off.



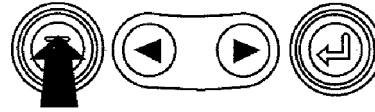
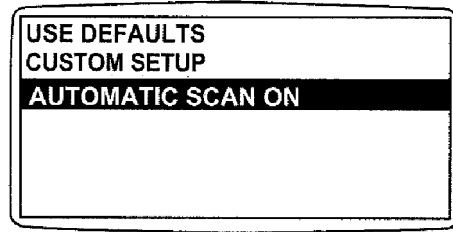
Automatic Scan Off

Continued on next page

OURGP11,00000B1 -19-03SEP03-16/18

RG13223 —UN—26SEP03

18. Once the "Use Defaults", "Custom Setup" and "Automatic Scan" functions have been set, press the "Menu" key to return to the main menu.

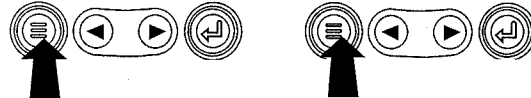
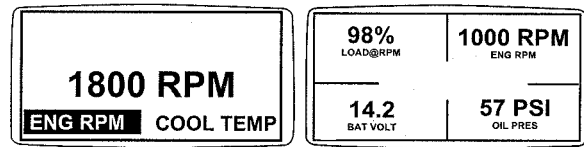


Menu Key

OURGP11,00000B1 -19-03SEP03-17/18

RG13224 —UN—26SEP03

19. Press the "Menu" key to exit the main menu and return to the engine parameter display.



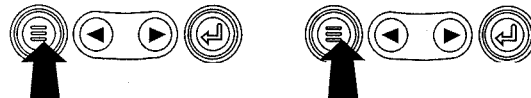
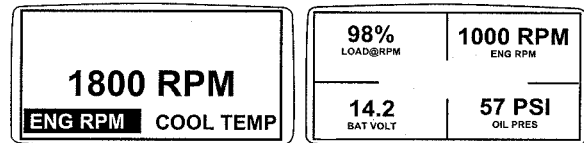
Exit Main Menu

OURGP11,00000B1 -19-03SEP03-18/18

RG13159 —UN—26SEP03

Setup 4-Up Display

1. Turn the key switch to the ON position. From the single or four engine parameter display, press the "Menu" key.

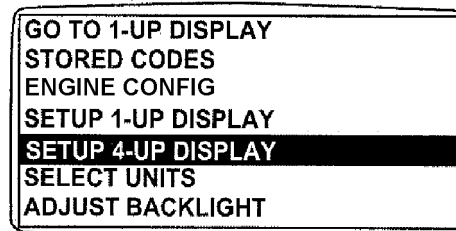


Menu Key

OURGP11,00000B2 -19-03SEP03-1/14

RG13159 —UN—26SEP03

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Setup 4-Up Display" is highlighted.



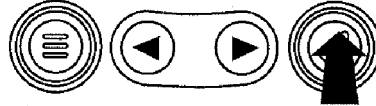
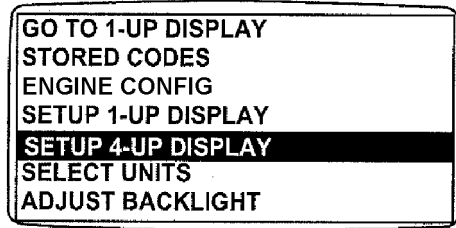
Select Setup 4-Up Display

Continued on next page

OURGP11,00000B2 -19-03SEP03-2/14

RG13225 —UN—02OCT03

3. Once the "Setup 4-Up Display" menu item has been highlighted, press the "Enter" key to activate the "Setup 4-Up Display" menu.



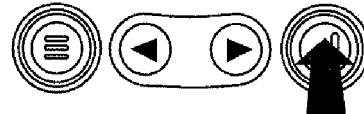
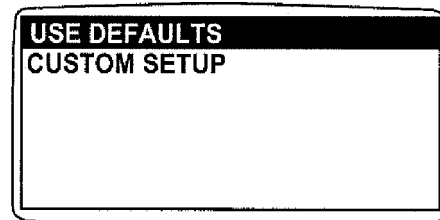
Press Enter Key

OURGP11,00000B2 -19-03SEP03-3/14

RG13226 —UN—02OCT03

4. Two options are available for the 4-Up Display.

- a. **Use Defaults** – This option contains the following engine parameters for display: Engine Speed, Battery Voltage, Coolant Temperature and Oil Pressure.
- b. **Custom Setup** – This option contains a list of engine parameters. Engine parameters from this list can be selected to replace any or all of the default parameters.

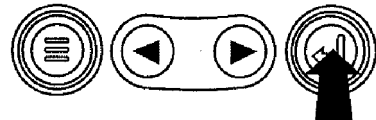
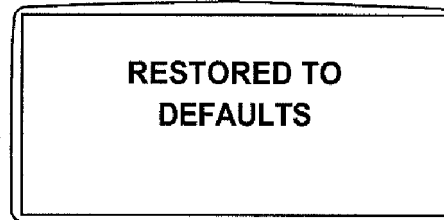


Select Factory Defaults

OURGP11,00000B2 -19-03SEP03-4/14

RG13244 —UN—02OCT03

5. To reset the display parameters to the factory defaults, scroll to and highlight "Use Defaults". Press the "Enter" key to activate the "Use Defaults" function. A message indicating the display parameters are reset to the factory defaults will be displayed, then the display will return to the "Setup 4-Up Display" menu.



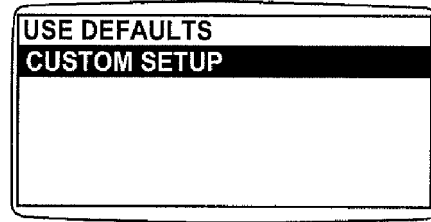
Restored To Defaults

Continued on next page

OURGP11,00000B2 -19-03SEP03-5/14

RG13149 —UN—24SEP03

6. **Custom Setup** - To perform a custom setup of the 4-Up Display, use the arrow buttons to scroll to and highlight "Custom Setup" on the display.

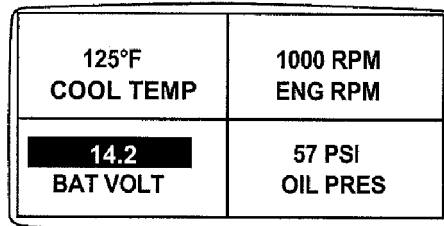


Custom Setup

RG13227 —UN—26SEP03

OURGP11,00000B2 -19-03SEP03-6/14

7. The quadrant with the highlighted parameter value is the current selected parameter. Use the "Arrow" keys to highlight the value in the quadrant you wish to change to a new parameter.

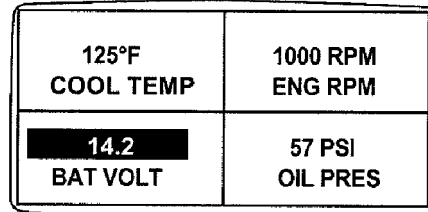


Select Parameters

RG13228 —UN—26SEP03

OURGP11,00000B2 -19-03SEP03-7/14

8. Press the "Enter" key and a list of engine parameters will be displayed.



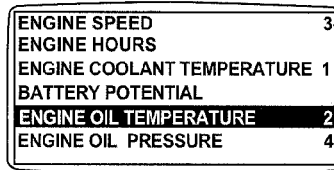
List Of Engine Parameters

RG13229 —UN—26SEP03

Continued on next page

OURGP11,00000B2 -19-03SEP03-8/14

9. The parameter that is highlighted is the selected parameter for the screen. Use the "arrow" keys to highlight the new parameter to be placed in the "4-Up Display".



The number to the right of the parameter indicates the quadrant in which it is displayed.
 1. = Upper Left Quadrant
 2. = Lower Left Quadrant
 3. = Upper Right Quadrant
 4. = Lower Right Quadrant

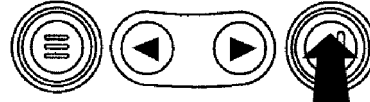
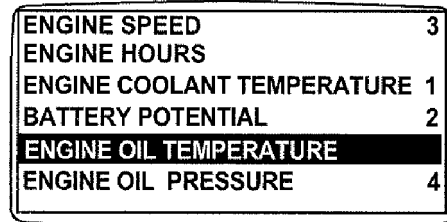


Select Desired Engine Parameter

OURGP11,00000B2 -19-03SEP03-9/14

RG13230 —UN—26SEP03

10. Press the "Enter" key to change the selected parameter in the quadrant to the new parameter.

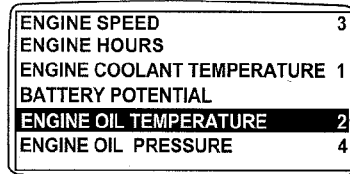


Enter Selected Parameter

OURGP11,00000B2 -19-03SEP03-10/14

RG13231 —UN—26SEP03

11. Use the "Menu" keys to return to the "4-Up Custom Setup" screen.



Note the number to the right of the selected parameter indicating that the parameter is now assigned to that display location.

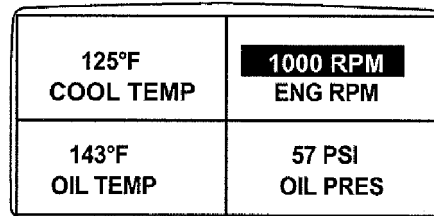


Return To 4-Up Custom Setup

OURGP11,00000B2 -19-03SEP03-11/14

RG13232 —UN—26SEP03

12. The selected quadrant has now changed to the new selected parameter.



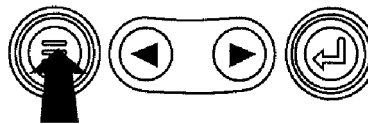
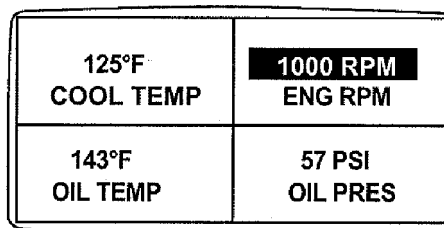
4-Up Display

Continued on next page

OURGP11,00000B2 -19-03SEP03-12/14

RG13153 —UN—24SEP03

13. Repeat the parameter selection process until all spaces are as desired.
14. Press the "Menu" key to return to the main menu.

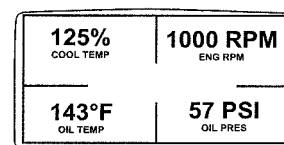
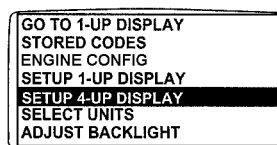


Return To Main Menu

RG13154 —UN—24SEP03

OURGP11,0000B2 -19-03SEP03-13/14

15. Press the "Menu" key to exit the main menu and return to the engine parameter display.



Select Remaining Parameters

RG13155 —UN—07OCT03

OURGP11,0000B2 -19-03SEP03-14/14

Break-in period

Within first 100 hours of operation:

During the first 100 hours of operation, avoid overloading, excessive idling and no-load operation.

If oil has to be added during this time, see ENGINE BREAK-IN OIL.

NOTE: During the break-in period a higher-than-usual oil consumption should be considered as normal.

After first 100 hours of operation:

After the first 100 hours, drain the crankcase and change the oil filter (see CHANGING ENGINE OIL AND FILTER). Fill crankcase with seasonal viscosity grade oil (see DIESEL ENGINE OIL).

Check tension of alternator belt.

Check connections of air intake hoses.

Check for proper tightening of cap screws all around the engine.

DPSG,CD03523,17 -19-22JAN07-1/1

Starting the engine

CAUTION: Before starting engine in a confined building, install proper outlet exhaust ventilation equipment. Always use safety approved fuel storage and piping.

NOTE: If temperature is below 0 ° C (32 ° F), it may be necessary to use cold weather starting aids (See COLD WEATHER OPERATION).

1. Perform all prestarting checks outlined in Maintenance/Daily Section.
2. Open the fuel supply shut-off valve, if equipped.
3. Activate the starter motor switch to crank the engine and release it as soon as engine starts.

NOTE: Do not operate the starter motor more than 20 seconds at a time.

DPSG,CD03523,18 -19-22JAN07-1/1

Cold Weather Operation

Depending on equipment, various cold weather starting aids are available to assist in starting the engine at temperature below 0° C (32 °F).

Air intake heater

CAUTION: DO NOT use starting fluid on engines equipped with grid-type air intake heater or glow plug (s). Ether starting fluid is highly flammable and may explode, causing serious injury.

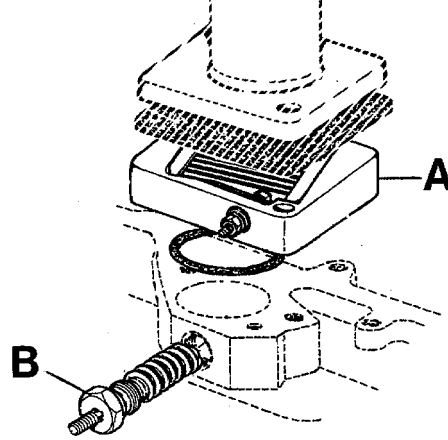
NOTE: On engines with electronically controlled fuel system, the air intake heater operates automatically, controlled by the ECU. An engine preheater indicator light comes on when the key switch is turned ON. In warm weather, the light comes on briefly for a light check. In cold weather, the light remains ON during the automatic operation of the air intake heater or glow plug (s). Operating time depends on temperature. Do not crank engine until light goes OFF.

- **3029 engines** are optionally equipped with the single glow plug (B) screwed in cylinder head intake manifold. Activate the glow plug (preheater position) for 30 seconds maximum then start the engine.
- **4045, 6068 and 6090 engines** are optionally equipped with the grid-type air heater (A). Turn key switch ON, but DO NOT crank engine until engine preheater indicator light turns OFF.

A—Grid-Type Air Heater (4045, 6068 and 6090 Engines) B—Single Glow Plug (3029 Engines)



Handle Starting Fluid with Care



Glow Plug or Grid-Type Air Heater

TS1356 —UN—18MAR92

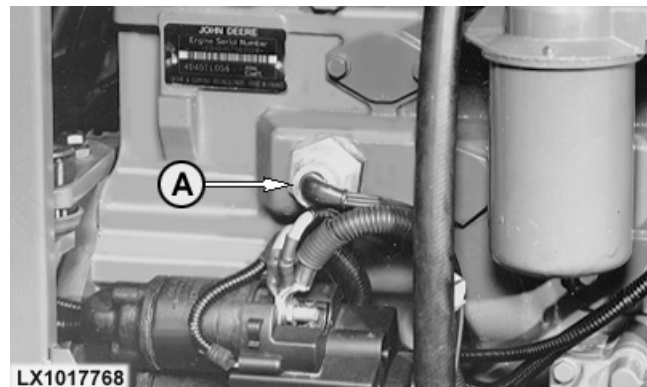
CD30750 —UN—03SEP99

CD03523.00002AD -19-25NOV10-1/3

Coolant heater

Connect plug of coolant heater (A) to a proper power source (110 or 220 V).

At an ambient temperature of -15 °C (5 °F), the heating process takes approximately 2 hours. Extend heating period if ambient temperature is lower.



Coolant Heater

Continued on next page

CD03523.00002AD -19-25NOV10-2/3

Fuel preheater

Fuel preheater (A) switches ON and OFF automatically in relation with the ambient temperature.



Fuel Preheater

CD03523.00002AD -19-25NOV10-3/3

Using a booster battery or charger

A 12-volt booster battery can be connected in parallel with battery(ies) on the unit to aid in cold weather starting. ALWAYS use heavy duty jumper cables.

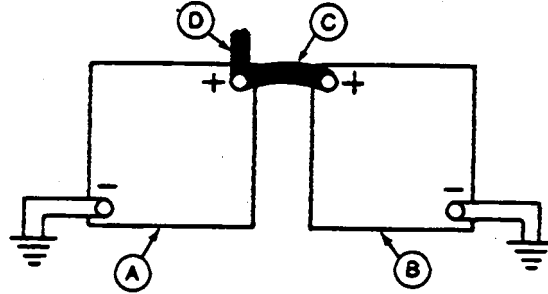
⚠ CAUTION: Gas given off by battery is explosive. Keep sparks and flames away from battery. Before connecting or disconnecting a battery charger, turn charger off. Make last connection and first disconnection at a point away from battery. Always connect NEGATIVE (-) cable last and disconnect this cable first.

IMPORTANT: Be sure polarity is correct before making connections. Reversed polarity will damage electrical system. Always connect positive to positive and negative to ground. Always use 12-volt booster battery for 12-volt electrical systems and 24-volt booster battery(ies) for 24-volt electrical systems.

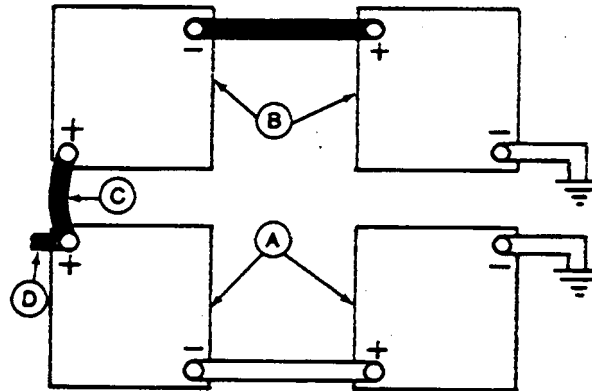
1. Connect booster battery or batteries to produce the required system voltage for your engine application.

NOTE: To avoid sparks, DO NOT allow the free ends of jumper cables to touch the engine.

2. Connect one end of jumper cable to the POSITIVE (+) post of the booster battery.
3. Connect the other end of the jumper cable to the POSITIVE (+) post of battery connected to starter.
4. Connect one end of the other jumper cable to the NEGATIVE (-) post of the booster battery.
5. ALWAYS complete the hookup by making the last connection of the NEGATIVE (-) cable to a good ground on the engine frame and away from the battery(ies).
6. Start the engine. Disconnect jumper cables immediately after engine starts. Disconnect NEGATIVE (-) cable first.



12-Volt System



24-Volts System

A—12-Volt Machine battery (ies) C—Booster cable
 B—12-Volt Booster battery (ies) D—Cable to starter motor

TS204 —UN—23AUG88

RG4678 —UN—14DEC88

RG4698 —UN—14DEC88

DPSG,CD03523,20 -19-22JAN07-1/1

Engine operation

Warming engine

Operate engine at high idle for 1 to 2 minutes before applying the load.

NOTE: This procedure does not apply to standby generator sets where the engine is loaded immediately upon reaching rated speed.

Normal engine operation

Compare engine coolant temperature and engine oil pressure with specifications below:

	Specification
Minimum oil pressure at full load rated speed ¹ —Pressure.....	275 kPa (2.75 bar) (40 psi)
Coolant temperature range—Temperature.....	82°—94°C (180°—202°F)

Stop engine immediately if coolant temperature is above or oil pressure below specifications or if there are any signs of part failure. Symptoms that may be early signs of engine problems could be:

- Sudden loss of power

¹Oil at normal operating temperature of 115°C (240°F).

- Unusual noise or vibration
- Excessive black exhaust
- Excessive fuel consumption
- Excessive oil consumption
- Fluid leaks

Recommendation for turbocharger engines

Should the engine stall when operating under load, IMMEDIATELY restart it to prevent overheating of turbocharger components.

Idling engine

Avoid excessive engine idling. Prolonged idling may cause the engine coolant temperature to fall below its normal range. This, in turn, causes crankcase oil dilution, due to incomplete fuel combustion, and permits formation of gummy deposits on valves, pistons, and piston rings. It also promotes rapid accumulation of engine sludge and unburned fuel in the exhaust system. If an engine will be idling for more than 5 minutes, stop and restart later.

NOTE: Generator set applications have the governor locked at a specified speed and do not have a slow idle function. These engines idle at no load governed speed (fast idle).

DPSG,CD03523,21 -19-22JAN07-1/1

Standby power units

To assure that your engine will deliver efficient standby operation when needed, start engine and run at rated speed (with 50%—70% load) for 30 minutes every 2

weeks. DO NOT allow engine to run extended period of time with no load.

DPSG,CD03523,22 -19-22JAN07-1/1

Stopping the engine

1. Before stopping, run engine for at least 2 minutes at fast idle and no load.

2. Stop the engine.

DPSG,CD03523,23 -19-22JAN07-1/1

Changing Generator Frequency

All generator sets are dual-frequency; 50 Hz (1500 rpm) or 60 Hz (1800 rpm). Refer to the generator set documentation for more information.

CD03523,00002AE -19-25NOV10-1/1

Maintenance

Observe service intervals

Using hour meter as a guide, perform all services at the hourly intervals indicated on following pages. At each scheduled maintenance interval, perform all previous maintenance operations in addition to the ones specified. Keep a record of hourly intervals and services performed using charts provided in Maintenance Records Section.

IMPORTANT: Recommended service intervals are for normal operating conditions. Service MORE OFTEN if engine is operated under adverse conditions. Neglecting maintenance can result in failures or permanent damage to the engine.

DPSG,CD03523,24 -19-22JAN07-1/1

Use correct fuels, lubricants and coolant

IMPORTANT: Use only fuels, lubricants, and coolants meeting specifications outlined in Fuels, Lubricants, and Coolant Section when servicing your John Deere Engine.

Consult your John Deere engine distributor, servicing dealer or your nearest John Deere Parts Network for recommended fuels, lubricants, and coolant. Also available are necessary additives for use when operating engines in tropical, arctic, or any other adverse conditions.



TS100—UN—23AUG88

DPSG,CD03523,25 -19-22JAN07-1/1

Maintenance Interval Chart

Item	10 H / Daily	Every 2 Weeks	500 H	1000 H / 1 Year	2000 H / 2 Years	3000 H / 3 Years	4500 H	As Re- quired
Check engine oil and coolant level	•							
Check air filter restriction indicator ^a	•							
Check fuel filter/Water bowl	•							
Operate engine at rated speed and 50—70% load a minimum of 30 minutes ^b		•						
Change engine oil and filter ^c			•					
Replace fuel filter element(s)			•					
Check crankcase vent system			•					
Check engine mounts			•					
Check engine ground connection			•					
Check belt tension and automatic tensioner				•				
Check cooling system				•				
Check air intake system				•				
Replace crankcase vent filter (optional)				•				
Check crankshaft vibration damper (6 cyl.) ^d				•				
Check and adjust engine speed				•				
Drain and flush cooling system ^e					•	•		
Adjust valve clearance					•			
Replace crankshaft vibration damper (6 cyl.)							•	
Bleed the fuel system								•
Clean or replace air filter element (see note a)								•
Replace fan/alternator belt								•
Test thermostat and injection nozzles (see your dealer) ^f								•

^aClean air filter element when restriction indicator is red. Replace filter element after 6 cleanings or once a year.

^bFor standby generator set only.

^cChange oil and filter after the first 100 hours of operation, then every 500 hours maximum thereafter. Change oil and filter at least once a year.

^dHave your authorized dealer or engine distributor replace the vibration damper every 4500 hours/5 years.

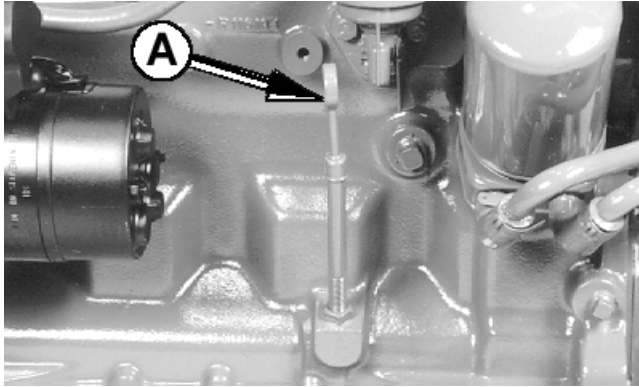
^eDrain and flush cooling system every 3000 hours/3 years when John Deere COOL-GARD II coolant is used. Otherwise every 2000 hours/2 years.

^fContact your dealer when thermostat or injection nozzles are suspected to be defective. Replace injection nozzles every 5000 hours and thermostat every 10000 hours.

Maintenance/Daily or Every 10 Hours

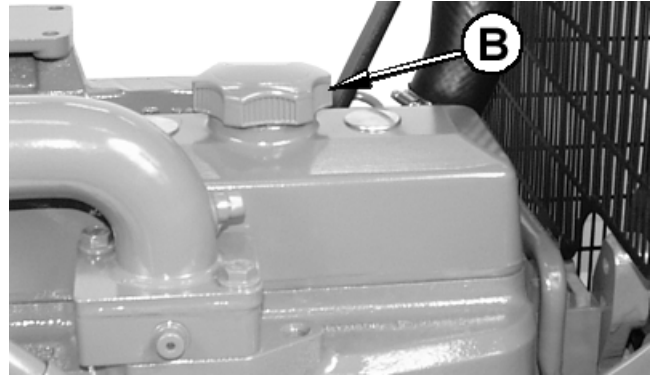
Check Engine Oil Level

3029 Engines



CD30754 —UN—26AUG99

Oil Dipstick on 3029 Engines



CD30755 —UN—24SEP99

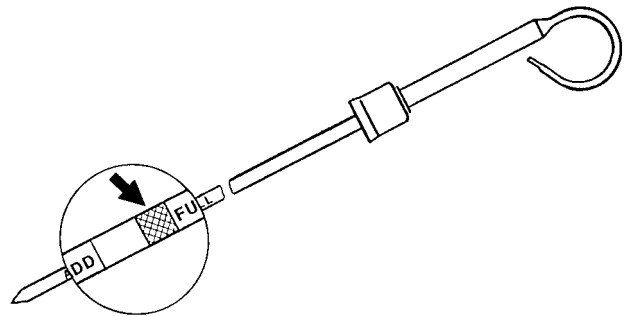
Oil Filler Cap

Before starting the engine for the first time of the day, check engine oil level on dipstick (A). Add oil as required, using seasonal viscosity grade oil, at rocker arm cover filler cap (B).

IMPORTANT: DO NOT fill above the crosshatch area. Oil levels anywhere within crosshatch area are considered in the acceptable operating range.

A—Oil Dipstick

B—Oil Filler Cap



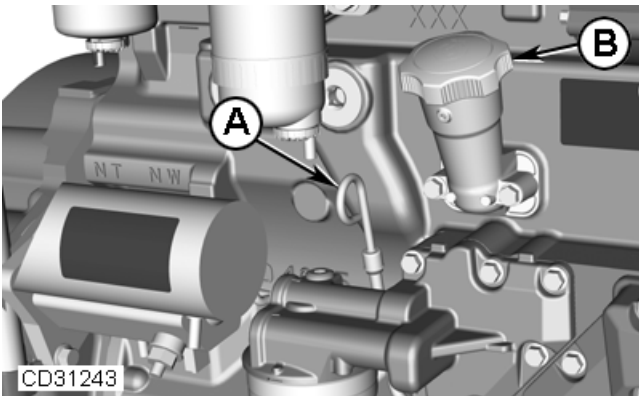
FD000047

Crosshatch Area on Oil Dipstick

FD000047 —UN—13MAR96

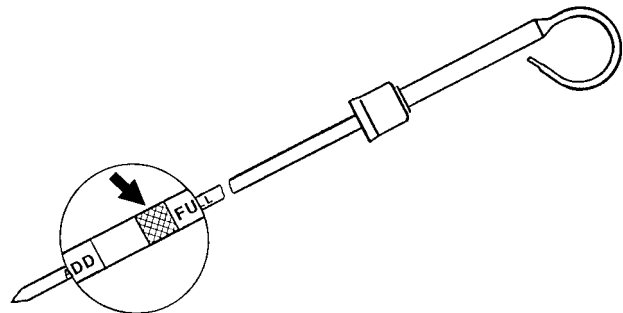
CD03523,00002B0 -19-23DEC10-1/3

4045 and 6068 Engines



CD31243 —UN—30NOV10

Oil Dipstick and Oil Filler Neck on 4045/6068 Engines



FD000047

Crosshatch Area on Oil Dipstick

FD000047 —UN—13MAR96

Before starting the engine for the first time of the day, check engine oil level on dipstick (A). Add oil as required, using seasonal viscosity grade oil, at oil filler neck (B).

IMPORTANT: DO NOT fill above the crosshatch area. Oil levels anywhere within crosshatch area are considered in the acceptable operating range.

Continued on next page

CD03523,00002B0 -19-23DEC10-2/3

6090 Engines

Before starting the engine for the first time of the day, check engine oil level on oil dipstick /filler cap (A) as follows:

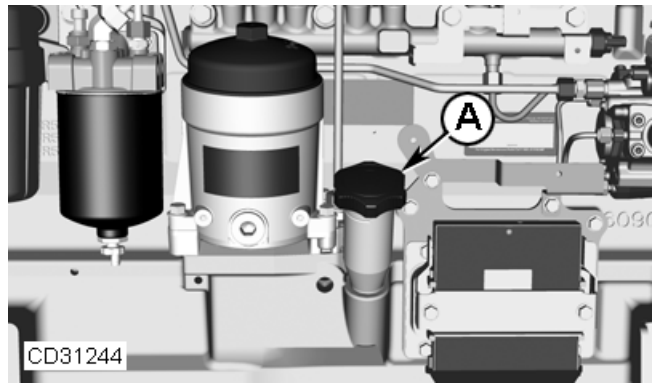
1. Remove oil dipstick/filler cap (A).
2. Wipe dipstick blade to remove oil.
3. Reinstall dipstick then tighten by hand.
4. Again remove dipstick and check oil level.

Add oil as required, using seasonal viscosity grade oil.

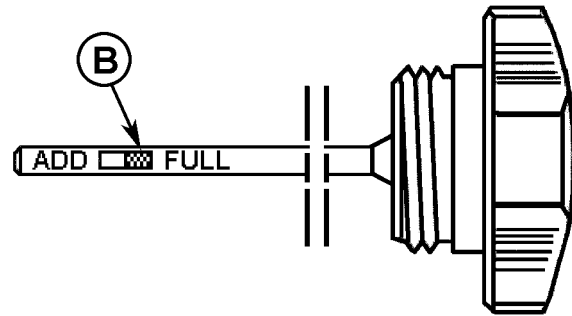
IMPORTANT: DO NOT fill above the crosshatch area (B). Oil levels anywhere within crosshatch area are considered in the acceptable operating range.

A—Oil Dipstick/Filler Cap

B—Crosshatch Area on Oil Dipstick/Filler Cap



Oil Dipstick/Filler Cap



CD31245

Crosshatch Area on Oil Dipstick/Filler Cap

CD03523,00002B0 -19-23DEC10-3/3

Check Coolant Level

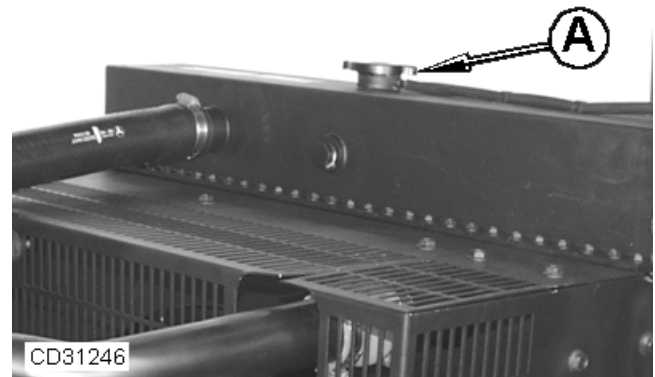


A—Radiator Cap

CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

Only remove filler cap when engine is cold or when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

TS281 —UN—23AUG88

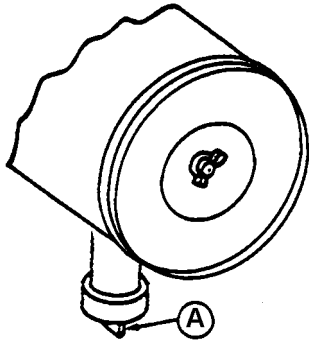


Radiator Cap

Remove radiator cap (A) and check coolant level which should be at bottom of filler neck. Fill radiator with proper coolant solution if level is low. Check entire cooling system for leaks.

CD03523,00002B1 -19-03JAN11-1/1

Check Air Filter



CD31247

Check Dust Unloader Valve



CD31247 —UN—30NOV10

CD31248

CD31248 —UN—30NOV10

Check Air Restriction Indicator

A—Dust Unloader Valve **B—Air Restriction Indicator**

1. If air filter has a dust unloader valve (A), squeeze valve tip to release any trapped dirt particles.
2. Check air intake restriction indicator (B). When indicator is red, air filter needs to be cleaned.

IMPORTANT: Maximum air intake restriction is 6.25 kPa (0.06 bar) (1.0 psi) (25 in. H₂O). A clogged air cleaner element will cause excessive intake restriction and a reduced air supply to the engine.

3. Make a thorough inspection of the engine compartment.

NOTE: Wipe all fittings, caps, and plugs before performing any maintenance to reduce the chance of system contamination.

CD03523,00002B2 -19-23DEC10-1/1

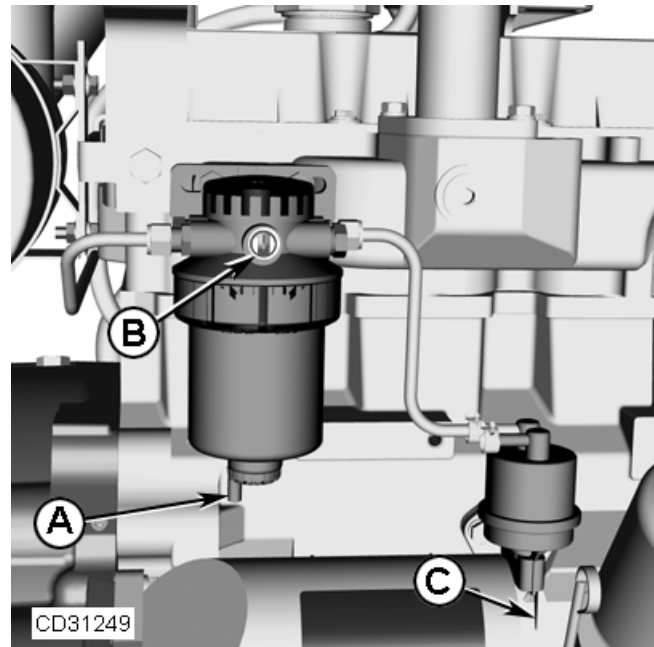
Check Fuel Filter

3029 Engines

Check the fuel filter daily for water or debris and drain as necessary.

IMPORTANT: Drain water into a suitable container and dispose of properly.

1. Loosen drain plug (A) at bottom of fuel filter two or three turns.
2. Loosen air bleed plug (B) two full turns on fuel filter base and drain water from bottom until fuel starts to drain out.
3. When fuel starts to drain out, hand tighten drain plug. After draining water from the fuel filter, the filter must be primed by bleeding all air from the fuel system.
4. Operate primer lever (C) of the fuel supply pump until fuel flow is free from air bubbles.
5. Tighten bleed plug securely by hand. Continue operating hand primer until pumping action is not felt. When finished, pull hand primer outward (away from engine) as far as it will go.



CD31249

CD31249 —UN—30NOV10

Drain Water from Fuel Filter

A—Drain Plug
B—Air Bleed Plug

C—Primer Lever

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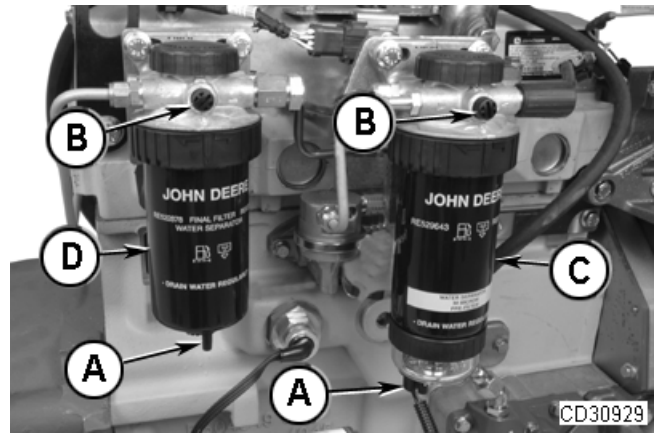
CD03523,00002B3 -19-23DEC10-1/3

4045 and 6068 Engines

NOTE: Engines have two fuel filters (primary and final) equipped with a water-in-fuel sensor. Depending on application, an indicator light on the instrument panel will signal the operator that water should be drained from filter bowls.

Check fuel filters (C) and (D) daily for water or debris and drain as necessary.

1. Loosen drain plugs (A) at bottom of both fuel filters two or three turns.
2. Loosen air bleed plugs (B) two full turns and drain water into a suitable container.
3. When fuel starts to drain out, tighten drain plugs securely.
4. Bleed fuel system.



Drain Water from Fuel Filters

- | | |
|-------------------|-----------------------|
| A—Drain Plugs | C—Primary Fuel Filter |
| B—Air Bleed Plugs | D—Final Fuel Filter |

CD03523,00002B3 -19-23DEC10-2/3

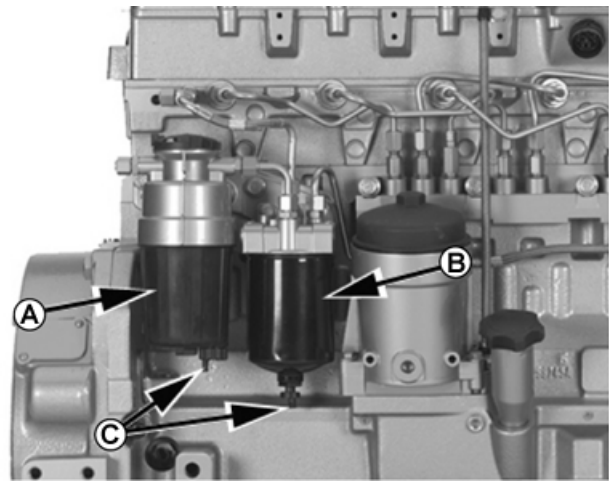
CD30929 —JUN—07FEB07

6090 Engines

NOTE: Depending on application, the primary fuel filter is equipped with a sensor that detects the presence of water in the fuel filter element. This sensor will illuminate the red "STOP ENGINE" warning light on the diagnostic gauge and also sound an audible alarm. A Diagnostic Trouble Code (DTC), a description of the trouble code and the corrective action needed will be displayed on the diagnostic gauge.

Check fuel filters (A) and (B) daily for water or debris and drain as necessary.

1. Loosen drain plugs (C) at bottom of both fuel filters two or three turns.
2. Drain water into a suitable container.
3. Retighten drain plugs securely.
4. Turn ignition key to "ON" for 60 seconds to prime the fuel system before starting engine.



Drain Water from Fuel Filters

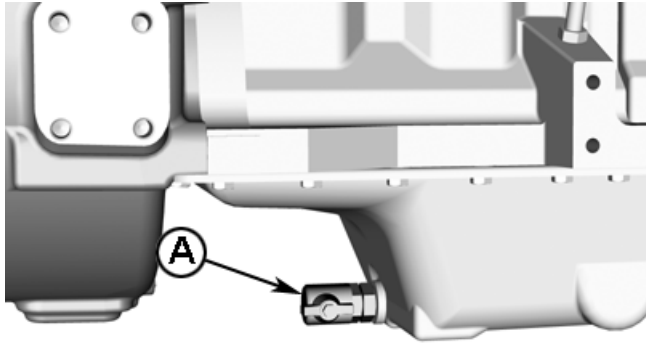
- | | |
|-----------------------|---------------|
| A—Primary Fuel Filter | C—Drain Plugs |
| B—Final Fuel Filter | |

CD03523,00002B3 -19-23DEC10-3/3

RG13845 —JUN—11JAN05

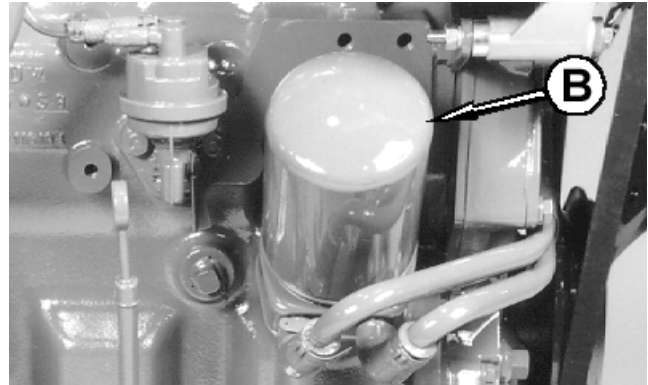
Maintenance/500 Hours

Change Engine Oil and Filter (3029 Engines)



CD31250

Oil Pan Drain Valve on 3029 Engines

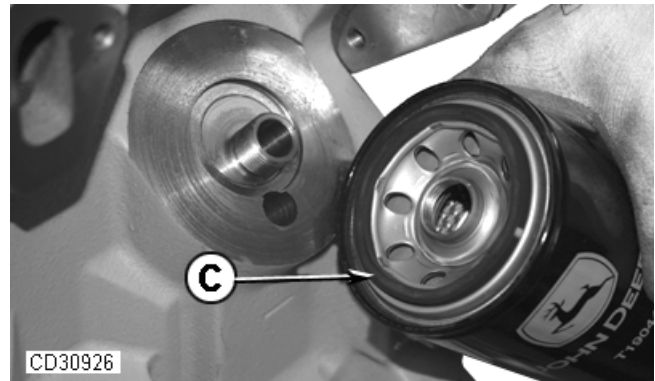


Oil Filter on 3029 Engines

IMPORTANT: Filtration of oils is critical to proper lubrication. Always change filter regularly. Use filter meeting John Deere performance specifications.

NOTE: Change engine oil and filter for the first time after 100 hours maximum of operation, then every 500 hours thereafter. Change oil and filter at least once a year.

