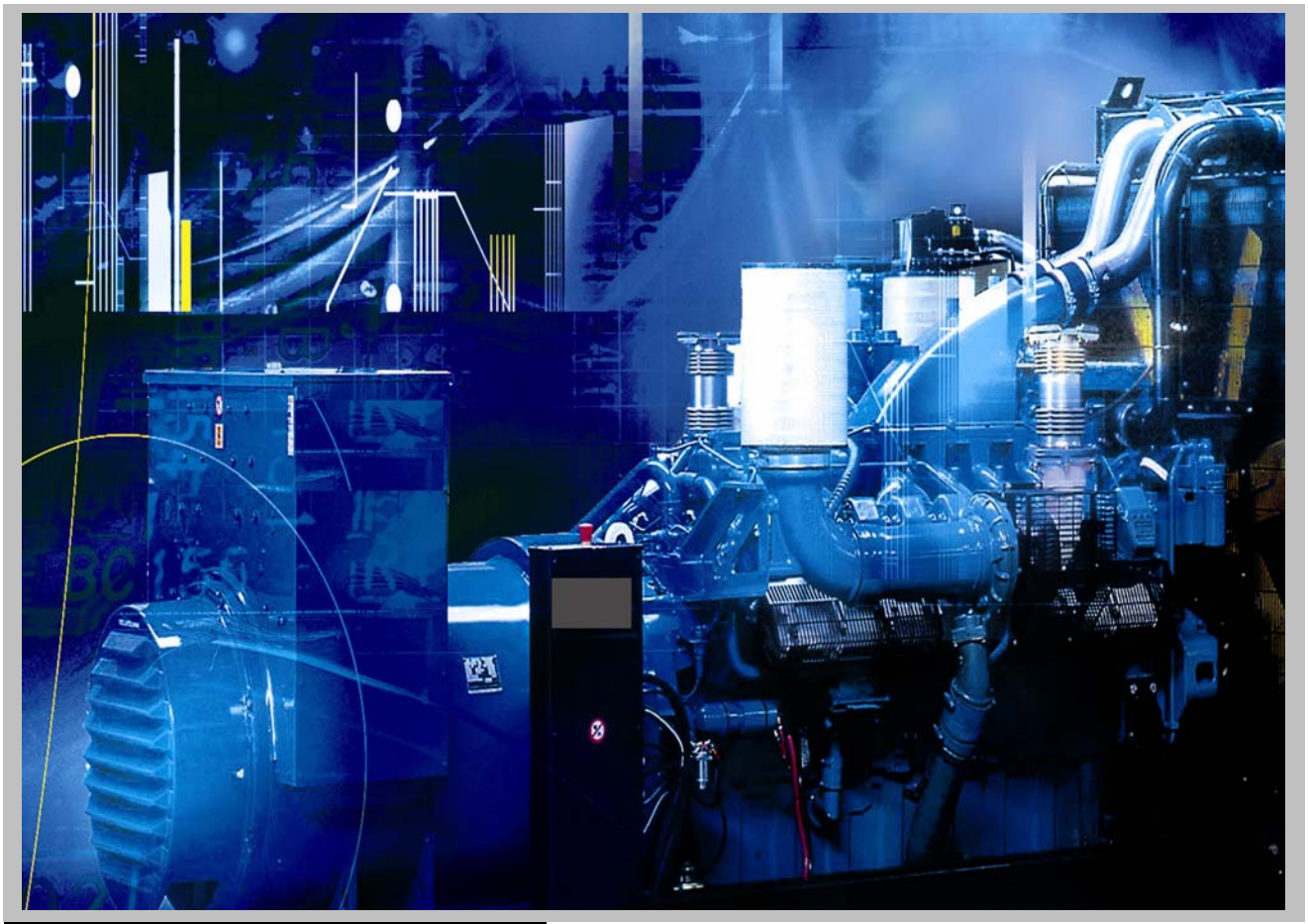
Users guide and maintenance manual for the generating sets

Model(s) : G110M

Control device : Intellisys



Réf. constructeur : 33501179501

Réf. GPAO : 33501179501NE

Revised (10-12)

Users guide and maintenance manual

All generating sets

General considerations

Safety instructions

Réf. constructeur : MUE-IR A	Réf. GPAO : 33522051901

Attached documents

User manual for the control unit
User and maintenance manual for the engine
User and maintenance manual and spare parts catalogue for the alternator
Wiring diagrams (supplied with the electrical generating set)
Genset parts catalog.

1. PREAMBLE

1.1. Introduction

1.1.1 General recommendations

Thank you for choosing an electrical generating set from our company.

This manual has been designed to help you operate and maintain your electrical generating set correctly.

Read the safety instructions carefully in order to prevent any accident, incident or damage. These instructions must always be followed.

In order to obtain optimum efficiency and the longest possible life for the electrical generating sets, maintenance operations must be carried out according to the periods indicated in the attached preventative maintenance tables.
If the electrical 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 the appropriate training. The dealers are suitably qualified and can answer all of your questions. They can also supply you with spare parts and other services.

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

Our electrical generating sets have been designed so that damaged or worn parts can be replaced by new or reconditioned parts thereby reducing the out of action period to a minimum.
For all parts replacement, contact your nearest dealer representing our company who will have the necessary equipment and properly trained and informed staff to carry out maintenance, parts replacement and even total reconditioning of generating sets.

Contact your local dealer for the available repair manuals and to make the necessary arrangements for training personnel in implementation and maintenance.

IMPORTANT
Some user manuals and maintenance manuals for the engines fitted to the electrical generator assemblies include information on the control units and detail the engine starting and stopping procedures.
As the electric generator assemblies are fitted with assembly-specific test and control panels, only the information in the documentation regarding the panels fitted to the assemblies should be taken into consideration.

1.1.2. Structure of the reference material

The reference material delivered with the generating sets enables you to get to know the equipment, operate it and maintain it, both on a daily basis and periodically.
The reference material for the engines and alternators fitted to the sets consists of engine user and maintenance manuals (from the manufacturer) and alternator user and maintenance manuals (from the manufacturer).

The reference material contains:

- the user and maintenance manual, containing among other things:
  - general recommendations and safety regulations to be adhered to
  - general recommendations for installing generating sets
  - tables of capacities (lubricants and coolants) and fuel tanks of different engines that may be fitted to the sets according to their configurations
  - general reference material for maintaining starter batteries
- user and maintenance manual for the engine fitted to the set
- maintenance manual for the alternator fitted to the set
- user manual for the control panel
- wiring diagrams (these diagrams are delivered with the generating set)

1.2. Pictograms and their meanings

Warning danger

Warning, risk of electric shock

Warning, toxic materials

Warning, pressurised liquids

Warning, high temperature, risk of burns

Publications delivered with the generating set must be referred to

Protective clothing must be worn

Your eyes and ears must be protected

Periodic maintenance must be carried out

Battery level must be checked

Warning, rotating or moving parts (risk of getting caught in the machinery)

Warning, corrosive product

Warning, risk of explosion

Entry prohibited to non-authorised persons

Power

Earth

Lifting point required

Stacking point required

Naked flames and unprotected lights prohibited.
No smoking

Exctinction by water prohibited

When on a trailer, earth the set before starting it

Emergency cut-out

Application of EU Machine Directive 98/37 of 22 June 1998 in relation to generating sets.

- access restricted to authorised personnel only according to the legislation in force
- live installation: possible automatic start-up.

1.3. Safety instructions and regulations

THESE SAFETY PRECAUTIONS ARE IMPORTANT

If you do not understand or have any questions about any point in this manual, contact your dealer who will explain it to you or give you a demonstration. A list of risks and precautionary measures to take follows. You should also refer to any local and national regulations that apply in accordance with your own jurisdiction.

1.3.1 General advice

- Read and understand the manuals provided with the generating set in full.
- Do not wear loose clothing and do not go near the machines when operating. Note that the fans are not clearly visible when the engine is running.
- Warn all people present to keep well back during operation.

■

- The generating set should always be controlled by an experienced person.
- Always test the generating set from the control panel.
- Follow the maintenance table and its directions.
- Never let anyone else use the generating set without having first given them the necessary instructions.
- Do not run the engine without having refitted the protective covers.
- Engine with turbocharger: never start the engine without fitting the air filter. The rotating compressor wheel in the turbocharger can cause severe physical injury. Foreign objects in the intake duct can cause mechanical damage.
- Engine with air preheating (starter components): never use starter aerosol or similar product as starter assistance.
  When it comes into contact with the starter component, an explosion may occur in the inlet manifold and lead to physical injury.
- Never let a child touch the generating set, even when not in use. Avoid using the generating set in the presence of animals (can distress the animal).
- Never start the engine without an air filter or exhaust.
- Always follow current local regulations regarding generating sets and use of fuel (petrol and gas) before using your generating set.
- Never use sea water or any other electrolitic or corrosive product in the coolant circuit.

■

- Disconnect the battery and pneumatic starter (if there is one) before carrying out any repair, to prevent the engine from starting accidentally. Fit a panel over the controls to prevent any attempt at starting.
- Do not modify the engine.
- Only use the correct techniques for turning the crankshaft to rotate the crankshaft manually. Do not try to rotate the crankshaft by pulling or exerting force on the lever on the fan. This method can cause serious physical or material harm or damage the fan blade (s), leading to premature breakdown of the fan.
- Always use tools in good condition. Check that you have understood how to use them before starting a procedure.
- Only fit original spare parts.
- Use tools that correspond to the work being carried out.
- Clean all traces of oil or coolant with a clean cloth.
- Never use petrol or other flammable substances to clean parts. Use only approved cleaning solvents.
- Do not use a high-pressure cleaner for cleaning the engine and fittings. The radiator, hoses, electrical components etc. could be damaged.
- Avoid accidental contact with parts that reach high temperatures (exhaust manifold, exhaust)
- Engage the parking brake when the generating set on its trailer is installed on the operating site.
- When setting on a slope; check that no-one is behind the trailer.
- Protective eyewear must be worn when handing during maintenance operations. Operators should remove watches, chains, etc.

1.3.2 Risks related to feed gas (concerns gas sets)

WARNING – DANGER

The gas is explosive. It is forbidden to smoke, go near or create sparks when the tank is being filled and near to the generating set.

- Request the user technical notes and LPG or NG safety data sheets from your gas supplier.

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- Gas installations must be installed, maintained and repaired by recognised specialists.
- Do not attempt to open, unseal or intervene in gas supply pressure relief valves and on the gas line in general.

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- Gas supply procedures must be carried out in fresh air (outside) in accordance with local regulations, in an area well away from fire, people or animals.

1.3.3 Risks related to exhaust gases and fuels

WARNING - DANGER

generating sets should not be operated in unventilated areas.

- Always follow the local regulations in force regarding generating sets and use of fuel (petrol, diesel and gas) before using your generating set.
- Fuel filling should be carried out when the engine is stopped (except for sets with an automatic filling system)
- Engine exhaust gases are toxic: Do not operate the generating set in non ventilated areas. When installed in a ventilated area, the additional requirements for protection against fire and explosions must be observed.
- If a burnt gas exhaust leaks, the generating set may become more noisy. In order to be sure of its efficiency, you should periodically examine the burnt gas exhaust.
- Pipes must be replaced as soon as their condition requires it.

1.3.4 Risks related to toxic products

WARNING – DANGER

The corrosion inhibitor contains alkali. This substance should not come into contact with the eyes. Avoid any prolonged or repeated contact with skin. It should not be swallowed. In the event of skin contact, wash thoroughly with water and soap. In the event of contact with eyes, rinse immediately with plenty of water for at least 15 minutes. CALL A DOCTOR IMMEDIATELY. KEEP THE PRODUCT OUT OF THE REACH OF CHILDREN.

The anti-rust product is toxic and dangerous if absorbed. Avoid any contact with skin or eyes. Read the instructions on the packaging.

Glycol is a toxic product and dangerous if absorbed. Avoid any contact with skin or eyes. Read the instructions on the packaging.

- Never expose the equipment to liquid splashes or rainfall, and do not place it on wet ground.
- Always use the recommended fuels. Using low quality fuels risks damaging the engine and altering performance
- The battery electrolyte is harmful to skin and especially eyes. If splashes get into eyes, rinse immediately with running water and/or a 10% diluted boric acid solution**.**
- Wear protective eyewear and strong base resistant gloves for handling the electrolyte **.**

1.3.5 Risk of fire, burns and explosion

WARNING – DANGER

The engine should not be operated in areas containing explosive products. There is a risk of sparks forming where all electrical and mechanical components are not shielded.

- Beware of creating sparks or flames and do not smoke near batteries as the electrolyte gases are highly flammable (especially when the battery is being filled). Their acid is also harmful to the skin and particularly the eyes.
- Never clean, lubricate or adjust an engine when it is in operation (unless you are qualified to do so, in which case extreme care must be taken to avoid accidents)
- Never make adjustments that you are not familiar with.
- Never cover the generating set with any material while it is working or just after it stops (wait until the engine has cooled)
- Do not touch hot components such as the exhaust pipe and do not put combustible material on them.
- Keep all flammable or explosive products (petrol, oil, cloth, etc.) well away when the set is running.

- Good ventilation is required for your generating set to work properly. Without ventilation, the engine will quickly reach an excessive temperature that could lead to accidents or damage to the equipment and surrounding items.
- Do not take off the radiator cap when the engine is hot and the coolant is pressurised due to risk of burns.
- Depressurise the air, oil and coolant circuits, before removing or disconnecting any unions, ducts or connected components. Be aware of any possible pressure that might be present when disconnecting a device from a pressurised system. Do not look for pressure leaks manually. High pressure oil can cause physical accidents.
- Some preservative oils are flammable. Also, some are dangerous to inhale. Check that ventilation is good. Use a protective mask.
- Hot oil causes burns. Avoid contact with hot oil. Check that the system is no longer pressurised before carrying out any procedures. Never start or run the engine when the oil filling cap is off as oil may be ejected.
- Never start or run the engine when the oil filling cap is off as oil may be ejected.
- Never cover the generating set with a fine layer of oil for anti-rust protection.
- Never fill up the oil or coolant when the generating set is running or when the engine is hot.

1.3.6 Risks related to electrical networks

- The electrical equipment supplied with the generating set complies with standard NF C15.100 or the standards of the relevant countries
- Read the manufacturer's identification plate carefully. The values for voltage, power, current and frequency are shown. Check that these values match the supply use.
- Never accidentally touch naked wires or disconnected connections.
- Never handle a generating set with wet hands or feet.
- Maintain electrical wires and connections in good condition. Using equipment in poor condition can lead to electrocution and damage to equipment.

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- Any procedure on the equipment must be carried out voltage free.
- Electrical connections must be made in accordance with current standards and regulations in the country.
- Do not use faulty, poorly insulated or provisionally connected wires.
- Do not invert the positive and negative terminals of batteries when connecting them. Such an inversion can lead to severe damage to the electrical equipment. Follow the wiring diagram supplied by the manufacturer.
- The generating set should not be connected to any other power sources, such as the public distribution network. In specific cases where there is a reserve connection to existing electrical networks, it must only be carried out by a qualified electrician, who should take the operating differences of the equipment into account, according to whether the public distribution network or generating set is being used.
- Protection against electric shocks is ensured by an assembly of specific equipment. If this needs to be replaced, it should be by components with identical nominal values and specifications.
- Due to strict mechanical specifications you should only use flexible resistant rubber sleeved wires, in compliance with CEI 245-4 or equivalent wires.

1.3.7 Dangers presented by electric currents (first aid)

First aid

In the event of an electric shock, cut off the voltage immediately and activate the set's emergency stop. If the voltage has not yet been cut off, move the victim out of contact with the live conductor as quickly as possible. Avoid direct contact both with the live conductor and the victim's body. Use a dry plank of wood, dry clothes or other non-conductive materials to move the victim away. The live wire may be cut with an axe. Take extreme care to avoid the electric arc that results from this.

Begin emergency procedures

Resuscitation

If breathing has stopped, begin artificial respiration at once in the same place the accident took place unless the victim or operator's life could be endangered by this.

In the event of cardiac arrest, carry out cardiac massage.

1.3.8 Risks related to moving the set

- Use lifting units to lift the generating set. Always make sure that the lifting equipment is in good condition and has a sufficient lifting capacity.
- In order to work in complete safety and prevent the components fitted to the top of the engine from being damaged, the engine should be lifted with an adjustable boom. All chains and cables should be parallel to one another and as perpendicular as possible to the top of the set.
- If other equipment fitted to the generating set alters its centre of gravity, special lifting devices may be required to maintain the correct balance for working in total safety.
- Never carry out work on a generating set that is suspended on a lifting device only.

1.3.9 Recommendation for the operator and environment

- Operating personnel should be aware of the safety and operating instructions. These will be regularly updated.
- Operating should be monitored, directly or indirectly, by someone designated by the operator who is familiar with the installation and dangers and problems regarding products stored and used in the installation.

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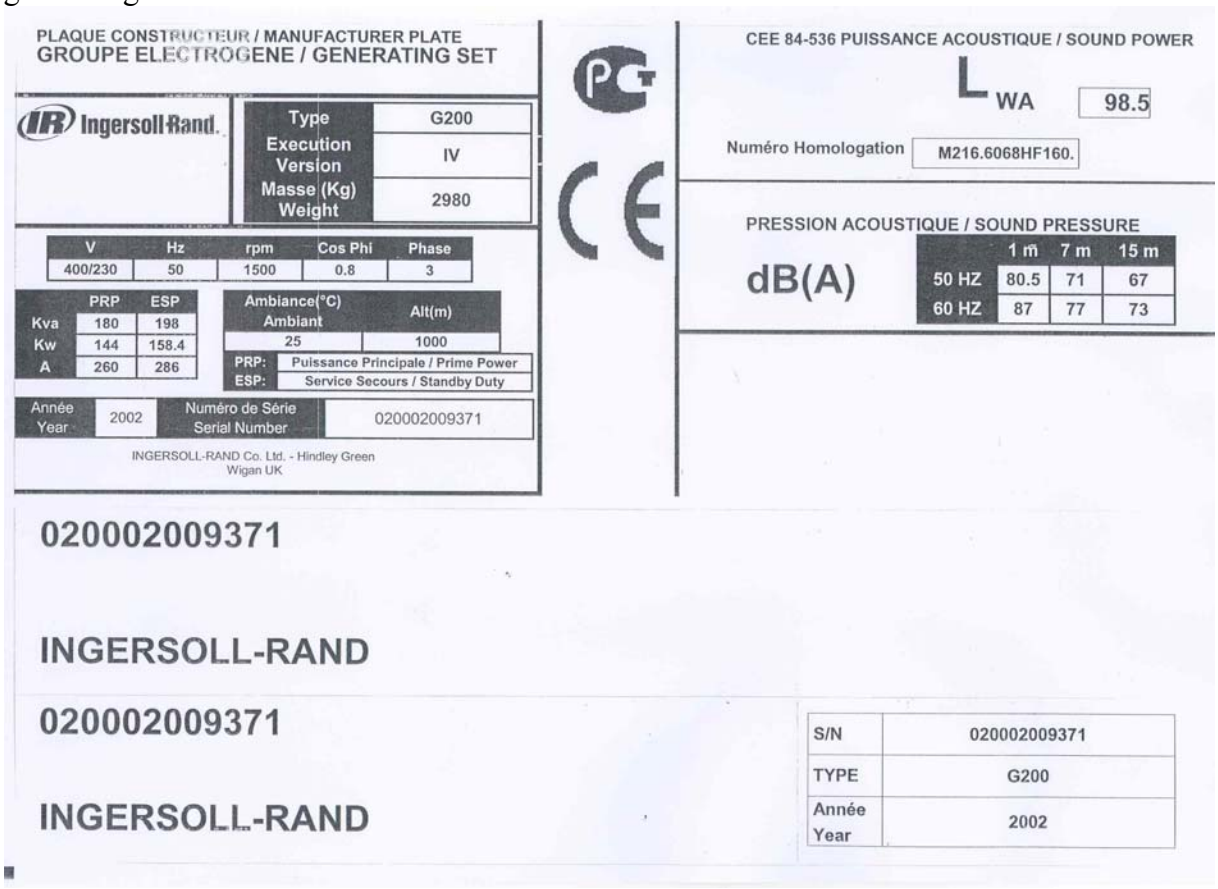
- Manufacturers' notes should be available to technical staff, on site if possible.
- Written operating instructions must be available for operations that involve dangerous handling procedures and driving installations. In particular, these instructions prescribe:
    - Operating modes
    - Frequency of testing for safety devices and devices for handling pollution and other harmful substances generated by the installation
    - Methods for maintenance, checking and use of adjustment equipment and safety devices.
- The presence of dangerous or combustible materials on premises where combustion apparatus is sheltered is limited to what is required for the operation.
- The installations must be operated under the constant supervision of a qualified person. This person should periodically check that the safety devices are working properly and ensure the correct fuel supply to the combustion apparatus.
- Apart from combustion apparatus, flames in any form are prohibited. This should be displayed in bold on a sign.
- Residual water, mud and waste spray is prohibited.
- The fuels to be used should correspond to the ones in the declaration file and the specifications prescribed by the combustion apparatus manufacturer.
- The fuel is considered as being in the physical state that is introduced into the combustion chamber.
- Always protect your hands when detecting leaks. Pressurised fluids can enter body tissues and cause severe harm. Risk of blood poisoning.
- Drain and discard engine oil in a designated container (the fuel distributors can collect your used oil).

1.4. Identifying sets

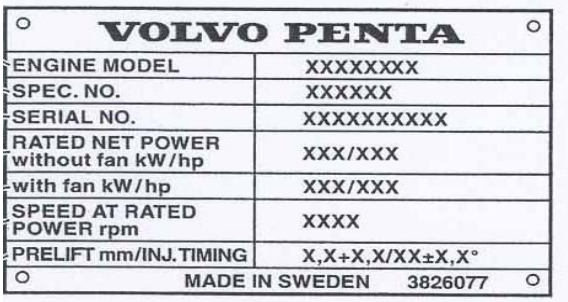
generating sets and their components are identified by means of identification plates.
The precise rules for identifying each major component (engine, alternator etc.) are set out in each manufacturer's documents contained in this manual.

Examples of identification plates

generating set



Engines



Alternator


LEROY SOMER
ALTERNATEURS PARTNER® ALTERNATORS
LSA 44.2S7 C 6/4
Date 01/14
N° 117204 / 9
60 Hz
Min-¹/R.P.M. 1800
Protection IP23
Cos Ø /P.F. 0,8
Cl.ther./Th.class H
Régulateur/A.V.R. R438 LS/C AREP
Altit. < 1000m
Masse/Weight 440 Kg
Rlt AV/D.E bearing
Rlt AR/N.D.E bearing 6309 2RS
Graisse/Grease Esso UNIREX N3
Valeurs excit/Excit.values 480 V / 40°C
en charge / full load 17,70 V / 3,84 A
à vide / at no load 0,95 A
PUISSANCE / RATING
Tension Voltage 480 440 416 240 208 240 V
Phase 3 3 3 3 3 1
Conn. Y Y Y Δ Δ ZZ
Cont. 150 135 130 150 130 78 kVA
Base 120 108 104 120 104 62.4 KW
40°C 180 177 180 361 361 325 A
Secours 165 150 144 165 144 87 kVA
Std by 132 120 115 132 115 69.6 KW
27°C 198 197 200 397 400 363 A
Made by Leroy Somer - 1 024 930/a
LR 57008
CE
Conforme à C.E.I 34-1(1994). According to I.E.C 34-1(1994).

2. INSTALLATION

2.1. Unloading

2.1.1 Safety during unloading

In order to unload generating sets from their transport mountings, under optimum conditions of safety and efficiency, you should check that the following points are being followed correctly.
- Suitable lifting vehicles or equipment for the work.
- Slings positioned in the rings provided for this procedure or lifting arms resting fully underneath the frame cross beams.
- Suitable ground to accommodate the load of the set and lifting vehicle, without strain (if not, put down sufficiently strong and stable boards).

Remove the set as close as possible to its place of use or transport, in a clear space with free access.

2.1.2 Example of material

- crane, slings, lifting beam, safety hook, shackles.
- fork lift truck.

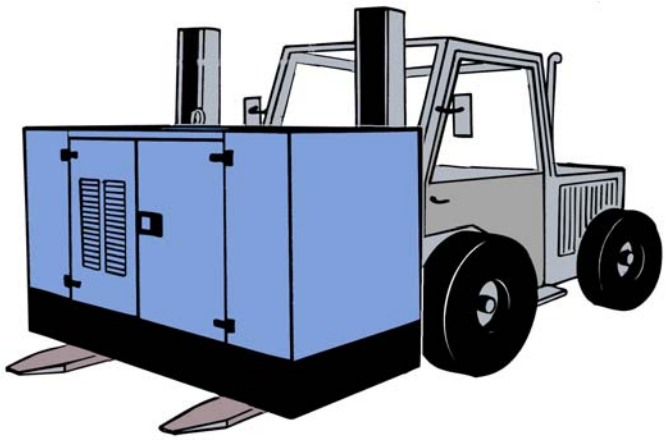
2.1.3 Instructions for unloading

2.1.3.1 Slings

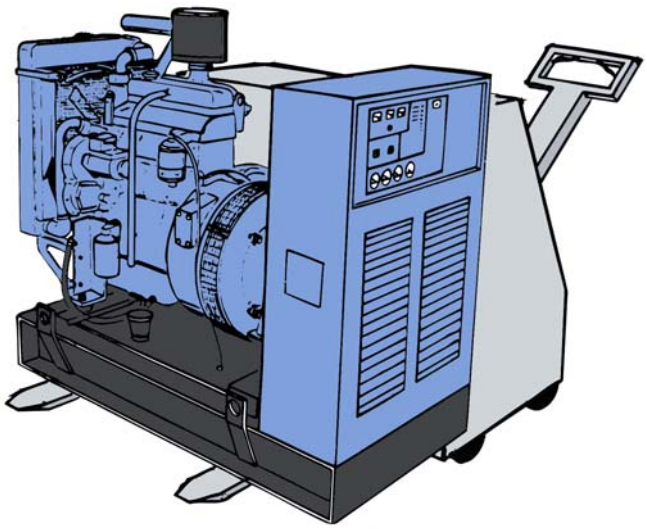
- attach the lifting vehicle slings to the rings on the generating set designed for this procedure.
- hang the slings carefully.
- check that the slings are correctly attached and the equipment is solid.
- lift the generating set carefully.
- direct and stabilise the set towards the chosen position.
- carefully set down the equipment while continuing to position it.
- release the slings, then detach and remove the lifting rings.

2.1.3.2 Fork lift truck

- position the arms of the fork lift under the frame, making sure that only the cross beams are resting on the arms.
- lift and handle the equipment carefully.
- set down the generating set in its unloading position.



It is recommended to use a fork lift truck with arms that are longer than the width of the frame

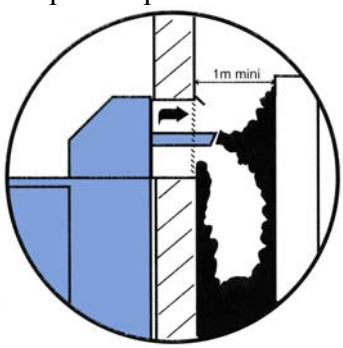


3. INSTALLATION OF MOBILE SITE SETS

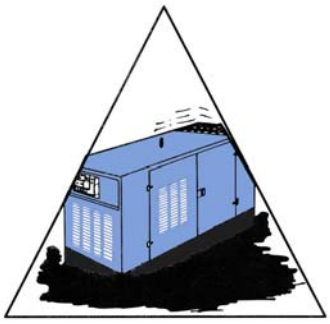
3.1 Specific arrangements

An area will be reserved to install the generating set. Its should be flat and strong enough so that the generator does not sink into it. It could be made of concrete or even large planks fitted together.
It should be noted that a generating set that does not rest correctly on its base (frame or trailer) will be subject to vibrations that could cause damage to all the equipment.
The location of the set on site should be chosen for ease of fuel supply and distribution of current to the users.
Access to the set's doors should be available at all times for safety and maintenance reasons.
Ventilation of the generating set should not be affected if there are different objects close by. It will cause abnormal heating and reduced power.
Burnt gas evacuation will take place in such a way that there is no reaspiration into the air filter or cooling system.
The generating set's neutral speed must be used to protect people.
Earthing is carried out using a metal post buried deeply in the ground.
These sets are to be covered or protected from bad weather by a suitable construction (see previous sections).

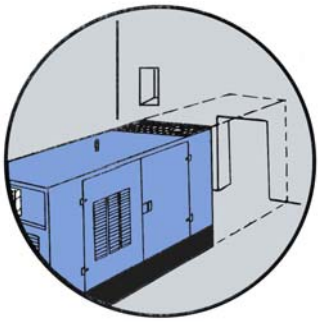
Examples of problems that may be encountered :



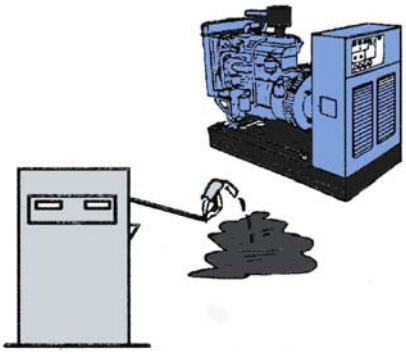
Incorrect exhaust and ventilation



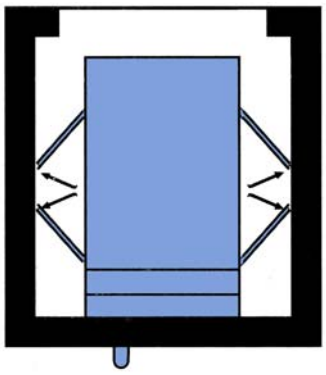
Ground too uneven or soft. Set incorrectly positioned



Reduced access



Fuel filling impossible



Opening cover doors impossible

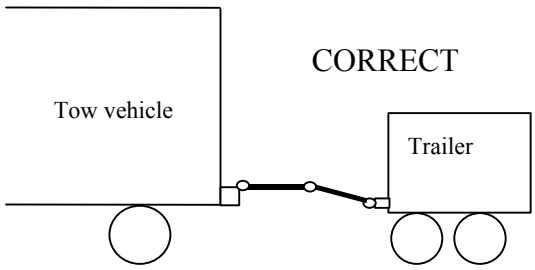
4. ROAD TRAILER

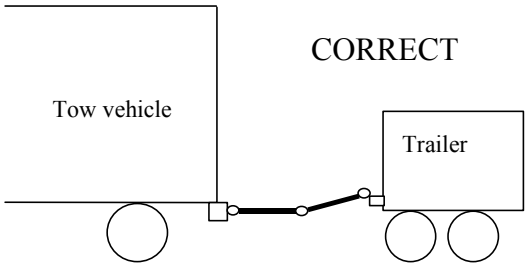
4.1 Trailer linkage

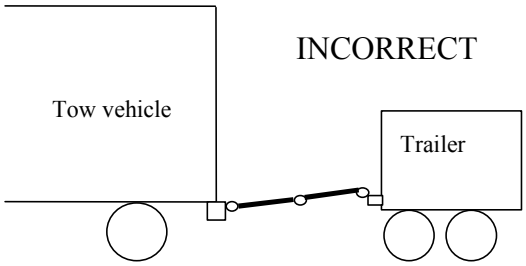
Before attaching the trailer, check the trailer hook on the tow vehicle; it should fit the trailer ring perfectly.

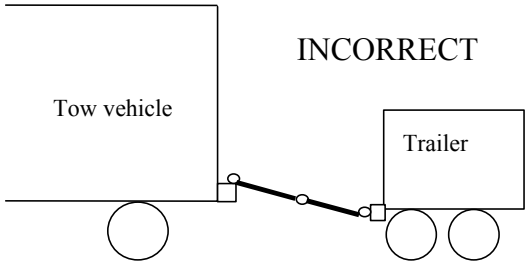
WARNING – DANGER
Trying to tow a trailer with a non-matching device (bar, wires, cords, etc.) could lead to serious accidents.
Also check:
- no incipient fractures or excessive wear on the hitching system.
- locking system is operating properly

To hitch the trailer, proceed as follows:
- lock the wheels to stop the trailer from moving
- lift up the rear trailer supports and lock them
- release the parking brake
- release the locking levers for the draw bar arms and adjust the ring to the same height as the vehicle hook
- hitch the trailer, remove the locks on each side of the wheels then lift up the front wheel fullly using its handle
- connect the electrical circuit of the trailer to that of the tow vehicle
- hook the handbrake safety wire onto the hook on the tow vehicle.









4.2 Check before towing

Before towing carry out the following checks:
- wheel torquing
- lock trailer hook
- tyre pressure
- light signals working
- cover doors closed
- parking brake off
- front wheels and rear supports lifted.
- tightening and fixing the draw bar arms locking levers
- brake test for "road" type trailers
- fitting brake safety cable.

4.3 Driving

- "On-site" type trailer
These trailers are not fitted with a main brake and so cannot brake when operating; the tyres are designed for a speed of 17 mph (27 Km/h). Therefore, it is absolutely forbidden to exceed this speed .

- "Road" type trailer
The driving speed should be adapted to road conditions and the trailer handling.
Driving at sustained speed causes tyres to heat up; therefore it is important to stop from time to time to check them. Excessive heating can lead to a blow out and hence a serious accident.
When reversing, do not forget to lock the overrun brake.

NOTE
Particular attention must be paid to wheel torquing on new vehicles. Indeed, during the first few miles, heat build-ups on the wheel hubs and brake drums lead to reduced wheel torquing. It is therefore essential to check the torquing every 6 miles (10 kilometres) until no further loosening is noted.
The torque test should nevertheless be carried out before towing.

4.4 Unhitching the trailer

This operation should be carried out on horizontal, flat, stable ground.
- lock the wheels
- lower the front wheel
- disconnect the road signals wire
- refit the hitch using the wheel to release the hook ring from the tow vehicle,
- release the tow vehicle
- engage the handbrake.

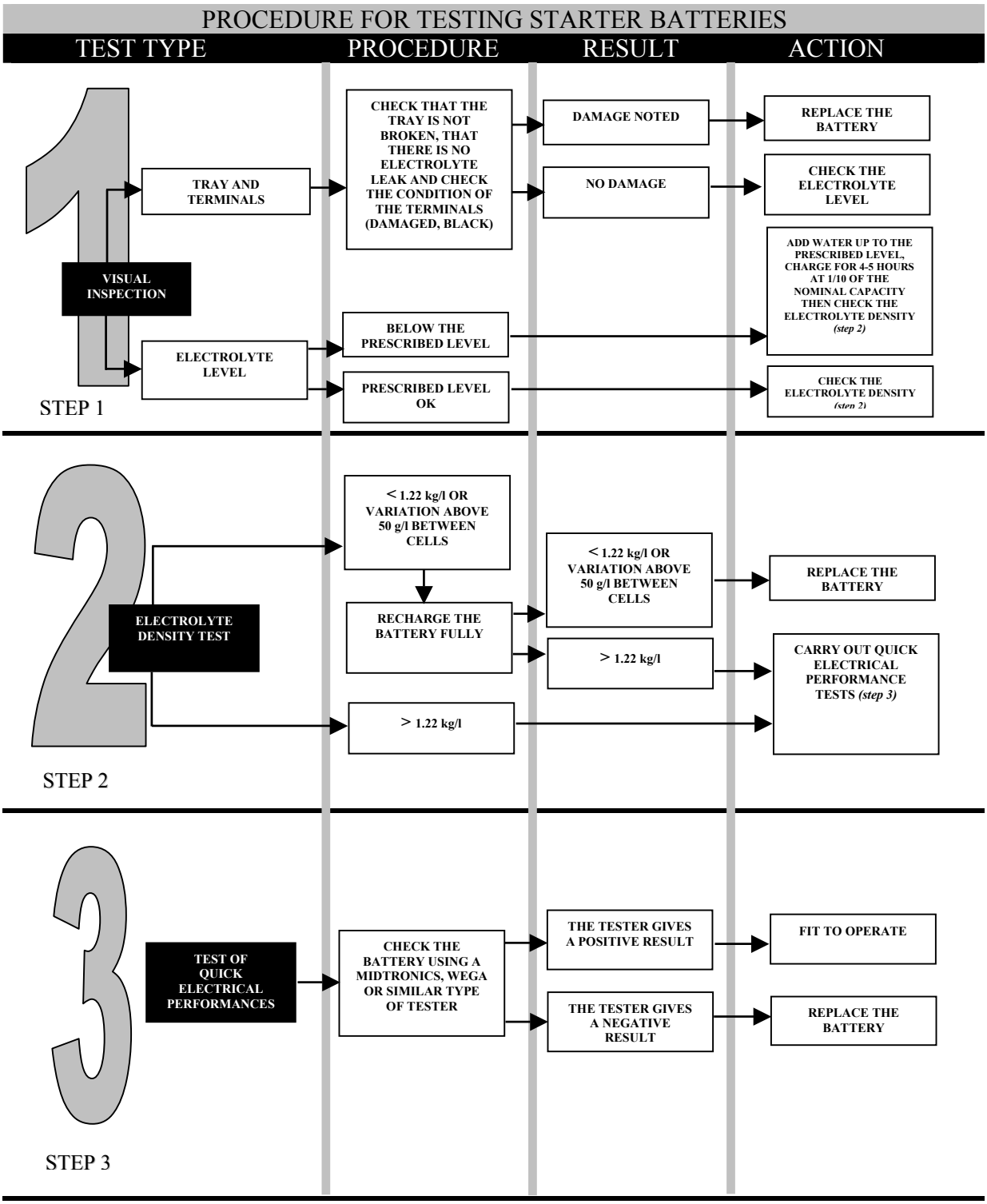
4.5 Implementation for installation

Procedures to be carried out:
- check that the ground is strong enough for the assembly not to sink into it
- using the front wheel, position the set as horizontally as possible
- engage the handbrake.
- lower the rear trailer supports and lock them

5. BATTERY MAINTENANCE

WARNING – DANGER

- install the battery so that it has the correct ventilation
- never place the battery close to a flame or fire
- use only insulated tools
- never use sulphuric acid or acid water to top up the electrolyte level.



6. FUEL AND CONSUMABLES

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

6.1 Circuit capacities – Mitsubishi engines

Engines / CIRCUIT AND TANK CAPACITY	S4L2-SD (series SL)	S4Q2 (series SQ)	S4S (series SS)
MODEL	G 16	G 22	G 33
LUBRICATION (in litres)	5.4	5.5	10
COOLING (in litres)	4.9	8.1	8.9
FUEL (in litres)	100	100	100

6.2 Circuit capacities – john Deere engines

Engines / CIRCUIT AND TANK CAPACITY	3029TF120	4045TF120	4045HF120	6068TF220	6068HF120 (153kW@1500rpm)	6068HF160 (183kW@1500rpm)
MODEL	G 44	G 66 G 77	G 110	G 130	G 160	G 200
LUBRICATION (in litres)	6	13.5	13.5	21.5	21.5	31.5
COOLING (in litres)	16.1	23.6	20.2	27.3	25.8	25.8
FUEL (in litres)	100	175	200	410	410	410

6.3 Circuit capacities – Volvo engines

ENGINES / CIRCUIT AND TANK CAPACITY	TWD 740	TAD 740	TAD 1032	TAD 1242	TAD 1631
MODEL	G 220	G 270	G 330	G 440	G 550
LUBRICATION (in litres)	29	29	36	35	64
COOLING (in litres)	41.9	36.9	37.3	44	64
FUEL (in litres)	350	700	700	800	800

User's manual

Ingersoll Rand
Control unit
Intellisys
Level 1
1.06F

Réf. constructeur

Réf. GPAO : 33502013801

SAFETY SYMBOLS


Caution : danger


Caution : risk of electric shock


Caution : toxic substances


Caution : pressuried fluids


Caution : high temperature (risk of burning)


Caution : rotating or moving parts (risk of entanglement)


Caution : risk of corrosion


Caution : risk of explosion


Authorised personnel only


Power

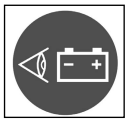

Earth


Caution, refer to the publications supplied with the Genset


Protective clothing required.


Eye and hearings protection necessary

Periodic maintenance required


Check battery charge


Recommended Lifting point


Fork lift stacking point


Naked flame and non protected lightining forbidden, no smoking


Do not use water based fire extinguishers


Trailer : link up the earth before starting the generator


Emergency stop

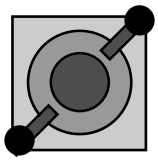
MACHINERY DIRECTIVE 98/37/CE INSTRUCTION FOR GENERATING SETS

- Access prohibited to unauthorized personnel
- Live installation, potencial automatic starting.

PRESENTATION

Key

ENGLISH
Control unit Generating set programmable controller
Panel light indicator Lighting for wall mounted or free standing panel
Emergency Stop The genset shuts down immediately and the control unit goes into STOP mode
MICS AMPG Device for electrical value display
Potentiometer volts Adjusts the alternator voltage
Dual fréquency switch 50/60 Hz to select the frequency
Potentiometer switch to select the voltage



FOREWORD

Control unit upgrade:

The software compatibility is ensured with the old interface boards, meaning it is possible to reprogram, on site, an interface board having a software index 1.01B with a software having an index 1.04D and 1.05E. However, a display defined for software version 1.2 and higher is required to use a software version 1.05E.
Software upgrade 1.04D comprises the following:
- Addition of functions and parameters
- Modification of standard value of certain parameters
- Modification of utilization limits of certain parameters
- Supervision and remote management
- Control/command of engines MTU 2000 and 4000
- Control/command compatible with standards NFPA110 and CSA C282
- Control/command compatible with French standards NF S 61-940 and NF E 37-312
- Control/command for Cummins engines type QST30
- Control/command for Nevada engines
- Generating sets with "multi-voltage" option
- Generating sets with "bi-frequency/bi-voltage" option
- Option 5 module (this module is only used with applications on MTU 2000/4000 engines and CUMMINS engines QST30).

The software version 1.06F used with the CB and CB12 I/O cards extends the functionality and working range of the Intellisys. A summary of the developments and changes incorporated into the new software is shown below. Each development is then described in detail in the subsequent paragraphs.

Compatibility with earlier I/O cards has been provided, and it is therefore possible to reprogram I/O cards originally using software versions 1.01B, 1.04D or 1.05E with version 1.06F, without having to remove the card.
Software version 1.06F includes the following features:
- Command and control of the JDEC electronics used with the John Deere 6081HF engines using the optional module 5.
- Command and control of the EDC III electronics used with Volvo D12 engines using the optional module 5.
- Changing the number of working hours for the generator (clear or preset) by entering a single access code.
- Option 4 of module 4, allowing operation at three different voltages (480V, 208V and 240V), may be fine tuned to reflect the customer's actual usage.
- The "low coolant level" LED of the optional module 6 comes on when either the 'low coolant level' or 'air cooling inadequate ' inputs are enabled (only for NFPA110 applications).
- For gas-powered generators, the "low gas pressure" fault condition now has a five-second fixed timer. This timer prevents the engine being switched off by sudden load changes. In practice, the gas pressure has a tendency to drop when the load increases sharply, before returning to its normal value.

Supervision and remote management:

Supervision and remote management is possible using the "wintelys" software on a PC computer under a Windows 95, 98; NT or 2000 environment.
A complete document describing the supervision and remote management features can be obtained from the "products and development" department.
Supervision and remote management are operational on software version 1.01B with a few restrictions as concerns the various data acquisition and display features. In this respect, with software version 1.01B, it will not be possible to:
- Control the generator set from a remote location
- Display the status of the alarm and fault LEDs on the front panel of the display or retro-information concerning the position of the Normal/Backup switch.

In addition, with software version 1.01B, the Intellisys is automatically reset when the generating set is configured from a remote location.
For optimum use of the supervision/remote management function, we recommend that you use software version 1.04D or later.

Supervision

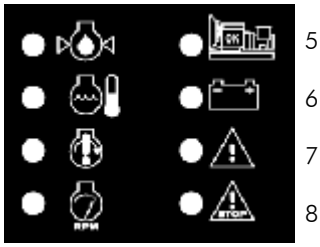
Remote management

Module 5:

Module 5 is simply module OPT345 configured as module 5.
This module is programmed specifically for the applications with engines using an integrated control electronics (MTU and Cummins engines).
The selection parameter for this module already exists in software version 1.01B.
However, a line has been added in the INPUTS and OUTPUTS screens to display the logical state of the inputs and outputs of the module according to its programming.

CONTENTS

PRESENTATION AND TECHNICALS CHARACTERISTICS



1. Oil pressure fault/shutdown (red LED on).
2. Water T° fault/shutdown (red LED on).
3. Overcranking fault/shutdown (red LED on).
4. Overspeed fault/shutdown (red LED on).
5. Genset on load or ready to take the load (green LED on).
6. Charge alternator fault/shtdwn (red LED on).
7. General alarm/warning (yellow LED flashing).
8. General fault/shutdown (red LED flashing).

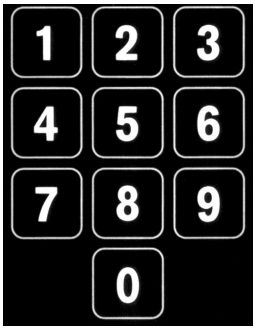
Power on after automatic shutdown (with LED).

Button to access the main menu (programming/display)

Button to validate a selection.

Button to exit a selection

Buttons to browse through menus and adjust contrast



Number pad

Button to display the voltages.

Button to display the currents

Button to display the frequency and hours counter

Button to display the engine parameters

Button to select Auto mode (with LED).

Button to select Test mode (with LED).

Button reset a fault.

Button to select Manu mode (with LED).

Button to select Manu mode (with LED).

Button to test the LEDs (except ON button LED).

1 - Features

- Display module (**DM**)
- Interface board available in 2 versions (**CB**, **CB12**) depending on customer optional equipment.
- Option 3 module, option 4 module and option 5 module **(OPT 345)**
- Block building system enabling multiple combinations.

Note: **DM** required in all combinations

2 - Display module (Fig. 2)

- LCD screen, 8 lines 21 characters, built-in back-light and keyboard adjustable contrast
- 26 momentary push buttons (two types; 10 and 13 dia.)
- 13 display LEDs (alarms/warnings, faults/shutdowns, status, operating modes)
- UL approved polycarbonate case supplied with cable and connector for connection to the interface board
- Dimensions 192x144x70
- Quick installation using brackets and nuts screws
- IP65 on panel face with seal (not supplied), IP20 inside
- Extremely user friendly man-machine interface: multiple-message screens, diagnostic, genset status, ...

3 - Interface board (Fig. 1)

- CB = Main board
- CB12 = Main board with option 1 and option 2 built in
- Electronics in a sheet steel case (base + lid)
- Dimensions : 435x263x31
- Voltage bus; alternator, mains and DC built into the printed circuit board (see paragraphs 7, 8 and 9)
- 16 bit microcontroller, (Flash, RAM and EEPROM) memories, real-time clock, battery backup for time and date
- Supply from 9 to 33Volts DC and from 6Volts DC, for voltage drop at start-up
- All connections are built into the printed circuit board on both sides with full screen printing

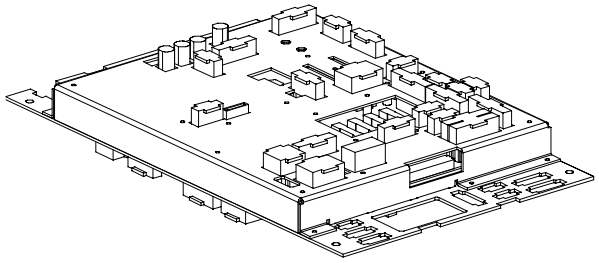


Fig. 1 - CB12 board

Fig. 2 - Display module

4 - Logical/analog I/O

All inputs and outputs are allocated to a specific use (see tables below).

Type	Logical output description	CB	CB12
F	oil pressure	x	x
F	water temperature	x	x
A or F	day tank low fuel level	x	x
F	emergency stop	x	x
A or F	overload or short-circuit	x	x
C	water heater thermostat	x	x
C	external start-up command	x	x
F	radiator low water level	x	x
C	Mains contactor home position	x	x
C	Stand-by contactor home position	x	x
F	external emergency stop	x	x
F	oil temperature		x
F	low oil level		x
A or F	water heater failure		x
A or F	battery charger failure		x
A or F	differential or CIC trip		x
F	differential relay available		x
F	Constant Insulation Check available		x
F	air cooler disconnection		x
F	air cooler low water level		x
A or F	fuel pump 1 disconnection		x
A or F	retention bund		x
C	bulk tank CF80		x
A or F	bulk tank low fuel level		x
C	EJP switch (*)		x
C	EJP start-up (*)		x
C	EJP advanced warning (*)		x

* : France only

Type	Logical output description	CB	CB12
T	fuel solenoid control	x	x
T	starter 1 contr ol	x	x
T	engine preglow control	x	x
T	water heater control	x	x
T	hooter control (general fault)	x	x
R	Mains contactor control	x	x
R	Stand-by contactor control	x	x
T	air damper control		x
T	starter 2 control		x
R	electro-flaps control		x
T	fuel pump 1 control		x
R	CIC remote contact		x

Type	Analogue input description	CB	CB12
Ω	oil pressure indication	x	x
Ω	water temperature indication	x	x
Ω	day tank low fuel level indication	x	x
Ω	oil temperature indication		x

Type	Specific I/|O	CB	CB12
ana.	charge alternator excitation	x	x

Note: Alarm or Fault selection via programming
Key:
A=Alarm, F=Fault, ana.=analog, C=Control
T=Transistor, R=Relay, Ω=resistive

5 - Option 3, 4 and 5 modules (OPT345)

- Modular case, dimensions : 160x90x58
- Programming specific to each module (dip-switch)
- 8 allocated inputs and 10 programmable outputs on option 3 for remote volt free contacts
- 8 programmable inputs and 10 programmable outputs on option 4 , with 24 preprogrammed options
- Specific programming of some entries

6 - Alternator current input

- 4-wire, unisolated, on current transformer with 5A secondary (not built into the electronics)
- Measurements in true root mean square values
- Measurement range: 60A to 5000A

7 - Alternator voltage input

- 4-wire (3ph + neutral), unisolated, with 12.5A-500Vac built in power bus in 50 and 60Hz
- Measurements in true root mean square values
- Frequency measurement on phase 1 for screen display and engine overspeed sensing

8 - Mains voltage mains 1

- 4-wire (3ph + neutral), unisolated, with 15A-600Vac built in power bus in 50 and 60Hz
- No voltage and frequency measurements

9 - Mains voltage mains 2

- 2-wire (1ph + neutral), unisolated, with 10A-240Vac built in power bus in 50 and 60Hz
- No voltage and frequency measurements

10 - Charge alternator input

- Charge alternator excitation and fault
- Starter hardware fail safe on software failure

11 - Communication

- RS485 serial port with J-Bus protocol (Mod bus RTU)
- 9-pin SUB-D connector
- Monitoring possible in local mode (≤ 1000meters)
- Remote management possible with 2 modems (>1000m)
- Optional monitoring/remote management software

12 - CAN Link

- Link between interface board and option module(s)
- Standard CAN bus version 2.0b, 9-pin SUB-D connector for CC supply to module
- 1 connector on CB and CB1, 2 connectors on CB12

13 - Fuse protection

- Fn, F1, F2, F3, 12.5A-500V fuses for alternator bus
- Mains bus protected by circuit breaker in the ATS
- F5, 10A fuse for the DC bus
- F7, 2.5A delayed action fuse for the interface board
- F6, 1A delayed action fuse for option 3 Module
- F8, 1A delayed action fuse for option 4, 5 Module (CB12 only)

14 - Connections

- Multi-pin (2 to 15 pins) connectors with polarizer
- Number of connectors varies with interface board
- Each connector has a specific use

15 - Programming options

- Multiple programming possibilities
- Access code required to read/program

16 - Options connected to the interface

Option description	CB	CB12
external start-up command	x	x
auto predisposition + external command	x	x
3ph+neutral or 1ph+N mains connection	x	x
battery charger (3 possible ratings)	x	x
water heater (3 poss. depending on supply V)	x	x
hooter	x	x
RS485 for monitoring or remote management	x	x
option 3 module / CAN bus connection	x	x
additional engine kit (9 options) (*)		x
electro-flaps (DC or AC)		x
anti-condensation heater		x
EJP (switch, adv. warning and start-up) French only		x
1ph or 3ph fuel pump (control & power)		x
Air cooler (low level, disconnection)		x
differential protection and MX coil control		x
CIC protection with remote contact and MX coil control		x
bulk tank fuel pump (CF80, low level, retention bund)		x
AMPG with optional RS485		x
option 4 module / CAN bus connection		x
three-alarm (OP,WT,OT) and module 4 kit		x

*)indication and fault/shutdown for oil temperature, low oil level, water heater failure and alarm/warning for, oil pressure, water temperature, oil temperature, air damper control, starter 2 control.

17 - Sorties relais

- Max switching voltage: 250Vac (277Vac for *)
- Mains and Stand-by contactor control outputs: 4.9A, 1500VA breaking capacity at cosφ=0.7
- Electro-flaps outputs: 500mA & CIC remote contact:1A
- MX coil control output (*): 4.9A (optional relay on baseplate)

18 - Transistor outputs

- Protected against short-circuit
- Output for fuel solenoid/panel lighting: 700mA
- Other outputs: 300mA

19 - Hardware configuration

- C14/C15 connector, auxiliaries voltage selection
- C7 dip-switch, RS485 terminator
- P3 dip-switch, CAN bus terminator
- Dip-switch selection for VDE option

20 - Environment and standards

- Operating temperature: -15°C to +60°C
- Storage temperature: -20°C to +70°C
- Resistance to shocks: IK01, vibration: to CEI68-2-6
- Salt mist resistance : 96 hours according to EN68011-2-11
- Humidity : 95 % of humidity at 45°C.
- EMC :
  - Generic standards EN50081-2 and EN50082-2
  - Emissions EN55011 Class A
  - Immunity EN61000-4.2, EN6100-4.3, EN61000-4.4, EN61000-4.6, EN61000-4.8, ENV50201
- CE mark, UL listed, CSA certified

1. FOREWORD

1.1. Precautions

❑ The control unit is connected to various AC voltage sources (alternator, mains, ...).

⚠ While the generating set is idle, any work inside the control equipment is strictly forbidden as some parts of the electric and electronic equipment stay live (mains voltage available).

❑ If work inside the control panel is required, it must be performed by staff authorised to work live.

⚠ When the generating set is running, the fuses marked **Fn**, **F1**, **F2**, **F3** are at a dangerous potential which can lead to electric shock when touched.

These fuses must be replaced when the generating set is in complete shutdown. For any voltage measurement on these four fuses, please use suitable equipment.

❑ The generating set can be equipped with a remote start-up (simple contact) or with an automatic starting system [mains failure + ATS (Mains/Stand-by changeover switch)] .

⚠ Beware of possible electric shock by contact with any live part, during the generating set start up.

1.2. Power connection

For power connection, make sure that flexible cables of suitable cross section are used to avoid overheating and a major in-line voltage drop. Depending on laying method, ambient temperature and proximity of other cables, the conductor's cross section may vary.

1.3. Electric connections (control)

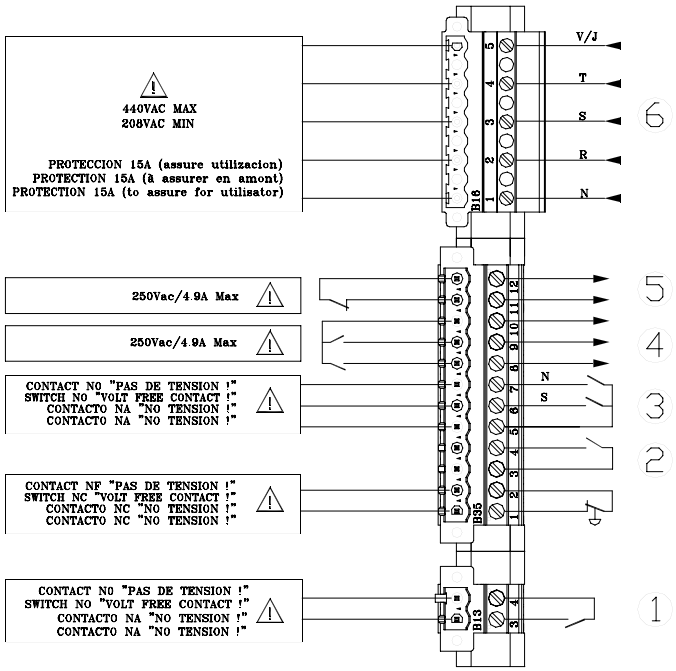
❑ **Generating set with manual start only** (from the control unit keyboard)
No external connection to make.

❑ **Generating set with remote (without mains) or automatic (with mains) start-up**
For proper operation, make the connections on the user terminal block as per the diagram below.

☞For DC signals, we recommend the use of a 5-core (5x1.5mm²) flexible cable between the ATS and the user terminal block.

☞For AC signals, we recommend the use of a 12-core (12G1.5mm²) flexible cable between the ATS and the user terminal block.
(G means cable with a Green/Yellow conductor)
Note: for a remote start only, a 2x1.5mm² flexible cable is sufficient (see ① overleaf)

⚠ The cross sections above are given as a guide as they can vary depending on the current to be drawn, length, temperature and control cable laying method.



① External command (mains sensing or client contact)
② Output C/B fault auxiliary signal contact
③ Mains and Stand-by contactors home position
④ Stand-by contactor control
⑤ Mains contactor control
⑥ 1 or 3 phase water heater

❑ If the user does not connect an ATS from our range, it is imperative to observe the board relay characteristics given below and to check that the coils power requirements are within these parameters.

Rated current=5A Rated voltage=250Vac
Maximum breaking capacity under a 0.7 cos φ: 1500VA

⚠ Not observing the above characteristics will damage or even destroy the board control relays.

1.4. Battery preliminary inspection and commissioning

The battery must be connected for the control unit to operate and the generating set to start, hence the need to check its connection:
- Red wire, positive polarity (+),
- Black wire, negative polarity (-).

Some generating sets are equipped with a battery isolator enabling the electric circuit to be isolated. Check that it is in the position enabling the operation.

⚠ The battery is supplied without electrolyte. Fill the battery with electrolyte at least 20 minutes before any start-up attempt (see maintenance manual).

1.5. Control unit first power-up

If the battery is connected and the electrolyte level correct, control unit powers up automatically and the initialisation screen below appears.

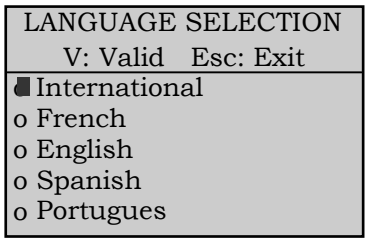
- This screen is visible for eight seconds. All LEDs are lit and will go out after 3 seconds except the **Power** button LED. When initialisation is complete, the **Stop** button LED comes on again.
- If other LEDs are lit or flashing, refer to paragraph 6.

Note: During initialisation, the display module software version appears on screen.

1.6. Welcome screens

❑ Screen 1

After the initialisation phase, the screen below appears. The operator is then able to choose in which language he wants the messages to be displayed on the control unit screen. Four languages are available: French, English, Spanish and Portuguese.



The language selection screen is then displayed. The cursor flashes by default on "international". If no action is taken while the four squares are displayed in the small overlaid window, the Intellisys is automatically positioned on the international language. You then have around 6 seconds to change the language by pressing the ➔ button then the **Enter** or **Exit** button (*).
(*) By pressing the **Enter** button, you store the selected language in memory meaning that the next time you power up the unit, the cursor will automatically go to the previously selected language. In addition, when you press the **Enter** button, the system goes to the next screen for modification of the date and time.

(*) If you press the **Exit** button, the selected language is not stored in memory. The next time the unit is powered up, the cursor will automatically be positioned on the international language.

- By pressing ➔ or ←, the operator places the cursor over the required language. Note : Depending on the cursor position, the text of the two upper lines changes to enable the operator to know where he is.

Press **Exit** to go directly to the " overview " screen (see paragraph 1.7).
There, the language used will be the one where the cursor was positioned.

Example : Cursor positioned over **English**. Pressing **Exit** configures the control unit in English. Any messages will appear be in English.

- If neither **Enter** nor **Exit** is pressed, the " overview " screen (see paragraph 1.7) appears automatically after three minutes. There, the language used will be the one where the cursor was positioned.

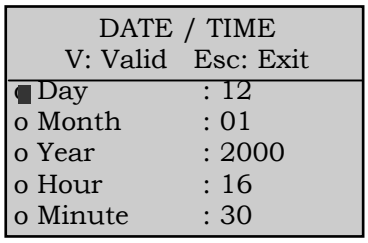
Not until the appearance of the " overview " screen will it be possible to start the generating set, however all inputs stay active (example: appearance of a fault).

- Press **Enter** to go to the second welcome screen, in the language where the cursor was before pressing **Enter**.

Note: If the "international" language is selected, refer to the "international language" appendix.

❑ Screen 2

Screen 2 will allow the date and time to be modified. This is only required when the clocks change because the internal clock is kept active by a lithium battery while control unit is powered off.



- The cursor ■ flashes over the **o** sign of the first line.
- Press ➔ to move the cursor to the next line, except if it flashes next to **Minute**.
- Press ← to move the cursor to the previous line, except if it flashes next to Day.
- By pressing ➔ or ←, the operator places the cursor on the line to be changed.

By following the instructions below, it is possible to change, line after line, the day, month, year, hours and minutes.

- Press **Enter** to take the cursor to the first digit after the : sign. By pressing one of the ten buttons **0** to **9**, the first digit is modified and the cursor is automatically moved to the second digit.
  The cursor can be moved to the second digit by pressing ➔ instead of one of the ten digits **0** to **9**. Afterwards, it can be moved back to the first digit by pressing ←.

Note: the year has four digits.

- Press **Enter** again to take the cursor back to **o** and to validate the entry made.
- When the cursor is positioned over one of the digits, press **Exit** to bring it back to **o**, without saving the entry made or without changing the previous value if there was no entry.
- Press **Exit** without any entry to go to the " overview " screen (see paragraph 1.7). There, the date and time taken into account will be the ones appearing on the screen before **Exit** was pressed.

⚠ When the clocks change, if you press **Exit** without changing the date and time, the generating set alarms, faults and status will not be correctly date and time stamped.

- Press **Exit** after changing one of more parameters (hour, minute,...) to go to the " overview " screen (see paragraph 1.7). There, the time and date taken into account will be those which were modified on screen before **Exit** was pressed.

If neither **Enter** nor **Exit** is pressed, the " overview " screen appears after three minutes. There, the time and date will be those of the previous screen (before going automatically to the " overview " screen).

Note : Not until the appearance of the " overview " screen will it be possible to start the generating set, however all engine protection shutdowns stay active (*example:* appearance of a fault).

1.7. " Overview " screen

The " overview " screen is the screen which appears systematically by default.

Using the four buttons: **V**, **A**, **Hz**, **Engine**, you can access all " overview " type screens (see paragraphs 4 and 5) which give details on:

- Electrical values and engine parameters
- Generating set alarms and faults
- Status of the generating set and its auxiliaries, date and time

❑ Normal operation

Following the language selection screen and/or possible date and time modification screen, the " overview " screen below appears during normal operating conditions.

Fuel Lev(%)	**50**
E.Speed(RPM)	**0**
Batt. (Volts)	**24.2**
ext command=0	16:45
gen stopped	12/01/00

- The first line indicates the fuel level, in %, in the day tank.
- The second line indicates the engine speed in RPM.
- The third line indicates the battery voltage in Volts.
- The fourth and fifth lines indicate the generating set status, the time, date and various other messages (see paragraph 9).

- If the cabling of the fuel level analogue input is faulty or if the sensor itself is faulty, there will be no digital indication on screen. However, the wording **Fuel Lev(%)** will appear (see also paragraph 5). This particular display is used to perform a quick diagnostic on the physical status of the input (sensor and cabling).
- If the fuel level analogue sensor is not available on the day tank, there will be no display on screen (see paragraph 5). This is the case for the Pacific range generating sets where the fuel level is read directly from a mechanical gauge.

Note 1 : Press successively one of the four buttons previously mentioned to modify the screen above (see paragraphs 4 and 5).

Note 2 : the date is given in day/month/year

❑ Abnormal operation

During abnormal operating conditions (presence of an alarm or fault, several alarms or faults or a mixture of both), the previous screen is replaced by the following one:

Fuel Lev(%)	10
E.Speed(RPM)	0
Batt. (Volts)	24.2
Alarm Low fuel level	
ext command=0	17:25
gen stopped	12/01/00

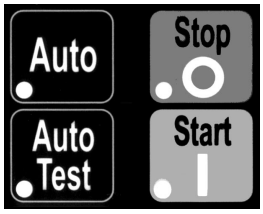
- Two extra lines are inserted to display the malfunctions (alarms and/or faults).
- Engine parameters and electric values appear on screen in a shortened form.
- The two lower lines stay unchanged.

The display of the generating set alarms and faults is detailed in paragraph 8.

2. OPERATING MODES

The control unit has four operating modes which can be accessed via the buttons (**Stop, Start, Auto, Auto Test**) on the display module:

- Mode **Stop**
- Mode **Manu**
- Mode **Auto**
- Mode **Test**



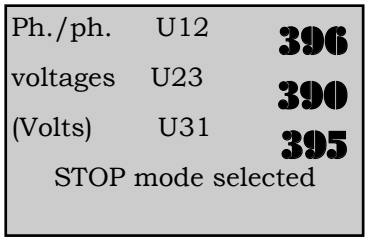
2.1. Stop Mode

After powering up (initialization, language selection and/or possible time and date update), the control unit automatically goes into **Stop** mode. The red LED associated with the button comes on and the "overview screen" appears.

Fuel Lev(%)	**50**
E.Speed(RPM)	**0**
Batt. (Volts)	**24.2**
ext command=0	16:45
gen stopped	12/01/00

Example of " overview " screen in **Stop** mode.

• In this operating mode, any event appearance (alarm, fault, external command, ...) is signalled on screen. However, the generating set is stopped and automatic start-up is not possible.



• When the generating set is running and whatever the current mode (**Auto, Test, Manu**), press the **Stop** button to stop it instantly without any cooling down. A message appears on screen for two seconds to signal that the button has been taken into account (see screen opposite).

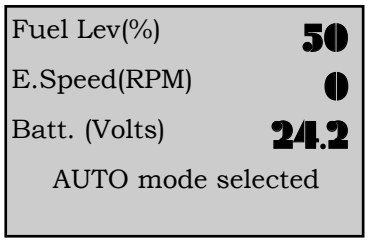
Note: if the engine is equipped with a water heater, the latter is not powered in **Stop** mode.

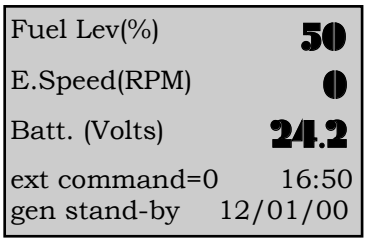
2.2. Manu Mode

• The **Manu** mode provides local control from the keyboard, ie, the operator is wholly in control of the start procedure.
-This mode may be accessed from the **Stop** or **Auto** modes.
The generator starts in **Manu** mode after a single press on the **Start** key. Using this function:
- The red LED usually associated with the **Start** key does not flash,
- The message confirming the selection of **Manu** mode does not appear.

2.3. Auto Mode

Auto mode can be accessed from **Stop**, **Manu** or **Test** mode. Press the **Auto** button to select the mode and to display the left-hand side screen below for two seconds. The red LED associated with the button comes on, then the right-hand screen appears. This screen corresponds to the standby state of the generating set.





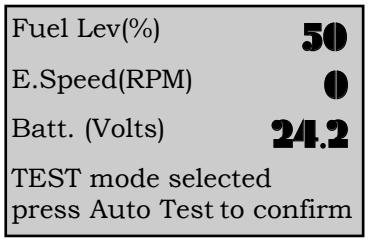
• From the waiting screen, the generating set start-up is conditioned by:
① Logical status change of the 'external command' input
② Logical status change of the 'EJP advance warning' or 'EJP start-up' inputs (France only)
③ Activation of the clock mode built into (if the mode is programmed).

Example: the right-hand side screen above informs of the logical status of the external start-up command (abbreviation ext **command=0** or ext **command=1**):
- External command = 0, no start-up
- External command = 1, imminent start-up possible

• When one of the three start-up conditions changes from 0 to 1 (for ① and ②) or from inactive to active (for ③), a new message informs the operator, then the generating set enters into an automatic start-up phase.
• When one of the three start-up conditions changes from 1 to 0 (for ① and ②) or from active to inactive (for ③), a new message informs the operator, then the generating set enters into an automatic shutdown phase.
• In **Auto** mode, the ATS toggle is completely automatic.

2.4. Test Mode

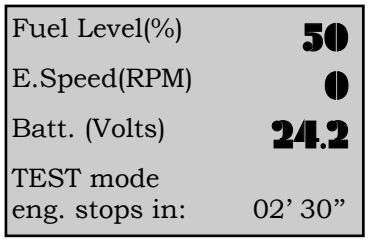
Test mode can only be accessed from **Auto** mode. If one of the inputs ; external command, EJP advance warning, EJP start-up, is in logical status 1 or if the clock is active, **Test** mode cannot be selected.
• If the inputs; external command, EJP advance warning, EJP start-up, are in logical status 0 or if the clock is inactive, press **Auto Test** button to select the mode and to bring up the screen below. The red LED associated with the button flashes.



• Press **Auto Test** button again to confirm the mode, the associated red LED comes on continuously and the generating set then enters into an automatic start-up phase.
• When the red LED flashes (waiting for confirmation), the mode can be changed by selecting **Stop** mode or **Auto** mode.

• If you do not press **Auto Test** to confirm, **Auto** mode is automatically selected after two minutes.

• In **Test** mode, the ATS cannot be toggled, this is a no-load operation. The generating set operating time is indicated on screen by a time displayed in minutes and seconds which counts down automatically. When the delay elapses, the generating set shuts down without cooling and automatically goes into **Auto** mode.



Example of " overview " screen in **Test** mode
There are two minutes and thirty seconds of operation left before the generating set stops and the control unit goes into **Auto** mode.

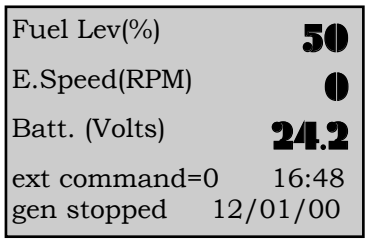
- During operation, if one of the inputs ; external command, EJP advance warning, EJP start-up, changes logical status (from 0 to 1) or if internal clock is activated, a screen message is displayed to indicate the status change or the clock activation. The **Test** mode timer is bypassed, automatically goes into **Auto** mode, the ATS toggles and you are then back in normal **Auto** mode operation.

3. SLEEP MODE AND AUTOMATIC SHUTDOWN

Is equipped with a sleep mode and an automatic shutdown.

3.1. Sleep mode

Sleep mode is possible when is in **Stop** mode or **Auto** mode with the generating set on stand-by (*). The sleep mode starts automatically after an adjustable time if there is no status change on one of the system logical inputs, no communication with a PC or no keystroke.
In this case, the back-light switches off and goes into a minimum consumption mode.



Example of a " overview " screen in sleep mode, the various indications stay visible on screen.

(*) Genset stopped with no external command, no EJP start-up and no clock activation.
- If one the system logical inputs changes status (alarm, fault, thermostat, external command, ...), the messages appear and the back-light switches back on.
- On the appearance of an alarm or a fault not generated by the change of state of an entry, the back-lighting does not come on again.

Note : if a low/high battery voltage alarm or fault or a CAN bus fault appears, the back-light will not switch itself back on.

3.2. Automatic shutdown

Automatic shutdown is only possible when is in **Stop** mode. In **Stop** mode, even if the back-light is switched off, the battery discharges slowly (electronics consumption) in cases where the generating set is not equipped with a battery charger.
To avoid the battery from discharging and thus the generating set from not being able to start, will shut down automatically after a delay.
After shutdown, the internal clock stays active. The generating set alarm, fault and status event log is kept unchanged.

⚠ Following an automatic shutdown, can be powered up again by simply pressing the **Power** button. Initialisation is carried out in the same conditions as with a first power-up.

After powering up via the **Power** button, automatically goes into **Stop** mode and brings up the " overview " screen (see paragraph 1.7) in the language used before the automatic shutdown. This way, the operator does not need to reselect the language and press **Exit** to return to the " overview " screen.

3.3. Special case

- On the appearance of any fault condition whatsoever, the Intellisys automatically sets itself into the **Stop** mode but, at the end of the 'auto cut-off' timer (setting 108 in the Timer menu), the Intellisys remains switched on. This function is particularly useful for those applications fitted with :
- An OPT345 module, programmed for Option 3
- An optional module 6
- The Wintelys supervision and remote management software.

This feature ensures that the signals provided by these modules (free potential contact, remote module 6 control) and the monitoring software will remain available for remote operating.

4. VIEWING THE ELECTRICAL VALUES

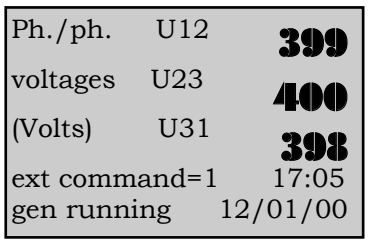
4.1. Voltages

You can view the various AC voltages by pressing the **V** button successively. Their values are expressed in true root mean square Volts. Depending on the client's needs (type of electrical installation), several screens are possible:

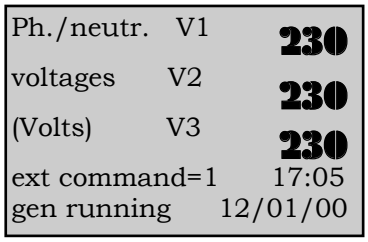
- 3 phase with neutral (3ph+N)
- 3 phase without neutral (3ph)
- 2 phase (2ph+N)
- 1 phase (1ph+N)

Note: one of the four choices above has been factory programmed as per the client's specification.

❑ 3 phase with neutral (3ph+N)

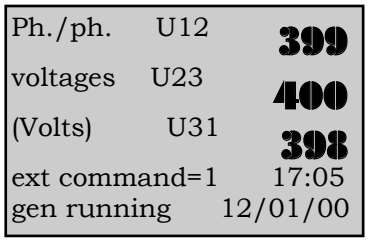


- Press **V** to get the three phase-to-phase voltages:
  U12 = voltage across phase 1 and phase 2
  U23 = voltage across phase 2 and phase 3
  U31 = voltage across phase 3 and phase 1



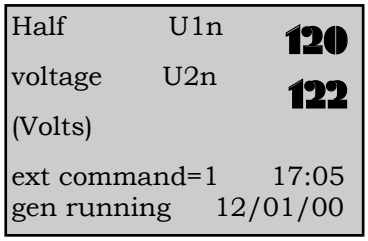
- Press **V** again to get the three phase-to-neutral voltages:
  V1 = voltage across phase 1 and neutral
  V2 = voltage across phase 2 and neutral
  V3 = voltage across phase 3 and neutral
- Press **V** again to bring up the first screen and so on...

❑ 3 phase without neutral (3ph)

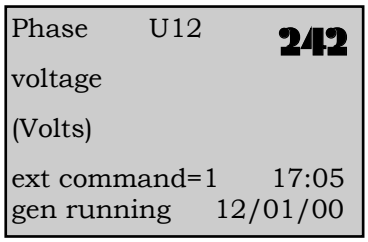


- Press **V** to get the three phase-to-phase voltages:
  U12 = voltage across phase 1 and phase 2
  U23 = voltage across phase 2 and phase 3
  U31 = voltage across phase 3 and phase 1
- If you press **V** nothing changes.

❑ 2 phase (2ph+N)

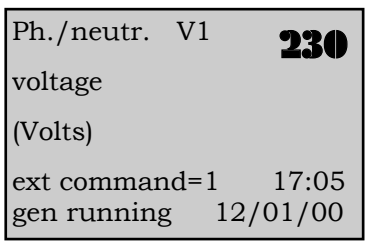


- Press **V** to get the two half voltages:
  U1n = voltage across phase 1 and neutral
  U2n = voltage across phase 2 and neutral



- Press **V** again to get the voltage across the two phases:
  U12 = voltage across phase 1 and phase 2
- Press **V** again to bring up the first screen and so on ...

❑ 1 phase (1ph+N)



- Press **V** button to get the voltage across phase and neutral:
  V1 = voltage across phase 1 and neutral
- If you press **V** again, nothing changes.

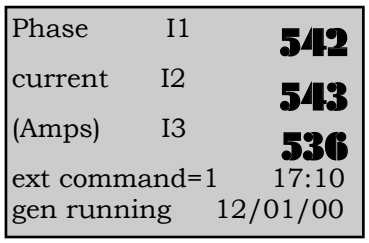
4.2. Currents

To view the various AC currents, press the **A** button successively. The values are expressed in true root mean square Amps. Depending on the client's needs (type of electrical installation), several screens are possible:

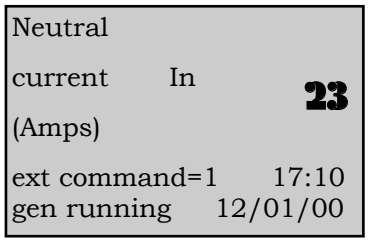
- 3 phase with neutral (3ph+N)
- 3 phase without neutral (3ph)
- 2 phase (2ph+N)
- 1 phase (1ph+N)

Note: one of the four choices above has been factory programmed as per the client's specification.

❑ 3 phase with neutral (3ph+N)



- Press **A** to get the three phase currents:
  I1 = current in phase 1
  I2 = current in phase 2
  I3 = current in phase 3

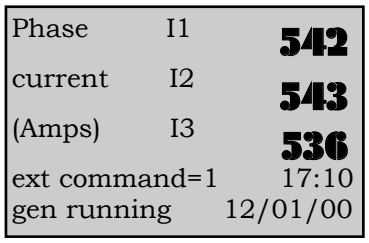


- Press **A** again to get the neutral current:
  In = current in the neutral

Note : the neutral current is calculated by vector summation of the three phase currents..

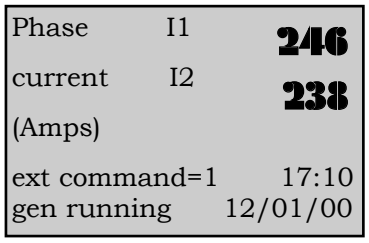
- Press **A** again to bring up the first screen and so on ...

❑ 3 phase without neutral (3ph)



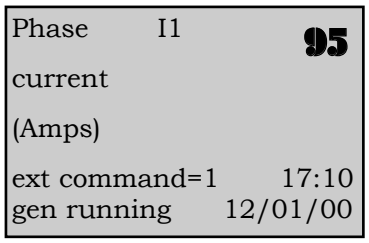
- Press **A** to get the three phase currents:
  I1 = current in phase 1
  I2 = current in phase 2
  I3 = current in phase 3
- If you press **A** again, nothing changes.

❑ 2 phase (2ph+N)



- Press **A** to get the two phase currents:
  I1 = current in phase 1
  I2 = current in phase 2
- If you press **A** again, nothing changes.

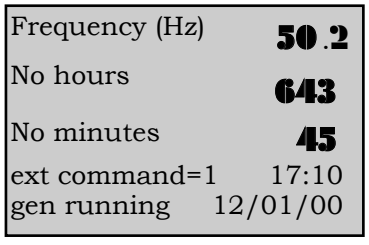
❑ 1 phase (1ph+N)



- Press **A** to get the 1 phase current :
  I1 = 1 phase current
- If you press **A** again, nothing changes.

4.3. Frequency and hours counter

To view the generating set frequency and number of running hours, press the **Hz** button. Values are expressed in Hertz (Hz) and in hours respectively.



The minutes are counted from 0 to 59 minutes; on the 60th minute, the number of hours is incremented and the number of minutes goes to 0.
Example of "overview" screen showing frequency and number of generator running hours and minutes.

Note: a maximum of 32767 running hours can be displayed. The display is in whole hours.

5. VIEWING THE ENGINE PARAMETERS

To view the engine parameters, press the **Engine** button successively. Three different screens can be viewed.
The values that can be displayed on these three screens are indications only.

❑ **Screen 1 :** Press the **Engine** button to get the following screen.

Fuel Lev(%)	**65**
E.Speed(RPM)	**1502**
Batt. (Volts)	**12.3**
ext command=	17:15
gen running	12/01/00

- The first line indicates the fuel level, expressed in %, in the day tank.
- The second line indicates the engine speed expressed in RPM.
- The third line indicates the battery voltage expressed in Volts.

❑ **Screen 2 :** Press **Engine** a second time to get the following screen.

Oil Pr.(Bar)	**6**
Oil T.(°C)	**90**
WaterT.(°C)	**75**
ext command=1	17:15
gen running	12/01/00

- The first line indicates the oil pressure expressed in Bar.
- The second line indicates the oil temperature expressed in degrees Celsius (°C).
- The third line indicates the water temperature expressed in degrees Celsius (°C).

❑ **Screen 3 :** Press **Engine** a third time to get the following screen.

Oil Pr. (PSI)	**90**
Oil T.(°F)	**194**
WaterT. (°F)	**167**
ext command=1	17:15
gen running	12/01/00

- The first line indicates the oil pressure expressed in PSI (pound per square inch).
- The second line indicates the oil temperature expressed in degrees Fahrenheit (°F).
- The third line indicates the water temperature expressed in degrees Fahrenheit (°F).

- Press **Engine** again to bring up the first screen and so on ...

The first screen is the one which appears by default after the has powered up (see paragraph 1.7) or after pressing **Exit** to exit the display mode.

- If one of the sensors is not declared available (optional sensor and/or factory programming), there will be no display on screen on the line corresponding to the undeclared sensor (see screen 1).
- If the cabling of one the analogue inputs is faulty or if a sensor is faulty, there will be no digital indication on screen on the line of the corresponding sensor (see screen 2).

Oil Pr. (Bar)	**6**
WaterT. (°C)	**75**
ext command=1	17:15
gen running	12/01/00

screen 1

Oil Pr. (Bar)	
Oil T.(°C)	**90**
WaterT.(°C)	**75**
ext command=	17:15
gen running	12/01/00

screen 2

6. DISPLAY LEDS AND LAMP TEST

On the display module panel face, fifteen LEDs are used to display various generating set status, alarms and faults.

❑ A set of eight LEDs are used to display the following alarms, faults and statuses:


Oil pressure fault/shutdown (red)

Genset ready to take load (green)


Water temperature fault/shutdown (red)


Charge alternator fault/shutdown (red)


Overcranking/Fail to start shutdown (red)


General alarm (yellow)

Overspeed fault/shutdown (red)

General fault (red)

All these LEDs are identified by an ISO symbol. The last two LEDs are flashing lights. The " general fault " LED flashes on appearance of any fault and the " general alarm " LED flashes on appearance of any alarm.

- ❑ Each blue coloured function button (**Stop, Start, Auto, Auto Test**) is associated with a LED. The operation of these four LEDs is described in paragraph 2.
- ❑ The **0** and **1** buttons are each associated with a LED.
- ❑ The **Power** button is associated with a LED. This LED is used to display the powering up (see paragraphs 1.5 and 3.2).

Press the **Lamp Test** button to light all the LEDs for six seconds. This is only possible on the " overview " type screens.

7. SCREEN CONTRAST

On the various " overview " type screens, the contrast of the characters displayed on screen can be adjusted via the ➔ and ← buttons:

- Press ➔ to increase the contrast on screen
- Press ← to reduce the contrast on screen.

Note: le The contrast obtained after using the ➔ and ← button is not saved when if powered down. The only way the contrast value, modified by the ➔ and ← buttons, can be saved is via the **Contrast** menu.

- Contrast adjustment is especially useful when is used in severe conditions (-15°C or +60°C).
- When temperature is above +60°C, the screen is very dark. It is therefore necessary to reduce the contrast by pressing ←.
- When temperature is below -15°C, the screen is very light. It is therefore necessary to increase the contrast by pressing ➔.

8. DISPLAYING THE ALARM AND FAULT MESSAGES

All alarms and faults are clearly viewed on screen. Two lines are dedicated for their display (see screens below).

8.1. Appearance of messages on screen

As soon as an alarm or fault appears, the electrical values and engine parameters are displayed on screen in a shortened form.

- The first alarm is displayed on screen over the first of the two lines (screen 1).
- The first fault is displayed on screen over the first of the two lines (screen 2).

Ph./ph.	U12	400
voltages	U23	401
(Volts)	U31	398
Alarm Low Fuel Level		
ext command=1		17:30
gen stopped		12/01/00

screen 1

Ph./ph.	U12	0
voltages	U23	0
(Volts)	U31	0
Fault Emergency Stop		
ext command=1		17:32
gen stopped		12/01/00

screen 2

Ph./ph.	U12	400
voltages	U23	401
(Volts)	U31	398
Alarm Retention Bund		
Alarm Low Fuel Level		
ext command=1		17:35
gen stopped		12/01/00

screen 3
As soon as another alarm appears on screen 1, the first alarm message slides down to the second line and the message of the new alarm positions itself on the first line (see screen opposite).
(example : **Alarm Retention Bund**)

Ph./ph.	U12	0
voltages	U23	0
(Volts)	U31	0
Fault Low Fuel Level		
Fault Emergency Stop		
ext command=1		17:38
gen stopped		12/01/00

screen 4
As soon as another fault appears on screen 2, the first fault message slides down to the second line and the message of the new fault positions itself on the first line (see screen opposite).
(example : **Fault Low Fuel Level**)

Ph./ph.	U12	0
voltages	U23	0
(Volts)	U31	0
Fault Emergency Stop		
Alarm Low Fuel Level		
ext command=1		17:35
gen stopped		12/01/00

screen 5
If an alarm appears on screen 2, the fault message stays on the first line and the alarm message is displayed on the second line (see screen opposite).
(example : ***Alarm Low Fuel Level***)
Priority is given to fault messages.

- If a fault appears on screen 3, the message on the second line disappears from the screen, the message on the first line slides down to the second line and the fault message takes the first line.
- If a third fault appears on screen 4, the message on the second line disappears from the screen, the message on the first line slides down to the second line and the third fault message takes the first line.
- If an alarm appears on screen 4, the message relating to that alarm will not appear.
- If a new alarm appears on screen 5, the message relating to that alarm will replace the alarm message on the second line.

8.2. Removing messages on screen

- If all the faults, displayed on screen or not, are no longer active (circuit-breaker pressed in, emergency stop unlocked, logical input inactive, connection restored, ...), press the **Reset** button to reset the last fault present on screen or in other words, the last recorded fault. This way, the previous fault(s) is/are moved forward one line.

The example below shows the screen changes with two faults displayed on screen and one fault not displayed but recorded. In order of appearance, the following faults are:
- Module 3 CAN
- Emergency stop
- Day tank low fuel level

The three faults are considered as no longer active (fuel level above low level, emergency stop unlocked, CAN connection restored on the option 3 module).

Ph./ph.	U12	0
voltages	U23	0
(Volts)	U31	0
Fault Low Fuel Level		
Fault Emergency Stop		
ext command=1		17:45
gen stopped	12/01/00	

Messages **Fault Low Fuel Level** and **Fault Emergency stop** are then displayed. Press **Reset** to reset the low fuel level fault (the message disappears).

Ph./ph.	U12	0
voltages	U23	0
(Volts)	U31	0
Fault Emergency Stop		
Fault module 3 CAN		
ext command=1		17:46
gen stopped	12/01/00	

The message **Fault module 3 CAN** then appears on the second line (see screen opposite).
Press **Reset** to reset the emergency stop fault (the message disappears).

Ph./ph.	U12	0
voltages	U23	0
(Volts)	U31	0
Fault module 3 CAN		
ext command=1		17:47
gen stopped	12/01/00	

The message **Fault module 3 CAN** then appears on the second line (see screen opposite).
Press **Reset** to reset the emergency stop fault (the message disappears).

Ph./ph.	U12	
voltages	U23	
(Volts)	U31	
ext command=1		17:48
gen stopped	12/01/00	

There are no more faults but is still in **Stop** mode. As the external command is still available, the operator must select the **Auto** mode for the generating set to restart automatically.

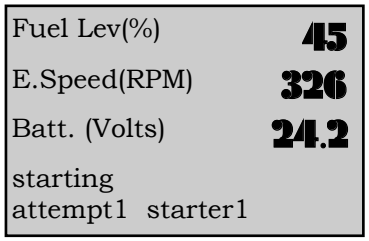
- An alarm message will automatically disappear when the alarm input is no longer in logical status 1.

9. DISPLAYING THE STATUS MESSAGES

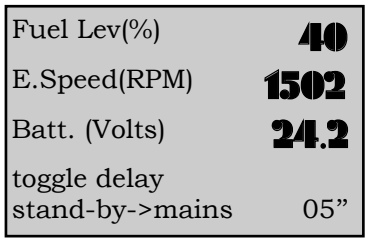
All status relating to the operation of the generating set and its auxiliaries are clearly viewed on the two lower lines.
As well as the date and time, the operator will be able to view:
- Operating mode selected (**Stop**, **Manu**, **Auto**, **Test**)
- Water heater control logical status (active or inactive)
- External command logical status (0 or 1)
- built-in mains failure and mains return delays
- Generating set status (genset on stand-by, stopped or running)
- Engine preglow period
- Cranking period (with attempt number and starter number)
- Starter rest period between two starting attempts, with possible indication of engine preglow
- Starter tripping (indicating starter number)
- RPM and Volts stabilising period
- Authorisation to close the Stand-by contactor in **Manu** mode

- ATS toggle delay: Mains➔Stand-by and Stand-by➔Mains, and closure confirmation of the Mains and Stand-by contactors- Motorised C/B opening and closure
- Engine cooling down time in **Auto** mode
- Operating time in **Test** mode
- Delayed shutdown on water temperature fault or overload/short-circuit fault
- Appearance of commands ; EJP J-1, EJP advance warning, EJP start-up
- Clock activated operation indicating time range number
- Shutdown bypass via switch (complying with French standard NFC 61940))

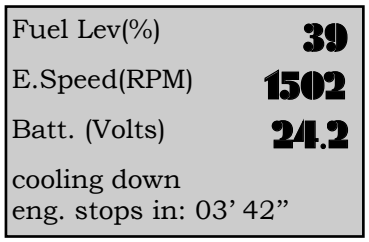
The three screens below show three examples of status messages displayed over the two last lines.



Starting period: attempt 1 on starter 1



S➔N toggle: Toggle from Stand-by contactor to Mains contactor in 5 seconds



Engine cooling down: Engine to stop in 3 minutes and 42 seconds in **Auto** mode

APPENDIX - SOFTWARE VERSION 1.05E OR LATER: "INTERNATIONAL" LANGUAGE

1 - Introduction

Software version 1.05E or later used with interface boards CB and CB12 enable you to use the Intellisys in a language which is different from the four standard languages already implemented. This language is based on the use of pictograms. Compatibility is ensured with the old interface boards. This means it is possible to reprogram, on site, an interface board having software index 1.01B or 1.04D with a software having an index 1.05E. However, use of a software version 1.05E requires a display defined for software version 1.2 (see paragraph 2).

2 - Starting up the Intellisys

When the Intellisys is powered up, the initialization screen indicates the display software version.
The initialization phase takes no more than 5 seconds.

Note: A display flashed to version 1.2 can be used with no problem with an interface board version 2.01B or 1.04D.

Next, the language selection screen is displayed. The cursor flashes by default on "International". If no action is taken while the four squares are displayed in the small overlaid window, the Intellisys automatically goes to the international language.

You then have around 6 seconds to change the language by pressing the ➔ button then the **Enter** or **Exit** (*) buttons.

(*) By pressing the **Enter** button, the selected language is stored, meaning that the next time the unit is powered up, the cursor will automatically go to the previously selected language. In addition, by pressing the **Enter** button, the system goes to the next screen to modify the date and time.
(*) If you press the **Exit** key, the selected language is not stored in memory. The next time the unit is powered up, the cursor will automatically be positioned on the international language.

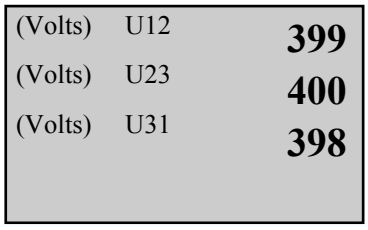
3 - Modifying display with international language

When the international language is selected on power up or during use:
- The time and date are no longer displayed on the screen. The time-stamped record of alarms, faults and statuses is however preserved.
- The comfort messages described in paragraph 9 of the user instructions manual, levels 1, 2 or 3, disappear. These messages are displayed on the last two lines of the screen.
- The alarms and/or faults are no longer displayed in plain language on the screen on the two lines located directly above the comfort messages, but are displayed in the form of codes in place of the time and date (see list of codes in paragraph 6).
- When an alarm or fault appears, the size of the electrical and mechanical value displays are not compressed.
- The programming display screens are accessed in the same way, the only difference is that all the screens are systematically in English.

4 - Display of electrical values

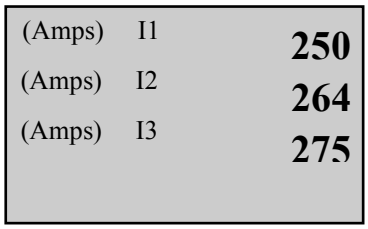
To facilitate understanding, the electrical values are not represented by pictograms.

■ Press the **V** button to display the line voltages and the single voltages by pressing the button successively.



The notations such as **U12**, **U23**, **U31**, etc. are preserved. For more information concerning the meaning of the notations, refer to the user paragraph 4.1. The Volt is the unit of measurement for the electrical voltages at the alternator terminals (screen display: **Volts**).

■ Press the **A** button to display the phase currents and the neutral current by pressing the button successively.



The notations such as **I1**, **I2**, **I3**, In, etc. are preserved. For more information concerning the meaning of the notations, refer to the user paragraph 4.2.

(Amps) In	22

The Ampere is the unit if measurement of the currents output by the alternator (screen display: **Amps**).

- Press the **Hz** key to display the generating set frequency and running hours and minutes.

(Symbol 1) (Hz)	50.2
(Symbol 2)	643
(Symbol 2)	45

Hz is the abbreviation for **Hertz**. Symbols 1 and 2 are represented in the table below.

Symbol number	Pictogram	Description
Symbol 1 (sinewave)		frequency of voltage output by alternator
Symbol 2 (hourglass)		number of generating set running hours and minutes

5 - Display of mechanical values

By pressing the Engine button successively, the following is displayed: oil pressure, water temperature, oil temperature, battery voltage, engine speed and fuel remaining in daily tank.

(symbol 3) (%)	50
(symbol 4) (RPM)	1500
(symbol 5) (Volts)	24.2

The notations: %, RPM and Volts are preserved. For more information on the meaning of the notations, refer to the user paragraph 5.

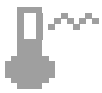
(symbol 6) (Bars)	6
(symbol 7) (°C)	90
(symbol 8) (°C)	75

The notations: Bars and C° are preserved. For more information on the meaning of the notations, refer to the user paragraph 5.

A third screen can be accessed using the **Engine** button with Anglo-Saxon notations for the oil pressure (PSI), the water temperature (°F) and the oil temperature (°F).

Note: if the oil temperature is not selected (Sensors menu) or if the analog pack has not been selected, the symbol(s) will not appear on the screen.

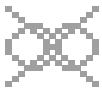
All the symbols related to the engine parameters are represented in the table below.

Symbol number	Pictogram	Description
Symbol 3 (fuel pump)		Fuel level in daily tank
Symbol 4 (galvanometer)		Engine speed
Symbol 5 (generating set battery)		Battery voltage
Symbol 6 (oil can)		Engine oil pressure
Symbol 7 (thermometer with oil drop)		Engine oil temperature
Symbol 8 (thermometer with cooling fluid level)		Cooling fluid temperature

6 - Other symbols

■ Loss of system voltage (symbol 9)

Loss of the system voltage (or loss of mains) is represented on the screen by a crossed-out transformer. The micro-cutout time-delay (parameter 103 of **Timing** menu) is displayed next to this symbol and decrements automatically from the adjustment setting to 0.



(symbol 3) (%)	**50**
(symbol 4) (RPM)	**0**
(symbol 5) (Volts)	**24.2**
(symbol 9) : 12"	

Example of screen showing system voltage is no longer available. 12 seconds remain prior to startup of the generating set (micro-cutout time delay).

■ Return of system voltage (symbol 10)

Return of the system voltage (or mains voltage) is represented on the screen by a transformer. The mains return time delay (parameter 104 of Timing menu) is displayed next to this symbol and decrements automatically from the adjustment setting to 0.

(Amps) 11	**645**
(Amps) 12	**680**
(Amps) 13	**653**
(symbol 10) : 2" 15"	

Example of screen showing system voltage is again available. Two minutes and fifteen seconds remain prior to automatic switchover from the generating set to the system (mains return time delay).

Note: The two previous symbols can only be displayed provided the type 2 control parameter is at 1 (see user paragraph 2.1.1).

■ Spark plug preheating (symbol 11)
If the generating set is ready to be started on an external command and if the "spark plug preheating" parameter is set to 1 (Factory menu), a symbol representing a solenoid appears on the screen during the spark plug preheating period prior to the first startup and also between two startup attempts.

(symbol 3) (%)	**50**
(symbol 4) (RPM)	**0**
(symbol 5) (Volts)	**24.2**
(symbol 11)	

Example of screen showing that spark plug preheating is in operation; generating set will start in a few seconds.

■ Engine cooling (symbol 12)
When the mains return time delay is completed, the emergency contactor opens, the normal contactor closes and the engine begins its cooling period which is displayed by the symbol shown opposite. The cooling time delay (parameter 10 of timing menu) is displayed next to the symbol and decrements automatically from the adjustment setting to 0.

(Volts) U12	**399**
(Volts) U23	**400**
(Volts) U31	**398**
(symbol 12) : 3" 10"	

Example of screen showing that three minutes and ten seconds remain for cooling of the generating set prior to complete shutdown.

7 - Alarms and fault codes

The alarms and faults are displayed on the right hand side of the two lower lines. As a general rule, a fault or alarm is displayed on the screen as follows:

XX-Y XX is a number between 00 and 99
Y takes two values: 0 to indicate an alarm, 1 to indicate a fault (same method used in **Options** menu).

Special case 1: for a single number, it is possible to display: XX-0 or XX-1. This means that the **Options** menu must be programmed to have one or the other on the screen.
Special case 2: if the alarm or fault are possible at the same time (two different sensors used on engine), the XX numbers are different (example: engine oil pressure fault = 02-1, engine oil pressure alarm = 64-0).
Note: When the word "impossible" appears in the table on the following page, this means that the alarm or fault does not exist (example: generating set emergency stop only managed for fault and not for alarm).

(symbol 3) (%)	**50**
(symbol 4) (RPM)	**0**
(symbol 5) (Volts)	**24.2**
	06-1

Example of screen showing "overload or short-circuit" fault designated 06-1.

(Volts) U12	**380**
(Volts) U23	**382**
(Volts) U31	**381**
	12-0

Example of screen showing "alternator min voltage " alarm designated **12-0**.

(símbolos 3) %	**50**
(símbolos 4) RPM	**0**
(símbolos 5) Volts	**24.2**
	00-1
	08-0

Example of screen showing "max. battery voltage" alarm designated **08-0** and "emergency stop" fault designated **00-1**.

The alarms and faults are displayed in the same way as for versions 0.01B and 1.04D:

- Up to two codes (max.) displayed on screen
- Fault takes priority over alarm
- Faults are reset in order of appearance

For more details, refer to paragraph 8.
All the alarms and faults which can appear on the Intellisys screen are listed in the table below.a.

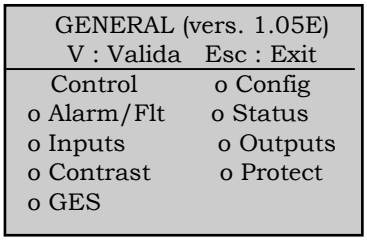
Wording	Alarm	Fault	Generated on
Generator set emergency stop	impossible	00-1	CB, CB12
External emergency stop	impossible	01-1	CB, CB12
Engine oil pressure	impossible	02-1	CB, CB12
Engine water temperature	impossible	03-1	CB, CB12
Daily fuel tank level low	04-0	04-1	CB, CB12
Radiator water level low	impossible	05-1	CB, CB12
Alternator overload or short-circuit	06-0	06-1	CB, CB12
Engine overspeed	impossible	07-1	CB, CB12
Min. battery voltage	08-0	08-1	CB, CB12
Max. battery voltage	09-0	09-1	CB, CB12
Lithium battery absent	10-0	impossible	CB, CB12
Generator set no start	impossible	11-1	CB, CB12
Min. alternator voltage	12-0	12-1	CB, CB12
Max. alternator voltage	13-0	13-1	CB, CB12
Min. alternator frequency	14-0	14-1	CB, CB12
Max. alternator frequency	15-0	15-1	CB, CB12
Option 3 module CAN bus	impossible	16-1	CB, CB12
Option 4 module CAN bus	impossible	17-1	CB12
Option 5 module CAN bus	impossible	18-1	CB12
Option 6 module CAN bus	impossible	19-1	CB12
Spare			
RS485 communication	21-1	impossible	CB, CB12
Hardware watchdog	impossible	22-1	CB, CB12
Spare			
Spare			
Normal contactor open (system side)	25-0	impossible	CB, CB12
Emergency contactor open (generating set side)	26-0	impossible	CB, CB12
Oil temperature	impossible	27-1	CB, CB12
Oil level low	impossible	28-1	CB12
No water preheating	29-0	29-1	CB12
Differential trigger	30-0	30-1	CB12
Permanent insulation monitor trigger	31-0	31-1	CB12
Differential relay connection	impossible	32-1	CB12
Permanent insulation monitor connection	impossible	33-1	CB12
Battery charger fault	34-0	34-1	CB12
Air cooler trip	impossible	35-1	CB12
Air cooler low level	impossible	36-1	CB12
Fuel pump 1 trip	37-0	37-1	CB12
Retention tank	38-0	38-1	CB12
Fuel tank low level	39-0	39-1	CB12
Water flow	impossible	40-1	module 3
Fire detection	impossible	41-1	module 3
Oil leak	impossible	42-1	module 3
Fuel leak	impossible	43-1	module 3
Air cooler compartment door open	impossible	44-1	module 3
MCPS door open	impossible	45-1	module 3
Main circuit breaker open	46-0	46-1	module 3
Overload	47-0	impossible	CB12
MTU engine oil pressure	impossible	48-1	module 5
MTU engine HV water temperature	impossible	49-1	module 5
MTU engine overspeed	impossible	50-1	module 5
MTU engine general fault	impossible	51-1	module 5

Wording	Alarm	Fault	Generated on
MTU engine general alarm	52-0	impossible	module 5
QST30 engine overspeed	impossible	53-1	module 5
QST30 engine general fault	impossible	54-1	module 5
QST30 engine general alarm	55-0	impossible	module 5
Engine oil high level	56-0	impossible	module 4
Engine oil high level	impossible	57-1	module 4
Startup battery min. voltage	58-0	impossible	module 4
Startup battery charger	59-0	impossible	module 4
MX coil	impossible	60-1	module 4
Damping valve	impossible	61-1	module 4
Starter air pressure	62-0	impossible	module 4
Magneto-thermal relay	63-0	impossible	module 4
Engine oil pressure	64-0	impossible	module 4
Engine water temperature	65-0	impossible	module 4
Engine oil temperature	66-0	impossible	module 4
Fuel low level (combined in option No. 16)	67-0	impossible	module 4
Fuel high level	68-0	impossible	module 4
Fuel very low level	impossible	69-1	module 4
Fuel very high level	impossible	70-1	module 4
Oil low level	71-0	impossible	module 4
Cylinder head temperature	impossible	72-1	module 4
Thermostat water inlet temperature	impossible	73-1	module 4
No water circulation	impossible	74-1	module 4
Bearing temperature	75-0	impossible	module 4
Bearing temperature	impossible	76-1	module 4
Stator temperature	77-0	impossible	module 4
Stator temperature	impossible	78-1	module 4
Fuel pump 2 trip	79-0	79-1	module 4

(*) Special case: the "engine oil high level" indication is possible as an alarm and as a fault with two different numbers (56-0 and 57-1).

8 - Access to programming and language change functions

The programming/browsing functions are always accessed using the **Menu** button. However, the various menus and parameters are always displayed in English only (when international language is selected).



The software version number appears on the first line next to **GENERAL**. All the texts are in English.

By pressing the **Menu** button for at least three seconds, the first screen is displayed to allow you to change the language, and possibly the time and date.

Use and maintenance manual

John – Deere
POWERTECH
4.5L & 6.8L
4045 and 6068
OEM Diesel Engines

Réf. constructeur : OMRG25204

Réf. GPAO : 33522039401

Introduction

Foreword

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 both metric and customary U.S. unit equivalents. Use only correct replacement parts and fasteners. Metric and inch fasteners may require a specific metric or inch wrench.

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.

WRITE ENGINE SERIAL NUMBERS and option codes in the spaces indicated in the Record Keeping 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.

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

CERTAIN ENGINE ACCESSORIES such as radiator, air cleaner, and instruments are optional equipment on John Deere OEM Engines. These accessories may be provided by the equipment manufacturer instead of John Deere. This operator's manual applies only to the engine and those options available through the John Deere distribution network.

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.

OMRGOEM,IFC –19–12JAN99–1/1

John Deere Engine Owner:

Don't wait until you need warranty or other service to meet your local John Deere Engine Distributor or Service Dealer.

Learn who he is and where he is. At your first convenience, go meet him. He'll want to get to know you and to learn what your needs might be.

Utilisateurs De Moteurs John Deere:

N'attendez pas d'être obligé d'avoir recours a votre Concessionnaire ou Point de Service le plus proche pour vous adresser a lui.

Renseignez-vous des que possible pour l'identifier et le localiser. A la premiere occasion, prenez contact avec lui et faites-vous connaître. Il sera lui aussi heureux de faire votre connaissance et de savoir que vous pourrez compter sur lui le moment venu.

An Den Besitzer Des John Deere Motors:

Warten Sie nicht auf einen evt. Reparaturfall um den nächstgelegenen John Deere Händler kennen zu lernen.

Machen Sie sich bei ihm bekannt und nutzen Sie sein "Service Angebot".

Proprietario Del Motore John Deere:

Non aspetti fino a quando ha bisogno della garanzia o di un altro tipo di assistenza per incontrarsi con il Suo Concessionario che fornisce l'assistenza tecnica.

Impari a conoscere chi è e dove si trova. Alla Sua prima occasione cerchi d'incontrarlo. Egli desidera farsi conoscere e conoscere le Sue necessità.

Propietario De Equipo John Deere:

No espere hasta necesitar servicio de garantía o de otro tipo para conocer a su Distribuidor de Motores John Deere o al Concesionario de Servicio.

Entérese de quién es, y dónde está situado. Cuando tenga un momento, vaya a visitarlo. A él le gustará conocerlo, y saber cuáles podrían ser sus necesidades.

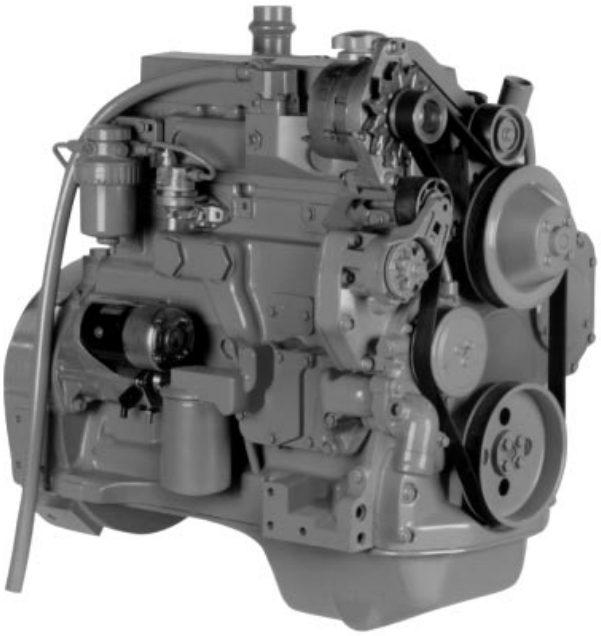
John Deere MotorÄgare:

Vänta inte med att besöka Din John Deere återförsäljare till dess att Du behöver service eller garanti reparation.

Bekanta Dig med var han är och vem han är. Tag första tillfälle att besöka honom. Han vill också träffa Dig för att få veta vad Du behöver och hur han kan hjälpa Dig.

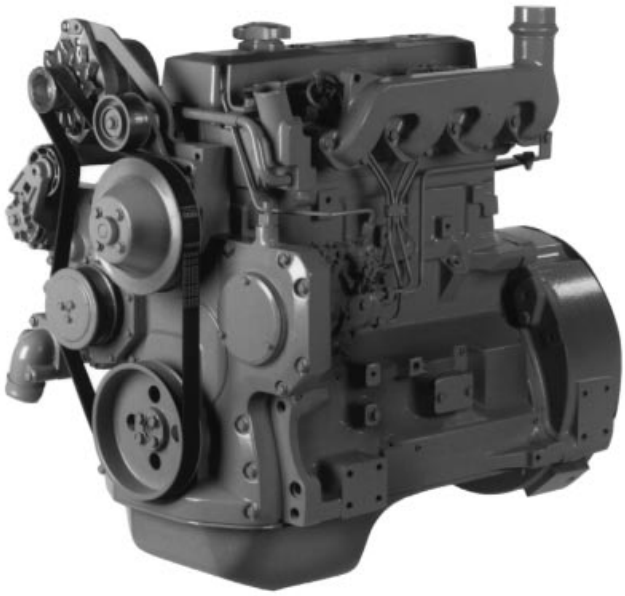
DPSG,OUOE003,2739 –19–12JAN99–1/1

POWERTECH® 4.5 L Engines



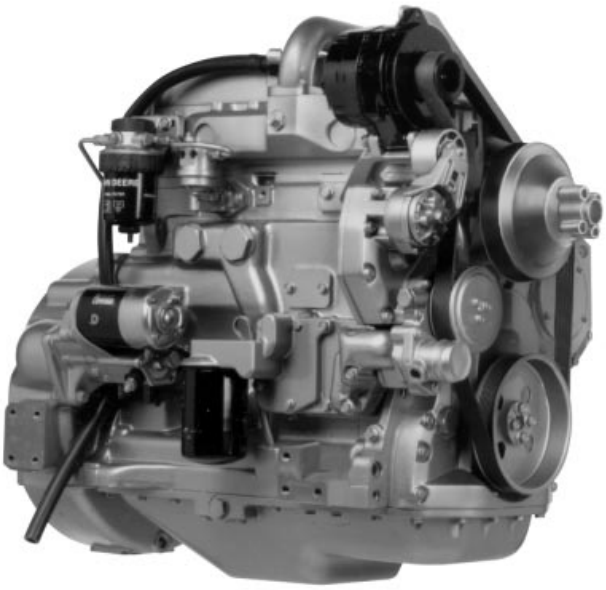
RG7999 –UN–19JUN00

4045D Engine



RG7998 –UN–19JUN00

4045D Engine



RG7996 –UN–19JUN00

4045T Engine

RG7997 –UN–19JUN00

4045T Engine

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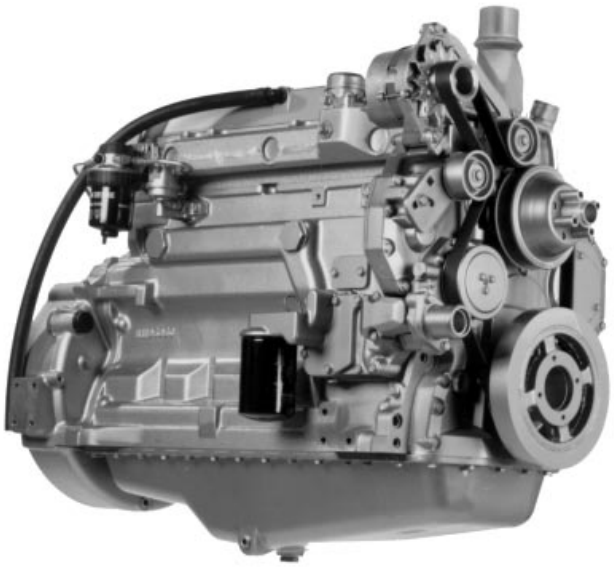
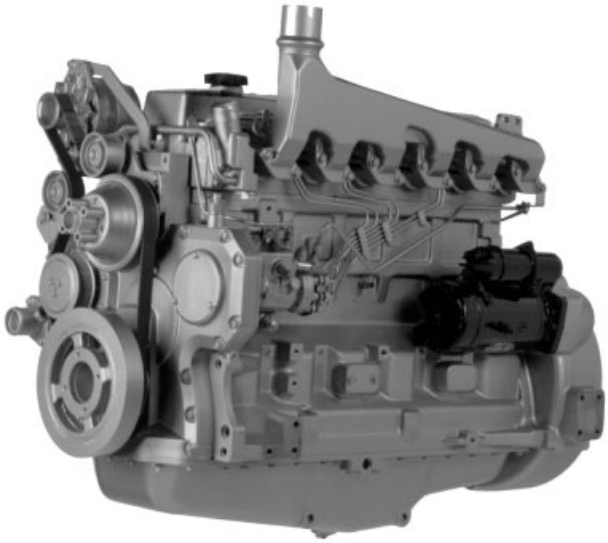
RG,RG34710,5501 –19–20MAY96–1/1

POWERTECH® 6.8 L Engines



RG8003 –UN–19JUN00

6068D Engine

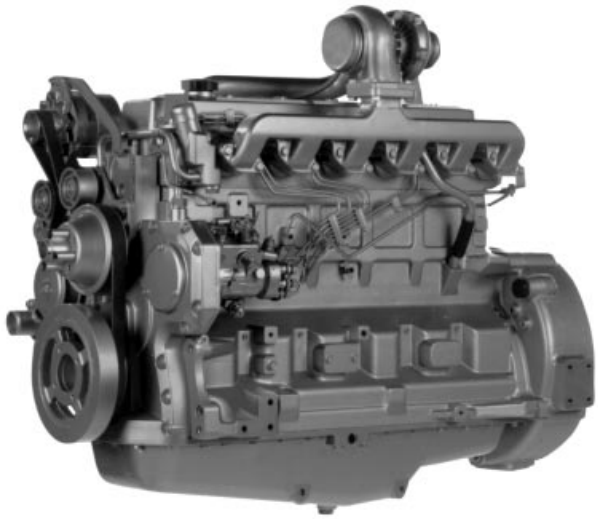


RG8002 –UN–19JUN00

6068D Engine

RG8001 –UN–19JUN00

6068T Engine



RG8000 –UN–19JUN00

6068T Engine

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RG,RG34710,5503 –19–20MAY96–1/1

Contents

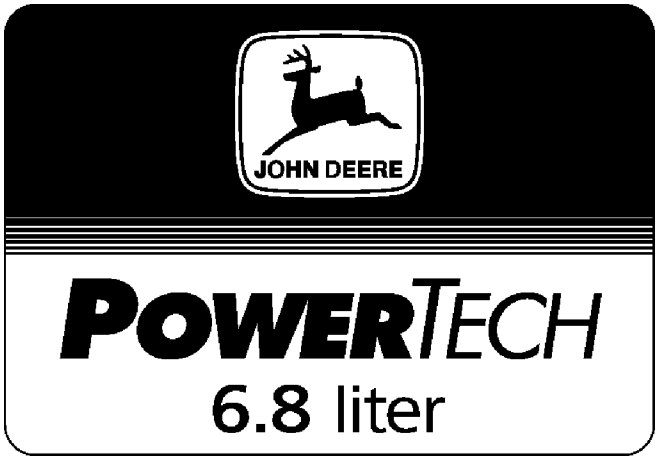
Continued on next page

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.

POWERTECH® Medallion

A medallion is located on the rocker arm cover which identifies each engine as a John Deere *POWERTECH*® engine.