1. Run engine approximately 5 minutes to warm up oil. Shut engine off.
2. Open oil pan drain valve (A).
3. Drain crankcase oil from engine while warm.
4. Replace oil filter as follows:
 - a. Remove and discard oil filter element (B) using a suitable filter wrench.
 - b. Oil packing (C) and install new filter element. Hand tighten element according to values printed on filter element. If values are not provided, tighten element



Oil Filter Packing

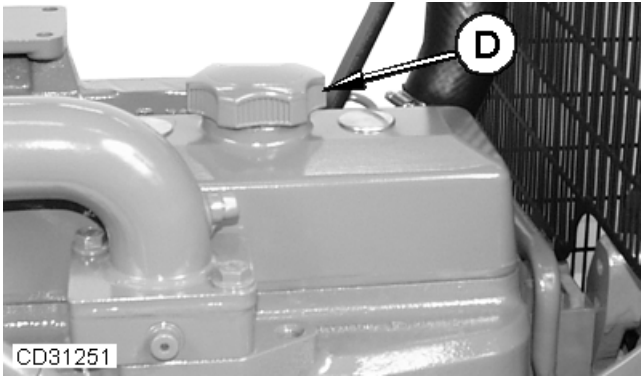
A—Oil Pan Drain Valve
B—Oil Filter Element

C—Oil Filter Packing

approximately 3/4 — 1-1/4 turn after packing contacts filter housing. DO NOT overtighten filter element.

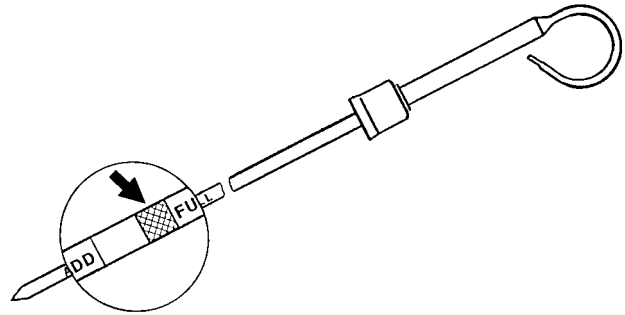
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CD03523,00002B4 -19-23DEC10-1/2



Oil Filler Cap

CD31251 — JUN — 06DEC10



FD000047

Crosshatch Area on Oil Dipstick

FD000047 — JUN — 13MAR96

D—Oil Filler Cap

5. Close oil pan drain valve.
6. Fill engine crankcase with correct John Deere engine oil through opening on rocker arm cover (D).

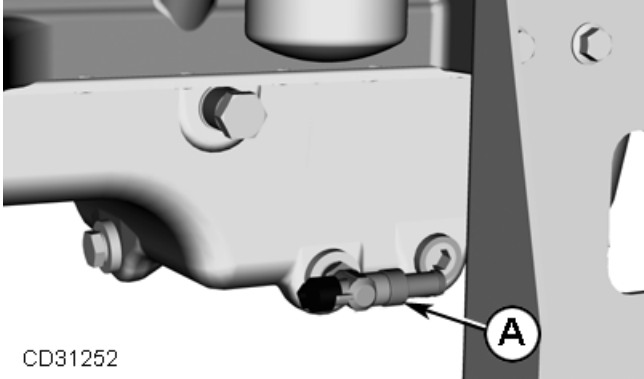
To determine the correct oil fill quantity for your engine, see the Specifications Section.

NOTE: Crankcase oil capacity may vary slightly. ALWAYS fill crankcase to full mark or within crosshatch area on dipstick, whichever is present. DO NOT overfill.

7. Start engine and run to check for possible leaks.
8. Stop engine and check oil level after 10 minutes. If necessary, top up.

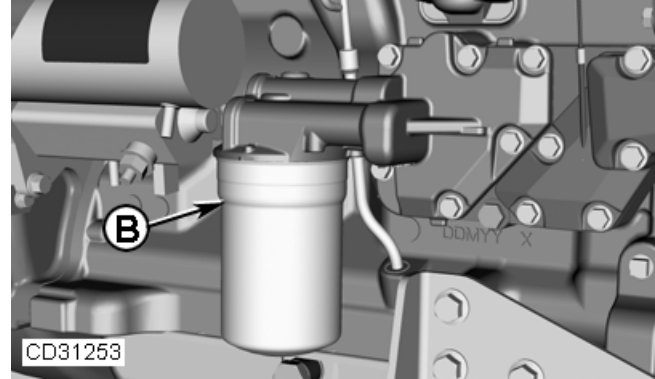
CD03523,00002B4 -19-23DEC10-2/2

Change Engine Oil and Filter (4045 and 6068 Engines)



Oil Pan Drain Valve on 4045/6068 Engines

CD31252—UN—06DEC10



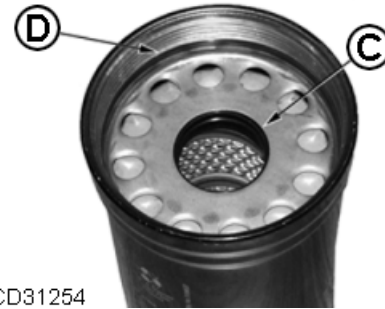
Oil Filter on 4045/6068 Engines

CD31253—UN—06DEC10

IMPORTANT: Filtration of oils is critical to proper lubrication. Always change filter regularly. Use filter meeting John Deere performance specifications.

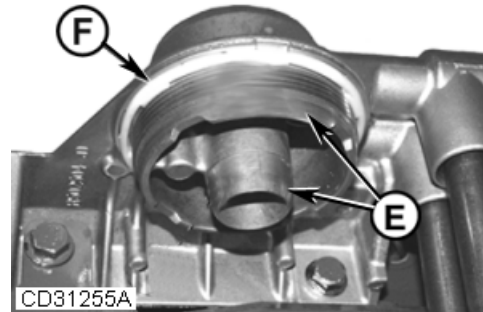
NOTE: Change engine oil and filter for the first time after 100 hours maximum of operation, then every 500 hours thereafter. Change oil and filter at least once a year.

1. Run engine approximately 5 minutes to warm up oil. Shut engine off.
2. Open oil pan drain valve (A).
3. Drain crankcase oil from engine while warm.
4. Replace oil filter as follows:
 - a. Remove and discard oil filter element (B) using a suitable filter wrench.
 - b. Apply clean engine oil to inner (C) and outer (D) seals and to filter threads.
 - c. Wipe both sealing surfaces (E) of the filter header with a clean rag. Ensure notches in dust seal (F) are properly installed in the slots in the housing. Replace dust seal if damaged.
 - d. Install and tighten oil filter by hand until it is tight against dust seal (F). DO NOT overtighten.
5. Close oil pan drain valve.



Oil Filter Seals

CD31254—UN—06DEC10



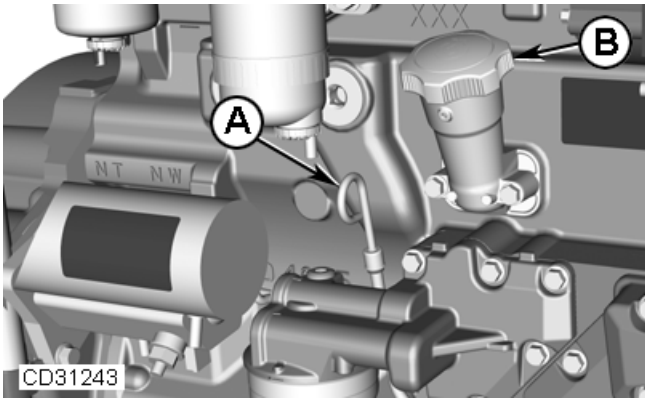
Oil Filter Header

CD31255A—UN—06DEC10

- | | |
|-----------------------------|---------------------------|
| A—Oil Drain Valve | D—Outer Seal |
| B—Oil Filter Element | E—Sealing Surfaces |
| C—Inner Seal | F—Dust Seal |

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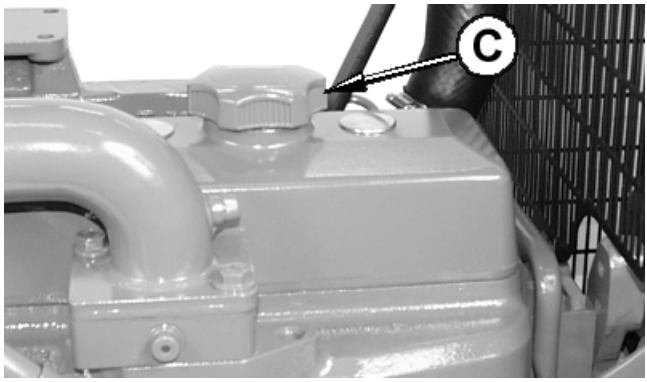
CD03523,00002B5 -19-23DEC10-1/2



CD31243

CD31243 —UN—30NOV10

Oil Filler Cap and Dipstick on 4045/6068 Engines



CD30761 —UN—24SEP99

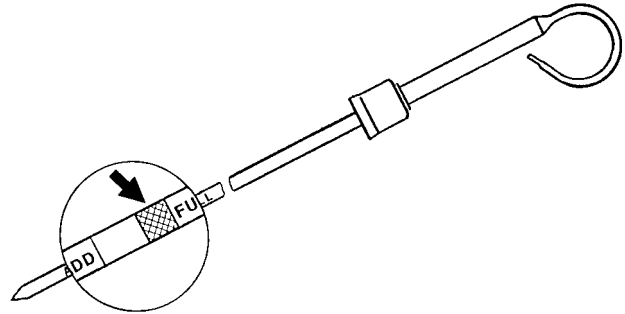
Oil Filler Cap on Rocker Arm Cover

6. Fill engine crankcase with correct John Deere engine oil through opening on rocker arm cover (C) or on the side of the engine (B).

To determine the correct oil fill quantity for your engine, see the Specifications Section.

NOTE: Crankcase oil capacity may vary slightly. ALWAYS fill crankcase to full mark or within crosshatch area on dipstick (A), whichever is present. DO NOT overfill.

7. Start engine and run to check for possible leaks.
8. Stop engine and check oil level after 10 minutes. If necessary, top up.



FD000047

Crosshatch Area on Oil Dipstick

FD000047 —UN—13MAR96

A—Oil Dipstick
B—Oil Filler Cap on Side of Engine

C—Oil Filler Cap on Rocker Arm Cover

CD03523,00002B5 -19-23DEC10-2/2

Change Engine Oil and Filter (6090 Engines)

IMPORTANT: Filtration of oils is critical to proper lubrication. Always change filter regularly. Use filter meeting John Deere performance specifications.

NOTE: Change engine oil and filter for the first time after 100 hours maximum of operation, then every 500 hours thereafter. Change oil and filter at least once a year.

1. Run engine approximately 5 minutes to warm up oil. Shut engine off.
2. Open oil pan drain valve (A).
3. Drain crankcase oil from engine while warm.

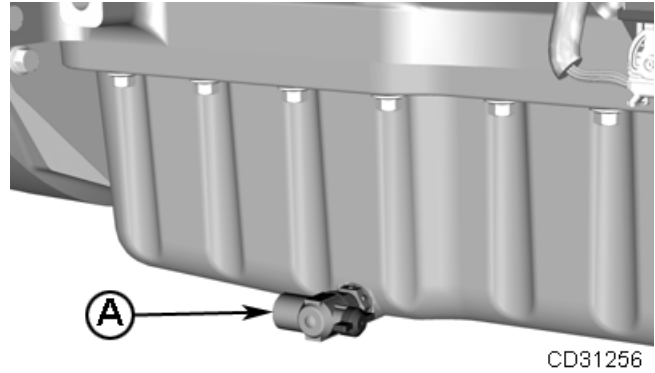
NOTE: Do NOT remove plug (B). Plug (B) is not an oil drain. Oil in filter will drain down automatically as filter cap is loosened.

4. Loosen filter cap (C) one-half turn with wrench. Wait 30 seconds to allow oil filter housing to drain. Remove cap and filter assembly.
5. While holding cap, strike filter element against solid surface as shown to unfasten filter from cap. Discard used filter.
6. Remove O-ring seal, and replace with new O-ring provided with new filter element.
7. Press new filter element into cap until it snaps into place.
8. Insert cap and filter assembly into oil filter housing. Screw cap into place.
9. Tighten cap to specifications.

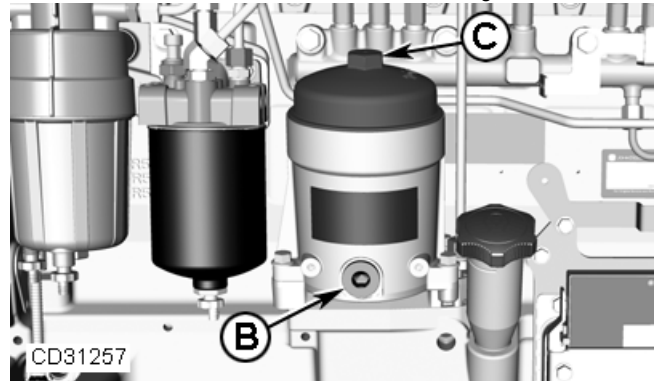
Specification

Top-Load Oil Filter
 Cap—Torque..... 45 N·m (33 lb.-ft.)

A—Oil Pan Drain Valve **C—Oil Filter Cap**
B—Plug (DO NOT REMOVE)



Oil Pan Drain Valve on 6090 Engines



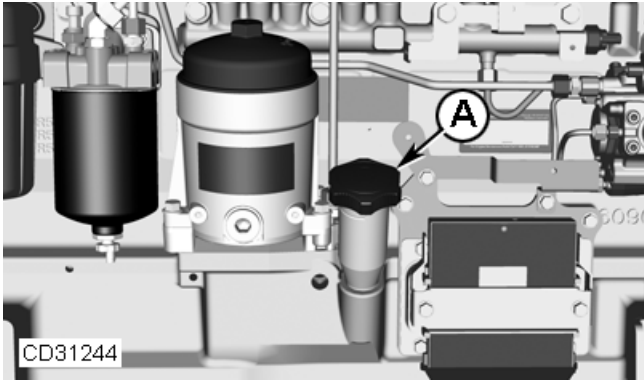
Oil Filter on 6090 Engines



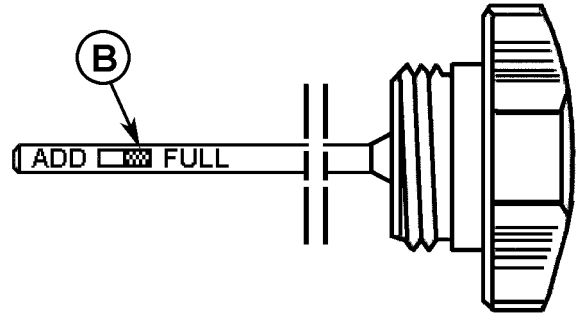
Remove Filter Element from Cap

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CD03523,00002B6 -19-23DEC10-1/2



Oil Dipstick/Filler Cap



Crosshatch Area on Oil Dipstick/Filler Cap

- A—Oil Dipstick/Filler Cap** **B—Crosshatch Area on Oil Dipstick/Filler Cap**

10. Close oil pan drain valve.
11. Remove oil dipstick/filler cap (A) and fill engine crankcase with correct John Deere engine oil.

NOTE: Crankcase oil capacity may vary slightly. ALWAYS fill crankcase to full mark or within crosshatch area on dipstick (B), whichever is present. DO NOT overfill.

To determine the correct oil fill quantity for your engine, see the Specifications Section.

To check oil level, proceed as follows:

- a. Remove oil dipstick/filler cap (A).
- b. Wipe dipstick blade to remove oil.

- c. Reinstall dipstick then tighten by hand.
- d. Again remove dipstick and check oil level.

IMPORTANT: Immediately after completing any oil change, crank engine for 30 seconds without permitting engine to start. This will help insure adequate lubrication to engine components before engine starts.

12. Start engine and run to check for possible leaks.
13. Stop engine and check oil level after 10 minutes. Oil level reading should be on upper mark of dipstick.

CD03523,00002B6 -19-23DEC10-2/2

Change Fuel Filter Element (3029 Engines)

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting fuel or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If any fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.

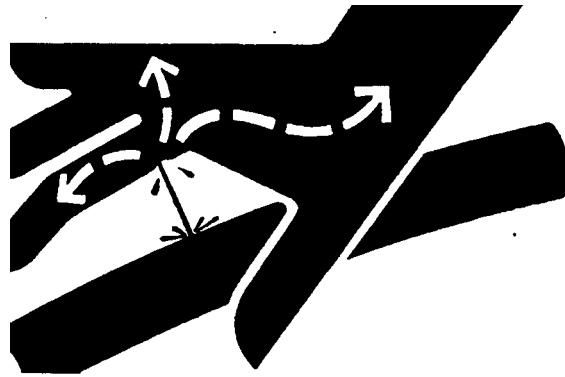
1. Thoroughly clean fuel filter assembly and surrounding area.
2. Loosen drain plug (A) and air bleed plug (B). Drain fuel into a suitable container.

NOTE: Lifting up on retaining ring as it is rotated helps to get it past raised locators.

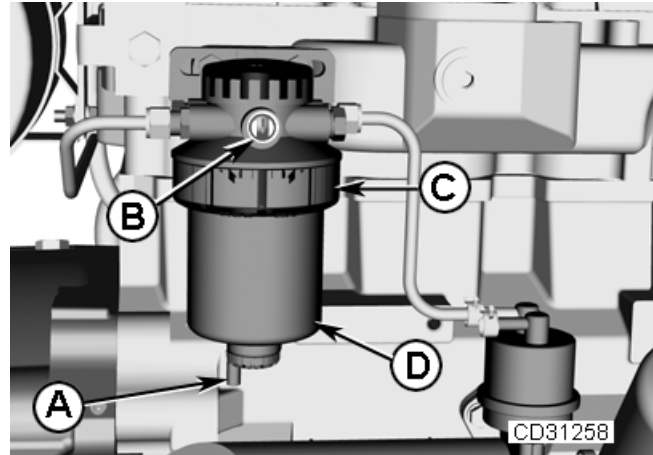
3. Firmly grasp the retaining ring (C) and rotate it clockwise 1/4 turn. Remove ring with filter element (D).
4. Save retaining ring and (if equipped) water separator bowl for reuse.

IMPORTANT: Do not dump the old fuel into the new filter element. This could cause fuel injection problems.

A plug is provided with the new element for plugging the used element.



Beware of High-Pressure Fluids



A—Drain Plug
B—Air Bleed Plug

C—Retaining Ring
D—Fuel Filter Element

5. Inspect filter mounting base for cleanliness. Clean as required.

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CD03523,00002B7 -19-23DEC10-1/2

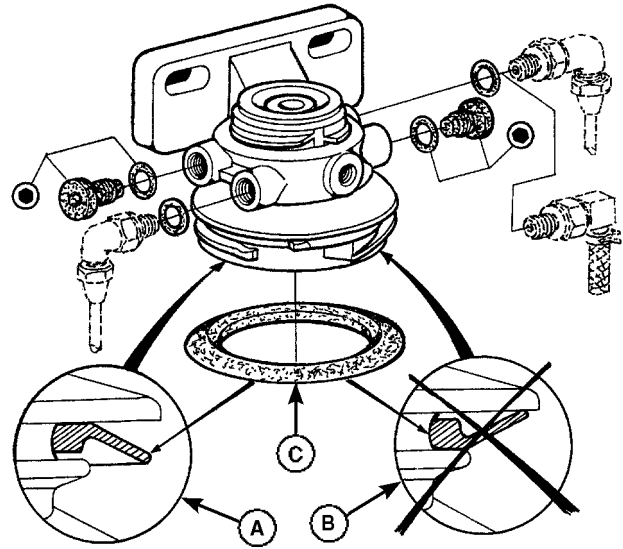
X9811 —UN—23AUG88

CD31258 —UN—07DEC10

6. Inspect condition of dust seal (C). Replace if necessary. Install dust seal as shown.

NOTE: Proper installation is indicated when a "click" is heard and a release of pressure on the ring is felt.

7. Align keys on filter element with slots in filter base, then tighten retaining ring counterclockwise 1/4 turn until it "snaps" into the detent. DO NOT overtighten.
8. If equipped with water separator, remove water separator bowl from removed filter element. Drain and clean separator bowl. Dry with compressed air. Install water separator bowl onto new element. Tighten securely.
9. Bleed the fuel system.



Fuel Filter Dust Seal Installation

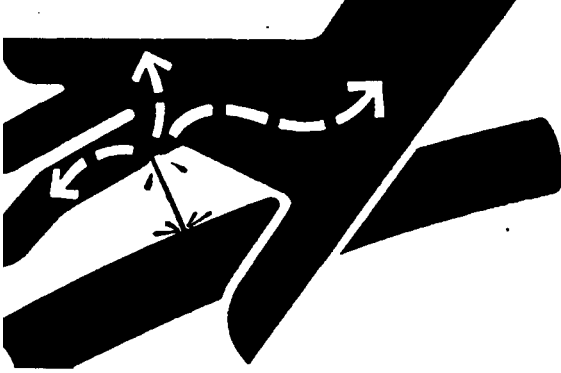
A—Correct Installation
B—Incorrect Installation

C—Dust Seal

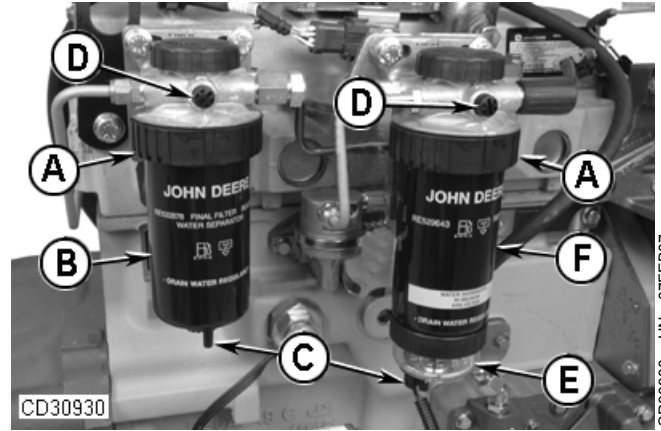
RG9187—UN—01DEC00

CD03523,00002B7 -19-23DEC10-2/2

Change Fuel Filter Elements (4045 and 6068 Engines)



X9811 —UN—23AUG88



CD30930 —UN—07FEB07

Fuel Filters

A—Retaining Ring
B—Final Fuel Filter Element
C—Drain Plug
D—Bleed Plug

E—Water Separator Bowl
F—Primary Fuel Filter Element

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting fuel or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If any fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.

NOTE: Engines are equipped with a primary fuel filter (F) and a final fuel filter (B). Both fuel filters have to be replaced together at the same time.

1. Thoroughly clean fuel filter assembly and surrounding area.
2. Disconnect water-in-fuel sensor wiring.
3. Loosen drain plug (C) and drain fuel into a suitable container.

NOTE: Lifting up on retaining ring as it is rotated helps to get it past raised locators.

4. Firmly grasp the retaining ring (A) and rotate it clockwise 1/3 turn. Remove ring along with filter element (B) or (F).

IMPORTANT: Do not dump the old fuel into the new filter element. This could cause fuel injection problems.

A plug is provided with the new element for plugging the used element.

5. Inspect filter mounting base for cleanliness. Clean as required.

NOTE: Raised locators on fuel filter canister must be indexed properly with slots in mounting base for correct installation.

6. Install new filter element dry onto mounting base. Be sure element is properly indexed and firmly seated on base. It may be necessary to rotate filter for correct alignment.

If equipped with water separator bowl (E), remove filter element from separator bowl. Drain and clean separator bowl. Dry with compressed air. Install bowl onto new filter element. Tighten securely.

7. Install retaining ring onto mounting base making certain dust seal is in place on filter base. Hand tighten ring (about 1/3 turn) until it "snaps" into the detent. DO NOT overtighten retaining ring.

NOTE: The proper installation is indicated when a "click" is heard and a release of the retaining ring is felt.

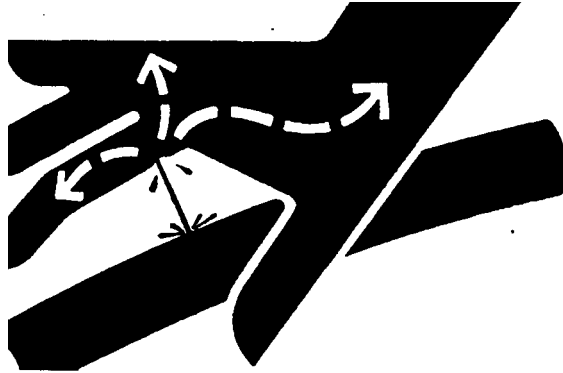
8. Bleed the fuel system.

CD03523.00002B8 -19-23DEC10-1/1

Change Fuel Filter Elements (6090 Engines)

⚠ CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting fuel or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type of injury or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.



High Pressure Fluids

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CD03523,00002B9 -19-23DEC10-1/3

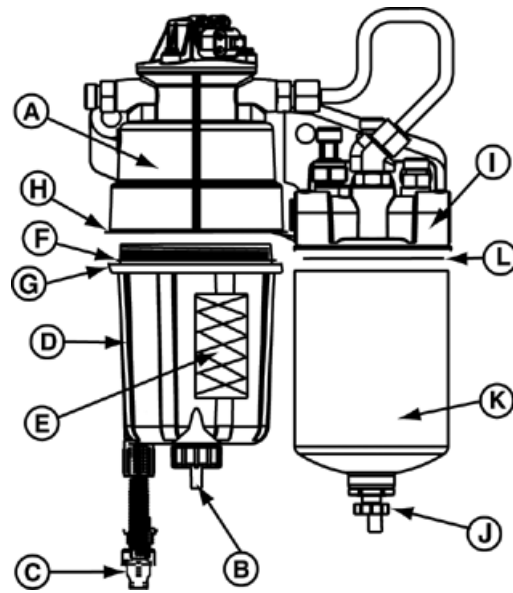
X9811 —UN—23AUG88

Remove and Install Primary Fuel Filter Element

CAUTION: Due to High Pressure Common Rail system design, fuel in filter is likely to be under high pressure. To avoid possible personal harm, open valves (B) and (J) on bottom of filters to relieve pressure prior to removing each filter.

NOTE: Engines are equipped with a primary fuel filter (A) and a final fuel filter (I). Both fuel filters have to be replaced together at the same time. Replace fuel filter elements anytime audible alarm sounds and trouble codes indicate plugged fuel filters (low fuel pressure). If no alarm sounds during the 12 month service interval, replace elements at that time, or after 500 hours operation, whichever comes first.

1. Thoroughly clean primary filter header (A) and surrounding area to prevent dirt and debris from getting into fuel system.
 2. Connect a fuel drain line to primary filter drain valve (B) on bottom of filter and drain all fuel from the primary filter canister (D).
 3. Disconnect water-in-fuel sensor connector (C).
 4. Turn primary filter canister (D) counterclockwise (CCW) to remove.
 5. Once primary filter canister (D) is removed, pull primary filter element (E) down to remove from primary filter header (A).
 6. Inspect primary filter header (A) and primary filter canister (D) sealing surfaces. Clean as required.
 7. Place new packing (F) on primary filter canister (D).
 8. Place thin film of fuel on primary filter packing (F).
- IMPORTANT: Do NOT pre-fill filter with fuel. This may introduce debris into the fuel system.**
9. Place new primary filter element (E) in canister (D) with tangs on bottom going into canister.



- | | |
|---------------------------------------|-------------------------------|
| A—Primary Filter Header | G—Primary Filter Canister Lip |
| B—Primary Filter Canister Drain Valve | H—Primary Filter Header Lip |
| C—Water-In-Fuel Sensor Connector | I—Final Fuel Filter Header |
| D—Primary Filter Canister | J—Final Filter Drain Valve |
| E—Primary Filter Element | K—Final Fuel Filter |
| F—Primary Filter Packing | L—Final Filter Packing |

10. Screw canister (D) into filter header (A) and turn clockwise (CW). Tighten until canister lip (G) snugly mates with header lip (H).
11. Turn filter additional 3/4 turn after seal contact with header.
12. Connect water-in-fuel sensor connector (C).

NOTE: Be sure to also replace final fuel filter and then prime system (see following).

Continued on next page

CD03523,00002B9 -19-23DEC10-2/3

RG14250—UN—06JUN05

Remove and Install Final Fuel Filter

CAUTION: Due to High Pressure Common Rail system design, fuel in filter is likely to be under high pressure. To avoid possible personal harm, open valves (B) and (J) on bottom of filters to relieve pressure prior to removing each filter.

NOTE: Engines are equipped with a primary fuel filter (A) and a final fuel filter (I). Both fuel filters have to be replaced together at the same time. Replace fuel filter elements anytime audible alarm sounds and trouble codes indicate plugged fuel filters (low fuel pressure). If no alarm sounds during the 12 month service interval, replace elements at that time, or after 500 hours operation, whichever comes first.

1. Thoroughly clean final filter header (I) and surrounding area to prevent dirt and debris from getting into fuel system.
2. Connect a fuel drain line to final filter drain valve (J) on bottom of filter and drain all fuel from the filter.
3. Turn final filter (K) counterclockwise (CCW) to remove.
4. Inspect final filter header (I) sealing surface. Clean as required.
5. Install new final filter fuel drain valve (J), tighten to specification.

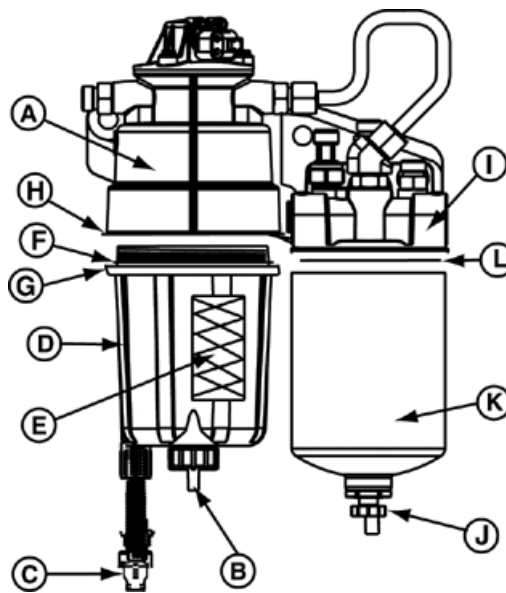
Specification

Final Fuel Filter Drain Valve—Torque..... 3.4—4 Nm (30—35 lb.-in.)

6. Place new final filter packing (L) on filter.
7. Place thin film of fuel on packing (L).

IMPORTANT: Do NOT pre-fill filter with fuel. This may introduce debris into the fuel system.

NOTE: Final filter replacement instructions are printed on the new filter.



- | | |
|---------------------------------------|-------------------------------|
| A—Primary Filter Header | G—Primary Filter Canister Lip |
| B—Primary Filter Canister Drain Valve | H—Primary Filter Header Lip |
| C—Water-In-Fuel Sensor Connector | I—Final Fuel Filter Header |
| D—Primary Filter Canister | J—Final Filter Drain Valve |
| E—Primary Filter Element | K—Final Fuel Filter |
| F—Primary Filter Packing | L—Final Filter Packing |

8. Screw final fuel filter (K) into final fuel filter header (I) and turn clockwise (CW). Tighten until final fuel filter (K) snugly mates with final fuel filter header (I).
9. Turn filter additional 3/4 turn after seal contact with header.

NOTE: Turn ignition Key to ON for 60 seconds to prime the fuel system before starting engine. It may be necessary to turn key off and on again to reprime the system before starting.

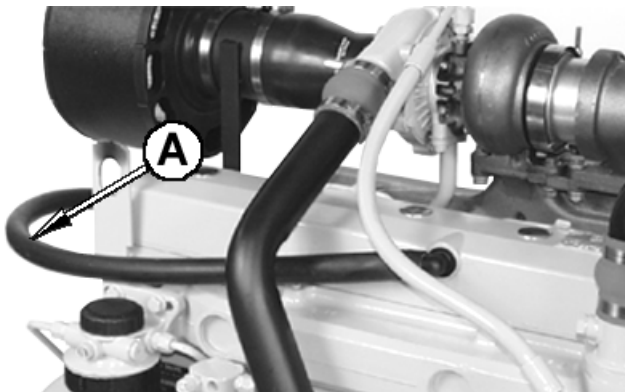
CD03523,00002B9 -19-23DEC10-3/3

Check Crankcase Vent System

If you operate the engine in dusty conditions, clean the tube at shorter intervals.

1. Remove and clean crankcase vent tube (A).
2. Install the vent tube. Be sure the O-ring fits correctly in the rocker arm cover for elbow adapter. Tighten hose clamp securely.

A—Crankcase Vent Tube



Crankcase Vent System

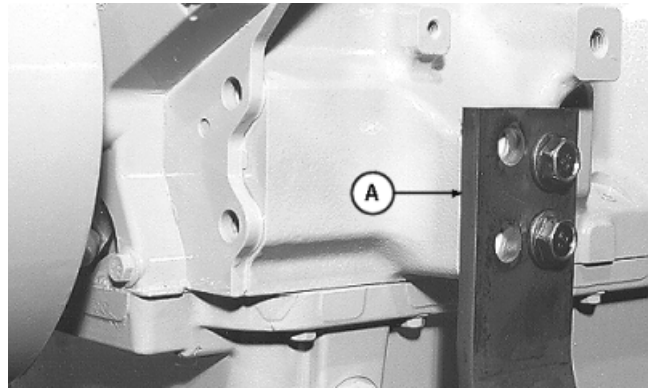
CD03523,00002C0 -19-23DEC10-1/1

Check Engine Mounts

Engine mounting is the responsibility of the vehicle or generator manufacturer. Follow manufacturer's guidelines for mounting specifications.

IMPORTANT: Use only Grade SAE 8 or higher grade of hardware for engine mounting.

1. Check the engine mounting brackets (A), vibration isolators, and mounting bolts on support frame and engine block for tightness. Tighten as necessary.
2. Inspect overall condition of vibration isolators, if equipped. Replace isolators, as necessary, if rubber has deteriorated or is crushed due to a loss of elasticity.



Engine Mounting

A—Mounting Bracket

RG9905—UN—06JAN99

CD03523,00002C3 -19-23DEC10-1/1

Check Engine Electrical Ground Connections

Keep all engine ground connections clean and tight to prevent electrical arcing which can damage engine or electronic components.

CD03523,00002C4 -19-23DEC10-1/1

Check Belt (3029 Engines)

1. Inspect belt for cracks, fraying, or stretched out areas. Replace as necessary.
2. Check belt tension using one of following methods:

a) Use of JDG529 Tension Gauge (A)

Specification

Belt tension—New belt..... 578—622 N (130—140 lb.-force)
Used belt 378—423 N (85—94 lb.-force)

NOTE: Belt is considered used after 10 minutes of operation.

b) Use of tension tester (B) and straight edge (C)

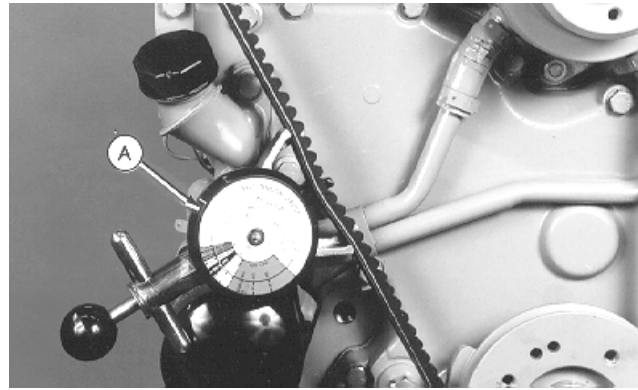
A 89 N (20 lb.) force applied halfway between pulleys should deflect belt by 19 mm (0.75 in.).

3. If adjustment is necessary, loosen alternator nuts (D) and (E). Pull alternator frame outward until belt is correctly tensioned.

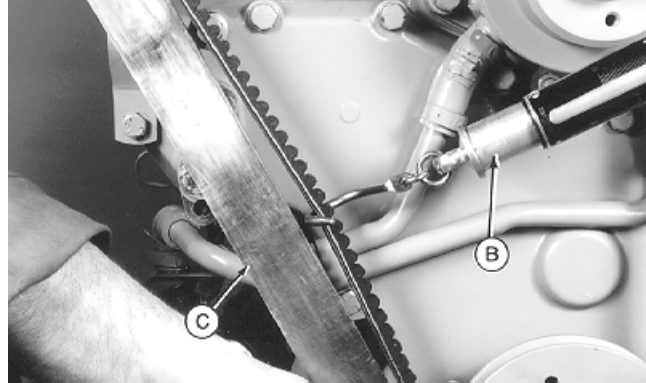
IMPORTANT: Do not pry against the alternator rear frame. Do not tighten or loosen belts while they are hot.

4. Tighten alternator bracket nuts firmly.
5. Run engine for 10 minutes then recheck belt tension.

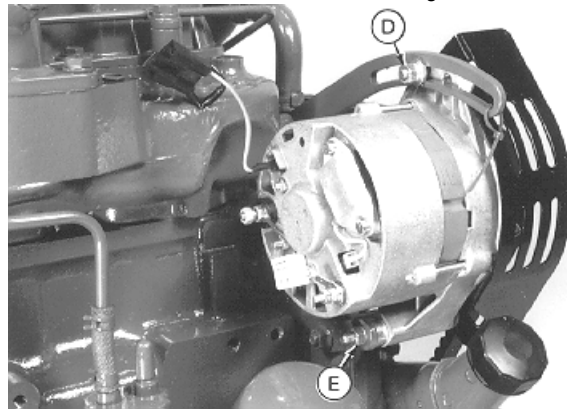
A—JDG529 Tension Gauge D—Upper Nut
B—Tension Tester E—Lower Nut
C—Straight Edge



Check Belt Tension with JDG529



Check Belt Tension using Tester



Alternator Fastening

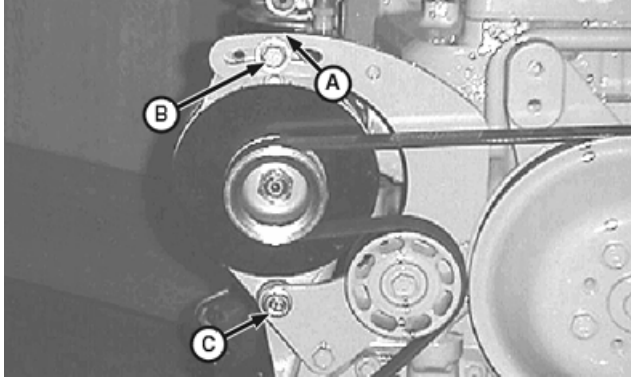
CD03523.00002BA -19-15DEC10-1/1

CD30644 —UN—04MAY98

CD30645 —UN—04MAY98

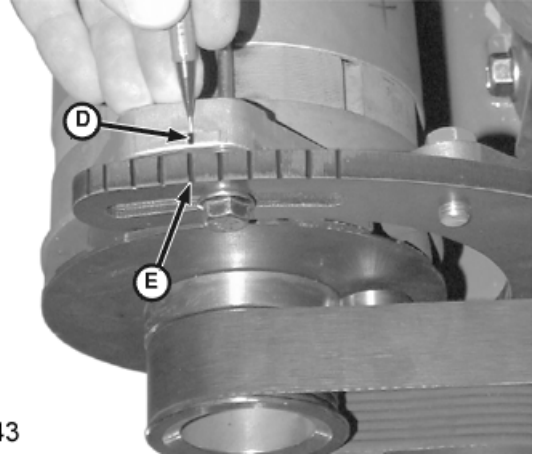
CD30646 —UN—04MAY98

Check Belt (4045 and 6068 Engines with Manual Tensioner)



Manual Belt Tensioner on 4045 and 6068 Engines

RG9132 —UN—04OCT99



CD30843

Reference Marks

CD30843 —UN—10JAN03

A—Belt Gauge
B—Cap Screw

C—Cap Screw
D—Reference Mark

E—Alternator Upper Bracket
Notch

Inspect belts for cracks, fraying, or stretched out areas. Replace if necessary.

NOTE: Belt adjustment is measured using a gauge stamped on the top edge of the alternator bracket.

1. Loosen cap screws (B) and (C).
2. Slide alternator in slot by hand to remove all excess slack in belt. Scribe a reference mark (D) on line with notch (E) on upper alternator bracket.

IMPORTANT: Do not pry against alternator rear frame.

3. Using the gauge (A) on the alternator bracket, stretch belt by prying outward on alternator front frame. Stretch the belt 1 gauge unit for a used belt and 1.5 gauge units for a new belt.
4. Tighten cap screws (B) and (C).

CD03523,00002BB -19-10DEC10-1/1

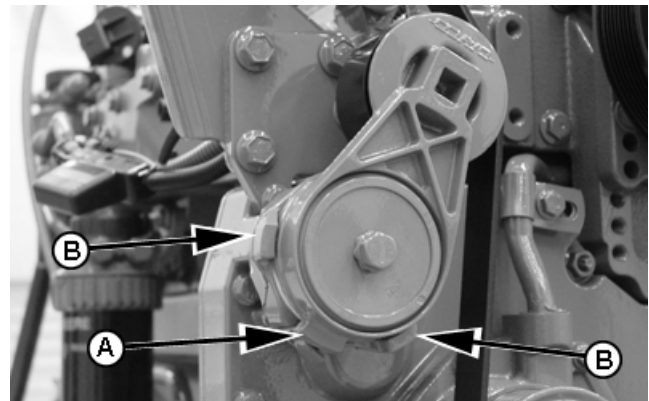
Check Belt (4045 and 6068 Engines with Automatic Tensioner)

NOTE: With the belt loosened, inspect pulleys and bearings. Rotate and feel for hard turning or any unusual sounds. If pulleys or bearings need replacement, see your John Deere dealer.

Belt drive systems equipped with automatic (spring) belt tensioners cannot be adjusted or repaired. The automatic belt tensioner is designed to maintain proper belt tension over the life of the belt. If tensioner spring tension is not within specification, replace tensioner assembly.

• Check belt wear

The belt tensioner is designed to operate within the limit of arm movement provided by the cast stops (A and B) when correct belt length and geometry is used. If the tensioner stop on swing arm (A) is hitting the fixed stop (B), check mounting brackets (alternator, belt tensioner, idler pulley, etc.) and the belt length. Replace belt as needed (see Replace Fan and Alternator Belt, Maintenance/As Required Section).