RG10601 –UN–19JUN00



RG10602 –UN–13JUN00

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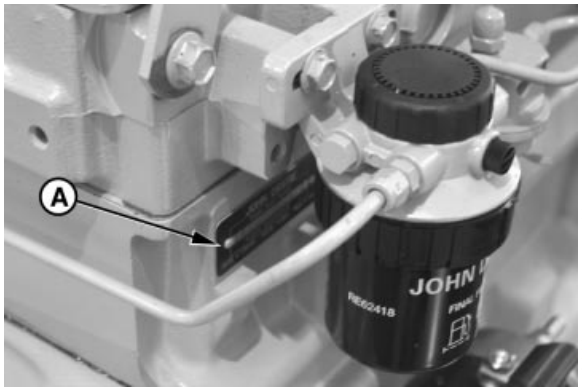
RG,RG34710,5505 –19–20MAY96–1/1

Engine Serial Number Plate

Each engine has a 13-digit John Deere engine serial number. The first two digits identify the factory that produced the engine:

- "T0" indicates the engine was built in Dubuque, Iowa
- "CD" indicates the engine was built in Saran, France
- "PE" indicates the engine was built in Torreon, Mexico

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



RG8007 –UN–15JAN99

RG,RG34710,5506 –19–20MAY96–1/1

Record Engine Serial Number

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)

_____

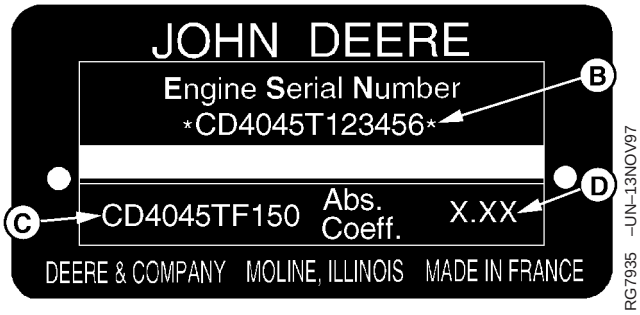
Engine Model Number(C)

_____

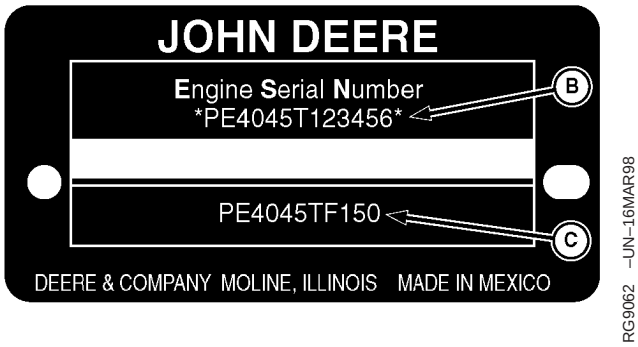
Coefficient of Absorption Value (D)
(Saran Engines Only)

_____

Dubuque Engine Serial Number Plate



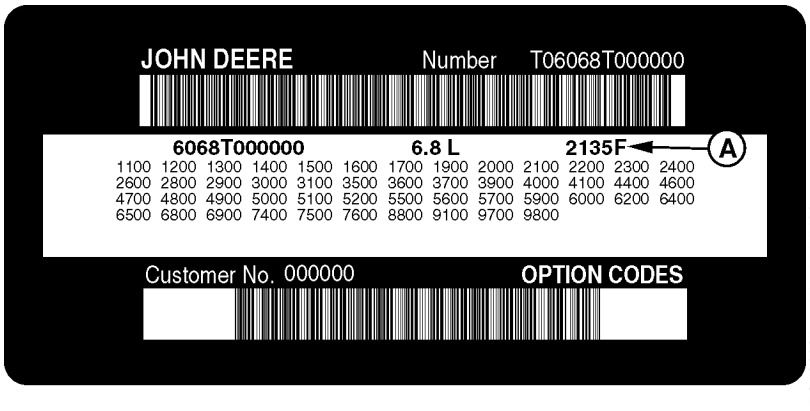
Saran Engine Serial Number Plate



Torreon Engine Serial Number Plate

RG,RG34710,5507 –19–20MAY96–1/1

Engine Option Codes



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.

The engine option code label includes an engine base code (A). This base code must also be recorded along with the option codes.

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: 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.

Engine Base Code:

_____

Continued on next page

Option Codes	Description	Option Codes	Description
11	Rocker Arm Cover	45	Balancer Shaft
12	Oil Fill Inlet	46	Cylinder Block With Liners and Camshaft
13	Crankshaft Pulley	47	Crankshaft and Bearings
14	Flywheel Housing	48	Connecting Rods and Pistons
15	Flywheel	49	Valve Actuating Mechanism
16	Fuel Injection Pump	50	Oil Pump
17	Air Inlet	51	Cylinder Head With Valves
18	Air Cleaner	52	Auxiliary Gear Drive
19	Oil Pan	55	Shipping Stand
20	Water Pump	56	Paint Option
21	Thermostat Cover	57	Water Pump Inlet
22	Thermostat	59	Oil Cooler
23	Fan Drive	60	Add-on Auxiliary Drive Pulley
24	Fan Belt	62	Alternator Mounting Bracket
25	Fan	64	Exhaust Elbow
26	Engine Coolant Heater	65	Turbocharger
27	Radiator	66	Temperature Switch
28	Exhaust Manifold	67	Electronic Tachometer Sensor
29	Ventilator System	68	Damper
30	Starting Motor	69	Engine Serial Number Plate
31	Alternator	74	Air Conditioner Compressor Mounting
32	Instrument Panel	75	Air Restriction Indicator
33	Tachometer	76	Oil Pressure Switch
35	Fuel Filter	78	Air Compressor
36	Front Plate	81	Water Separator
37	Fuel Transfer Pump	86	Fan Pulley
39	Thermostat Housing	87	Belt Tensioner
40	Oil Dipstick	88	Oil Filter
41	Belt-Driven Front Auxiliary Drive	95	Special Equipment (Factory Installed)

Continued on next page

Option Codes	Description	Option Codes	Description
43_____	Starting Aid	97_____	Special Equipment (Field Installed)
44_____	Timing Gear Cover With Gears	98_____	Shipping

RG,RG34710,5508 –19–20MAY96–3/3

Record PTO Serial Number

Serial number and model number are located on cover plate (arrow) of PTO housing. Record the numbers in the following spaces:

Serial Number

_____

Model Number

_____

RG4622 –UN–15DEC88

RG,RG34710,5510 –19–20MAY96–1/1

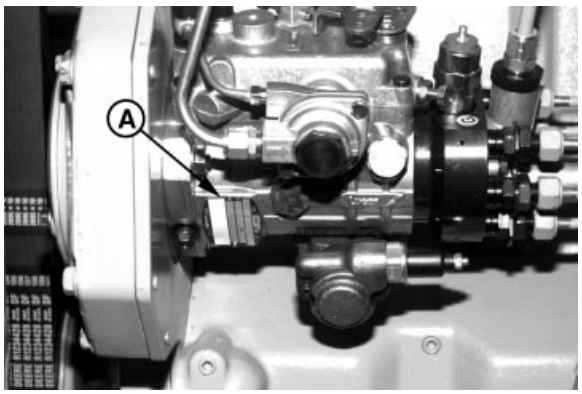
Record Fuel Injection Pump Model Number

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

Model No._____ | RPM_____

Manufacturer's No._____

Serial No._____



RG8008A –UN–13JUN00

RG,RG34710,5511 –19–20MAY96–1/1

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

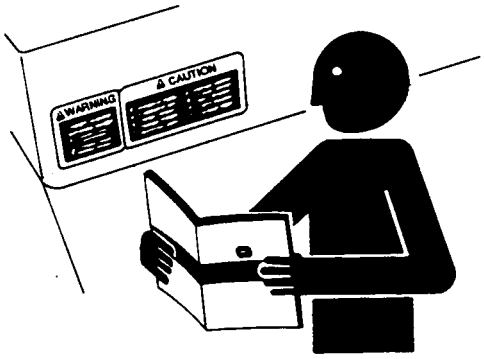
Follow Safety Instructions

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.

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.

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

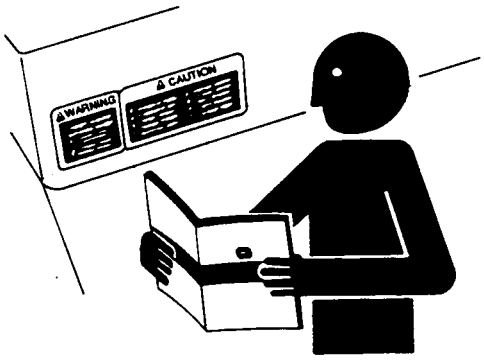


TS201 –UN–23AUG88

DX,READ –19–03MAR93–1/1

Replace Safety Signs

Replace missing or damaged safety signs. See the machine operator's manual for correct safety sign placement.



TS201 –UN–23AUG88

DX,SIGNS1 –19–04JUN90–1/1

Prevent Bypass Starting

Avoid possible injury or death from engine runaway.

Do not start engine by shorting across starter terminal. Engine will start with PTO engaged if normal circuitry is bypassed.

Start engine only from operator's station with PTO disengaged or in neutral.

RG5419 –UN–28FEB89

RG,RG34710,7508 –19–30JUN97–1/1

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

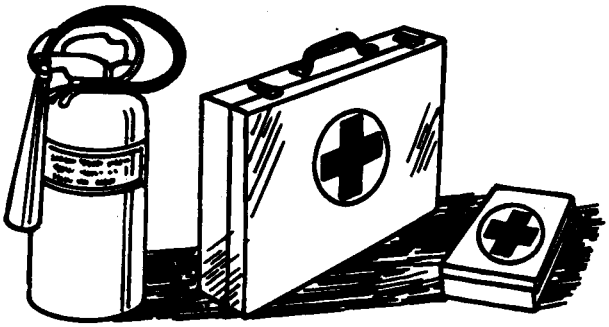
DX,FIRE1 –19–03MAR93–1/1

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

Handle Fluids Safely—Avoid Fires

When you work around fuel, do not smoke or work near heaters or other fire hazards.

Store flammable fluids away from fire hazards. Do not incinerate or puncture pressurized containers.

Make sure engine is clean of trash, grease, and debris.

Do not store oily rags; they can ignite and burn spontaneously.

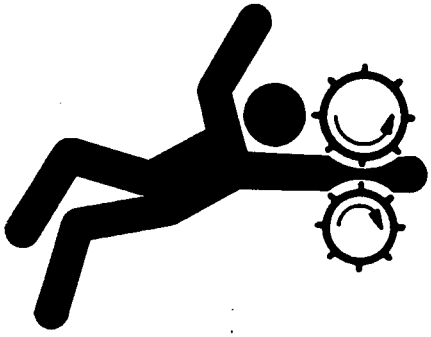
TS227 –UN–23AUG88

DX,FLAME –19–29SEP98–1/1

Service Engines Safely

Tie long hair behind your head. Do not wear a necktie, scarf, loose clothing, or necklace when you work near engine tools or moving parts. If these items were to get caught, severe injury could result.

Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.



TS228 –UN–23AUG88

DX,LOOSE –19–04JUN90–1/1

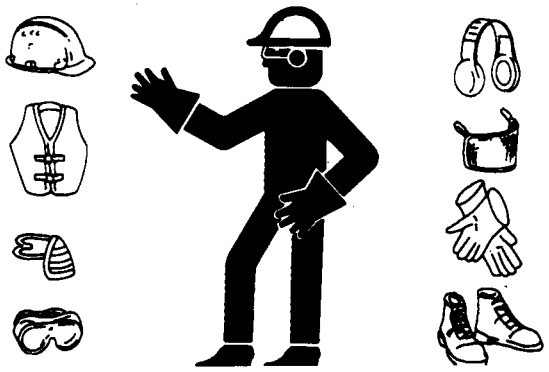
Wear Protective Clothing

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.



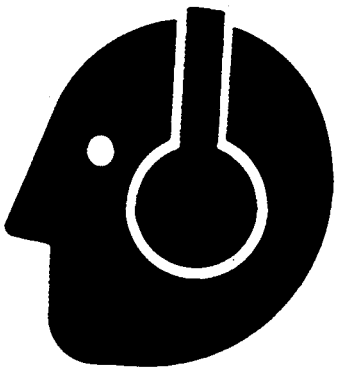
TS206 –UN–23AUG88

DX,WEAR –19–10SEP90–1/1

Protect Against Noise

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

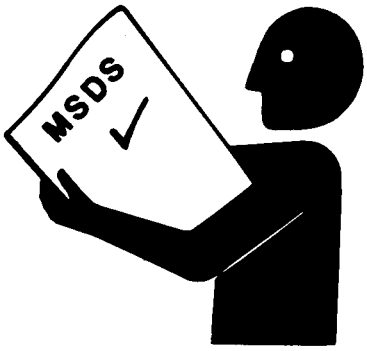
Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.



TS207 –UN–23AUG88

DX,NOISE –19–03MAR93–1/1

Handle Chemical Products Safely



TS1132 –UN–26NOV90

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.)

DX,MSDS,NA –19–03MAR93–1/1

Stay Clear of Rotating Drivelines

TS1644 –UN–22AUG95

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 PTO driveline is stopped before making adjustments, connections, or cleaning out PTO driven equipment.

DX,PTO –19–12SEP95–1/1

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.

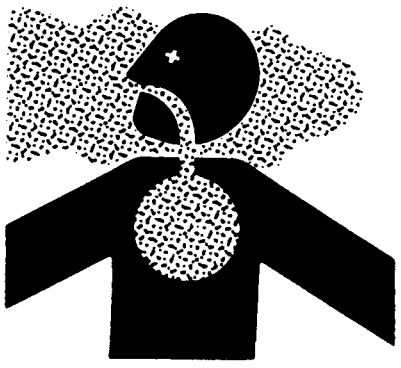
TS218 –UN–23AUG88

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

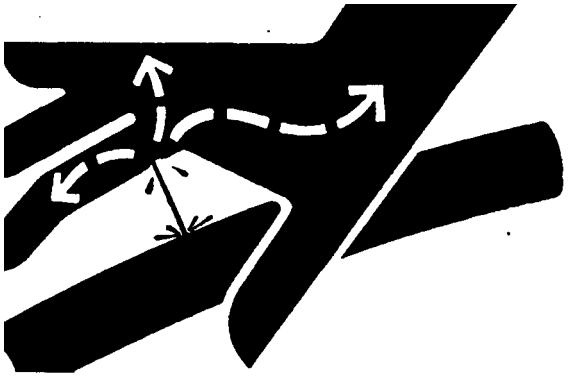
Avoid High-Pressure Fluids

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 from Deere & Company Medical Department in Moline, Illinois, U.S.A.



X9811 –UN–23AUG88

DX,FLUID –19–03MAR93–1/1

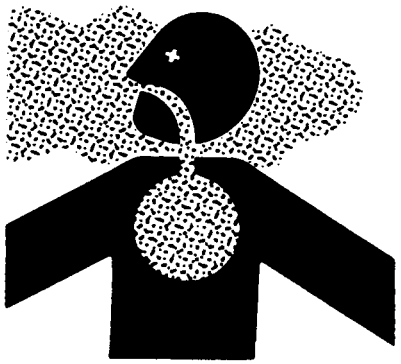
Avoid Heating Near Pressurized Fluid Lines

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 be accidentally cut when heat goes beyond the immediate flame area.

TS953 –UN–15MAY90

DX,TORCH –19–03MAR93–1/1

Remove Paint Before Welding or Heating



TS220 –UN–23AUG88

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:

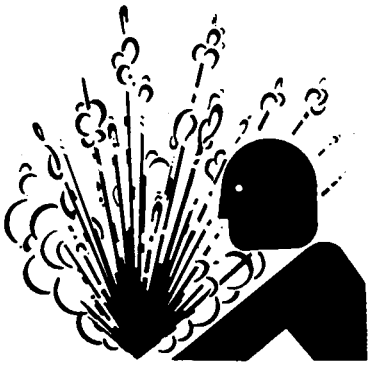
- Remove paint a minimum of 76 mm (3 in.) from area to be affected by heating.
- If you sand or grind paint, avoid breathing the dust. Wear an approved respirator.
- If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

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

Dispose of paint and solvent properly.

DX,PAINT –19–22OCT99–1/1

Service Cooling System Safely



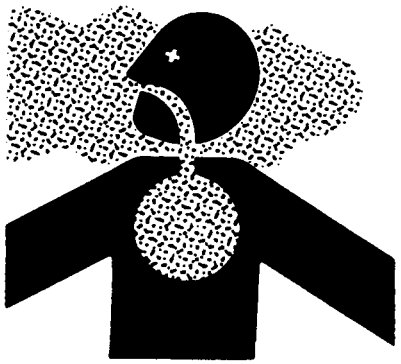
TS281 –UN–23AUG88

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.

DX,RCAP –19–04JUN90–1/1

Avoid Harmful Asbestos Dust



TS220 –UN–23AUG88

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.

Keep bystanders away from the area.

DX,DUST –19–15MAR91–1/1

Prevent Battery Explosions

TS204 –UN–23AUG88

Keep sparks, lighted matches, and open flame away from the top of battery. Battery gas can explode.

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

Do not charge a frozen battery; it may explode. Warm battery to 16°C (60°F).

DX,SPARKS –19–03MAR93–1/1

Prevent Acid Burns

Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, eat holes in clothing, and cause blindness if splashed into eyes.

Avoid the hazard by:

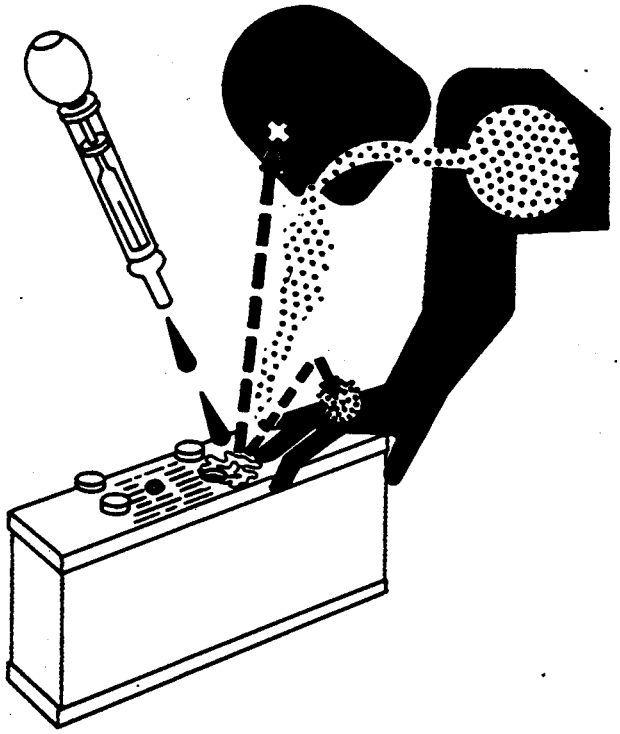
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Use proper jump start procedure.

If you spill acid on yourself:

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

If acid is swallowed:

1. Do not induce vomiting.
2. Drink large amounts of water or milk, but do not exceed 2 L (2 quarts).
3. Get medical attention immediately.



TS203 –UN–23AUG88

DX,POISON –19–21APR93–1/1

Protect Against High Pressure Spray

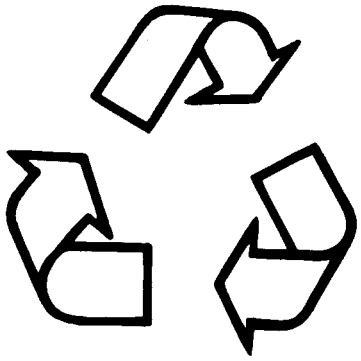
Spray from high pressure nozzles can penetrate the skin and cause serious injury. Keep spray from contacting hands or body.

If an accident occurs, see a doctor immediately. Any high pressure spray 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 from Deere & Company Medical Department in Moline, Illinois, U.S.A.

TS1343 –UN–18MAR92

DX,SPRAY –19–16APR92–1/1

Dispose of Waste Properly



TS1133 –UN–26NOV90

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.

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.

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

Cetane number of 40 minimum. Cetane number greater than 50 is preferred, especially for temperatures below -20°C (-4°F) or elevations above 1500 m (5000 ft).

Cold Filter Plugging Point (CFPP) below the expected low temperature OR **Cloud Point** at least 5°C (9°F) below the expected low temperature.

Fuel lubricity should pass a minimum of 3100 gram load level as measured by the BOCLE scuffing test.

Sulfur content:

- Sulfur content should not exceed 0.5%. Sulfur content less than 0.05% is preferred.
- If diesel fuel with sulfur content greater than 0.5% sulfur content is used, reduce the service interval for engine oil and filter by 50%.
- DO NOT use diesel fuel with sulfur content greater than 1.0%.

Bio-diesel fuels may be used ONLY if the fuel properties meet DIN 51606 or equivalent specification.

DO NOT mix used engine oil or any other type of lubricant with diesel fuel.

DX,FUEL1 –19–24JAN00–1/1

Lubricity of Diesel Fuel

Diesel fuel must have adequate lubricity to ensure proper operation and durability of fuel injection system components.

Diesel fuels for highway use in the United States and Canada require sulfur content less than 0.05%.

Diesel fuel in the European Union requires sulfur content less than 0.05%.

Experience shows that some low sulfur diesel fuels may have inadequate lubricity and their use may reduce performance in fuel injection systems due to inadequate lubrication of injection pump components. The lower concentration of aromatic compounds in these fuels also adversely affects injection pump seals and may result in leaks.

Use of low lubricity diesel fuels may also cause accelerated wear, injection nozzle erosion or corrosion, engine speed instability, hard starting, low power, and engine smoke.

Fuel lubricity should pass a minimum of 3100 gram load level as measured by the BOCLE scuffing test.

ASTM D975 and EN 590 specifications do not require fuels to pass a fuel lubricity test.

If fuel of low or unknown lubricity is used, add John Deere PREMIUM DIESEL FUEL CONDITIONER (or equivalent) at the specified concentration.

DX,FUEL5 –19–24JAN00–1/1

Diesel Fuel Storage

Proper fuel storage is critically important. Use clean storage and transfer tanks. Periodically drain water and sediment from bottom of tank. Store fuel in a convenient place away from buildings.

IMPORTANT: DO NOT store diesel fuel in galvanized containers. Diesel fuel stored in galvanized containers reacts with zinc coating on container to form zinc flakes. If fuel contains water, a zinc gel will also form. The gel and flakes will quickly plug fuel filters, damage injection nozzles and injection pump.

DO NOT use brass-coated containers for fuel storage. Brass is an alloy of copper and zinc.

Store diesel fuel in plastic, aluminum, and steel containers specially coated for diesel fuel storage.

Avoid storing fuel over long periods of time. If fuel is stored for more than a month prior to use, or there is a slow turnover in fuel tank or supply tank, add a fuel conditioner such as John Deere PREMIUM DIESEL FUEL CONDITIONER or equivalent to stabilize the fuel and prevent water condensation. John Deere PREMIUM DIESEL FUEL CONDITIONER is available in winter and summer formulas. Fuel conditioner also reduces fuel gelling and controls wax separation during cold weather.

Consult your John Deere engine distributor or servicing dealer for recommendations and local availability. Always follow manufacturer's directions on label.

RG,RG34710,7526 –19–30JUN97–1/1

Filling Fuel Tank

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

DO NOT smoke while filling fuel tank or servicing fuel system.

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.

TS202 –UN–23AUG88

Fill fuel tank at the end of each day's operation to prevent condensation in tank. As moist air cools, condensation may form and freeze during cold weather.

RG,RG34710,7527 –19–30JUN97–1/1

Minimizing the Effect of Cold Weather on Diesel Engines

John Deere diesel engines are designed to operate effectively in cold weather.

However, for effective starting and cold weather operation, a little extra care is necessary. The information below outlines steps that can minimize the effect that cold weather may have on starting and operation of your engine. See your authorized engine distributor or servicing dealer for additional information and local availability of cold weather aids.

Use Grade No. 1-D Fuel

When temperatures fall below 5°C (40°F), Grade No. 1-D fuel is best suited for cold weather operation. Grade No. 1-D fuel has a lower cloud point and a lower pour point.

Cloud point is the temperature at which wax will begin to form in the fuel and this wax causes fuel filters to plug. **Pour point** is the temperature at which fuel begins to thicken and becomes more resistant to flow through fuel pumps and lines.

NOTE: On an average, Grade No. 1-D fuel has a lower BTU (heat content) rating than Grade No. 2-D fuel. When using Grade No. 1-D fuel you may notice a drop in power and fuel efficiency, but should not experience any other engine performance effects. Check the grade of fuel being used before troubleshooting for low power complaints in cold weather operation.

Coolant Heaters

Engine block heaters (coolant) are an available option to aid cold weather starting.

Seasonal Viscosity Oil and Proper Coolant Concentration

Use seasonal grade viscosity engine oil based on expected air temperature range between oil changes and a proper concentration of low silicate antifreeze as recommended. (See DIESEL ENGINE OIL and ENGINE COOLANT REQUIREMENTS later in this section).

Diesel Fuel Flow Additive

IMPORTANT: Treat fuel when outside temperature drops below 0°C (32°F). For best results, use with untreated fuel. Follow all recommended instructions on label.

Use John Deere Premium Diesel Fuel Conditioner (Winter) or equivalent to treat fuel during the cold weather season. This winter formulation is a combination diesel fuel conditioner and anti-gel additive.

Winterfronts

Use of fabric, cardboard, or solid winterfronts is not recommended with any John Deere engine. Their use can result in excessive engine coolant, oil, and charge air temperatures. This can lead to reduced engine life, loss of power and poor fuel economy. Winterfronts may also put abnormal stress on fan and fan drive components potentially causing premature failures.

If winterfronts are used, they should never totally close off the grill frontal area. Approximately 25% area in the center of the grill should remain open at all times. At no time should the air blockage device be applied directly to the radiator core.

Radiator Shutters

If equipped with a thermostatically controlled radiator shutter system, this system should be regulated in such a way that the shutters are completely open by the time the coolant reaches 93°C (200°F) to prevent excessive intake manifold temperatures. Manually controlled systems are not recommended.

Continued on next page

If air-to-air aftercooling is used, the shutters must be completely open by the time the intake manifold air temperature reaches the maximum allowable temperature out of the charge air cooler.

For more information, see your John Deere engine distributor or servicing dealer.

RG,RG34710,7529 –19–30JUN97–2/2

Diesel Engine Break-In Oil

New engines are filled at the factory with John Deere ENGINE BREAK-IN OIL. During the break-in period, add John Deere ENGINE BREAK-IN OIL as needed to maintain the specified oil level.

Change the oil and filter after the first 100 hours of operation of a new or rebuilt engine.

After engine overhaul, fill the engine with John Deere ENGINE BREAK-IN OIL.

If John Deere ENGINE BREAK-IN OIL is not available, use a diesel engine oil meeting one of the following during the first 100 hours of operation:

- API Service Classification CE
- ACEA Specification E1

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

IMPORTANT: Do not use PLUS-50 oil or engine oils meeting API CH-4, API CG4, API CF4, ACEA E3, or ACEA E2 performance levels during the first 100 hours of operation of a new or rebuilt engine. These oils will not allow the engine to break-in properly.

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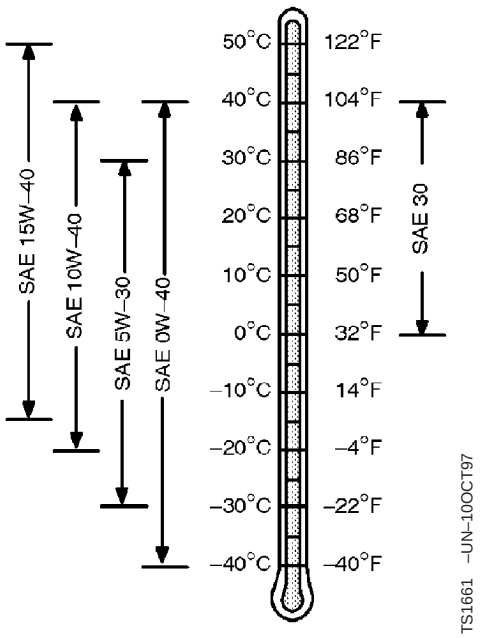
DX,ENOIL4 –19–24JAN00–1/1

Diesel Engine Oil



Use oil viscosity based on the expected air temperature range during the period between oil changes.

The following oil is preferred:

- John Deere PLUS-50®

The following oil is also recommended:

- John Deere TORQ-GARD SUPREME®

Other oils may be used if they meet one or more of the following:

- API Service Classification CH-4
- API Service Classification CG-4
- API Service Classification CF-4
- ACEA Specification E3
- ACEA Specification E2

Multi-viscosity diesel engine oils are preferred.

If diesel fuel with sulfur content greater than 0.5% is used, reduce the service interval by 50%.

Extended service intervals may apply when John Deere preferred engine oils are used. Consult your John Deere dealer for more information.

PLUS-50 is a registered trademark of Deere & Company.
TORQ-GARD SUPREME is a registered trademark of Deere & Company

DX,ENOIL –19–24JAN00–1/1

Extended Diesel Engine Oil Service Intervals

When John Deere PLUS-50® oil and the specified John Deere filter are used, the service interval for engine oil and filter changes may be increased by 50%.

If other than PLUS-50®oil and the specified John Deere filter are used, change the engine oil and filter at the normal service interval.

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DX,ENOIL6 –19–10OCT97–1/1

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 engine distributor or servicing dealer to obtain specific information and recommendations.

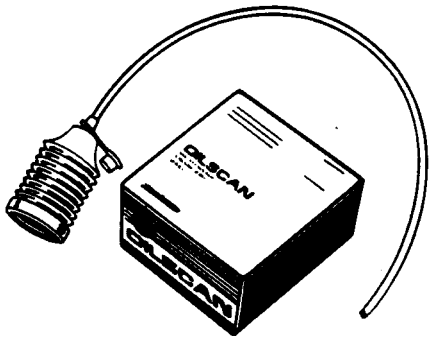
DX,LUBMIX –19–18MAR96–1/1

OILSCAN®and COOLSCAN™

OILSCAN,® OILSCAN PLUS,®and COOLSCAN™ are John Deere sampling programs to help you monitor machine performance and identify potential problems before they cause serious damage.

Oil and coolant samples should be taken from each system prior to its recommended change interval.

Check with your John Deere engine distributor or servicing dealer for the availability of OILSCAN,® OILSCAN PLUS,® and COOLSCAN™ kits.



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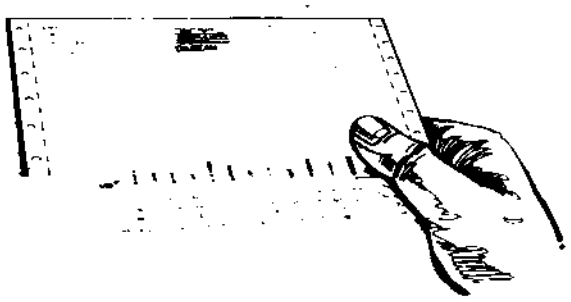

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OILSCAN is a registered trademark of Deere & Company.
COOLSCAN is a trademark of Deere & Company.
OILSCAN PLUS is a registered trademark of Deere & Company.

DX,OILSCAN –19–16APR92–1/1

Alternative and Synthetic Lubricants

Conditions in certain geographical areas may require lubricant recommendations different from those printed in this manual.

Some John Deere brand coolants and lubricants may not be available in your location.

Consult your John Deere dealer to obtain information and recommendations.

Synthetic lubricants may be used if they meet the performance requirements as shown in this manual.

The temperature limits and service intervals shown in this manual apply to both conventional and synthetic oils.

Re-refined base stock products may be used if the finished lubricant meets the performance requirements.

DX,ALTER –19–15JUN00–1/1

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

Grease

Use grease based on NLGI consistency numbers and the expected air temperature range during the service interval.

The following greases are preferred:

- John Deere SD POLYUREA GREASE

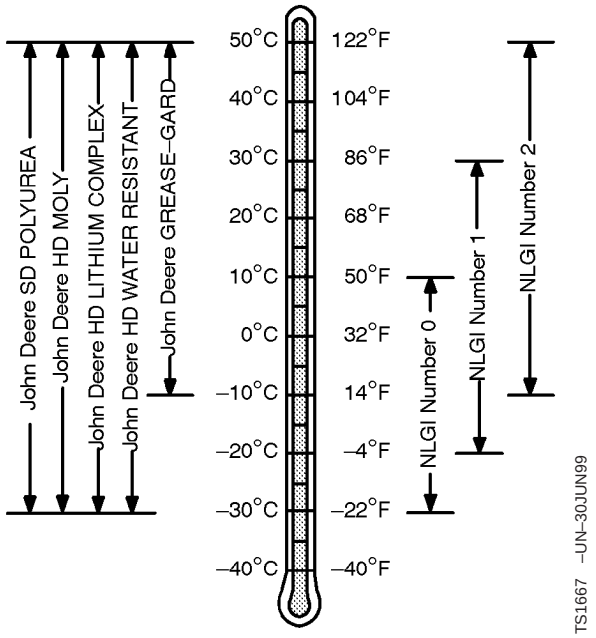
The following greases are also recommended:

- John Deere HD MOLY GREASE
- John Deere HD LITHIUM COMPLEX GREASE
- John Deere HD WATER RESISTANT GREASE
- John Deere GREASE-GARD

Other greases may be used if they meet the following:

- NLGI Performance Classification GC-LB

IMPORTANT: Some types of grease thickener are not compatible with others. Consult your grease supplier before mixing different types of grease.



DX,GREA1 –19–24JAN00–1/1

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).

The following engine coolant is preferred for service:

- John Deere COOL-GARD Prediluted Coolant

The following engine coolant is also recommended:

- John Deere COOL-GARD Coolant Concentrate in a 40 to 60% mixture of concentrate with quality water.

Other low silicate ethylene glycol base coolants for heavy-duty engines may be used if they meet one of the following specifications:

- ASTM D5345 (prediluted coolant)
- ASTM D4985 (coolant concentrate) in a 40 to 60% mixture of concentrate with quality water

Coolants meeting these specifications require use of supplemental coolant additives, formulated for heavy-duty diesel engines, for protection against corrosion and cylinder liner erosion and pitting.

A 50% mixture of ethylene glycol engine coolant in water provides freeze protection to -37°C (-34°F). If protection at lower temperatures is required, consult your John Deere dealer for recommendations.

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

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

Coolant Drain Intervals

Drain the factory fill engine coolant, flush the cooling system, and refill with new coolant after the first 3 years or 3000 hours of operation. Subsequent drain intervals are determined by the coolant used for service. At each interval, drain the coolant, flush the cooling system, and refill with new coolant.

When John Deere COOL-GARD is used, the drain interval may be extended to 5 years or 5000 hours of operation, provided that the coolant is tested annually AND additives are replenished, as needed, by adding a supplemental coolant additive.

If COOL-GARD is not used, the drain interval is reduced to 2 years or 2000 hours of operation.

DX,COOL3 –19–05FEB99–1/1

Diesel Engine Coolants, Supplemental Additive Information

Engine coolants are a combination of three chemical components: ethylene glycol (antifreeze), inhibiting coolant additives, and quality water.

Coolant Specifications

Some products, including John Deere John Deere COOL-GARD Prediluted Coolant, are fully formulated coolants that contain all three components in their correct concentrations. Do not add an initial charge of supplemental coolant additives to these fully formulated products.

Some coolant concentrates, including John Deere COOL-GARD Coolant Concentrate, contain both ethylene glycol antifreeze and inhibiting coolant additives. Mix these products and quality water, but do not add an initial charge of supplemental coolant additives.

Coolants meeting ASTM D5345 (prediluted coolant) or ASTM D4985 (coolant concentrate) require an initial charge of supplemental coolant additives.

Replenish Coolant Additives

The concentration of coolant additives is gradually depleted during engine operation. Periodic replenishment of inhibitors is required, even when John Deere COOL-GARD is used. Follow the recommendations in this manual for the use of supplemental coolant additives.

Why Use Supplemental Coolant Additives?

Operating without proper coolant additives will result in increased corrosion, cylinder liner erosion and pitting, and other damage to the engine and cooling system. A simple mixture of ethylene glycol and water will not give adequate protection.

Use of supplemental coolant additives reduces corrosion, erosion, and pitting. These chemicals reduce the number of vapor bubbles in the coolant and help form a protective film on cylinder liner surfaces. This film acts as a barrier against the harmful effects of collapsing vapor bubbles.

Avoid Automotive-Type Coolants

Never use automotive-type coolants (such as those meeting ASTM D3306 or ASTM D4656). These coolants do not contain the correct additives to protect heavy-duty diesel engines. They often contain a high concentration of silicates and may damage the engine or cooling system.

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 base engine coolant concentrate. All water used in the cooling system should meet the following minimum specifications for quality:

Chlorides	<40 mg/L
Sulfates	<100 mg/L
Total Dissolved Solids	<340 mg/L
Total Hardness	<170 mg/L
pH	5.5 to 9.0

Freeze Protection

The relative concentrations of ethylene glycol and water in the engine coolant determine its freeze protection limit.

Ethylene Glycol	Freeze Protection Limit
40%	-24°C (-12°F)
50%	-37°C (-34°F)
60%	-52°C (-62°F)

DO NOT use a coolant-water mixture greater than 60% ethylene glycol.

DX,COOL7 –19–24JAN00–1/1

Testing Diesel Engine Coolant

Maintaining adequate concentrations of glycol and inhibiting additives in the coolant is critical to protect the engine and cooling system against freezing, corrosion, and cylinder liner erosion and pitting.

Test the coolant solution at 600 hours or 12 month intervals or less and whenever excessive coolant is lost through leaks or overheating.

Coolant Test Strips

Coolant test strips are available from your John Deere engine distributor or servicing dealer. These test strips provide a simple, effective method to check the freeze point and additive levels of your engine coolant.

Compare the results to the supplemental coolant additive (SCA) chart to determine the amount of inhibiting additives in your coolant and whether more John Deere COOLANT CONDITIONER should be added.

RG7297 –UN–22SEP99

RG7397 –UN–05DEC97

COOLSCAN™

For a more thorough evaluation of your coolant, perform a COOLSCAN analysis. See your John Deere engine distributor or servicing dealer for information about COOLSCAN.

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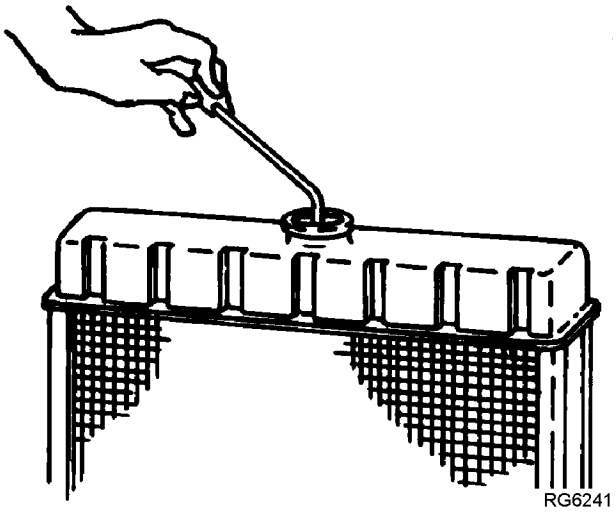
DX,COOL9 –19–17FEB99–1/1

Replenishing Supplemental Coolant Additives (SCAs) Between Coolant Changes



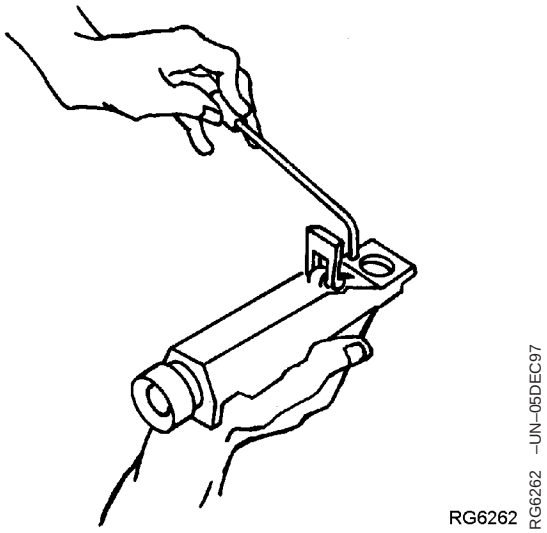
IMPORTANT: Do not add supplemental coolant additives when the cooling system is drained and refilled with John Deere Cool-Gard.

Through time and use, the concentration of coolant additives is gradually depleted during engine operation. Periodic replenishment of inhibitors is required, even when John Deere COOL-GARD is used. The cooling system must be recharged with additional supplemental coolant additives available in the form of liquid coolant conditioner.

Maintaining the correct coolant conditioner concentration (SCAs) and freeze point is essential in your cooling system to protect against rust, liner pitting and corrosion, and freeze-ups due to incorrect coolant dilution.

John Deere COOLANT CONDITIONER is recommended as a supplemental coolant additive in John Deere engines.

Test the coolant solution at 600 hours or 12 months of operation using either John Deere coolant test strips or a COOLSCAN analysis. If a COOLISCAN analysis is not available, recharge system per instructions printed on label of John Deere COOLANT CONDITIONER.



IMPORTANT: ALWAYS maintain coolant at correct level and concentration. DO NOT operate engine without coolant for even a few minutes.

If frequent coolant makeup is required, the glycol concentration should be checked with JT07298 Coolant/Battery to assure that the desired freeze point is maintained. Follow manufacturer's instructions provided with Coolant/Battery.

Add the manufacturer's recommended concentration of supplemental coolant additive. DO NOT add more than the recommended amount.

The use of non-recommended supplemental coolant additives may result in additive drop-out and gelation of the coolant.

If other coolants are used, consult the coolant supplier and follow the manufacturer's recommendation for use of supplemental coolant additives.

See ENGINE COOLANT SPECIFICATIONS earlier in this section for proper mixing of coolant ingredients before adding to the cooling system.

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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.

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 –19–18MAR96–1/1

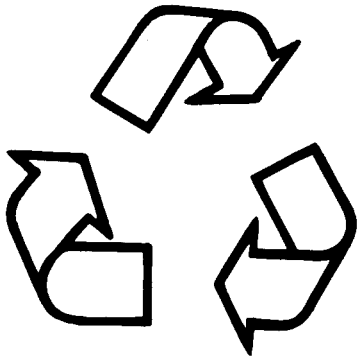
Disposing of Coolant

Improperly disposing of engine coolant can threaten the environment and ecology.

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.

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



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Instrument (Gauge) Panels

All controls and gauges are optional equipment for John Deere OEM Engines. They may be provided by the equipment manufacturer instead of John Deere. The following information applies only to those controls and gauges provided by John Deere.

IMPORTANT: Any time an electric gauge or meter does not register correctly, replace it with a new one. Do not attempt to repair it.

Two types of instrument panels are offered on 4.5 L and 6.8 L engines, as shown on this page. See following for complete information on each type of instrument panel.

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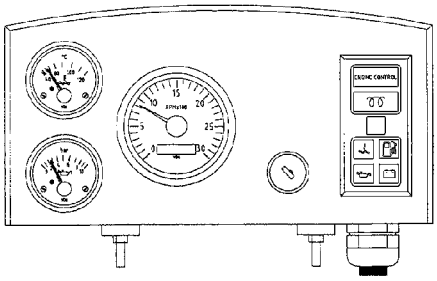
North American Instrument Panel



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VDO Instrument Panel (Except North America)

DPSG,RG34710,107 –19–18OCT99–1/1

Instrument (Gauge) Panel (North America)

All controls and gauges are optional equipment for John Deere OEM Engines. They may be provided by the equipment manufacturer instead of John Deere. The following information applies only to those controls and gauges provided by John Deere.

IMPORTANT: Any time an electric gauge or meter does not register correctly, replace it with a new one. Do not attempt to repair it.

Following is a brief description of the components on the instrument (gauge) panel:

A—Oil Pressure Gauge - This gauge indicates oil pressure. It also has an adjustable electrical contact which activates the safety switch when oil pressure goes below the pressure set point. This will automatically stop the engine.

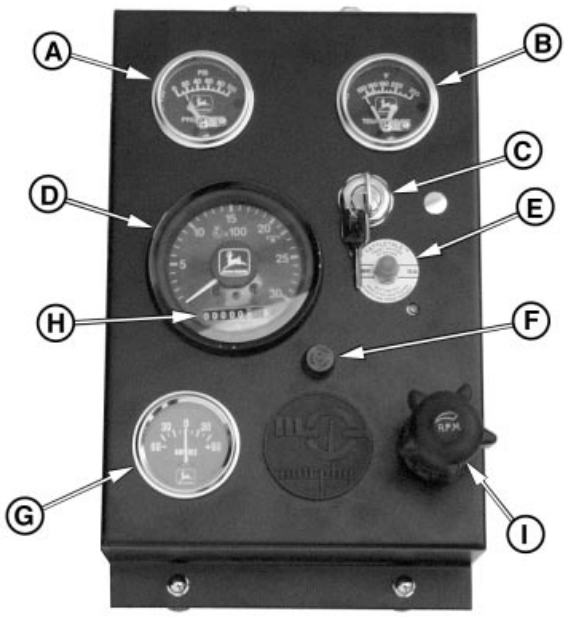
B—Coolant Temperature Gauge - This gauge indicates coolant temperature. It also has an electrical contact which activates the safety switch when coolant temperature goes above the temperature set point. This will automatically stop the engine.

C—Key Switch - The key switch is used to start and stop the engine. A key is required to operate the switch so as to prevent unauthorized operation of the engine.

D—Tachometer - The tachometer indicates engine speed in hundreds of revolutions per minute (rpm).

E—Safety Switch (Reset Button) - The safety switch de-energizes the fuel shut-off solenoid or injection rack puller to stop the engine, if one or more conditions are met:

- Low or no oil pressure
- High coolant temperature
- Low crankcase oil level (if equipped with engine oil level switch)
- High crankcase oil level (if equipped with engine oil level switch)



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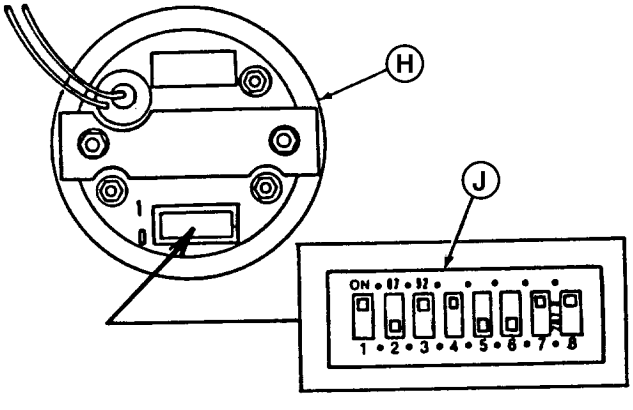

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A—Oil Pressure Gauge
B—Coolant Temperature Gauge
C—Key Switch
D—Tachometer
E—Reset (Safety) Switch
F—Fuse Holder (14 Amp Fuse)
G—Ammeter
H—Hourmeter
I—Hand Throttle
J—Tachometer Binary Code

Continued on next page

The reset button has to be held in when starting the engine. The button allows the safety switch to override the shut-down circuits until safe engine oil pressure is maintained. Once engine oil pressure is within specifications, the safety switch will latch and the reset button can be released.

F—Fuse Holder - Contains 14 amp fuse.

G—Ammeter - The ammeter indicates the rate of charge (+) or discharge (—) of the battery. When the engine is first started, the ammeter will usually indicate a charge rate of approximately 30 amps. After a short period of operation, the ammeter needle will point slightly to the right of “0”, indicating the charging system is operating normally. A problem with the charging system is indicated if the ammeter needle points to the left of “0” during engine operation.

H—Hour Meter - The hour meter operates when the engine is operating, or when the reset button is manually held in while the key switch is in the ON position. The accumulated hours are displayed in hours and tenths of hours. On some panels, the hourmeter may be separate from the tachometer.

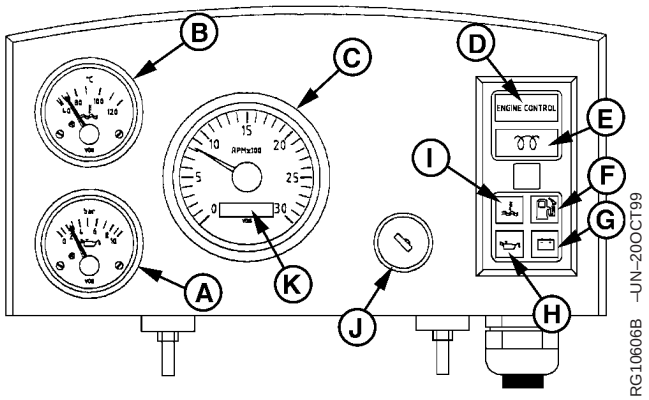
I—Hand Throttle - The hand throttle is used to manually control engine speed. If the hand throttle is electronic (as shown), turn the knob clockwise or counterclockwise to change engine speed. If the hand throttle is mechanical (not shown), turning the handle, either clockwise or counterclockwise, will lock the throttle position. Turn the handle half way between the two lock positions to unlock the throttle.

J—Tachometer Binary Code - The tachometer is calibrated to the number of flywheel gear teeth read. The dip switch to set the binary code is located in back of tachometer and must be set at “10110011” to operate at 30 pulses per revolution.

VDO Instrument (Gauge) Panel (Except North America)

All controls and gauges are optional equipment for John Deere OEM Engines. They may be provided by the equipment manufacturer instead of John Deere. The following information applies only to those controls and gauges provided by John Deere.

IMPORTANT: Any time an electric gauge or meter does not register correctly, replace it with a new one. Do not attempt to repair it.



A—Oil Pressure Gauge
B—Coolant Temperature Gauge
C—Tachometer
D—Engine Control Light
E—Preheater Light
F—Fuel Level Light
G—Battery Light
H—Oil Pressure Light
I—Coolant Temperature Light
J—Key/Start Switch
K—Hour Meter

Following is a brief description of the components on the instrument (gauge) panel:

A—Oil Pressure Gauge - The oil pressure gauge indicates engine oil pressure.

B—Coolant Temperature Gauge - The coolant temperature gauge iindicates coolant temperature.

C—Tachometer - The tachometer indicates engine speed in hundreds of revolutions per minute (rpm).

The engine control system consists of the following:

D—Engine Control Light - The engine control light illuminates after the engine has started and oil pressure is up to specification. The light indicates that the engine protection circuitry is activated.

E—Preheater Light -The preheater light illuminates when the key is turned to the bulb test position (position I). It should go off after approximately five seconds. When the key switch is held in position II, the engine preheater is energized and the preheater light illuminates.

F—Fuel Level Light - The fuel level light illuminates when the key is turned to the bulb test position (position I). It should go off after approximately five seconds. After the engine is running, if the engine runs out of fuel, the light will illuminate and protection circuitry will stop the engine. The fuel level light will remain on indicating the engine was stopped due to the fuel tank being empty.

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G—Battery Light - The batttery light illuminates when the key is turned to the bulb test position (position I). It should go off after approximately five seconds. After the engine is running, if the alternator stops charging, the light will illuminate and protection circuitry will stop the engine. The battery light will remain on indicating the engine was stopped due to the alternator not charging.

H—Oil Pressure Light - The oil pressure light illuminates when the key switch is turned to the bulb test position (positon I). The light will remain on until the engine is started and the specified oil pressure is reached. If oil pressure is lost during engine operation, the light will illuminate and protection circuitry will stop the engine. The oil pressure light will remain on, indicating that the engine was stopped due to a low oil pressure condition.

I—Coolant Temperature Light - The coolant temperature light illuminates when the key is turned to the bulb test position (position I). It should go off after approximately five seconds. After the engine is running, if the engine overheats, the light will illuminate and protection circutiry will stop the engine. The coolant temperature light will remain on indicating the engine was stopped due to the engine overheating.

Other components on the instrument panel:

J—Key/Start Switch - The four-position key start switch controls the electrical system.

K—Hour Meter - The hour meter is an integral part of the tachometer. It shows the accumulated hours of engine service. The hour meter operates when the engine is running and accumulated hours are displayed in hours and tenths of hours.

DPSG,RG34710,109 –19–20OCT99–2/2

Normal Engine Operation

Observe engine coolant temperature and engine oil pressure. Temperatures and pressures will vary between engines and with changing operating conditions, temperatures, and loads.

Normal engine coolant operating temperature range is 82°—94°C (180°—202°F). If coolant temperature rises above 112°C (234°F), reduce load on engine. Unless temperature drops quickly, stop engine and determine cause before resuming operation.

Operate the engine under a lighter load and at slower than normal speed for first 15 minutes after start-up. DO NOT run engine at slow idle.

IMPORTANT: Should the engine die while operating under load, immediately remove load and restart the engine. Overheating of the turbocharger parts may occur when oil flow is stopped.

Stop engine immediately if there are any signs of part failure. Symptoms that may be early signs of engine problems are:

- Sudden drop in oil pressure
- Abnormal coolant temperatures
- Unusual noise or vibration
- Sudden loss of power
- Excessive black exhaust
- Excessive fuel consumption
- Excessive oil consumption
- Fluid leaks

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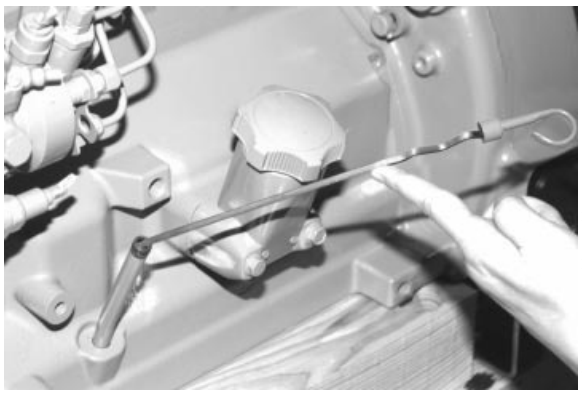
Break-In Service

The engine is ready for normal operation. However, extra care during the first 100 hours of operation will result in more satisfactory long-term engine performance and life. DO NOT exceed 100 hours of operation with break-in oil.

1. This engine is factory-filled with John Deere ENGINE BREAK-IN OIL. Operate the engine at heavy loads with minimal idling during the break-in period.

2. If the engine has significant operating time at idle, constant speeds, and/or light load usage, or makeup oil is required in the first 100 hour period, a longer break-in period may be required. In these situations, an additional 100 hour break-in period is recommended using a new change of John Deere ENGINE BREAK-IN OIL and a new John Deere oil filter.



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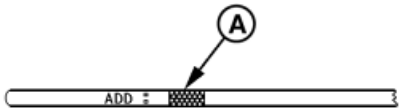

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RG,RG34710,5553 –19–20MAY96–1/4

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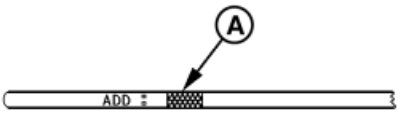


IMPORTANT: DO NOT add makeup oil until the oil level is BELOW the ADD mark on dipstick. John Deere ENGINE BREAK-IN OIL (TY22041) should be used to make up any oil consumed during the break-in period.

3. Check engine oil level more frequently during engine break-in period. If oil must be added during this period, John Deere ENGINE BREAK-IN OIL is preferred. See ENGINE BREAK-IN OIL, in Fuels, Lubricants, and Coolant Section.

IMPORTANT: DO NOT use PLUS-50® Engine Oil during the break-in period of a new engine or engine that has had a major overhaul. PLUS-50® oil will not allow a new or overhauled engine to properly wear during this break-in period.

DO NOT fill above the crosshatch pattern (A) or the FULL mark, whichever is present. Oil levels anywhere within the crosshatch are considered in the acceptable operating range.

Specification	
Engine[1] Oil Pressure at Full Load Rated Speed	345 ± 103 kPa (3.45 ± 1.03 bar) (50 ± 15 psi)
Minimum Oil Pressure at Rated Speed	275 (2.75 bar) (40 psi)
Minimum Oil Pressure at 850 rpm	105 kPa (1.05 bar) (15 psi)
Coolant Temperature Range	82°–94°C (180°–202°F)

PLUS-50 is a trademark of Deere & Company.

[1]At normal operating temperature of 115°C (240°F) sump.

Continued on next page

RG,RG34710,5553 –19–20MAY96–2/4

4. During the first 20 hours, avoid prolonged periods of engine idling or sustained maximum load operation. If engine will idle longer than 5 minutes, stop engine.

5. Before the first 100 hours (maximum), change engine oil and replace engine oil filter (A). (See CHANGING ENGINE OIL AND REPLACING OIL FILTER in Lubrication and Maintenance/Engine Oil Section.) Fill crankcase with seasonal viscosity grade oil. (See DIESEL ENGINE OIL, in Fuels, Lubricants, and Coolant Section.)

NOTE: Some increase in oil consumption may be expected when low viscosity oils are used. Check oil levels more frequently.

If air temperature is below -10°C (14°F), use an engine block heater.

RG7961B –UN–22JAN99

RG,RG34710,5553 –19–20MAY96–3/4

6. Watch coolant temperatures (A) closely. If coolant temperature rises above 112°C (234°F), reduce load on engine. Unless temperature drops quickly, stop the engine and determine the cause before resuming operation.

NOTE: When the coolant temperature gauge reads approximately 115°C (239°F), the engine will shutdown automatically, if equipped with safety controls.

7. Check poly-vee belt for proper alignment and seating in pulley grooves.

RG11299F –UN–17AUG00

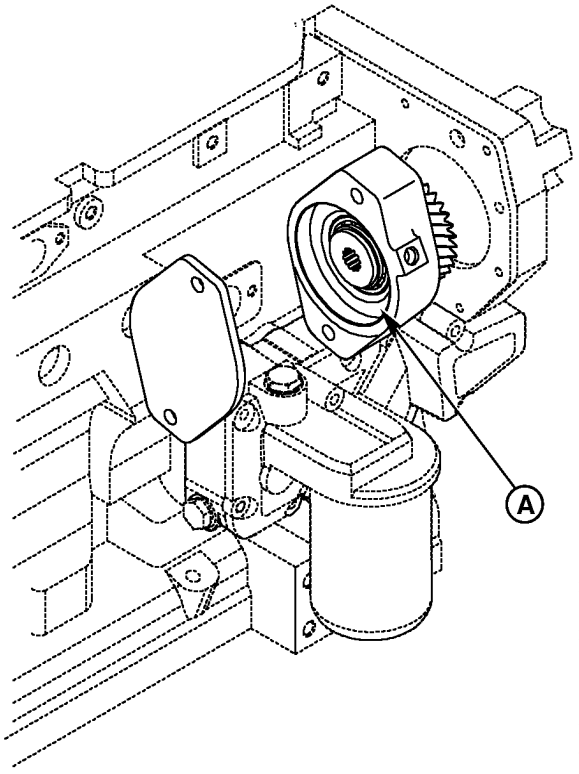
North American (1999—) Instrument Panel Shown

RG,RG34710,5553 –19–20MAY96–4/4

Auxiliary Gear Drive Limitations

IMPORTANT: When attaching an air compressor, hydraulic pump, or other accessory to be driven by the auxiliary gear drive (A) (engine timing gear train at front of engine), power requirements of the accessory must be limited to values listed below:

- 30 kW (40 hp) Continuous Operation at 2500 rpm
- 37 kW (50 hp) Intermittent Operation at 2500 rpm



RG,RG34710,5555 –19–20MAY96–1/1

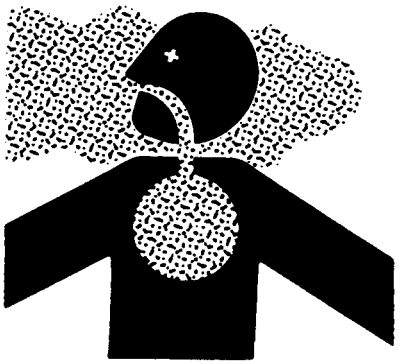
Generator Set (Standby) Applications

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.

RG,RG34710,5556 –19–20MAY96–1/1

Starting the Engine

The following instructions apply to the optional controls and instruments available through the John Deere Parts Distribution Network. The controls and instruments for your engine may be different from those shown here; always follow manufacturer's instructions.

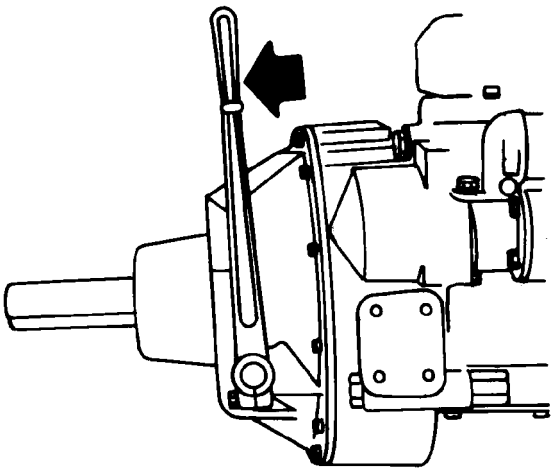


TS220 –UN–23AUG88

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, later in this section).

1. Perform all prestarting checks outlined in Lubrication & Maintenance/Daily Section later in this manual.
2. Open the fuel supply shut-off valve, if equipped.
3. If equipped with PTO clutch, pull lever (arrow) rearward (away from engine) to disengage PTO clutch.



RG5602 –UN–16JUN00

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RG,RG34710,5557 –19–20MAY96–1/2

4. Electronically controlled governor applications may be equipped with a rotary speed potentiometer on instrument panel.

   On mechanical governor (7–10 % regulation) engines, pull hand throttle (A) 1/3 of the way out. Turn the handle in either direction to lock it in place.

5. If equipped, depress and hold reset button (B) while starting.

IMPORTANT: Do not operate the starter for more than 30 seconds at a time. To do so may overheat the starter. If the engine does not start the first time, wait at least 2 minutes before trying again. If engine does not start after four attempts, see Troubleshooting Section.

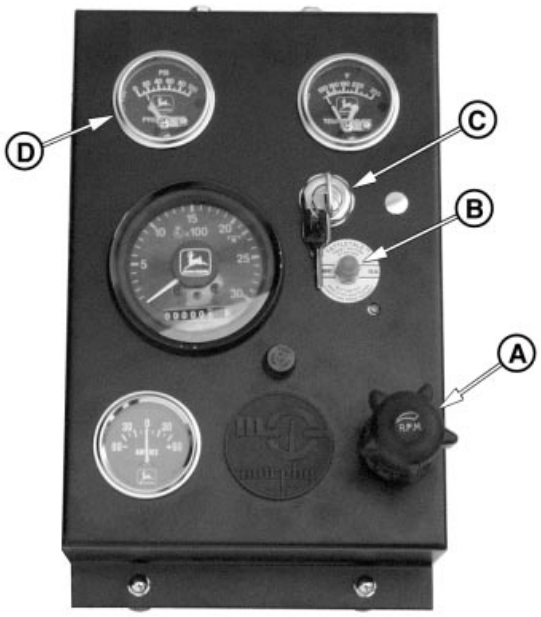
6. Turn the key switch (C) clockwise to crank the engine. When the engine starts, release the key so that it returns to the "ON" position.

IMPORTANT: If the key switch is released before the engine starts, wait until the starter and the engine stop turning before trying again. This will prevent possible damage to the starter and/or flywheel.

7. After the engine starts, continue to hold the reset button in until the oil pressure gauge (D) reads at least 105kPa (1.05 bar) (15 psi). The safety controls will not allow the engine to run at a lower oil pressure unless the reset button is held in.

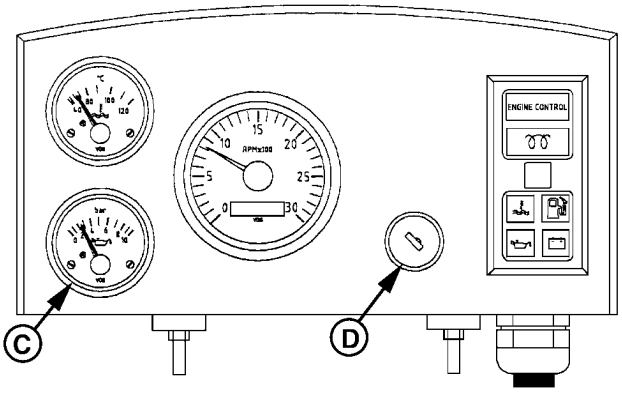
IMPORTANT: Should the engine die when operating under load, immediately disengage PTO clutch and restart the engine. Overheating of turbocharger parts may occur when oil flow is stopped.

8. Check all gauges for normal engine operation. If operation is not normal, stop the engine and determine the cause.



RG11299G –UN–08SEP00

North American (1999—) Instrument Panel



RG10611 –UN–21OCT99

VDO Instrument Panel (Except North America)

A—Hand Throttle
B—Reset Button
C—Key Start Switch
D—Oil Pressure Gauge

RG,RG34710,5557 –19–20MAY96–2/2

Cold Weather Operation

Additional information on cold weather operation is available from your engine distributor or authorized servicing dealer.

Some engines are equipped with an air intake heater which will make starting the engine easier in cold weather. If equipped, follow steps 1–4 as listed under STARTING THE ENGINE, earlier in this section. Switch on the air intake heater for 30 seconds and then proceed to operate the starter. Follow remaining steps 5–8.

TS1356 –UN–18MAR92

CAUTION: Starting fluid is highly flammable. DO NOT use starting fluid on engines equipped with air intake heaters.

DO NOT use starting fluid near fire, sparks, or flames. DO NOT incinerate or puncture a starting fluid container.

RG,RG34710,5559 –19–20MAY96–1/1

Warming Engine

IMPORTANT: To assure proper lubrication, operate engine at or below 1200 rpm with no load for 1–2 minutes. Extend this period 2–4 minutes when operating at temperatures below freezing.

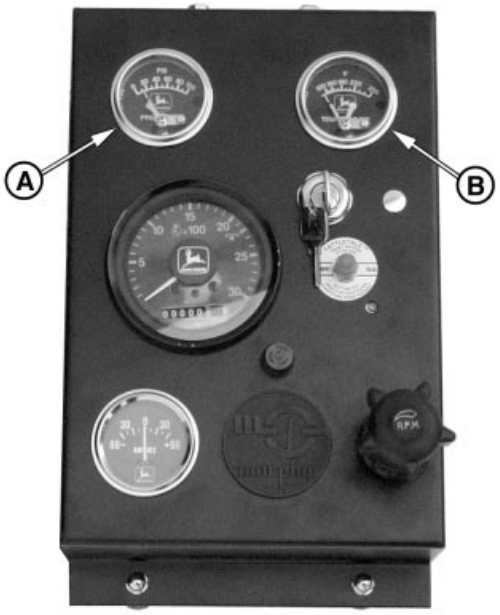
Engines used in generator set applications where the governor is locked at a specified speed may not have a slow idle function. Operate these engines at high idle for 1 to 2 minutes before applying the load. This procedure does not apply to standby generator sets where the engine is loaded immediately upon reaching rated speed.

1. Check oil pressure gauge (A) as soon as engine starts. If gauge needle does not rise above minimum oil pressure specification of 105 kPa (1.05 bar) (15.0 psi) within 5 seconds, stop the engine and determine the cause. Normal engine oil pressure is 345 kPa (3.45 bar) (50 psi) at rated full load speed (1800–2500 rpm) with oil at normal operating temperature of 115°C (240°F).

NOTE: On certain engines, the oil pressure and coolant temperature gauges are replaced by indicator warning lights. The lights must be "OFF" when engine is running.

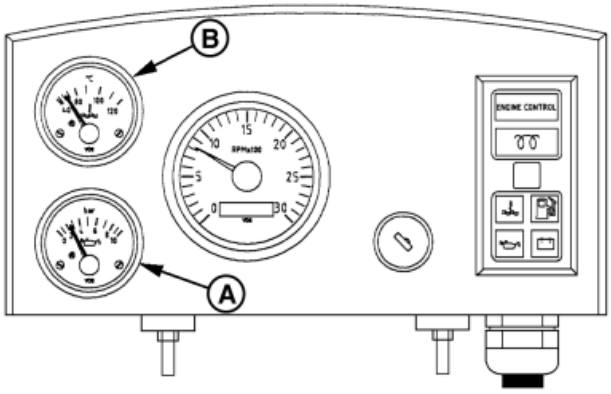
2. Watch coolant temperature gauge (B). Do not place engine under full load until it is properly warmed up. The normal engine coolant temperature range is 82°—94°C (180°—202°F).

NOTE: It is a good practice to operate the engine under a lighter load and at lower speeds than normal for the first few minutes after start-up.



RG11299H –UN–11SEP00

North American Instrument Panel



RG10613 –UN–21OCT99

VDO Instrument Panel (Except North America)

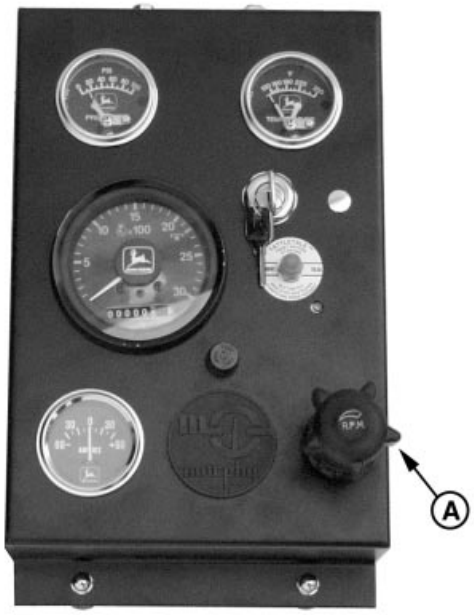
A—Oil Pressure Gauge
B—Coolant Temperature Gauge

RG,RG34710,5560 –19–20MAY96–1/1

Changing Engine Speed–Standard (Mechanical) Governor

To increase engine speed, turn handle (A), if equipped, to the horizontal position and pull out until desired engine speed is obtained. Turn the handle in either direction to lock throttle position. The handle is pushed inward to decrease engine speed.

NOTE: On engines without handle, use throttle lever to control engine speed.



RG11299I –UN–11SEP00

North American Instrument Panel Shown

RG,RG34710,5561 –19–20MAY96–1/1

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.

Once an engine is warmed to normal operating temperatures, engine should be idled at slow idle speed. Slow idle speed for this engine is 850 rpm at factory. If an engine will be idling for more than 5 minutes, stop and restart later.

NOTE: Generator set applications where the governor is locked at a specified speed may not have a slow idle function. These engines will idle at no load governed speed (high idle).

RG,RG34710,5562 –19–20MAY96–1/1

Stopping the Engine

1. Pull PTO clutch lever (arrow) rearward (away from engine) to disengage clutch, if equipped.

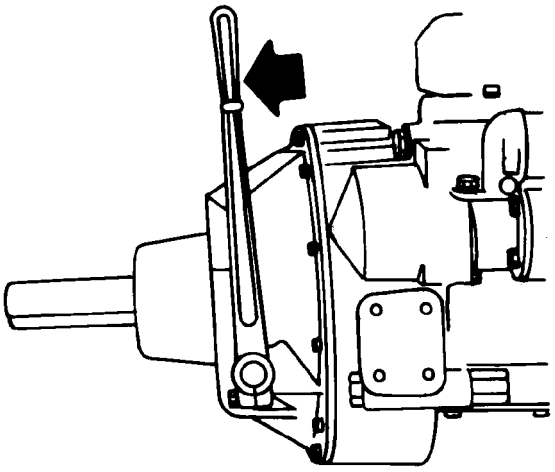
2. Move the throttle lever (A) to slow idle on standard (mechanical) governor engines.

IMPORTANT: Before stopping an engine that has been operating at working load, idle engine at least 2 minutes at 1000–1200 rpm to cool hot engine parts.

For engines in generator set applications, where the governor is locked at a specified speed and no slow idle function is available, run engine for at least 2 minutes at fast idle and no load.

3. Turn key switch (B) to "OFF" position to stop the engine. Remove ignition key.

IMPORTANT: Make sure that exhaust stack cap (rain cap) is installed when engine is not running. This will prevent water and dirt from entering engine.



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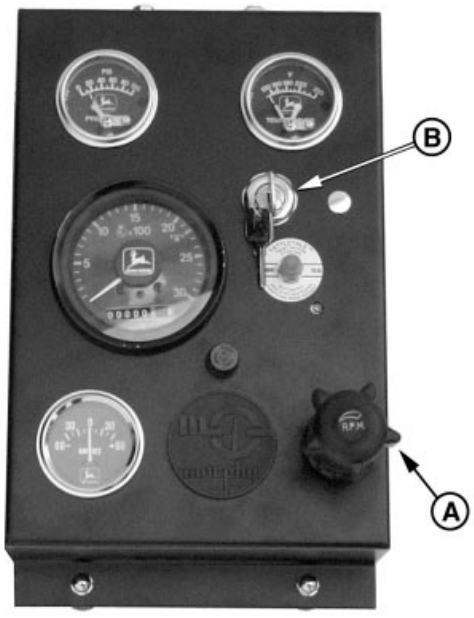


RG11299J –UN–11SEP00

North American Instrument Panel Shown

RG10616 –UN–16JUN00

RG,RG34710,5563 –19–20MAY96–1/1

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.

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

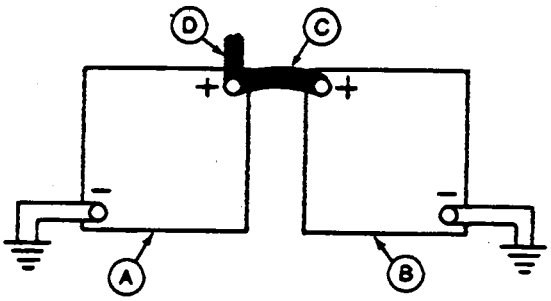
IMPORTANT: Be sure polarity is correct before making connections. Reversed polarity will damage electrical system. Always connect positive to positive and negative to ground. Always use 12-volt booster battery for 12-volt electrical systems and 24-volt booster battery(ies) for 24-volt electrical systems.

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.

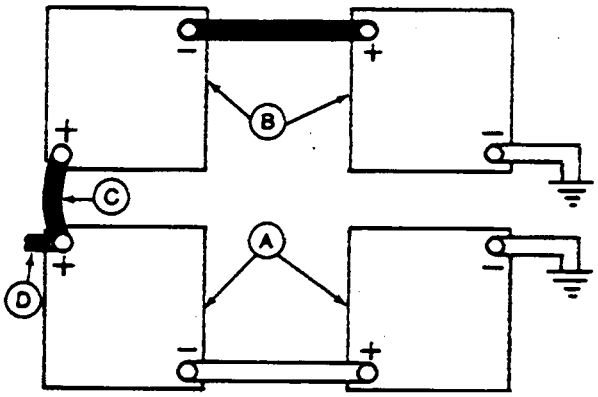
2. Connect one end of jumper cable to the POSITIVE (+) post of the booster battery.
3. Connect the other end of the jumper cable to the POSITIVE (+) post of battery connected to starter.
4. Connect one end of the other jumper cable to the NEGATIVE (–) post of the booster battery.
5. ALWAYS complete the hookup by making the last connection of the NEGATIVE (–) cable to a good ground on the engine frame and away from the battery(ies).

TS204 –UN–23AUG88



RG4678 –UN–14DEC88

12-Volt System



RG4698 –UN–14DEC88

24-Volt System

A—12-Volt Machine Battery (ies)
B—12-Volt Booster Battery (ies)
C—Booster Cable
D—Cable to Starting Motor

Continued on next page

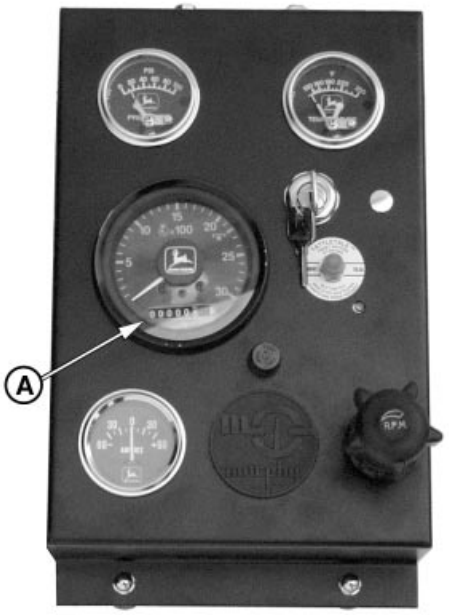
6. Start the engine. Disconnect jumper cables immediately after engine starts. Disconnect NEGATIVE (–) cable first.

RG,RG34710,5564 –19–20MAY96–2/2

Observe Service Intervals

Using hour meter (A) as 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 Lubrication and 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.



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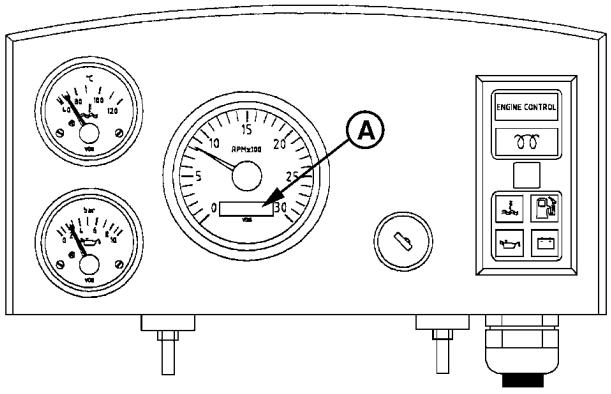
North American Instrument Panel



RG10618 –UN–21OCT99

VDO Instrument Panel (Except North America)

DPSG,OUOE003,20 –19–06JAN99–1/1

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,OUOE003,20 –19–06JAN99–1/1

Lubrication and Maintenance Service Interval Chart—Standard

Item	Lubrication and Maintenance Service Intervals				
	Daily	250 Hour/ 6 Month	500 Hour/ 12 Month	2000 Hour/ 24 Month	As Required
Check Engine Oil and Coolant Level	•				
Check Fuel Filter/Water Separator Bowl	•				
Lubricate PTO Release Bearings	•				
Check Air Cleaner Dust Unloader Valve & Restriction Indicator Gauge[a]	•				
Visual Walkaround Inspection	•				
Service Fire Extinguisher		•			
Lubricate PTO Clutch Shaft Bearings		•			
Change Engine Oil and Replace Oil Filter[b]		•			
Check PTO Clutch Adjustment		•			
Service Battery		•			
Check Manual Belt Tensioner and Belt Wear		•			
Lubricate PTO Clutch Levers and Linkage			•		
Clean Crankcase Vent Tube			•		
Check Air Intake Hoses, Connections, & System			•		
Replace Fuel Filter Element			•		
Check Automatic Belt Tensioner and Belt Wear			•		
Check Cooling System			•		
Coolant Solution Analysis-Add SCAs as required			•		
Pressure Test Cooling System			•		
Check Crankshaft Vibration Damper *(6-Cylinder)* [c]				•	
Flush Cooling System[d]				•	
Test Thermostats				•	
Check and Adjust Engine Valve Clearance				•	

[a]Replace primary air cleaner element when restriction indicator shows a vacuum of 625 mm (25 in.) H2O.

[b]Change the oil for the first time before 100 hours maximum of (break-in) operation, then every 250 hours thereafter. If PLUS-50 oil is used along with a John Deere oil filter, the oil change interval may be extended by 50 percent to 375 hours.

[c]Replace crankshaft damper at 4500 hours or 60 months, whichever occurs first.

[d]If John Deere COOL-GARD is used, the flushing interval may be extended to 3000 hours or 36 months. If John Deere COOL-GARD is used and the coolant is tested annually AND additives are replenished as needed by adding a supplemental coolant additive, the flushing interval may be extended to 5000 hours or 60 months, whichever occurs first.

Continued on next page

Item	Lubrication and Maintenance Service Intervals				
	Daily	250 Hour/ 6 Month	500 Hour/ 12 Month	2000 Hour/ 24 Month	As Required
Replace Air Cleaner Elements					•
Replace Poly-vee Belt					•

RG,RG34710,7559 –19–30JUN97–2/2

MAINTENANCE INTERVAL CHART- Generator Applications

Item	10 H / daily	500 H	1000 H / 1 year	2000 H / 2 years	2500 H / 3 years	As required
Check engine oil and coolant level	•					
Check air filter restriction indicator[a]	•					
Change engine oil and filter[b]		•				
Replace fuel filter element		•				
Check belt tension and automatic tensioner[c]		•	•			
Check and adjust valve clearance[d]			•			
Clean crankcase vent tube			•			
Check air intake hoses, connections and system			•			
Check vibration damper (6 cyl.)[e]				•		
Check engine speed and speed droop governor				•		
Drain and flush cooling system[f]				•	•	
Drain water and sediment from fuel filter						•
Clean filter element (see note a)						•
Test thermostat and injection nozzles (see your dealer)[g]						•

[a]Clean air filter element when restriction indicator is red. Replace filter element after 6 cleanings or once a year.

[b]Change oil and filter after the first 100 hours of operation, then every 500 hours thereafter. Change oil and filter at least once a year.

[c]Check belt tension every 500 hours on 300-Series engines and on POWERTech engines with manual tensioner. Check automatic belt tensioner every 1000 hours/1 year on POWERTech engines when equipped.

[d]Have your authorized servicing dealer or engine distributor adjust valve clearance as follows. After the first 500 hours of operation then every 1000 hours thereafter on 300-Series engines. Every 2000 hours on POWERTech engines.

[e]Have your authorized dealer or engine distributor replace the vibration damper every 4500 hours/5 years.

[f]Drain and flush cooling system every 2500 hours/3 years when John Deere COOL-GARD coolant is used. Otherwise every 2000 hours/2 years.

[g]Contact your dealer when thermostat or injection nozzles are suspected to be defective. Replace injection nozzles every 5000 hours and thermostat every 10000 hours.

DPSG,CD03523,26 –19–09JUL99–1/1

Daily Prestarting Checks

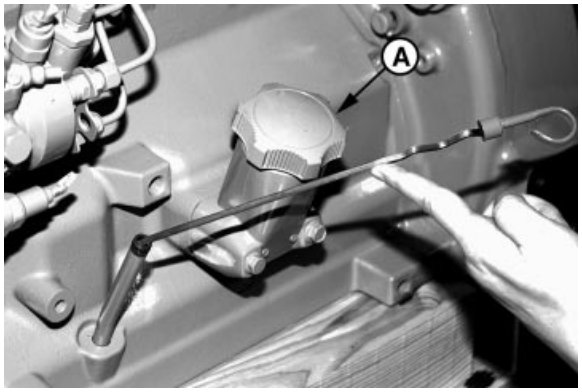
Do the following BEFORE STARTING THE ENGINE for the first time each day:

IMPORTANT: DO NOT add makeup oil until the oil level is BELOW the add mark.

1. Check engine oil level on dipstick. Add as required, using seasonal viscosity grade oil. (See DIESEL ENGINE OIL in Fuels, Lubricants, and Coolant Section for oil specifications.)

   Depending on application, oil may be added at left (A) or right (B) side oil filler cap and rocker arm cover filler cap (C) locations.

IMPORTANT: DO NOT fill above the top mark (D) on the dipstick. Oil levels anywhere within crosshatch are considered in the acceptable operating range.



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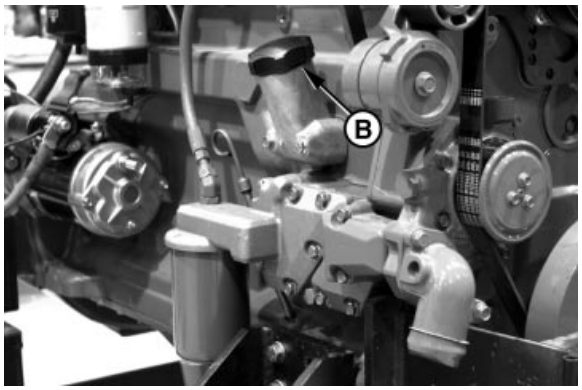
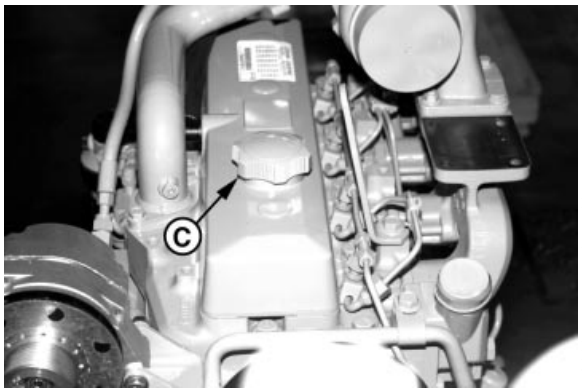


RG8054A –UN–16JUN00



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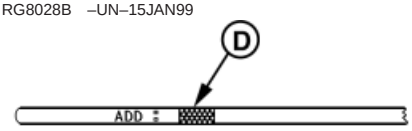

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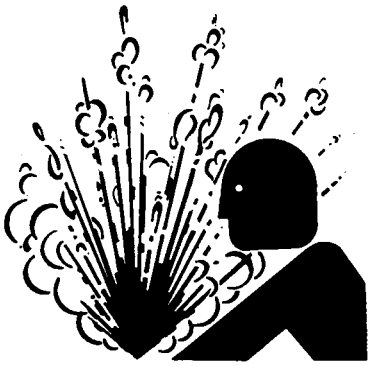
DPSG,OUOE003,20 –19–06JAN99–1/5

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

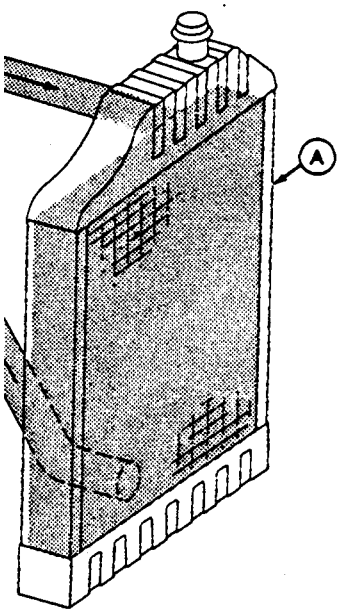
Only remove filler cap when engine is cold or when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.



TS281 –UN–23AUG88

2. Check the coolant level when engine is cold. Coolant level should be at bottom of filler neck. Fill radiator (A) with proper coolant solution if level is low. (See ADDING COOLANT in Service As Required Section.) Check overall cooling system for leaks.

NOTE: Refer to your vehicle's operator's manual for recommendations for non-John Deere supplied accessories.



RG4675 –UN–14DEC88

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DPSG,OUOE003,20 –19–06JAN99–2/5

3. Check the fuel filter for water or debris. If filter is fitted with a see-through bowl, drain as needed based on a daily visual inspection.

IMPORTANT: Drain water into a suitable container and dispose of properly.

a. Loosen drain plug (B) at bottom of fuel filter or bowl, if equipped, two or three turns.

b. Loosen air bleed plug two full turns (A) on fuel filter base and drain water from bottom until fuel starts to drain out.

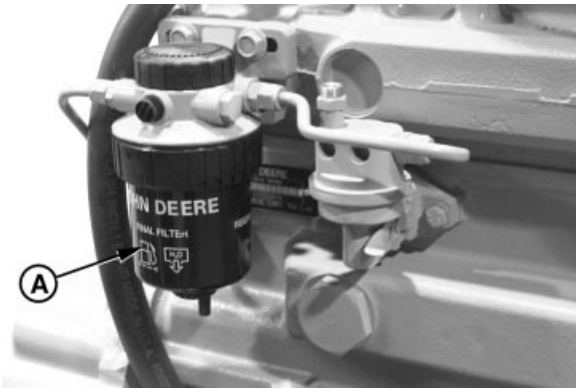
c. When fuel starts to drain out, tighten drain plug securely.

After draining water from the fuel filter, the filter must be primed by bleeding all air from the fuel system.

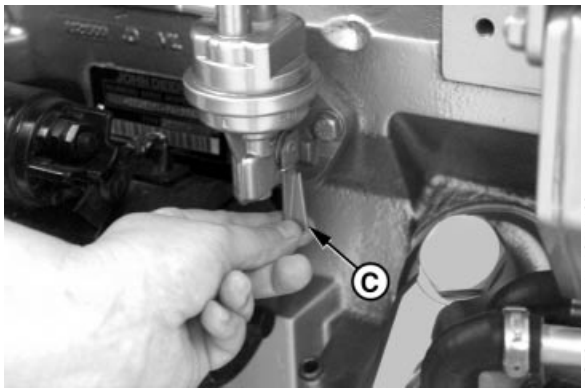
a. Operate primer lever of the fuel supply pump (C) until fuel flow is free from air bubbles.

b. Tighten bleed plug securely, continue operating hand primer until pumping action is not felt. Push hand primer inward (toward engine) as far as it will go.

If the fuel system needs further bleeding of air, see BLEEDING FUEL SYSTEM in Service As Required Section, later in this manual.



RG7986 –UN–14NOV97



RG7317A –UN–16JUN00

DPSG,OUOE003,20 –19–06JAN99–3/5

4. Apply one shot of John Deere Multi-Purpose Lubricant or equivalent at PTO release bearing grease fitting (A). NO NOT over lubricate.

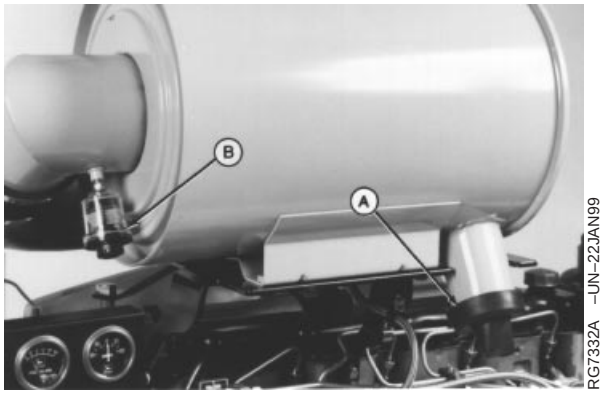
RG7331A –UN–26JUN00

Continued on next page

DPSG,OUOE003,20 –19–06JAN99–4/5

5. If the air cleaner has an automatic dust unloader valve (A), squeeze the unloader valve on air cleaner assembly to clear away any dust buildup.

   If equipped with air intake restriction indicator gauge (B), check gauge to determine if air cleaner needs to be serviced.



RG7332A –UN–22JAN99

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.

6. Make a thorough inspection of the engine compartment. Look for oil or coolant leaks, worn fan and accessory drive belts, loose connections and trash build-up. Remove trash buildup and have repairs made as needed if leaks are found.

NOTE: Wipe all fittings, caps, and plugs before performing any maintenance to reduce the chance of system contamination.

Inspect:

- Radiator for leaks and trash build-up.
- Air intake system hoses and connections for cracks and loose clamps.
- Fan, alternator, and accessory drive belts for cracks, breaks or other damage.
- Water pump for coolant leaks.

NOTE: It is normal for a small amount of leakage to occur as the engine cools down and parts contract. Excessive coolant leakage may indicate the need to replace the water pump seal. Contact your engine distributor or servicing dealer for repairs.

DPSG,OUOE003,20 –19–06JAN99–5/5

Servicing Fire Extinguisher

A fire extinguisher (A) is available from your authorized servicing dealer or engine distributor.

Read and follow the instructions which are packaged with it. The extinguisher should be inspected at least every 250 hours of engine operation or once a month. Once extinguisher is operated, no matter how long, it must be recharged. Keep record of inspections on the tag which comes with the extinguisher instruction booklet.

RW4918 –UN–15DEC88

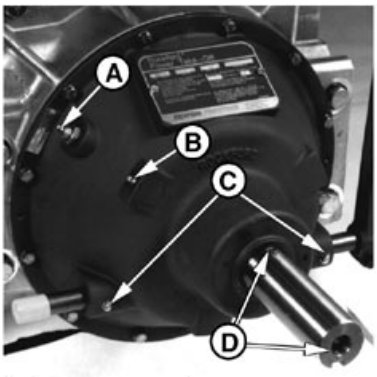
RG,RG34710,5567 –19–20MAY96–1/1

Lubricating PTO Clutch Shaft Bearings

Apply one or two shots of John Deere Multipurpose Lubricant or equivalent at clutch drive shaft bearing fitting (B) and pilot bearing fittings (D). DO NOT over-lubricate to avoid getting oil on clutch facings.

NOTE: Location of pilot bearing fitting will depend on application. Only one fitting will be used.

A—Release Bearing Grease Fitting
B—Drive Shaft Bearing Fitting
C—Lever Cross Shaft Fittings
D—Pilot Bearing Fitting



RG7331B –UN–19JUN00

RG,RG34710,5566 –19–20MAY96–1/1

Changing Engine Oil and Replacing Oil Filter

NOTE: Change engine oil and filter for the first time before 100 hours maximum of operation.


RG4881 –UN–29NOV88

OILSCAN® or OILSCAN PLUS®is a John Deere sampling program to help you monitor machine performance and identify potential problems before they cause serious damage. OILSCAN® and OILSCAN PLUS®kits are available from your John Deere engine distributor or servicing dealer. Oil samples should be taken prior to the oil change. Refer to instructions provided with kit.

1. Run engine approximately 5 minutes to warm up oil. Shut engine off.
2. Remove oil pan drain plug (arrow).
3. Drain crankcase oil from engine while warm.

NOTE: Drain plug location may vary, depending on the application.

PLUS-50 is a trademark of Deere & Company.
OILSCAN is a trademark of Deere & Company.
OILSCAN PLUS is a trademark of Deere & Company.

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RG,RG34710,5570 –19–20MAY96–1/3

4. Remove and discard oil filter element (A) using a suitable filter wrench.

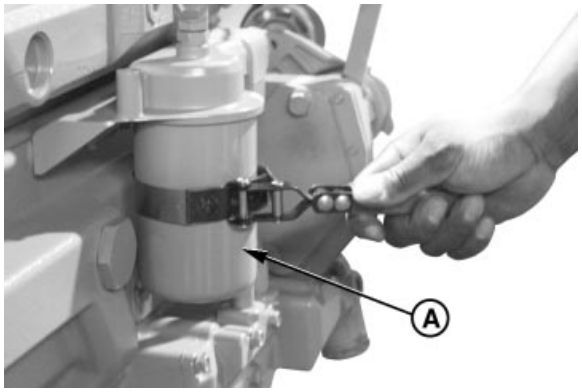
NOTE: Depending on engine application, oil filter may be located on either side of the engine.

5. Remove oil filter packing and clean filter mounting pad.

IMPORTANT: Filtration of oils is critical to proper lubrication. Always change filter regularly. Use filter meeting John Deere performance specifications.

6. Oil new packing and install new filter element. Hand tighten element according to values printed on filter element. If values are not provided, tighten element approximately 3/4 — 1-1/4 turn after packing contacts filter housing. DO NOT overtighten filter element.

7. Install oil pan drain plug with a new seal when equipped.



RG7961A –UN–22JAN99

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RG,RG34710,5570 –19–20MAY96–2/3

8. Fill engine crankcase with correct John Deere engine oil through rocker arm cover opening (B) or either side oil filler (C) depending on engine application. (See DIESEL ENGINE OIL in Fuels, Lubricants, and Coolant Section for determining correct engine oil.)

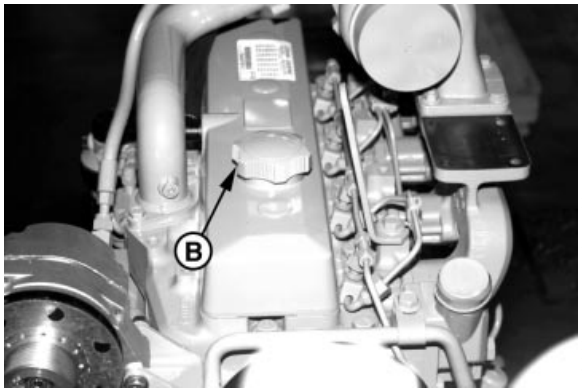
   To determine the correct oil fill quantity for your engine, see ENGINE CRANKCASE OIL FILL QUANTITIES in the Specifications Section of this manual.

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.

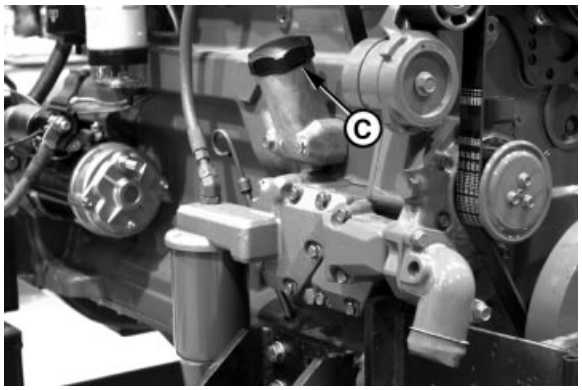
NOTE: Crankcase oil capacity may vary slightly. ALWAYS fill crankcase to full mark or within crosshatch on dipstick, whichever is present. DO NOT overfill.

9. Start engine and run to check for possible leaks.

10. Stop engine and check oil level after 10 minutes. Oil level reading should be within crosshatch of dipstick.



RG8025A –UN–19JUN00



RG8054B –UN–19JUN00

RG,RG34710,5570 –19–20MAY96–3/3

Checking PTO Clutch Adjustment

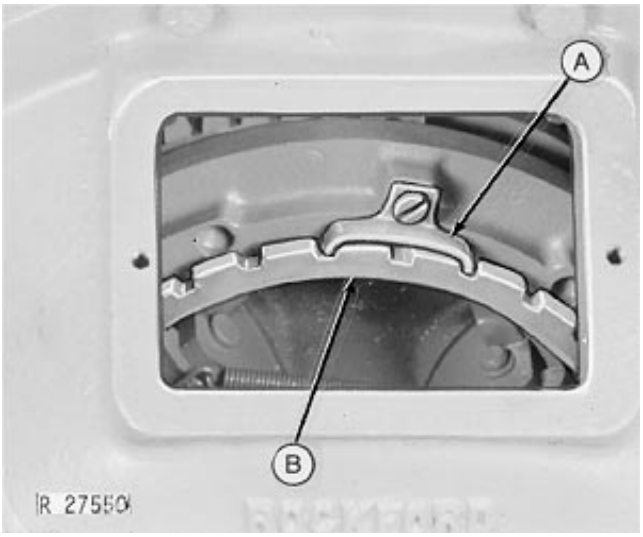

TS198 –UN–23AUG88

CAUTION: Never attempt to service the PTO while it is in operation. Loose clothing could get caught in moving parts; keep clothing tight against body. Use extreme care when working around the PTO.

1. Measure clutch engagement force at handle grip using a spring scale. The engagement force should be 267–311 N (60–70 lb force).

IMPORTANT: Improper adjustments of the PTO clutch may shorten clutch life. Make sure adjustments are made properly.

2. If adjustments are needed, disengage clutch and stop engine. Remove cover plate from clutch housing (shown removed).
3. Remove adjusting lock (A).
4. Turn adjusting ring (B) to adjust clutch engagement pressure.
5. Measure engagement force at clutch handle with spring scale.
6. Install lock screw and adjusting lock in clutch body splines when specified engagement pressure is achieved.
7. Tighten screw securely.
8. Recheck clutch engagement force with spring scale. Install cover plate. Disengage clutch.



R27550 –UN–14DEC88

RG,RG34710,5572 –19–20MAY96–1/1

Checking Engine Mounts

Engine mounting is the responsibility of the 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 bracket, 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 if rubber has deteriorated or mounts have collapsed, as necessary.

DPSG,RG34710,111 –19–30OCT99–1/1

Servicing Battery

TS204 –UN–23AUG88

CAUTION: Battery gas can explode. Keep sparks and flames away from batteries. Use a flashlight to check battery electrolyte level.

Never check battery charge by placing a metal object across the posts. Use a voltmeter or hydrometer.

Always remove grounded NEGATIVE (–) battery clamp first and replace it last.

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

1. On regular batteries, check electrolyte level. Fill each cell to bottom of filler neck with distilled water.

NOTE: Low-maintenance or maintenance-free batteries should require little additional service. However, electrolyte level can be checked by cutting the center section of decal on dash-line, and removing cell plugs. If necessary, add clean, soft water to bring level to bottom of filler neck.

2. Keep batteries clean by wiping them with a damp cloth. Keep all connections clean and tight. Remove any corrosion, and wash terminals with a solution of 1 part baking soda and 4 parts water. Tighten all connections securely.

NOTE: Coat battery terminals and connectors with a mixture of petroleum jelly and baking soda to retard corrosion.

3. Keep battery fully charged, especially during cold weather. If a battery charger is used, turn charger off before connecting charger to battery(ies). Attach POSITIVE (+) battery charger lead to POSITIVE (+) battery post. Then attach NEGATIVE (–) battery charger lead to a good ground.

Continued on next page

CAUTION: Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, eat holes in clothing, and cause blindness if splashed into eyes.

Avoid the hazard by:

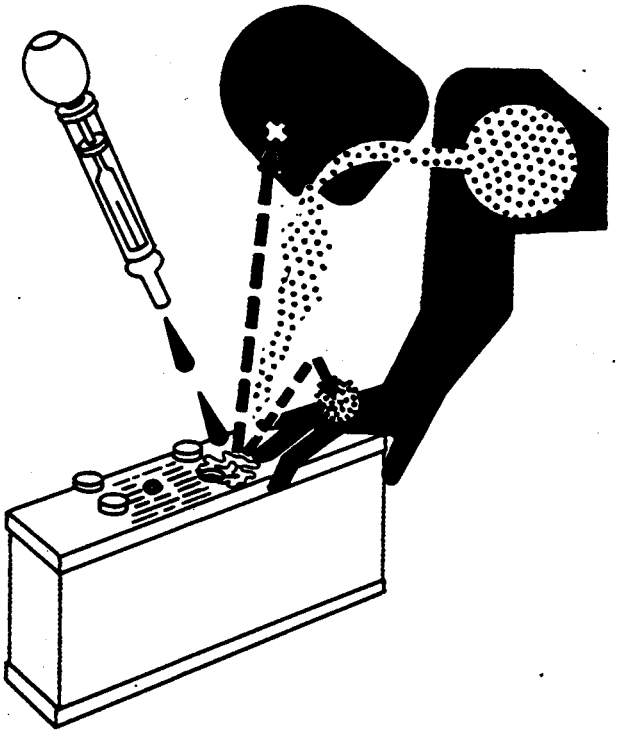
1. **Filling batteries in a well-ventilated area.**
2. **Wearing eye protection and rubber gloves.**
3. **Avoiding breathing fumes when electrolyte is added.**
4. **Avoiding spilling or dripping electrolyte.**
5. **Use proper jump start procedure.**

If you spill acid on yourself:

1. **Flush your skin with water.**
2. **Apply baking soda or lime to help neutralize the acid.**
3. **Flush your eyes with water for 10–15 minutes. Get medical attention immediately.**

If acid is swallowed:

1. **Drink large amounts of water or milk.**
2. **Then drink milk of magnesia, beaten eggs, or vegetable oil.**
3. **Get medical attention immediately.**



TS203 –UN–23AUG88

In freezing weather, run engine at least 30 minutes to assure thorough mixing after adding water to battery.

If necessary to replace battery(ies), replacements must meet or exceed the following recommended capacities at -18°C (0°F):

Specification	
12 Volt Standard Duty Starter Cold Cranking Amps	640
12 Volt Heavy Duty Starter Cold Cranking Amps	800
24 Volt Standard Duty Starter Cold Cranking Amps	570

RG,RG34710,5568 –19–20MAY96–2/2

Manual Belt Tensioner Adjustment

NOTE: Two types of manual tensioners shown.

Inspect belts for cracks, fraying, or stretched-out areas. Replace if necessary.

As a reference check, twist belt in the middle of a 10—12 inch span with two fingers. A properly tensioned belt will turn 75—85 degrees. If belt turns more, it needs to be tightened. If belt turns less, it needs to be loosened.

NOTE: If timing gear cover or alternator bracket interfere with installation/centering of belt tension gauge (A), install gauge with face toward engine.

1. Install JDG1341 Belt Tension Gauge (A) on belt, halfway between pulleys as shown. (JDG1341 Belt Tension Gauge available from local John Deere Dealer or Distributor.)

2. Loosen cap screws (B) and (C).

3. Slide alternator or tensioner bracket (D) in slot by hand to remove all excess slack in belt.

IMPORTANT: Do not pry against alternator rear frame.

4. Stretch belt by prying outward on alternator front frame or tensioner bracket. Observing tension gauge, stretch the belt until specified tension is achieved.

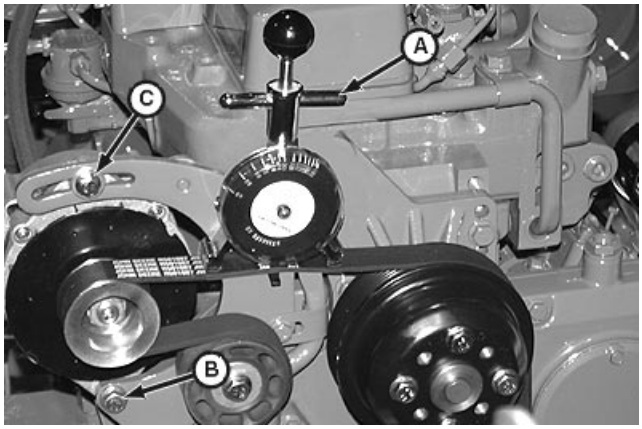
Specification

8-Rib Poly-Vee Belt Bosch and New Magneton Alternator New Belt Tension	535—715 N (120—160 lb-force)
Old Magneton Alternator New Belt (Option Code 3101) Tension	470—650 N (105—145 lb-force)
Used Belt Tension	400—580 N (90—130 lb-force)

5. Tighten cap screws (B) and (C).

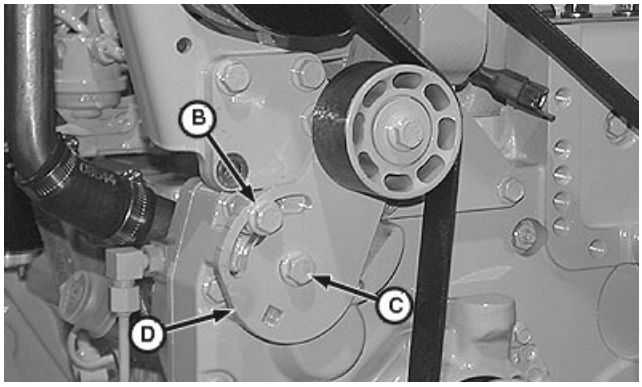
NOTE: After ten minutes run-in, new belts are considered used. Belt tension must then be rechecked per used belt specifications.

6. Run engine for ten minutes and immediately re-check belt tension per used belt specification above.



RG10556 –UN–21DEC99

Adjust Belt Tension



RG10557 –UN–21DEC99

Adjust Belt Tension

A—Belt Tension Gauge
B—Cap Screw
C—Cap Screw
D—Tensioner Bracket

Continued on next page

7. Reset belt tension as necessary.

DPSG,RG41165,128 –19–19JUN00–2/2

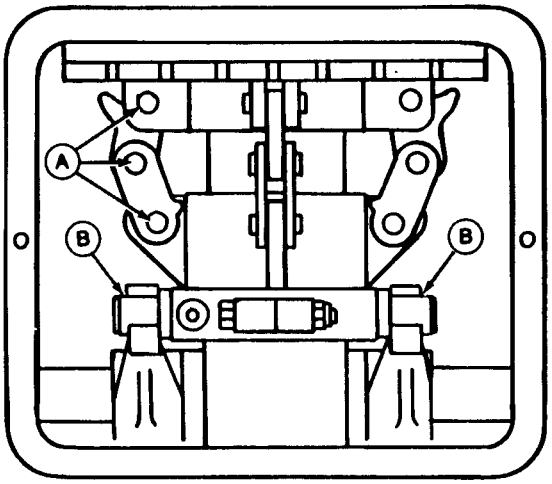
Lubricating PTO Clutch Internal Levers and Linkage


TS198 –UN–23AUG88

CAUTION: Never attempt to service the PTO while it is in operation. Loose clothing could get caught in moving parts; keep clothing tight against body. Use extreme care when working around the PTO.

1. Remove the PTO housing cover and apply one shot of John Deere Multipurpose Lubricant or equivalent (See FUELS, LUBRICANTS, and COOLANT Section) to the pivot points (A) of each clutch linkage.

2. Apply one shot of John Deere Multipurpose Lubricant or equivalent to the two PTO release lever shaft fittings (B).



RG6641 –UN–18FEB93

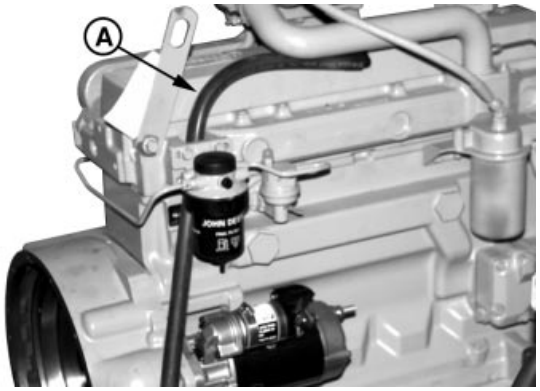
RG,RG34710,5573 –19–20MAY96–1/1

Cleaning Crankcase Vent Tube

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.



RG8017A –UN–19JUN00

RG,RG34710,5574 –19–20MAY96–1/1

Checking Air Intake System

IMPORTANT: The air intake system must not leak. Any leak, no matter how small, may result in internal engine damage due to abrasive dirt and dust entering the intake system.

1. Inspect all intake hoses (piping) for cracks. Replace as necessary.

2. Check clamps (A) on piping which connect the air cleaner, engine and, if present, turbocharger. Tighten clamps as necessary. This will help prevent dirt from entering the air intake system through loose connections causing internal engine damage.

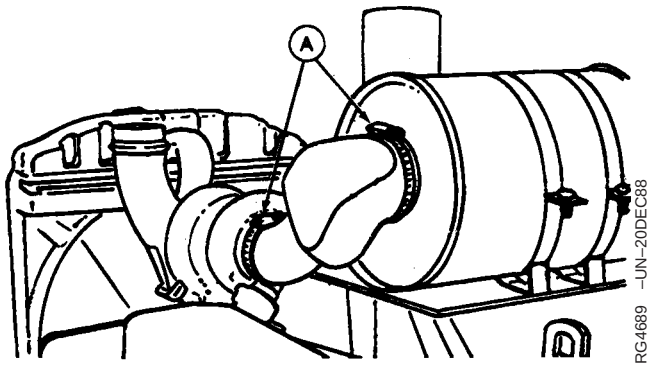
3. If engine has a rubber dust unloader valve (B), inspect the valve on bottom of air cleaner for cracks or plugging. Replace as necessary.

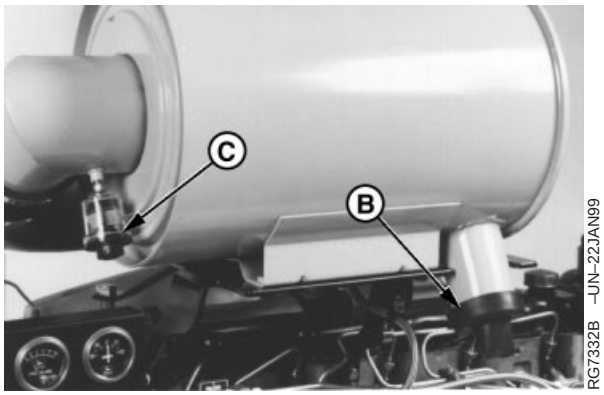
IMPORTANT: ALWAYS REPLACE primary air cleaner element when air restriction indicator shows a vacuum of 625 mm (25 in.) H_2O, is torn, or visibly dirty.

4. Test air restriction indicator (C) for proper operation. Replace indicator as necessary.

IMPORTANT: If not equipped with air restriction indicator, replace air cleaner elements at 600 Hours or 12 Months, whichever occurs first.

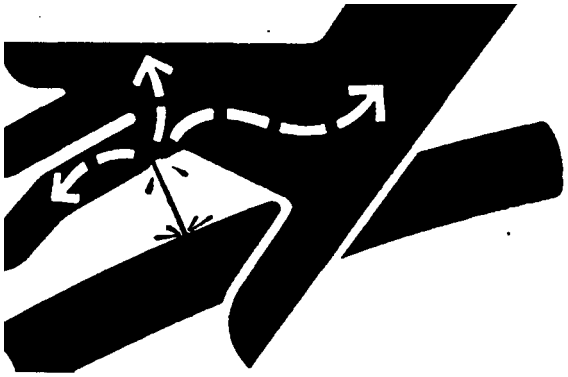
5. Remove and inspect primary air cleaner element. Service as necessary. (See INSPECTING PRIMARY FILTER ELEMENT and REPLACING AIR CLEANER ELEMENTS in Service As Required Section.)





RG,RG34710,5575 –19–20MAY96–1/1

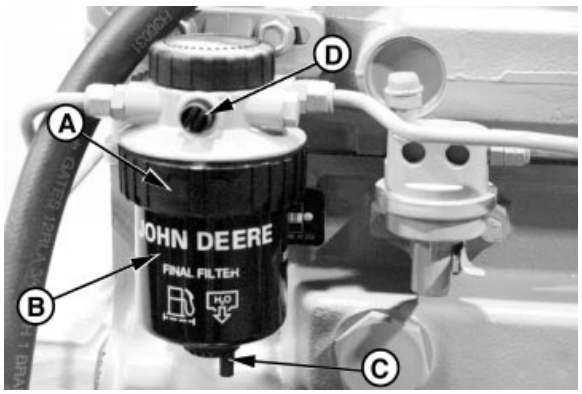
Replacing Fuel Filter Element



X9811 –UN–23AUG88

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.



RG7721 –UN–15JAN99

A—Retaining Ring
B—Filter Element
C—Drain Plug
D—Bleed Plug

1. Close fuel shut-off valve, if equipped.
2. Thoroughly clean fuel filter assembly and surrounding area.
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 counterclockwise 1/4 turn. Remove ring with filter element (B).
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 onto mounting base. Be sure element is properly indexed and firmly seated on base. It may be necessary to rotate filter for correct alignment.

Continued on next page

RG,RG34710,5576 –19–20MAY96–1/2

If equipped with water separator, remove filter element from water separator bowl. Drain and clean separator bowl. Dry with compressed air. Install water separator bowl onto new element. Tighten securely.

7. Align keys on filter element with slots in filter base.

8. 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.

A plug is provided with the new element for plugging the used element.

9. Open fuel shut-off valve and bleed the fuel system. (See BLEEDING FUEL SYSTEM in Service As Required Section.) Tighten bleed plug (D).

RG,RG34710,5576 –19–20MAY96–2/2

Checking Belt Tensioner Spring Tension and Belt Wear (Automatic Tensioner)

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.

Continued on next page

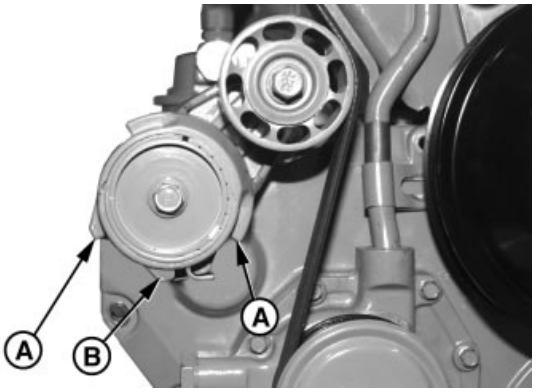
RG,RG34710,5578 –19–20MAY96–1/3

Checking 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.

Visually inspect cast stops (A and B) on belt tensioner assembly.

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 REPLACING FAN AND ALTERNATOR BELTS in Service As Required Section).