Automatic Belt Tensioner

A—Tensioner Stop

B—Fixed Stop

RG13744 —UN—11NOV04

Continued on next page

CD03523,00002BC -19-10DEC10-1/2

• **Check tensioner spring tension**

A belt tension gauge will not give an accurate measure of the belt tension when automatic spring tensioner is used. Measure tensioner spring tension using a torque wrench and procedure outlined below:

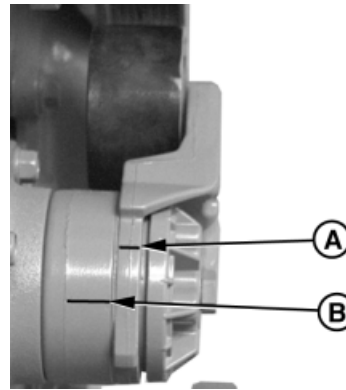
- a. Release tension on belt using a long-handled 1/2 inch drive tool in tensioner arm. Remove belt from pulleys.
- b. Release tension on tensioner arm and remove drive tool.
- c. Put a mark (A) on swing arm of tensioner as shown.
- d. Measure 21 mm (0.83 in.) from mark (A) and put a mark (B) on tensioner mounting base.
- e. Install torque wrench in square hole so that it is aligned with center of roller and tensioner as shown. Rotate the swing arm using a torque wrench until marks (A and B) are aligned.
- f. Record torque wrench measurement and compare with specification below. Replace tensioner assembly as required.

Specification

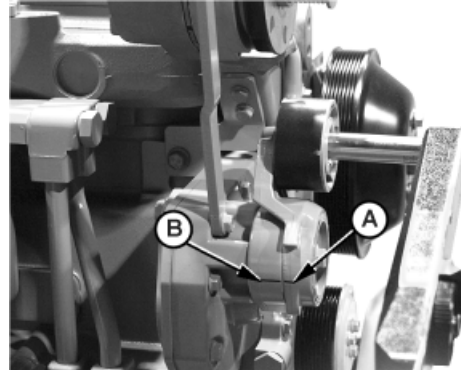
Spring—Force..... 18—22 N·m (13—16 lb.-ft.)

A—Mark on Swing Arm

B—Mark on Tensioner Mounting Base



Marks on Tensioner



Align Marks

RG7977 —UN—14NOV97

RG12054 —UN—08JAN02

CD03523,00002BC -19-10DEC10-2/2

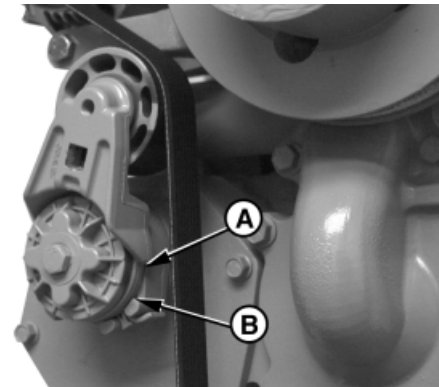
Check Belt (6090 Engines with Automatic Tensioner)

NOTE: With the belt loosened, inspect pulleys and bearings. Rotate and feel for hard turning or any unusual sounds. If pulleys or bearings need replacement, see your John Deere dealer.

Belt drive systems equipped with automatic (spring) belt tensioners cannot be adjusted or repaired. The automatic belt tensioner is designed to maintain proper belt tension over the life of the belt. If tensioner spring tension is not within specification, replace tensioner assembly.

• **Check belt wear**

The belt tensioner is designed to operate within the limit of arm movement provided by the cast stops (A and B) when correct belt length and geometry is used. If the tensioner stop (A) on swing arm is hitting the fixed stop (B), check mounting brackets (alternator, belt tensioner, idler pulley, etc.) and the belt length. Replace



Automatic Belt Tensioner

A—Tensioner Stop

B—Fixed Stop

belt as needed (see Replace Fan and Alternator Belt, Maintenance/As Required Section).

Continued on next page

CD03523,00002BD -19-10DEC10-1/2

RG7380 —UN—28NOV97

• **Check tensioner spring tension**

A belt tension gauge will not give an accurate measure of the belt tension when automatic spring tensioner is used. Measure tensioner spring tension using a torque wrench and procedure outlined below:

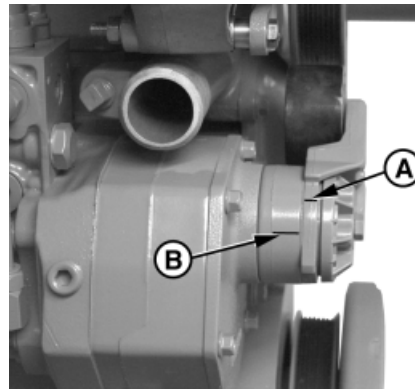
- a. Release tension on belt using a long-handled 1/2 inch drive tool in tensioner arm. Remove belt from pulleys.
- b. Release tension on tensioner arm and remove drive tool.
- c. Put a mark (A) on swing arm of tensioner as shown.
- d. Measure 21 mm (0.83 in.) from mark (A) and put a mark (B) on tensioner mounting base.
- e. Install torque wrench in square hole so that it is aligned with center of roller and tensioner as shown. Rotate the swing arm using a torque wrench until marks (A and B) are aligned.
- f. Record torque wrench measurement and compare with specification below. Replace tensioner assembly as required.

Specification

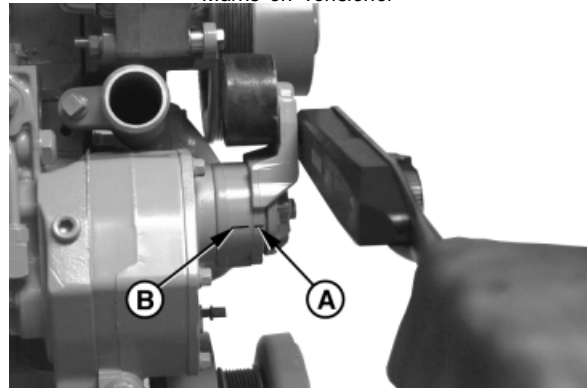
Spring—Force..... 18—22 N·m (13—16 lb.-ft.)

A—Mark on Swing Arm

B—Mark on Tensioner Mounting Base



Marks on Tensioner



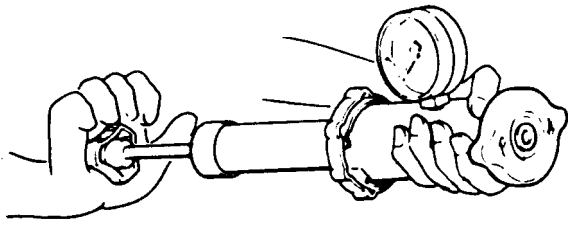
Align Marks

RG7382 —UN—28NOV97

RG7381 —UN—28NOV97

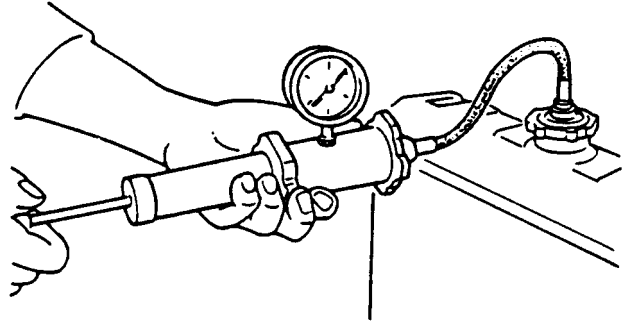
CD03523.00002BD -19-10DEC10-2/2

Check Cooling System



Test Radiator Cap

RG6557 —UN—20JAN93



Test Cooling System

RG6558 —UN—20JAN93

CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engines. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

Test Radiator Cap

1. Remove radiator cap and attach to D05104ST tester as shown.
2. Pressurize cap to specification listed. Gauge should hold pressure for 10 seconds within the normal range if cap is acceptable.

If gauge does not hold pressure, replace radiator cap.

Specification

Radiator Cap
 Calibration—Pressure..... 100 kPa (1.00 bar)
 (14,5 psi) for 10 seconds minimum

3. Remove the cap from gauge, turn it 180°, and retest cap to confirm measurement.

Test Cooling System

NOTE: Engine should be warmed up to test overall cooling system.

1. Allow engines to cool, then carefully remove radiator cap.
2. Fill radiator with coolant to the normal operating level.

IMPORTANT: DO NOT apply excessive pressure to cooling system, doing so may damage radiator and hoses.

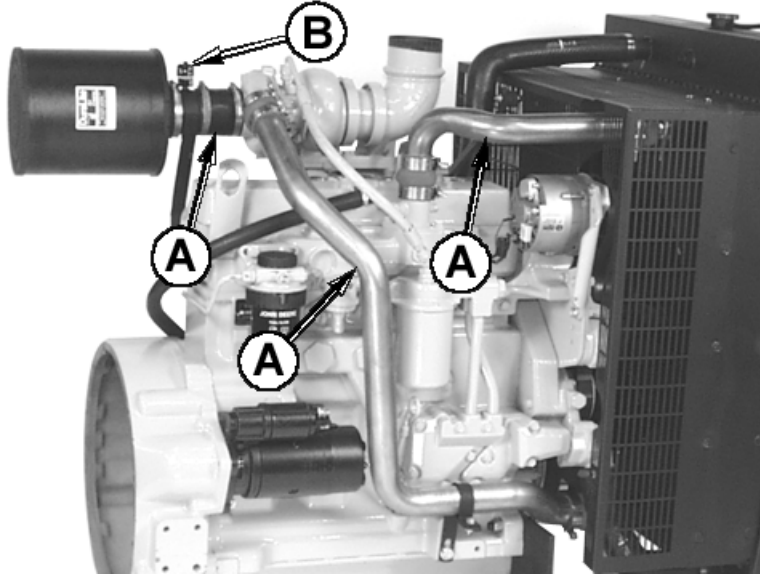
3. Connect gauge and adapter to radiator filler neck. Pressurize cooling system to specification listed for radiator cap.
4. With pressure applied, check all cooling system hose connections, radiator, and overall engine for leaks.

If leakage is detected, correct as necessary and test system pressure again.

If no leakage is detected, but the gauge indicated a drop in pressure, coolant may be leaking internally within the system or at the block-to-head gasket. Have your engine distributor or servicing dealer correct this problem immediately.

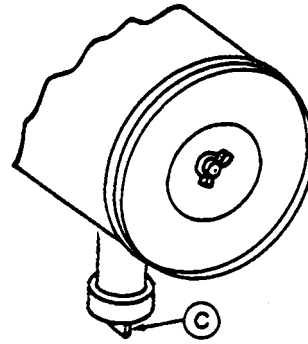
CD03523.00002BE -19-23DEC10-1/1

Check Air Intake System



IMPORTANT: The air intake system must not leak. Any leak, no matter how small, may result in engine failure due to abrasive dirt and dust entering the intake system.

1. Inspect all intake hoses (piping) for cracks. Replace as necessary.
2. Check clamps on air pipes (A) which connect the air filter, engine and, if present, turbocharger and air-to-air radiator. Tighten clamps as necessary.
3. Test air restriction indicator (B) for proper operation. Replace indicator as necessary.
4. If engine has a rubber dust unloader valve (C), inspect the valve on bottom of air filter for cracks or plugging. Replace as necessary.
5. Service air filter as necessary.



A—Air Pipes
B—Air Restriction Indicator

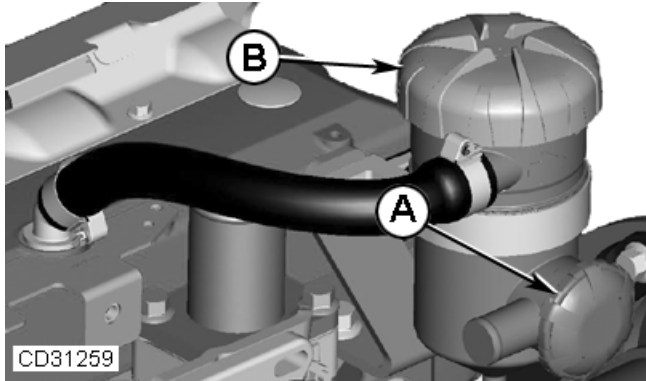
C—Dust Unloader Valve

CD03523,00002BF -19-15DEC10-1/1

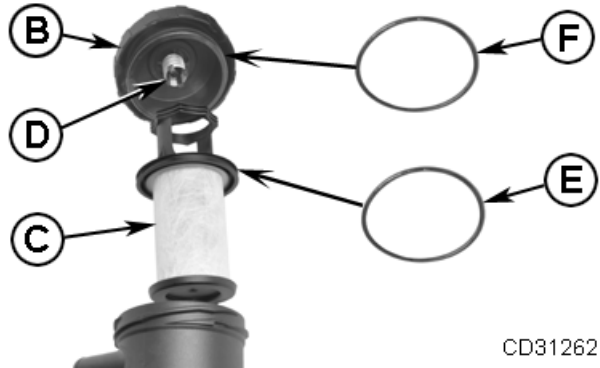
CD30762 —UN—27AUG99

RG4687 —UN—20DEC88

Replace Crankcase Vent Filter (Optional)



Crankcase Vent Filter



Install New Crankcase Vent Filter Element

A—Side Cap (DO NOT REMOVE) B—Top Cap
C—Filter Element D—Blow-Off Valve

E—Filter Element O-Ring F—Cap O-Ring

IMPORTANT: Do not remove the cap (A), otherwise crankcase vent filter will be irretrievably destroyed.

1. Remove top cap (B) and filter element (C).
2. Clean filter canister.

3. Check blow-off valve (D) for proper operation.
4. Install a new filter element with O-ring (E).
5. Install new O-ring (F) onto top cap (B) and then reinstall the cap. Tighten securely.

CD03523.00002C1 -19-23DEC10-1/1

Check Crankshaft Vibration Damper (6068 and 6090 Engines)

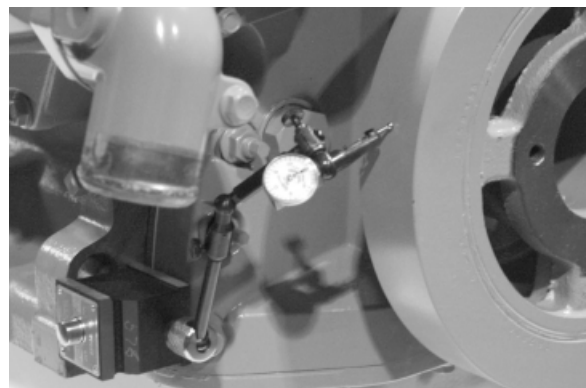
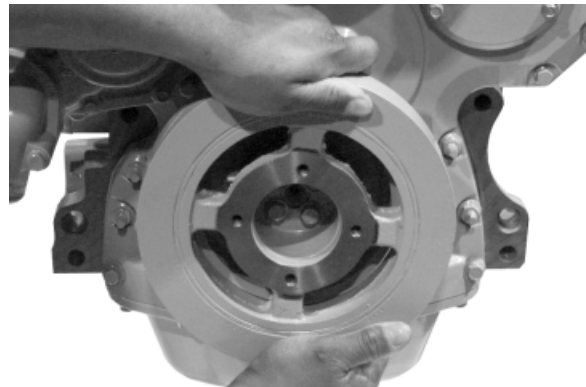
1. Remove belts (shown removed).
2. Grasp vibration damper with both hands and attempt to turn it in both directions. If rotation is felt, damper is defective and should be replaced.

IMPORTANT: The vibration damper assembly is not repairable and should be replaced every 4500 hours or 5 years, whichever occurs first.

3. Check vibration damper radial runout by positioning a dial indicator so probe contacts damper outer circumference.
4. With engine at operating temperature, rotate crankshaft using JDG820 or JDE83 Flywheel Turning Tool.
5. Note dial indicator reading. If runout exceeds specifications given below, replace vibration damper.

Specification

Damper—Maximum radial runout..... 1.50 mm (0.060 in.)



CD03523.00002C2 -19-23DEC10-1/1

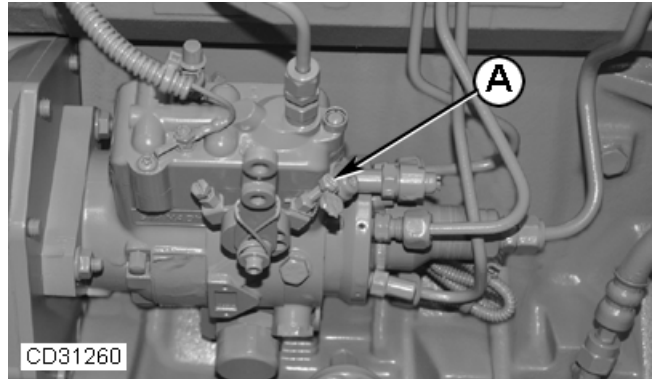
Check Engine Speed (3029 Engines)

NOTE: Most engines for generator set application (1500 rpm for 50 Hz or 1800 rpm for 60 Hz) run only at fast idle and therefore they do not have slow idle.

Specification

Fast Idle—50 Hz	
Generator Set.....	1550—1580 rpm
60 Hz Generator Set.....	1865—1890 rpm

NOTE: Fast idle is settled by the factory and then the idle adjusting screw (A) is sealed to prevent from tampering. Fast idle adjustment can only be done by an authorized fuel system agent.



Fast Idle Adjusting Screw

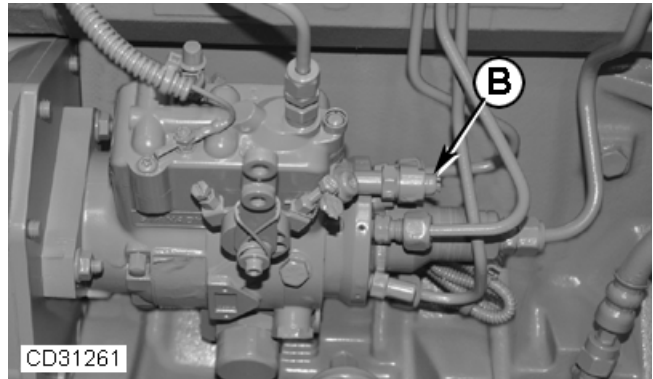
A—Fast Idle Adjusting Screw

CD03523.00002C5 -19-23DEC10-1/1

Adjust Speed Droop Governor (3029 Engines)

1. Warm engine to normal operating temperature.
2. Run engine at fast idle.
3. Apply full load.
4. If specified power cannot be obtained, turn screw (B) to adjust droop until the requested power is reached.

NOTE: If surging exits upon removing the load, turn screw (B) clockwise to eliminate.



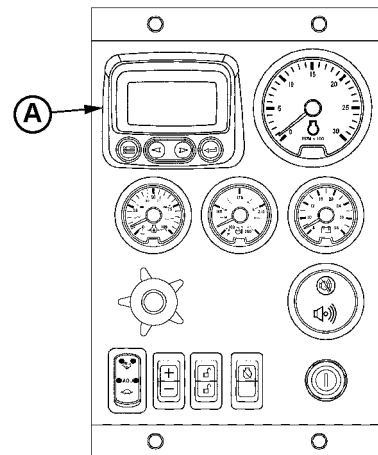
Speed Droop Governor Adjusting Screw

B—Speed Droop Governor Adjusting Screw

CD03523.00002C6 -19-23DEC10-1/1

Check Engine Speed (4045, 6068, and 6090 Engines)

If equipped with a tachometer (A) on the instrument panel, observe tachometer reading to verify engine speeds. Refer to Specifications Section later in this manual. If engine speed adjustment is required, see your authorized servicing dealer or engine distributor.



Using Tachometer to Check Engine Speeds

A—Tachometer

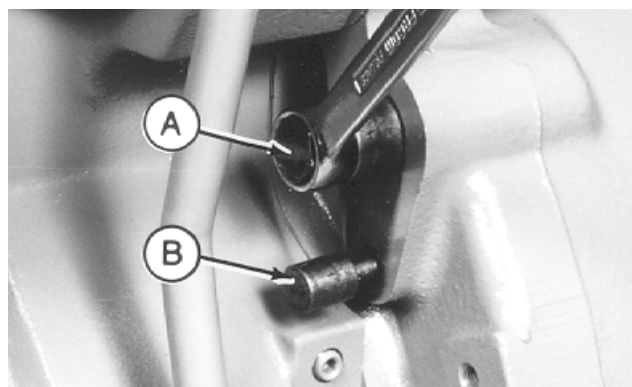
CD03523.00002C7 -19-23DEC10-1/1

Maintenance/2000 Hours/2 Years

Check and Adjust Engine Valve Clearance (3029 Engines)

Adjust engine valve clearance as follows or have your authorized servicing dealer or engine distributor adjust the engine valve clearance.

1. Remove rocker arm cover and crankcase vent tube.
2. Using JDE83 or JDG820 Flywheel Turning Tool (A), rotate engine flywheel in running direction (clockwise viewed from water pump) until No. 1 piston (front) has reached top dead center (TDC) on compression stroke. Insert timing pin JDE81-4 (B) into flywheel bore.



Lock Engine at Top Dead Center

A—Flywheel Turning Tool

B—Timing Pin

CD03523.00002C8 -19-23DEC10-1/2

3. Check and adjust valve clearance to specifications according to the following procedure:

NOTE: Firing order is 1-2-3

- a. Lock No. 1 piston at TDC compression stroke (D).
- b. Adjust valve clearance on No. 1 and 2 exhaust valves and No. 1 and 3 intake valves.
- c. Rotate flywheel 360°. Lock No. 1 piston at TDC exhaust stroke (E).
- d. Adjust valve clearance on No. 3 exhaust valve and No. 2 intake valve.



Adjust Valve Clearance

Specification

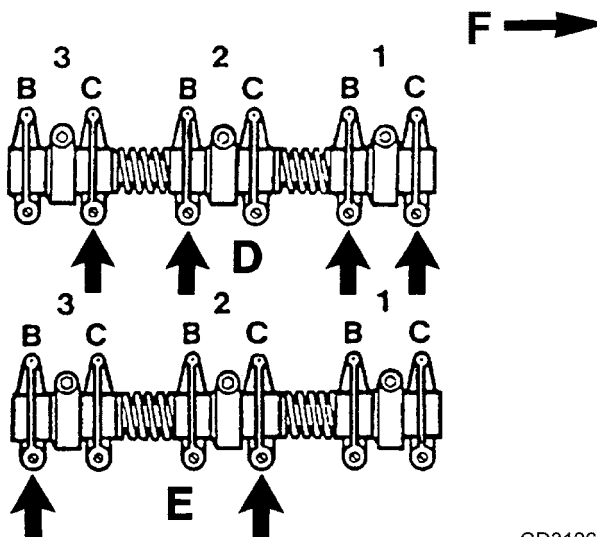
Valve Clearance (Engine

Cold)—Intake.....	0.35 mm (0.014 in.)
Exhaust.....	0.45 mm (0.018 in.)

4. If valves need adjusting, loosen the locknut on rocker arm adjusting screw. Turn adjusting screw until feeler gauge slips with a slight drag. Hold the adjusting screw from turning with screwdriver and tighten locknut (A) to 27 N·m (20 lb.-ft.). Recheck clearance after tightening locknut. Readjust clearance as necessary.
5. Reinstall rocker arm cover and crankcase vent tube.

A—Adjusting Locknut
B—Exhaust Valve
C—Intake Valve

D—No. 1 Piston at TDC
Compression Stroke
E—No. 1 Piston at TDC
Exhaust Stroke
F—Front of Engine



CD31263

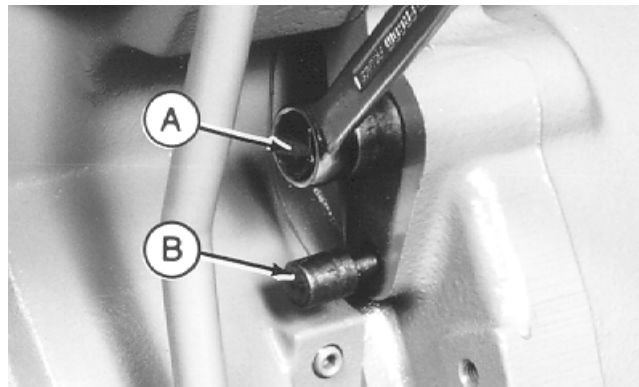
Valve Clearance Adjustment on 3029 Engines

CD03523.00002C8 -19-23DEC10-2/2

Check and Adjust Engine Valve Clearance (4045 and 6068 Engines)

Adjust engine valve clearance as follows or have your authorized servicing dealer or engine distributor adjust the engine valve clearance.

1. Remove rocker arm cover and crankcase vent tube.
2. Using JDE83 or JDG820 Flywheel Turning Tool (A), rotate engine flywheel in running direction (clockwise viewed from water pump) until No. 1 piston (front) has reached top dead center (TDC) on compression stroke. Insert timing pin JDG1571 (B) into flywheel bore.



Lock Engine at Top Dead Center

A—Flywheel Turning Tool

B—Timing Pin

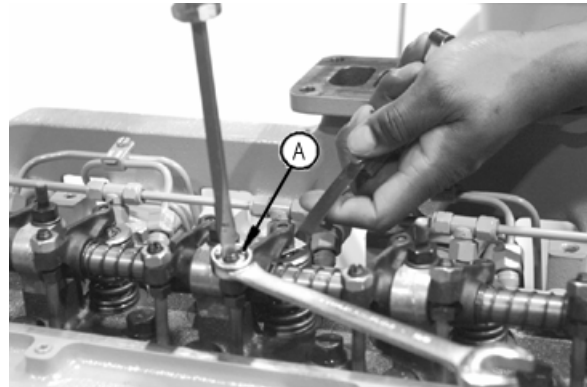
CD03523.00002C9 -19-23DEC10-1/4

3. Check and adjust valve clearance to specifications according to the following procedure:

Specification

Valve Clearance (Engine Cold)—Intake.....	0.35 mm (0.014 in.)
Exhaust.....	0.45 mm (0.018 in.)

4. If valves need adjusting, loosen the locknut on rocker arm adjusting screw. Turn adjusting screw until feeler gauge slips with a slight drag. Hold the adjusting screw from turning with screwdriver and tighten locknut (A) to 27 N·m (20 lb.-ft.). Recheck clearance after tightening locknut. Readjust clearance as necessary.
5. Reinstall rocker arm cover and crankcase vent tube.



Adjust Valve Clearance

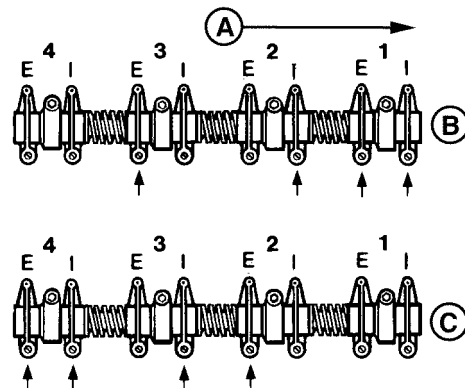
A—Locknut

CD03523.00002C9 -19-23DEC10-2/4

4045 Engine:

NOTE: Firing order is 1-3-4-2.

1. Lock No. 1 piston at TDC compression stroke (B).
2. Adjust valve clearance on No. 1 and 3 exhaust valves and No. 1 and 2 intake valves.
3. Rotate flywheel 360°. Lock No. 4 piston at TDC compression stroke (C).
4. Adjust valve clearance on No. 2 and 4 exhaust valves and No. 3 and 4 intake valves.



Valve Clearance Adjustment on 4045 Engines

A—Front of Engine
 B—No. 1 Piston at TDC Compression Stroke
 C—No. 4 Piston at TDC Compression Stroke
 E—Exhaust Valve
 I—Intake Valve

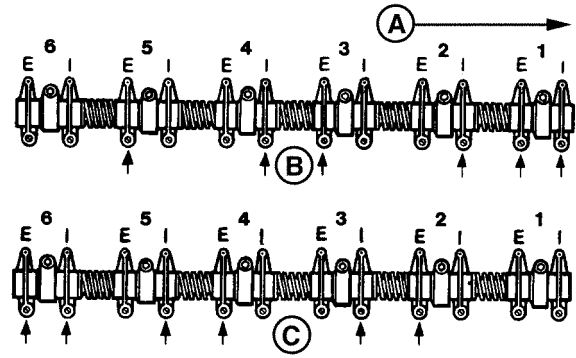
Continued on next page

CD03523.00002C9 -19-23DEC10-3/4

6068 Engine:

NOTE: Firing order is 1-5-3-6-2-4.

1. Lock No. 1 piston at TDC compression stroke (B).
2. Adjust valve clearance on No. 1, 3, and 5 exhaust valves and No. 1, 2, and 4 intake valves.
3. Rotate flywheel 360°. Lock No. 6 piston at TDC compression stroke (C).
4. Adjust valve clearance on No. 2, 4, and 6 exhaust valves and No. 3, 5, and 6 intake valves.



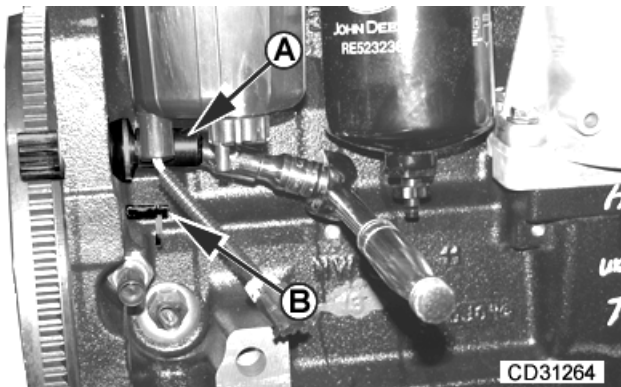
Valve Clearance Adjustment on 6068 Engines

- A—Front of Engine
- B—No. 1 Piston at TDC Compression Stroke
- C—No. 6 Piston at TDC Compression Stroke
- E—Exhaust Valve
- I—Intake Valve

RG4777—UN—31OCT97

CD03523.00002C9 -19-23DEC10-4/4

Check and Adjust Engine Valve Clearance (6090 Engines)

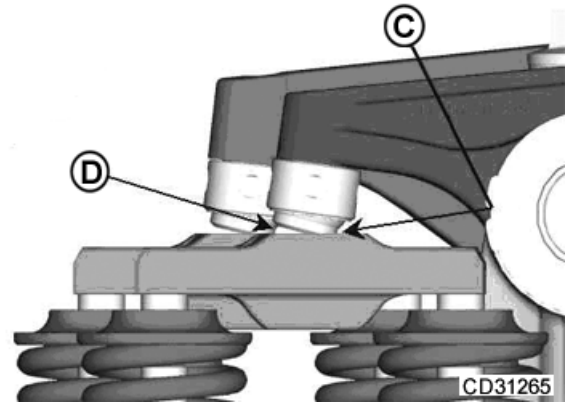


Lock Engine at Top Dead Center

- A—Flywheel Turning Tool
- B—Timing Pin

Adjust engine valve clearance as follows or have your authorized servicing dealer or engine distributor adjust the engine valve clearance.

1. Remove rocker arm cover and crankcase vent tube.
2. Using JDE83 or JDG820 Flywheel Turning Tool (A), rotate engine flywheel in running direction (clockwise viewed from water pump) until No. 1 piston (front)



Valve Clearance Setting Procedure

- C—Rocker Arm Foot
- D—Feeler Gauge Access

has reached top dead center (TDC) on compression stroke. Insert timing pin JDG1571 (B) into flywheel bore.

NOTE: To assist in adjusting valve clearance, push the rocker arm foot (C) forward for easier feeler gauge access (D).

Continued on next page

CD03523.00002CA -19-23DEC10-1/3

- With engine locked at "TDC" of No. 1 piston's compression stroke, use a bent feeler gauge to check valve clearance on Nos. 1, 3, and 5 exhaust valves and Nos. 1, 2, and 4 intake valves. If out of specification, loosen lock nut on rocker arm adjusting screw. Turn adjusting screw until feeler gauge slips with a slight drag. Hold the adjusting screw from turning with screwdriver and tighten lock nut to specifications.

Specification

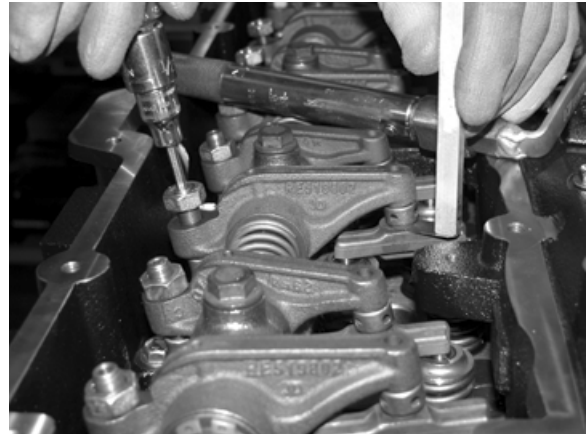
Intake Valve Clearance
(Rocker Arm-to-Valve
Tip With Engine
Cold)—Clearance..... 0.18 mm
(0.007 in.)

Exhaust Valve Clearance
(Rocker Arm-to-Valve
Tip With Engine
Cold)—Clearance..... 0.64 mm
(0.025 in.)

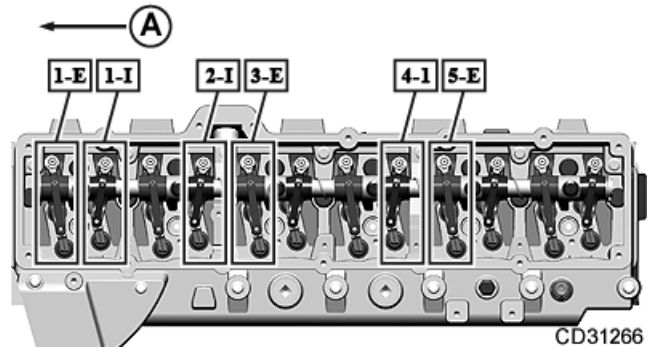
Valve Adjusting Screw
Lock Nut—Torque..... 27 N•m (20 lb.-ft.)

Recheck clearance again after tightening lock nut.
Readjust clearance as necessary.

A—Front of Engine



Checking Valve Clearance Using Bent Feler Gauge

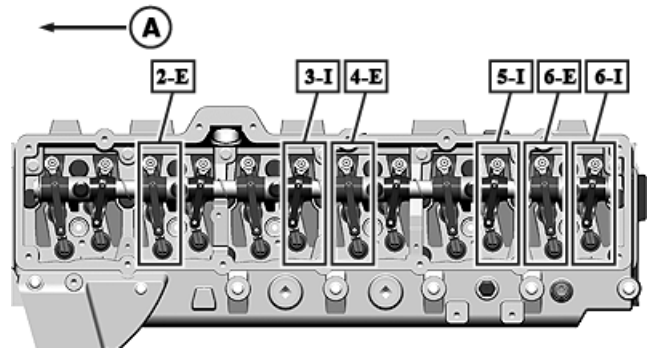


Valve Adjusting Sequence - No. 1 Cylinder at TDC

CD03523.00002CA -19-23DEC10-2/3

- Remove timing pin and rotate flywheel 360°, then reinstall timing pin. No. 6 piston is now at "TDC" of its compression stroke. Rocker arms for No. 6 piston should be loose.
- Check and adjust valve clearance to the same specifications on Nos. 2, 4, and 6 exhaust and Nos. 3, 5, and 6 intake valves.

A— Front of Engine



Valve Adjusting Sequence - No. 6 Cylinder at TDC

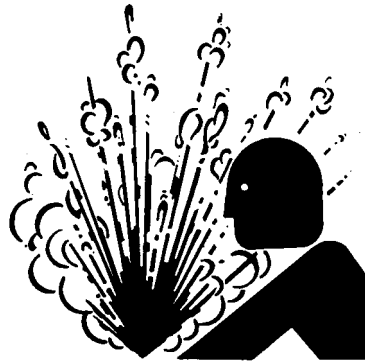
CD03523.00002CA -19-23DEC10-3/3

Drain and Flush Cooling System

NOTE: Drain and flush cooling system every 3000 hours/3 years when John Deere COOL-GARD coolant is used. Otherwise every 2000 hours/2 years.

CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.



1. Slowly open the radiator cap.
2. Drain engine coolant according to following procedures:

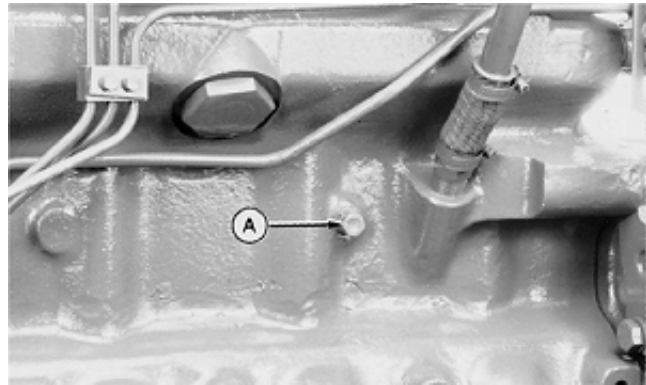
CD03523.00002CB -19-23DEC10-1/6

TS281 —UN—23AUG88

a. 3029 Engines

Remove engine block drain plug (A).

A—Engine Block Drain Plug



Engine Block Drain Plug

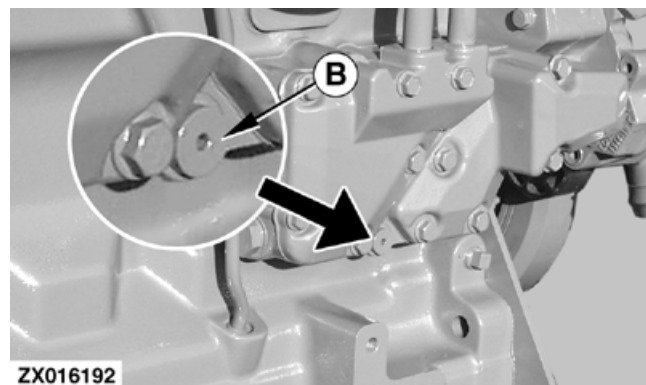
CD03523.00002CB -19-23DEC10-2/6

RG4894 —UN—14DEC88

b. 4045 or 6068 Engines

Remove oil cooler housing drain plug (B).

B—Oil Cooler Housing Drain Plug



Oil Cooler Housing Drain Plug

Continued on next page

CD03523.00002CB -19-23DEC10-3/6

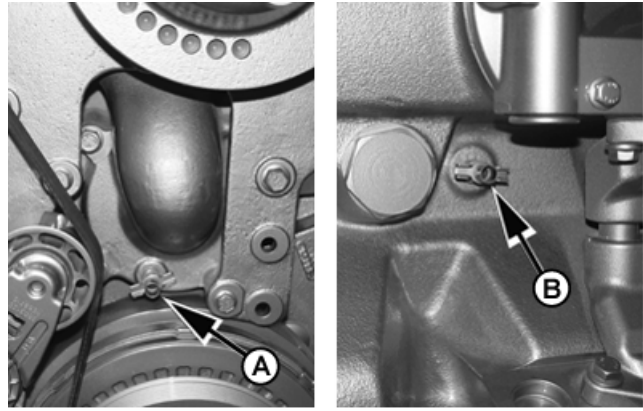
ZX016192 —UN—11JAN99

c. 6090 Engines

Open coolant pump drain valve (A) and engine block drain valve (B) on left side of engine. Drain all coolant from engine block.

A—Pump Drain Valve

B—Block Drain Valve



Cooling System Drain Valves

RG13858—UN—17JAN05

CD03523,00002CB -19-23DEC10-4/6

3. Open radiator drain valve (C). Drain all coolant from radiator.
4. Close all drain orifices after coolant has drained.
5. Fill the cooling system with clean water. Run engine until water passes through the thermostat to stir up possible rust or sediment.
6. Stop engine and immediately drain the water from system before rust and sediment settle.
7. After draining water, close all drain orifices and fill the cooling system with cleaning product such as PMCC2610 or PMCC2638 Cooling System Cleaners available from your John Deere Dealer. Follow manufacturer's directions on label.
8. After cleaning the cooling system, drain cleaner and fill with water to flush the system. Run engine until water passes through the thermostat, then drain out flushing water.
9. Check cooling system hoses for proper condition. Replace as necessary.
10. Close all drain orifices and fill the cooling system with specified coolant (see Diesel Engine Coolant).



Radiator Drain Valve

C—Radiator Drain Valve

CD30765—UN—27AUG99

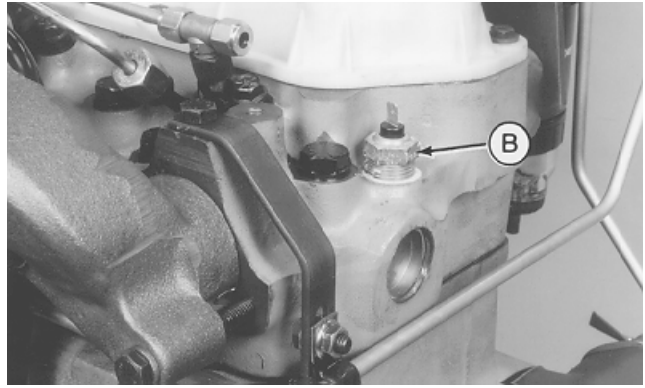
Cooling system capacity	
Engine Model	Cooling system capacity
3029 Engines	11 L (12 qt.)
4045 Engines	20 L (21.5 qt.)
6068 Engines	27 L (29 qt.)
6090 Engines	36 L (38.5 qt.)

Continued on next page

CD03523,00002CB -19-23DEC10-5/6

11. When refilling cooling system, loosen temperature sensor (B) or plug at the rear of cylinder head to allow air to escape (except for 6090 engines).
12. Run engine until it reaches operating temperature then check coolant level and entire cooling system for leaks.

B—Coolant Temperature Sensor



Coolant Temperature Sensor

CD30643 —UN—04MAY98

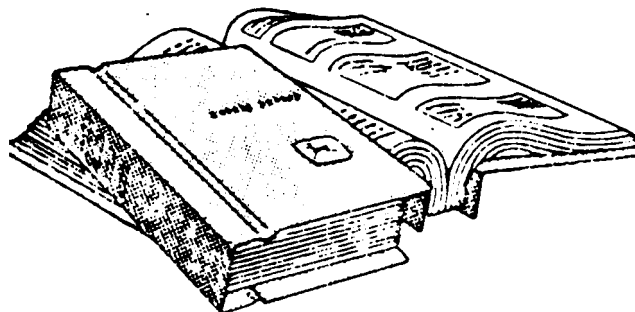
CD03523.00002CB -19-23DEC10-6/6

Maintenance/As Required

Additional Service Information

This manual does not allow a complete repair of your engine. If you want more detailed service information, the following publications are available from your regular parts channel.