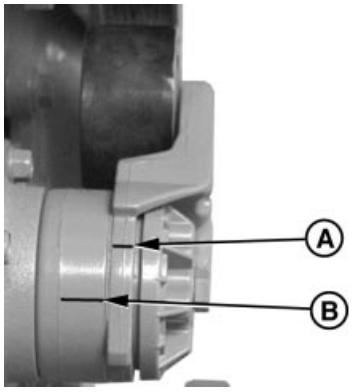
RG8098 –UN–18NOV97

RG,RG34710,5578 –19–20MAY96–2/3

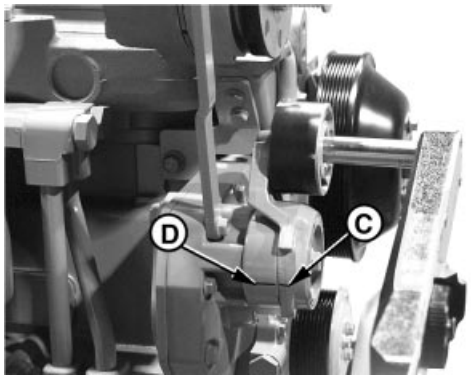
Checking Tensioner Spring Tension

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:

1. Release tension on belt using a breaker bar and socket on tension arm. Remove belt from pulleys.
2. Release tension on tension arm and remove breaker bar.
3. Put a mark (A) on swing arm of tensioner as shown.
4. Measure 21 mm (0.83 in.) from (A) and put a mark (B) on tensioner mounting base.
5. Rotate the swing arm using a torque wrench until marks (A and B) are aligned.
6. Record torque wrench measurement and compare with specification below. Replace tensioner assembly as required.



RG7977 –UN–14NOV97



RG8037C –UN–11SEP00

Specification

Spring Tension Torque..... 18-22 N•m (13-16 lb-ft)

RG,RG34710,5578 –19–20MAY96–3/3

Checking Cooling System

TS281 –UN–23AUG88

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.

IMPORTANT: Air must be expelled from cooling system when system is refilled. Loosen temperature sending unit fitting at rear of cylinder head or plug in thermostat housing to allow air to escape when filling system. Retighten fitting or plug when all the air has been expelled.

1. Visually check entire cooling system for leaks. Tighten all clamps securely.

2. Thoroughly inspect all cooling system hoses for hard, flimsy, or cracked condition. Replace hoses if any of the above conditions are found.

RG,RG34710,5580 –19–20MAY96–1/1

Checking Effectiveness of Coolant Solution

When your coolant has accumulated 500 hours or 12 months of operating time, the effectiveness of your engine coolant should be evaluated by obtaining a coolant sample.

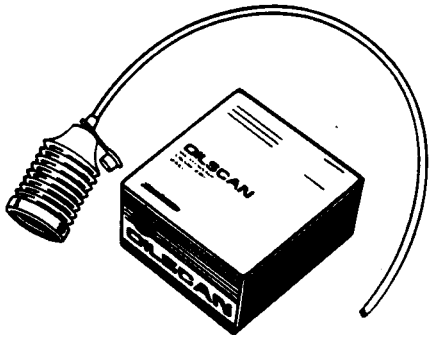
Maintaining adequate concentrations of glycol and inhibiting additives (SCAs) in the coolant is critical to protect the engine and cooling system against freezing, corrosion, and cylinder liner erosion and pitting.

A coolant strip test kit provides a simple, effective way to check freeze point and additive levels.

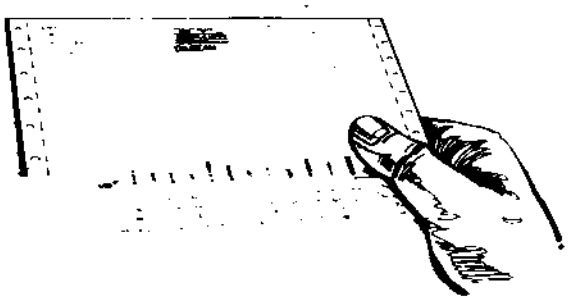
For a more thorough evaluation of your coolant, CoolScan™, where available, is a John Deere sampling program to help you monitor the effectiveness of your engine's coolant solution and identify potential problems before they cause serious damage.

TY16175 or TY16176 3-Way Heavy Duty Coolant Test Kit and DS0251 CoolScan™ kits are available from your John Deere engine distributor or servicing dealer. Refer to instructions provided with kits.

Usually recharging your engine coolant with the recommended amount of TY16004 or TY16005 Liquid Coolant Conditioner at 500 hours or 12 months of operation is adequate. However, with a CoolScan™ analysis report you will be given a more thorough evaluation of your engine coolant condition along with detailed service recommendations. (See ADDING SUPPLEMENTAL COOLANT ADDITIVES, later in this section.)



T6828AB –UN–15JUN89



T6829AB –UN–18OCT88

RG7297 –UN–22SEP99

CoolScan is a trademark of Deere & Company.

RG,RG34710,5581 –19–20MAY96–1/1

Adding Supplemental Coolant Additives (SCA's)

After 500 hours or 12 months of engine operating time, recharge your engine coolant with the recommended amount (see label on container) of TY16004 or TY16005 Liquid Coolant Conditioner.

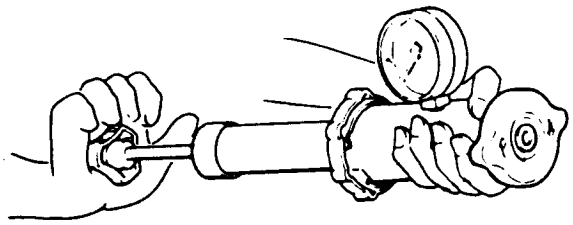
IMPORTANT: TY16004 or TY16005 Liquid Coolant Conditioner is a non-chromate inhibitor and should be used only with low silicate, ethylene-glycol base antifreeze. It does not protect the cooling system from freezing.

RG7276 –UN–05DEC97

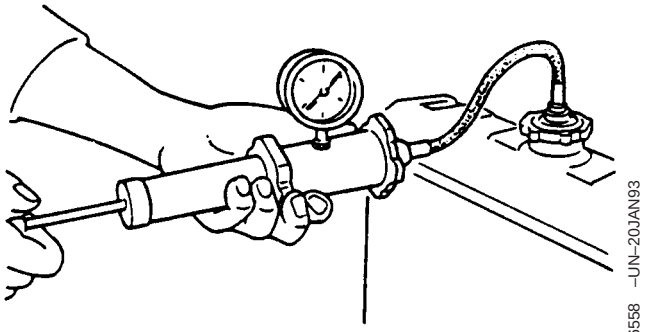
Liquid Coolant Conditioner

RG,RG34710,5582 –19–20MAY96–1/1

Pressure Testing Cooling System



RG6557 –UN–20JAN93



RG6558 –UN–20JAN93

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.

Test Radiator Cap

1. Remove radiator cap and attach to D05104ST Tester as shown.
2. Pressurize cap to 70 kPa (0.7 bar) (10 psi)[1]. Gauge should hold pressure for 10 seconds within the normal range if cap is acceptable.

   If gauge does not hold pressure, replace radiator cap.
3. Remove the cap from gauge, turn it 180°, and retest cap. This will verify that the first measurement was accurate.

Test Cooling System

NOTE: Engine should be warmed up to test overall cooling system.

1. Allow engine 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 70 kPa (0.7 bar) (10 psi)[1].
4. With pressure applied, check all cooling system hose connections, radiator, and overall engine for leaks.

   If leakage is detected, correct as necessary and pressure test system 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.

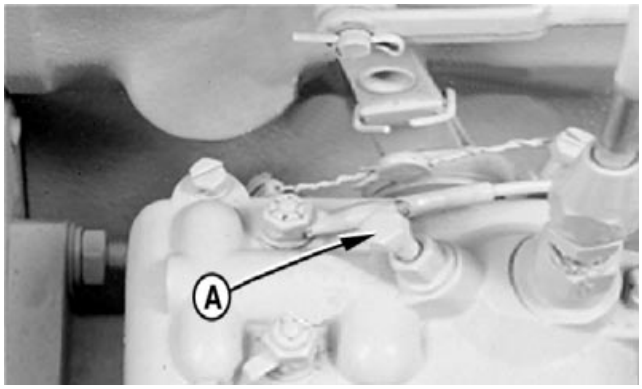
[1]Test pressures recommended are for all Deere OEM cooling systems. On specific vehicle applications, test cooling system and pressure cap according to the recommended pressure for that vehicle.

RG,RG34710,5586 –19–20MAY96–1/1

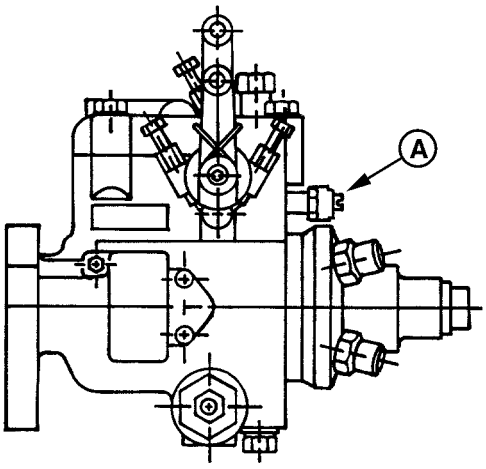
Adjusting Variable Speed (Droop) on Generator Set Engines

Stanadyne Injection Pumps Only

1. Warm engine to normal operating temperature.
2. Run engine at rated speed.
3. Apply full load.
4. Remove load.
5. Note the no-load speed or frequency.
6. If throttle is not spring-loaded type, disconnect throttle linkage or cable.
7. Turn screw (A) to adjust droop.
8. If necessary, adjust and connect throttle linkage or cables.



RG8100 –UN–19JAN99



RG8101 –UN–19JUN00

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RG,RG34710,5583 –19–20MAY96–1/3

Denso In-Line Injection Pumps Only

1. Check for specified no-load (frequency). If governor regulation is within 5–7% range, no adjustment is necessary.

2. If governor regulation is above 7% or below 5%, stop engine and remove cap nuts from adjusting screws before making adjustments.

3. Remove droop adjusting screw access plug (B, shown removed) from top of governor housing.

4. Back out slow idle (adjusting) screw (D) and bumper screw. Pull back on throttle lever (F, toward rear of governor housing) by hand until the droop adjusting screw (C) inside housing can be adjusted through the access plug hole.

5. Screw the droop screw in (clockwise), counting the turns until screw bottoms out. Then, return screw to original setting.

NOTE: A noticable click will occur at each 1/4 turn of droop adjusting screw. One click clockwise will increase no-load speed approximately 10 rpm, counter-clockwise will reduce speed by 10 rpm.

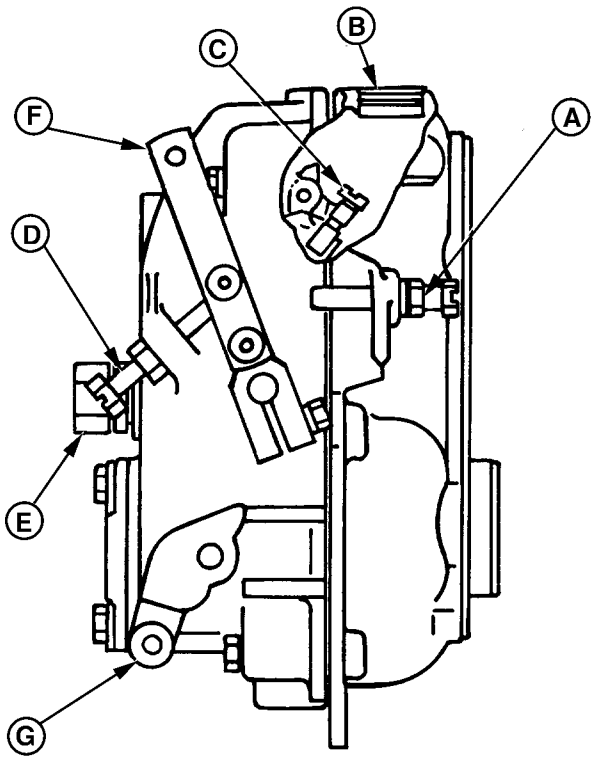
6. Screw in the droop screw (clockwise) no more than 1/2 turn (two clicks) at a time to reducegovernor droop. Turn counterclockwise no more than two clicks at a time to increase governor droop (to reduce governor sensitivity).

7. Replace access plug in top of governor housing. Start engine, apply full (100%) load, and readjust high idle adjusting screw until 1500 rpm is obtained at the specified power.

8. Screw in idle (bumper) spring until engine speed increases 5–10 rpm.

9. Repeat steps 4 through 7 until governor regulation is within the 5–7% range.

10. Replace all cap nuts onto adjusting screws and tighten lock nuts securely.



RG5752 –UN–03NOV97

A—Fast Idle (Stop) Screw
B—Droop Adjusting Screw Access Plug Location
C—Droop Adjusting Screw
D—Slow Idle (Adjusting) Screw
E—Idle (Bumper) Spring
F—Throttle Lever
G—Mechanical Shutoff Lever

Continued on next page

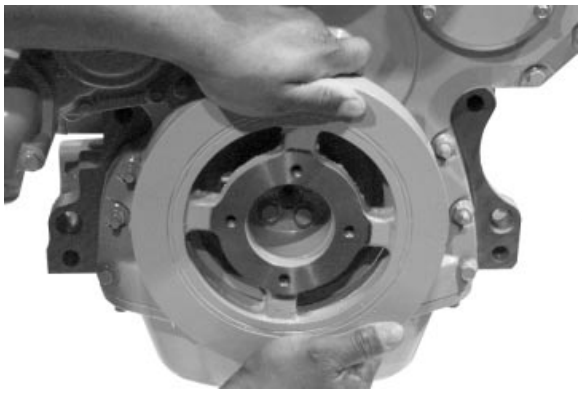
RG,RG34710,5583 –19–20MAY96–2/3

Lucas Injection Pumps Only

See your authorized Lucas Repair Station for speed droop adjustment. This service requires that an internal pump adjustment be made.

RG,RG34710,5583 –19–20MAY96–3/3

Checking Crankshaft Vibration Damper (6-Cylinder Engine Only)

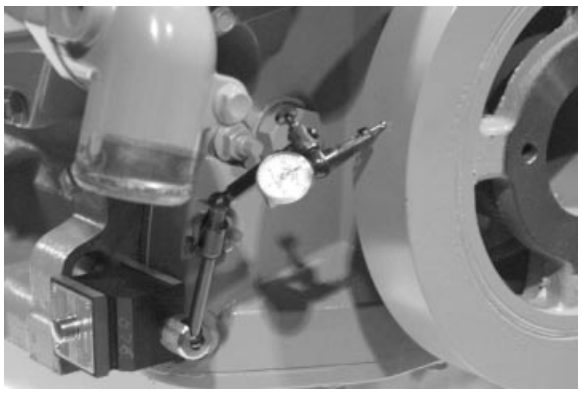


RG8018 –UN–15JAN99

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 60 months, whichever occurs first.

3. Check vibration damper radial runout by positioning a dial indicator (A) so probe contacts damper outer diameter.
4. With engine at operating temperature, rotate crankshaft using either JD281A, JDG820, or JDE83 Flywheel Turning Tool.
5. Note dial indicator reading. If runout exceeds specifications given below, replace vibration damper.



RG7508 –UN–23NOV97

Specification

Vibration Damper Maximum Radial Runout ..... 1.50 mm (0.060 in.)

RG,RG34710,5585 –19–20MAY96–1/1

Flushing Cooling System

TS281 –UN–23AUG88

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.

NOTE: When John Deere COOL-GARD is used, the drain interval is 3000 hours or 36 months. The drain interval may be extended to 5000 hours or 60 months of operation, ***provided that the coolant is tested annually AND additives are replenished, as needed, by adding a supplemental coolant additive (SCA)****.*

If COOL-GARD is not used, the flushing interval is 2000 hours or 24 months of operation.

Drain old coolant, flush the entire cooling system, test thermostats, and fill with recommended clean coolant.

1. Pressure test entire cooling system and pressure cap if not previously done. (See PRESSURE TESTING COOLING SYSTEM, in the Lubrication and Maintenance/600 Hour/12 Month Section.)

2. Slowly open the engine cooling system filler cap or radiator cap to relieve pressure and allow coolant to drain faster.

Continued on next page

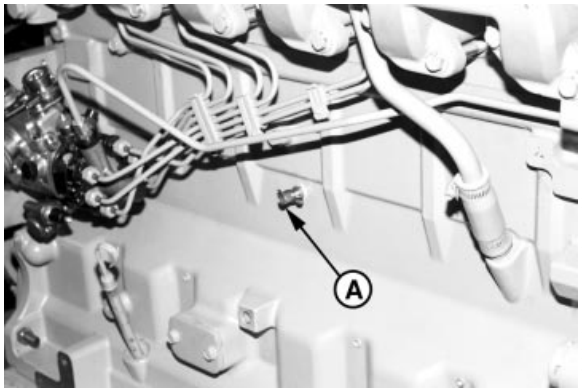
RG,RG34710,5587 –19–20MAY96–1/3

3. Open engine block drain valve (A) on left side of engine. Drain all coolant from engine block.

4. Open radiator drain valve. Drain all coolant from radiator.

5. Remove thermostats at this time, if not previously done. Install cover (without thermostats) using old gasket and tighten cap screws to 47 N•m (35 lb-ft).

6. Close all drain valves after coolant has drained.



RG8019A –UN–19JUN00

CAUTION: Do not run engine longer than 10 minutes. Doing so may cause engine to overheat which may cause burns when radiator water is draining.

7. Fill the cooling system with clean water. Run the engine about 10 minutes to stir up possible rust or sediment.

8. Stop engine, pull off lower radiator hose and remove radiator cap. Immediately drain the water from system before rust and sediment settle.

9. After draining water, close drain valves. Reinstall radiator cap and radiator hose and clamp. Fill the cooling system with clean water and TY15979 John Deere Heavy Duty Cooling System Cleaner or an equivalent cleaner such as Fleetguard® RESTORE™ and RESTORE PLUS™. Follow manufacturer's directions on label.

10. After cleaning the cooling system, drain cleaner and fill with water to flush the system. Run the engine about 10 minutes, remove radiator cap and pull off lower radiator hose, then drain out flushing water.

11. Close all drain valves on engine and radiator. Reinstall radiator hose and tighten clamps securely. Install thermostats using a new gasket. (See TESTING THERMOSTATS OPENING TEMPERATURE later in this section.)

Fleetguard is a trademark of Cummins Engine Company, Inc.
RESTORE is a trademark of Fleetguard.
RESTORE PLUS is a trademark of Fleetguard.

Continued on next page

RG,RG34710,5587 –19–20MAY96–2/3

IMPORTANT: Air must be expelled from cooling system when system is refilled. Loosen temperature sending unit fitting at rear of cylinder head or plug in thermostat housing to allow air to escape when filling system. Retighten fitting or plug after filling cooling system.

12. Add coolant to radiator until coolant touches bottom of filler neck. (See ADDING COOLANT in Service As Required Section.) Install radiator cap.

13. Run engine until it reaches operating temperature. This mixes the solution uniformly and circulates it through the entire system. The normal engine coolant temperature range is 82°—94°C (180° — 202°F).

14. After running engine, check coolant level and entire cooling system for leaks.

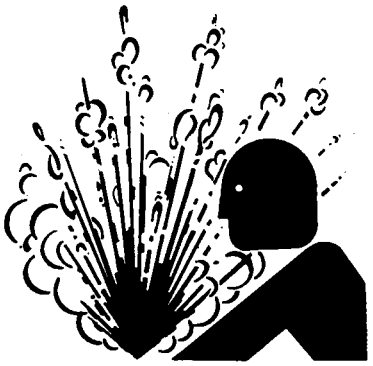
RG,RG34710,5587 –19–20MAY96–3/3

Testing Thermostats Opening Temperature

To Remove Thermostat(s)

NOTE: On some engines, the water manifold/thermostat housing is an integral part of the cylinder head.

CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns. DO NOT drain coolant until it has cooled below operating temperature. Always loosen radiator pressure cap or drain valve slowly to relieve pressure.



TS281 –UN–23AUG88

1. Visually inspect area around thermostat housing for leaks.

2. Remove radiator pressure cap and partially drain cooling system.

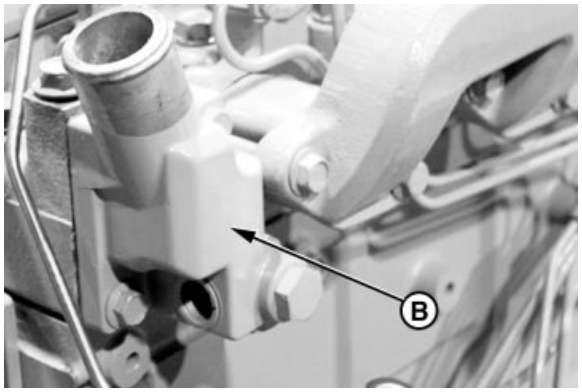
3. Remove thermostat cover-to-water pump tube (A) and seal.

RG8115A –UN–15JAN98

Continued on next page

DPSG,RG34710,112 –19–05NOV99–1/5

4. Remove water manifold.thermostat cover (B) with gasket.
5. Remove thermostat(s)
6. Remove and discard all gasket material. Clean gasket surfaces.
7. Clean and check cover for cracks or damage.



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DPSG,RG34710,112 –19–05NOV99–2/5

Testing Thermostats Opening Temperature

1. Remove thermostat(s).

2. Visually inspect thermostat(s) for corrosion or damage. If dual thermostats, replace as a matched set as necessary.

CAUTION: DO NOT allow thermostat or thermometer to rest against the side or bottom of container when heating water. Either may rupture if overheated.

3. Suspend thermostat and a thermometer in a container of water.

4. Stir the water as it heats. Observe opening action of thermostat and compare temperatures with the specification given in chart below.

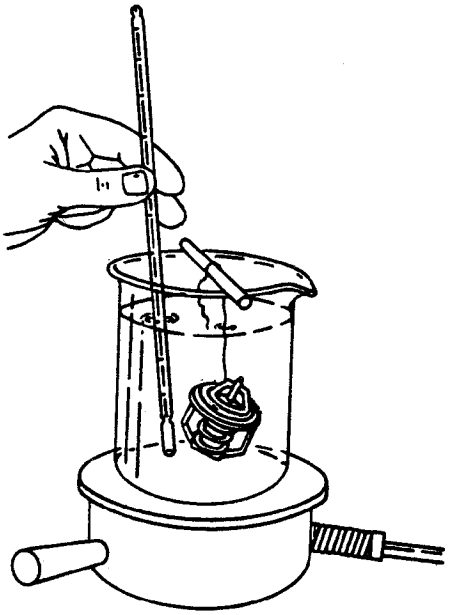
NOTE: Due to varying tolerances of different suppliers, initial opening and full open temperatures may vary slightly from specified temperatures.

THERMOSTAT TEST SPECIFICATIONS

Rating	Initial Opening (Range)	Full Open (Nominal)
71°C (160°F)	69—72°C (156—162°F)	84°C (182°F)
77°C (170°F)	74—78°C (166—172°F)	89°C (192°F)
82°C (180°F)	80—84°C (175—182°F)	94°C (202°F)
89°C (192°F)	86—90°C (187—194°F)	101°C (214°F)
90°C (195°F)	89—93°C (192—199°F)	103°C (218°F)
92°C (197°F)	89—93°C (193—200°F)	105°C (221°F)
96°C (205°F)	94—97°C (201—207°F)	100°C (213°F)
99°C (210°F)	96—100°C (205—212°F)	111°C (232°F)

5. Remove thermostat and observe its closing action as it cools. In ambient air the thermostat should close completely. Closing action should be smooth and slow.

6. Replace any defective thermostat. On a dual thermostat engine, replace both thermostats.



RG5971 –UN–23NOV97

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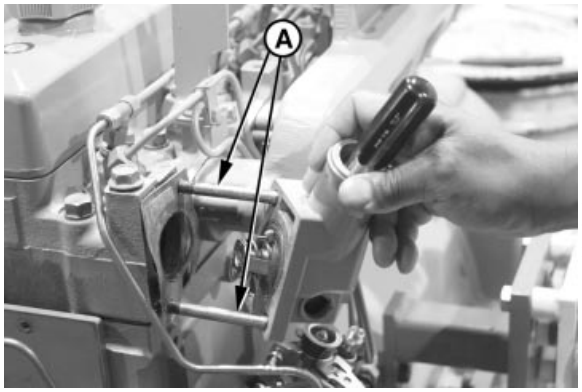
DPSG,RG34710,112 –19–05NOV99–3/5

To Install Thermostats

IMPORTANT: Install manifold gasket so that smaller (round) holes are at lower left and upper right corners of manifold (matching studs A).

1. Clean all gasket material from thermostat cover and housing mounting surfaces.
2. Using guide studs (A) to keep gasket in place, install a new gasket on cylinder head.
3. Install thermostat(s) with jiggle wire facing up in the 12 o'clock position.
4. Using a screwdriver to hold thermostat(s) in place, install thermostat(s) and water manifold/thermostat cover.
5. Tighten cover cap screws to 70 N•m (52 lb-ft).
6. Lubricate new O-ring with PT507 Multi-Purpose Grease. Install seal (B) in thermostat cover.



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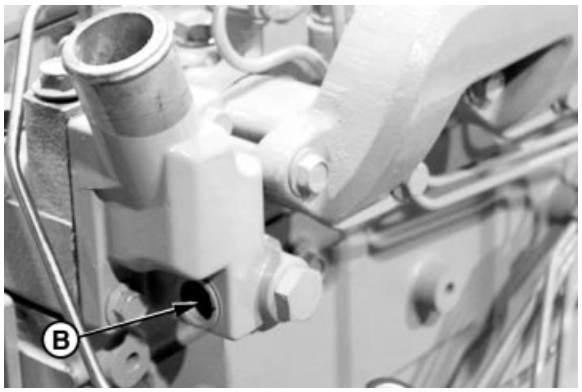

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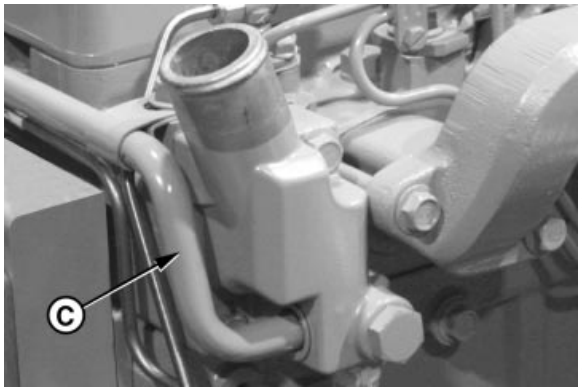
DPSG,RG34710,112 –19–05NOV99–4/5

7. Install water manifold/thermostat cover-to-water pump tube (C). Tighten clamps.
8. If not already done, fill cooling system and check for leaks.

IMPORTANT: Air must be expelled from cooling system when filling. Loosen temperature sending unit fitting at rear of cylinder head or plug in thermostat housing to allow air to escape when filling system. Tighten fitting or plug when all air has been expelled.



RG8115B –UN–15JAN98

DPSG,RG34710,112 –19–05NOV99–5/5

Check and Adjust Valve Clearance

CAUTION: To prevent accidental starting of engine while performing valve adjustments, always disconnect NEGATIVE (—) battery terminal.

IMPORTANT: Valve clearance MUST BE checked and adjusted with engine COLD.

1. Remove rocker arm cover and crankcase ventilator tube.

IMPORTANT: Visually inspect contact surfaces of valve tips and rocker arm wear pads. Check all parts for excessive wear, breakage, or cracks. Replace parts that show visible damage.

Rocker arms that exhibit excessive valve clearance should be inspected more thoroughly to identify damaged parts.

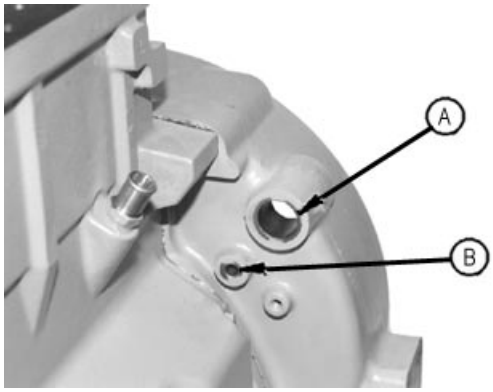
2. Remove plastic plugs or cover plate from engine timing/rotation hole (A) and timing pin hole (B).

NOTE: Some engines are equipped with flywheel housings which do not allow use of an engine flywheel rotation tool. These engines may be rotated from front nose of engine, using JDG966 Crankshaft Front/Rear Rotation Adapter.

3. Using JDE83 or JDG820 Flywheel Turning Tool, rotate engine flywheel in running direction (clockwise viewed from front) until No. 1 cylinder is at TDC compression stroke. Insert JDE81-4 Timing Pin in flywheel.

   If No.1 cylinder rocker arms are loose, the engine is at No. 1 TDC compression.

   If No. 1 cylinder rocker arms are not loose, rotate engine one full revolution (360°) to No. 1 TDC compression.



RG7408 –UN–06AUG96

Flywheel Housing Timing Holes

A—Timing/Rotation Hole
B—Timing Pin Hole

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DPSG,RG41165,137 –19–15AUG00–1/5

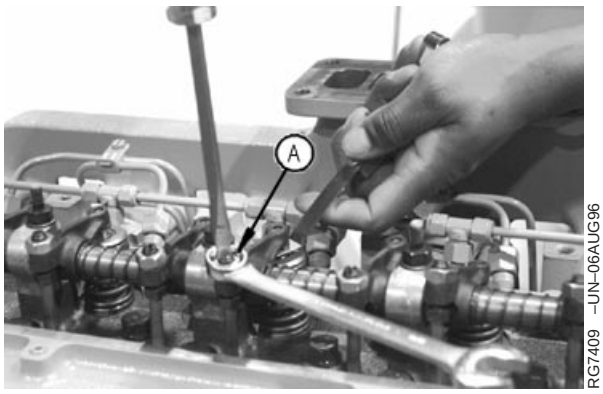
4. With engine lock-pinned at TDC of No. 1 piston's compression stroke, check valve clearance to following specifications. (Use sequence for 4-cylinder or 6-cylinder engines as outlined on next page.)

Specification	
Intake Valve Clearance Checking (Rocker Arm-to-Valve Tip) (Engine Cold) Clearance	0.31—0.38 mm (0.012—0.015 in.)
Exhaust Valve Clearance Checking (Rocker Arm-to-Valve Tip) (Engine Cold) Clearance	0.41—0.48 mm (0.016—0.019 in.)

DPSG,RG41165,137 –19–15AUG00–2/5

5. If valves need adjusting, use the appropriate valve clearance adjustment procedure on the next page and adjust to specifications below. Loosen the jam nut (A) 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 jam nut to specifications. Recheck clearance again after tightening jam nut. Readjust clearance as necessary.

Specification	
Intake Valve Clearance Adjustment (Rocker Arm-to-Valve Tip) (Engine Cold) Clearance	0.36 mm (0.014 in.)
Exhaust Valve Clearance Adjustment (Rocker Arm-to-Valve Tip) (Engine Cold) Clearance	0.46 mm (0.018 in.)



Adjusting Valves

A—Adjusting Screw Jam Nut

Specification	
Rocker Arm Adjusting Screw Jam Nut Torque	27 N•m (20 lb-ft)

6. Replace rocker arm cover and crankcase ventilator tube.

Continued on next page

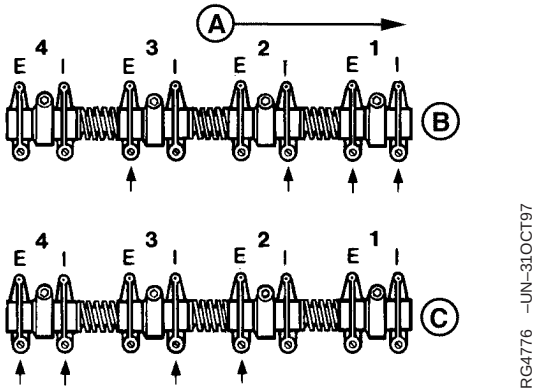
DPSG,RG41165,137 –19–15AUG00–3/5

4-Cylinder Engine:

NOTE: Firing order is 1-3-4-2.

1. Using JDE81-4 Timing Pin, 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. Turn crankshaft 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.

A—Front of Engine
B—No. 1 Piston TDC Compression
C—No. 4 Piston TDC Compression
E—Exhaust Valve
I—Intake Valve



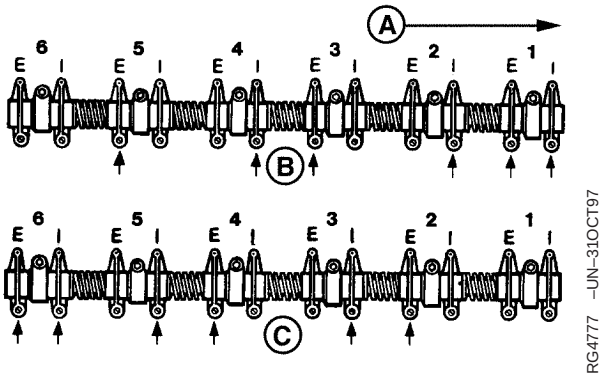
4-Cylinder Engine Valve Adjustment

DPSG,RG41165,137 –19–15AUG00–4/5

6-Cylinder 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. Turn crankshaft 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.



6-Cylinder Engine Valve Adjustment

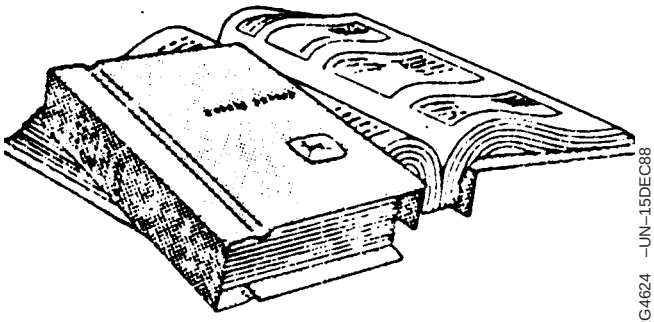
A—Front of Engine
B—No. 1 Piston TDC Compression
C—No. 6 Piston TDC Compression
E—Exhaust Valve
I—Intake Valve

DPSG,RG41165,137 –19–15AUG00–5/5

Service as Required

Additional Service Information

This is not a detailed service manual. If you want more detailed service information, use the form in the back of this manual to order a component technical manual.



RG4624 –UN–15DEC88

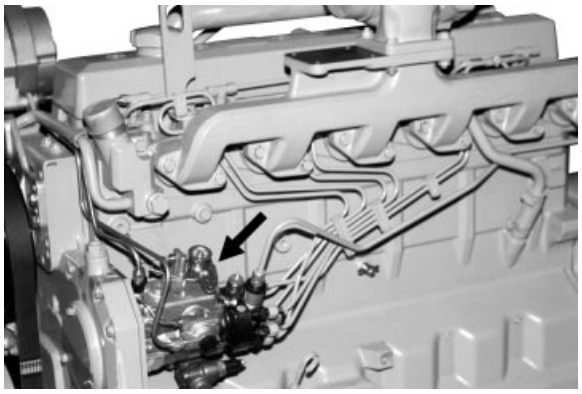
RG,RG34710,5591 –19–20MAY96–1/1

Do Not Modify Fuel System

IMPORTANT: Modification or alteration of the injection pump (arrow), the injection pump timing, or the 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.)



RG8022A –UN–19JUN00

RG,RG34710,5592 –19–20MAY96–1/1

Adding Coolant

TS281 –UN–23AUG88

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.

IMPORTANT: Never pour cold liquid into a hot engine, as it may crack cylinder head or block. DO NOT operate engine without coolant for even a few minutes.

John Deere TY15161 Cooling System Sealer may be added to the radiator to stop leaks. DO NOT use any other stop-leak additives in the cooling system.

Air must be expelled from cooling system when coolant is added.

1. Loosen temperature sending unit fitting at rear of cylinder head or plug in side of thermostat housing to allow air to escape when filling system.

IMPORTANT: When adding coolant to the system, use the appropriate coolant solution. (See ENGINE COOLANT SPECIFICATIONS in Fuels, Lubricants, and Coolant Section for mixing of coolant ingredients before adding to cooling system.)

Do not overfill cooling system. A pressurized system needs space for heat expansion without overflowing at top of radiator.

2. Fill until coolant level touches bottom of radiator filler neck.

3. Tighten plugs and fittings when air has been expelled from system.

Continued on next page

RG,RG34710,5593 –19–20MAY96–1/2

4. Run engine until it reaches operating temperature.

RG,RG34710,5593 –19–20MAY96–2/2

Replacing Single Stage Air Cleaner

IMPORTANT: ALWAYS REPLACE air cleaner when air restriction indicator shows a vacuum of 625 mm (25 in.) H_2O, is torn, or visibly dirty.

NOTE: This procedure applies to John Deere single stage air cleaner kits. Refer to manufacturers' instructions for servicing air cleaners not supplied by John Deere.

1. If equipped, loosen body clamp.
2. Loosen clamp around outlet neck (A).
3. Remove air cleaner.
4. Install new filter so that overlap (B) of air cleaner outlet neck and engine intake pipe is to specification below.

Specification

Air Cleaner Neck to Engine Intake Overlap ..... 38 mm (1.5 in)

5. Tighten neck clamp (A) to specification below.

Specification

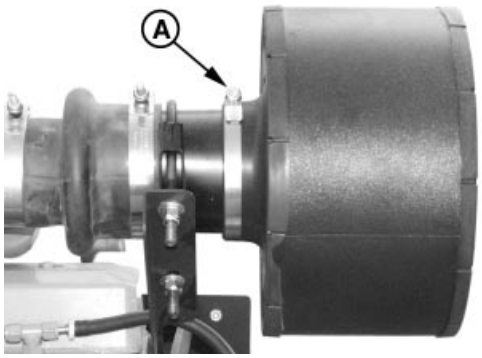
Air Cleaner Neck Clamp Torque ..... 6.8 N•m (60 lb-in.)

IMPORTANT: Do NOT overtighten body clamp. Overtightening may cause crushing of air cleaner body. Tighten body clamp only until snug.

6. If equipped, tighten body clamp until snug.

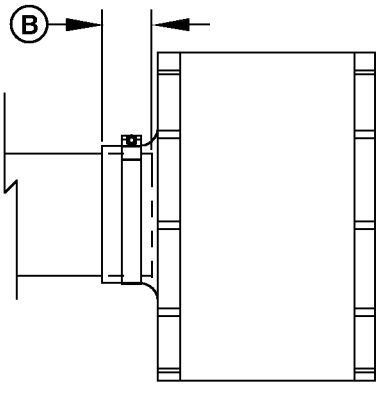
IMPORTANT: Whenever the air cleaner has been serviced or removed, ALWAYS fully depress the air restriction indicator reset button (if equipped) to assure accurate readings.

7. If equipped, fully depress air restriction indicator reset button and release to reset indicator.



RG11319A –UN–06SEP00

Single Stage Air Filter



RG11320 –UN–07SEP00

A—Outlet Neck Clamp
B—Filter to Engine Overlap

RG,RG34710,5594 –19–20MAY96–1/1

Replacing Axial Seal Air Cleaner Filter Element

IMPORTANT: ALWAYS REPLACE primary air cleaner element when air restriction indicator shows a vacuum of 625 mm (25 in.) H_2O, is torn, or visibly dirty.

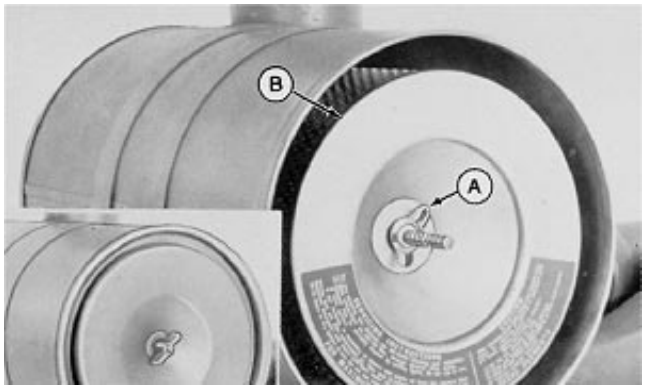
NOTE: This procedure applies to John Deere 2-stage axial seal air cleaner kits. Refer to manufacturers' instructions for servicing air cleaners not supplied by John Deere.

1. Remove wing nut and remove canister cover shown in small illustration inset.
2. Remove wing nut (A) and remove primary element (B) from canister.
3. Thoroughly clean all dirt from inside canister.

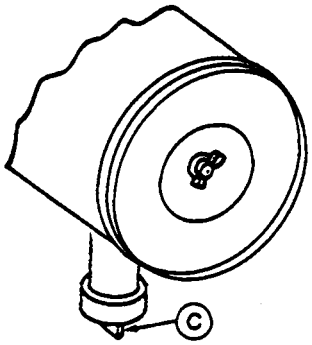
NOTE: Some engines may have a dust unloader valve (C) on the air cleaner. If equipped, squeeze valve tip to release any trapped dirt particles.

IMPORTANT: Remove secondary (safety) element (E) ONLY for replacement. DO NOT attempt to clean, wash, or reuse secondary element. Replacement of secondary element is usually necessary ONLY when primary element has a hole in it.

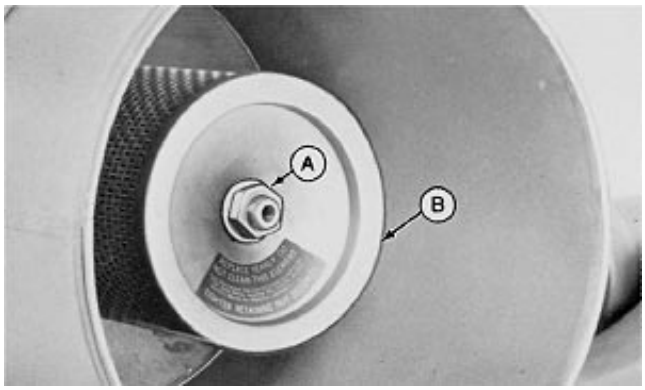
4. To replace secondary element, remove retaining nut (D) and secondary element (E). Immediately replace secondary element with new element to prevent dust from entering air intake system.
5. Install new primary element and tighten wing nut securely. Install cover assembly and tighten retaining wing nut securely.



RG4686 –UN–20DEC88



RG4687 –UN–20DEC88



RG4688 –UN–20DEC88

Continued on next page
RG41165,000008A –19–06SEP00–1/2

IMPORTANT: Whenever the air cleaner has been serviced or had cover removed, ALWAYS fully depress the air restriction indicator reset button (if equipped) to assure accurate readings.

6. If equipped, fully depress air restriction indicator reset button and release to reset indicator.

RG41165,000008A –19–06SEP00–2/2

Replacing Radial Seal Air Cleaner Filter Element

IMPORTANT: ALWAYS REPLACE primary air cleaner element when air restriction indicator shows a vacuum of 625 mm (25 in.) H_2O, is torn, or visibly dirty.

NOTE: This procedure applies to John Deere 2-stage radial seal air cleaner kits. Refer to manufacturers' instructions for servicing air cleaners not supplied by John Deere.

1. Unlatch and remove dust cup/cover (A) of air cleaner.
2. Move end of filter (B) back and forth gently to break seal.
3. Pull filter (B) off outlet tube and out of housing.
4. Thoroughly clean all dirt from inside housing and from outlet bore.

IMPORTANT: Remove secondary (safety) element (C) ONLY for replacement. DO NOT attempt to clean, wash, or reuse secondary element. Replacement of secondary element is usually necessary ONLY when primary element has a hole in it.

5. To replace secondary element (C), pull filter element out gently. Immediately replace secondary element with new element to prevent dust from entering air intake system.
6. Install new primary filter element. Apply pressure by hand at outer rim of filter.

IMPORTANT: Do NOT use latches on cover to force filter into air cleaner. Using cover to force filter will damage cleaner housing.

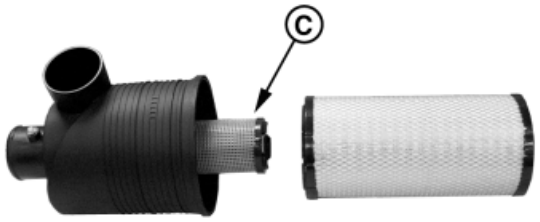
7. Close housing with dust unloader valve aimed down and latch latches.

RG11321A –UN–08SEP00

Dust Cup/Cover

RG11322A –UN–08SEP00

Primary Filter Element



RG11327A –UN–08SEP00

Secondary Filter Element

A—Dust Cap/Cover
B—Primary Filter Element
C—Secondary Filter Element

Continued on next page

IMPORTANT: Whenever the air cleaner has been serviced or had cover removed, ALWAYS fully depress the air restriction indicator reset button (if equipped) to assure accurate readings.

8. If equipped, fully depress air restriction indicator reset button and release to reset indicator.

RG41165,000008B –19–06SEP00–2/2

Replacing Fan and Alternator Belts

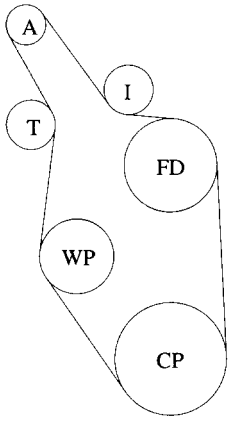
Refer to CHECKING BELT TENSIONER SPRING TENSION AND BELT WEAR in Lubrication and Maintenance/250 Hour/6 Month Section for additional information on the belt tensioner.

1. Inspect belts for cracks, fraying, or stretched out areas. Replace if necessary.
2. To replace belt with automatic tensioner, release tension on belt using a breaker bar and socket on tension arm.

   To replace belt with manual tensioner, release tension at belt tensioner (See MANUAL BELT TENSIONER ADJUSTMENT in Lubrication and Maintenance/250 Hour/6 Month Section.)
3. Remove poly-vee belt from pulleys and discard belt.
4. Install new belt, making sure belt is correctly seated in all pulley grooves. Refer to belt routing at right for your application.
5. Apply tension to belt with tensioner. Remove socket.
6. Start engine and check belt alignment.

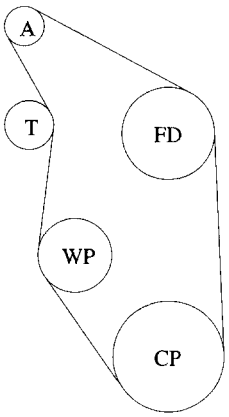
[1]

A—Alternator
CP—Crank Pulley
FC—Freon Compressor
FD—Fan Drive
I—Idler Pulley
T—Tensioner
WP—Water Pump



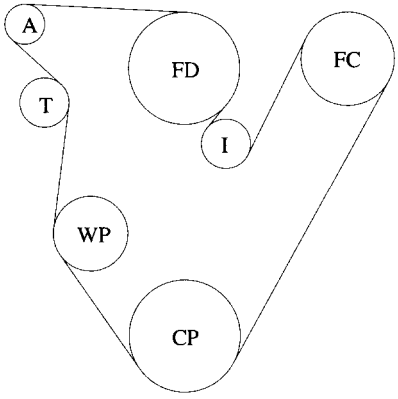
RG8102 –UN–19JUN00

**290 mm (11.4 in.) Fan Height and Lower*



RG8103 –UN–19JUN00

**338 mm (13.3 in.) Fan Height and Higher Without Freon Compressor*



RG8104 –UN–19JUN00

**402 mm (15.8 in.) Fan Height With Freon Compressor*

[1]**Measured from crank centerline to fan drive center.*

RG,RG34710,5599 –19–20MAY96–1/1

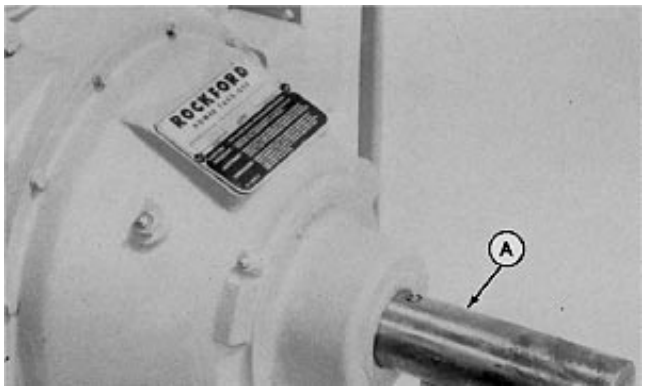
Power Take-Off (PTO) Clutch

CAUTION: Entanglement in rotating driveline can cause serious injury or death. Keep shield on PTO drive shaft (A) between the clutch housing and the engine driven equipment at all times during engine operation. Wear close fitting clothing. Stop the engine and be sure PTO driveline is stopped before making adjustments.

TS198 –UN–23AUG88

Proper performance of the power take-off unit will be related to the care it is given. Lubricate it periodically and keep the clutch properly adjusted. (See Lubrication and Maintenance/250 Hour Section.)

If the power take-off does not work properly after adjustment and lubrication, contact your authorized servicing dealer or engine distributor.



RG4693 –UN–14DEC88

RG,RG34710,5600 –19–20MAY96–1/1

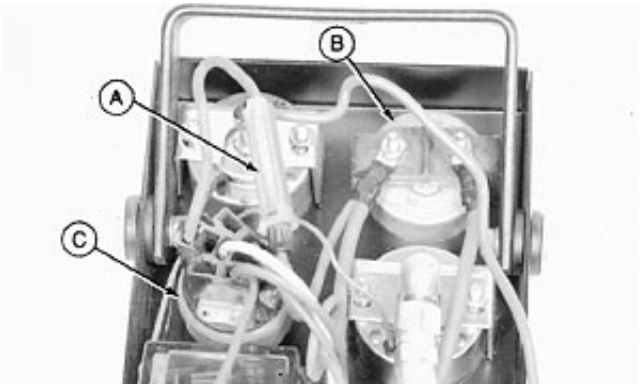
Checking Fuses

The following instructions apply to engines equipped with a John Deere instrument panel.

1. On engines with the early instrument panel (—1998), check the fuse (A) between the ammeter (B) and key switch (C) located on back side of instrument panel. If defective, replace with an equivalent 25-amp fuse.

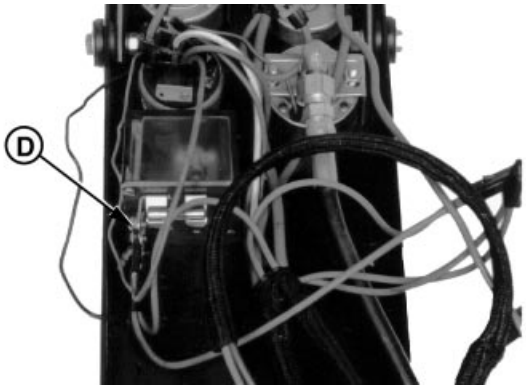
2. Check the fuse (D) mounted on the bottom of the magnetic safety switch. If defective, install an equivalent 14-amp fuse.

3. On later (1999—) North American instrument panels, check the fuse in fuse holder (E) on front face of instrument panel. Replace as necessary with an equivalent 14-amp fuse.



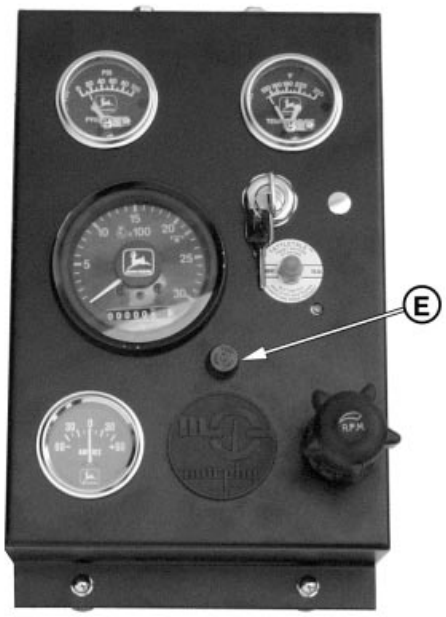
RG4493 –UN–14DEC88

North American (—1998) Instrument Panel Shown



RG4496A –UN–19JUN00

North American (—1998) Instrument Panel Shown

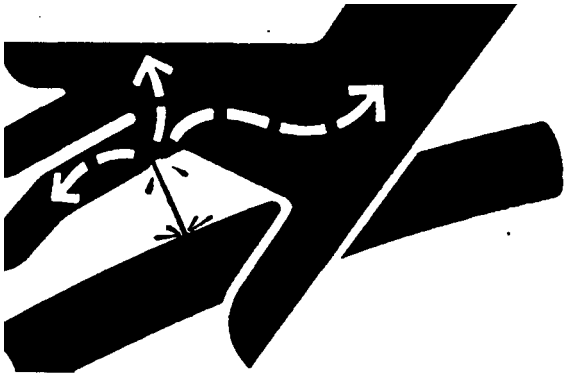


RG11299K –UN–11SEP00

North American (1999—) Instrument Panel Shown

RG,RG34710,5601 –19–20MAY96–1/1

Bleeding the Fuel System



X9811 –UN–23AUG88

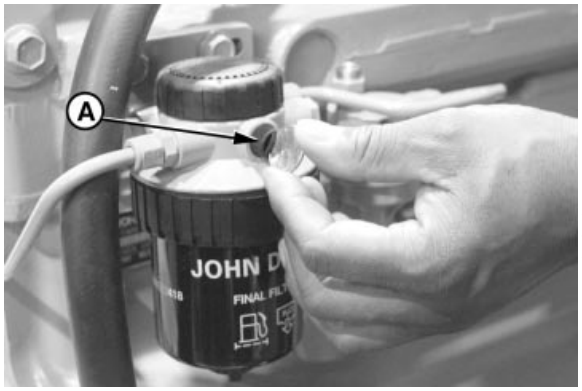
CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting fuel or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of 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.

Whenever the fuel system has been opened up for service (lines disconnected or filters removed), it will be necessary to bleed air from the system.

RG,RG34710,5602 –19–20MAY96–1/7

1. Loosen the air bleed vent screw (A) two full turns by hand on fuel filter base.



RG7947 –UN–13NOV97

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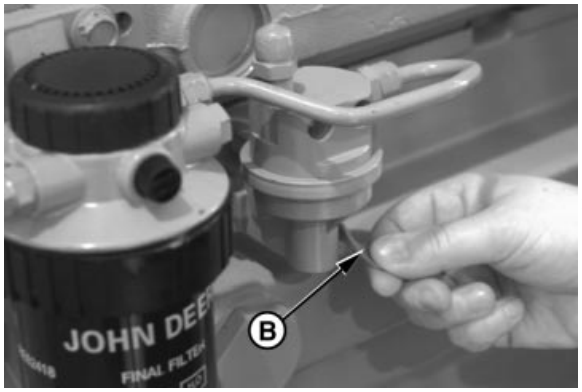
RG,RG34710,5602 –19–20MAY96–2/7

2. Operate supply pump primer lever (B) until fuel flow is free from air bubbles.

3. Tighten bleed plug securely, continue operating hand primer until pumping action is not felt. Push hand primer inward (toward engine) as far as it will go.

4. Start engine and check for leaks.

   If engine will not start, it may be necessary to bleed air from fuel system at fuel injection pump or injection nozzles as explained next.



RG8013A –UN–15JAN99

RG,RG34710,5602 –19–20MAY96–3/7

At Fuel Injection Pump

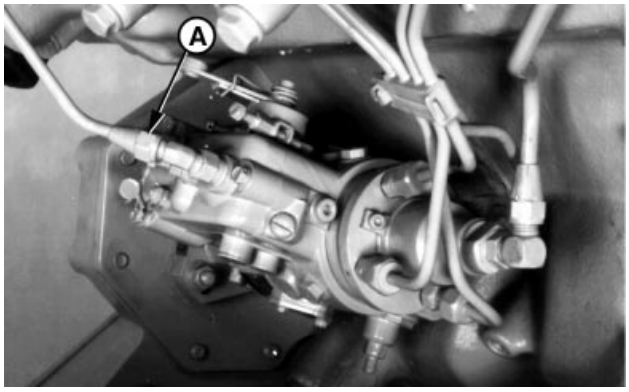
On Stanadyne rotary pumps:

1. Slightly loosen fuel return line connector (A) at fuel injection pump.

2. Operate fuel supply pump primer lever until fuel, without air bubbles, flows from fuel return line connection.

3. Tighten return line connector to 27 N•m (20 lb-ft).

4. Leave hand primer in the up position away from the cylinder block.



RG6264 –UN–03NOV97

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RG,RG34710,5602 –19–20MAY96–4/7

On Lucas rotary pumps:

1. Loosen bleed screw (B) on pump cover.

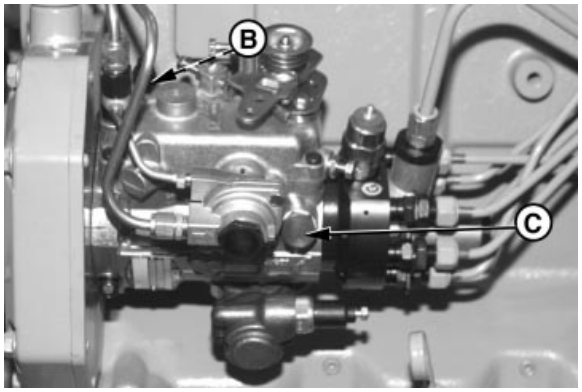
NOTE: On Models DP200/201/203 Injection Pumps, bleed screw is located on top of cover near the fuel return line.

2. Operate fuel supply pump primer lever or turn ignition switch to “ON”.

3. Wait until fuel flow is free of air bubbles. Tighten bleed screw.

4. Leave hand primer in the up position away from the cylinder block.

CAUTION: NEVER loosen screw (C) securing pump head, otherwise pump damage may occur.



RG7948 –UN–13NOV97

RG,RG34710,5602 –19–20MAY96–5/7

On Denso in-line pumps:

1. Unscrew hand primer on fuel supply pump until it can be pulled by hand.

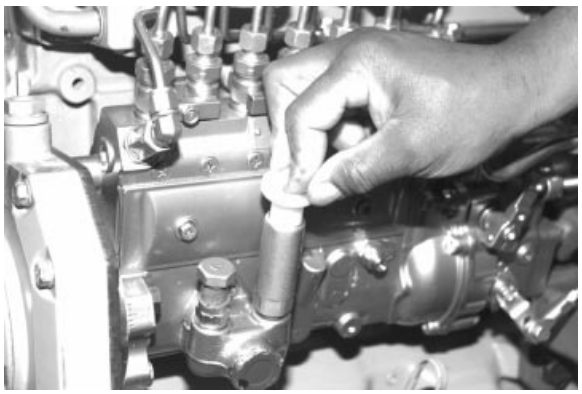
2. Open filter port plug.

3. Operate the hand primer until a smooth flow of fuel, free of bubbles, comes out of the filter plug hole.

IMPORTANT: Be sure hand primer is all the way down in barrel before tightening to prevent internal thread damage.

4. Simultaneously stroke the hand primer down and close the filter port plug. This prevents air from entering the system. Tighten plug securely. DO NOT overtighten.

5. Lock hand primer in position.


RG8069 –UN–23NOV97

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RG,RG34710,5602 –19–20MAY96–6/7

At Fuel Injection Nozzles

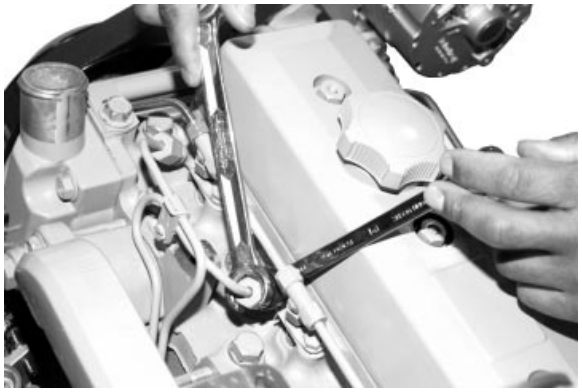
1. Move the speed control lever to half throttle position. On engines equipped with electronic fuel shut-off solenoid, energize solenoid.

2. Using two open-end wrenches, loosen fuel line connection at injection nozzle.

3. 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).

4. 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.



RG7725 –UN–08JAN97

RG,RG34710,5602 –19–20MAY96–7/7

Troubleshooting

General Troubleshooting Information

Troubleshooting engine problems can be difficult. An engine wiring diagram is provided in this section to help isolate electrical problems on power units using John Deere wiring harness and instrument (gauge) panel.

Wiring diagrams are shown for each of the three types of instrument panels offered for these engines.

Later in this section is a list of possible engine problems that may be encountered accompanied by possible causes and corrections. The illustrated diagrams and troubleshooting information are of a general nature, final design of the overall system for your engine application may be different. See your engine distributor or servicing dealer if you are in doubt.

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.

RG,RG34710,5605 –19–20MAY96–1/1

Engine Wiring Diagram Legend (North America)

A1 — Speed Control Unit
B1 — Magnetic Speed Sensor
B2 — Coolant Temperature Sensor
B3 — Oil Pressure Sensor
F1 — Starting Circuit Fuse (14 amp)
F3 — Fuse (Early Models)[1]
G1 — Battery
G2 — Alternator
H1 — Coolant Temperature Indicator Lamp
H2 — Oil Pressure Indicator Lamp
H3 — Alternator Indicator Lamp
K1 — Starter Relay
M1 — Starter Motor
P1 — Coolant Temperature Gauge
P2 — Oil Pressure Gauge
P3 — Crankcase Oil Level Switch/Gauge
P4 — Tachometer[1]
P5 — Hourmeter (Early Models)[2]
P6 — Ammeter
R1 — Resistor (48 ohm)[3]
S1 — Key Switch
S2 — Magnetic Safety Switch—North American
Auto Override Module—European (Saran)
W1 — Ground on K1 Starter Relay Mounting Stud
Y1 — Starter Solenoid
Y2 — Fuel Shut-off Solenoid
BLK — Black
BLU — Blue
BRN — Brown
DK BLU — Dark Blue
GRN — Green
ORG — Orange
PUR — Purple
RED — Red
YEL — Yellow

[1] P4 tachometer has a built-in hourmeter. On some earlier engines, a separate hourmeter (P5) and fuse (F3) were used.

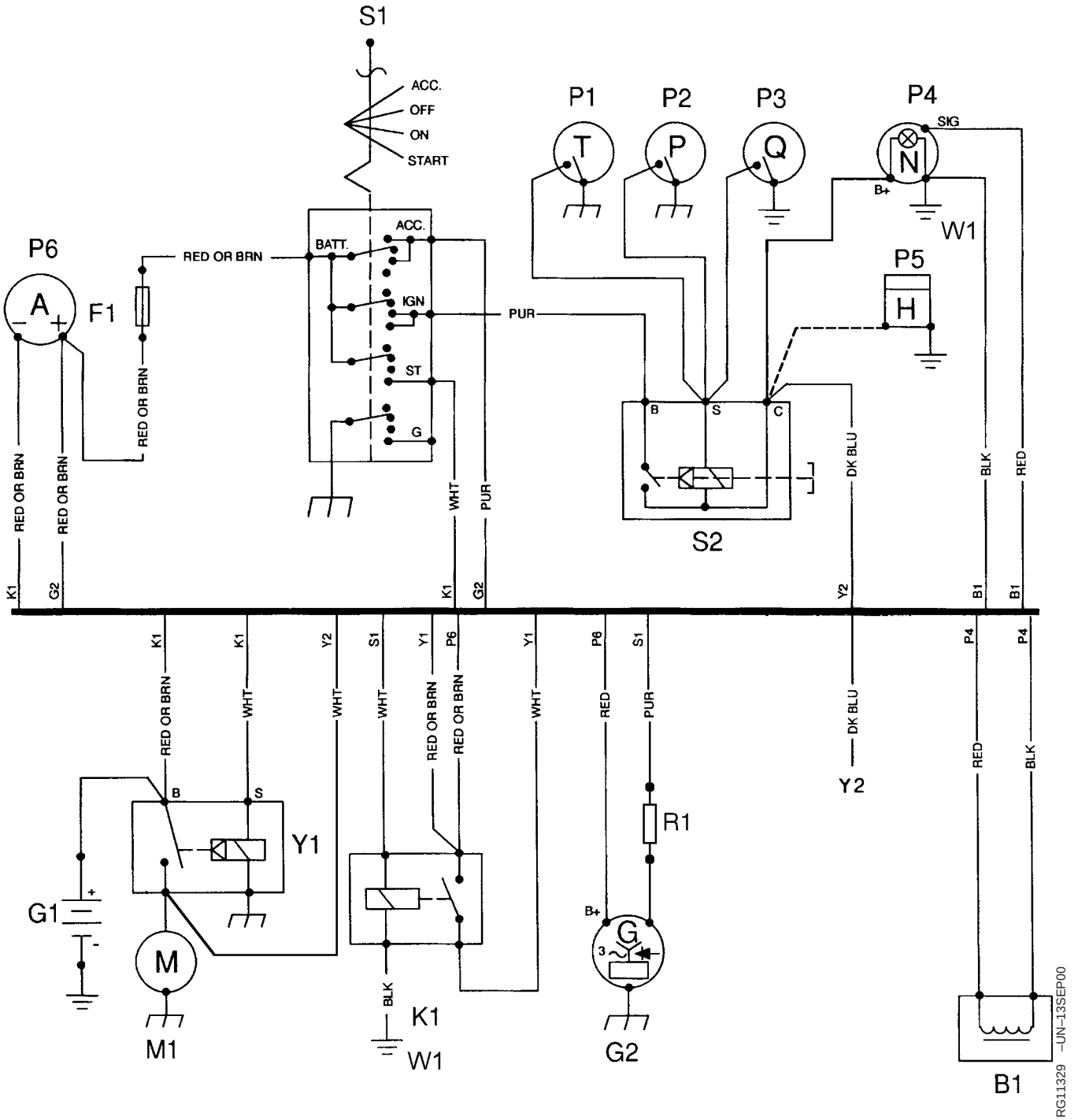
[2] P4 tachometer has a built-in hourmeter. On some engines, a separate hourmeter (P5) and fuse (F3) are used.

[3] Later harnesses have two parallel 100 ohm resistors for the alternator.

DPSG,RG41165,126 –19–19JUN00–1/1

Wiring Diagram (North America)

S1 KEY SWITCH					
	B	G	ACC.	ON	ST.
OFF					
ACC.	•		•		
ON	•		•	•	
START	•	•		•	•



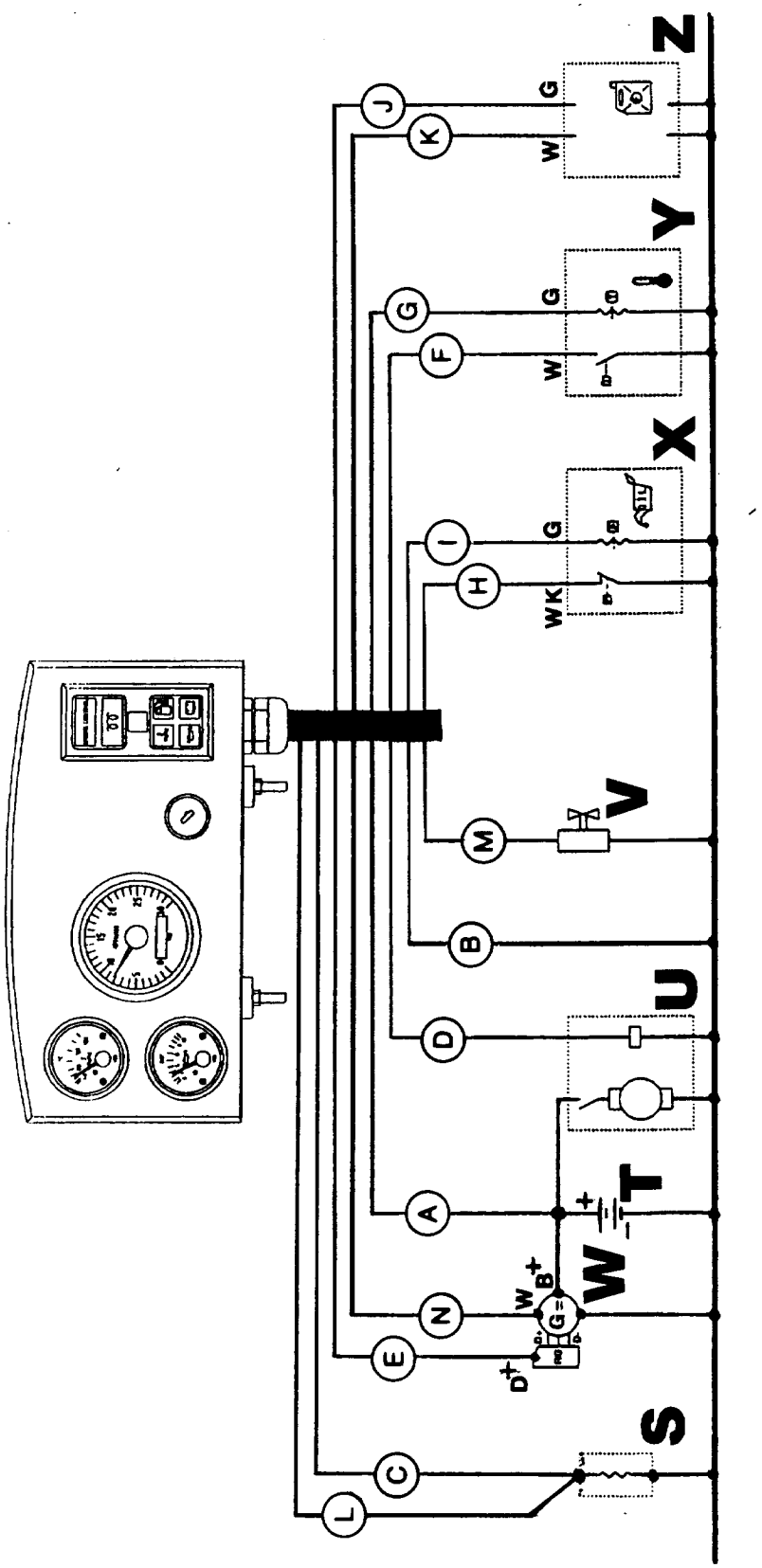
DPSG,RG41165,127 –19–19JUN00–1/1

Engine Wiring Diagram Legend—VDO Instrument Panel (Except North America)

A — 6 mm^2, Red
B — 1.5 mm^2, Black
C — 6 mm^2, Blue
D — 4 mm^2, Black
E — 0.75 mm^2, Orange
F — 0.75 mm^2, White
G — 0.75 mm^2, Blue
H — 0.75 mm^2, Purple
I — 0.75 mm^2, Grey
J — 0.75 mm^2, Brown
K — 0.75 mm^2, Dark Blue
L — 0.75 mm^2, Black
M — 0.75 mm^2, Green/Yellow
N — 0.75 mm^2, Red
O—R — Not Used
S — Preheater
T — Battery
U — Starting Motor
V — Electrical Shut-Off
W — Alternator
X — Oil Pressure Sensor
Y — Coolant Temperature Sensor
Z — Fuel Tank Gauge

DPSG,RG41165,129 –19–19JUN00–1/1

Engine Wiring Diagram—VDO Instrument Panel (Except North America)



CD623P5 –UN–13NOV98

DPSG,RG41165,131 –19–19JUN00–1/1

Engine Troubleshooting

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.	Disengage PTO.
	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”.

Continued on next page

Symptom	Problem	Solution
Engine knocks	Low engine oil level.	Add oil to engine crankcase.
	Injection pump out of time.	See your authorized servicing dealer or engine distributor.
	Low coolant temperature.	Remove and check thermostat.
	Engine overheating.	See “Engine Overheats”.
Engine runs irregularly or stalls frequently	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.
	Dirty or faulty injection nozzles.	Have authorized servicing dealer or engine distributor check injectors.
Below normal engine temperature	Defective thermostat.	Remove and check thermostat.
	Defective temperature gauge or sender.	Check gauge, sender, and connections.
Lack of power	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.

Continued on next page

Symptom	Problem	Solution
	Turbocharger not functioning. (Turbocharger engines only.)	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.
	Improper type of oil.	Drain, fill crankcase with oil of proper viscosity and quality.
High oil consumption	Crankcase oil too light.	Use proper viscosity oil.
	Oil leaks.	Check for leaks in lines, gaskets, and drain plug.
	Restricted crankcase vent tube.	Clean vent tube.
	Defective turbocharger.	See your authorized servicing dealer or engine distributor.
Engine emits white smoke	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 out of time.	See your authorized servicing dealer or engine distributor.
Engine emits black or gray exhaust smoke	Improper type of fuel.	Use proper fuel.
	Clogged or dirty air cleaner.	Service air cleaner.

Continued on next page

Symptom	Problem	Solution
	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-vee belt or defective belt tensioner.	Check automatic belt tensioner and check belts for stretching. Replace as required.
	Low engine oil level.	Check oil level. Add oil as 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.

Continued on next page

Symptom	Problem	Solution
	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.
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.
	Defective alternator.	Test charging system.
Battery uses too much water	Cracked battery case.	Check for moisture and replace as necessary.
	Defective battery.	Test battery.
	Battery charging rate too high.	Test charging system.
Batteries will not charge	Loose or corroded connections.	Clean and tighten connections.
	Sulfated or worn-out batteries.	See your authorized servicing dealer or engine distributor.
	Stretched poly-vee belt or defective belt tensioner.	Adjust belt tension or replace belts.
Starter will not crank	PTO engaged.	Disengage PTO.
	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.

Continued on next page

Symptom	Problem	Solution
	Blown fuse (MDL-25)	Replace fuse.
Starter cranks slowly	Low battery output.	See your authorized servicing dealer or engine distributor.
	Crankcase oil too heavy.	Use proper viscosity oil.
	Loose or corroded connections.	Clean and tighten loose connections.
Starter and hour meter functions; rest of electrical system does not function	Blown fuse on magnetic switch.	Replace fuse.
Entire electrical system does not function	Faulty battery connection.	Clean and tighten connections.
	Sulfated or worn-out batteries.	See your authorized servicing dealer or engine distributor.
	Blown fuse (MDL-25).	Replace fuse.

RG,RG34710,5608 –19–20MAY96–6/6

Engine Storage Guidelines

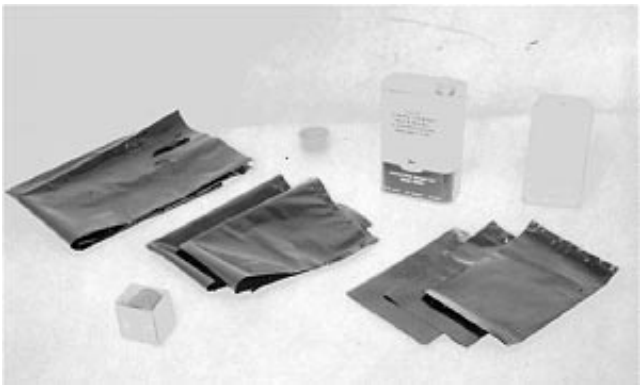
1. John Deere engines can be stored outside for up to three (3) months with no long term preparation IF COVERED BY WATERPROOF COVERING.
2. John Deere engines can be stored in a standard overseas shipping container for up to three (3) months with no long term preparation.
3. John Deere engines can be 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, long term storage preparation MUST BE taken. (See PREPARING ENGINE FOR LONG TERM STORAGE, later in this section.)
5. For John Deere engines not yet installed in machines, run a line from a container of AR41937 Nucle Oil to the fuel transfer pump intake, and another line from the fuel return manifold to the tank, so that Nucle Oil is circulated through the injection system during cranking.

RG,RG34710,5610 –19–20MAY96–1/1

Use AR41785 Engine Storage Kit

See your John Deere servicing dealer or engine distributor for an AR41785 Engine Storage Kit. Closely follow instructions provided with this kit.

IMPORTANT: Inhibitors can easily change to gas. Seal or tape each opening immediately after adding inhibitor.



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RG,RG34710,5611 –19–20MAY96–1/1

Preparing Engine for Long Term Storage

The following storage preparations are good 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. Use the AR41785 Engine Storage Kit. Follow recommended service procedure included with storage kit.

1. Change engine oil and replace filter. Used oil will not give adequate protection. (See CHANGE ENGINE OIL AND FILTER in Lubrication and Maintenance/250 Hour Section.)

2. Service air cleaner. (See REPLACING AIR CLEANER FILTER ELEMENTS in Service As Required Section.)

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 be drained, flushed, and refilled. Refill with appropriate coolant. (See RECOMMENDED ENGINE COOLANT in Fuels, Lubricants, and Coolant Section and ADDING COOLANT in Service As Required Section.)

4. Drain fuel tank and add 30 ml (1 oz) of inhibitor to the fuel tank for each 15 L (4 U.S. gal) of tank capacity. Completely drain fuel filter and close fuel valve, if equipped.

5. Add 30 ml (1 oz) of inhibitor to the engine crankcase for each 0.95 L (1 qt) of crankcase oil.

6. Disconnect air intake piping from the manifold. Pour 90 ml (3 oz) of inhibitor into intake system and reconnect the piping.

Continued on next page

7. Crank the engine several revolutions with starter (do not allow the engine to start).

8. Remove fan/alternator poly-vee belt, if desired.

9. Remove and clean batteries. Store them in a cool, dry place and keep them fully charged.

10. Disengage the PTO clutch.

11. Clean the exterior of the engine with salt-free water and touchup any scratched or chipped painted surfaces with a good quality paint.

12. Coat all exposed (machined) metal surfaces with grease or corrosion inhibitor if not feasible to paint.

13. Seal all openings on engine with plastic bags and tape supplied in storage kit. Follow instructions supplied in kit.

14. 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.

RG,RG34710,5612 –19–20MAY96–2/2

Removing 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.

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 poly-vee belt if removed.
4. Fill fuel tank.
5. Perform all appropriate prestarting checks. (See DAILY PRESTARTING CHECKS in Lubrication and Maintenance/Daily Section.)

IMPORTANT: DO NOT operate starter more than 30 seconds at a time. Wait at least 2 minutes for starter to cool before trying again.

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 low idle and 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.

RG,RG34710,5613 –19–20MAY96–1/1

General OEM Engine Specifications

ITEM	ENGINE							
	4045DF120	4045DF150	4045TF120	4045TF150	4045TF220	4045TF250	4045HF120	4045HF150
Number of Cylinders	4	4	4	4	4	4	4	4
Bore	106 mm (4.19 in.)	106 mm (4.19 in.)	106 mm (4.19 in.)	106 mm (4.19 in.)	106 mm (4.19 in.)	106 mm (4.19 in.)	106 mm (4.19 in.)	106 mm (4.19 in.)
Stroke	127 mm (5.0 in.)	127 mm (5.0 in.)	127 mm (5.0 in.)	127 mm (5.0 in.)	127 mm (5.0 in.)	127 mm (5.0 in.)	127 mm (5.0 in.)	127 mm (5.0 in.)
Displacement	4.5 L (276 cu in.)	4.5 L (276 cu in.)	4.5 L (276 cu in.)	4.5 L (276 cu in.)	4.5 L (276 cu in.)	4.5 L (276 cu in.)	4.5 L (276 cu in.)	4.5 L (276 cu in.)
Compression	17.8:1	17.6:1	17.0:1	17.0:1	17.0:1	17.0:1	17.0:1	17.0:1
Max. Crank Pressure	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)
Governor Regulation (Industrial)	7—10 %	7—10 %	N/A	7—10 %	N/A	7—10 %	N/A	7—10 %
Governor Regulation (Generator)	N/A	5 %	5%	5 %	5%	5 %	5%	5 %
Oil Pressure Rated Speed	345 kPa (50 psi)	345 kPa (50 psi)	345 kPa (50 psi)	345 kPa (50 psi)	345 kPa (50 psi)	345 kPa (50 psi)	345 kPa (50 psi)	345 kPa (50 psi)
Oil Pressure Low Idle	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)
Length	844.0 mm (33.2 in.)	861.0 mm (33.9 in.)	861.0 mm (33.9 in.)	861.0 mm (33.9 in.)	861.0 mm (33.9 in.)	861.0 mm (33.9 in.)	861.0 mm (33.9 in.)	861.0 mm (33.9 in.)
Width	550 mm (21.7 in.)	598 mm (23.5 in.)	598 mm (23.5 in.)	598 mm (23.5 in.)	598 mm (23.5 in)	598 mm (23.5 in.)	598 mm (23.5 in.)	598 mm (23.5 in.)
Height	871 mm (34.3 in.)	854 mm (33.6 in.)	980 mm (38.6 in.)	980 mm (38.6 in.)	980 mm (38.6 in.)	980 mm (38.6 in.)	980 mm (38.6 in.)	980 mm (38.6 in.)
Weight	429 kg (945 lb)	387 kg (851 lb)	396 kg (872 lb)	396 kg (872 lb)	396 kg (872 lb)	396 kg (872 lb)	396 kg (872 lb)	396 kg (872 lb)

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RG,RG34710,5614 –19–20MAY96–1/2

ITEM	ENGINE							
	6068DF150	6068TF120	6068TF150	6068TF220	6068TF250	6068HF120	6068HF150	6068HF250
Number of Cylinders	6	6	6	6	6	6	6	6
Bore	106 mm (4.19 in.)	106 mm (4.19 in.)	106 mm (4.19 in.)	106 mm (4.19 in.)	106 mm (4.19 in.)	106 mm (4.19 in.)	106 mm (4.19 in.)	106 mm (4.19 in.)
Stroke	127 mm (5.0 in.)	127 mm (5.0 in.)	127 mm (5.0 in.)	127 mm (5.0 in.)	127 mm (5.0 in.)	127 mm (5.0 in.)	127 mm (5.0 in.)	127 mm (5.0 in.)
Displacement	6.8 L (414 cu in.)	6.8 L (414 cu in.)	6.8 L (414 cu in.)	6.8 L (414 cu in.)	6.8 L (414 cu in.)	6.8 L (414 cu in.)	6.8 L (414 cu in.)	6.8 L (414 cu in.)
Compression	17.6:1	17.0:1	17.0:1	17.0:1	17.0:1	17.0:1	17.0:1	17.0:1
Max. Crank Pressure	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)	0.5 kPa 2 H_2O)	0.5 kPa 2 H_2O)	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)
Governor Regulation (Industrial)	7—10 %	N/A	7—10 %	7—10 %	7—10 %	N/A	7—10 %	7—10 %
Governor Regulation (Generator)	5 %	5%	5 %	5%	5 %	5%	5 %	5 %
Oil Pressure Rated Speed	345 kPa (50 psi)	345 kPa (50 psi)	345 kPa (50 psi)	345 kPa (50 psi)	345 kPa (50 psi)	345 kPa (50 psi)	345 kPa (50 psi)	345 kPa (50 psi)
Oil Pressure Low Idle	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)
Length	1117 mm (44.0 in.)	1117 mm (44.0 in.)	1117 mm (44.0 in.)	1116 mm (43.9 in.)	1117 mm (44.0 in.)	1141 mm (44.9 in.)	1116 mm (43.9 in.)	1141 mm (44.9 in.)
Width	598 mm (23.5 in.)	598 mm (23.5 in.)	598 mm (23.5 in.)	623 mm (24.5 in.)	598 mm (23.5 in.)	623 mm (24.5 in.)	623 mm (24.5 in.)	623 mm (24.5 in.)
Height	956 mm (37.6 in.)	984 mm (38.7 in.)	984 mm (38.7 in.)	1012 mm (39.9 in.)	984 mm (38.7 in.)	1009 mm (39.7 in.)	1009 mm (39.7 in.)	1009 mm (39.7 in.)
Weight	522 kg (1149 lb)	533 kg (1172 lb)	533 kg (1172 lb)	551 kg (1212 lb)	533 kg (1172 lb)	568 kg (1250 lb)	550 kg (1210 lb)	568 kg (1250 lb)

RG,RG34710,5614 –19–20MAY96–2/2

Fuel Injection Pump Specifications[1]

Engine Model	Injection Pump Option Codes	Power Rating @ Rated Speed Without Fan kW (hp)	Rated Speed[a](rpm)	Slow Idle (rpm)	Fast Idle [b](rpm)
4045DF120	16MR, 16MS	63 (85)	2500	850	2700
4045DF150	1601, 1671, 1691	60 (80)	2500	850	2700
	1602, 16BG, 16BH	63 (85)	2500	850	2700
	1603	53 (71)	1800	1150	1870
	1663, 16HK	43 (57)	2500	1600	2700
	1673, 1674	53 (71)	1800	1400	1870
	1691	60 (80)	2500	1400	2700
	16BJ, 16HV	36 (48)	2250	850	2450
	16CL	58 (78)	2200	950	2400
	16DL	61 (81)	2400	850	2600
	16EN, 16GB, 16GC	60 (80)	2500	850	2700
	16HJ	60 (80)	2500	1400	2700
	16KE	52 (70)	2500	850	2700
	16LM	60 (80)	2500	850	2700
	16LN	53 (71)	1800	1150	1870
	16RB, 16RC	44 (59)	1500	N/A	1560
4045DF151	1663	60 (80)	2500	1600	2700
4045DF152	1601, 16GB	60 (80)	2500	850	2700
4045DF153	16AY, 16JS	62 (83)	2400	850	2600
4045DF157	16AA, 16BB	44 (59)	1500	N/A	1560
4045DF158	1673, 1674, 16CC, 16DD	53 (71)	1800	N/A	1870
	16AA, 16BB	44 (59)	1500	N/A	1560
4045DFG50	16BG	63 (85)	2500	800	2700
	16NS	60 (80)	2300	800	2500
4045HF120	16GR, 16LW	102 (137)	1500	1400	1560
4045HF150	1610, 160C	104 (140)	2400	850	2600
	1611, 160B	95 (127)	1800	1400	1870
	16GR, 16LW	100 (134)	1500	N/A	1560
	16QZ, 16RA	111, (149)	1800	N/A	1870
4045HF157	16GR, 16LW	100 (134)	1500	N/A	1560

[a]Generator set engines (3–5% governor) usually run at 1500 rpm (50 Hz) or 1800 (60 Hz) when operating under load depending on cycles of AC current.

[b]For engines with standard governor, fast idle is 7–10% above rated speed. For engines with generator set governors, fast idle is 3–5% above rated speed.

[1] Engine speeds listed are preset to factory specification. Slow idle speed may be reset depending upon specific vehicle application requirements. Refer to your machine operator's manual for engine speeds that are different from those preset at the factory.

Continued on next page

Engine Model	Injection Pump Option Codes	Power Rating @ Rated Speed Without Fan kW (hp)	Rated Speed[a](rpm)	Slow Idle (rpm)	Fast Idle [b](rpm)
4045HF158	16GR, 16LW	100 (134)	1500	N/A	1560
	16ME, 16MF	123 (170)	1800	N/A	1870
4045TF120	16MT, 16MU	70 (94)	1500	1400	1560
4045TF150	1605, 1675, 1676	86 (115)	2500	850	2700
	1606	93 (125)	2400	850	2600
	1656, 1677, 16LP	75 (100)	1800	1150	1870
	1692	86 (115)	2500	1400	2700
	1694, 1695, 16AB, 16CE	75 (100)	2500	850	2700
	16BF	73 (98)	2200	950	2400
	16CM	66 (89)	2200	950	2400
	16GL	78 (105)	2300	850	2500
	16LZ, 16MA	82 (110)	1800	1400	1870
	16MT, 16MU	70 (94)	1500	N/A	1560
4045TF151	1677	75 (100)	1800	850	1870
	16CU	75 (100)	1800	850	1870
	16NH	75 (100)	1800	N/A	1870
4045TF152	16AX	76 (102)	2400	850	2600
4045TF153	16EP	72 (97)	2200	950	2400
4045TF154	1605	86 (115)	2500	850	2700
4045TF155	16AX, 16JT	76 (102)	2400	850	2600
4045TF157	16GQ, 16LV	83 (111)	1500	N/A	1560
4045TF158	16GQ	83 (111)	1500	N/A	1560
	16LZ, 16MA	82 (110)	1800	N/A	1870
	16MT, 16MU	70 (94)	1500	N/A	1560
4045TF220	16GO, 16LV	83 (111)	1500	1400	1560
	16MV, 16MW	100 (134)	1800	1400	1870
	16NT, 16NU	86 (115)	2500	850	2700
4045TF250	1606, 1667, 1683	93 (125)	2400	850	2600
	1608, 1682, 160R, 16LQ	84 (113)	1800	1400	1870
	16CV	85 (114)	2200	950	2400
	16GQ, 16LV	83 (111)	1500	N/A	1560
	16MB, 16MC	91 (122)	1800	1400	1870
4045TF251	1606	93 (125)	2400	850	2600
4045TF257	16GQ, 16LV	83 (111)	1500	N/A	1560
4045TF258	16GQ, 16LV	83 (111)	1500	N/A	1560
	16MB, 16MC	91 (122)	1800	N/A	1870
	16MV, 16MW	100 (134)	1800	N/A	1870
6068DF150	1613, 1678, 16LR	93 (125)	2500	850	2700
6068HF120	16GT, 16LY	155 (208)	1500	1400	1560
	16RL, 16SJ	197 (264)	2100	——	2200

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Engine Model	Injection Pump Option Codes	Power Rating @ Rated Speed Without Fan kW (hp)	Rated Speed[a](rpm)	Slow Idle (rpm)	Fast Idle [b](rpm)
6068HF150	1621, 160D	157 (210)	2400	850	2600
	16CY	143 (192)	2200	1350	2400
	16GT, 16LY	153 (205)	1500	N/A	1560
	16ML, 16MM	187 (251)	1800	1400	1870
	16QV, 160W	166 (223)	1800	N/A	1870
6068HF157	16GT, 16LY	153 (205)	1500	N/A	1560
6068HF158	16GT, 16LY	153 (205)	1500	N/A	1560
	16ML, 16MM	187 (251)	1800	N/A	1870
6068HF250	1622	168 (225)	2400	850	2600
	1623	148 (198)	1800	——	1870
6068TF120	16MX, 165MY	105 (141)	1500	1400	1560
6068TF150	1614, 1680	127 (170)	2500	850	2700
	1681, 1688, 16LS	112 (150)	1800	1150	1870
	1696, 1697, 16DY	116 (155)	2500	850	2700
	16BE	117 (157)	2200	950	2400
	16CN	110 (148)	2100	950	2300
	16CP	94 (126)	2200	950	2400
	16DK	96 (129)	2100	900	2300
	16GM	110 (148)	2300	850	2500
	16GN	116 (155)	2400	850	2600
	16MG, 16MH	123 (165)	1800	1400	1870
6068TF151	1681, 16NJ	112 (150)	1800	N/A	1870
	1696	116 (155)	2500	850	2700
6068TF152	1696, 16JU	116 (155)	2500	N/A	2700
6068TF157	16GS, 16LX	120 (161)	1500	N/A	1560
6068TF158	16GS	120 (161)	1500	N/A	1560
	16JV, 16JW	100 (134)	1500	N/A	1560
	16MG, 16MH	123 (165)	1800	N/A	1870
	16MX, 16MY	105 (141)	1500	N/A	1560
6068TF159	16PD	96 (129)	2100	850	2250
6068TF220	16GS, 16LX	121 (162)	1500	1400	1560
	16KK	127 (170)	2500	850	2700
	16RK, 16SH	138 (185)	2600	——	2700
	16RJ, 16SG	172 (231)	2100	——	2200
6068TF250	1615, 1668, 1686, 16LT	138 (185)	2400	850	2600
	1619, 1685, 16LU	124 (166)	1800	1150	1870
	16CW	106 (142)	2200	950	2400
	16CX	128 (172)	2300	900	2500
	16GS, 16LX	120 (161)	1500	N/A	1560
	16MJ, 16MK	142 (190)	1800	1400	1870
	16UG	149 (200)	2400	925	2600
6068TF251	1615	138 (185)	2400	N/A	2600

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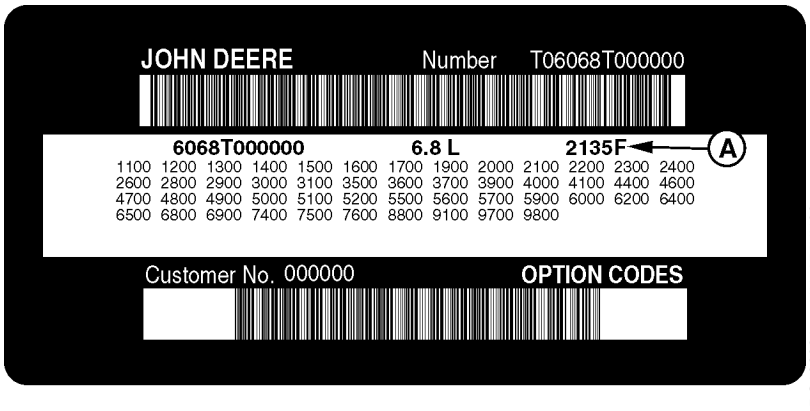
Engine Model	Injection Pump Option Codes	Power Rating @ Rated Speed Without Fan kW (hp)	Rated Speed[a](rpm)	Slow Idle (rpm)	Fast Idle [b](rpm)
6068TF257	16GS, 16LX	120 (161)	1500	N/A	1560
6068TF258	16GS, 16LX	120 (161)	1500	N/A	1560
	16MJ, 16MK	142 (190)	1800	N/A	1870

RG,RG34710,5616 –19–20MAY96–4/4

Engine Crankcase Oil Fill Quantities



Option Code Label

Each engine has a 13-digit John Deere engine serial number. The first two digits identify the factory that produced the engine:

“CD” indicates the engine was built in Saran, France

“PE” indicates the engine was built in Torreon, Mexico

“T0” indicates the engine was built in Dubuque, Iowa

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.

To determine the option code for the oil fill quantity of your engine, refer to the engine option code label affixed to the rocker arm cover. The first two digits of the code (19) identify the oil pan option group. The last two digits of each code identify the specific oil pan on your engine.

The following table lists engine crankcase oil fill quantities:

Continued on next page

RG,RG34710,5617 –19–20MAY96–1/4

Engine Model	Oil Pan Option Code(s)	Crankcase Oil Capacity L (qt)
4045DF120	1901	8.0 (8.5)
	1902	8.0 (8.5)
	1903	12.5 (13.2)
	1904	13.5 (14.3)
	1923	14.5 (15.3)
4045DF150	1901	8.0 (8.5)
	1902	8.0 (8.5)
	1903	12.5 (13.2)
	1904	13.5 (14.3)
	1923	14.5 (15.3)
	1949	12.5 (13.2)
4045DF151	1901	8.0 (8.5)
4045DF152	1902	8.0 (8.5)
4045DF153	1901	8.0 (8.5)
	1903	12.5 (13.2)
	1937	12.5 (13.2)
4045DF154	1937	12.5 (13.2)
4045DF157	1902	8.0 (8.5)
4045DF158	1902	8.0 (8.5)
4045DFG50	1901	8.0 (8.5)
	1964	x.x (x.x)
4045HF120	1904	13.5 (14.3)
4045HF150	1904	13.5 (14.3)
	1921	16.5 (17.4)
	1922	16.5 (17.4)
	1949	12.5 (13.2)
4045HF157	1949	12.5 (13.2)
4045HF158	1949	12.5 (13.2)
4045TF120	1903	12.5 (13.2)
	1904	13.5 (14.3)
	1923	14.5 (15.3)
4045TF150	1903	12.5 (13.2)
	1904	13.5 (14.3)
	1923	14.5 (15.3)
	1949	12.5 (13.2)
4045TF151	1903	12.5 (13.2)
	1934	12.5 (13.2)
	1936	12.5 (13.2)
4045TF152	1903	12.5 (13.2)
	1937	12.5 (13.2)

Continued on next page

Engine Model	Oil Pan Option Code(s)	Crankcase Oil Capacity L (qt)
4045TF154	1904	13.5 (14.3)
4045TF155	1937	12.5 (13.2)
4045TF157	1949	12.5 (13.2)
4045TF158	1949	12.5 (13.2)
4045TF220	1903	12.5 (13.2)
	1904	13.5 (14.3)
	1923	14.5 (15.3)
4045TF250	1903	12.5 (13.2)
	1904	13.5 (14.3)
	1923	14.5 (15.3)
	1949	12.5 (13.2)
4045TF251	1904	13.5 (14.3)
4045TF257	1949	12.5 (13.2)
4045TF258	1949	12.5 (13.2)
6068DF150	1907	19.0 (20.1)
	1908	19.0 (20.1)
	1909	18.0 (19.0)
	1944	20.0 (21.1)
	1948	20.0 (21.1)
6068HF120	1907	19.0 (20.1)
	1908	19.0 (20.1)
	1909	18.0 (19.0)
	1956	18.0 (19.0)
6068HF150	1907	19.0 (20.1)
	1908	19.0 (20.1)
	1909	18.0 (19.0)
	1924	23.5 (24.8)
	1944	20.0 (21.1)
	1948	20.0 (21.1)
	1950	20.0 (21.1)
	1956	18.0 (19.0)
6068HF157	1950	20.0 (21.1)
6068HF158	1950	20.0 (21.1)
6068HF250	1907	19.0 (20.1)
	1908	19.0 (20.1)
	1909	18.0 (19.0)
	1924	23.5 (24.8)
	1944	20.0 (21.1)
	1948	20.0 (21.1)
	1961	32.0 (33.8)
6068TF120	1907	19.0 (20.1)
	1908	19.0 (20.1)

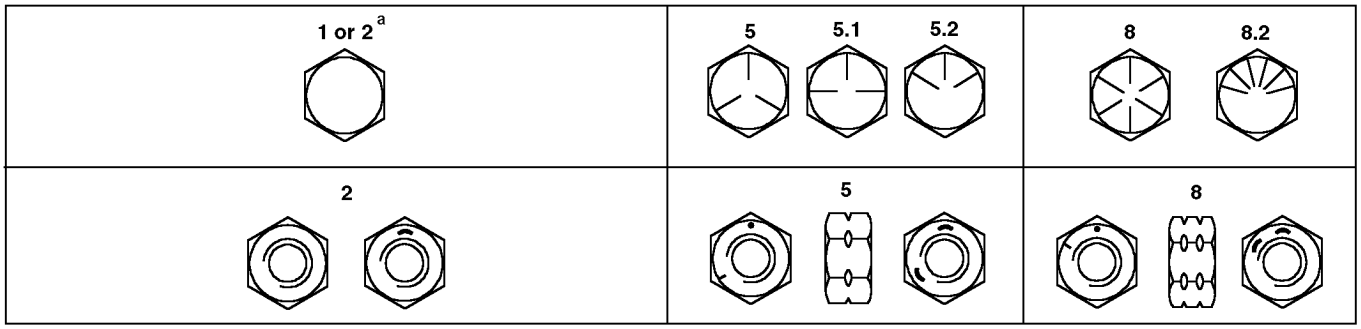
Continued on next page

Engine Model	Oil Pan Option Code(s)	Crankcase Oil Capacity L (qt)
	1909	18.0 (19.0)
	1944	20.0 (21.1)
	1956	18.0 (19.0)
6068TF150	1907	19.0 (20.1)
	1908	19.0 (20.1)
	1909	18.0 (19.0)
	1944	20.0 (21.1)
	1948	20.0 (21.1)
	1956	18.0 (19.0)
6068TF151	1907	19.0 (20.1)
	1909	18.0 (19.0)
	1944	20.0 (21.1)
6068TF152	1909	18.0 (19.0)
6068TF157	1950	20.0 (21.1)
6068TF158	1950	20.0 (21.1)
6068TF159	1963	21.5 (22.7)
6068TF220	1907	19.0 (20.1)
	1908	19.0 (20.1)
	1909	18.0 (19.0)
	1944	20.0 (21.1)
	1948	20.0 (21.1)
	1956	18.0 (19.0)
6068TF250	1907	19.0 (20.1)
	1908	19.0 (20.1)
	1909	18.0 (19.0)
	1944	20.0 (21.1)
	1948	20.0 (21.1)
	1950	20.0 (21.1)
	1956	18.0 (19.0)
6068TF251	1909	18.0 (19.0)
6068TF257	1950	20.0 (21.1)
6068TF258	1950	20.0 (21.1)

NOTE: Crankcase oil capacity may vary slightly from amount shown. ALWAYS fill crankcase to within crosshatch. DO NOT overfill.

RG,RG34710,5617 –19–20MAY96–4/4

Unified Inch Bolt and Cap Screw Torque Values



TORQ1A –UN–27SEP99

Top, SAE Grade and Head Markings; Bottom, SAE Grade and Nut Markings

	Grade 1 (No Mark)		Grade 2[a] (No Mark)		Grade 5, 5.1 or 5.2		Grade 8 or 8.2	
Size	**Lubricated[b] N•m(lb-ft)**	**Dry[c] N•m(lb-ft)**	**Lubricated[b] N•m(lb-ft)**	**Dry[c] N•m(lb-ft)**	**Lubricated[b] N•m(lb-ft)**	**Dry[c] N•m(lb-ft)**	**Lubricated[b] N•m(lb-ft)**	**Dry[c] N•m(lb-ft)**
1/4	3.8 (2.8)	4.7 (3.5)	6 (4.4)	7.5 (5.5)	9.5 (7)	12 (9)	13.5 (10)	17 (12.5)
5/16	7.7 (5.7)	9.8 (7.2)	12 (9)	15.5 (11.5)	19.5 (14.5)	25 (18.5)	28 (20.5)	35 (26)
3/8	13.5 (10)	17.5 (13)	22 (16)	27.5 (20)	35 (26)	44 (32.5)	49 (36)	63 (46)
7/16	22 (16)	28 (20.5)	35 (26)	44 (32.5)	56 (41)	70 (52)	80 (59)	100 (74)
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)

[a] Grade 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, or fasteners with phosphate and oil coatings.

[c] "Dry" means plain or zinc plated without any lubrication.

DO NOT use these values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

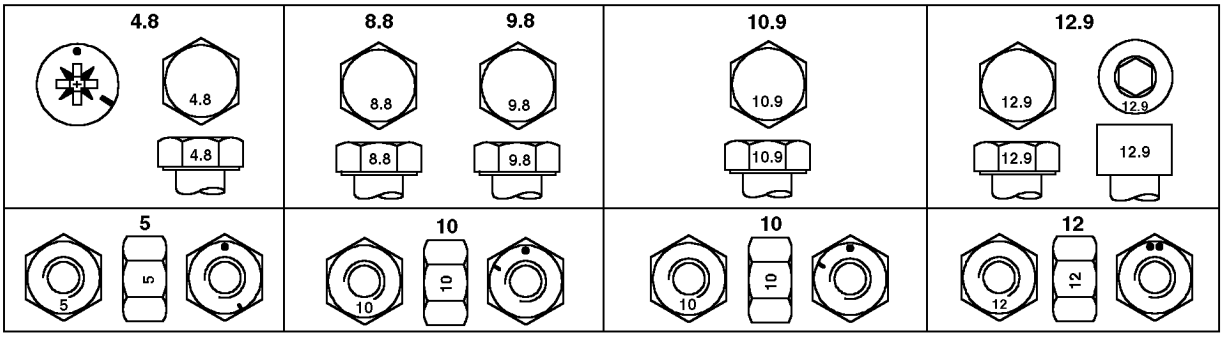
Fasteners should be replaced with the same or higher grade. If higher grade fasteners are used, these should only be tightened to the strength of the original.

Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

DX,TORQ1 –19–01OCT99–1/1

Metric Bolt and Cap Screw Torque Values



TORQ2 –UN–07SEP99

Top, Property Class and Head Markings; Bottom, Property Class and Nut Markings

	Class 4.8		Class 8.8 or 9.8		Class 10.9		Class 12.9	
Size	**Lubricated[a] N•m(lb-ft)**	**Dry[b] N•m(lb-ft)**	**Lubricated[a] N•m(lb-ft)**	**Dry[b] N•m(lb-ft)**	**Lubricated[a] N•m(lb-ft)**	**Dry[b] N•m(lb-ft)**	**Lubricated[a] N•m(lb-ft)**	**Dry[b] N•m(lb-ft)**
M6	4.7 (3.5)	6 (4.4)	9 (6.6)	11.5 (8.5)	13 (9.5)	16.5 (12.2)	15.5 (11.5)	19.5 (14.5)
M8	11.5 (8.5)	14.5 (10.7)	22 (16)	28 (20.5)	32 (23.5)	40 (29.5)	37 (27.5)	47 (35)
M10	23 (17)	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)

[a] *"Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings.*

[b] *"Dry" means plain or zinc plated without any lubrication.*

DO NOT use these values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class.

Fasteners should be replaced with the same or higher property class. If higher property class fasteners are used, these should only be tightened to the strength of the original.

Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

DX,TORQ2 –19–01OCT99–1/1

Lubrication and Maintenance Records

Using Lubrication and Maintenance Records

Refer to specific Lubrication and Maintenance Section for detailed service procedures.

1. Keep a record of the number of hours you operate your engine by regular observation of hour meter.

2. Check your record regularly to learn when your engine needs service.

3. DO ALL the services within an interval section. Write the number of hours (from your service records) and the date in the spaces provided. For a complete listing of all items to be performed and the service intervals required, refer to the quick-reference chart near the front of the Lubrication and Maintenance Section.

IMPORTANT: The service recommendations covered in this manual are for the accessories that are provided by John Deere. Follow manufacturer's service recommendations for servicing engine driven equipment not supplied by Deere.

RG,RG34710,5620 –19–20MAY96–1/1

Daily (Prestarting) Service

- Check engine oil level.
- Check coolant level.

IMPORTANT: Drain water by rotating drain valve counter-clockwise. Premature pump failure may occur if water is not drained daily.

- Check fuel filter/water separator bowl.
- Lubricate PTO release bearing.
- Check air cleaner dust unloader valve and air restriction indicator, if equipped.
- Visual walkaround inspection.

RG,RG34710,5621 –19–20MAY96–1/1

250 Hour/6 Month Service

- Change engine oil and filter.[1]
- Service fire extinguisher.
- Lubricate PTO clutch shaft bearings.
- Check PTO clutch adjustment.
- Service battery.
- Check automatic belt tensioner and belt wear.

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[1] If John Deere PLUS-50 oil is used along with a John Deere oil filter, the oil change interval may be extended by 50 percent to 375 hours.

RG,RG34710,5623 –19–20MAY96–1/1

500 Hour/12 Month Service

- Lubricate PTO clutch internal levers and linkage.
- Clean crankcase vent tube.
- Check air intake hoses, connections, and system.
- Replace fuel filter element.
- Check automatic belt tensioner and belt wear.
- Check cooling system.
- Coolant solution analysis – add SCAs as needed.
- Pressure test cooling system.

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RG,RG34710,5624 –19–20MAY96–1/1

2000 Hour/24 Month Service

- Check crankshaft vibration damper (6-cylinder only).
- Flush cooling system.[1]
- Test thermostats.
- Check and adjust valve clearance.

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[1] If John Deere COOL-GARD is used, the flushing interval may be extended to 3000 hours, or 36 months. If John Deere COOL-GARD is used and the coolant is tested annually AND additives are replenished as needed by adding a supplemental coolant additive, the flushing interval may be extended to 5000 hours or 60 months, whichever occurs first.

RG,RG34710,5625 –19–20MAY96–1/1

Service as Required

- Service air cleaner.
- Replace poly-vee belts.

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RG,RG34710,5627 –19–20MAY96–1/1

Emission System Warranty

U.S. EPA Emissions Control Warranty Statement

Emissions control-related parts and components are warranted by John Deere for five years or 3000 hours of operation, whichever occurs first. John Deere further warrants that the engine covered by this warranty was designed, built, and equipped so as to conform at the time of sale with all U.S. emissions standards at the time of manufacture, and that it is free of defects in materials and workmanship which would cause it not to meet these standards within the period of five years or 3000 hours of operation, whichever occurs first.

Warranties stated in this manual refer only to emissions-related parts and components of your engine. The complete engine warranty, less emissions-related parts and components, is provided separately as the “John Deere New Off-Highway Engine Warranty”.

RG,RG34710,7629 –19–30JUN97–1/1

Emissions Control System Certification Label

CAUTION: Statutes providing severe penalties for tampering with emissions controls may apply to the user or dealer.

The emissions warranty described below applies only to those engines marketed by John Deere that have been certified by the United States Environmental Protection Agency (EPA) and/or California Air Resources Board (CARB); and used in the United States and Canada in non-road mobile (self-propelled or portable/transportable[1]) equipment. The presence of an emissions label like the one shown signifies that the engine has been certified with the EPA and/or CARB. The EPA and CARB warranties only apply to new engines having the certification label affixed to the engine and sold as stated above in the geographic areas. The presence of an EU number in the third line of the label signifies that the engine has been certified with the European Union countries per Directive 97/68/EC. The emissions warranty does not apply to the EU countries.

NOTE: The hp/kW rating on the engine emissions certification label specifies the gross engine hp/kW, which is flywheel power without fan. In most applications this will not be the same rating as the advertised vehicle hp/kW rating.

Emissions Label

[1]*Equipment moved at least once every 12 months.*

DPSG,RG41165,133 –19–10JUL00–1/1

John Deere Service Literature Available

Technical Information

Technical information is available from John Deere. Some of this information is available in electronic as well as printed form. Order from your John Deere dealer or call **1-800-522-7448**. Please have available the model number, serial number, and name of the product.

Available information includes:

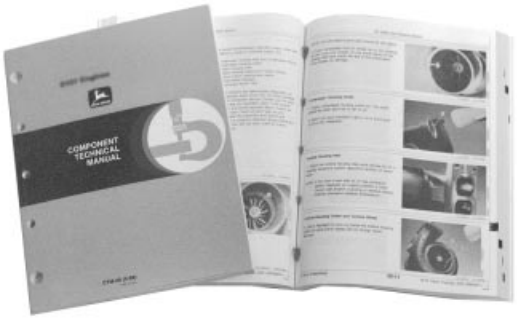
- PARTS CATALOGS list service parts available for your machine with exploded view illustrations to help you identify the correct parts. It is also useful in assembling and disassembling.
- OPERATOR'S MANUALS providing safety, operating, maintenance, and service information. These manuals and safety signs on your machine may also be available in other languages.
- OPERATOR'S VIDEO TAPES showing highlights of safety, operating, maintenance, and service information. These tapes may be available in multiple languages and formats.
- TECHNICAL MANUALS outlining service information for your machine. Included are specifications, illustrated assembly and disassembly procedures, hydraulic oil flow diagrams, and wiring diagrams. Some products have separate manuals for repair and diagnostic information. Some components, such as engines, are available in separate component technical manuals
- FUNDAMENTAL MANUALS detailing basic information regardless of manufacturer:
  - Agricultural Primer series covers technology in farming and ranching, featuring subjects like computers, the Internet, and precision farming.
  - Farm Business Management series examines "real-world" problems and offers practical solutions in the areas of marketing, financing, equipment selection, and compliance.
  - Fundamentals of Services manuals show you how to repair and maintain off-road equipment.
  - Fundamentals of Machine Operation manuals explain machine capacities and adjustments, how to improve machine performance, and how to eliminate unnecessary field operations.

RG9262 –UN–16MAR98

Parts Catalogs

RG9260 –UN–16MAR98

Operator Manuals



RG9261 –UN–16MAR98

Component Technical Manuals

TS1663 –UN–10OCT97

Fundamental Manuals

DPSG,RG41165,134 –19–10JUL00–1/1

Publications for this Engine

Technical information is available from John Deere in support of our products. Some of this information is available in electronic as well as printed form. Order from your John Deere dealer or call **1-800-522-7448.** Please have available the model number, and name of the product.

Title	Order Number
POWERTECH 4.5 L and 6.8 L OEM Diesel Engines (English):	
Operation and Maintenance Manual	OMRG25204
Parts Catalogs *POWERTECH* 4.5 L *POWERTECH* 6.8 L	 PC2521 PC2522
Component Technical Manual Binder Binder Includes: Base Engine Mechanical Fuel Systems Level 4 Electronic Fuel Injection System with Bosch VP44 Pump	CTM350 CTM104 CTM207 CTM170
OEM Engine Accessories	CTM67
Alternators and Starter Motors	CTM77

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POWERTECH 4.5/6.8 OEM Engines

OMRG25204 (22SEP00)

GENERATOR PARTS LISTS

GENERATOR MODEL
G110M

EDITION: JUNE 2002 CPN 85622009 33519009101

SALES OFFICES

Sales Office United Kingdom
Facility details

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Wigan WN2 4EZ
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Fax +44 (0) 1942 523 417

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Coordonnées du Site

Ingersoll-Rand Portable Power
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Téléphone +33 1 30 07 68 62
Fax +33 1 30 07 68 71

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Unternehmensdetails

Ingersoll-Rand Gmbh
Gewerbealle 17
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Germany
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Fax +49 208 99 94 111

Dirección de la organización en España
Dirección

Ingersoll-Rand Iberia, S.L.
C/ Tierra de Barros nº 2
Poligono Industrial de Coslada
28820 Coslada (Madrid)
Spain
Teléfono +34 91 627 74 07
Fax +34 91 627 74 08

Sales Office The Netherlands
Facility details

Ingersoll-Rand Benelux N.V.
Produktieweg 10
2382 PB Zoeterwoude-Rijndijk
The Netherlands
Phone +31 (0)71 58 23456
Fax +31 (0)71 58 23400

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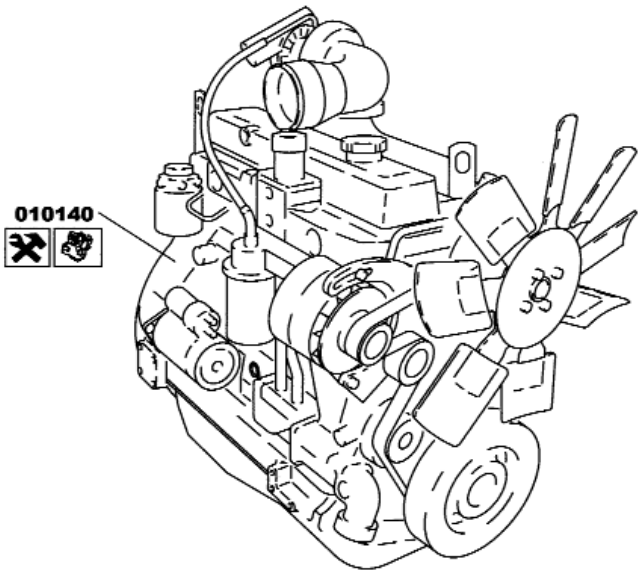
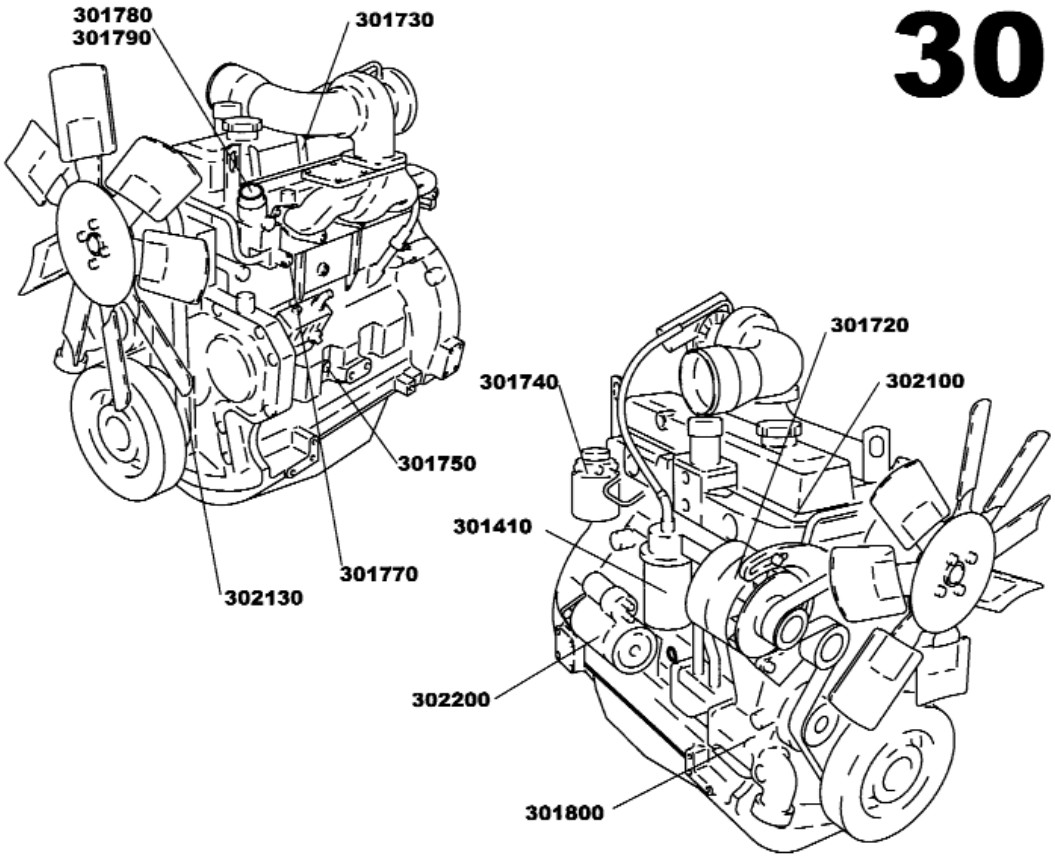


Item	Part Number	Description	Quantity	Units
F01039		ENGINE FUNCTION 4045H	1.0	UN
010140	85402980	ENGINE JD 4045HF SAE 3/11.5	1.0	UN

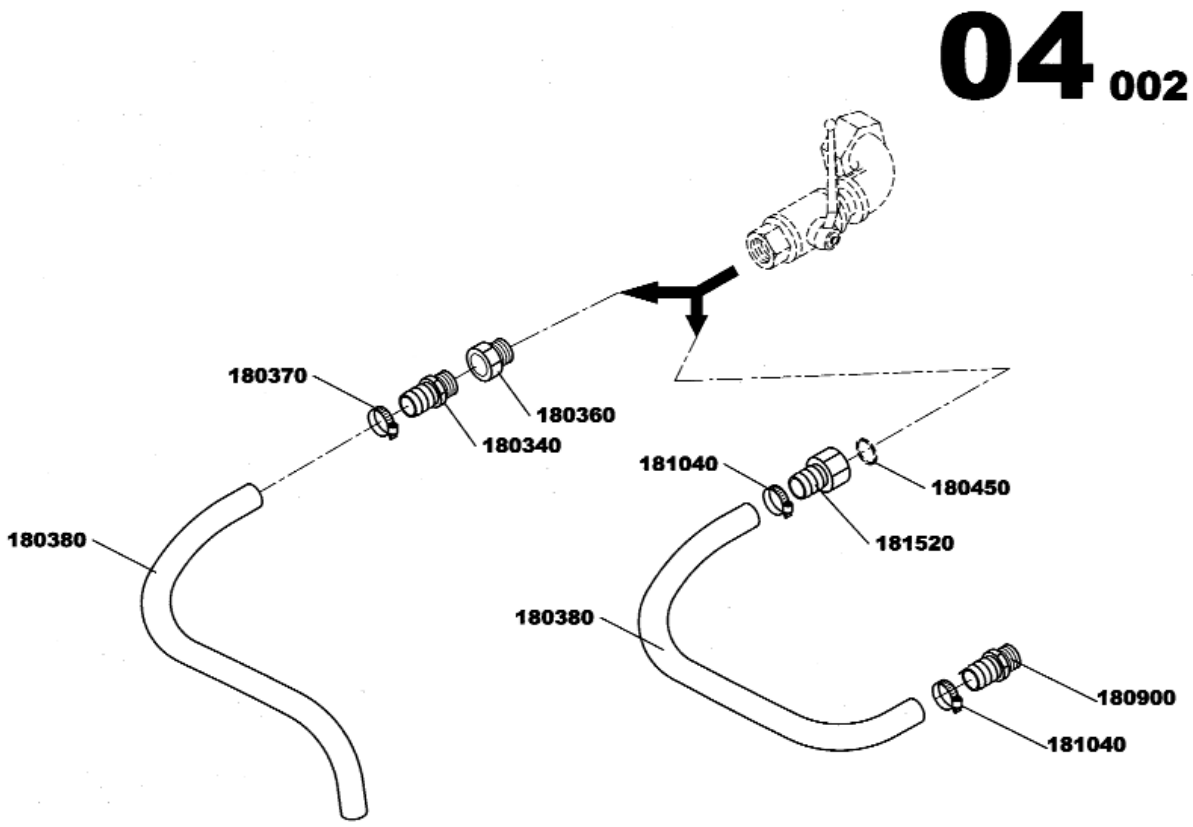
Part numbers listed are the only parts used in this model.