- PC10598 — Parts Catalog for 4045HFU82 Engines
- PC10600 — Parts Catalog for 6068HFU82 Engines
- PC10602 — Parts Catalog for 3029TFU80 Engines
- PC10604 — Parts Catalog for 6090HFU84 Engines
- CTM104 — Component Technical Manual for 4045 and 6068 base engines (English)
- CTM125 — Component Technical Manual for 3029 engines (English)
- CTM385 — Component Technical Manual for 6090 HPCR fuel system engines (English)
- CTM400 — Component Technical Manual for 6090 base engines (English)
- CTM502 — Component Technical Manual for HPCR Fuel System on 4045 and 6068 with 2-Valve Head Engines (English)



RG4624 —UN—15DEC88

- CTM67 — Component Technical Manual for OEM Engine accessories (English only)

CD03523,00002CC -19-20DEC10-1/1

Do Not Modify Fuel System

CAUTION: Do not open high-pressure fuel system.

High-pressure fluid remaining in fuel lines can cause serious injury. Do not disconnect or attempt repair of fuel lines, sensors, or any other components between the high-pressure fuel pump and nozzles on engines with High Pressure Common Rail (HPCR) fuel system.

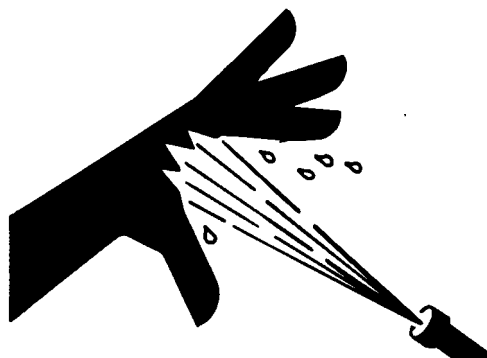
Only technicians familiar with this type of system can perform repairs. See your John Deere dealer.

IMPORTANT: Never steam clean or pour cold water on an injection pump while it is still warm. To do so may cause seizure of pump parts.

Modification or alteration of injection pump or high-pressure fuel pump (A), injection timing, or fuel injectors in ways not recommended by the manufacturer will terminate the warranty obligation to the purchaser.

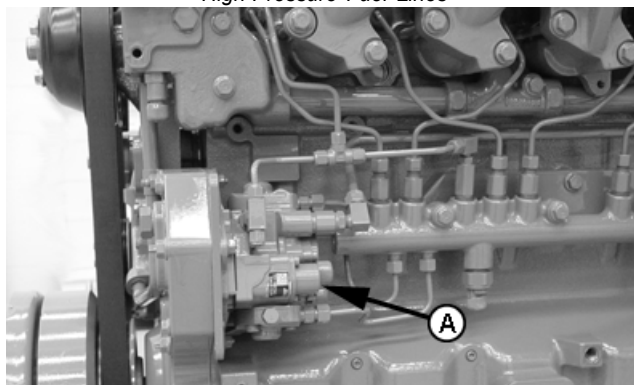
In addition, tampering with fuel system which alters emission-related equipment on engines may result in fines or other penalties, per EPA regulations or other local emission laws.

Do not attempt to service injection pump or fuel injectors yourself. Special training and special tools are required. (See your authorized servicing dealer or engine distributor.)



TS1343 —UN—18MAR92

High-Pressure Fuel Lines



RG13735 —UN—11NOV04

Fuel System

A—High-Pressure Fuel Pump

CD03523,00002CD -19-20DEC10-1/1

Welding Near Electronic Control Units

IMPORTANT: Do not jump-start engines with arc welding equipment. Currents and voltages are too high and may cause permanent damage.

1. Disconnect the negative (-) battery cable(s).
2. Disconnect the positive (+) battery cable(s).
3. Connect the positive and negative cables together. Do not attach to vehicle frame.
4. Clear or move any wiring harness sections away from welding area.
5. Connect welder ground close to welding point and away from control units.



TS963 —UN—15MAY90

6. After welding, reverse Steps 1—5.

DX,WW,ECU02 -19-14AUG09-1/1

Keep Electronic Control Unit Connectors Clean

IMPORTANT: Do not open control unit and do not clean with a high-pressure spray. Moisture, dirt, and other contaminants may cause permanent damage.

1. Keep terminals clean and free of foreign debris. Moisture, dirt, and other contaminants may cause the terminals to erode over time and not make a good electrical connection.
2. If a connector is not in use, put on the proper dust cap or an appropriate seal to protect it from foreign debris and moisture.
3. Control units are not repairable.
4. Since control units are the components LEAST likely to fail, isolate failure before replacing by completing a diagnostic procedure. (See your John Deere dealer.)



RG16946 —UN—31MAR09

5. The wiring harness terminals and connectors for electronic control units are repairable.

DX,WW,ECU04 -19-11JUN09-1/1

Clean or Replace Air Filter (One-Piece)

Clean air filter when restriction indicator (A) is red. Air filter can be cleaned up to six times. Thereafter, or at least once a year, it must be replaced.

Proceed as follows:

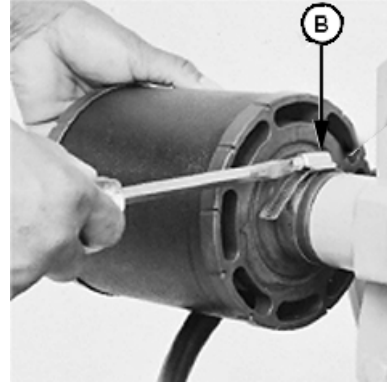
1. Thoroughly clean all dirt around air filter area.
2. Loosen clamp (B) then remove air filter.

IMPORTANT: Never reinstall an air filter which shows evidence of bad condition (punched, dented etc.) allowing no filtered air to enter the engine.

3. Clean air filter with compressed air working from "clean" to "dirty" side.

NOTE: Compressed air pressure must not exceed 600 kPa (6 bar; 88 psi).

4. Mark air filter to keep track of each cleaning operation.
5. Fully depress air restriction indicator reset button and release to reset indicator.
6. Check air system entirely for proper condition (see Check Air Intake System).

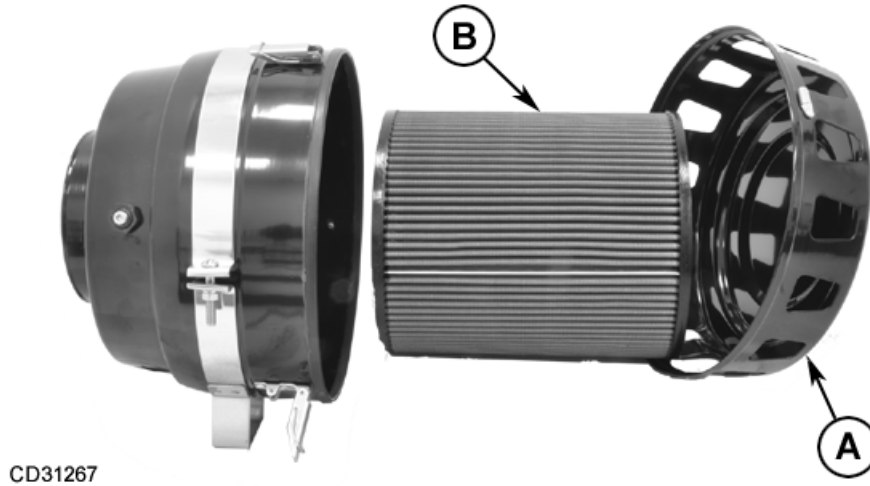


CD30766 —UN—06SEP99

RG9912 —UN—25FEB99

CD03523.00002CF -19-20DEC10-1/1

Clean or Replace Air Filter Element



Replace Air Filter Element (6090 Engine Shown)

A—Air Filter Cover

B—Air Filter Element

NOTE: The procedure for replacing air filter element can vary depending on air filter configuration.

(punched, dented etc.) allowing no filtered air to enter the engine.

Clean air filter element when restriction indicator is red. Air filter element can be cleaned up to six times. Thereafter, or at least once a year, it must be replaced.

5. Clean air filter element with compressed air working from "clean" to "dirty" side.

Proceed as follows:

NOTE: Compressed air pressure must not exceed 600 kPa (6 bar; 88 psi).

1. Thoroughly clean all dirt around air filter area.
2. Unlatch and remove air filter cover (A).
3. Remove air filter element (B) from canister.
4. Clean all dirt from inside canister.

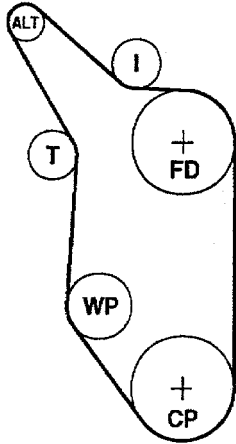
6. Mark air filter to keep track of each cleaning operation.
7. Fully depress air restriction indicator reset button and release to reset indicator.
8. Check air system entirely for proper condition (see Check Air Intake System).

IMPORTANT: Do not reinstall an air filter element which shows evidence of bad condition

CD03523,00002CE -19-20DEC10-1/1

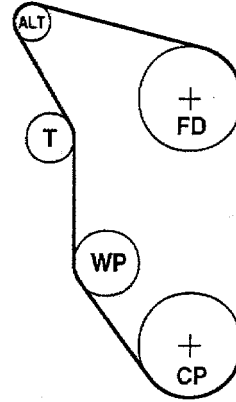
CD31267—UN—20DEC10

Replace Fan/Alternator Poly-V Belt (4045, 6068, and 6090 Engines)



Fan/Alternator Belt Installation on 4045 Engines

CD30769 —UN—01SEP99



Fan/Alternator Belt Installation on 6068 Engines

CD30770 —UN—01SEP99

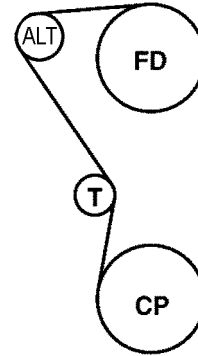
NOTE: With the belt removed, inspect pulleys and bearings. Rotate and feel for hard turning or any unusual sounds. If pulleys or bearings need replacement, see your John Deere Dealer or Distributor.

Refer to Check Belt in Section 35 to determine if belt needs to be replaced.

1. Inspect belts for cracks, fraying, or stretched out areas. Replace if necessary.
2. On engines with automatic belt tensioner, release tension on belt using a breaker bar and socket on tension arm.

On engines with manual tensioner, loosen cap screws holding the alternator.

3. Remove poly-V belt from pulleys and discard belt.
4. Install new belt, making sure belt is correctly seated in all pulley grooves. Refer to belt routing shown for your application.
5. Apply tension to belt (See Check Belt in Section 35).



CD31268

Fan/Alternator Belt Installation on 6090 Engines

CD31268 —UN—21DEC10

ALT— Alternator
CP—Crank Pulley
FD—Fan Drive

I— Idler Pulley
T— Tensioner
WP—Water Pump

6. Start engine and check belt alignment.

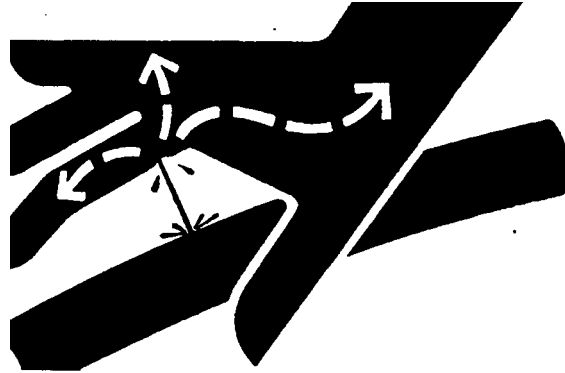
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Bleed the Fuel System

⚠ CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting fuel or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type of injury or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.

NOTE: 3029 engines have a single fuel filter while 4045, 6068, and 6090 engines have two fuel filters (primary and final). Whenever the fuel

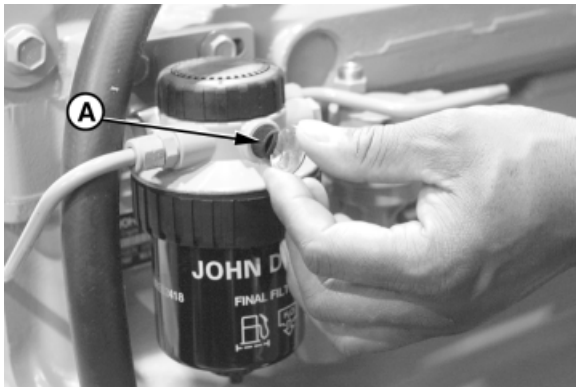


X9811 —UN—23AUG88

system has been opened up for service (lines disconnected or filters removed), it will be necessary to bleed air from the system. On dual fuel filter system, bleed air only from final filter.

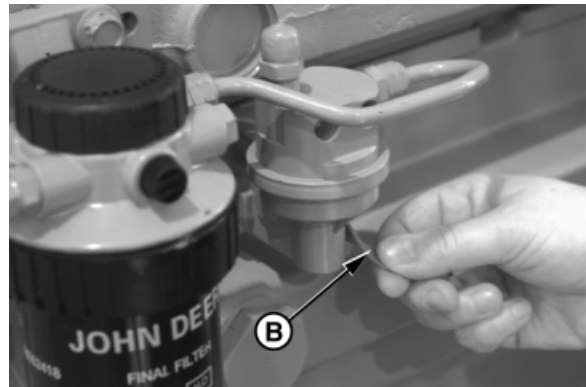
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3029 Engines



RG7947 —UN—13NOV97

Fuel Filter Bleed Screw



RG8013A —UN—15JAN99

Fuel Pump Primer Lever

- A—Air Bleed Screw** **B—Fuel Pump Primer Lever**
1. Loosen the air bleed screw (A) two full turns.
 2. Operate fuel pump primer lever (B) until fuel flow is free from air bubbles.
 3. Tighten bleed screw securely, continue operating hand primer until pumping action is not felt.

4. Start engine and check for leaks.

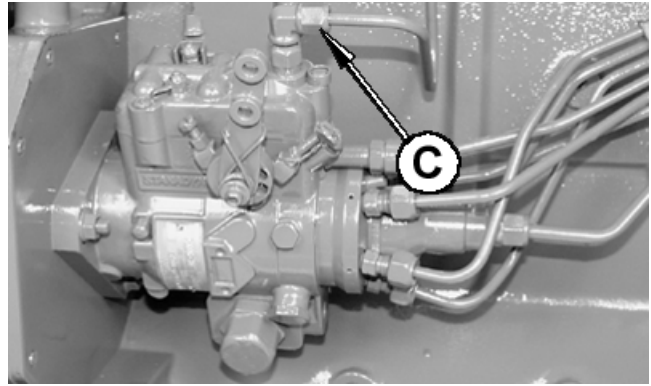
If engine does not start, it will be necessary to bleed air from fuel system at fuel injection pump or injection nozzles as explained next.

Continued on next page

CD03523,00002D1 -19-21DEC10-2/6

5. At Fuel Injection Pump:

- a. Slightly loosen fuel return line connection (C) at fuel injection pump.
- b. Operate fuel pump primer lever until fuel, without air bubbles, flows from fuel return line connection.
- c. Securely tighten return line connection.



C—Fuel Return Line Connection

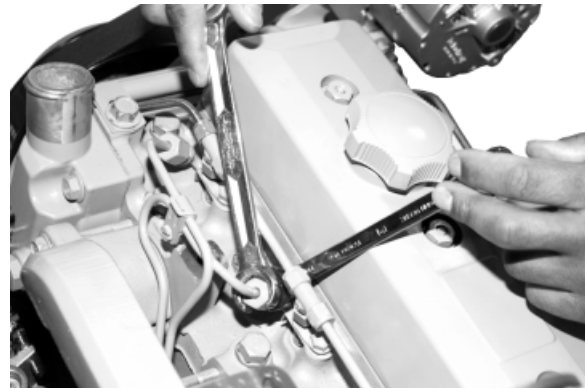
Mechanical Injection Pump Return Line

CD30771 —UN—24SEP99

CD03523,00002D1 -19-21DEC10-3/6

6. At Fuel Injection Nozzles:

- a. Using two open-end wrenches, loosen fuel line connection at injection nozzle.
- b. Crank engine over with starting motor, (but do not start engine), until fuel free from bubbles flows out of loosened connection. Retighten connection to 27 N·m (20 lb.-ft.).
- c. Repeat procedure for remaining injection nozzles (if necessary) until all air has been removed from fuel system.
If engine still will not start, see your authorized servicing dealer or engine distributor.



Bleed Fuel System at Fuel Injection Nozzles

RG7725 —JUN—08JAN97

Continued on next page

CD03523,00002D1 -19-21DEC10-4/6

4045 and 6068 Engines



TS1343 —UN—18MAR92



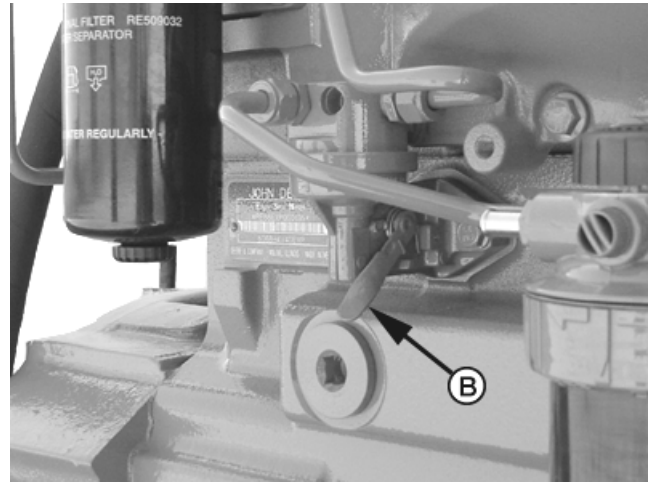
RG12220 —UN—24MAY02

Final Fuel Filter Bleed Screw

CAUTION: High-pressure fluid remaining in fuel lines can cause serious injury. Do not disconnect fuel lines between the high pressure fuel pump and nozzles. Only bleed the fuel system at the fuel filter bleed screw (A).

1. Loosen the air bleed screw (A) two full turns on final filter base only.
2. Operate fuel supply pump primer lever (B) until fuel flow is free from air bubbles.
3. Tighten bleed screw securely. Continue operating primer until pumping action is not felt.
4. Start engine and check for leaks.

If engine will not start, repeat steps 1-4.



RG12221 —UN—24MAY02

Fuel Pump Primer Lever

A—Air Bleed Screw

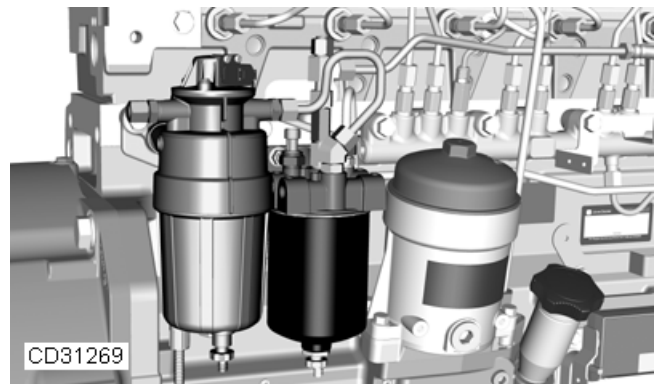
B—Fuel Pump Primer Lever

CD03523.00002D1 -19-21DEC10-5/6

6090 Engines

NOTE: The fuel system is self-priming and self-bleeding, and does not require a bleeding procedure by the operator.

If engine will not start after filter change, turn ignition key ON for 60 seconds to prime the fuel system. It may be necessary to turn the key OFF and ON again to reprime the system before starting.



CD31269

CD31269 —UN—21DEC10

CD03523.00002D1 -19-21DEC10-6/6

Troubleshooting

General Troubleshooting Information

Troubleshooting electronically controlled engine problems can be difficult. The first thing to do is to identify the type of problem which can be mechanical or electrical.

An engine wiring layout is provided in this section to identify electrical components (engine controller, sensors, connectors etc.).

Later in this section is a list of possible engine problems and diagnostic trouble codes that may be encountered accompanied by possible causes and corrections. This troubleshooting information is of a general nature. See also the generator documentation for a complete information of your application.

A reliable program for troubleshooting engine problems should include the following basic diagnostic thought process:

- Know the engine and all related systems.
- Study the problem thoroughly.
- Relate the symptoms to your knowledge of engine and systems.

- Diagnose the problem starting with the easiest things first.
- Double-check before beginning the disassembly.
- Determine cause and make a thorough repair.
- After making repairs, operate the engine under normal conditions to verify that the problem and cause was corrected.

NOTE: 4045, 6068, and 6090 engines have electronic control systems which may generate diagnostic trouble codes to signal problems (see *Displaying of Diagnostic Trouble Codes*).

1. If diagnostic trouble codes are present, perform the suggested corrective actions.
2. If this does not correct the engine problem, contact your servicing dealer.
3. If engine has problems but no diagnostic trouble codes are displayed, refer to *Engine Troubleshooting for problems and solutions*.

CD03523,00002D2 -19-22DEC10-1/1

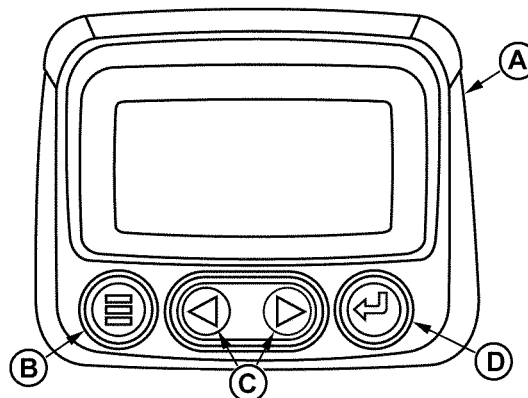
Using Diagnostic Gauge for Retrieving Diagnostic Trouble Codes (DTC's)

NOTE: The method below applies on applications having the optional diagnostic gauge shown (refer to the generator documentation for more information).

1. Make sure all engine mechanical and other systems not related to the electronic control system are operating properly. See Engine Troubleshooting.

NOTE: Diagnostic gauge (A) has a menu key (B) to access various engine functions, two arrow keys (C) to scroll through the engine parameter list and view the menu list, and an enter key (D) to select highlighted items.

2. Read and record DTC(s) displayed on LCD of diagnostic gauge (A). For procedure to access diagnostic trouble codes, refer to Using Diagnostic Gauge to Access Engine Information, earlier in this manual.
3. Go to the Listing of Diagnostic Trouble Codes (DTC) to interpret the DTC(s) present.
4. Contact your nearest engine distributor or servicing dealer with a list of DTC(s) so that necessary repairs can be made.



Diagnostic Trouble Code Display on Instrument Panel

A—Diagnostic Gauge
B—Menu Key

C—Arrow Keys
D—Enter Key

RG13740—JUN—11NOV04

CD03523,00002D3 -19-22DEC10-1/1

Displaying Of Diagnostic Trouble Codes (DTCs)

There are several different methods for displaying both stored and active DTCs from the ECU via a fault lamp or a diagnostic gauge on the electronic instrument panel.

2-DIGIT CODES

Some engines display Service Codes or DTCs as 2-digit codes read from a fault lamp which gives blink codes.

SPN/FMI CODES

Stored and active diagnostic trouble codes are output on the diagnostic gauge on the Deere electronic instrument panel according to the J1939 standard as a two-part code as shown on the tables on the following pages.

The first part is a six-digit Suspect Parameter Number (SPN) followed by a two-digit Failure Mode Identifier (FMI) code. In order to determine the exact failure, both parts (SPN and FMI) of the code are needed.

The SPN identifies the system or the component that has the failure; for example SPN 000110 indicates a failure in the engine coolant temperature circuit.

The FMI identifies the type of failure that has occurred; for example FMI 03 indicates value above normal. Combining SPN 000110 with FMI 03 yields engine coolant temperature input voltage too high, or the equivalent of 2-digit fault code 18.

If diagnosing an application that shows DTCs as SPNs and FMIs, using the following list, determine the equivalent 2-digit code and have your dealer use the diagnostic procedure in the component technical manual for that 2-digit code.

Always contact your servicing dealer for help in correcting diagnostic trouble codes which are displayed for your engine.

CD03523,0000190 -19-02FEB07-1/1

Using Blink Code Method for Retrieving Diagnostic Trouble Codes (DTC's)

NOTE: The method below applies to applications having a fault lamp on instrument panel (refer to the generator documentation for more information).

The Electronic Control Unit (ECU) has the ability to display DTCs using blinking sequence of the fault lamp.

NOTE: The ECU blinks the codes in 2-digit codes only. See Listing of Diagnostic Trouble Codes (DTCs).

1. Press Override Shutdown Switch while turning the ignition switch "ON".
2. The Fault Lamp will begin to flash a code number. For example, flash three times...short pause...flash two times...long pause. This example is code 32.
3. The ECU begins the flashing sequence by flashing a code 32, this indicates the start of blinking active codes. If there are any active DTCs, the ECU will flash its 2-digit number. If there is more than one active DTC, the ECU will flash each code in numerical order.

If there are no active DTCs, the Fault Lamp will flash a code 88.

4. Following the active codes, the Fault Lamp will flash a code 33. This indicates the start of blinking stored codes. If there are any stored DTCs, the Fault Lamp will flash its 2-digit number. If there is more than one stored DTC, the ECU will flash each code in numerical order. If there are no stored DTCs, the Fault Lamp will flash a code 88.
5. Once completed, this sequence will be repeated.
6. When completed, turn ignition "OFF".

As an example, if an engine had an active DTC 18 and stored DTC 53, the flashing sequence would be: flash three times...short pause...flash two times...long pause...flash one time...short pause...flash eight times...long pause...flash three times...short pause...flash three times...long pause...flash five times...short pause...flash three times.

CD03523,00002D9 -19-22DEC10-1/1

Intermittent Fault Diagnostics (With Electronic Controls)

Intermittent faults are problems that periodically "go away". A problem such as a terminal that intermittently doesn't make contact can cause an intermittent fault. Other intermittent faults may be set only under certain operating conditions such as heavy load, extended idle, etc. When diagnosing intermittent faults, take special note of the condition of wiring and connectors, since a high percentage of intermittent problems originate here. Check for loose, dirty or disconnected connectors. Inspect the wiring routing, looking for possible shorts caused by contact with external parts (for example, rubbing against sharp sheet metal edges). Inspect the connector vicinity, looking for wires that have been pulled out of connectors, poorly positioned terminals, damaged connectors and corroded or damaged splices and terminals. Look for broken wires, damaged splices, and wire-to-wire shorts. Use good judgement if component replacement is thought to be required.

NOTE: The engine control unit (ECU) is the component LEAST likely to fail.

Suggestions for diagnosing intermittent faults:

- If the problem is intermittent, try to reproduce the operating conditions that were present when the diagnostic trouble code (DTC) was set.
- If a faulty connection or wire is suspected to be the cause of the intermittent problem: clear DTCs, then check the connection or wire by wiggling it while watching the diagnostic gauge to see if the fault resets.

Possible causes of intermittent faults:

- Faulty connection between sensor or actuator harness.
- Faulty contact between terminals in connector.
- Faulty terminal/wire connection.
- Electromagnetic interference (EMI) from an improperly installed 2-way radio, etc., can cause faulty signals to be sent to the ECU.

NOTE: Refer also to generator documents for more information about connections and wirings.

CD03523.00002DA -19-22DEC10-1/1

Listing of Diagnostic Trouble Codes (DTCs)

NOTE: Not all of these codes are used on all OEM engine applications.

Diagnostic Trouble Codes

SPN	FMI	Description of Fault	Corrective Action
000028	03	Throttle #3 Signal Out of Range High	Check Sensor and Wiring
	04	Throttle #3 Signal Out of Range Low	Check Sensor and Wiring
000029	03	Throttle #2 Signal Out of Range High	Check Sensor and Wiring
	04	Throttle #2 Signal Out of Range Low	Check Sensor and Wiring
000084	31	Vehicle Speed Signal Unreliable	Contact Servicing Dealer
000091	03	Throttle #1 Signal Out of Range High	Check Switch and Wiring
	04	Throttle #1 Signal Out of Range Low	Check Switch and Wiring
	09	Throttle #1 Communication Signal Erratic	Check Sensor and Wiring
000094	03	Low Pressure Fuel Signal Out of Range High	Check Sensor and Wiring
	04	Low Pressure Fuel Signal Out of Range Low	Check Sensor and Wiring
	10	Low Pressure Fuel Rate of Change Abnormal	Contact Servicing Dealer
	13	Low Pressure Fuel Out of Calibration	Contact Servicing Dealer
	17	High Pressure Fuel System- Pressure Slightly Low	Contact Servicing Dealer
000097	00	Water in Fuel Continuously Detected	Contact Servicing Dealer
	03	Water-in-Fuel Signal Out of Range High	Check Sensor and Wiring
	04	Water-in-Fuel Signal Out of Range Low	Check Sensor and Wiring
	16	Water in Fuel Detected	Stop and Drain Water Separator
000100	01	Engine Oil Pressure Signal Extremely Low	Check Oil Level
	03	Engine Oil Pressure Signal Out of Range High	Check Sensor and Wiring
	04	Engine Oil Pressure Signal Out of Range Low	Check Sensor and Wiring
	18	Engine Oil Pressure Signal Moderately Low	Check Oil Level
000105	00	Intake Manifold Air Temperature Signal Extremely High	Check Air Cleaner, Aftercooler, or Room Temperature
	03	Intake Manifold Air Temperature Signal Out of Range High	Check Sensor and Wiring
	04	Intake Manifold Air Temperature Signal Out of Range Low	Check Sensor and Wiring
	16	Intake Manifold Air Temperature Signal Moderately High	Check Air Cleaner, Aftercooler, or Room Temperature
000107	00	Air Filter Pressure Differential Extremely High	Check for plugged air filter
000110	00	Engine Coolant Temperature Signal Extremely High	Check Cooling System, Reduce Power
	03	Engine Coolant Temperature Signal Out of Range High	Check Sensor and Wiring
	04	Engine Coolant Temperature Signal Out of Range Low	Check Sensor and Wiring
	15	Engine Coolant Temperature Signal Slightly High	Check Cooling System, Reduce Power
	16	Engine Coolant Temperature Signal Moderately High	Check Cooling System, Reduce Power
000111	01	Engine Coolant Level Low	Check Operator's Manual, "Adding Coolant"
000158	17	ECU Power Down Error (Internal ECU Problem)	Contact Servicing Dealer
000160	02	Axle Speed Signal Unreliable	Contact Servicing Dealer
000174	00	Fuel Temperature Signal Extremely High	Add Fuel or Switch Fuel Tanks
000174	03	Fuel Temperature Signal Out of Range High	Check Sensor and Wiring
	04	Fuel Temperature Signal Out of Range Low	Check Sensor and Wiring
	16	Fuel Temperature Signal Moderately High	Add Fuel or Switch Fuel Tanks
000189	00	Engine Speed Derate Condition Exists	Check Diagnostic Trouble Codes or Contact Servicing Dealer
000190	00	Engine Speed Extremely High	Reduce Engine Speed
	16	Engine Speed Moderately High	Reduce Engine Speed
000611	03	Injector Shorted to Power	Check Wiring
	04	Injector Shorted to Ground	Check Wiring

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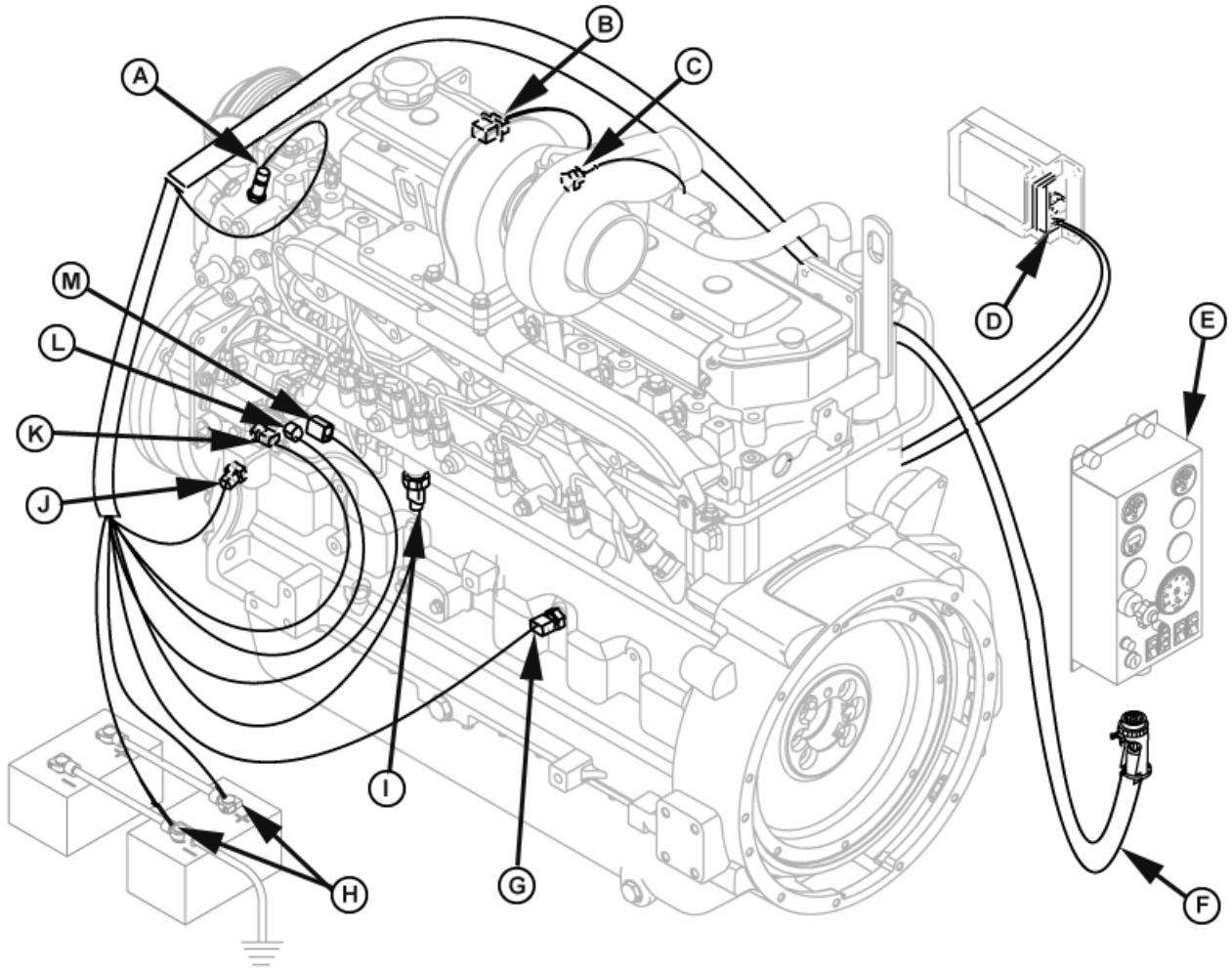
Troubleshooting

SPN	FMI	Description of Fault	Corrective Action
000620	03	Sensor Supply 2 Voltage High	Check Wiring
	04	Sensor Supply 2 Voltage Low	Check Wiring
000627	01	All Injector Currents Are Low	Check Battery Voltage and Wiring
000629	13	ECU Programming Error	Contact Service Dealer
000636	02	Engine Position Sensor Signal Unreliable	Check Sensor and Wiring
	08	Engine Position Sensor Signal Missing	Check Sensor and Wiring
	10	Engine Position Sensor Signal Rate of Change Abnormal	Check Sensor and Wiring
000637	02	Engine Timing Sensor Signal Unreliable	Check Sensor and Wiring
	07	Engine Timing and Position Sensors Out of Sync	Check Sensor and Wiring
	08	Engine Timing Sensor Signal Missing	Check Sensor and Wiring
	10	Engine Timing Signal Rate of Change Abnormal	Check Sensor and Wiring
000639	13	CAN Bus Error (Communication network problem)	Contact Servicing Dealer
000651	05	Injector Number 1 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector Number 1 Circuit Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	Injector Number 1 Not Responding	Injector Failed or Flow Limiter Closed
000652	05	Injector Number 2 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector Number 2 Circuit Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	Injector Number 2 Not Responding	Injector Failed or Flow Limiter Closed
000653	05	Injector Number 3 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector Number 3 Circuit Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	Injector Number 3 Not Responding	Injector Failed or Flow Limiter Closed
000654	05	Injector Number 4 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector Number 4 Circuit Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	Injector Number 4 Not Responding	Injector Failed or Flow Limiter Closed
000655	05	Injector Number 5 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector Number 5 Circuit Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	Injector Number 5 Not Responding	Injector Failed or Flow Limiter Closed
000656	05	Injector Number 6 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector Number 6 Circuit Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	Injector Number 6 Not Responding	Injector Failed or Flow Limiter Closed
000898	09	Vehicle Speed or Torque Message Unreliable	Contact Servicing Dealer
000970	31	External Shutdown Switch Activated	Not Engine Fault. Check Other Shutdown Devices
000971	31	External Fuel Derate Switch Active	Not Engine Fault. Check Other Shutdown Devices
001069	09	Tire Size Invalid	Contact Servicing Dealer
	31	Tire Size Error	Contact Servicing Dealer
001079	03	Sensor Supply 1 Voltage High	Check Wiring
	04	Sensor Supply 1 Voltage Low	Check Wiring
001080	03	Fuel Rail Pressure Sensor Supply Voltage High	Check Wiring
	04	Fuel Rail Pressure Sensor Supply Voltage Low	Check Wiring
001109	31	Engine Protection Shutdown Warning	Shut Down Engine, Check Diagnostic Trouble Codes
001110	31	Engine Protection Shutdown Active	Shut Down Engine, Check Diagnostic Trouble Codes
001347	03	High Pressure Fuel Pump Control Valve Signal Out of Range High	Contact Servicing Dealer
	05	High Pressure Fuel Pump Solenoid Number 1 Circuit Has High Resistance	Check Pump Wiring
	07	High Pressure Fuel Pump Not Able to Meet Required Rail Pressure	Check Fuel Filter and Lines
001568	02	Requested Torque Curve Signal Unreliable	Contact Servicing Dealer
001569	31	Engine in Derate Condition	Check Diagnostic Trouble Codes
002000	13	Security Violation	Contact Servicing Dealer

DTC's Listing in Ascending SPN/FMI Codes

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Engine Wiring Harness Layout (4045 and 6068 Engines)



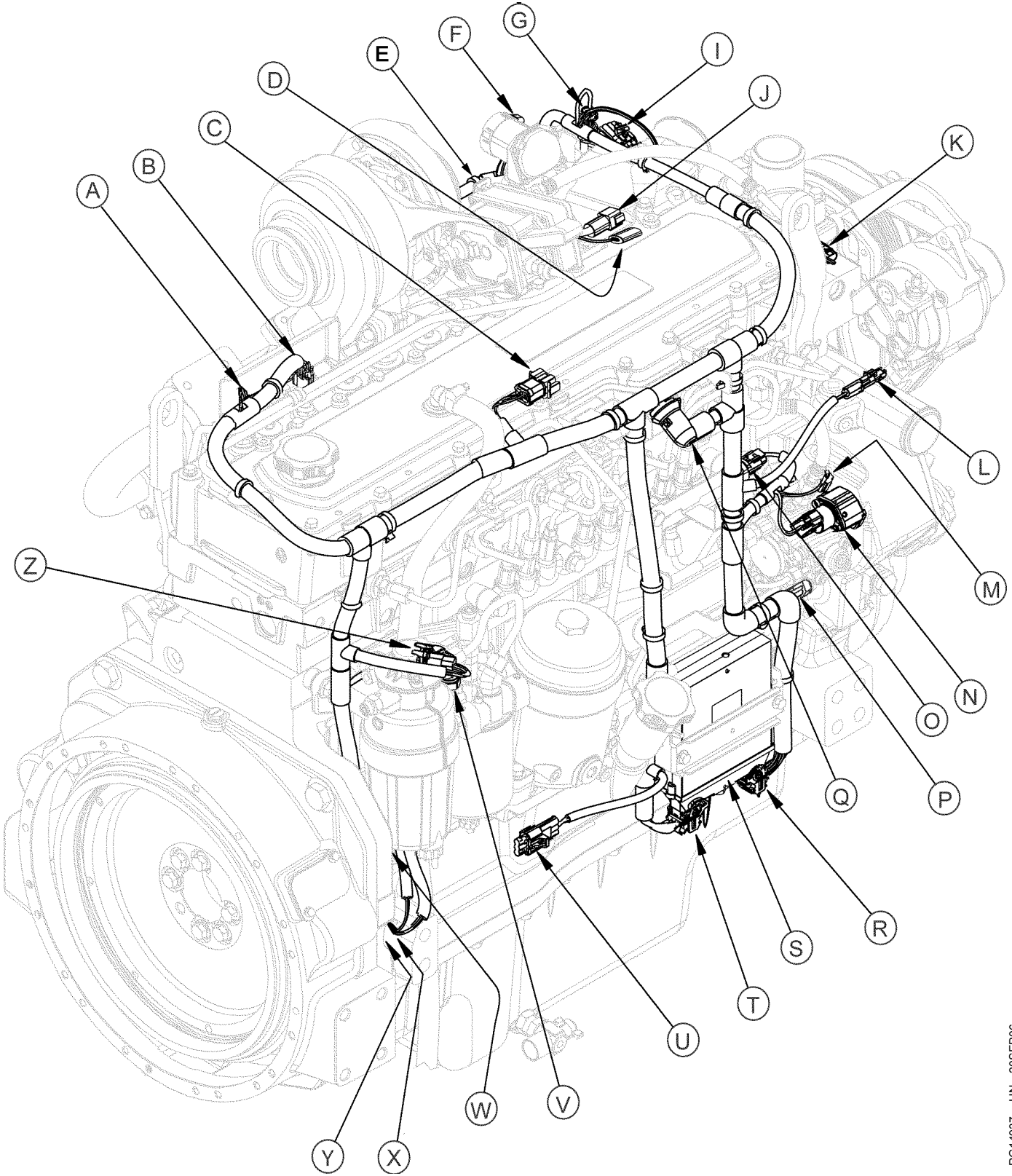
6068HFU82 Engine Shown

- | | | | |
|---|---|--------------------------------|---------------------------|
| A—Engine Coolant Temperature (ECT) Sensor | E—Optional Instrument Panel or Generator Instrument Panel | I— Fuel Rail Pressure Sensor | M—Fuel Temperature Sensor |
| B—Electronic Injector Connector | F—Engine Wiring Harness | J— Crankshaft Position Sensor | |
| C—Manifold Air Temperature (MAT) Sensor | G—Engine Oil Pressure Sensor Connector | K—Pump Position Sensor | |
| D—ECU Connector | H—Power and Ground Battery Connections | L— Pump Control Valve Solenoid | |

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RG12224 —UN—19JUN02

Engine Wiring Harness Layout (6090 Engines)



Electrical Wiring Harness Layout

RG14937 - UN - 20SEP06

Continued on next page

CD03523.00002D6 - 19-22DEC10-1/2

Troubleshooting

A —Manifold Air Pressure (MAP) Sensor Connector	H —Exhaust Gas Recirculation (EGR) Fresh Air Sensor Connector	O —Fuel Rail Pressure Sensor Connector	V —Fuel Pressure Sensor
B —Exhaust Gas Recirculation (EGR) Mixed Air Temperature Sensor Connector	I — Air Heater Jumper Connection	P —Camshaft Sensor Connector	W —Water-in-Fuel Sensor
C —Turbocharger Sensor Jumper Connector	J —VGT Turbocharger Connector	Q —Fuel Injector Connector	X —Crankshaft Speed/Position Sensor
D —VGT Turbocharger Connector	K —Coolant Temperature Sensor Connector	R —ECU Connector	Y —Oil Pressure Sensor
E —Exhaust Gas Recirculation (EGR) Exhaust Temperature Sensor Connector	L —Alternator Excitation Connector	S —ECU	Z —Fuel Transfer Pump Sensor
F —Exhaust Gas Recirculation (EGR) Valve Sensor Connector	M —Fuel Temperature Sensor Connector	T —ECU Connector	
G —Exhaust Pressure Sensor Connector	N —Fuel Pump Control Valve Connector	U —Auxiliary Power Connector	

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Engine Troubleshooting

NOTE: Before troubleshooting 4045, 6068, or 6090 engine, first retrieve any diagnostic trouble codes

on the diagnostic gauge display and perform the corrective actions. If any problems remain, use the following charts to solve engine problems.

Symptom	Problem	Solution
Engine cranks but will not start	Incorrect starting procedure.	Verify correct starting procedure.
	No fuel.	Check fuel in tank and manual shut-off valve.
	Exhaust restricted.	Check and correct exhaust restriction.
	Fuel filter plugged or full of water.	Replace fuel filter or drain water from filter.
	Injection pump not getting fuel or air in fuel system.	Check fuel flow at supply pump or bleed fuel system.
	Faulty injection pump or nozzles.	Consult authorized diesel repair station for repair or replacement.
Engine hard to start or will not start	Engine starting under load.	Remove load.
	Improper starting procedure.	Review starting procedure.
	No fuel.	Check fuel tank.
	Air in fuel line.	Bleed fuel line.
	Cold weather.	Use cold weather starting aids.
	Slow starter speed.	See "Starter Cranks Slowly".
	Crankcase oil too heavy.	Use oil of proper viscosity.
	Improper type of fuel.	Consult fuel supplier; use proper type fuel for operating conditions.
	Water, dirt, or air in fuel system.	Drain, flush, fill, and bleed system.
	Clogged fuel filter.	Replace filter element.
	Dirty or faulty injection nozzles.	Have authorized servicing dealer or engine distributor check injectors.
	Injection pump shut-off not reset.	Turn key switch to "OFF" then to "ON".
	Engine knocks	Low engine oil level.
Injection pump out of time.		See your authorized servicing dealer or engine distributor.
Low coolant temperature.		Remove and check thermostat.

Continued on next page

CD03523,00002D7 -19-22DEC10-1/4

Symptom	Problem	Solution
Engine runs irregularly or stalls frequently	Engine overheating.	See "Engine Overheats".
	Low coolant temperature.	Remove and check thermostat.
	Clogged fuel filter.	Replace fuel filter element.
	Water, dirt, or air in fuel system.	Drain, flush, fill, and bleed system.
Below normal engine temperature	Dirty or faulty injection nozzles.	Have authorized servicing dealer or engine distributor check injectors.
	Defective thermostat.	Remove and check thermostat.
Lack of power	Defective temperature gauge or sender.	Check gauge, sender, and connections.
	Engine overloaded.	Reduce load.
	Intake air restriction.	Service air cleaner.
	Clogged fuel filter.	Replace filter elements.
	Improper type of fuel.	Use proper fuel.
	Overheated engine.	See "Engine Overheats".
	Below normal engine temperature.	Remove and check thermostat.
	Improper valve clearance.	See your authorized servicing dealer or engine distributor.
	Dirty or faulty injection nozzles.	Have authorized servicing dealer or engine distributor check injectors.
	Injection pump out of time.	See your authorized servicing dealer or engine distributor.
	Turbocharger not functioning.	See your authorized servicing dealer or engine distributor.
	Leaking exhaust manifold gasket.	See your authorized servicing dealer or engine distributor.
	Defective aneroid control line.	See your authorized servicing dealer or engine distributor.
	Restricted fuel hose.	Clean or replace fuel hose.
Low fast idle speed.	See your authorized servicing dealer or engine distributor.	
Low oil pressure	Low oil level.	Add oil.

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CD03523,00002D7 -19-22DEC10-2/4

Symptom	Problem	Solution
High oil consumption	Improper type of oil.	Drain, fill crankcase with oil of proper viscosity and quality.
	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.
Engine emits white smoke	Defective turbocharger.	See your authorized servicing dealer or engine distributor.
	Improper type of fuel.	Use proper fuel.
	Low engine temperature.	Warm up engine to normal operating temperature.
	Defective thermostat.	Remove and check thermostat.
	Defective injection nozzles.	See your authorized servicing dealer or engine distributor.
Engine emits black or gray exhaust smoke	Engine out of time.	See your authorized servicing dealer or engine distributor.
	Improper type of fuel.	Use proper fuel.
	Clogged or dirty air cleaner.	Service air cleaner.
	Engine overloaded.	Reduce load.
	Injection nozzles dirty.	See your authorized servicing dealer or engine distributor.
	Engine out of time.	See your authorized servicing dealer or engine distributor.
	Turbocharger not functioning.	See your authorized servicing dealer or engine distributor.
Engine overheats	Engine overloaded.	Reduce load.
	Low coolant level.	Fill radiator to proper level, check radiator and hoses for loose connections or leaks.
	Faulty radiator cap.	Have serviceman check.
	Stretched poly V-belt or defective belt tensioner.	Check automatic belt tensioner and check belts for stretching. Replace as required.

Continued on next page

CD03523,00002D7 -19-22DEC10-3/4

Symptom	Problem	Solution
	Low engine oil level.	Check oil level. Add oil as required.
	Cooling system needs flushing.	Flush cooling system.
	Defective thermostat.	Remove and check thermostat.
	Defective temperature gauge or sender.	Check water temperature with thermometer and replace, if necessary.
	Incorrect grade of fuel.	Use correct grade of fuel.
High fuel consumption	Improper type of fuel.	Use proper type of fuel.
	Clogged or dirty air cleaner.	Service air cleaner.
	Engine overloaded.	Reduce load.
	Improper valve clearance.	See your authorized servicing dealer or engine distributor.
	Injection nozzles dirty.	See your authorized servicing dealer or engine distributor.
	Engine out of time.	See your authorized servicing dealer or engine distributor.
	Defective turbocharger.	See your authorized servicing dealer or engine distributor.
	Low engine temperature.	Check thermostat.

CD03523.00002D7 -19-22DEC10-4/4

Electrical Troubleshooting

Symptom	Problem	Solution
Undercharged system	Excessive electrical load from added accessories.	Remove accessories or install higher output alternator.
	Excessive engine idling.	Increase engine rpm when heavy electrical load is used.
	Poor electrical connections on battery, ground strap, starter, or alternator.	Inspect and clean as necessary.
	Defective battery.	Test battery.
Battery uses too much water	Defective alternator.	Test charging system.
	Cracked battery case.	Check for moisture and replace as necessary.
	Defective battery.	Test battery.
Batteries will not charge	Battery charging rate too high.	Test charging system.
	Loose or corroded connections.	Clean and tighten connections.
	Sulfated or worn-out batteries.	See your authorized servicing dealer or engine distributor.
Starter will not crank	Stretched poly V-belt or defective belt tensioner.	Adjust belt tension or replace belts.
	Engine under load.	Remove load.
	Loose or corroded connections.	Clean and tighten loose connections.
	Low battery output voltage.	See your authorized servicing dealer or engine distributor.
	Faulty start circuit relay.	See your authorized servicing dealer or engine distributor.
	Blown fuse.	Replace fuse.
	Low battery output.	See your authorized servicing dealer or engine distributor.
Starter cranks slowly	Crankcase oil too heavy.	Use proper viscosity oil.
	Loose or corroded connections.	Clean and tighten loose connections.
	Faulty battery connection.	Clean and tighten connections.
Entire electrical system	Faulty battery connection.	Clean and tighten connections.

Continued on next page

CD03523.00002D8 -19-22DEC10-1/2

Troubleshooting

Symptom	Problem	Solution
	Sulfated or worn-out batteries.	See your authorized servicing dealer or engine distributor.
	Blown fuse.	Replace fuse.

CD03523,00002D8 -19-22DEC10-2/2

Storage

Engine Storage Guidelines

1. John Deere engines can be stored outside for up to three (3) months with no long term preparation IF COVERED BY WATERPROOF COVERING.
2. John Deere engines can be stored in a standard overseas shipping container for up to three (3) months with no long term preparation.
3. John Deere engines can be stored inside, warehoused, for up to six (6) months with no long term preparation.
4. John Deere engines expected to be stored more than six (6) months MUST have long term storage preparation. See Prepare Engine for Long Term Storage.

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Prepare Engine for Long Term Storage

The following storage preparations are used for long term engine storage up to one year. After that, the engine should be started, warmed up, and retreated for an extended storage period.

IMPORTANT: Any time your engine will not be used for over six (6) months, the following recommendations for storing it and removing it from storage will help to minimize corrosion and deterioration.

1. Change engine oil and replace filter. Used oil will not give adequate protection. See Change Oil and Filter.
2. Service air cleaner. See Clean or Replace Air Filter.
3. Draining and flushing of cooling system is not necessary if engine is to be stored only for several months. However, for extended storage periods of a year or longer, it is recommended that the cooling system is drained, flushed, and refilled. Refill with appropriate coolant. See Diesel Engine Coolant.
4. Fill the fuel tank.
5. Remove fan/alternator belt, if desired.
6. Remove and clean batteries. Store them in a cool, dry place and keep them fully charged.
7. Clean the exterior of the engine with salt-free water and touchup any scratched or chipped painted surfaces with a good quality paint.
8. Coat all exposed (machined) metal surfaces with grease or corrosion inhibitor if not feasible to paint.
9. Seal all openings on engine with plastic bags and tape.
10. Store the engine in a dry protected place. If engine must be stored outside, cover it with a waterproof canvas or other suitable protective material and use a strong waterproof tape.

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Remove Engine from Long Term Storage

Refer to the appropriate section for detailed services listed below or have your authorized servicing dealer or engine distributor perform services that you may not be familiar with.

IMPORTANT: DO NOT operate starter more than 30 seconds at a time. Wait at least 2 minutes for starter to cool before trying again.

1. Remove all protective coverings from engine. Unseal all openings in engine and remove covering from electrical systems.
2. Remove the batteries from storage. Install batteries (fully charged) and connect the terminals.
3. Install fan/alternator belt if removed.
4. Check for filled fuel tank.
5. Perform all appropriate prestarting checks. Refer to Maintenance/Daily or Every 10 Hours.
6. Crank engine for 20 seconds with starter (do not allow the engine to start). Wait 2 minutes and crank engine an additional 20 seconds to assure bearing surfaces are adequately lubricated.
7. Start engine and run at no load for several minutes. Warm up carefully and check all gauges before placing engine under load.
8. On the first day of operation after storage, check overall engine for leaks and check all gauges for correct operation.

CD03523,00002DD -19-22DEC10-1/1

Specifications

General Engine Pack Specifications

ITEM	UNIT OF MEASURE	3029TFU80	4045HFU82 - 80 kVA	4045HFU82 - 100 kVA	4045HFU82 - 120 kVA
Number of Cylinders		3	4	4	4
Fuel		Diesel	Diesel	Diesel	Diesel
Bore	mm	106.5	106.5	106.5	106.5
Stroke	mm	110	127	127	127
Displacement	L	2.9	4.5	4.5	4.5
Compression Ratio		17.2:1	19.0:1	19.0:1	19.0:1
POWER ^a at 1500 rpm (Prime)	kW (hp)	28(38)	76 (103)	94 (127)	112 (152)
POWER ^a at 1500 rpm (Standby)	kW (hp)	31 (42)	83 (113)	103 (140)	123 (167)
POWER ^a at 1800 rpm (Prime)	kW (hp)	33 (45)	78 (106)	96 (131)	115 (156)
POWER ^a at 1800 rpm (Standby)	kW (hp)	36 (49)	86 (117)	106 (144)	126 (171)
Width (overall)	mm	590	755	755	755
Length (overall)	mm	888	1359	1359	1359
Height (overall)	mm	1005	1155	1155	1155
Weight (dry) ^b	kg	363	598	598	598
Engine oil quantity	L	8	15	15	15
Engine coolant quantity	L	11	20	20	20

^aWith Fan

^bApproximate

ITEM	UNIT OF MEASURE	6068HFU82 - 150 kVA	6068HFU82 - 200 kVA	6090HFU84 - 250 kVA	6090HFU84 - 300 kVA
Number of Cylinders		6	6	6	6
Fuel		Diesel	Diesel	Diesel	Diesel
Bore	mm	106.5	106.5	118.4	118.4
Stroke	mm	127	127	136	136
Displacement	L	6.8	6.8	9.0	9.0
Compression Ratio		19.0:1	19.0:1	16.0:1	16.0:1
POWER ^a at 1500 rpm (Prime)	kW (hp)	139 (189)	184 (250)	233 (317)	277 (376)
POWER ^a at 1500 rpm (Standby)	kW (hp)	153 (208)	202 (274)	256 (348)	304 (413)
POWER ^a at 1800 rpm (Prime)	kW (hp)	142 (193)	193 (262)	237 (321)	282 (378)
POWER ^a at 1800 rpm (Standby)	kW (hp)	156 (212)	212 (288)	260 (353)	315 (428)
Width (overall)	mm	819	819	1072	1072
Length (overall)	mm	1524	1524	1755	1755
Height (overall)	mm	1387	1387	1625	1625
Weight (dry) ^b	kg	750	750	1089	1089
Engine oil quantity	L	20	32	40	40
Engine coolant quantity	L	27	27	36	36

^aWith Fan

^bApproximate

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Specifications

General Bare Engine Specifications

ITEM	UNIT OF MEASURE	4045HFS86	4045HFS87	4045HFS88
Number of Cylinders		4	4	4
Fuel		Diesel	Diesel	Diesel
Bore	mm	106.5	106.5	106.5
Stroke	mm	127	127	127
Displacement	L	4.5	4.5	4.5
Compression Ratio		19.0:1	19.0:1	19.0:1
POWER ^a at 1500 rpm (Prime)	kW (hp)	76 (103)	94 (127)	112 (152)
POWER ^a at 1500 rpm (Standby)	kW (hp)	83 (113)	103 (140)	123 (167)
POWER ^a at 1800 rpm (Prime)	kW (hp)	78 (106)	96 (131)	115 (156)
POWER ^a at 1800 rpm (Standby)	kW (hp)	86 (117)	106 (144)	126 (171)
Width (overall)	mm	612	612	612
Length (overall)	mm	860	860	860
Height (overall)	mm	1039	1039	1039
Weight (dry) ^b	kg	491	491	491
Engine oil quantity	L	14	14	14

^aWith Fan

^bApproximate

ITEM	UNIT OF MEASURE	6068HFS85	6068HFS86
Number of Cylinders		6	6
Fuel		Diesel	Diesel
Bore	mm	106.5	106.5
Stroke	mm	127	127
Displacement	L	6.8	6.8
Compression Ratio		19.0:1	19.0:1
POWER ^a at 1500 rpm (Prime)	kW (hp)	139 (189)	184 (250)
POWER ^a at 1500 rpm (Standby)	kW (hp)	153 (208)	202 (275)
POWER ^a at 1800 rpm (Prime)	kW (hp)	142 (193)	193 (262)
POWER ^a at 1800 rpm (Standby)	kW (hp)	157 (214)	212 (288)
Width (overall)	mm	657	657
Length (overall)	mm	1123	1123
Height (overall)	mm	1036	1036
Weight (dry) ^b	kg	608	608
Engine oil quantity	L	20	32

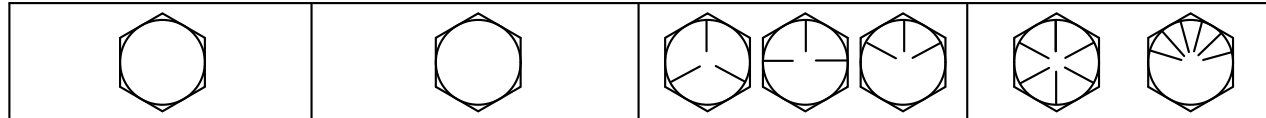
^aWith Fan

^bApproximate

CD03523.00002DF -19-23DEC10-1/1

Unified Inch Bolt and Screw Torque Values

TS1671 —UN—01MAY03



Bolt or Screw Size	SAE Grade 1				SAE Grade 2 ^a				SAE Grade 5, 5.1 or 5.2				SAE Grade 8 or 8.2			
	Lubricated ^b		Dry ^c		Lubricated ^b		Dry ^c		Lubricated ^b		Dry ^c		Lubricated ^b		Dry ^c	
	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.
1/4	3.7	33	4.7	42	6	53	7.5	66	9.5	84	12	106	13.5	120	17	150
													N·m	lb.-ft.	N·m	lb.-ft.
5/16	7.7	68	9.8	86	12	106	15.5	137	19.5	172	25	221	28	20.5	35	26
									N·m	lb.-ft.	N·m	lb.-ft.				
3/8	13.5	120	17.5	155	22	194	27	240	35	26	44	32.5	49	36	63	46
			N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.								
7/16	22	194	28	20.5	35	26	44	32.5	56	41	70	52	80	59	100	74
	N·m	lb.-ft.														
1/2	34	25	42	31	53	39	67	49	85	63	110	80	120	88	155	115
9/16	48	35.5	60	45	76	56	95	70	125	92	155	115	175	130	220	165
5/8	67	49	85	63	105	77	135	100	170	125	215	160	240	175	305	225
3/4	120	88	150	110	190	140	240	175	300	220	380	280	425	315	540	400
7/8	190	140	240	175	190	140	240	175	490	360	615	455	690	510	870	640
1	285	210	360	265	285	210	360	265	730	540	920	680	1030	760	1300	960
1-1/8	400	300	510	375	400	300	510	375	910	670	1150	850	1450	1075	1850	1350
1-1/4	570	420	725	535	570	420	725	535	1280	945	1630	1200	2050	1500	2600	1920
1-3/8	750	550	950	700	750	550	950	700	1700	1250	2140	1580	2700	2000	3400	2500
1-1/2	990	730	1250	930	990	730	1250	930	2250	1650	2850	2100	3600	2650	4550	3350

Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For plastic insert or crimped steel type lock nuts, for stainless steel fasteners, or for nuts on U-bolts, see the tightening instructions for the specific application. Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Replace fasteners with the same or higher grade. If higher grade fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

^aGrade 2 applies for hex cap screws (not hex bolts) up to 6 in. (152 mm) long. Grade 1 applies for hex cap screws over 6 in. (152 mm) long, and for all other types of bolts and screws of any length.

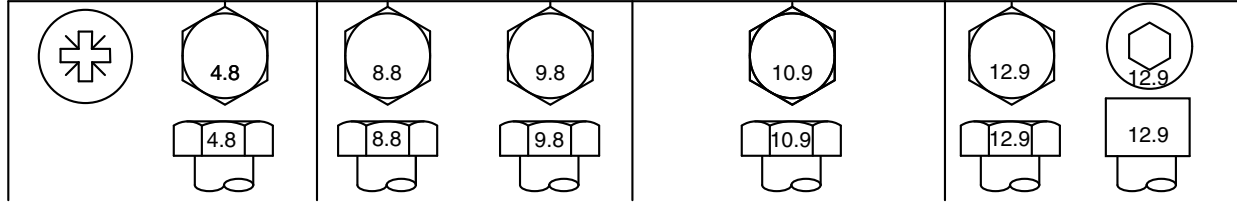
^b"Lubricated" means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or 7/8 in. and larger fasteners with JDM F13C, F13F or F13J zinc flake coating.

^c"Dry" means plain or zinc plated without any lubrication, or 1/4 to 3/4 in. fasteners with JDM F13B, F13E or F13H zinc flake coating.

DX,TORQ1 -19-12JAN11-1/1

Metric Bolt and Screw Torque Values

TS1670 —UN—01MAY03



Bolt or Screw Size	Class 4.8				Class 8.8 or 9.8				Class 10.9				Class 12.9			
	Lubricated ^a		Dry ^b		Lubricated ^a		Dry ^b		Lubricated ^a		Dry ^b		Lubricated ^a		Dry ^b	
	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.
M6	4.7	42	6	53	8.9	79	11.3	100	13	115	16.5	146	15.5	137	19.5	172
M8	11.5	102	14.5	128	22	194	27.5	243	32	23.5	40	29.5	37	27.5	47	35
M10	23	204	29	21	43	32	55	40	63	46	80	59	75	55	95	70
M12	40	29.5	50	37	75	55	95	70	110	80	140	105	130	95	165	120
M14	63	46	80	59	120	88	150	110	175	130	220	165	205	150	260	190
M16	100	74	125	92	190	140	240	175	275	200	350	255	320	235	400	300
M18	135	100	170	125	265	195	330	245	375	275	475	350	440	325	560	410
M20	190	140	245	180	375	275	475	350	530	390	675	500	625	460	790	580
M22	265	195	330	245	510	375	650	480	725	535	920	680	850	625	1080	800
M24	330	245	425	315	650	480	820	600	920	680	1150	850	1080	800	1350	1000
M27	490	360	625	460	950	700	1200	885	1350	1000	1700	1250	1580	1160	2000	1475
M30	660	490	850	625	1290	950	1630	1200	1850	1350	2300	1700	2140	1580	2700	2000
M33	900	665	1150	850	1750	1300	2200	1625	2500	1850	3150	2325	2900	2150	3700	2730
M36	1150	850	1450	1075	2250	1650	2850	2100	3200	2350	4050	3000	3750	2770	4750	3500

Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For stainless steel fasteners or for nuts on U-bolts, see the tightening instructions for the specific application. Tighten plastic insert or crimped steel type lock nuts by turning the nut to the dry torque shown in the chart, unless different instructions are given for the specific application.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class. Replace fasteners with the same or higher property class. If higher property class fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

^a"Lubricated" means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or M20 and larger fasteners with JDM F13C, F13F or F13J zinc flake coating.

^b"Dry" means plain or zinc plated without any lubrication, or M6 to M18 fasteners with JDM F13B, F13E or F13H zinc flake coating.

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10.2. Appendix B - Alternator user and maintenance manual

User guide and maintenance manual

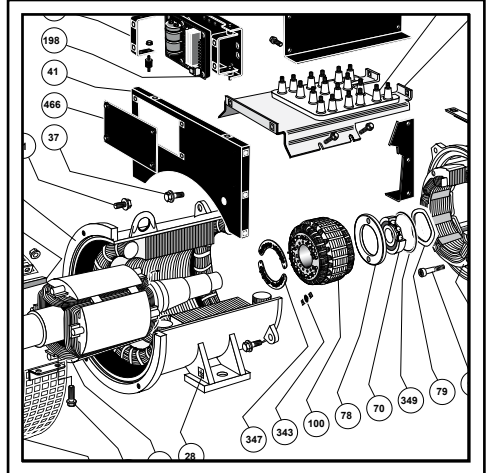
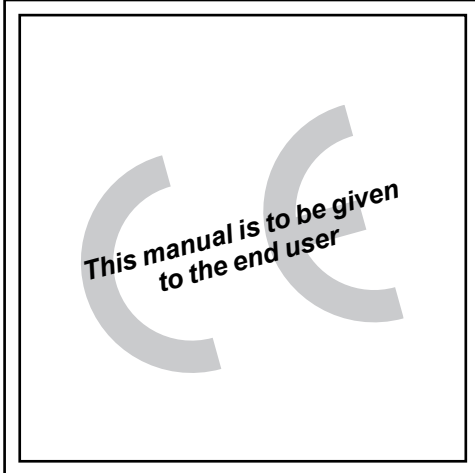
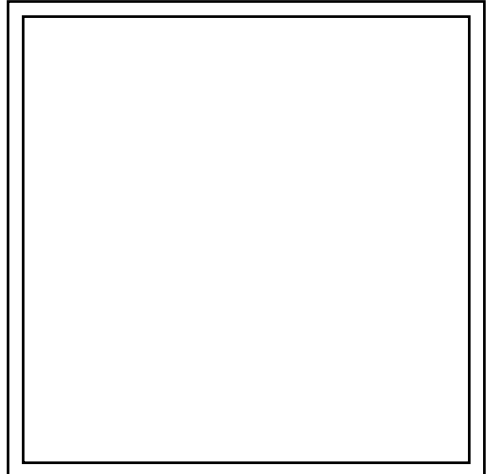
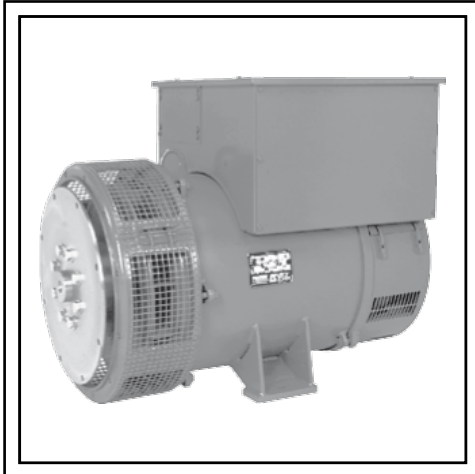
LEROY SOMER

Alternator

**LSA46.2 L6 - L9
LSA46.2 M3 - M5
46-2 SHUNT & AREP & PMG**

**3856 h
01/03/2012**

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LSA 46.2 - 4 POLES ALTERNATORS

Installation and maintenance

LSA 46.2 - 4 POLES ALTERNATORS

This manual concerns the alternator which you have just purchased.

We wish to draw your attention to the contents of this maintenance manual.

SAFETY MEASURES

Before using your machine for the first time, it is important to read the whole of this installation and maintenance manual.

All necessary operations and interventions on this machine must be performed by a qualified technician.

Our technical support service will be pleased to provide any additional information you may require.

The various operations described in this manual are accompanied by recommendations or symbols to alert the user to the potential risk of accidents. It is vital that you understand and take notice of the different warning symbols used.

WARNING

Warning symbol for an operation capable of damaging or destroying the machine or surrounding equipment.



Warning symbol for general danger to personnel.



Warning symbol for electrical danger to personnel.

WARNING SYMBOLS

We wish to draw your attention to the following 2 safety measures which must be complied with:

a) During operation, do not allow anyone to stand in front of the air outlet guards, in case anything is ejected from them.

b) Do not allow children younger than 14 to go near the air outlet guards.

A set of self-adhesive stickers depicting the various warning symbols is included with this maintenance manual. They should be positioned as shown in the drawing below once the machine has been fully installed.

WARNING

The alternators must not be put into service until the machines in which they are to be incorporated have been declared compliant with Directives EC and plus any other directives that may be applicable.

Note: LEROY-SOMER reserves the right to modify the characteristics of its products at any time in order to incorporate the latest technological developments. The information contained in this document may therefore be changed without notice.

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LSA 46.2 - 4 POLES ALTERNATORS

1 - RECEIPT

1.1 - Standards and safety measures

Our alternators comply with most international standards.

See the EC Declaration of Incorporation on the last page.

1.2 - Inspection

On receipt of your alternator, check that it has not suffered any damage in transit. If there are obvious signs of knocks, contact the transporter (you may be able to claim on their insurance) and after a visual check, turn the machine by hand to detect any malfunction.

1.3 - Identification

The alternator is identified by means of a nameplate fixed on the machine (see drawing).

Make sure that the nameplate on the machine conforms to your order.

The machine name is defined according to various criteria, for example :

LSA 46.2 M5 C6/4 -

- LSA : name used in the PARTNER range
- M : Marine
- C : Cogeneration
- T : Telecommunications
- 46.2 : machine type
- M5 : model

- C : excitation system

(C : AREP / J : SHUNT or PMG / E : COMPOUND)

- 6/4 : winding number / number of poles.

1.3.1 - Nameplate

So that you can identify your machine quickly and accurately, we suggest you write its specifications on the nameplate below.

1.4 - Storage

Prior to commissioning, machines should be stored :



- Away from humidity (< 90%); after a long period of storage, check the machine insulation (section 3.2.1). To prevent the bearings from becoming marked, do not store in an environment with significant vibration.

1.5 - Application

These alternators are mainly designed to produce electricity in the context of applications involving the use of generators.

1.6 - Contraindications to use

Use of the machine is restricted to operating conditions (environment, speed, voltage, power, etc) compatible with the characteristics indicated on the nameplate.

LEROY-SOMER		ALTERNATEURS PARTNER ALTERNATORS	
LSA <input type="text"/>	Date <input type="text"/>		
N <input type="text"/>	<input type="text"/> Hz		
Min ⁻¹ /R.P.M. <input type="text"/>	Protection <input type="text"/>		
Cos Ø /P.F. <input type="text"/>	Cl. ther. / Th.class <input type="text"/>		
Régulateur/A.V.R. <input type="text"/>			
Altit. <input type="text"/> m	Masse / Weight <input type="text"/>		
Rit AV/D.E bearing <input type="text"/>	Rit AR/N.D.E bearing <input type="text"/>		
Graisse / Grease <input type="text"/>			
Valeurs excit / Excit. values			
en charge / full load <input type="text"/>	<input type="text"/>		
à vide / at no load <input type="text"/>	<input type="text"/>		
PUISANCE / RATING			
Tension <input type="text"/>	<input type="text"/>	<input type="text"/>	V
Voltage <input type="text"/>	<input type="text"/>	<input type="text"/>	Ph.
Connex. <input type="text"/>	<input type="text"/>	<input type="text"/>	
Continue <input type="text"/>	<input type="text"/>	<input type="text"/>	kVA
Continuous <input type="text"/>	<input type="text"/>	<input type="text"/>	kW
40C <input type="text"/>	<input type="text"/>	<input type="text"/>	A
Secours <input type="text"/>	<input type="text"/>	<input type="text"/>	kVA
Std by <input type="text"/>	<input type="text"/>	<input type="text"/>	kW
27C <input type="text"/>	<input type="text"/>	<input type="text"/>	A
(*) Tension maxi. / maximum voltage			
 166631			
Conforme à C.E.I 60034-1. According to I.E.C 60034-1.			
Made in France - 1 024 959/a			

LSA 46.2 - 4 POLES ALTERNATORS

2 - TECHNICAL CHARACTERISTICS

2.1 - Electrical characteristics

The LSA 46.2 alternator is a machine without sliprings or revolving armature brushes, wound as "2/3 pitch", 6 or 12-wire, with class H insulation and a field excitation system available in either SHUNT, AREP or «PMG» version (see diagrams and AVR manuals).

2.1.1 - Electrical options

- Stator temperature detection sensors
- Bearing sensors (PTC, PT100, etc)
- Space heater

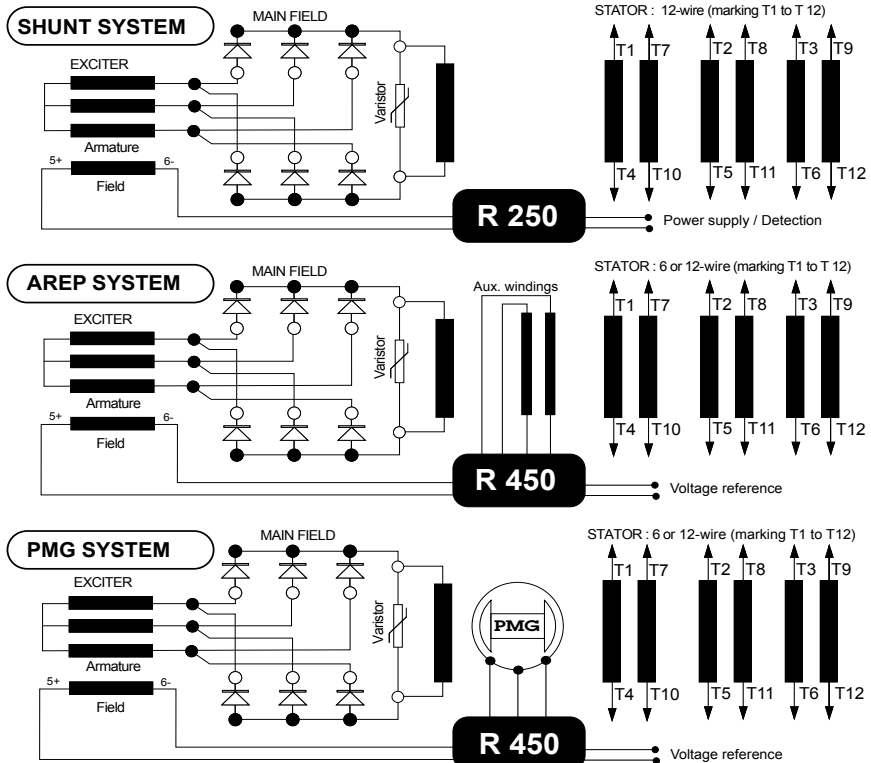
Interference suppression conforms to standard EN 55011, group 1, class B (Europe).

2.2 - Mechanical characteristics

- Steel frame
- Cast iron end shields
- Protected ball bearings, greased for life
- Mounting arrangements:
IM 1201 (MD 35) foot and flange mounted, single-bearing with SAE coupling disc.
IM 1001 (B 34) double-bearing with SAE flange and standard cylindrical shaft extension.
- Drip-proof machine, self-cooled
- Degree of protection: IP 23

2.1.1 - Mechanical options

- Air inlet filter
- Regreasable ball bearings
- IP 44 protection



LSA 46.2 - 4 POLES ALTERNATORS

3 - INSTALLATION

Personnel undertaking the various operations indicated in this section must wear personal protective equipment appropriate for mechanical and electrical hazards.

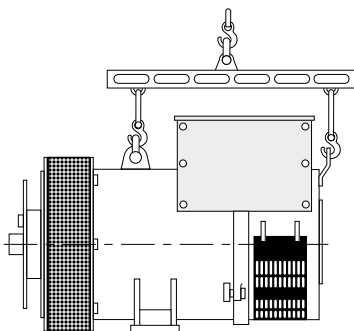
3.1 - Assembly



All mechanical handling operations must be undertaken using suitable equipment and the machine must be horizontal. Check how much the machine weighs (see 4.8.3.) before choosing the lifting tool.

3.1.1 - Handling

The generously-sized lifting rings are for handling the alternator alone. They must not be used to lift the genset. The choice of lifting hooks or handles should be determined by the shape of these rings. Choose a lifting system which respects the integrity and the environment of the alternators.



During this operation, do not allow anyone to stand under the load.

3.1.2 - Coupling

3.1.2.1 - Single-bearing alternator

Before coupling the machines, check that they are compatible by:

- undertaking a torsional analysis of the transmission,
- checking the dimensions of the flywheel and its housing, the flange, coupling discs and offset.

WARNING

When coupling the alternator to the prime mover, do not use the fan to turn the alternator or rotor.

The holes of the coupling discs should be aligned with the flywheel holes by cranking the engine.

Make sure the alternator is securely bedded in position during coupling.

Check that there is lateral play on the crankshaft.

3.1.2.2 - Double-bearing alternator

- Semi-flexible coupling

Careful alignment of the machines is recommended, checking that the lack of concentricity and parallelism of both parts of the coupling do not exceed 0.1 mm.

This alternator has been balanced with a 1/2 key.

3.1.3 - Location

The room where the alternator is placed must be ventilated to ensure that the ambient temperature cannot exceed the data on the nameplate.

3.2 - Checks prior to first use

3.2.1 - Electrical checks



Under no circumstances should an alternator, new or otherwise, be operated if the insulation is less than 1 megohm for the stator and 100,000 ohms for the other windings.

LSA 46.2 - 4 POLES ALTERNATORS

There are 2 possible methods for restoring the above minimum values.

a) Dry out the machine for 24 hours in a drying oven at a temperature of 110 °C (without the regulator).

b) Blow hot air into the air intake, having made sure that the machine is rotating with the exciter field disconnected.

Note : Prolonged standstill: In order to avoid these problems, we recommend the use of space heaters, as well as turning over the machine from time to time. Space heaters are only really effective if they are working continuously while the machine is stopped.

WARNING

Ensure that the alternator has the degree of protection matching the defined environmental conditions.

3.2.2 - Mechanical checks

Before starting the machine for the first time, check that:

- all fixing bolts and screws are tight.
- the cooling air is drawn in freely.
- the protective grilles and housing are correctly in place.

- the standard direction of rotation is clockwise as seen from the shaft end (phase rotation in order 1 - 2 - 3).

For anti-clockwise rotation, swap 2 and 3.

- the winding connection corresponds to the site operating voltage (see section 3.3).

3.3 - Terminal connection diagrams

To modify the connection, change the position of the stator cables on the terminals. The winding code is specified on the nameplate.

3.3.1 - Terminal connection: 12 wire

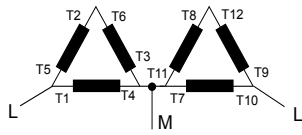
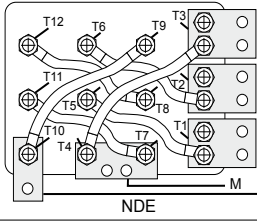

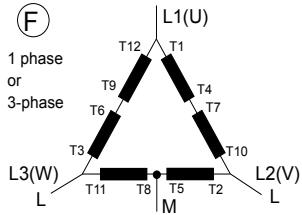
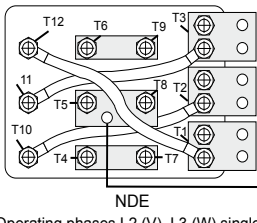

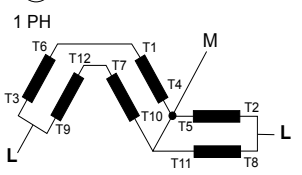
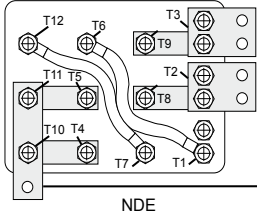

The connection accessories are detailed in section 5.3.3.




Any intervention on the alternator terminals during reconnection or checks should be performed with the machine stopped.

Connection codes		Voltage L-L			Factory connection	
(A) 3-phase 	Winding	50 Hz	60 Hz			
	6	190 - 208	190 - 240			
	7	220	-			
	8	-	190 - 208			
		R 250 voltage detection : 0 => (T8) / 110 V => (T11) R 450 voltage detection : 0 => (T3) / 220 V => (T2)				
(D) 3-phase 	Winding	50 Hz	60 Hz			
	6	380 - 415	380 - 480			
	7	440	-			
	8	-	380 - 416			
		R 250 voltage detection : 0 => (T8) / 110 V => (T11) R 450 voltage detection : 0 => (T3) / 380 V => (T2)				
		Winding 9	500	600		
		Winding 9 : R 450 voltage detection + transformer (See specific diagram AREP or SHUNT)				
In case of reconnection, ensure that AVR voltage detection is correct ! The factory can supply a set of flexible shunts and special connection links as an option for making these connections. (*).						