30 037



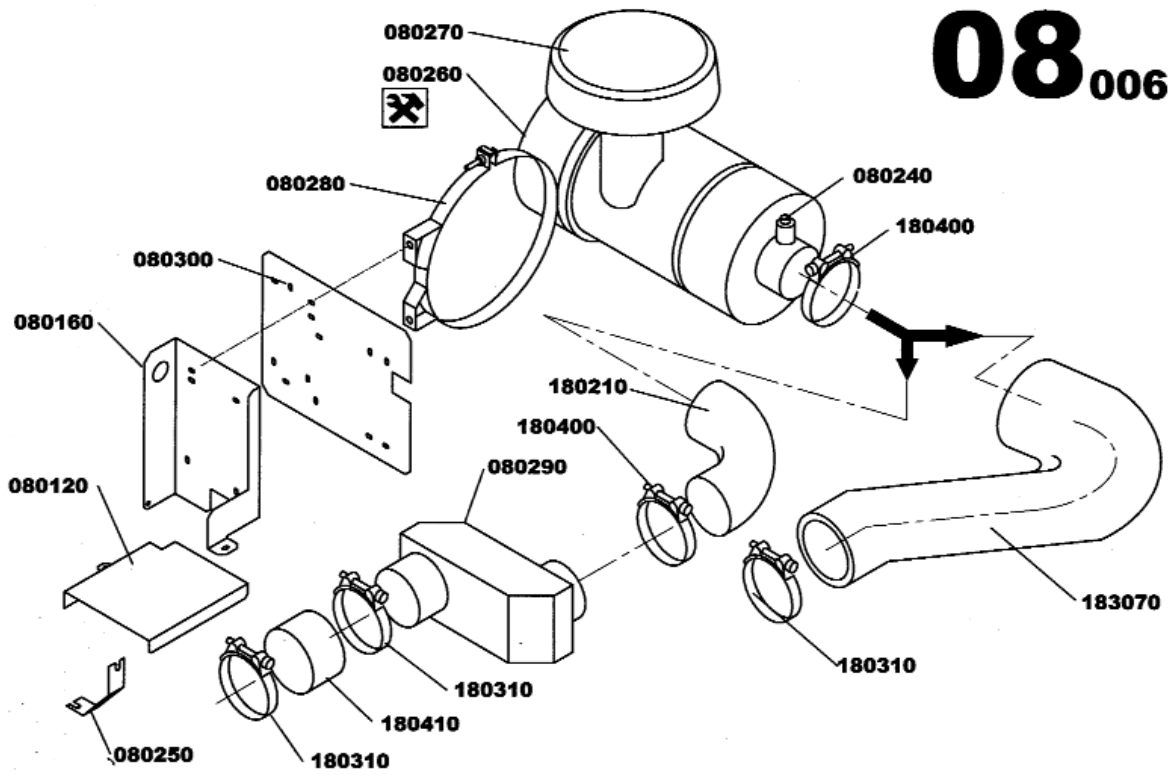
Item	Part Number	Description	Quantity	Units
F30037		ENGINE JD 4045H DETAIL	1.0	UN
301410	36881696	OIL FILTER	1.0	UN
301740	85400976	FUEL FILTER	1.0	UN
302130	85425452	BELT	1.0	UN
301730	85400893	INJECTOR	4.0	UN
302200	85400927	STARTER	1.0	UN
301720	85400877	CHARGING ALTERNATOR	1.0	UN
301800	85401305	WATER PUMP	1.0	UN
301750	85401099	PRESSURE SWITCH	1.0	UN
301770	85401164	TEMPERATURE SWITCH	1.0	UN
301790	85401206	THERMOSTAT SEAL	1.0	UN
301780	85401180	THERMOSTAT	1.0	UN
302100	85402725	ROCKER COVER GASKET	1.0	UN

Part numbers listed are the only parts used in this model.



Item	Part Number	Description	Quantity	Units
F04002	85403459	OIL SUMP DRAIN TAP ASSEMBLY	1.0	UN
180900	85423267	PIPE UNION MAL/MAL 1/2G	1.0	UN
181520	85492551	PIPE UNION FEMAL/MAL 1/2G	1.0	UN
181040	85417756	HOSE CLIP D16/27	2.0	UN
180450	85410298	GASKET D14x18	1.0	UN
180380	85409597	FLEXIBLE HOSE D15x23	1.0	UN

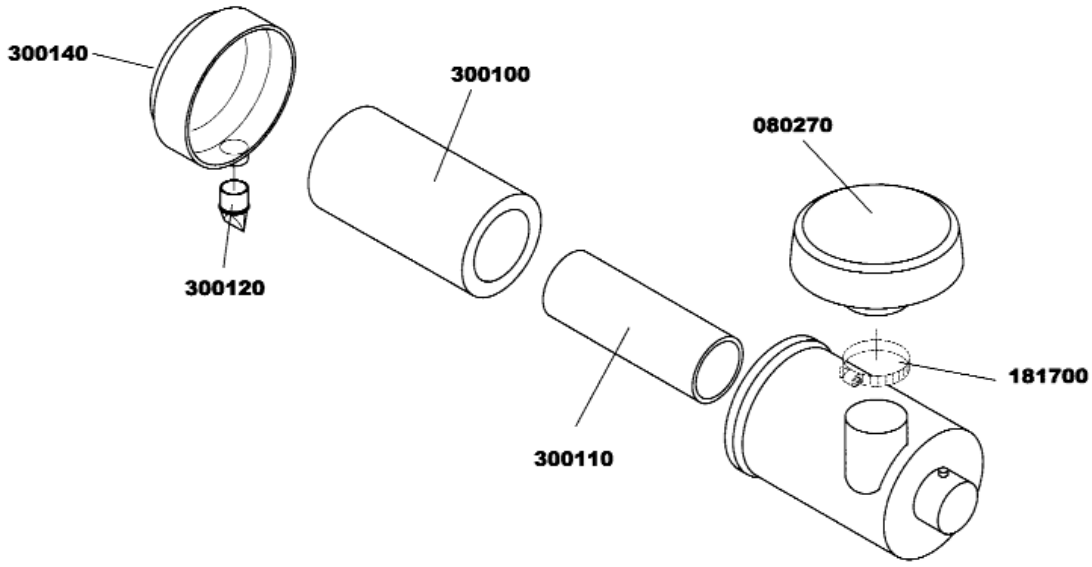
Part numbers listed are the only parts used in this model.



Item	Part Number	Description	Quantity	Units
F08006	85403996	AIR FILTER HEAVY DUTY ASSEMBLY	1.0	UN
080260	85403913	AIR FILTER HEAVY DUTY	1.0	UN
080270	85403939	RAIN CAP	1.0	UN
080280	85403947	CLAMP D259	1.0	UN
080120	85404010	HEATER GUARD AIR FILTER	1.0	UN
080250	85404051	BRACKET HEATER GUARD	1.0	UN
080160	85404069	AIR FILTER BRACKET JD 4039	1.0	UN
080300	85404101	AIR FILTER BRACKET ALL JD	1.0	UN
180310	85409431	HOSE CLIP D80/100	1.0	UN
180400	85409449	HOSE CLIP D110/130	1.0	UN
183070	85509701	RUBBER HOSE ELBOW D76	1.0	UN
080240	85410108	AIR RESTRICTION INDICATOR	1.0	UN

Part numbers listed are the only parts used in this model.

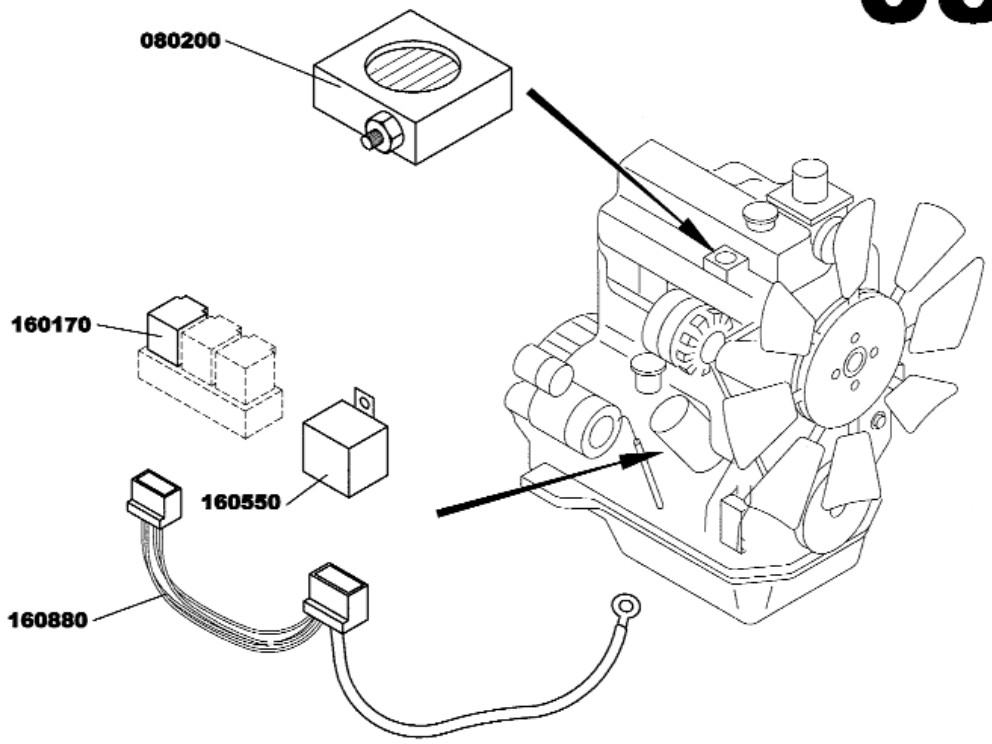
30012



Item	Part Number	Description	Quantity	Units
F30012		AIR FILTER 080260 DETAIL	1.0	UN
300100	85400752	FILTER CARTRIDGE	1.0	UN
300110	85400802	FILTER CARTRIDGE	1.0	UN
300120	85501229	VACUATOR VALVE	1.0	UN
300140	85501245	DUST CUP	1.0	UN
080270	85403939	RAIN CAP	1.0	UN
181700	85501864	HOSE CLIP D100/120	1.0	UN

Part numbers listed are the only parts used in this model.

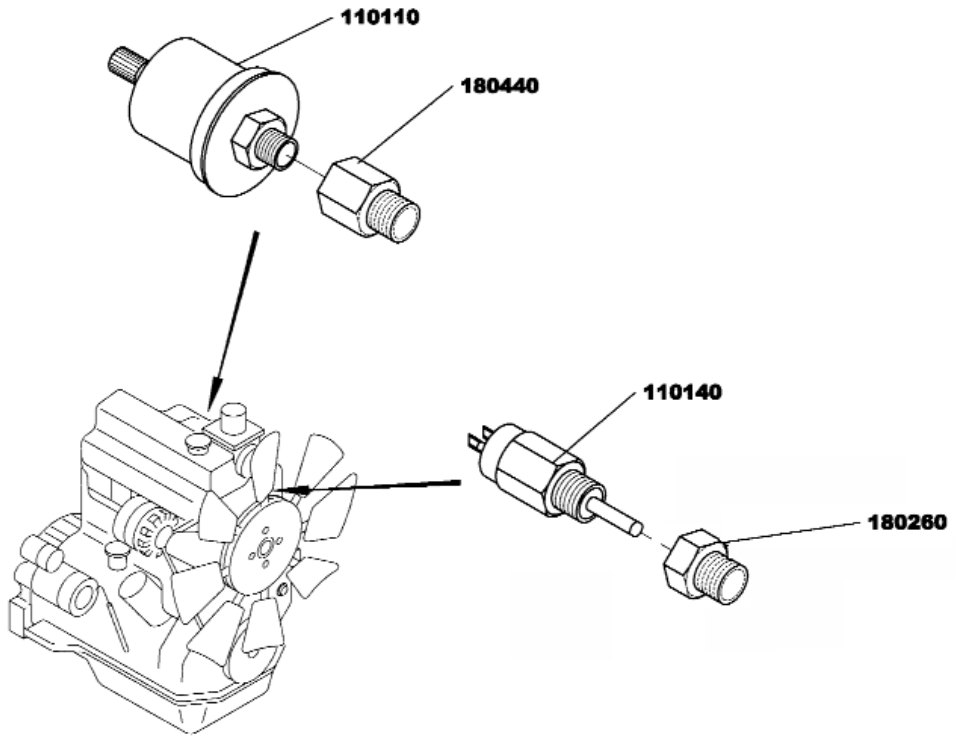
08 008



Item	Part Number	Description	Quantity	Units
F08008	85404291	AIR HEATER ASSEMBLY	1.0	UN
080200	85404267	AIR HEATER RESISTANCE 1200W 12V	1.0	UN
160880	85408177	AIR HEATER WIRING LOOM JD 6068	1.0	UN
160550	85408938	RELAY 12V 180A	1.0	UN
160170	85408896	RELAY 12V 20/30A	1.0	UN

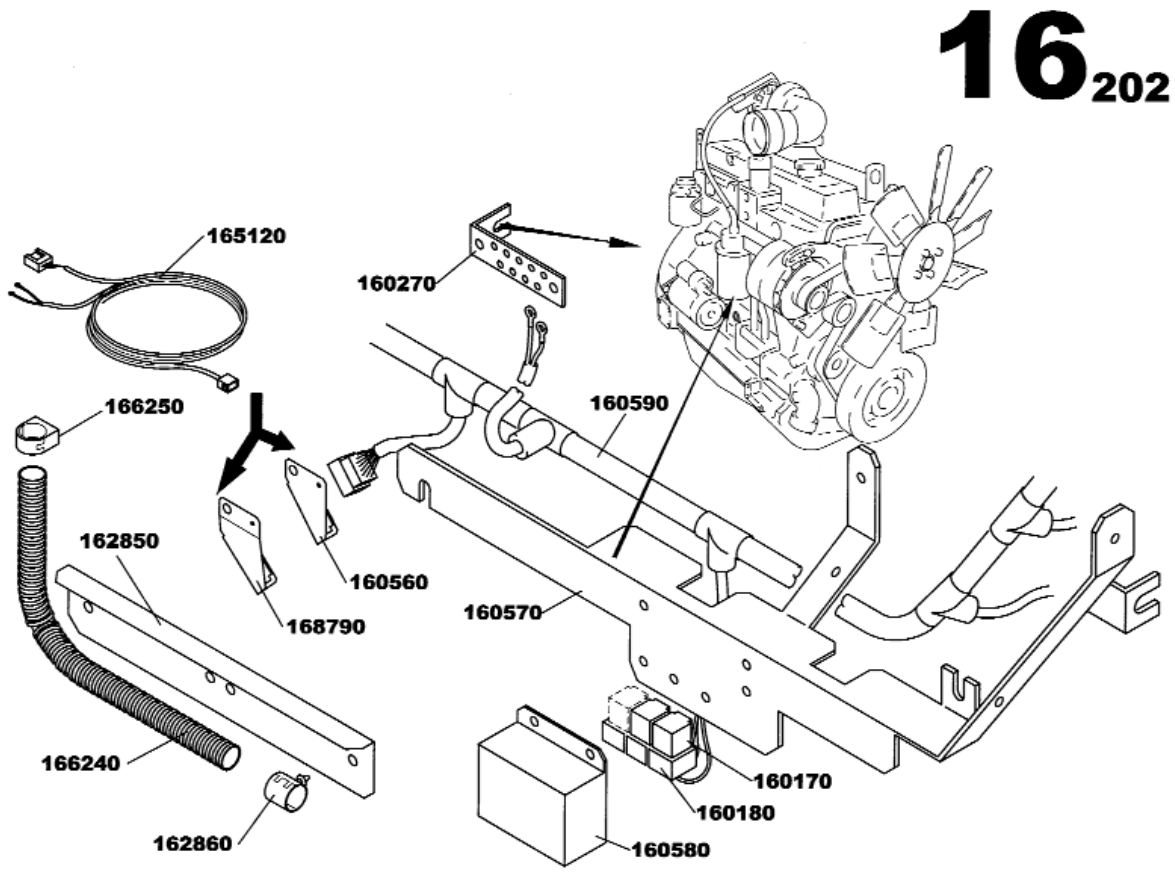
Part numbers listed are the only parts used in this model.

11 002



Item	Part Number	Description	Quantity	Units
F11002	85404705	TRANS. WATER TEMPERATURE-OIL PRESSURE ASSEMBLY	1.0	UN
110110	85404598	PRESSURE SWITCH 00/10 BAR	1.0	UN
110140	85404606	TEMPERATURE SENSOR 40/120°	1.0	UN
180440	85409134	PIPE UNION REDUCER MAL/FEM 3/8SAE 1/8G	1.0	UN
180260	85409340	PIPE UNION REDUCER MAL/FEM M14x150 1/8NPTF	1.0	UN

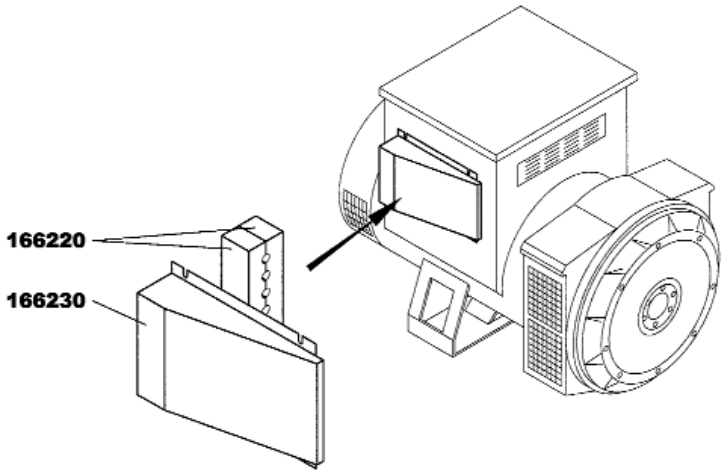
Part numbers listed are the only parts used in this model.



Item	Part Number	Description	Quantity	Units
F16202	85408037	ENGINE WIRING LOOM 4045H	1.0	UN
168790	85509164	CONNECTOR BRACKET	1.0	UN
160570	85407955	WIRING BRACKET JD 4045	1.0	UN
160580	85407971	STARTING RELAY PROTECTION PANEL	1.0	UN
160590	85408029	ENGINE WIRING LOOM JD 4045	1.0	UN
160270	85408078	COPPER BAR 5x25	1.0	UN
160170	85408896	RELAY 12V 20/30A	1.0	UN
160180	85408912	AUTOMOBILE RELAY BASE	1.0	UN
165120	85410652	INTELLISYS WIRING LOOM 010	1.0	UN
162850	85492056	ELECTRICAL SHAFT BRACKET	1.0	UN
166240	85427268	ELECTRICAL SHAFT D29	1.0	UN
162860	85427276	CLIP D29	1.0	UN
166250	85427029	CLIP D29	1.0	UN

Part numbers listed are the only parts used in this model.

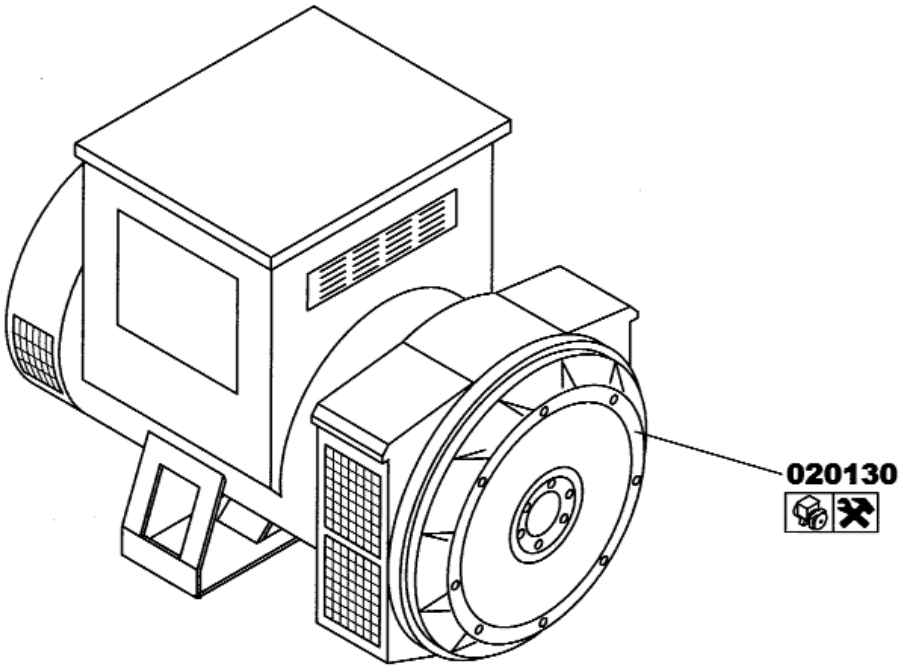
16 012



Item	Part Number	Description	Quantity	Units
F16012	85427235	OUTPUT CABLES ALTERNATOR ASSEMBLY	1.0	UN
166220	85427169	FOAM CABLE PROTECTION	1.0	UN
166230	85427227	CABLE OUTLET PLATE	1.0	UN

Part numbers listed are the only parts used in this model.

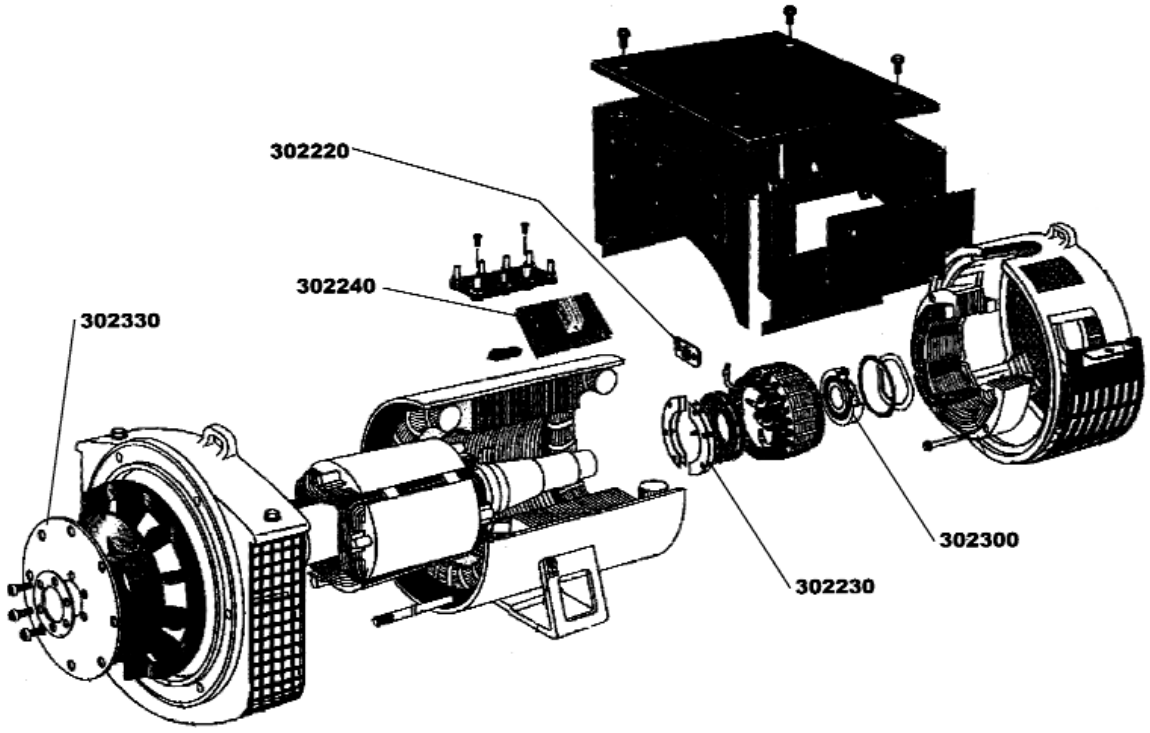
02004



Item	Part Number	Description	Quantity	Units
F02004		ALTERNATOR LS 442S ASSEMBLY	1.0	UN
020130	85403103	ALTERNATOR LS 442S	1.0	UN

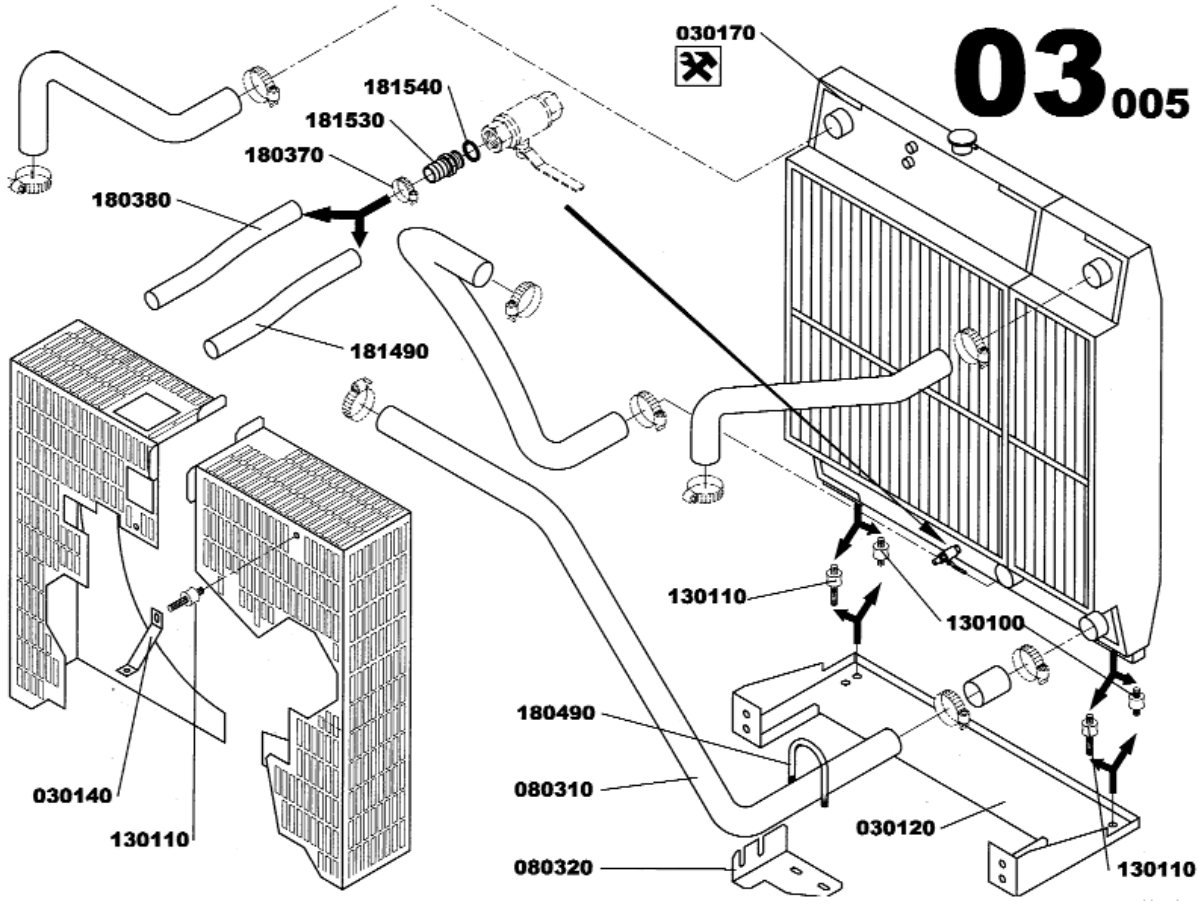
Part numbers listed are the only parts used in this model.

30 039



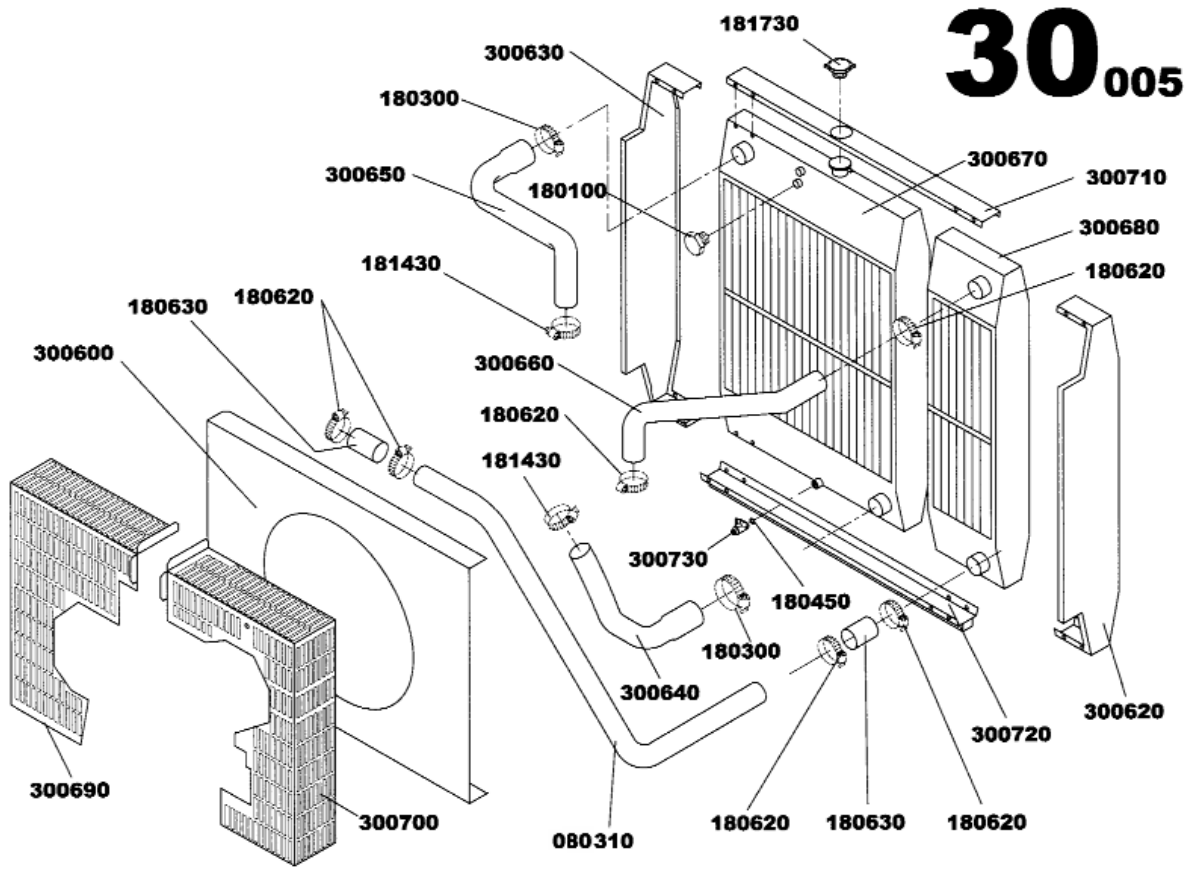
Item	Part Number	Description	Quantity	Units
F30039		ALTERNATOR LS 442S7 SAE 3/11,5 DETAIL	1.0	UN
302240	85402451	GOVERNOR	1.0	UN
302300	85425908	BEARING LSA 442	1.0	UN
302330	85425932	DRIVE DISC LSA 442	1.0	UN
302230	85425593	DIODE BRIDGE ASSEMBLY	1.0	UN
302220	85425585	SURGE SUPPRESSOR LSA 432/442	1.0	UN

Part numbers listed are the only parts used in this model.



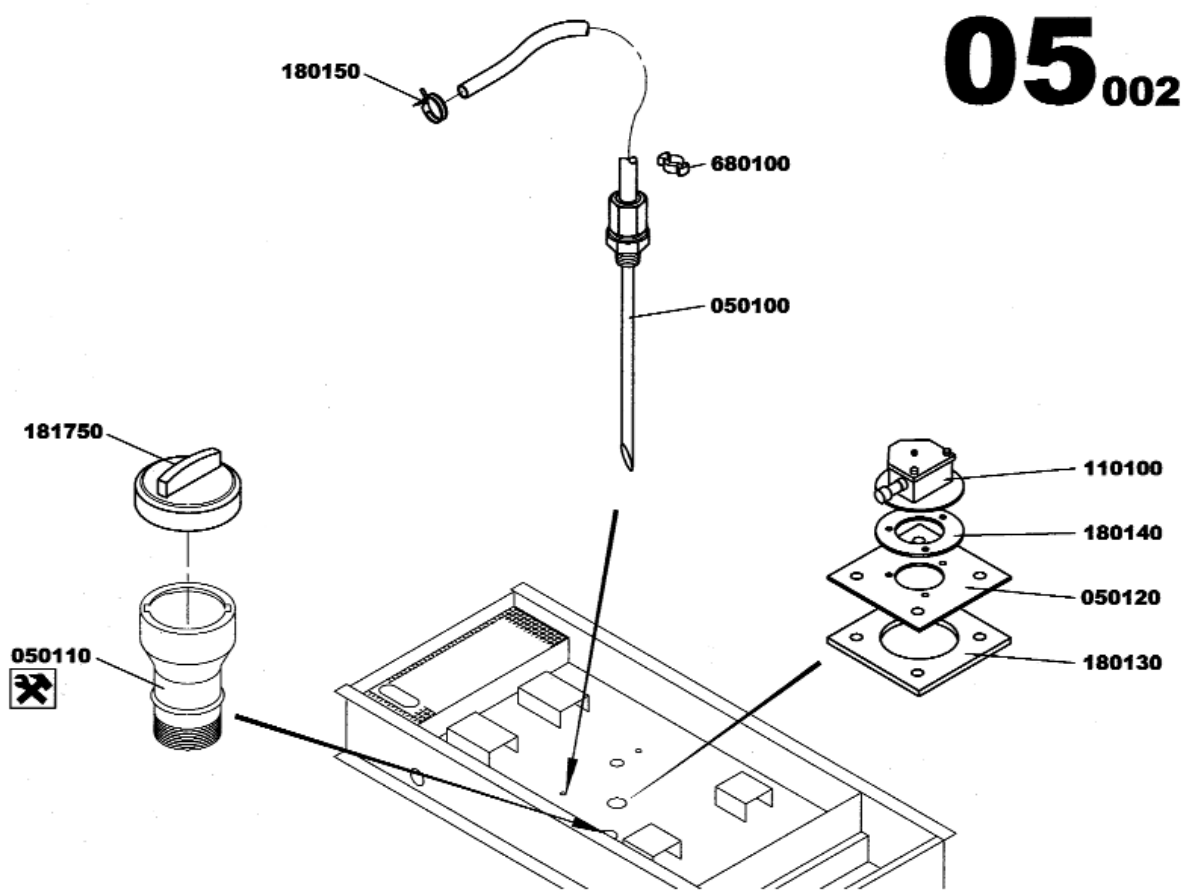
Item	Part Number	Description	Quantity	Units
F03005	85491819	RADIATOR FITTINGS JD4045H ASSEMBLY	1.0	UN
030140	85403228	RADIATOR BRACKET ENGINE JD 4045	1.0	UN
030170	85403301	RADIATOR JD 4045H WITH HOSE KIT	1.0	UN
030120	85509404	RADIATOR BRACKET JD 4CYL	1.0	UN
080310	85404044	AIR INLET PIPE JD 4045H	1.0	UN
080320	85404127	AIR HOSE BRACKET JD 4045H	1.0	UN
130110	85405017	ANTI-VIBRATION MOUNT D40 Th28	1.0	UN
180490	85409456	HOSE CLAMP D60	1.0	UN
181530	85427110	PIPE UNION FEMAL/MAL 1/4G	1.0	UN
180370	85409423	HOSE CLIP D20/32	1.0	UN
181540	85492163	GASKET D6x10	1.0	UN
181490	85416444	FLEXIBLE HOSE D12x19	1.0	UN

Part numbers listed are the only parts used in this model.



Item	Part Number	Description	Quantity	Units
F30005		RADIATOR 030170 DETAIL	1.0	UN
300640	85425999	RADIATOR BOTTOM HOSE	1.0	UN
300650	85426021	RADIATOR TOP HOSE	1.0	UN
180630	85426393	RUBBER HOSE D50	2.0	UN
300660	85502607	RADIATOR CHARGE AIR HOSE	1.0	UN
080310	85404044	AIR INLET PIPE JD 4045H	1.0	UN
300670	85500577	WATER RADIATOR	1.0	UN
300680	85500668	AIR RADIATOR	1.0	UN
181730	85500536	PLUG RADIATOR	1.0	UN
180300	85409399	HOSE CLIP D60/80	2.0	UN
181430	85412922	HOSE CLIP D50/70	2.0	UN
180620	85426385	T BOLT CLAMP D60/63	6.0	UN
300690	85500759	LEFT FAN PROTECTION	1.0	UN
300700	85500841	RIGHT FAN PROTECTION	1.0	UN
300600	85500965	PLENUM	1.0	UN
300710	85502516	RADIATOR TOP TRAVERSE	1.0	UN
300720	85502573	RADIATOR BOTTOM TRAVERSE	1.0	UN
300620	85501047	RADIATOR RIGHT UPRIGHT	1.0	UN
300630	85501120	RADIATOR LEFT UPRIGHT	1.0	UN
300730	85502649	2 WAY VALVE	1.0	UN
180450	85410298	GASKET D14x18	1.0	UN
180100	85409316	PLUG 1/2G	1.0	UN

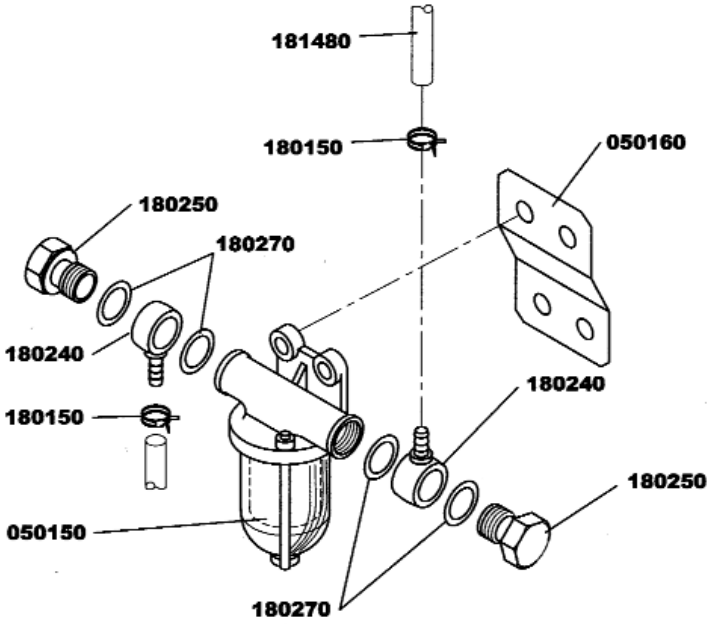
Part numbers listed are the only parts used in this model.



Item	Part Number	Description	Quantity	Units
F05002	85403541	FUEL TANK M216 ASSEMBLY	1.0	UN
050100	85403467	FUEL SUCCION PIPE L215 D8 3/8G	1.0	UN
050110	85403517	FUEL FILLING FUNNEL BASE TANK	1.0	UN
181750	85503035	PLUG TANK	1.0	UN
050120	85403509	LEVEL SENSOR ADAPTER	1.0	UN
110100	85404572	LEVEL SENSOR	1.0	UN
180130	85409068	SQARE FLANGE GASKET	1.0	UN
180140	85409076	ROUND FLANGE GASKET	1.0	UN
180150	85409514	SPRING CLAMP D13/15	1.0	UN

Part numbers listed are the only parts used in this model.

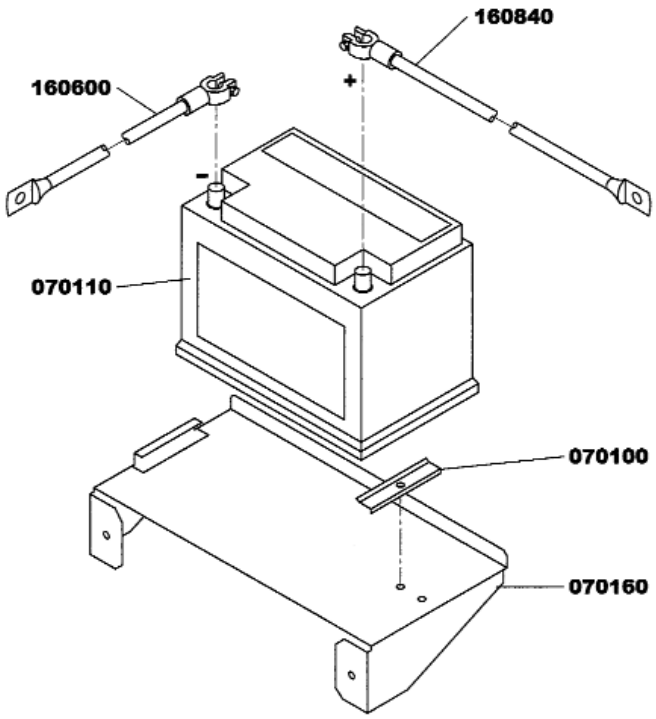
05004



Item	Part Number	Description	Quantity	Units
F05004	85403558	FUEL PREFILTER KIT ASSEMBLY	1.0	UN
050160	85403483	FUEL FILTER BRACKET	1.0	UN
050150	85403525	FUEL FILTER SEPARATOR	1.0	UN
180240	85409274	BANJO CONNECTOR MALE D08	1.0	UN
180250	85409282	BANJO SCREW M14X150 L26	1.0	UN
180150	85409514	SPRING CLAMP D13/15	1.0	UN
180270	85409522	GASKET D14x20	1.0	UN
181480	85416436	FLEXIBLE HOSE D8x14	1.0	UN

Part numbers listed are the only parts used in this model.

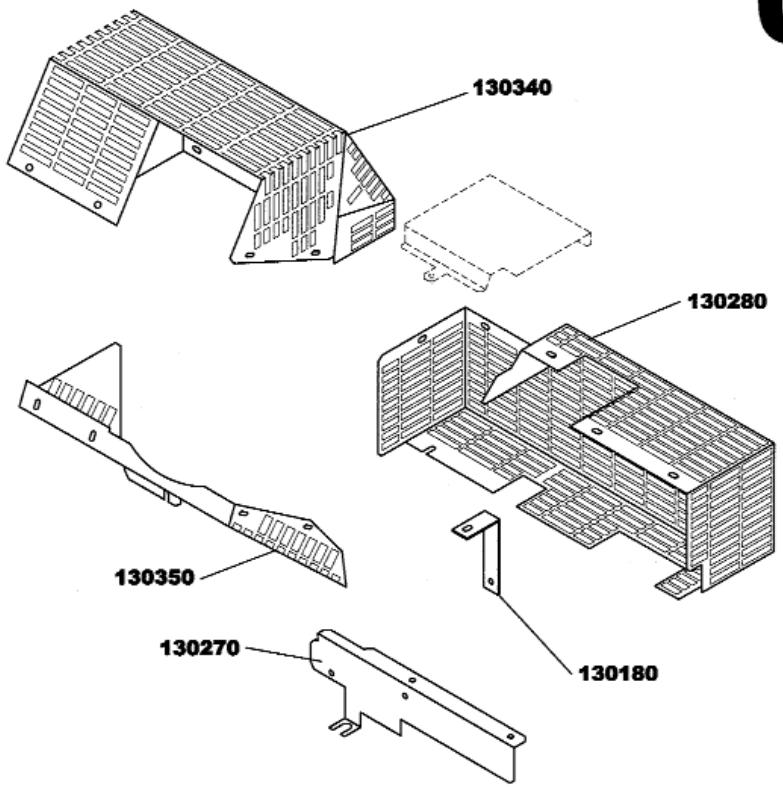
07 003



Item	Part Number	Description	Quantity	Units
F07003	85403814	ELECTRIC STARTER ASSEMBLY	1.0	UN
070100	85403699	BATTERY FIXING BRACKET	1.0	UN
070110	85403715	STARTING BATTERY 12V 70Ah 400A	1.0	UN
070160	85403806	BATTERY SUPPORT BRACKET M214/216	1.0	UN
160600	85406395	BATTERY CABLE (-) 50mm2 L700 BLACK	1.0	UN
160840	85408110	BATTERY CABLE (+) 50mm2 L1200 RED	1.0	UN

Part numbers listed are the only parts used in this model.

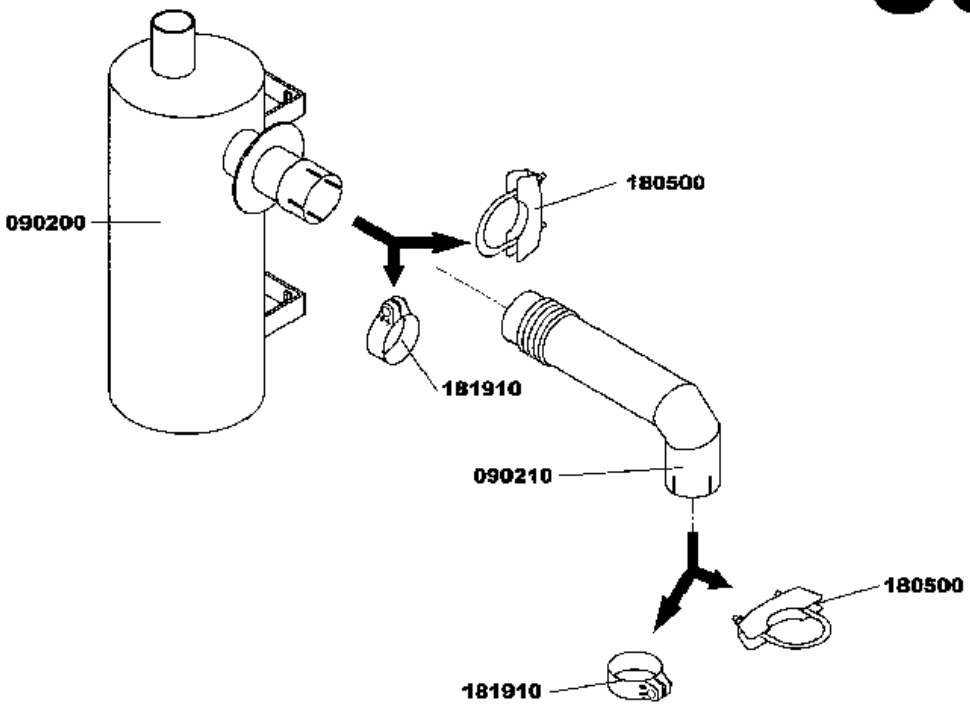
09009



Item	Part Number	Description	Quantity	Units
F09009	85404465	HOT SPOT GUARDS ASSEMBLY	1.0	UN
080250	85404051	BRACKET HEATER GUARD	1.0	UN
130270	85405041	HOT SPOT GUARD BRACKET JD 4045	1.0	UN
130280	85405058	HOT SPOT GUARD JD 4045	1.0	UN
130180	85405066	HOT SPOT GUARD BRACKET JD 4039	1.0	UN
130340	85405132	HOT SPOT GUARD JD 4045H	1.0	UN
130350	85405140	HOT SPOT GUARD JD 4045H	1.0	UN

Part numbers listed are the only parts used in this model.

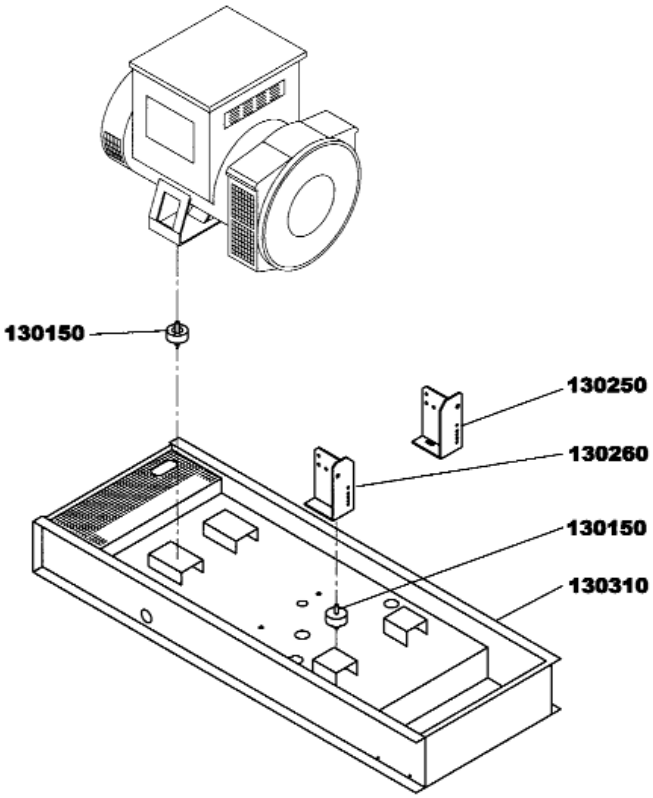
09 008



Item	Part Number	Description	Quantity	Units
F09008	85621738	EXHAUST MUFFLER M214 ASSEMBLY	1.0	UN
090200	85404366	29dB MUFFLER	1.0	UN
090210	85503589	EXHAUST PIPE D114 JD	1.0	UN
181910	85509230	HOSE CLAMP D115	1.0	UN

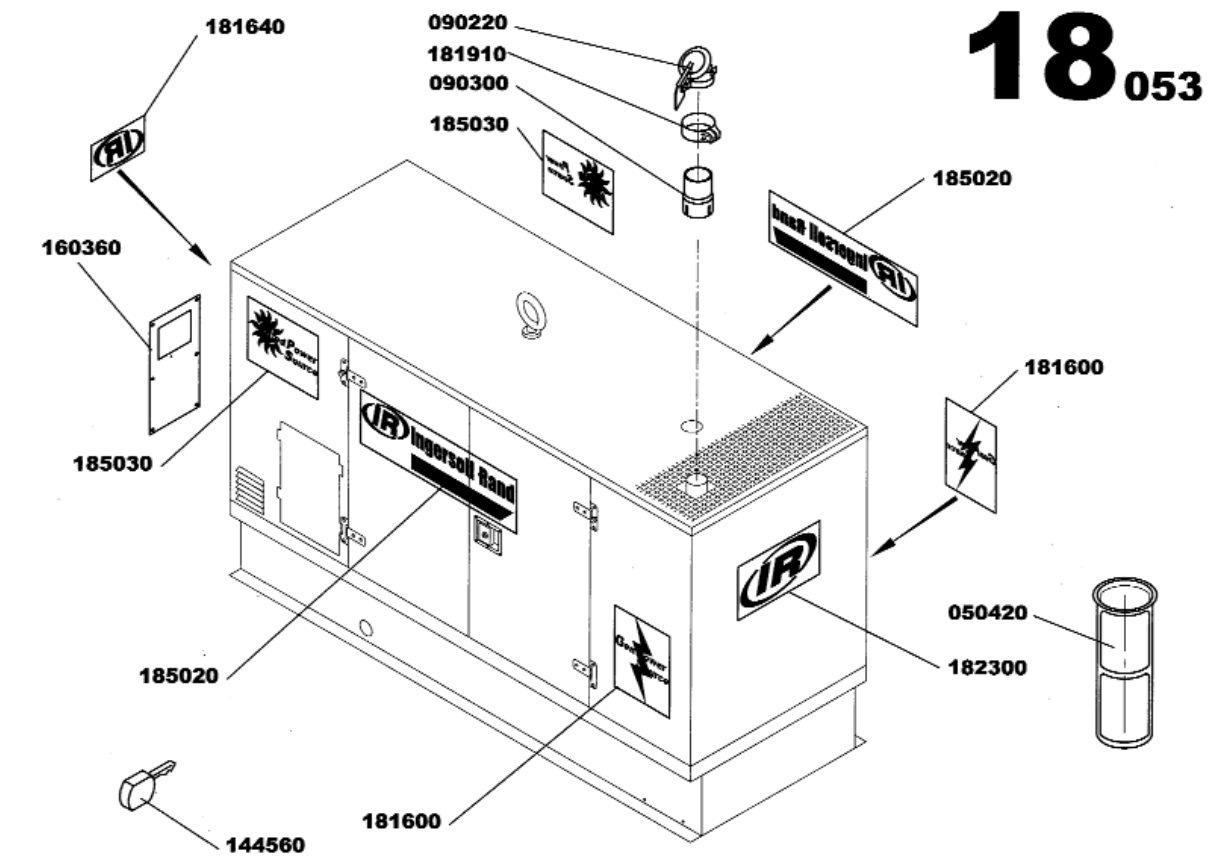
Part numbers listed are the only parts used in this model.

13 011



Item	Part Number	Description	Quantity	Units
F13011	85404796	FRAME M214 JD 4045 ASSEMBLY	1.0	UN
130310	85404788	FRAME TANK 200L M214	1.0	UN
130150	85401032	ANTI-VIBRATION MOUNT 600daN 8mm	1.0	UN
130250	85509248	ENGINE SUPPORT JD 4045/6068 LEFT SIDE	1.0	UN
130260	85509255	ENGINE SUPPORT JD 4045/6068 RIGHT SIDE	1.0	UN

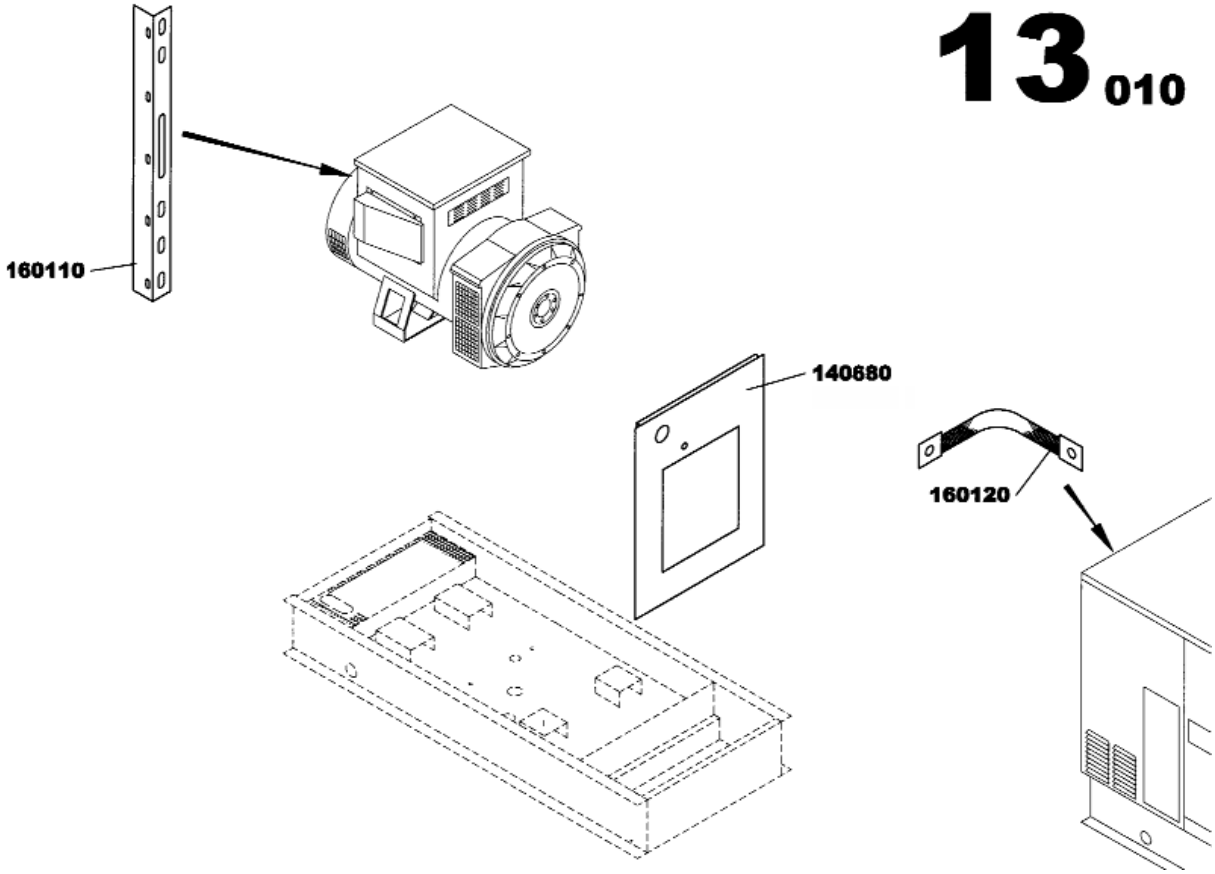
Part numbers listed are the only parts used in this model.