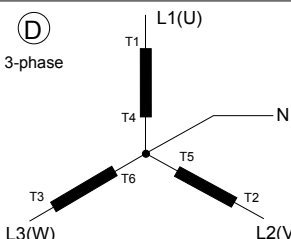
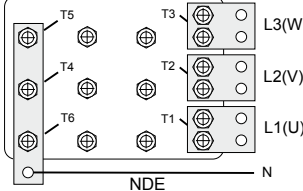
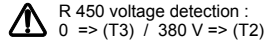
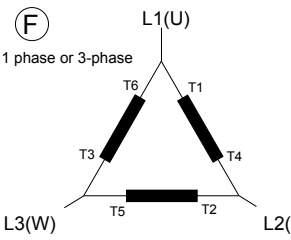
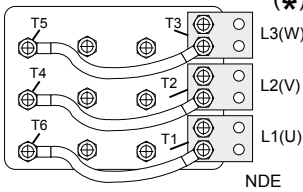
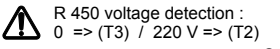
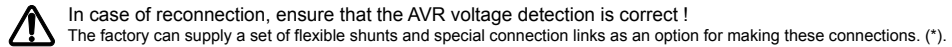
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Connection codes	Voltage L.L			Factory connection
(FF) 1 phase  Voltage LM = 1/2 voltage LL	Winding	50 Hz	60 Hz	 (*)
	6	220 - 240	220 - 240	
	7	240 - 254	-	
	8	-	220 - 240	
	 R 250 voltage detection : 0 => (T4) / 110 V => (T1) R 450 voltage detection : 0 => (T10) / 220 V => (T1)			
(F) 1 phase or 3-phase  Voltage LM = 1/2 voltage LL	Winding	50 Hz	60 Hz	 (*) Operating phases L2 (V), L3 (W) single phase
	6	220 - 240	220 - 240	
	7	240 - 254	-	
	8	-	220 - 240	
	 R 250 voltage detection : 0 => (T4) / 110 V => (T1) R 450 voltage detection : 0 => (T3) / 220 V => (T2)			
(G) 1 PH  Voltage LM = 1/2 voltage LL	Winding	50 Hz	60 Hz	 (*)
	6	220 - 240	220 - 240	
	7	250 - 260	-	
	8	200	220 - 240	
	 R 250 voltage detection : 0 => (T8) / 110 V => (T11) R 450 voltage detection : 0 => (T3) / 220 V => (T2)			

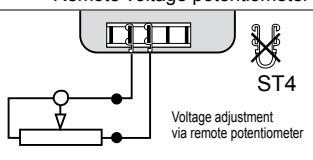
 In case of reconnection, ensure that AVR voltage detection is correct !
 The factory can supply a set of flexible shunts and special connection links as an option for making these connections. (*)

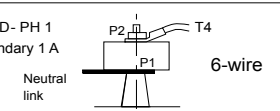
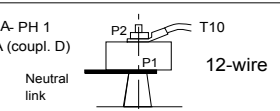
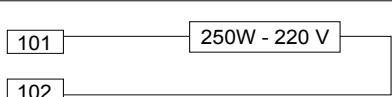
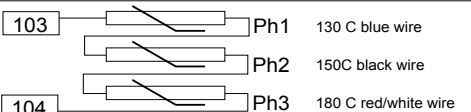
LSA 46.2 - 4 POLES ALTERNATORS

3.3.2 - Terminal connection: 6 wire (not possible with the R 250)

Connection codes		Voltage L.L			Factory connection										
(D) 3-phase 	<table border="1"> <tr> <th>Winding</th> <th>50 Hz</th> <th>60 Hz</th> </tr> <tr> <td>6S</td> <td>380 - 415</td> <td>380 - 480</td> </tr> <tr> <td>7S</td> <td>440</td> <td>-</td> </tr> <tr> <td>8S</td> <td>-</td> <td>380 - 416</td> </tr> </table>	Winding	50 Hz	60 Hz	6S	380 - 415	380 - 480	7S	440	-	8S	-	380 - 416		
		Winding	50 Hz	60 Hz											
		6S	380 - 415	380 - 480											
		7S	440	-											
8S	-	380 - 416													
		Winding 9 : R 450 voltage detection + transformer (See specific diagram)													
<table border="1"> <tr> <th>Winding</th> <th>50 Hz</th> <th>60 Hz</th> </tr> <tr> <td>9S</td> <td>-</td> <td>600</td> </tr> </table>		Winding	50 Hz	60 Hz	9S	-	600								
Winding	50 Hz	60 Hz													
9S	-	600													
(F) 1 phase or 3-phase 	<table border="1"> <tr> <th>Winding</th> <th>50 Hz</th> <th>60 Hz</th> </tr> <tr> <td>6S</td> <td>220 - 240</td> <td>220 - 277</td> </tr> <tr> <td>7S</td> <td>240 - 254</td> <td>-</td> </tr> <tr> <td>8S</td> <td>-</td> <td>220 - 240</td> </tr> </table>	Winding	50 Hz	60 Hz	6S	220 - 240	220 - 277	7S	240 - 254	-	8S	-	220 - 240		
		Winding	50 Hz	60 Hz											
		6S	220 - 240	220 - 277											
		7S	240 - 254	-											
8S	-	220 - 240													
		Operating phases : L2 (V), L3 (W) single phase													
<table border="1"> <tr> <th>Winding</th> <th>50 Hz</th> <th>60 Hz</th> </tr> <tr> <td>9S</td> <td>-</td> <td>600</td> </tr> </table>		Winding	50 Hz	60 Hz	9S	-	600								
Winding	50 Hz	60 Hz													
9S	-	600													
															

3.3.3 - Option connection diagram

R 791 T interference suppression kit (standard for CE marking)	Remote voltage potentiometer																								
Connections <table border="1"> <tr> <td></td> <td>(A)</td> <td>(D)</td> <td>(F)</td> </tr> <tr> <td>Black</td> <td>T1</td> <td>T1</td> <td>T1</td> </tr> <tr> <td>Black</td> <td>T2</td> <td>T2</td> <td>T2</td> </tr> <tr> <td>Black</td> <td>T3</td> <td>T3</td> <td>T3</td> </tr> <tr> <td>Blue</td> <td>N</td> <td>N</td> <td>⊥</td> </tr> <tr> <td>White</td> <td>⊥</td> <td>⊥</td> <td>⊥</td> </tr> </table>		(A)	(D)	(F)	Black	T1	T1	T1	Black	T2	T2	T2	Black	T3	T3	T3	Blue	N	N	⊥	White	⊥	⊥	⊥	
	(A)	(D)	(F)																						
Black	T1	T1	T1																						
Black	T2	T2	T2																						
Black	T3	T3	T3																						
Blue	N	N	⊥																						
White	⊥	⊥	⊥																						

Current transformer connection (optional)	
Coupling D- PH 1 In - Secondary 1 A  6-wire	Coupling D & A- PH 1 In - Secondary 1A (coup. D)  12-wire
Anti condensation heater 	Thermistor (PTC) temperature 

LSA 46.2 - 4 POLES ALTERNATORS

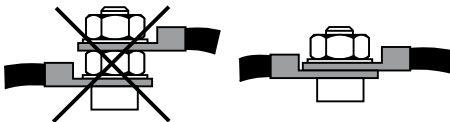
3.3.4 - Connection checks



Electrical installations must comply with the current legislation in force in the country of use.

Check that:

- The residual circuit-breaker conforms to legislation on protection of personnel, in force in the country of use, and has been correctly installed on the alternator power output as close as possible to the alternator. (In this case, disconnect the wire of the interference suppression module linking the neutral).
- Any protection devices in place have not been tripped.
- If there is an external AVR, the connections between the alternator and the cabinet are made in accordance with the connection diagram.
- There is no short-circuit phase-phase or phase-neutral between the alternator output terminals and the generator set control cabinet (part of the circuit not protected by circuitbreakers or relays in the cabinet).
- The machine should be connected with the busbar separating the terminals as shown in the terminal connection diagram.



3.4 - Commissioning



The machine can only be started up and used if the installation is in accordance with the regulations and instructions defined in this manual.

The machine is tested and set up at the factory. When first used with no load, make sure that the drive speed is correct and stable (see the nameplate). With the regreasable bearing option, we recommend greasing the bearings at the time of commissioning (see 4.2.3).

On application of the load, the machine should achieve its rated speed and voltage; however, in the event of abnormal operation, the machine setting can be altered (follow the adjustment procedure in section 3.5). If the machine still operates incorrectly, the cause of the malfunction must be located (see section 4.4).

3.5 - Setting up



The various adjustments during tests must be made by a qualified engineer. Ensure that the drive speed specified on the nameplate is reached before commencing adjustment. After operational testing, replace all access panels or covers. The AVR is used to make any adjustments to the machine.

LSA 46.2 - 4 POLES ALTERNATORS

4 - SERVICING - MAINTENANCE

4.1 - Safety measures

Serviceing or troubleshooting must be carried out strictly in accordance with instructions so as to avoid the risk of accidents and to maintain the machine in its original state.



All such operations performed on the alternator should be undertaken by personnel trained in the commissioning, servicing and maintenance of electrical and mechanical components, who must wear personal protective equipment appropriate for mechanical and electrical hazards.

Before any intervention on the machine, ensure that it cannot be started by a manual or automatic system and that you have understood the operating principles of the system.

4.2 - Routine maintenance

4.2.1 - Checks after start-up

After approximately 20 hours of operation, check that all fixing screws on the machine are still tight, plus the general state of the machine and the various electrical connections in the installation.

4.2.2 - Bearings

As standard, the alternator is fitted with permanently greased bearings. As an option, they may be regreaseable. It is advisable to lubricate the alternator during operation. Time intervals and quantity of grease are given in the table below.

NDE/DE bearing	6316 C3	6315 C3
Quantity of grease	33 g	30 g
Regreasing interval	4000 H	4500 H

Lubrication intervals are given for grease type: LITHIUM - standard - NLGI 3.

In the factory, the grease used for lubrication is: ESSO - Unirex N3.

Before using another grease, check for compatibility with the original one. Monitor the temperature rise in the bearings (see section 4.4).

4.2.3 - Electrical servicing

Commercially-available volatile degreasing agents can be used.

WARNING

Do not use: trichlorethylene, perchlorethylene, trichloroethane or any alkaline products.



These operations must be performed at a cleaning station, equipped with a vacuum system that collects and flushes out the products used.

The insulating components and the impregnation system are not at risk of damage from solvents. Avoid letting the cleaning product run into the slots.

Apply the product with a brush, sponging frequently to avoid accumulation in the housing. Dry the winding with a dry cloth. Let any traces evaporate before reassembling the machine.

4.2.4 - Mechanical servicing

WARNING

Cleaning the machine using water or a highpressure washer is strictly prohibited. Any problems arising from such treatment are not covered by our warranty.

Degreasing: Use a brush and detergent (suitable for paintwork).

Dusting: Use an air gun.

If the machine is fitted with air inlet and outlet filters, the maintenance personnel should clean them routinely at regular intervals. In the case of dry dust, the filter can be cleaned using compressed air and/or replaced if it is clogged.

After cleaning the alternator, it is essential to check the winding insulation (see sections 3.2 and 4.8).

4.3 - Fault detection

If, when commissioned, the alternator does not work normally, the source of the malfunction must be identified (see sections 4.4 and 4.5).

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4.4 - Mechanical defects

Fault		Action
Bearing	Excessive temperature rise in one or both bearings (bearing temperature more than 80 °C) with or without abnormal bearing noise	<ul style="list-style-type: none"> - If the bearing has turned blue or if the grease has turned black, change the bearing - Bearing not fully locked (abnormal play in the bearing cage) - Check the end shield alignment (flange not properly fitted)
Abnormal temperature	Excessive temperature rise in the alternator housing (more than 40° C above the ambient temperature)	<ul style="list-style-type: none"> - Air flow (intake-outlet) partially clogged or hot air is being recycled from the alternator or engine - Alternator operating at too high a voltage (> 105% of Un on load) - Alternator overloaded
Vibration	Excessive vibration	<ul style="list-style-type: none"> - Misalignment (coupling) - Defective mounting or play in coupling - Rotor balancing fault (Engine - Alternator)
	Excessive vibration and humming noise coming from the machine	<ul style="list-style-type: none"> - Phase imbalance - Stator short-circuit
Abnormal noise	Alternator damaged by a significant impact, followed by humming and vibration	<ul style="list-style-type: none"> - System short-circuit - Mis-paralleling Possible consequences: <ul style="list-style-type: none"> - Broken or damaged coupling - Broken or bent shaft extension - Shifting and short-circuit of revolving field winding - Fan fractured or coming loose on shaft - Irreparable damage to rotating diodes, AVR, surge suppressor

4.5 - Electrical faults

Fault	Action	Effect	Check/Cause
No voltage at no load on start-up	Connect a new battery of 4 to 12 volts to terminals E- and E+, respecting the polarity, for 2 to 3 seconds	The alternator builds up and its voltage is still correct when the battery is removed	- Lack of residual magnetism
		The alternator builds up but its voltage does not reach the rated value when the battery is removed	<ul style="list-style-type: none"> - Check the connection of the voltage reference to the AVR - Faulty diodes - Armature short-circuit
		The alternator builds up but its voltage disappears when the battery is removed	<ul style="list-style-type: none"> - Faulty AVR - Field windings open circuit (check winding) - Revolving field coil open circuit (check the resistance)
Voltage too low	Check the drive speed	Correct speed	Check the AVR connections (AVR may be faulty) <ul style="list-style-type: none"> - Field windings short-circuited - Rotating diodes burnt out - Revolving field coil short-circuited - Check the resistance
		Speed too low	Increase the drive speed (do not touch the AVR voltage pot. (P2) before running at the correct speed)
Voltage too high	Adjust AVR voltage potentiometer	Adjustment ineffective	Faulty AVR
Voltage oscillations	Adjust the AVR stability potentiometer	If no effect: try normal or fast stability modes (ST2)	<ul style="list-style-type: none"> - Check the speed: possibility of cyclic irregularity - Loose connections - Faulty AVR - Speed too low when on load (or AVR LAM set too high)
Voltage correct at no load and too low when on load	Run at no load and check the voltage between E+ and E- on the AVR	Voltage between E+ and E- (DC) SHUNT / AREP / PMG < 10V	- Check the speed (or AVR LAM set too high)
		Voltage between E+ and E- SHUNT / AREP / PMG > 15V	<ul style="list-style-type: none"> - Faulty rotating diodes - Short-circuit in the revolving field coil. Check the resistance. - Faulty exciter armature. Check the resistance.
Voltage disappears during operation	Check the AVR, the surge suppressor, the rotating diodes, and replace any defective components	The voltage does not return to the rated value	<ul style="list-style-type: none"> - Exciter winding open circuit - Faulty exciter armature - Faulty AVR - Revolving field coil open circuit or short-circuited

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4.5.1 - Checking the winding

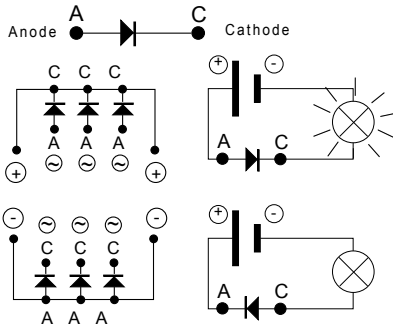
You can check the winding insulation by performing a high voltage test. In this case, you must disconnect all AVR wires.

WARNING

Damage caused to the AVR in such conditions is not covered by our warranty.

4.5.2 - Checking the diode bridge

A diode in good working order should allow the current to flow only in the anode-to-cathode direction.



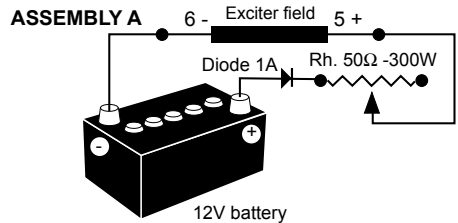
4.5.3 - Checking the windings and rotating diodes using separate excitation



During this procedure, make sure that the alternator is disconnected from any external load and inspect the terminal box to check that the connections are fully tightened.

- 1) Stop the unit, disconnect and isolate the AVR wires.
- 2) There are two ways of creating an assembly with separate excitation.

Assembly A: Connect a 12 V battery in series with a rheostat of approximately 50 ohms - 300 W and a diode on both exciter field wires (5+) and (6-).

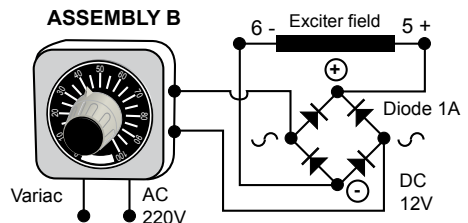


Assembly B: Connect a “Variac” variable power supply and a diode bridge on both exciter field wires (5+) and (6-).

Both these systems should have characteristics which are compatible with the field excitation power of the machine (see the nameplate).

3) Run the unit at its rated speed.

4) Gradually increase the exciter field current by adjusting the rheostat or the variac and measure the output voltages on L1 - L2 - L3, checking the excitation voltage and current at no load (see the machine nameplate or ask for the factory test report). When the output voltage is at its rated value and balanced within 1% for the rated excitation level, the machine is in good working order. The fault therefore comes from the AVR or its associated wiring (ie. sensing, auxiliary windings).



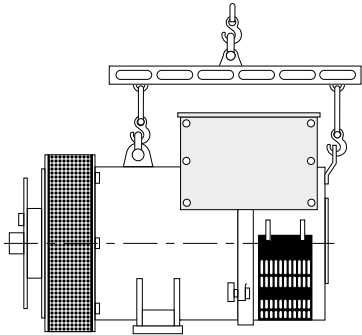
LSA 46.2 - 4 POLES ALTERNATORS

4.6 - Dismantling, reassembly (see sections 5.4.1. & 5.4.2.)

WARNING

During the warranty period, this operation should only be carried out in an LEROY-SOMER approved workshop or in our factory, otherwise the warranty may be invalidated.

Whilst being handled, the machine should remain horizontal (rotor not locked in position). Check how much the machine weighs (see 4.8.3) before choosing the lifting method.



4.6.1 - Tools required

To fully dismantle the machine, we recommend using the tools listed below:

- 1 ratchet spanner + extension
- 1 torque wrench
- 1 set of flat spanners: 8 mm, 10 mm, 18 mm
- 1 socket set: 8, 10, 13, 16, 18, 21, 24, 30 mm
- 1 socket with male ferrule: 5 mm
- 1 puller

4.6.2 - Screw tightening torque

See section 5.4.

4.6.3 - Access to diodes

- Open the air intake grille (51).
- Disconnect the diodes.
- Check the 6 diodes, change the diode bridges if necessary.

4.6.4 - Access to connections and the regulation system

Access directly by removing the top of the cover (48) or the AVR access door (466).

4.6.5 - Replacing the NDE bearing

- Remove the box lid (48) and the NDE panel (365) and remove the 2 screws from the part (122).
- Disconnect the stator outputs (T1 to T12).
- Disconnect the auxiliary winding wires AREP (X1,X2,Z1,Z2).

- Disconnect the exciter wires (5+,6-).

- Remove the air inlet louvre (51).

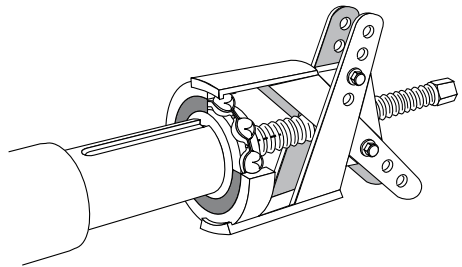
If using a single-bearing or double-bearing machine with the regreasable bearing option:

- Remove the bearing (78) thrust screws (72).

- Remove all 4 screws (37).

- Remove the shield (36).

- Take out the antifriction bearing (70) using a puller with a central screw (see drawing below).



- Fit the new antifriction bearing onto the shaft after heating it by induction to approximately 80 °C.

- Mount the new preloading (wavy) washer (79) + the new "O" ring seal (349) in the shield (36) and coat the bearing seat with adhesive paste (see After Sales Service).

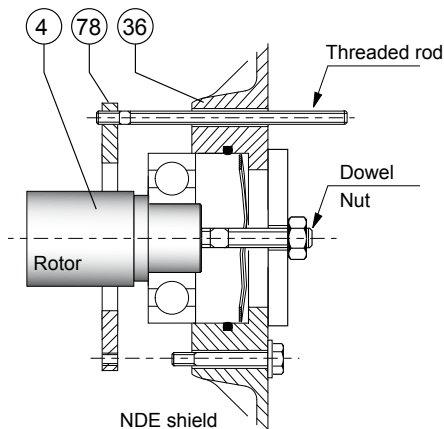
If using a single-bearing or double-bearing machine with the regreasable bearing option:

- Screw a threaded rod into the thrust bearing (78).

- Refit the end shield on the machine using a dowel and nut in the shaft extension (see drawing).

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- Slide the threaded rod into the shield hole to make it easier to assemble (see basic diagram).



- Fit the thrust bearing screws (78), remove the threaded rod, fit the other screw and tighten up the assembly.
- Tighten the 4 bearing screws (37).
- Reconnect wires.
- Fit the 2 support screws (122).
- Fit the air inlet louvre (51).
- Replace the cover.

WARNING

When dismantling the shields, you will need to change the antifriction bearings, the "O" ring seal, the preloading (wavy) washer and adhesive paste.

4.6.6 - Replacing the DE bearing

- Remove the air outlet grille (33).
- Remove the 6 screws (31) from the DE shield and the 3 screws (62) from the inner bearing retainer.
- Remove the shield (30).
- Take out the ball bearing (60) using a puller with a central screw (see section 4.6.5).
- Fit the new bearing, after heating it by induction to approximately 80 °C.
- Screw a threaded rod into the thrust bearing (68).
- Refit the shield (30) on the machine.

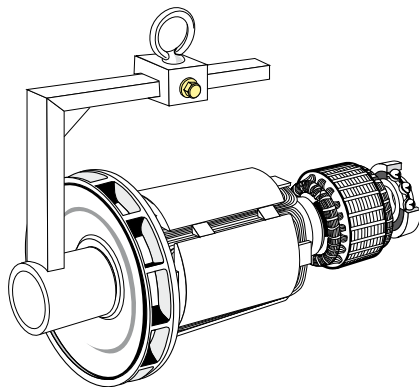
- Slide the threaded rod into the shield hole to make it easier to assemble (see basic diagram).

- Tighten the bottom thrust bearing screws (78), remove the threaded rod and fit the other screws.
- Tighten the 6 shield screws (31).
- Refit the air outlet grille (33).

4.6.7 - Dismantling the rotor assembly

- Remove the NDE shield (36) as described in section 4.6.5.
- Remove the DE shield (30) as described in section 4.6.6 if it is a double-bearing machine.
- Support the DE rotor (4) with a strap or with a support constructed in accordance with the following drawing.
- Move the strap as the rotor moves in order to distribute the weight over it.

WARNING



When dismantling the rotor involves changing parts or rewinding, the rotor must be rebalanced.

4.6.8 - Reassembling the machine

- Mount the rotor (4) in the stator (1) (see drawing above) taking care not to knock the windings.

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If using a single-bearing or double-bearing machine with the regreasable bearing option:

- Mount the new preloading (wavy) washer (79) + the new "O" ring seal (349) in the shield (36).
- Screw a threaded rod into the thrust bearing (78).
- Refit the shield (36) on the machine using a dowel and nut in the shaft extension (see diagram).
- Slide the threaded rod into the shield hole to make it easier to assemble (see diagram).
- Fit the thrust bearing screws (78), remove the threaded rod, fit the other screw and tighten up the assembly.
- Tighten the 4 bearing screws (37).
- Reconnect exciter wires E+, E-.
- Finish reassembling the cover.
- Refit the flange (30) on the stator (1).
- Tighten the screws (31).

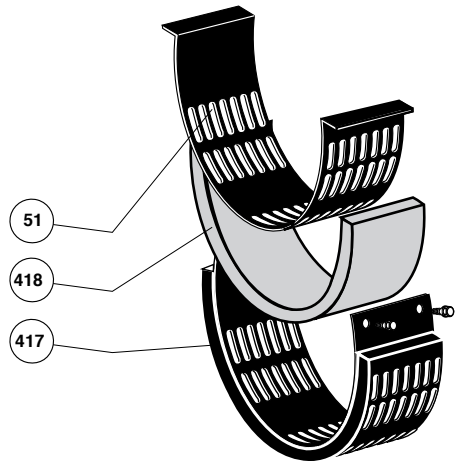
If using a double-bearing machine:

- Mount the new preloading (wavy) washer (79) + the new "O" ring seal (349) in the shield (36).
- Refit the shield (36) on the machine using a dowel and nut in the shaft extension (see diagram).
- Tighten the 4 shield screws (37).
- Reconnect exciter wires E+, E-.
- Finish reassembling the cover.
- Screw a threaded rod into the thrust bearing (68).
- Refit the shield (30) on the machine.
- Slide the threaded rod into the shield hole to make it easier to assemble (see basic diagram).
- Fit the thrust bearing screws (68), remove the threaded rod, fit the other screw and tighten up the assembly.
- Tighten the 6 shield screws (31).
- Refit the air outlet grille (33).
- Check that the machine assembly is correctly mounted and that all screws are tightened.

4.6.9 - Dismantling and reassembly of the filters

- Remove the grille (417) then take out the filter (418). Change the filter if necessary; please refer to section 4.2.5 for cleaning the filter.

To replace, follow the instructions in reverse order.



4.7 - Installation and maintenance of the PMG

For the LSA 46.2, the PMG reference is: PMG 2.

See the PMG manual ref : 4211.

LSA 46.2 - 4 POLES ALTERNATORS

4.8 - Table of characteristics

Table of average values

Alternator - 4 poles - 50 Hz - Standard winding No. 6.

(400V for the excitation values)

The voltage and current values are given for no-load operation and operation at rated load with separate field excitation.

All values are given to within $\pm 10\%$ and may be changed without prior notification (for exact values, consult the test report).

4.8.1 - LSA46.2 average values

Resistances at 20 °C (Ω)

LSA 46.2	Stator L/N	Rotor	Field	Armature
M3	0.022	0.23	8.8	0.035
M5	0.0182	0.24	8.8	0.035
L6	0.0148	0.264	8.8	0.035
L9	0.012	0.295	8.8	0.035
VL12	0.0085	0.343	10	0.037

Resistance of AREP auxiliary windings at 20 °C (Ω)

LSA 46.2	Auxil wdg: X1, X2	Auxil wdg: Z1, Z2
M3	0.24	0.4
M5	0.215	0.36
L6	0.185	0.36
L9	0.19	0.32
VL12	0.17	0.32

Field excitation current i_{exc} (A)

Symbols : "i exc": excitation current of the exciter field

LSA 46.2	No load	At rated load
M3	1.1	4
M5	1.1	3.8
L6	1.1	4.1
L9	1.2	4
VL12	1.1	3.5

For 60 Hz machines, the "i exc" values are approximately 5 to 10 % lower.

4.8.2 - Voltage of auxiliary windings at no load

LSA 46.2	Auxil wdg: X1, X2	Auxil wdg: Z1, Z2
50 Hz	70 V	10 V
60 Hz	85 V	12 V

4.8.3 - Table of weights

(values given for information only)

LSA 46.2	Total weight (kg)	Rotor (kg)
M3	600	250
M5	700	260
L6	800	290
L9	850	320
VL12	1000	380



After operational testing, it is essential to replace all access panels or covers.

LSA 46.2 - 4 POLES ALTERNATORS

5 - SPARE PARTS

5.1 - First maintenance parts

Emergency repair kits are available as an option.

They contain the following items:

Emergency kit SHUNT	ALT 472 KS 001
AVR R 250	-
Diode bridge assembly	-
Surge suppressor	-

Emergency kit AREP	ALT 461 KS 001
AVR R 450	-
Diode bridge assembly	-
Surge suppressor	-

Single-bearing kit	ALT 471 KB 002
Non drive end bearing	-
«O» ring	-
Preloading (wavy) washer	-

Double-bearing kit	ALT 471 KB 001
Non drive end bearing	-
Drive end bearing	-
«O» ring	-
Preloading (wavy) washer	-

5.2 - Technical support service

Our technical support service will be pleased to provide any additional information you may require.

When ordering spare parts, you should indicate the complete machine type, its serial number and the information given on the nameplate.

Address your enquiry to your usual contact.

Part numbers should be identified from the exploded views and their description from the parts list.

Our extensive network of service centres can dispatch the necessary parts without delay.

To ensure correct operation and the safety of our machines, we recommend the use of original manufacturer spare parts.

In the event of failure to comply with this advice, the manufacturer cannot be held responsible for any damage.

5.3 - Accessories

5.3.1 - Space heater for use when stopped

The space heater must run as soon as the alternator stops. It is installed at the rear of the machine. Its standard power is 250W with 220V or 250W with 110V on request.



Warning: the power supply is present when the machine has stopped.

5.3.2 - Temperature sensors with thermistors (PTC)

These are thermistor triplets with a positive temperature coefficient installed in the stator winding (1 per phase). There can be a maximum of 2 triplets in the winding (at 2 levels: warning and trip) and 1 or 2 thermistors in the shields.

These sensors must be linked to adapted sensing relays (supplied optionally).

Cold resistance of cold thermistor sensors: 100 to 250 Ω per sensor.

5.3.3 - Connection accessories

- 6-wire machines : coupling (F)
- 12-wire machines : coupling (A), (F .F), (F)

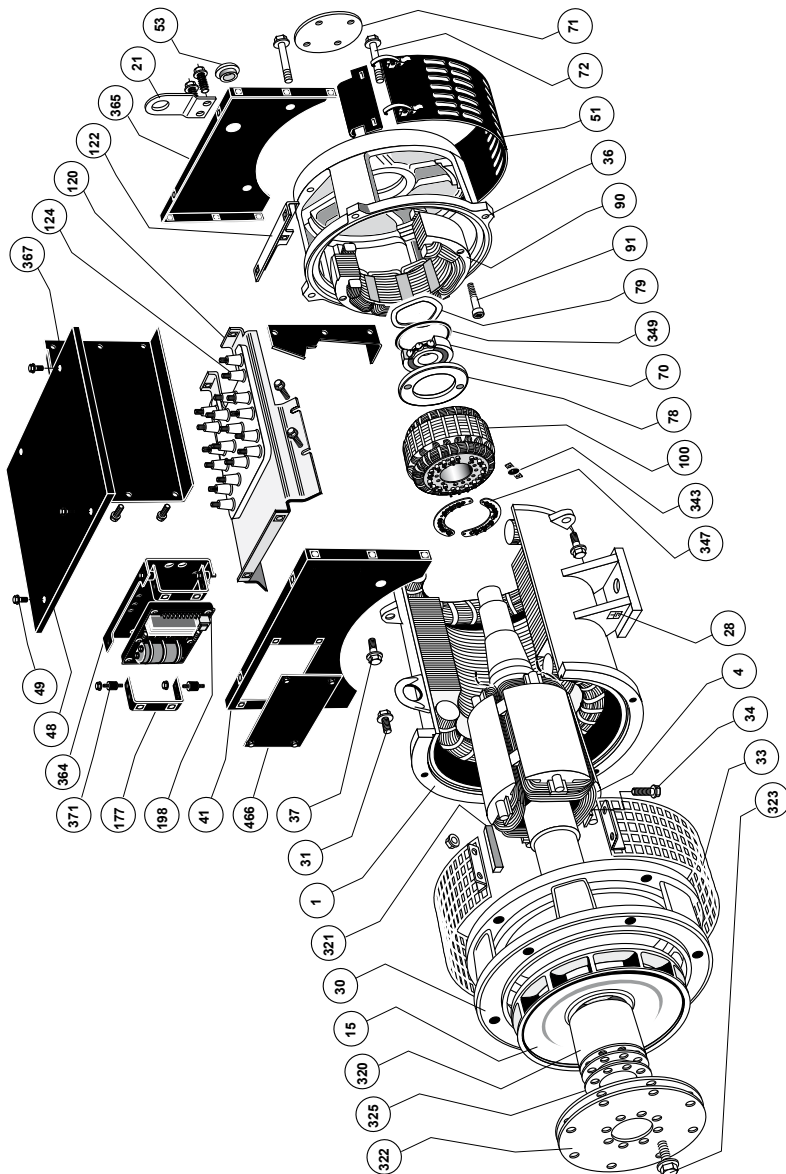


After operational testing, it is essential to replace all access panels or covers.

LSA 46.2 - 4 POLES ALTERNATORS

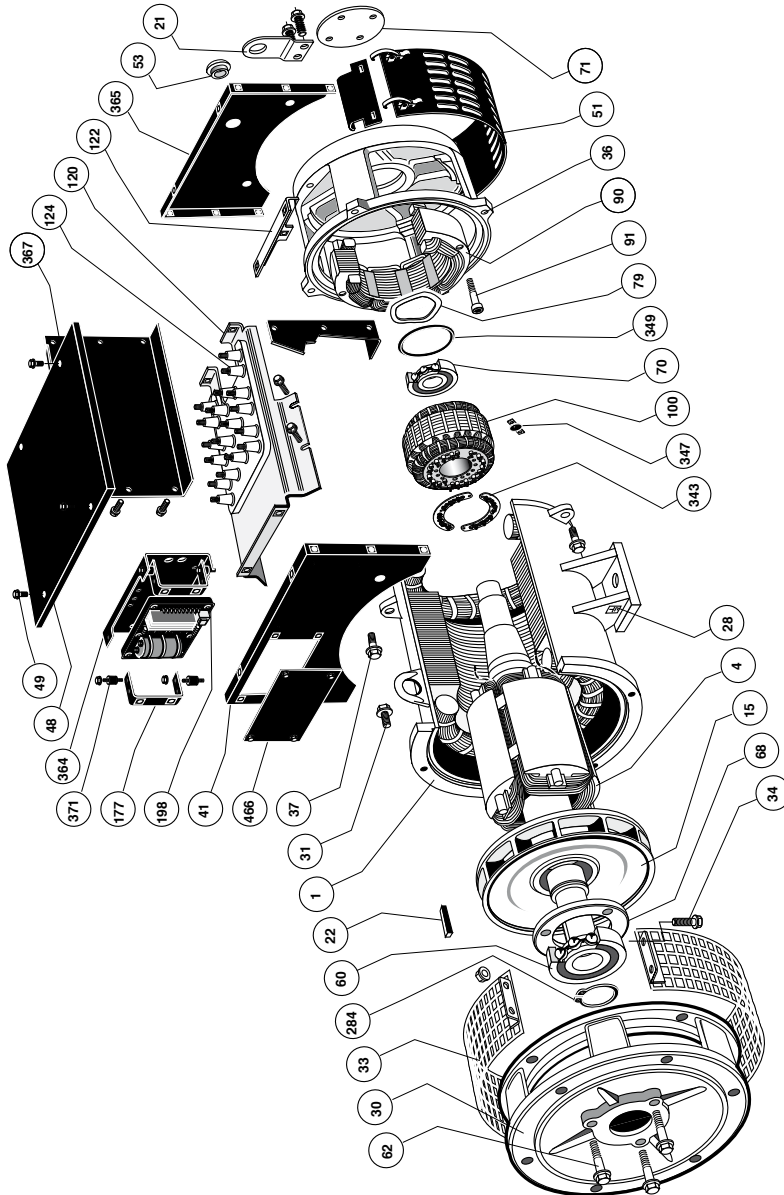
5.4 - Exploded view, parts list and tightening torque

5.4.1 - LSA 46.2 single-bearing



LSA 46.2 - 4 POLES ALTERNATORS

5.4.2 - LSA 46.2 double-bearing



LSA 46.2 - 4 POLES ALTERNATORS

Ref.	Qty	Description	Screw Ø	Torque N.m	Ref.	Qty	Description	Screw Ø	Torque N.m
1	1	Stator assembly	-	-	90	1	Exciter field	-	-
4	1	Rotor assembly	-	-	91	4	Fixing screws	M6	10
15	1	Fan	-	-	100	1	Exciter armature	-	-
21	1	Lifting ring	-	-	120	1	Terminal plate support	-	-
22	1	Shaft extension key	-	-	122	1	Plate support	-	-
28	1	Earth terminal	M10	20	124	1	Terminal plate	M12	35
30	1	Drive end shield	-	-	177	2	AVR support bracket	-	-
31	6 or 4	Fixing screws	M14	80(*)	198	1	Voltage regulator (AVR)	-	-
33	1	Protective grille	-	-	284	1	Circlips	-	-
34	2	Fixing screws	M6	5	320	1	Coupling sleeve	-	-
36	1	Exciter end shield	-	-	321	1	Sleeve key	-	-
37	4	Fixing screws	M12	50	322	3	Coupling disc	-	-
41	1	Cover front panel	-	-	323	6	Fixing screw	M16	230
48	1	Cover top panel	-	-	325	-	Spacer shim	-	-
49	-	Cover screws	M6	5	343	1	Diode bridge assembly	M6	4
51	1	Air intake grille	-	-	347	1	Protection varistor (+ PCB)	-	-
53	1	Plug	-	-	349	1	"O" ring	-	-
60	1	Drive end bearing	-	-	364	1	AVR support	-	-
62	3 or 4	Fixing screws	M8	20	365	1	Cover rear panel	-	-
68	1	Inner bearing retainer	-	-	367	2	Side panel	-	-
70	1	Non drive end bearing	-	-	371	4	Damper	-	-
71	1	Cover	-	-	416	1	Filter	-	-
72	2	Fixing screws	M8	20	417	1	Filter support	-	-
78	1	Inner bearing retainer	-	-	466	2	AVR inspection door	-	-
79	1	Preloading (wavy) washer	-	-					

(*) 80 N.m in M / 190 N.m in L, VL

LSA 46.2 - 4 POLES ALTERNATORS

Electric Power Generation Division

Declaration of CE compliance and incorporation

This Declaration applies to the generators designed to be incorporated into machines complying with the Machinery Directive Nr 2006/42/CE dated 17 May 2006.

MOTEURS LEROY-SOMER
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MOTEURS LEROY-SOMER
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Boite Postale 1517
45800 St Jean de Bray
France

Declares hereby that the electric generators of the types LSA 36 – 37– 40 – 42.2 – 43.2 – 44.2 – 46.2 – 47.2 – 49.1 – 50.2 – 51.2, as well as their derivatives, manufactured by Leroy Somer or on Leroy Somer's behalf, comply with the following International Standards and Directive :

- EN and IEC 60034 -1 and 60034 -5
- ISO 8528 – 3 “ Reciprocating internal combustion engine driven alternating current generating sets. Part 3. Alternating current generators for generating sets ”
- Low Voltage Directive Nr 2006/95/CE dated 12 December 2006.

Furthermore, these generators, designed in compliance with the Machine Directive Nr 2006/42, are therefore able to be incorporated into Electrical Gen-Sets complying with the following International Directives :

- Machinery Directive Nr 2006/42/CE dated 17 May 2006
- EMC Directive Nr 2004/108/CE dated 15 December 2004, as intrinsic levels of emissions and immunity are concerned

WARNING :

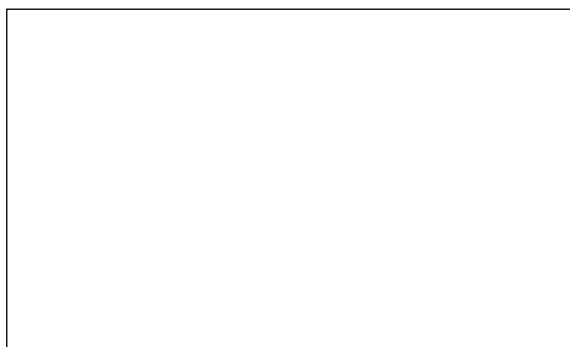
The here above mentioned generators should not be commissioned until the corresponding Gen-Sets have been declared in compliance with the Directives Nr 2006/42/CE et 2004/108/CE, as well as with the other relevant Directives.

Leroy Somer undertakes to transmit, in response to a reasoned request by the national authorities, relevant information on the generator.

Technical Managers
P Betge – J.Begué



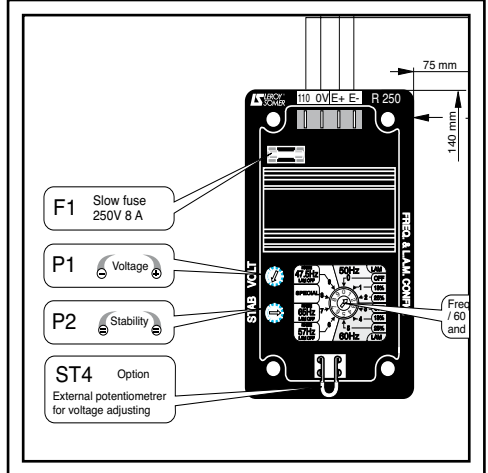
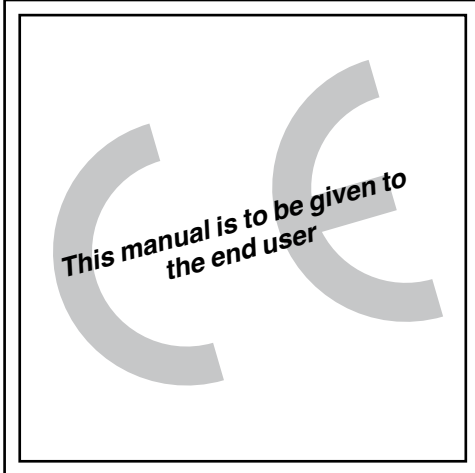
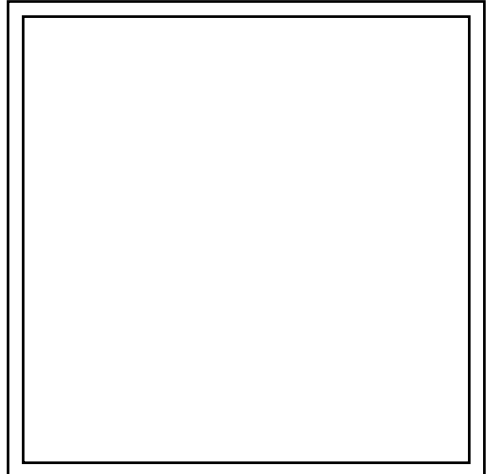
**LSA 46.2 - 4 POLES
ALTERNATORS**



LEROY-SOMER 16015 ANGOULÊME CEDEX - FRANCE

338 567 258 RCS ANGOULÊME

www.leroy-somer.com



R250

A.V.R.

Installation and maintenance

R250
A.V.R.

This manual concerns the alternator A.V.R. which you have just purchased.

We wish to draw your attention to the contents of this maintenance manual. By following certain important points during installation, use and servicing of your A.V.R., you can look forward to many years of trouble-free operation.

SAFETY MEASURES

Before using your machine for the first time, it is important to read the whole of this installation and maintenance manual.

All necessary operations and interventions on this machine must be performed by a qualified technician.

Our technical support service will be pleased to provide any additional information you may require.

The various operations described in this manual are accompanied by recommendations or symbols to alert the user to potential risks of accidents. It is vital that you understand and take notice of the following warning symbols.

WARNING

Warning symbol for an operation capable of damaging or destroying the machine or surrounding equipment.



Warning symbol for general danger to personnel.



Warning symbol for electrical danger to personnel.

Note : LEROY-SOMER reserves the right to modify the characteristics of its products at any time in order to incorporate the latest technological developments.

The information contained in this document may therefore be changed without notice.

R250 A.V.R.

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Any maintenance or breakdown operations on the A.V.R. are to be done by personnel trained on commissioning, servicing and maintenance for the electrical and mechanical elements.

The R250 is an IP00 product. It must be installed inside a unit so that this unit's cover can provide IP20 minimum total protection (it must only be installed on LS alternators in the appropriate location so that when viewed externally, it has a higher degree of protection than IP20).

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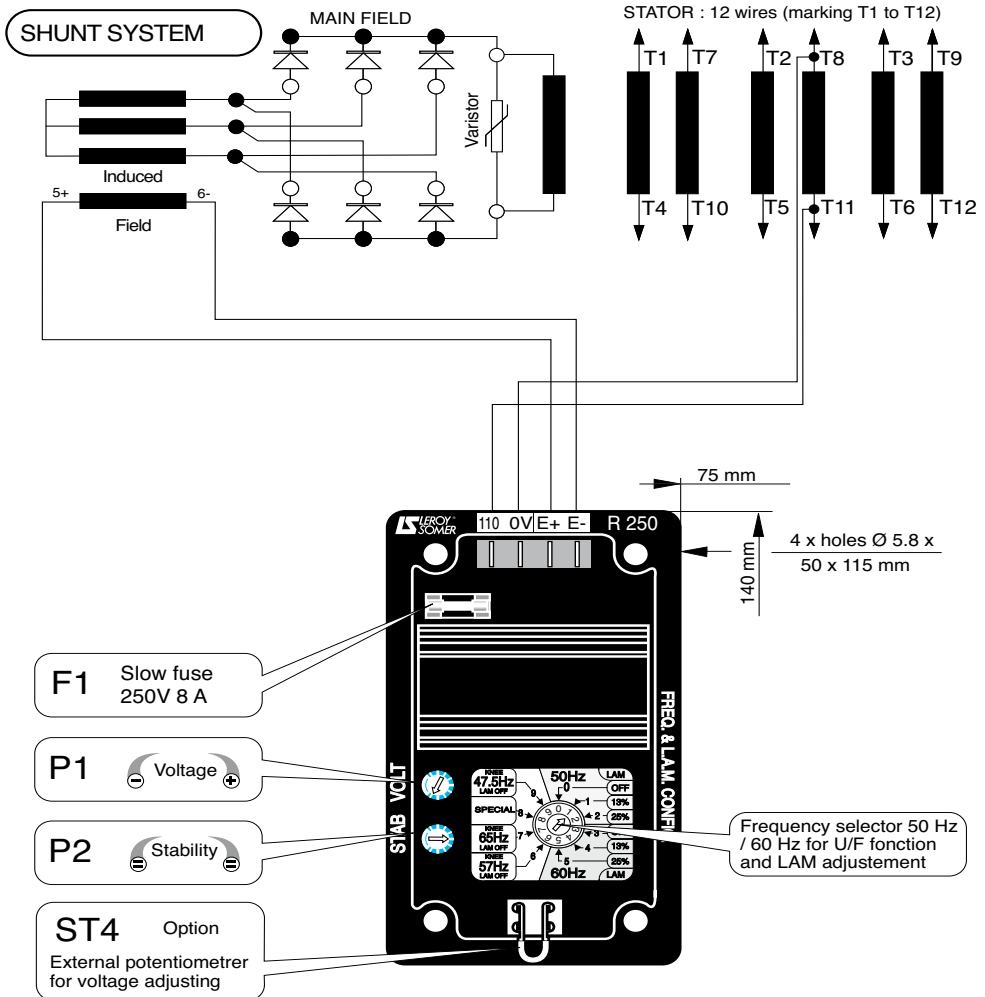
R250 A.V.R.

1 - SUPPLY

1.1 - SHUNT excitation system

The SHUNT excitation alternator is auto-excited with a R 250 voltage regulator.

The regulator controls the excitation current according to the alternator's output voltage. With a very simple conception, the SHUNT excitation alternator does not have a short circuit capacity.



R250

A.V.R.

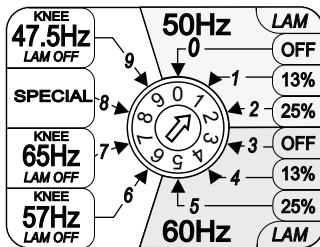
2 - R250 A.V.R.

2.1 - Characteristics

- Storage: -55°C; +85°C
- Operation: -40°C; +70°C
- Voltage regulation: around $\pm 0,5\%$.
- Supply range/voltage detection 85 to 139 V (50/60Hz).
- Rapid response time (500 ms) for a transient voltage variation amplitude of $\pm 20\%$.
- Voltage setting **P1**.
- Stability setting **P2**.
- Power supply protected by 8 A fuse, replacement product: Ferraz-Shawmut T084013T fast-blow fuse, 8 A FA 250 V, breaking capacity 30 kA.

2.2 - U/F Fonction and LAM

The threshold position (50 Hz - 60 Hz) to action the U/F fonction as well as the LAM setting type is selected using the potentiometer.



WARNING: The jumper settings must correspond to the rated operating frequency (see the nameplate on the alternator).

Risk of destruction for the alternator.

The threshold position and LAM fonction settings are done with the jumper.

Operating at 50 Hz: (U/F gradient)

0: threshold at 48 Hz without LAM for impacts between 30 and 40% of the rated load.

1: threshold at 48 Hz with LAM 13% for impacts between 40 and 70% of the rated load.

2: threshold at 48 Hz with LAM 25% for impacts > 70% of the rated load.

Operating at 60 Hz: (U/F gradient)

3: threshold at 58 Hz without LAM for impacts between 30 and 40% of the rated load.

4: threshold at 58Hz with LAM 13% for impacts 40 and 70% of the rated load.

5: threshold at 58Hz with LAM 25% for impacts > 70% of the rated load.

Specific operating

6: threshold at 57Hz without LAM for speed variations at a steady state > 2 Hz

7: threshold at 65Hz without LAM for variable speed and tractelec / gearlec (U/F gradient).

8: special: the factory setting 48Hz 2U/F gradient ; a special programme is possible on request. This programme must be specified before ordering, during the project study.

9: threshold at 47.5 Hz without LAM for speed variations at a steady state > 2 Hz. For hydraulic applications, it is advisable to select:

- position 0 for 50 Hz
- position 3 for 60 Hz

R250

A.V.R.

2.3 - R250 A.V.R. option

Potentiometer for voltage setting, 1000 W / 0,5 W min: setting range $\pm 5\%$.

- Remove the **ST4** jumper.



For wiring up the external potentiometer; the “earth” wires must be isolated as well as the potentiometer terminals (wires at the same voltage as the power).

2.4 - LAM characteristics (Load Acceptance Module)

2.4.1 - Voltage drop

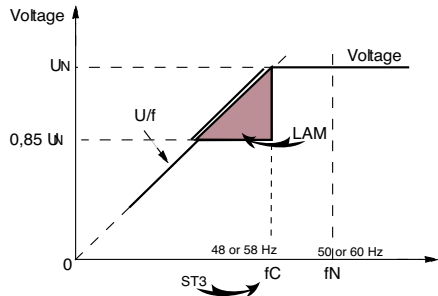
The LAM system is integrated in the A.V.R. It is active as standard. It can be adjusted to 13% or 25%.

- Role of the «LAM» (Load Adjustment Module):

On application of a load, the rotation speed of the generator set decreases. When it passes below the preset frequency threshold, the LAM causes the voltage to drop by approximately 13% or 25% and consequently the amount of active load applied is reduced by approximately 25% to 50%, until the speed reaches its rated value again.

Hence the “LAM” can be used either to reduce the speed variation (frequency) and its duration for a given applied load, or to increase the applied load possible for one speed variation (turbo-charged engines). To avoid voltage oscillations, the trip threshold for the “LAM” function should be set approximately 2 Hz below the lowest frequency in steady state.

It is advised to use the “LAM” at 25% for load impacts > at 70% of the genset rated power.

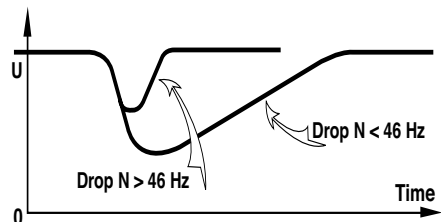


2.4.2 - Gradual voltage return function

During load impacts, the function helps the genset to return to its rated speed faster thanks to a gradual increase in voltage according to the following principles:

- if the speed drops between 46 Hz and 50 Hz, the rated voltage follows a fast gradient as it is restored.

- if the speed drops below 46 Hz, since the engine needs more help, the voltage follows a slow gradient as it returns to the reference value.

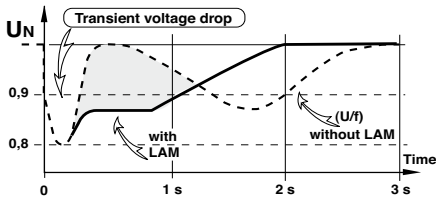


R250

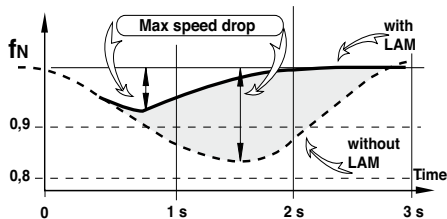
A.V.R.

2.5 - Typical effects of the LAM with a diesel engine or without a LAM (U/F only)

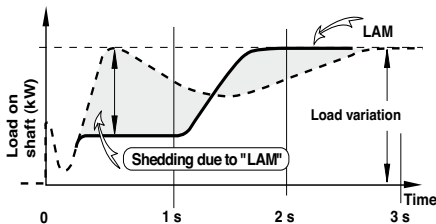
2.5.1 - Voltage



2.5.2 - Frequency



2.5.3 - Power



R250 A.V.R.

3 - INSTALLATION - COMMISSIONING

3.1 - Electrical checks on the AVR

- Check that all connections have been made properly as shown in the attached wiring diagram.
- Check that the position of the jumper corresponds to the operating frequency.
- Check whether the ST4 jumper or the remote adjustment potentiometer have been connected.

3.2 - Settings



The different settings made during the trial are to be done by qualified personnel. Respecting the load speed specified on the nameplate is vital in order to start a settings procedure. After operational testing, replace all access panels or covers. The only possible settings on the machine are to be done with the A.V.R.

3.2.1 - R250 settings (SHUNT system)

Initial potentiometer positions

- voltage setting potentiometer **P1** for the A.V.R.: full left
- remote voltage setting potentiometer: in the middle.

Operate the alternator at its rated speed: if the voltage does not rise it is necessary to re-magnetise the magnetic circuit.

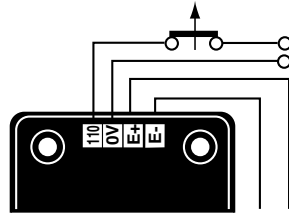
- slowly adjust the voltage potentiometer of the A.V.R. **P1** until the output voltage reaches its rated value.
- Stability setting with **P2**.

3.2.2 - Special type of use

WARNING

Excitation circuit E+, E- must not be left open when the machine is running: A.V.R. damage will occur.

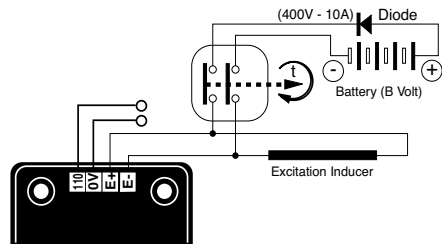
3.2.2.1 - R250 field weakening (SHUNT)



The exciter is switched off by disconnecting the A.V.R. power supply (1 wire - 0 or 110V). Contact rating: 16A - 250V AC

Do not reclose the power supply until the voltage has reached a value $\leq 15\%$ of the rated voltage (approximately 5 seconds after opening)

3.2.2.2 - R250 field forcing



The battery must be isolated from the mass.



Exciter field may be at line potential.

R250 A.V.R.

3.3 - Electrical faults

Fault	Action	Effect	Check/cause
No voltage at no load on start-up	Connect a new battery of 4 to 12 volts to terminals E- and E+ respecting the polarity for 2 to 3 seconds	The alternator starts up and its voltage is still correct when the battery is removed.	- Lack of residual magnetism
		The alternator starts up but its voltage does not reach the rated value when the battery is removed.	- Check the connection of the voltage reference to the A.V.R. - Faulty diodes - Induced short circuit
		The alternator starts up but its voltage disappears when the battery is removed	- Faulty A.V.R. - Exciter field short-circuited - Short-circuit in the main field. Check the resistance
Voltage too low	Check the drive speed	Correct speed	Check the A.V.R. connections (A.V.R. may be faulty) - Field windings short-circuited - Rotating diodes burnt out - Main field winding short-circuited - Check the resistance
		Speed too low	Increase the drive speed (Do not touch the A.V.R. pot (P1) before returning to the correct speed.)
Voltage too high	Adjust A.V.R. potentiometer	Adjustment ineffective	- Faulty A.V.R. - 1 faulty diode
Voltage oscillations	Adjust A.V.R. stability potentiometer		- Check the speed: possibility of cyclic irregularity - Loose terminals - Faulty A.V.R. - Speed too low on load (or U/F gradient set too high)
Voltage correct at no load and too low when on load (*)	Run at no load and check the voltage between E+ and E- on the A.V.R.		- Check the speed (or U/F gradient set too high)
			- Faulty rotating diodes - Short-circuit in the main field. Check the resistance - Faulty induced excitation
(*) Warning: For single-phase operation, check that the sensing wires coming from the A.V.R. are correctly connected to the operating terminals (see the alternator manual).			
Voltage disappears during operation	Check the A.V.R., the surge suppressor, the rotating diodes and replace any defective components	The voltage does not return to the rated value	- Exciter winding open circuit - Faulty induced excitation - Faulty A.V.R. - Main field open circuit or short-circuited



Warning: after setting-up or troubleshooting, replace all access panels or covers.

R250
A.V.R.**4 - SPARE PARTS****4.1 - Designation**

Description	Type	Code
A.V.R.	R 250	AEM 110 RE 019

4.2 - Technical support service

Our technical support service will be pleased to help you with any information needed.

For replacement part orders, it is necessary to indicate the type and the code number of the A.V.R.

Please contact your usual correspondent.

An extensive network of service centres is available to rapidly supply any necessary parts.

In order to ensure the correct operation and safety of our machines, we strongly recommend that original manufacturer's spare parts are used.

Failure to do so, will discharge the manufacturer from liability in the case of damage.

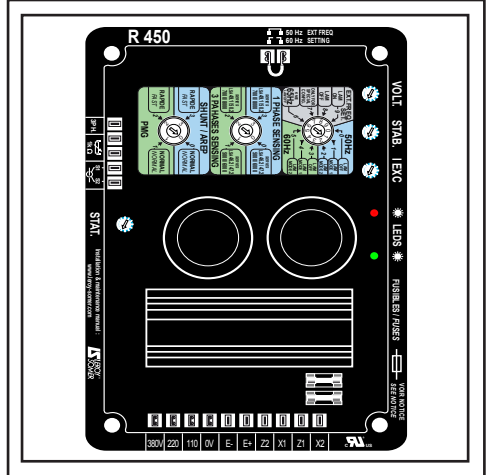
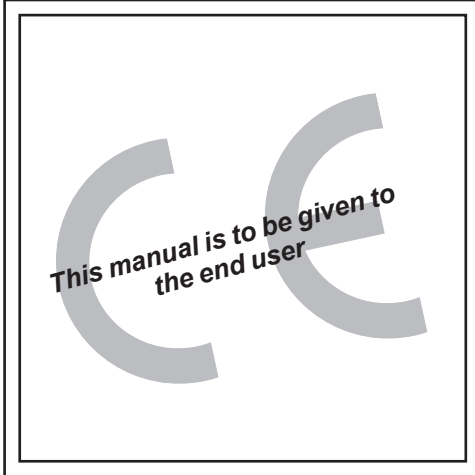
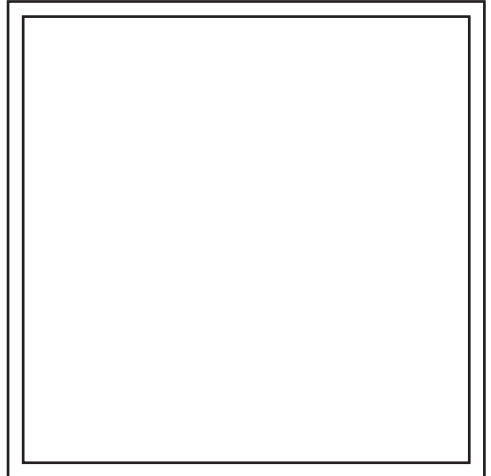
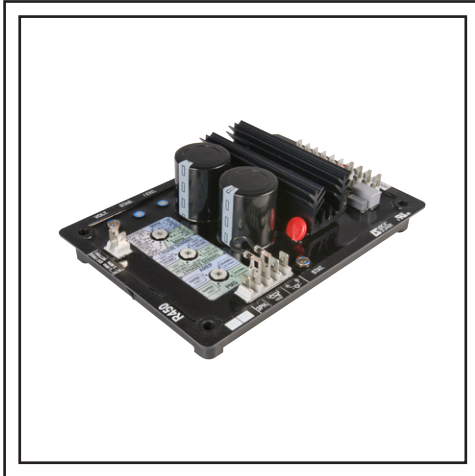
R250
A.V.R.



MOTEURS LEROY-SOMER 16015 ANGOULÊME CEDEX - FRANCE

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R 450

AVRs

Installation and maintenance

R 450 AVRs

This manual concerns the alternator AVR which you have just purchased.

We wish to draw your attention to the contents of this maintenance manual. By following certain important points during installation, use and servicing of your AVR, you can look forward to many years of trouble-free operation.

SAFETY MEASURES

Before using your machine for the first time, it is important to read the whole of this installation and maintenance manual.

All necessary operations and interventions on this machine must be performed by a qualified technician.

Our technical support service will be pleased to provide any additional information you may require.

The various interventions described in this manual are accompanied by recommendations or symbols to alert the user to potential risks of accidents. It is vital that you understand and take notice of the various warning symbols used.

WARNING

Warning symbol for an operation capable of damaging or destroying the machine or surrounding equipment.



Warning symbol for general danger to personnel.



Warning symbol for electrical danger to personnel.

Note: LEROY-SOMER reserves the right to modify the characteristics of its products at any time in order to incorporate the latest technological developments. The information contained in this document may therefore be changed without notice.

R 450

AVRs

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All servicing or repair operations performed on the AVR should be undertaken by personnel trained in the commissioning, servicing and maintenance of electrical and mechanical components.

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R 450 AVRs

1 - GENERAL INFORMATION

1.1 - Description

The R450 AVR is supplied in a casing designed to be mounted on a panel with dampers.

- Operating temperature: - 30°C to + 65° C.

- Storage temperature: - 55°C to + 85°C.

- Shocks on the base: 9 g depending on the 3 axes.

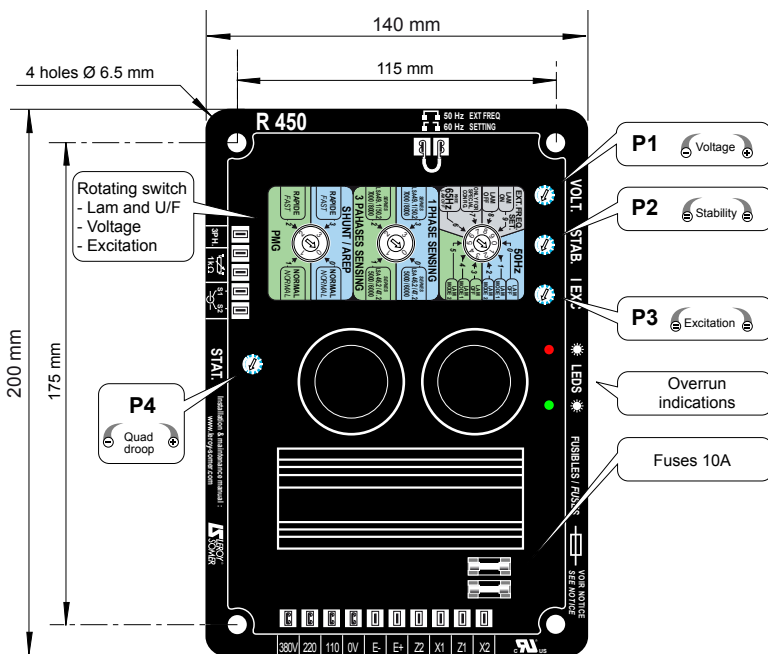
- Vibrations: less than 10 Hz, 2 mm half-peak amplitude 10 Hz to 100 Hz: 100 mm/s, above 100 Hz: 8 g.

1.2 - Characteristic

The connection is realised by "Faston" connectors and the voltage sensing is single - phase.

WARNING

The AVR is IP00, it must be incorporated in an environment which ensures it a IP20 protection.



R 450 AVRs

2 - POWER SUPPLY

Both the SHUNT/AREP & PMG excitation systems are controlled by the AVR.

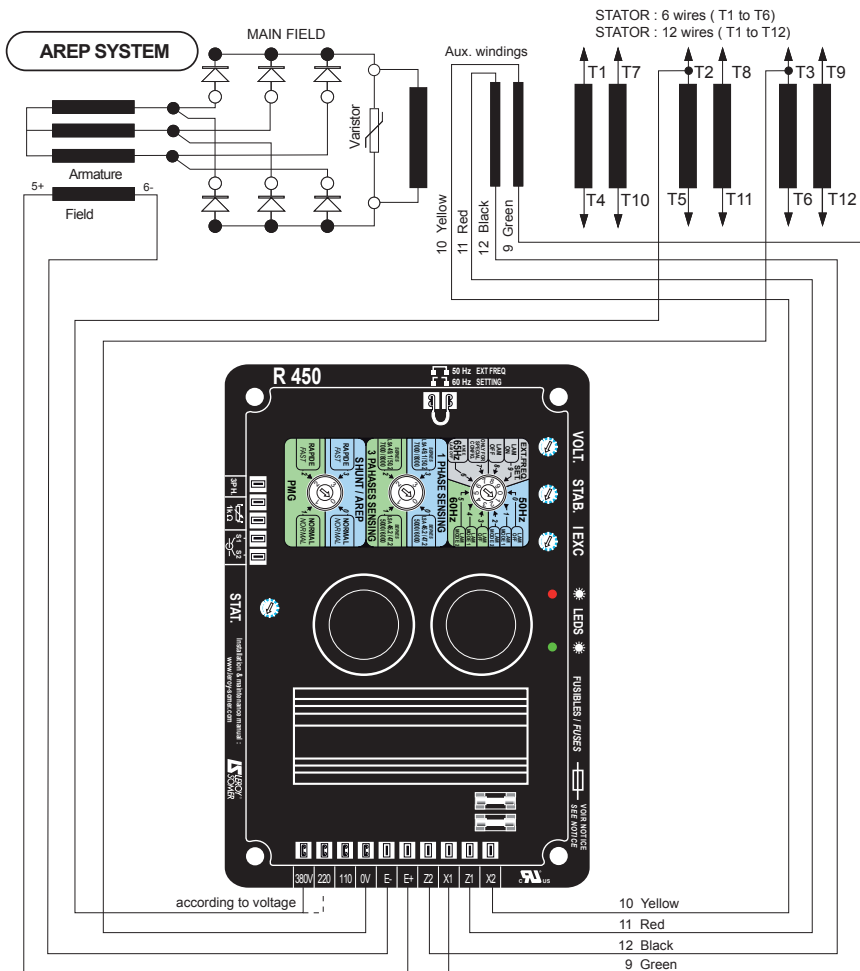
2.1 - AREP excitation system

With AREP excitation, the electronic AVR is powered by two auxiliary windings which are independent of the voltage sensing circuit.

The first winding has a voltage proportional to the alternator main voltage (Shunt

characteristic), the second one has a voltage proportional to the stator current (compound characteristic : Booster effect). The power supply voltage is rectified and filtered before being used by the AVR monitoring transistor.

This system provides the machine with a short-circuit current capacity of 3 IN for 10 s. The rotating switch should be in the AREP position (see 3.2.3).

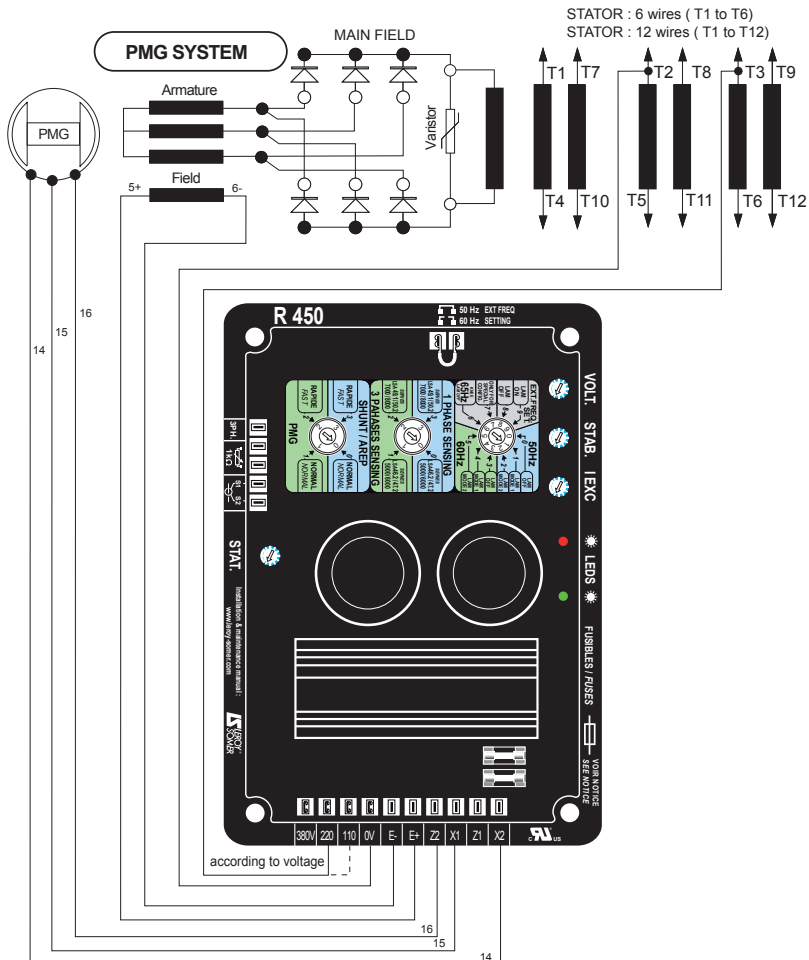


R 450 AVRs

2.2 - PMG excitation system

With **PMG** excitation, a permanent magnet generator (PMG) added to the alternator supplies the AVR with voltage which is independent of the main alternator winding. This system provides the machine with a short-circuit current capacity of 3 IN for 10 s.

The AVR monitors the alternator output voltage by adjusting the excitation current. The rotating switch should be in the PMG position (see 3.2.3).

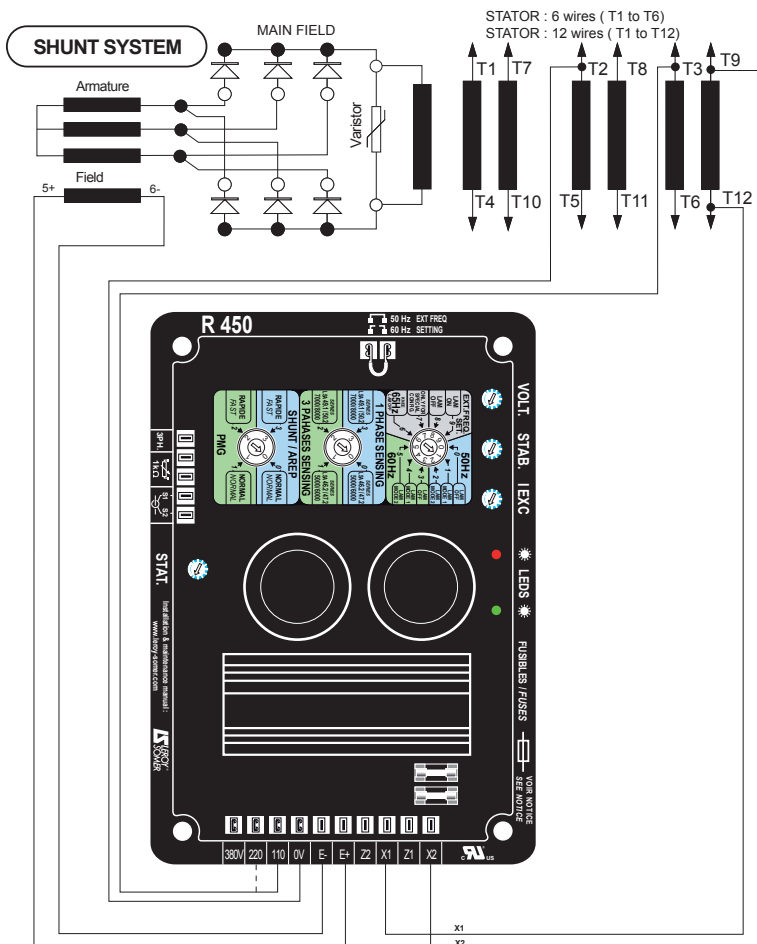


R 450 AVRs

2.3 - SHUNT or separate excitation system

With SHUNT excitation, the AVR is powered by the main winding (100V to 140V - 50/60 Hz) by using X1, X2 on the AVR.

The rotating switch should be in the SHUNT/AREP position (see 3.2.3).



R 450

AVRs

3 - TECHNICAL CHARACTERISTICS

3.1 - Electrical characteristics

- maximum power supply: 150V - 50/60 Hz
- Rated overload current: 10 A - 10 s
- Electronic protection:
 - In the case of a short-circuit, the excitation current is reduced to a value less than 1A after 10 s
 - In the event of loss of voltage reference, the excitation current is reduced to a value less than 1A after 1s for AREP/SHUNT, 10 s for PMG.
 - In the event of overexcitation, the current is reduced as indicated in the next diagram (see 3.2.1.4).
- Fuses: F1 on X1 and F2 on Z2 10A, 250V.
- Voltage sensing
 - 0-110 V terminals = 95 to 140 V
 - 0-220 V terminals = 170 to 260 V
 - 0-380 V terminals = 340 to 528 V

For other voltages, a transformer should be used.

- Voltage regulation: $\pm 0.5\%$.
- Current sensing: (parallel operation): input S1, S2 intended for 1 C.T. $< 2.5 \text{ VA cl1}$, secondary 1 A or 5 A.

3.2 - Configurations:

3.2.1 - Settings

3.2.1.1 - Voltage

Voltage adjustment via potentiometer **P1** in the ranges described in the table below:

For 50 and 60 Hz	Max.
High range	$320\text{V} < U_n \leq 530 \text{ V}$
Low range	$80 \text{ V} \leq U_n \leq 320 \text{ V}$

WARNING

The allowed adjustment range is $\pm 5\%$; when the setting exceeds these limits, please check that it is conform with the power table.

3.2.1.2 - Quadrature droop:

Quadrature droop adjustment via potentiometer **P4** within a range :

- from 0 to 8% with a PF=0.8 for 400V applications.
- From 0 to 14% with a PF=0.8 for 240V applications.
- From 0 to 8% for 110V applications with a step-up transformer (ratio of 4) placed on the voltage reference.

The potentiometer **P4** has a non linear response. Then, when a 1A secondary CT is connected the effective range starts from the the second 1/3 of **P4** range and in the case of a 5A secondary CT the effective range starts from the first 1/3.

When a 5ACT is used, the adjustment range is higher, so **P4** must be set to the first 1/4 (anti-clockwise) and then progressively increase it.

WARNING

The CT must be connected.

3.2.1.3 - Stability:

Stability adjustment via potentiometer **P2**. Selection of rotating switch according to the machine type and the response time as indicated in paragraph 3.2.3.

3.2.1.4 - Excitation limitation:

Excitation limitation adjustment via potentiometer **P3** as described below. The excitation current limitation threshold in steady state is set by a potentiometer at 110% of the rated value. The adjustment is made by the operator during the on-load test at rated power by tuning the potentiometer. When the excitation current exceeds this value, a counter is activated at the speed of one record per second for 90 s. When this time is elapsed, the current is reduced to the value of the rated excitation current. If in the meantime the excitation current drops below the threshold value, the counter counts down at the same speed.

R 450 AVRs

WARNING

The limitation threshold must be adjustable between 1 and 5.5 A. The genset breaker must be open during the short circuit. If the genset is restarted in short circuit, there is a excitation build up during 10s again at the maximum value.

Operation between 3 and 6 In when short-circuited:

The excitation current ceiling during a short-circuit equals 2.9 times the fixed threshold when setting the permitted excitation ceiling in continuous operation. When the threshold is exceeded for a period = 10 s the current is reduced to a value between 0.5 and 0.7 A (shutdown). In all operating conditions the maximum

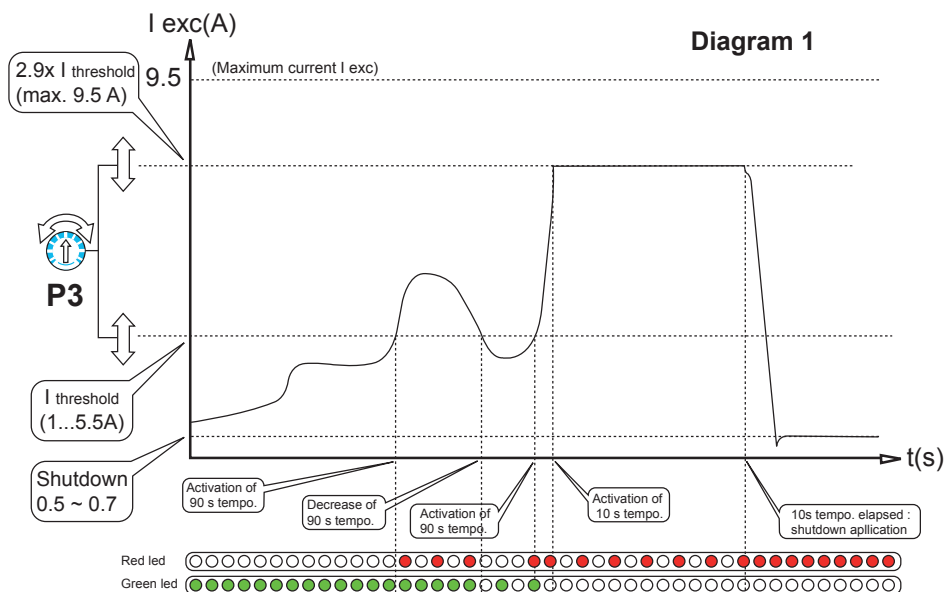
excitation current must be limited to $9\text{ A} \pm 0.5\text{ A}$.

Overrun indications:

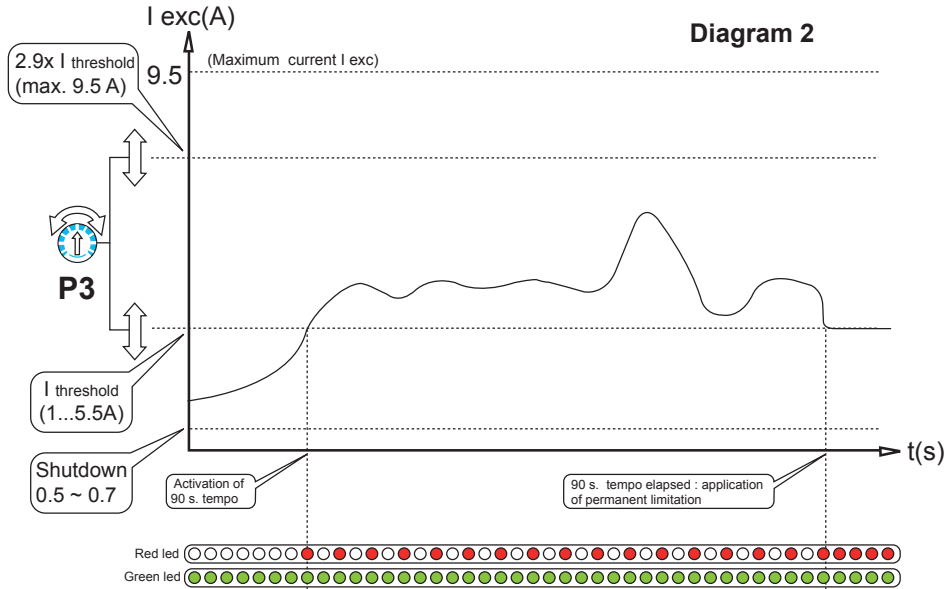
One green LED:

- Lights up when the excitation current is below the continuous operation threshold. It signals the AVR normal operation.
- Turns off when the excitation current ceiling used to obtain short-circuit operation is reached and when the excitation current is reduced to the shutdown value.
- Flashes when the over excitation counter is decrementing.

NB: After an obvious short-circuit, the voltage is limited to 70% of the rated voltage. This avoids overvoltages on machines whose no-load excitation current is below the "lower current" threshold (only in AREP).



R 450 AVRs



One red LED:

- Lights up simultaneously with the green led when the continuous operation threshold is reached for more than 90 s and the excitation current is reduced to the continuous operation threshold. It is used to set the excitation current ceiling
- Turns off when the excitation current is less than the setting value (< 110% I_n)
- Flashes when the excitation current is above the continuous operation threshold during less than 90 s.

Green LED stays on,

- flashes when the excitation current has reached the ceiling in < 10s with PMG excitation.
- stays on if I_{exc} = I Shutdown.

WARNING

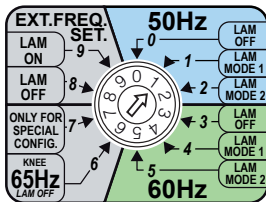
If the overload protection is activated, a voltage drop possibly exceeding 10% of the reference voltage will be observed.

The AVR does not provide undervoltage protection. The customer will need to make sure that their installation is correctly protected against undervoltages.

During load shedding, an overvoltage is observed, which will disappear in a few seconds.

R 450 AVRs

3.2.2 - Rotating switch selection: LAM and U/F

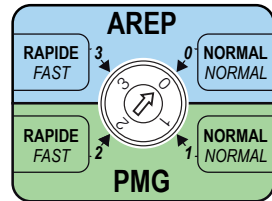


- **Pos 0:** Change in the voltage according to the U/F ratio, knee-point position at 48 Hz.
- **Pos 1:** Change in the voltage according to the 2U/F, knee-point position at 48 Hz.
- **Pos 2:** Change in the voltage according to the self auto-adaptating LAM combined with 2U/F, knee-point position at 48 Hz.
- **Pos 3:** Change in the voltage according to the U/F ratio, knee-point position at 58 Hz
- **Pos 4:** Change in the voltage according to the 2U/F, knee-point position at 58 Hz.
- **Pos 5:** Change in the voltage according to the self auto-adaptating LAM combined with 2U/F, knee-point position at 58 Hz.
- **Pos 6:** Change in the voltage according to the U/F ratio, knee-point position at 65 Hz (Tractelec application and variable speed above 1800 rpm).
- **Pos 7:** Special (not used).
- **Pos 8:** Change in the voltage according to the U/F ratio, knee-point position at 48 Hz or 58 Hz according to selection of the frequency by an external contact.
- **Pos 9:** Change in the voltage according to LAM 1, knee-point position at 48 Hz or 58 Hz according to selection of the frequency by an external contact

WARNING

For Pavers and hydraulic applications, select positions 0 (50 Hz) or 3 (60 Hz).

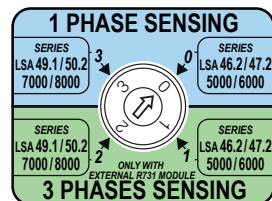
3.2.3 Rotating switch: excitation type and time response



- 0: AREP excitation and normal time response.
- 3: AREP excitation and fast time response.
- 1: PMG excitation and normal time response.
- 2: PMG excitation and fast time response.

For SHUNT applications, AREP excitation must be selected.

3.2.4 Rotating switch: voltage sensing



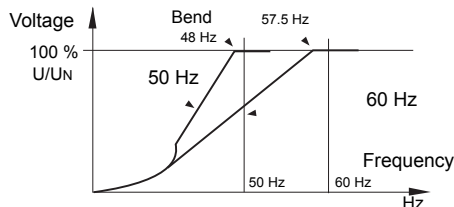
- 0: Single phase sensing
 - LSA46.2/47.2 series.
- 3: Single phase sensing
 - LSA49.1/50.2 series.
- 1: Three-phase sensing with optional module R731
 - LSA46.2/47.2 series.
- 2: Three-phase sensing with optional module R731
 - LSA49.1/50.2 series.

R 450

AVRs

3.3 - U/F and LAM function

3.3.1 - Frequency variation compared with voltage (without LAM)



3.3.2 - LAM (Load Acceptance Module) characteristics

3.3.2.1 - Voltage drop

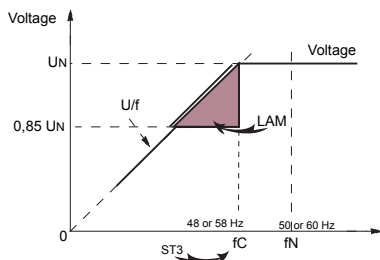
The LAM system is integrated in the AVR. As standard it is active.

Role of the LAM:

On application of a load, the genset rotation speed decreases. When it falls below the preset frequency threshold, the LAM causes the voltage to drop proportionately to the frequency (LAM1) or to the active power (LAM2) depending on the rotating switch position. This reduces the active load scale applied until the speed returns to its rated value.

Hence the LAM can be used either to reduce the speed variation (frequency) and its duration for a given applied load, or to increase the applied load possible for one speed variation (turbo-charged engine).

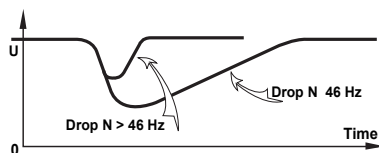
To avoid voltage oscillations, the trip threshold for the LAM function should be set approximately 2 Hz below the rated frequency.



3.3.2.2 - Soft voltage recovery function

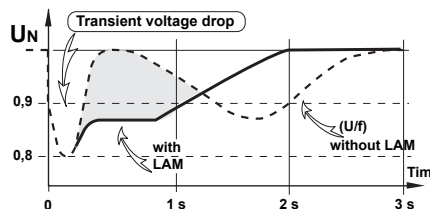
During load impacts, the function helps the genset to return to its rated speed faster with a gradual increase in voltage according to the principle:

- If the speed drops between 46 and 50 Hz (in 50Hz operation), the rated voltage is recovered by following a fast gradient.
- If the speed drops below 46 Hz, since the engine needs more help, the voltage follows a slow gradient as it returns to the reference value.

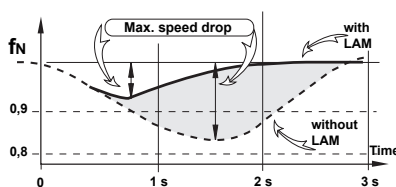


3.4 - Typical effects of the LAM with a diesel engine with or without a LAM (U/F only)

3.4.1 - Voltage

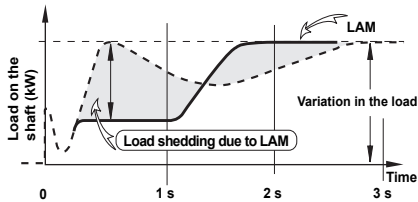


3.4.2 - Frequency



R 450 AVRs

3.4.3 - Power



- Equalization of voltages before paralleling (3 F).
- Possibility of coupling to the mains of alternators already running in parallel (4F).

- **R729 module:** same as R726 with additional functions.

- Detection of a diode fault.
- 4-20 mA input.
- Possibility of kVAR regulation.

3.5 - AVR options

- **Current transformer** for parallel operation of...../1 A or 5 A according to the potentiometer P4 position.

- **Voltage transformer** (adaptation)

- **Remote voltage adjustment potentiometer.**

For a range of variation:

± 5% : 470 Ω

± 10% : 1 kΩ

the power of the potentiometer can be 0.5 W, 2 W or 3 W.



The potentiometer input must be isolated. Do not connect it to the ground.

- **R 731 module:** 3-phase voltage sensing 200 to 500 V, compatible with parallel operation in balanced installations.

- **R 734 module:** 3-phase current and voltage sensing for parallel operation on unbalanced installations (unbalance > 15%).

- **R 726 module:** regulation system changed to “4 - function” (see the maintenance manual and connection diagram).

- PF regulation (2F) .

- **Voltage control:** with an **isolated** D.C. current source applied to the terminals used for the external potentiometer:

- Internal impedance 1.5 kΩ.
- A variation of ± 0.5 V corresponds to a voltage adjustment of ± 10%.

R 450 AVRs

4-INSTALLATION-COMMISSIONING

4.1 - Electrical checks on the AVR

- Check that all connections have been made properly as shown in the attached wiring diagram.
- Check the rotating switches selections
 - frequency,
 - type of alternator,
 - normal position (response time),
 - external potentiometer,
 - rated voltage,
 - secondary current of the CT used,
 - type of excitation.
- R450 optional operating modes

4.2 - Setting up







The various adjustments during tests must be made by a qualified engineer. It is essential that the drive speed specified on the nameplate is reached before commencing adjustment. After operational testing, replace all access panels or covers.

The AVR is used to make any adjustments to the machine.

4.2.1 - Setting up the R450

Before using the AVR, make sure that the rotating switches have been correctly configured with AREP/SHUNT or PMG excitation

a) Initial potentiometer settings (see table below)

Action	Factory setting	Pot.
Voltage minimum fully anti-clockwise	400 V - 50 Hz	
Stability	Not set (centre position)	
Excitation ceiling - Factory-sealed	10 A maximum	
Voltage quadrature droop (// operation with C.T.) - 0 quadrature droop fully anti-clockwise	Not set (fully anti-clockwise)	

Stability adjustments in standalone operation

b) Install a D.C. analogue voltmeter (needle dial) cal. 100 V on terminals F+, F- and an A.C. voltmeter cal. 300 - 500 or 1000 V on the alternator output terminals.

c) Check the rotating switch selection.

d) Voltage potentiometer P1 at minimum, fully anti-clockwise.

e) Stability potentiometer P2 around 1/3 in from the anti-clockwise stop.

f) Start the engine and set its speed to a frequency of 48 Hz for 50 Hz, or 58 for 60 Hz.

g) Set the output voltage to the desired value using P1.

- Rated voltage U_N for solo operation (eg. 400 V)

- Or $U_N + 2$ to 4% for parallel operation with C.T. (eg. 410 V -)

If the voltage oscillates, use P2 to make adjustments (try both directions), observing the voltage between F+ and F- (approx. 10 V D.C.). The best response time is obtained at the limit of the instability. If no stable position can be obtained, try selecting the fast position.

h) Check LAM operation: depending on the rotating switch selection.

R 450 AVRs

i) Vary the frequency (speed) around 48 or 58 Hz according to the operating frequency, and check the change in voltage from that observed previously (~ 15%).

j) Readjust the speed of the genset to its rated no-load value.

Adjustments in parallel operation

Before starting work on the alternator, make sure that the speed droop is identical for all engines.

k) Preset for parallel operation (with C.T. connected to S1, S2)

- Potentiometer **P4** (quadrature droop) in 1/4 position in the case of 5A CT and at 1/2 position in the case of 1A CT.

Apply the rated load (PF = 0.8 inductive). The voltage should drop by 2 to 3% (400 V). If it increases, check that neither V and W nor S1 and S2 have been reversed.

l) The no-load voltages should be identical for all the alternators intended to run in parallel.

- Couple the machines in parallel.
- By adjusting the speed, try to obtain 0 kW power exchange.

- By altering the voltage setting P1 on one of the machines, try to cancel (or minimise) the current circulating between the machines.

- From now on, do not touch the voltage settings.

m) Apply the available load (the setting is only correct if a reactive load is available)

- By altering the speed, match the kW (or divide the rated power of the units proportionally)

- By altering the quadrature droop potentiometer **P4**, match or divide the currents.

4.2.2 - Max. excitation adjustment (excitation ceiling)

In standard setting, the potentiometer P3 is in maximum position.

However, for applications requiring an overload protection (see 3.2.1.4), the excitation ceiling must be adjusted by using the following procedures in AREP and PMG.

Method 1 :

-Connect the AVR to the alternator
-apply load to 110% of rated machine rated at PF=0.8, the green led is on and the red one is off.

-record the excitation current value
-adjust P3 until obtaining the red led flashing, the green one is always on.

-decrease the load to 100% and make sure that the red led is off.

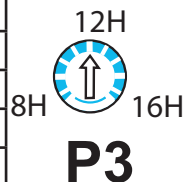
- Increase the load at 115%, check that the red LED flashes during 90 seconds and that the excitation current is brought back to the above adjusted value ($I_{\text{exc adjusted}}$).

Method 2 :

The rated excitation current (see machine plate) must be multiplied by 1.1 and the obtained value is used to set the potentiometer P3 at the right position.

The following table must be used.

Position of P3	I exc (A)
8h	1
9h	1.55
10h	1.95
11h	2.5
12h	3.15
13h	3.65
14h	4.25
15h	4.7
16h	5.15



NB: In the case of a permanent short-circuit, the excitation current must reach $2.9 \times I_{\text{exc adjusted}}$ (limited to 9.5A), during 1 second in AREP or 10 seconds in PMG and shuts down to a value less than 1A.

R 450 AVRs



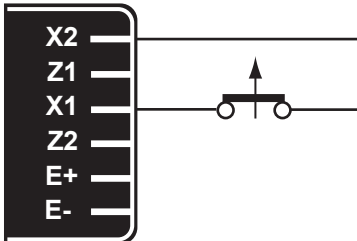
When the excitation current is set to the rated value, a voltage dip is observed in excitation current limit when the limitation is activated and the current limit is reached.

4.2.3 - Special type of use

WARNING

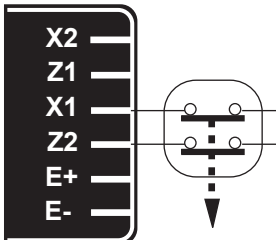
The excitation circuit F+, F- must not be left open when the machine is running: this will irreparably damage the AVR.

4.2.3.1 - R450 (SHUNT) field weakening



The exciter is switched off by disconnecting the AVR power supply (1 wire - X1 or X2)
Contact rating: 16 A - 250 V A.C.

4.2.3.2 - R450 (AREP/PMG) field weakening



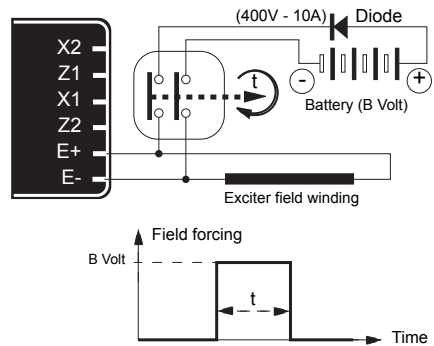
The exciter is switched off by disconnecting the AVR power supply (1 wire on each auxiliary winding) - contact rating 16 A - 250 V A.C.

Connection is identical for resetting the AVR internal protection.



If field weakening is used, provide field forcing.

4.2.3.3 - R450 field forcing



Applications	B Volt	Time t
Guaranteed voltage build-up	12 (1A)	1 - 2 s
Parallel operation, de-energized	12 (1A)	1 - 2 s
Parallel operation, at standstill	12 (1A)	5 - 10 s
Frequency starting	12 (1A)	5 - 10 s
Sustained voltage on overload	12 (1A)	5 - 10 s

R 450 AVRs

4.3 - Electrical faults

Fault	Action	Measurements	Check/Cause
No voltage at no load on start-up	Connect a new battery of 4 to 12 V to terminals F- and F+, respecting the polarity, for 2 to 3 seconds	The alternator builds up and its voltage is still correct when the battery is removed	- Lack of residual magnetism
		The alternator builds up but its voltage does not reach the rated value when the battery is removed	- Check the connection of the voltage reference to the AVR - Faulty diodes - Armature short-circuit
		The alternator builds up but its voltage disappears when the battery is removed	- Faulty AVR - Field windings disconnected - Revolving field coil open circuit. Check the resistance
Voltage too low	Check the drive speed	Correct speed	- Check the AVR connections and settings (AVR faulty) - Field windings short-circuited - Rotating diodes burnt out - Revolving field coil short-circuited - Check the resistance
		Speed too low	Increase the drive speed (Do not touch the AVR voltage pot. (P1) before running at the correct speed)
Voltage too high	Adjust AVR voltage potentiometer	Adjustment ineffective	- Faulty AVR - 1 faulty diode
Voltage oscillations	Adjust AVR stability potentiometer	If no effect: try normal/fast recovery modes	- Check the speed: possibility of cyclic irregularity - Loose connections - Faulty AVR - Speed too low when on load (or U/F knee-point set too high)
Voltage correct at no load and too low when on load (*)	Run at no load and check the voltage between F+ and F- on the AVR	Voltage between F+ and F- AREP/PMG < 10 V	- Check the speed (or U/F knee-point set too high)
		Voltage between F+ and F- AREP/PMG > 15 V	- Faulty rotating diodes - Short-circuit in the revolving field coil. Check the resistance - Faulty exciter armature
(*) Caution: For single-phase operation, check that the sensing wires coming from the AVR are correctly connected to the operating terminals.			
Voltage disappears during operation (**)	Check the AVR, the surge suppressor, the rotating diodes, and replace any defective components	The voltage does not return to the rated value	- Exciter winding open circuit - Faulty exciter armature - Faulty AVR - Revolving field coil open circuit or short-circuited - Overload (see LED)
(**) Caution: Internal protection may be activated (overload, open circuit, short-circuit)			



Caution: After operational testing or troubleshooting, replace all access panels or covers.

R 450

AVRs

5 - SPARE PARTS

5.1 - Designation

Description	Type	Code
Voltage regulator (AVR)	R 450	AEM 110 RE 031

5.2 - Technical support service

Our technical support service will be pleased to provide any additional information you may require.

When ordering spare parts, you should indicate the AVR type and code number.

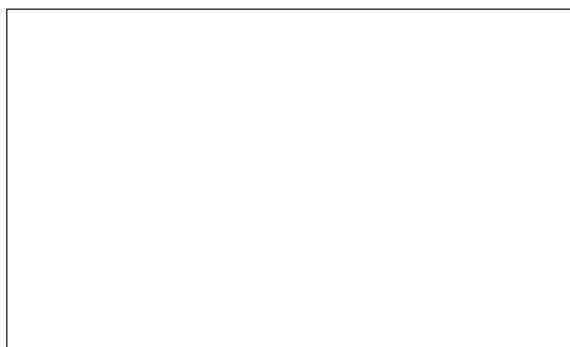
Address your enquiry to your usual contact.

Our extensive network of service centres can dispatch the necessary parts without delay.

To ensure correct operation and the safety of our machines, we recommend the use of original manufacturer spare parts.

In the event of failure to comply with this advice, the manufacturer cannot be held responsible for any damage.

R 450
AVRs



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10.3. Appendix C - List of John Deere - Volvo and Perkins fault codes

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
28									Throttle #3 Position	
					3				Throttle Voltage high, short to V+	Short to V+
					4				Throttle Voltage low, short to V-	Short to V-
29									Throttle #2 Position	
					3				Throttle Voltage high, short to V+	Short to V+
					4				Throttle Voltage low, short to V-	Short to V-
					14				Throttle voltage out of range	
84									Vehicle speed	
					2				Vehicle invalid or missing	Not possible with Genset application
					31				Vehicle speed mismatch	
91	91		91	132					Accelerator pedal position	FMI not determined for all VOLVO's
					3				Throttle Voltage high, short to V+	Not possible with genset application, codes declared by the CAN J1587 for VOLVO.
					4				Throttle Voltage low, short to V-	
					7				Throttle calibration invalid	
					8				PWM throttle abnormal pulse width	
					9				Throttle invalid (CAN value)	
					10				Throttle voltage out of range low	
					13				Throttle calibration aborted	
					14				Throttle voltage out of range	
94			94						Fuel rail pressure sensor	
					1				Fuel supply pressure extremely low	
					3				Fuel rail pressure input voltage high	Short to V+
					4				Fuel rail pressure input voltage low	Short to V-
					5				Fuel rail pressure sensor open circuit	
					10				Fuel rail pressure lost detected	
					13				Fuel rail pressure higher than expected	
					16				Fuel supply pressure moderately high	
					17				Fuel rail pressure not developed	
					18				Fuel supply pressure moderately low	
97			97						Water in fuel sensor	
					0				Water in fuel continuously detected	
					3				Water in fuel input voltage high	Short to V+
					4				Water in fuel input voltage low	Short to V-
					16				Water in fuel detected	
					31				Water in fuel detected	
98			98						Oil level sensor	
					1				Oil level value below normal	
					3				Oil level sensor input voltage high	Short to V+
					4				Oil level sensor input voltage low	Short to V-
					5				Oil level sensor open circuit	

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
100	100		100						Oil pressure sensor	
					1				Engine oil pressure extremely low	
					3				Oil pressure sensor input voltage high	Short to V+
					4				Oil pressure sensor input voltage low	Short to V-
					5				Oil pressure sensor open circuit	
					17				Engine oil pressure low	
					18				Engine oil pressure moderately low	
					31				Oil pressure detected, motor stopped	
102	273		102						Manifold air pressure sensor	
					0				Manifold air pressure above normal	
					1				Manifold air pressure below normal	
					2				Incoherent measurement of the oil pressure	
					3				Manifold air pressure sensor input voltage high	Short to V+
					4				Manifold air pressure sensor input voltage low	Short to V-
					15				Manifold air pressure moderately low	
					16				Manifold air pressure low	
103									Turbo speed sensor	
					0				Turbo speed too high	
					5				Turbo speed sensor circuit open	
					6				Sensor shorted to earth	Short to V-
					8				Speed signal invalid	
					31				Intermittent problem with speed information	
105			105						Manifold air temperature sensor	
					0				Manifold air temperature extremely high	
					3				Manifold air temperature sensor input voltage high	
					4				Manifold air temperature sensor input voltage low	
					5				Manifold air temperature sensor open circuit	
					15				Air temperature very high.	
					16				Manifold air temperature moderately high	
106			106						Air inlet pressure sensor	
					0				Air inlet pressure above normal	
					3				Air inlet pressure sensor input voltage high	
					5				Air inlet pressure sensor open circuit	

SPN			PID		FMI	John Deere	Volvo	Perkins	Description	Comment
107			107						Air filter differential pressure sensor	
					0				Air filter restriction high	
					3				Air filter differential pressure sensor input voltage high	
					4				Air filter differential pressure sensor input voltage low	
					5				Air filter differential pressure sensor open circuit	
					31				Air filter restriction high	
108	274		108						Barometric pressure sensor	Not use with EDC III and EMS2
					2				Air pressure invalid	
					3				High barometric pressure sensor short to high	
					4				High barometric pressure sensor short to low	
					17				High barometric pressure	ECM option, sensor not connected
110	110		110						Coolant temperature sensor	
					0				Coolant temperature extremely high	
					3				Coolant temperature sensor input voltage high	
					4				Coolant temperature sensor input voltage low	
					5				Coolant temperature sensor open circuit	
					15				Coolant temperature high least severe	
					16				Coolant temperature moderately high	
					17				Water temperature very low	
					31				Coolant temperature high	
111			111						Coolant level sensor	
					0				Engine coolant level low	
					1				Engine coolant level low	
					3				Coolant level sensor input voltage high	
					4				Coolant level sensor input voltage low	
153			153						Crankcase pressure sensor	
					0				Value above normal	
					3				Crankcase pressure sensor input voltage high	
					5				Crankcase pressure sensor open circuit	
157									Fuel pressure sensor in the common rail	
					1				Fuel pressure too low	
					3				Input voltage of the pressure sensor high	Short to V+
					4				Input voltage of the pressure sensor low	Short to V-
					10				Loss of fuel pressure detected	
					16				Fuel pressure moderately high	
					17				Fuel ramp pressure not reached	
					18				Oil pressure moderately low	

SPN			PID		FMI	John Deere	Volvo	Perkins	Description	Comment
158			158						Battery voltage sensor	
					1				Voltage above normal	
					17				ECU power down error	
160									Wheel speed sensor	
					2				Wheel speed input noise	
164		164							Injection pressure control	
168	168								Electrical system voltage	
					2				Electrical system voltage low	
172	172		172						Ambient air temperature sensor	Inlet air temperature sensor for PERKINS
					3				Ambient air temperature sensor input voltage high	Inlet air temperature sensor input voltage high
					4				Ambient air temperature sensor input voltage low	Inlet air temperature sensor input voltage low
					5				Ambient air temperature sensor open circuit	
					15					High Inlet air temperature alarm-warning
					16					High Inlet air temperature alarm-action alert
174	174								Fuel temperature sensor	
					0				Fuel temperature high most severe	
					3				Fuel temperature sensor input voltage high	
					4				Fuel temperature sensor input voltage low	
					15				Fuel temperature high	
					16				Fuel temperature moderately high	
					31				Fuel temperature sensor faulty	
175			175						Oil temperature sensor	
					0				Oil temperature extremely high	
					3				Oil temperature sensor input voltage high	
					4				Oil temperature sensor input voltage low	
					5				Oil temperature sensor open circuit	
177									Transmission oil temperature sensor	
					9				Transmission oil temperature invalid	Not possible with Genset application
189									Rated engine speed	
					0				Engine speed de rated	
					31				Engine speed de rated	
190	190		190						Engine speed sensor	
					0				Overspeed extreme	
					2				Engine speed sensor data intermittent	
					9				Engine speed sensor abnormal update	
					11				Engine speed sensor signal lost	
					12				Engine speed sensor signal lost	
					15				Overspeed	
					16				Overspeed moderate	

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
228	261								Speed sensor calibration	
					13				Engine timing abnormal calibration	
252	252								Software	
					11				Incorrect engine software	
234	253								Check system parameters	
					2				Incorrect parameters	
281	281								Action alert output status	
					3				Action alert output open/short to B+	
					4				Action alert output short to ground	
					5				Action alert output open circuit	
282	282								Overspeed output status	
					3				Overspeed output open/short to B+	
					4				Overspeed output short to ground	
285	285								Coolant temperature output status	
					3				Coolant temperature lamp open/short to B+	
					4				Coolant temperature lamp short to ground	
286	286								Oil pressure output status	
					3				Oil pressure output open/short to B+	
					4				Oil pressure output short to ground	
					5				Oil pressure output open circuit	
323	323								Shutdown output status	
					3				Shutdown output open/short to B+	
					4				Shutdown output short to ground	
					5				Shutdown output open circuit	
324	324								Warning output status	
					3				Warning output open/short to B+	
					4				Warning output short to ground	
					5				Warning output open circuit	
412									Temperature sensor in the EGR valve.	
					0				Temperature in the EGR extremely high	
					3				Input voltage of the temperature sensor high	Short to V+
					4				Input voltage of the temperature sensor low	Short to V-
					15				Temperature in the EGR high	
					16				Temperature in the EGR moderately high	
443	443								ENGINE RUN output status	
					3				Engine run output open/short to B+	
					4				Engine run output short to B-	
523									Gear selection	
					9				Gear selection invalid	Not possible with Genset application

SPN		SID			FMI	John Deere	Volvo	Perkins	Description	Comment
608		250							Data link faulty J1587 Start/Stop redundancy / J1939 communication bus	
608				132					Redundancy of the accelerator	
608				98					Redundancy of the Stop/start information	
611									Injector wiring status	
					3				Injector wiring shorted to power source	
					4				Injector wiring shorted to ground	
620	262	232							5 Volt sensor power supply	FMI not informed by VOLVO
					3				Sensor power supply open/short to B+	
					4				Sensor power supply short to ground	
626			45						Start enable device (intake heater and ether)	
					3				Start enable device output short to B+	Not used, the control panel is in charge of managing the start enable device
					4				Start enable device output short to ground	
					5				Start enable device output open circuit	
627									Power supply	
					1				Injector supply voltage problem	For 6125HF070 only
					4				ECU unswitched power missing	For 6068HF275 VP44 only
					18				Battery voltage below the operating voltage	For John DEERE Tiers III
628		240							Memory fault in EMS2	
629		254							ECU status/controller error	CIU module status
					2				RAM cell test failure	
					8				CPU watchdog reset test failure	
					11				Main and fuelling ASIC test fail	
					12				RAM address test failure	
					13				Watchdog trip failure	
					19				ECU to injection pump communication error	Possible only with 6068HF475 VP44
630		253							Data set memory EEPROM	
632									Injection status	
					2				Fuel shutoff error	
					5				Fuel shutoff non-functional	
636		21							Pump position sensor/Cam position sensor/Speed sensor CAM	Pump position or CAM position in function of the type of injection
					2				Pump position sensor/cam position sensor input noise	
					3				Permanent loss of signal	
					5				High impedance of the position sensor or circuit open	
					6				Sensor short to ground	
					8				Pump position sensor/cam position sensor input missing	
					9				Not informed by VOLVO	
					10				Pump position sensor/cam position sensor input pattern error	

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
637		22							Crank position sensor/Speed sensor flywheel	
					2				Crank position input noise	
					3				Permanent loss of signal	
					5				High impedance of the position sensor or open circuit	
					6				Sensor short to ground	
					7				Crank position/Cam position out of synchronisation	
					8				Crank position input missing	
					9				Not informed by VOLVO	
					10				Crank position sensor input pattern error	
639	247	231							Communication status	
					2				Bus Off error	
					9				Passive bus error	
					11				Data registers read back failure	
					12				Loss of message error	
					13				Bus CAN error	
640									Engine shutdown vehicle status	
					11				Engine shutdown vehicle request invalid	
					31				Engine shutdown vehicle request	
641									Status of the Turbo with variable geometry	
					4				Supply voltage of the Turbo actuator low	
					12				Error in communication between the ECU and the TGV actuator	
					13				Error in position of the TGV	
					16				Temperature of the actuator moderately high.	
647									Fan supply	
					3				Short circuit to earth	
					5				Open circuit	
651	1	1	651						Cylinder #1 injector status	
					0				Injector outside specifications	Recalibration of the injectors required
					1				Injector outside specifications	Recalibration of the injectors required
					2				Short circuit high side to B+	
					3				Short circuit high side to low side or low side to B+	
					4				Short circuit high or low side to ground	
					5				Cylinder #1 circuit open	
					6				Cylinder #1 circuit shorted	
					7				Cylinder #1 balancing error/mechanical failure	
					11				Cylinder #1 unknown error/mechanical failure	

SPN	CID	SID	PID	FMI	John Deere	Volvo	Perkins	Description	Comment
652	2	2	652					Cylinder #2 injector status	
				0				Injector outside the specifications	Recalibration of the injectors required
				1				Injector outside the specifications	Recalibration of the injectors required
				2				Short circuit high side to B+	
				3				Short circuit high side to low side or low side to B+	
				4				Short circuit high or low side to ground	
				5				Cylinder #2 circuit open	
				6				Cylinder #2 circuit shorted	
				7				Cylinder #2 balancing error/mechanical failure	
				11				Cylinder #2 unknown error/mechanical failure	
653	3	3	653					Cylinder #3 injector status	
				0				Injector outside the specifications	Recalibration of the injectors required
				1				Injector outside the specifications	Recalibration of the injectors required
				2				Short circuit high side to B+	
				3				Short circuit high side to low side or low side to B+	
				4				Short circuit high or low side to ground	
				5				Cylinder #3 circuit open	
				6				Cylinder #3 circuit shorted	
				7				Cylinder #3 balancing error/mechanical failure	
				11				Cylinder #3 unknown error/mechanical failure	
654	4	4	654					Cylinder #4 injector status	
				0				Injector outside the specifications	Recalibration of the injectors required
				1				Injector outside the specifications	Recalibration of the injectors required
				2				Short circuit high side to B+	
				3				Short circuit high side to low side or low side to B+	
				4				Short circuit high or low side to ground	
				5				Cylinder #4 circuit open	
				6				Cylinder #4 circuit shorted	
				7				Cylinder #4 balancing error/mechanical failure	
				11				Cylinder #4 unknown error/mechanical failure	

SPN	CID	SID	PID	FMI	John Deere	Volvo	Perkins	Description	Comment
655	5	5	655					Cylinder #5 injector status	
				0				Injector outside the specifications	Recalibration of the injectors required
				1				Injector outside the specifications	Recalibration of the injectors required
				2				Short circuit high side to B+	
				3				Short circuit high side to low side or low side to B+	
				4				Short circuit high or low side to ground	
				5				Cylinder #5 circuit open	
				6				Cylinder #5 circuit shorted	
				7				Cylinder #5 balancing error/mechanical failure	
				11				Cylinder #5 unknown error/mechanical failure	
656	6	6	656					Cylinder #6 injector status	
				0				Injector outside the specifications	Recalibration of the injectors required
				1				Injector outside the specifications	Recalibration of the injectors required
				2				Short circuit high side to B+	
				3				Short circuit high side to low side or low side to B+	
				4				Short circuit high or low side to ground	
				5				Cylinder #6 circuit open	
				6				Cylinder #6 circuit shorted	
				7				Cylinder #6 balancing error/mechanical failure	
				11				Cylinder #6 unknown error/mechanical failure	
676		39						Glow plug relay status	
				3				Glow plug relay voltage high	
				5				Glow plug relay voltage low	
677		39	3					Start relay status	
				3				Start relay control short circuit to high	
				4				Start relay control short circuit low	
				5				Start relay control open circuit	
678	41							8 Volt power supply	
				3				ACM 8 Volt DC supply open/short to B+	
				4				ACM 8 Volt DC supply open/short to ground	
679		42						Regulation sensor of the injection pressure control	
723	342							Secondary speed sensor	
				2				Secondary engine speed sensor data intermittent	
				11				Secondary engine speed sensor loss of signal	
				12				Loss of signal/sensor failure	



SPN		SID			FMI	John Deere	Volvo	Perkins	Description	Comment
729		70							Inlet air heater signal/Preheat detection	
					3				Inlet air heater signal high	
					5				Inlet air heater signal low	
810									Vehicle speed	
					2				Calculated vehicle speed input noise	Not possible with Genset application
861	861								Diagnostic output status	
					3				Diagnostic output open/short to B+	
					4				Diagnostic output short to ground	
898									CAN throttle status	
					9				Speed value invalid or missing	
970				6					Auxiliary engine shutdown switch status EMS	
					2				Auxiliary engine shutdown switch signal invalid	Not used
					31				Auxiliary engine shutdown switch active	
971									External engine de rate switch status	
					31				External engine de rate switch active	Not used
1069									Tire size status	
					2				Tire size error	Not possible with Genset application
					9				Tire size invalid	
					31				Tire size error	
1075									Feed pump of the fuel circuit	
					5				High impedance at the terminals of the pump or open circuit	
					6				Pump coil short to ground	
					12				Pump defective	
1076									Fuel Injection pump status	
					0				Pump control valve closure too long	Injection DE10
					1				Pump control valve closure too short	Injection DE10
					2				Pump detected defect	Injection VP44
					3				Pump solenoid current high	Injection DE10
					5				Pump solenoid circuit open	Injection DE10
					6				Pump solenoid circuit severely shorted	Injection DE10
					7				Pump control valve closure not detected	Injection DE10
					10				Pump solenoid circuit moderately shorted	Injection DE10
					13				Pump current decay time invalid	Injection DE10
1077									Fuel injection pump controller status	
					7				Attempting to fuel without command	
					11				Pump supply voltage out of range	
					12				Pump self test error	
					19				Pump detected communication error	
					31				Pump initiated engine protection	

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
1078									ECU/Pump timing status	
					7				ECU/Pump timing moderately out of synchronisation	
					11				ECU/Pump timing speed out of synchronisation	
					31				ECU/Pump timing extremely out of synchronisation	
1079		232							Sensor supply voltage (+5 Volt)	Analog throttle reference
					3				Sensor supply voltage high	> 5,5 Volt
					4				Sensor supply voltage low	< 4,44 Volt
1080		211							Sensor supply voltage (Oil pressure, Coolant temp, fuel pressure)/+5V sensor supply 2	
					3				Sensor supply voltage high	> 5,5 Volt
					4				Sensor supply voltage low	< 4,40 Volt
1109									Engine/ECU status	
					31				Engine shutdown warning	
1110									Engine status	
					31				Engine shutdown	
1111	268								Check parameters	
					2				Programmed parameter fault	
1136				55					ECU Temperature	
					0				ECU temperature extremely high	
					16				ECU temperature moderately high	
1172									Input temperature of the TGV compressor	
					3				Input voltage of the temperature sensor high	Short to V+
					4				Input voltage of the temperature sensor low	Short to V-
1180									Input temperature of the TGV turbine	
					0				Turbine temperature extremely high	Short to V+
					16				Turbine temperature moderately high	Short to V-
1184			173						Exhaust gas temperature sensor	
1239				96					Status of the pressure system of the common rail	
1347									Pump control valve status	Pump control valve #1 status for 6081HF070
					3				Pump control valve current high	
					5				Pump control valve error/mismatch	
					7				Fuel rail pressure control error	
					10				Pump control valve fuel flow not detected	
1348									Pump control valve #2 status	Only for 6081HF070
					5				Pump control valve #2 error/mismatch	
					10				Pump control valve #2 fuel flow not detected	

SPN			PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
1485			1485	5					Pump power relay status	ECU main relay of VOLVO EMS/EDC
					2				Pump power relay fault	
					3					ECU main relay short circuit high
1568									Torque curve selection	
					2				Torque curve selection invalid	
					4				Torque curve input voltage high	
					9				Torque curve selection missing	
SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
1569									Fuel supply status	
					31				Fuel de rate	
1639									Fan speed	
					1				Fan speed zero or absent	
					2				Fan speed signal erratic	
					16				Fan speed more than 300 rpm above its setpoint for at least 180s	
					18				Fan speed more than 300 rpm below its setpoint for at least 180s	
2000									ECU status	
					6				Vehicle ID missing	
					13				Security violation	
2630									Air temperature at the air cooler outlet	
					0				Air temperature extremely high	
					3				Sensor input voltage high	Short to V+
					4				Sensor input voltage low	Short to V-
					15				Air temperature high	
					16				Air temperature moderately high	
2659									Flow level of the EGR valve	
					2				Calculated EGR flow not valid	
					15				Calculated EGR flow rather high	
					17				Calculated EGR flow rather low	
2790									Air temperature at turbo compressor outlet	
					16				Temperature at compressor outlet moderately high	
2791				19					Statuses of the EGR valve	
					2				Valve position signal not valid	
					3				Input voltage of the position sensor high	Short to V+
					4				Input voltage of the position sensor low	Short to V-
					7				Inability of the EGR valve to reach the expected position	
					13				The EGR valve is out of calibration	
					31				Error in position of the EGR valve	

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
2795									Position of TGV actuator	
					7				The actuator does not respond or is not in the expected position	
3509									Common supply voltage of the sensors, output #1	
					3				Supply voltage of the sensor too high	Exceeding +5 volts
									Supply voltage of the sensor shorted to ground	
3510									Common supply voltage of the sensors, output #2	
					3				Supply voltage of the sensor too high	Exceeding +5 volts
									Supply voltage of the sensor shorted to ground	
3511									Common supply voltage of the sensors, output #3	
					3				Supply voltage of the sensor too high	Exceeding +5 volts
									Supply voltage of the sensor shorted to ground	
3512									Common supply voltage of the sensors, output #4	
					3				Supply voltage of the sensor too high	Exceeding +5 volts
									Supply voltage of the sensor shorted to ground	
3513									Common supply voltage of the sensors, output #5	
					3				Supply voltage of the sensor too high	Exceeding +5 volts
									Supply voltage of the sensor shorted to ground	
520192				8					Cooling status of the piston	
520194				4					Status of the starting request input	
520195				6					Stop request on CIU	



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FMI and Description

FMI=0—DATA VALID BUT ABOVE NORMAL OPERATIONAL RANGE - MOST SEVERE LEVEL

The signal communicating information is within a defined acceptable and valid range, but the real world condition is above what would be considered normal as determined by the predefined most severe level limits for that particular measure of the real world condition (*Region e* of the signal range definition) Broadcast of data values is continued as normal. Broadcast of data values is continued as normal.

FMI=1—DATA VALID BUT BELOW NORMAL OPERATIONAL RANGE - MOST SEVERE LEVEL

The signal communicating information is within a defined acceptable and valid range, but the real world condition is below what would be considered normal as determined by the predefined least severe level limits for that particular measure of the real world condition (*Region e* of the signal range definition). Broadcast of data values is continued as normal.

FMI=2—DATA ERRATIC, INTERMITTENT OR INCORRECT

Erratic or intermittent data includes all measurements that change at a rate that is not considered possible in the real world condition and must be caused by improper operation of the measuring device or its connection to the module. Broadcast of data value is substituted with the “error indicator” value.

Incorrect data includes any data not received and any data that is exclusive of the situations covered by FMIs 3, 4, 5 and 6. Data may also be considered incorrect if it is inconsistent with other information collected or known about the system.

FMI=3—VOLTAGE ABOVE NORMAL, OR SHORTED TO HIGH SOURCE

- a. A voltage signal, data or otherwise, is above the predefined limits that bound the range (*Region e* of the signal range definition). Broadcast of data value is substituted with the “error indicator” value.
- b. Any signal external to an electronic control module whose voltage remains at a high level when the ECM commands it to low. Broadcast of data value is substituted with the “error indicator” value.

FMI=4—VOLTAGE BELOW NORMAL, OR SHORTED TO LOW SOURCE

- a. A voltage signal, data or otherwise, is below the predefined limits that bound the range (*Region e* of the signal range definition). Broadcast of data value is substituted with the “error indicator” value.
- b. Any signal external to an electronic control module whose voltage remains at a low level when the ECM commands it to high. Broadcast of data value is substituted with the “error indicator” value.

FMI=5—CURRENT BELOW NORMAL OR OPEN CIRCUIT

- a. A current signal, data or otherwise, is below the predefined limits that bound the range (*Region e* of the signal range definition). Broadcast of data value is substituted with the “error indicator” value.
- b. Any signal external to an electronic control module whose current remains off when the ECM commands it on. Broadcast of data value is substituted with the “error indicator” value.

FMI=6—CURRENT ABOVE NORMAL OR GROUNDED CIRCUIT

- a. A current signal, data or otherwise, is above the predefined limits that bound the range. (*Region e* of the signal range definition). Broadcast of data value is substituted with the “error indicator” value.
- b. Any signal external to an electronic control module whose current remains on when the ECM commands it off. Broadcast of data value is substituted with the “error indicator” value.

FMI=7—MECHANICAL SYSTEM NOT RESPONDING OR OUT OF ADJUSTMENT

Any fault that is detected as the result of an improper mechanical adjustment or an improper response or action of a mechanical system that, with a reasonable confidence level, is not caused by an electronic or electrical system failure. This type of fault may or may be directly associated with the value of general broadcast information.

FMI=8—ABNORMAL FREQUENCY OR PULSE WIDTH OR PERIOD

To be considered in cases of FMI 4 and 5. Any frequency or PWM signal that is outside the predefined limits which bound the signal range for frequency or duty cycle (outside *Region b* or the signal definition). Also if the signal is an ECM output, any signal whose frequency or duty cycle is not consistent with the signal which is emitted. Broadcast of data value is substituted with the “error indicator” value.

FMI=9—ABNORMAL UPDATE RATE

Any failure that is detected when receipt of data via the data link or as input from a smart actuator or smart sensor is not at the update rate expected or required by the ECM (outside *Region c* of the signal range definition). Also any error that causes the ECM not to send information at the rate required by the system. This type of fault may or may be directly associated with the value of general broadcast information.



FMI=10—ABNORMAL RATE OF CHANGE

Any data, exclusive of the abnormalities covered by FMI 2, that is considered valid but whose data is changing at a rate that is outside the predefined limits that bound the rate of change for a properly functioning system (outside *Region c* of the signal range definition). Broadcast of data values is continued as normal.

FMI=11—ROOT CAUSE NOT KNOWN

It has been detected that a failure has occurred in a particular subsystem but the exact nature of the fault is not known. Broadcast of data value is substituted with the “error indicator” value.

FMI=12—BAD INTELLIGENT DEVICE OR COMPONENT

Internal diagnostic procedures have determined that the failure is one which requires the replacement of the ECU, used here to mean the packaged unit that includes some microprocessor and its associated components and circuits. It can be assumed that the communications subsystem is not the part that has failed, and the manufacturer has determined that there is no serviceable component smaller than the ECU involved in the failure. Broadcast of data value is substituted with the “error indicator” value if appropriate, as there may or may not be any broadcast involved. This error is to include all internal controller trouble codes that can not be caused by connections or systems external to the controller.

FMI=13—OUT OF CALIBRATION

A failure that can be identified to be the result of not being properly calibrated. This may be the case for a subsystem which can identify that the calibration attempting to be used by the controller is out of date. Or it may be the case that the mechanical subsystem is determined to be out of calibration. This failure mode does not relate to the signal range definition as do many of the FMIs.

FMI=14—SPECIAL INSTRUCTIONS

“Special Instructions” is the FMI to be used when the on-board system can isolate the failure to a small number of choices but not to a single point of failure. When the FMI is used, there is clear necessity for the service technician to take some action to complete the specific diagnosis, and the manufacturer has provided instructions for the completion of that diagnosis. There are two cases where this will be used: 1. for emission-related diagnostics where the particular failure cannot be separated between a sensor out of range and the case where the actual value is at the edge of a diagnostic region, and 2. for the older SPN 611 to 615 where the problem is in determining which of two or more circuits (which may interact) is the one that needs repair.

SPNs 611 through 615 are defined as “System Diagnostic Codes” and are used to identify failures that cannot be tied to a specific field replaceable component. Specific subsystem fault isolation is the goal of any diagnostic system, but for various reasons this cannot always be accomplished. These SPNs allow the manufacturer some flexibility to communicate non-“specific component” diagnostic information. Since SPNs 611-615 use the standard SPN/FMI format it allows the use of standard diagnostic tools, electronic dashboards, satellite systems and other advanced devices that scan Parameter Groups containing the SPN/FMI formats. Because manufacturer defined codes are not desirable in terms of standardization, the use of these codes should only occur when diagnostic information cannot be communicated as a specific component and failure mode.

Possible reasons for using a System Diagnostic Code include:

1. Cost of specific component fault isolation is not justified, or
2. New concepts in Total Vehicle Diagnostics are being developed, or
3. New diagnostic strategies that are not component specific are being developed.

Due to the fact that SPNs 611-615 are manufacturer defined and are not component specific, FMIs 0-13 and 15-31 have little meaning. Therefore, FMI 14, “Special Instructions”, is usually used. The goal is to refer the service personnel to the manufacturer's troubleshooting manual for more information on the particular diagnostic code. This failure mode does not relate to the signal range definition as do many of the FMIs. This type of fault may or may be directly associated with the value of general broadcast information.

FMI=15—DATA VALID BUT ABOVE NORMAL OPERATING RANGE - LEAST SEVERE LEVEL

The signal communicating information is within a defined acceptable and valid range, but the real world condition is above what would be considered normal as determined by the predefined least severe level limits for that particular measure of the real world condition (*Region i* of the signal range definition). Broadcast of data values is continued as normal.

FMI=16—DATA VALID BUT ABOVE NORMAL OPERATING RANGE - MODERATELY SEVERE LEVEL

The signal communicating information is within a defined acceptable and valid range, but the real world condition is above what would be considered normal as determined by the predefined moderately severe level limits for that particular measure of the real world condition (*Region k* of the signal range definition). Broadcast of data values is continued as normal.

FMI=17—DATA VALID BUT BELOW NORMAL OPERATING RANGE - LEAST SEVERE LEVEL

The signal communicating information is within a defined acceptable and valid range, but the real world condition is below what would be considered normal as determined by the predefined least severe level limits for that particular measure of the real world condition (*Region h* of the signal range definition). Broadcast of data values is continued as normal.

FMI=18—DATA VALID BUT BELOW NORMAL OPERATING RANGE - MODERATELY SEVERE LEVEL

The signal communicating information is within a defined acceptable and valid range, but the real world condition is below what would be considered normal as determined by the predefined moderately severe level limits for that particular measure of the real world condition (*Region j* of the signal range definition). Broadcast of data values is continued as normal.



FMI=19—RECEIVED NETWORK DATA IN ERROR

Any failure that is detected when the data received via the network is found substituted with the “error indicator” value (i.e. FE16, see J1939-71). This type of failure is associated with received network data. The component used to measure the real world signal is wired directly to the module sourcing the data to the network and not to the module receiving the data via the network. The FMI is applicable to *Region f* and *g* of the signal range definition. This type of fault may or may be directly associated with the value of general broadcast information.

FMI=20-30—RESERVED FOR SAE ASSIGNMENT

FMI=31—CONDITION EXISTS

Used to indicate that the condition that is identified by the SPN exists when no more applicable FMI exists or in cases when the reported SPN name spells out the component and a non-standard failure mode. This type of fault may or may be directly associated with the value of general broadcast information. This FMI will mean “not available” when the associated SPN is also “not available” as when the remainder of the packet is filled with binary ones after all data has been transmitted.