Item	Part Number	Description	Quantity	Units
F18053	85621746	G110M ACCESSORY ASSEMBLY	1.0	UN
050420	85431120	FUEL FILTER	1.0	UN
090300	85422772	MUFFLER EXTENSION D114	1.0	UN
090220	85404341	EXHAUST RAIN FLAP D114	1.0	UN
144560	85509263	WBH LATCHE KEY	1.0	UN
160360	85407146	CIRCUIT BREAKER CLOSURE PANEL	1.0	UN
180500	85409381	HOSE CLAMP D120	1.0	UN
181910	85509230	HOSE CLAMP D115	1.0	UN
181600	85428019	RECTANGULAR STICKER 450x600	1.0	UN
181640	85500197	ROUND STICKER D215	1.0	UN
182300	85500205	ROUND STICKER D285	1.0	UN
185020	85621753	RECTANGULAR STICKER 1015x295	1.0	UN
185030	85621639	RECTANGULAR STICKER 450x600	1.0	UN

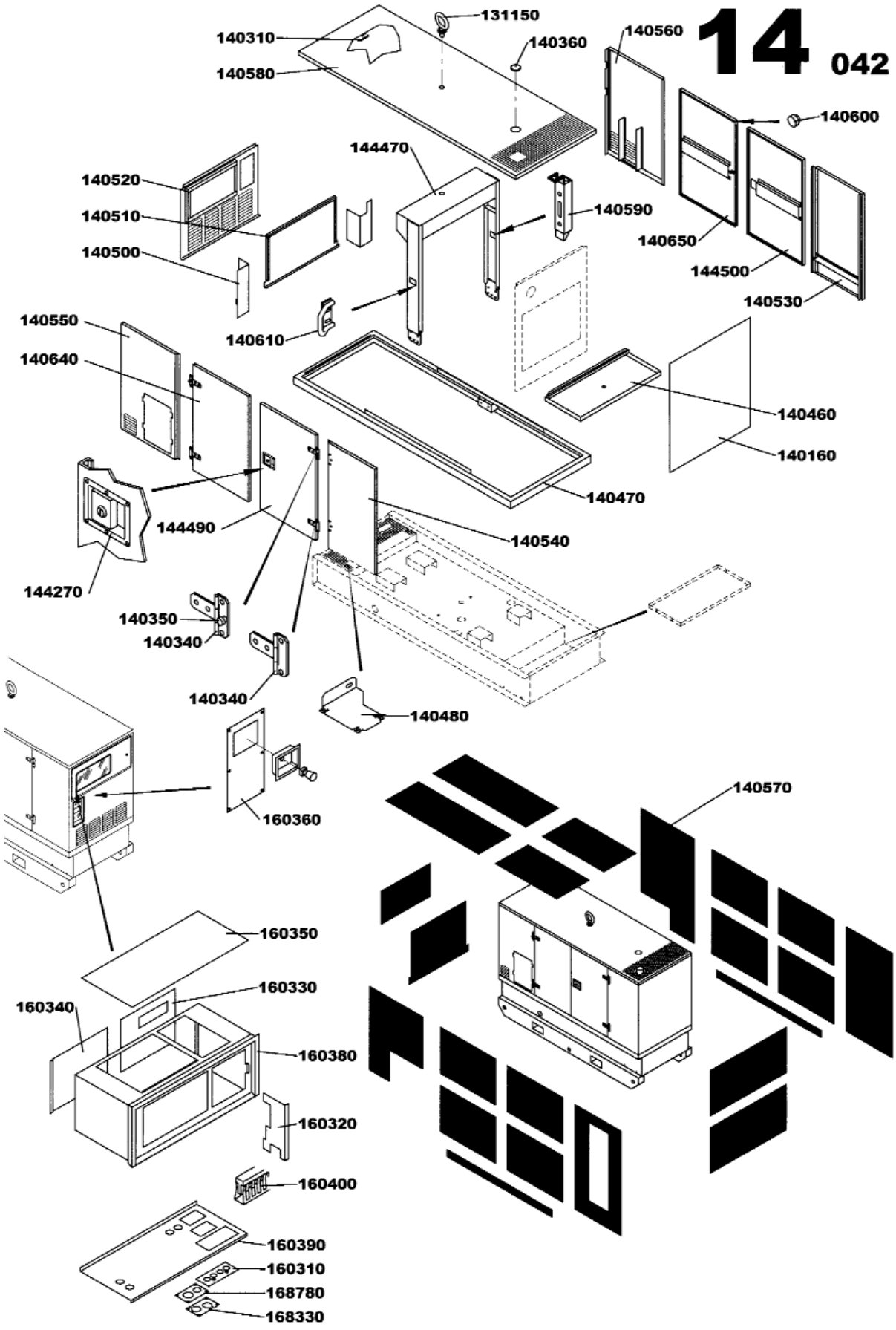
Part numbers listed are the only parts used in this model.

13 010



Item	Part Number	Description	Quantity	Units
F13010	85404812	M214 MISCELLANEOUS ASSEMBLY	1.0	UN
140680	85405835	RADIATOR PANEL M214 JD 4045H	1.0	UN
160120	85406452	GROUND WIRES 25mm2	1.0	UN

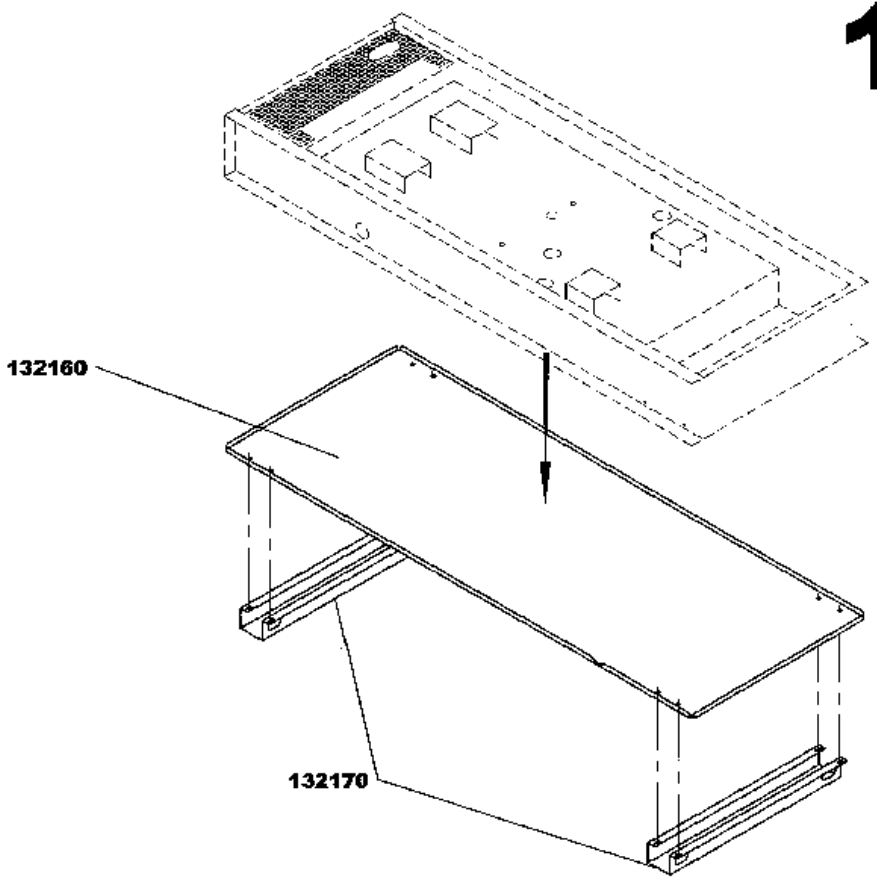
Part numbers listed are the only parts used in this model.


14 042
131150
140310
140360
140560
140580
140600
144470
140520
140590
140510
140650
140500
144500
140530
140610
140550
140640
140460
140160
140470
144490
140540
144270
140350
140340
140340
140480
140570
160360
160350
160330
160340
160380
160320
160400
160390
160310
168780
168330

Item	Part Number	Description	Quantity	Units
F14042	85509974	CANOPY M214 ASSEMBLY BEIGE	1.0	UN
131150	85492700	LIFTING EYE D61	1.0	UN
140160	85405439	FRONT HOOD CLOSURE PANEL M204/205	1.0	UN
140460	85405520	AIR DEFLECTOR M214 FRONT	1.0	UN
140470	85405546	BASEFRAME M214	1.0	UN
140480	85405595	FRAME CLOSURE PLATE M214	1.0	UN
144470	85509602	SUPPORT ARCH M214 BLACK	1.0	UN
140500	85405728	AIR DEFLECTOR M214 REAR LEFT	1.0	UN
140510	85405751	AIR DEFLECTOR M214 CENTER REAR	1.0	UN
140520	85405777	M214 CANOPY LOWER REAR PANEL	1.0	UN
140530	85405785	CANOPY FRONT RIGHT UPRIGHT M214	1.0	UN
140540	85405793	CANOPY FRONT LEFT UPRIGHT M214	1.0	UN
140550	85405801	CANOPY REAR LEFT UPRIGHT M214	1.0	UN
140560	85405843	CANOPY REAR RIGHTUPRIGHT M214	1.0	UN
140570	85405850	SOUNDPROOF PANELS BATCH M214	1.0	UN
140310	85406098	CANOPY TOP ISOLATION BRACKET M223/214/216	1.0	UN
140580	85406106	CANOPY TOP M214	1.0	UN
140340	85406155	DOOR HINGE	1.0	UN
140590	85406163	DOOR LATCH L75xW20xTh20	1.0	UN
140600	85406171	RUBBER STOP	1.0	UN
140350	85406189	ANTI-VIBRATION MOUNT 140daN 15mm	1.0	UN
144270	85509305	CANOPY DOOR LOCK KEY LOCK	1.0	UN
140360	85406205	PLUG D100	1.0	UN
140610	85406254	STRIKER PLATE M200 CANOPY DOOR	1.0	UN
140640	85406320	CANOPY DOOR M214 REAR HINGE ON RIGHT	1.0	UN
140650	85406312	CANOPY DOOR M214 REAR HINGE ON LEFT	1.0	UN
144490	85509867	CANOPY DOOR M214 FRONT HINGE ON RIGHT BEIGE	1.0	UN
144500	85509875	CANOPY DOOR M214 FRONT HINGE ON LEFT BEIGE	1.0	UN
160310	85406486	GLAND NUT PLATE CONTROL PANEL M204/205	1.0	UN
160320	85406718	PANEL ANGLE BAR	1.0	UN
160330	85406908	REAR PANEL M204/M205 CONTROL PANEL HOUSING	1.0	UN
160340	85406916	REAR PANEL M203/204/205 CONTROL PANEL HOUSING	1.0	UN
160350	85407054	UPPER CLOSURE PANEL	1.0	UN
168330	85427177	RUBBER GROMET SUPPORT	1.0	UN
160380	85407344	CONTROL PANEL HOUSING INTELLISYS M214	1.0	UN
160390	85407351	LOWER CLOSURE CONTROL PANEL	1.0	UN
168780	85427201	RUBBER GROMET SUPPORT	1.0	UN
167960	85408359	CLIP	1.0	UN
160400	85408409	WIRING LOOM SUPPORT	1.0	UN
160400	85408409	WIRING LOOM SUPPORT	1.0	UN
160400	85408409	WIRING LOOM SUPPORT	1.0	UN

Part numbers listed are the only parts used in this model.

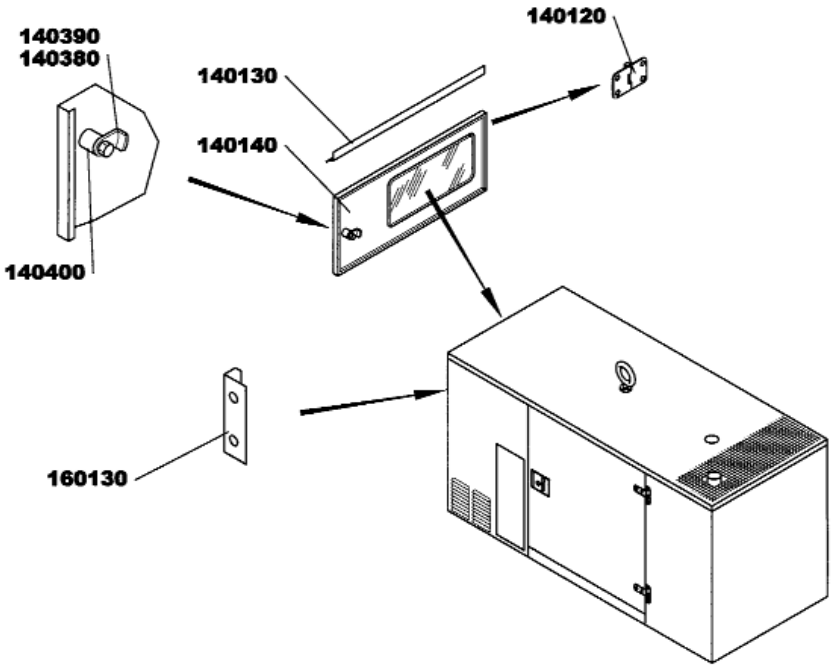
14048



Item	Part Number	Description	Quantity	Units
F14048	85621761	SINGLE BASE PLATE M214 ASSEMBLY	1.0	UN
132160	85621779	HOOD UNDERSHEETING M214	1.0	UN
132170	85621670	GENSET SPACER	1.0	UN
180390	85410165	WASHER 12x24	1.0	UN

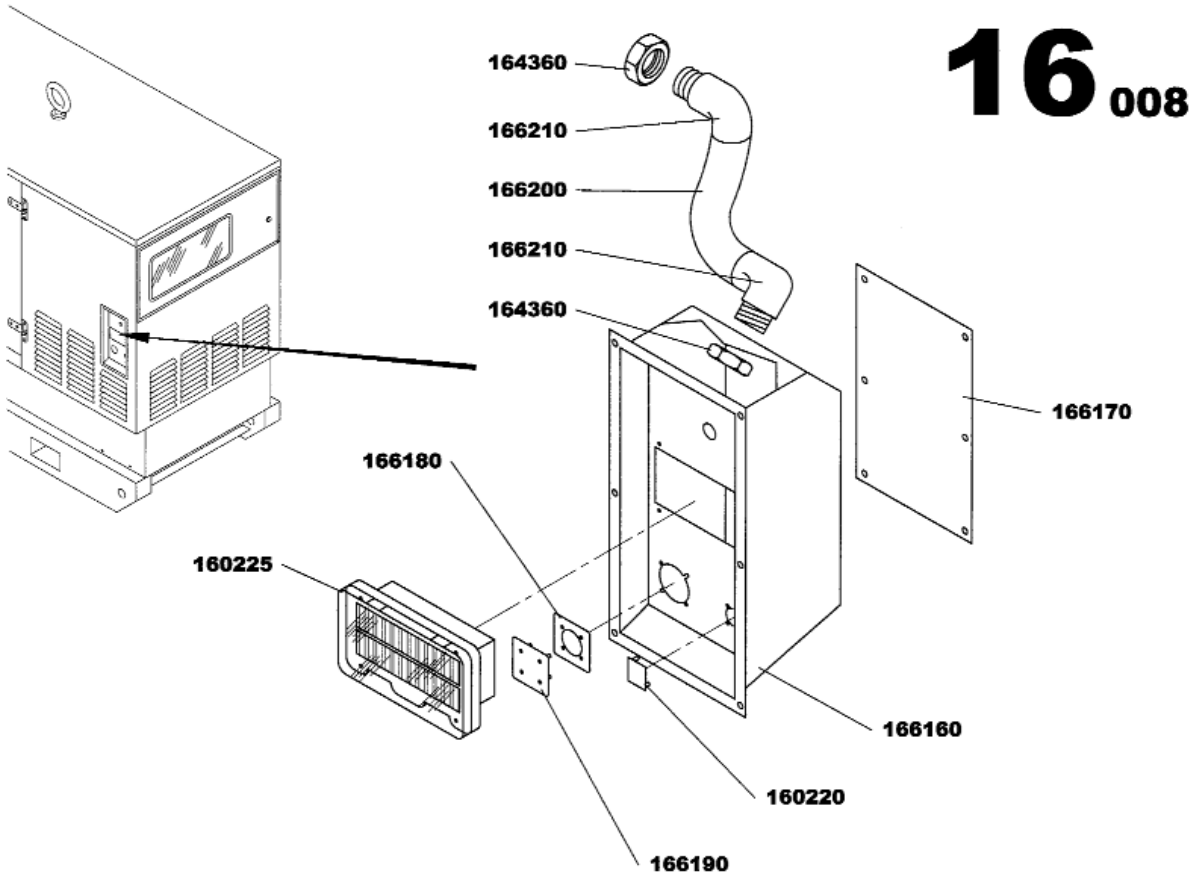
Part numbers listed are the only parts used in this model.

16 005



Item	Part Number	Description	Quantity	Units
F16005	85407153	PANEL WINDOW M214 ASSEMBLY	1.0	UN
140120	85406197	DOOR HINGE	1.0	UN
140380	85406221	SLAM SHUT DOOR LATCH	1.0	UN
140390	85406239	SLAM SHUT LATCH HANDLE	1.0	UN
140400	85406247	SLAM SHUT FASTENER	1.0	UN
140130	85406270	WATER DEFLECTOR PANEL TOP DOOR	1.0	UN
140140	85406353	CONTROL PANEL DOOR M214	1.0	UN
160130	85407229	STRIKER PLATE M214 CANOPY CONTROL PANEL DOOR	1.0	UN

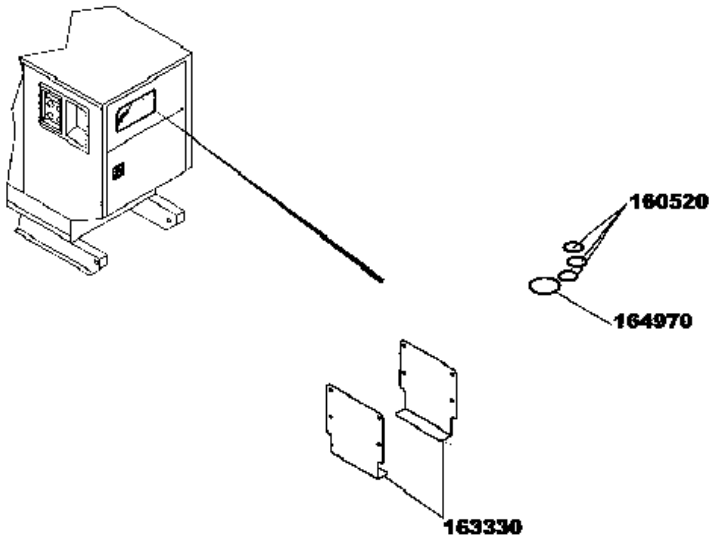
Part numbers listed are the only parts used in this model.



Item	Part Number	Description	Quantity	Units
F16008	85501666	EMERGENCY STOP PANEL +CB ASSEMBLY	1.0	UN
160220	85406866	OPTURATOR 24x24	1.0	UN
166160	85501518	EMERGENCY STOP BUTTON HOUSING	1.0	UN
166170	85501526	REAR PANEL M200 EMERGENCY STOP PANEL HOUSING	1.0	UN
166190	85501559	SOCKETS CLOSURE PLATE	1.0	UN
166200	85499440	ELECTRICAL SHAFT D36	1.0	UN
160225	85408276	CIRCUIT BREAKER SUPPORT PLATE 8 MODULES	1.0	UN
164360	85408680	GLAND NUT SCREW PG36	1.0	UN
166210	85499697	PIPE UNION ELBOW 45° PG36	1.0	UN

Part numbers listed are the only parts used in this model.

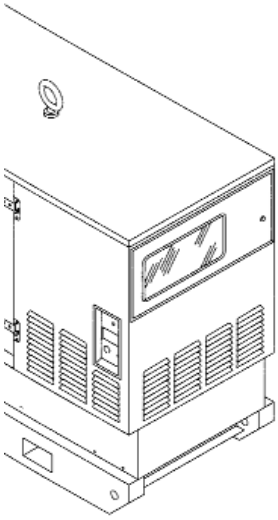
16 182

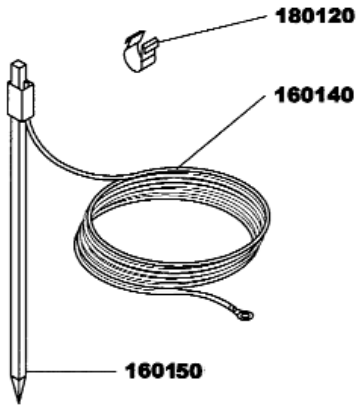


Item	Part Number	Description	Quantity	Units
F16182	85427219	R3000 BRACKET ASSEMBLY	1.0	UN
163330	85427193	INTELLISYS RACK BRACKET	1.0	UN
160520	85408391	RUBBER GROMMET D47	1.0	UN
164970	85427318	RUBBER GROMMET D64	1.0	UN

Part numbers listed are the only parts used in this model.

16 006

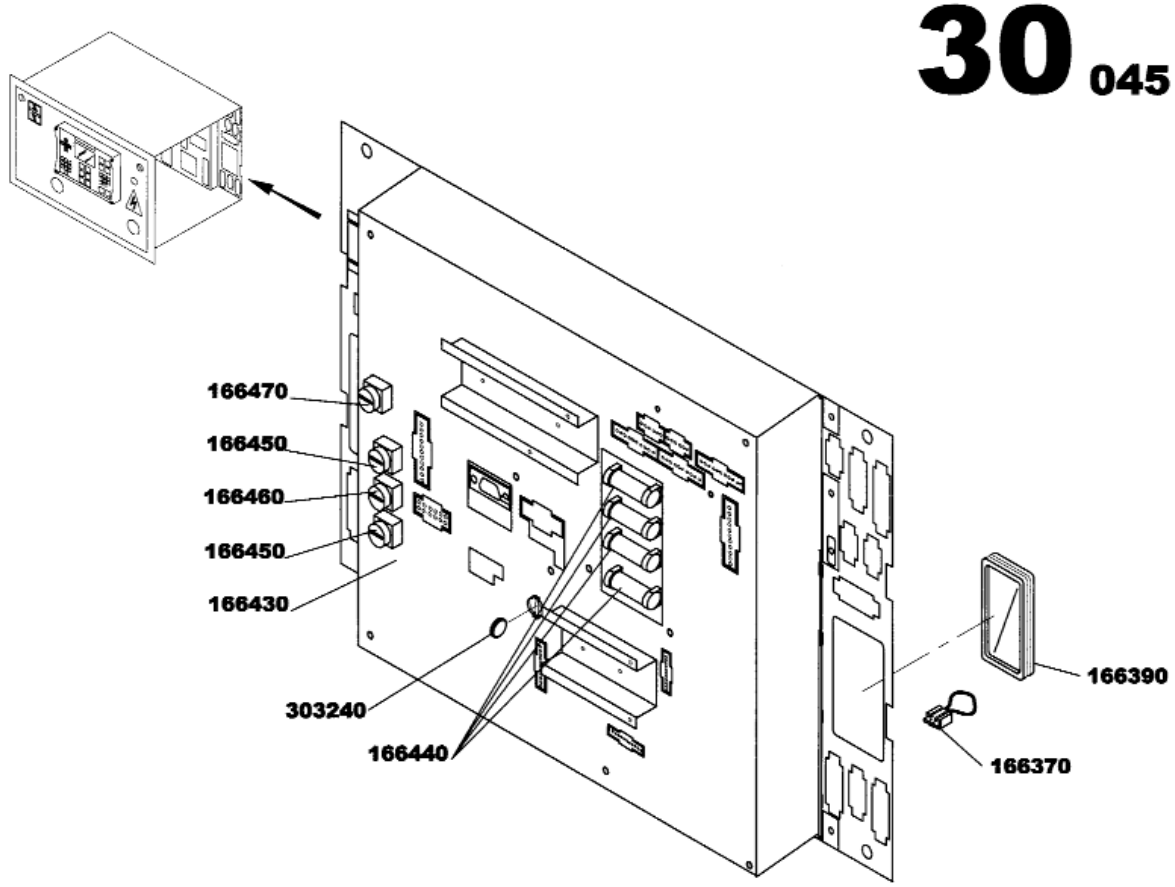




Item	Part Number	Description	Quantity	Units
F16006	85407906	EARTH ROD WITH CABLE CANOPY ASSEMBLY	1.0	UN
160140	85408227	NEUTRAL/EARTH SYSTEM CABLE 25mm2 L10000 Gr/Ye	1.0	UN
160150	85408334	EARTH ROD L1000	1.0	UN
180120	85409191	CLIP-ON BRACKET	1.0	UN

Part numbers listed are the only parts used in this model.

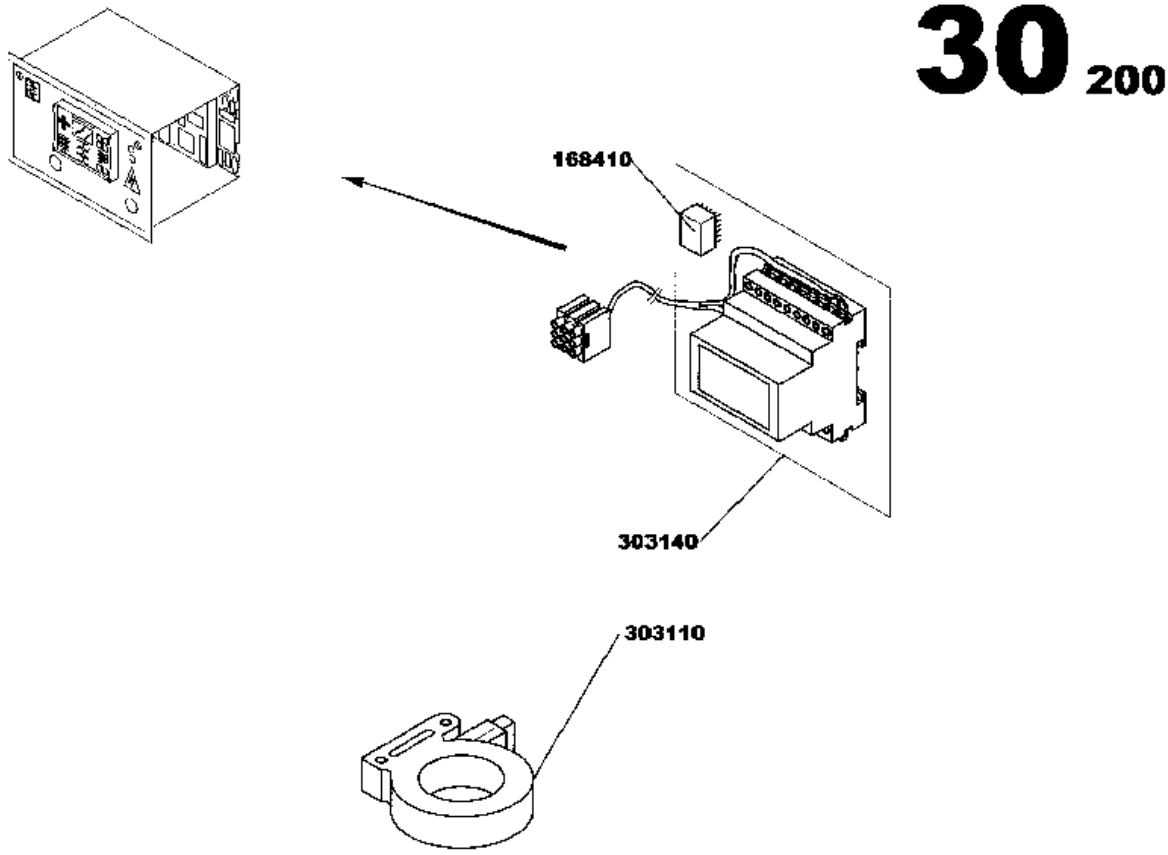
30 045



Item	Part Number	Description	Quantity	Units
F30045	85411569	INTELLISYS OPTION CB12 CARD	1.0	UN
166390	85504058	RUBBER GROMMET	1.0	UN
166430	85402592	INTELLISYS CARD CB12	1.0	UN
166370	85504033	INTELLISYS WIRING LOOM C35S	1.0	UN
166440	85426112	FUSE CYLINDRICAL 12A	4.0	UN
166470	85426120	FUSE CYLINDRICAL 10A	1.0	UN
166450	85426138	FUSE CYLINDRICAL 1A	2.0	UN
166460	85426146	FUSE CYLINDRICAL 2,5A	1.0	UN
303240	85505154	CR2032 CELL	1.0	UN

Part numbers listed are the only parts used in this model.

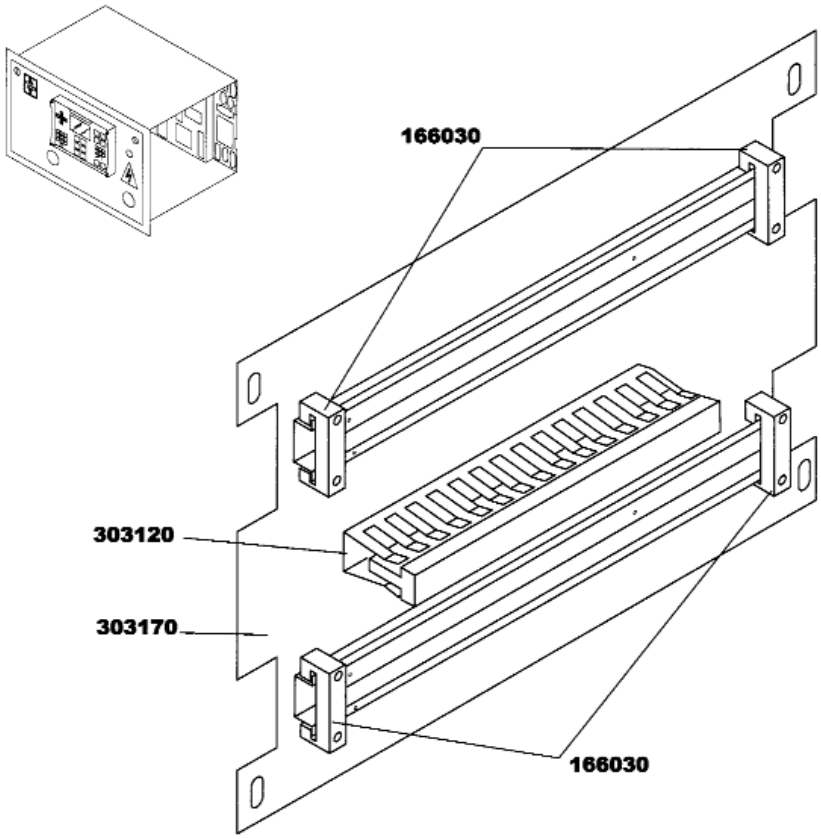
30 200



Item	Part Number	Description	Quantity	Units
F30200	85412245	INTELLISYS OPTION EARTH LEAKAGE RELAY	1.0	UN
303140	85504272	EARTH LEAKAGE RELAY 12V	1.0	UN
168410	85508570	RELAY CI 12V (RT2)	1.0	UN
303110	85423473	TORE	1.0	UN

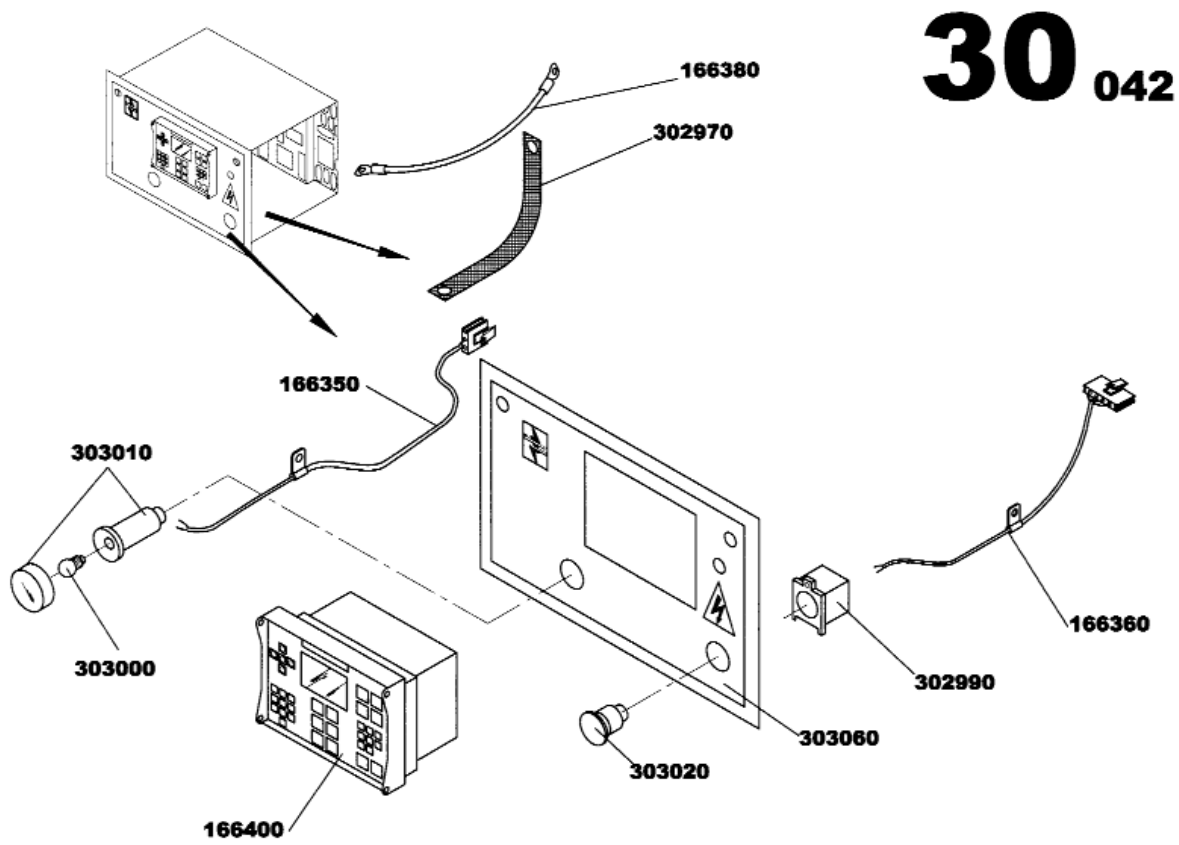
Part numbers listed are the only parts used in this model.

30 051



Item	Part Number	Description	Quantity	Units
F30051	85411619	INTELLISYS OPTION USING PLATEN	1.0	UN
166030	85408854	STOP	4.0	UN
303120	85504256	WIRING LOOM SUPPORT	0.21	ML
303170	85504306	USING TERMINAL	1.0	UN

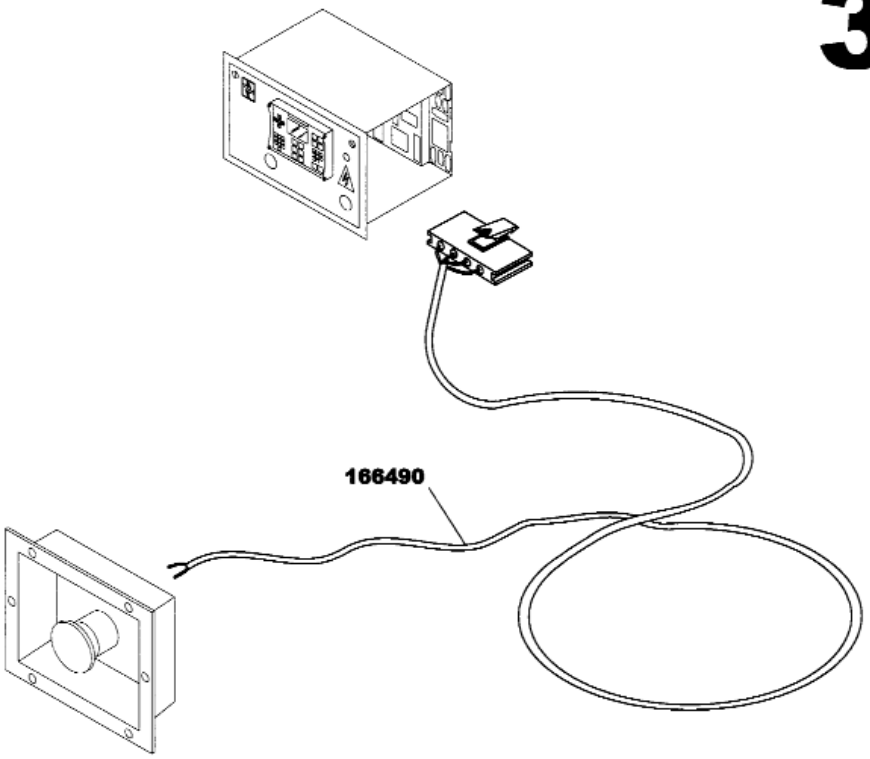
Part numbers listed are the only parts used in this model.



Item	Part Number	Description	Quantity	Units
F30042	85412013	INTELLISYS PANEL 12VDC ASSEMBLY	1.0	UN
302990	85426781	EMERGENCY STOP SWITCH	1.0	UN
302970	85504199	GROUND WIRES 10mm2	1.0	UN
166350	85504017	INTELLISYS WIRING LOOM C3 L810	1.0	UN
166360	85504025	INTELLISYS WIRING LOOM C11 L460	1.0	UN
303060	85504983	INTELLISYS PLASTIC PLATE	1.0	UN
166380	85504041	EARTHING INTELLISYS WIRING LOOM	1.0	UN
166400	85412021	INTELLISYS DISPLAY	1.0	UN
303000	85402519	LAMP 12V	1.0	UN
303010	85503522	PANEL LIGHT CYLINDRIC D22	1.0	UN
303020	85426773	EMERGENCY STOP BUTTON	1.0	UN

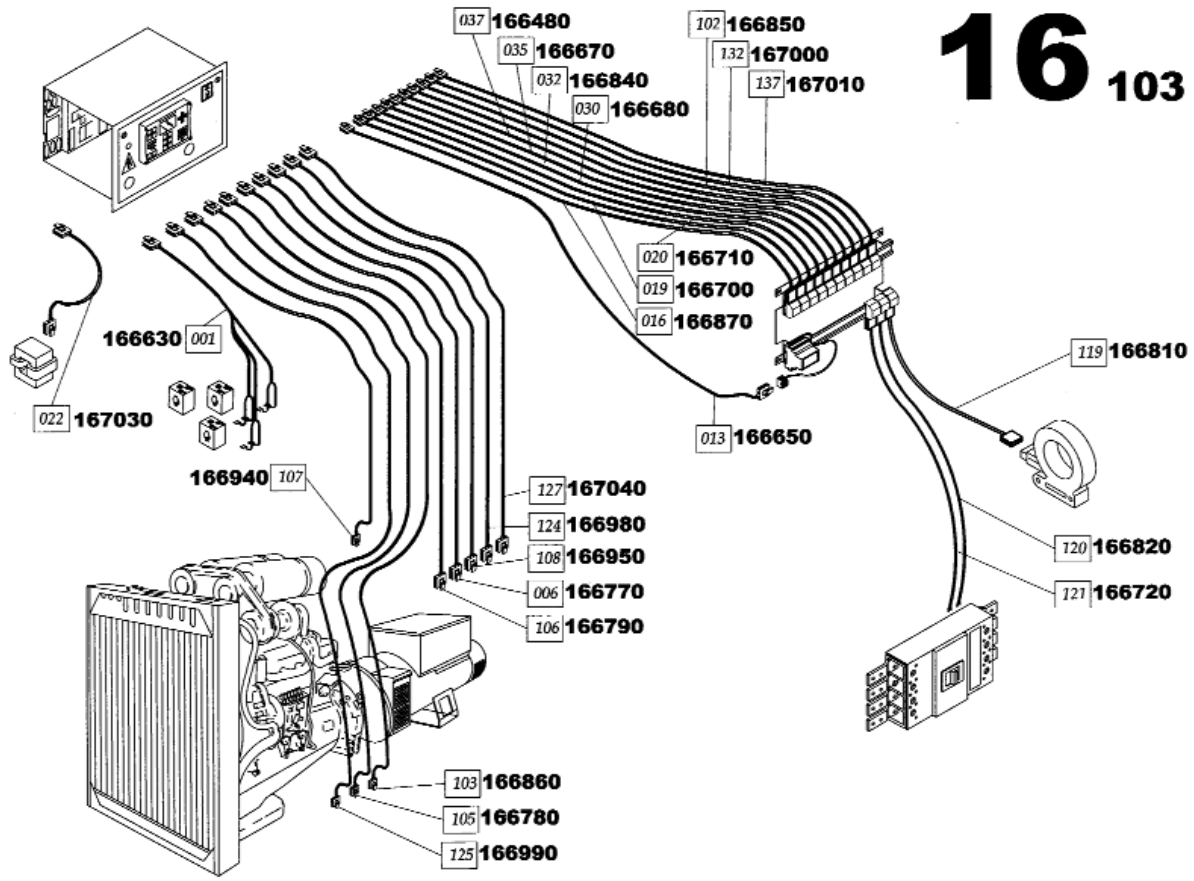
Part numbers listed are the only parts used in this model.

30 055



Item	Part Number	Description	Quantity	Units
F30055		INTELLISYS OPTION EMERGENCY STOP	1.0	UN
166490	85503977	INTELLISYS WIRING LOOM C11 L2000	1.0	UN

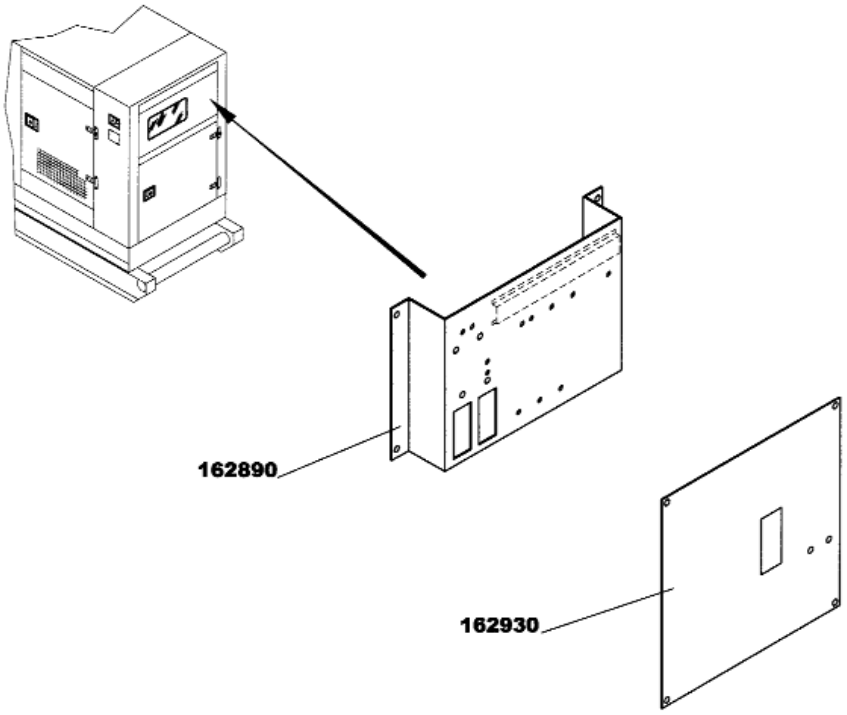
Part numbers listed are the only parts used in this model.



Item	Part Number	Description	Quantity	Units
F16103		INTELLISYS WIRING LOOM FUNCTION	1.0	UN
166480	85411213	INTELLISYS WIRING LOOM 037/041	1.0	UN
166630	85621688	INTELLISYS WIRING LOOM 001	1.0	UN
166770	85621696	INTELLISYS WIRING LOOM 006	1.0	UN
166810	85411452	INTELLISYS WIRING LOOM 119	1.0	UN
166820	85411460	INTELLISYS WIRING LOOM 120	1.0	UN

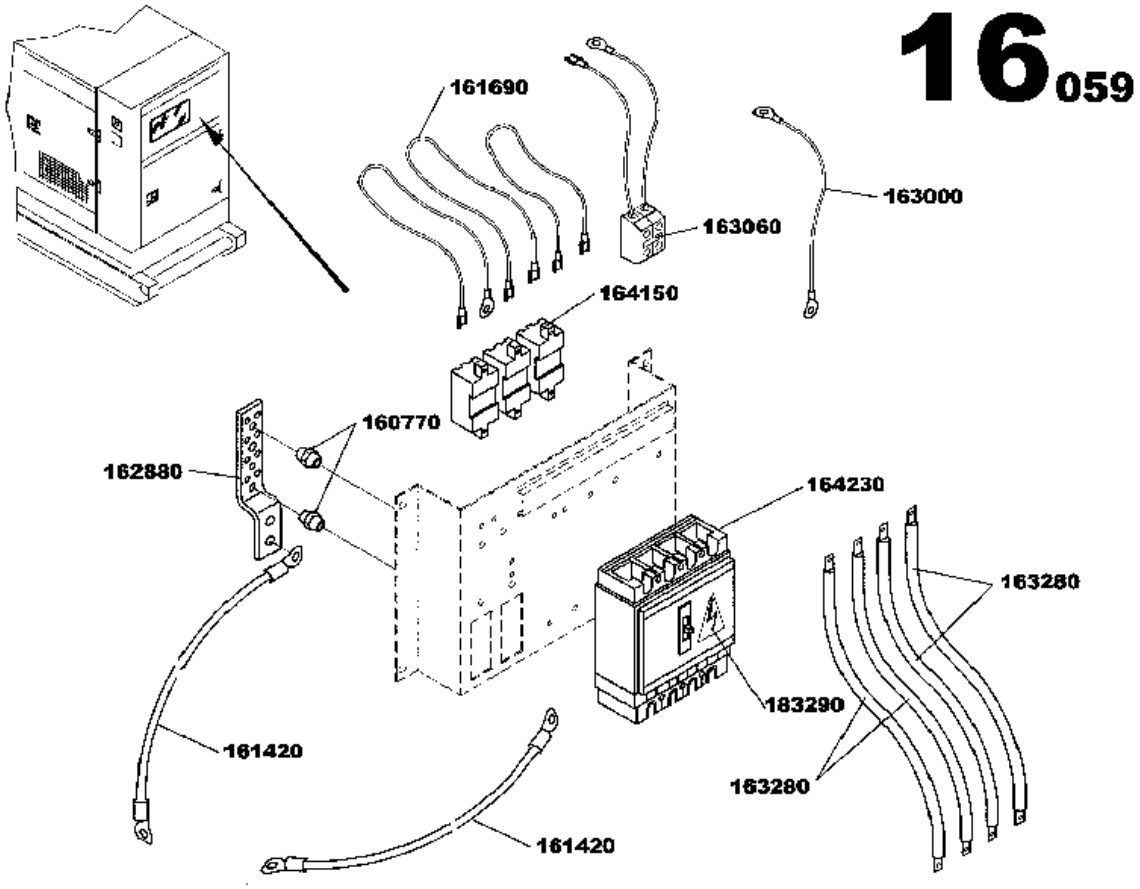
Part numbers listed are the only parts used in this model.

16 043



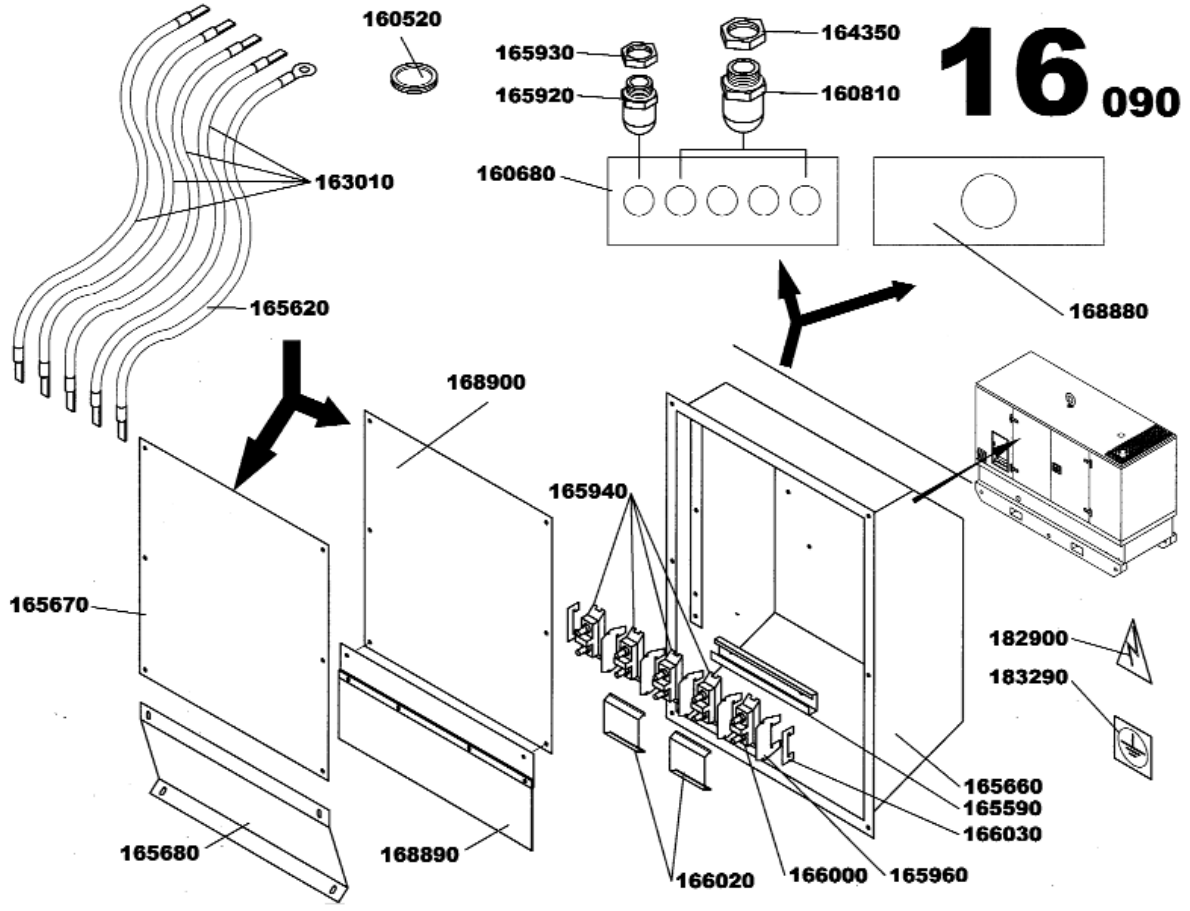
Item	Part Number	Description	Quantity	Units
F16043	85407401	TERMINAL BLOCK HOUSING 160<I<=250A ASSEMBLY	1.0	UN
162890	85406478	CIRCUIT BREAKER BRACKET M204/205	1.0	UN
162930	85406510	CIRCUIT BREAKER PROTECTION PANEL	1.0	UN

Part numbers listed are the only parts used in this model.



Item	Part Number	Description	Quantity	Units
F16059	85407443	POWER TERMINAL CONNECTIONS 160A ASSEMBLY	1.0	UN
162880	85406429	COPPER BAR 5x25	1.0	UN
163000	85406627	NEUTRAL/EARTH SYSTEM CABLE 25mm2 L250 Gr/Ye	1.0	UN
163280	85407070	POWER CABLE SINGLE CORE 30mm2 L1500	1.0	UN
161420	85621787	EARTHING CABLE D8xD10 25mm2 L1800 Gr/Ye	1.0	UN
160770	85408342	INSULATION PIN	1.0	UN
164150	85408441	CURRENT TRANSFORMER 200/5	1.0	UN
164230	85408508	COMPACT CIRCUIT BREAKER 4x160A	1.0	UN
162450	85408573	CIRCUIT BREAKER SHUNT RELEASE COIL 200/280VAC	1.0	UN

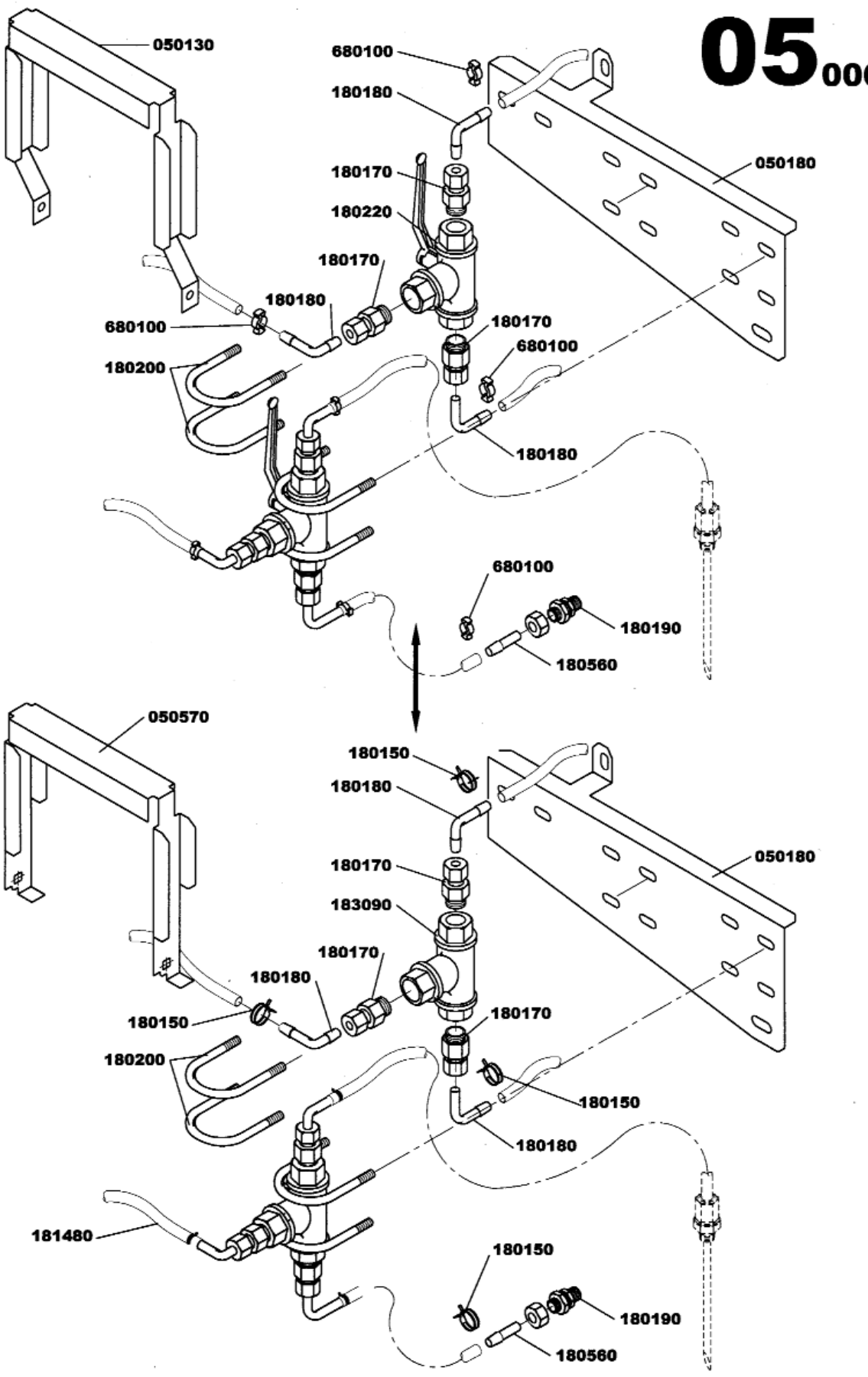
Part numbers listed are the only parts used in this model.



Item	Part Number	Description	Quantity	Units
F16090	85407575	CONNECTIONS BLOCK ASSEMBLY	1.0	UN
165590	85406973	ELECTRIC DIN RAIL 32X15	1.0	UN
163010	85498715	POWER CABLE SINGLE CORE 50mm2 L1100	1.0	UN
165620	85407039	EARTHING CABLE D8 35mm2 L900 Gr/Ye	1.0	UN
165660	85407542	CONNECTIONS BLOCK BRACKET M204/205	1.0	UN
168880	85621795	GLAND NUT PLATE TERMINAL CONNECTION M214	1.0	UN
168890	85621803	CABLE OUTLET PLATE WITH RUBBER SCREEN	1.0	UN
168900	85621811	FRONT PANEL M214BL CONTROL PANEL HOUSING	1.0	UN
160520	85408391	RUBBER GROMMET D47	1.0	UN
165920	85408623	GLAND NUT PG16	1.0	UN
160810	85408631	GLAND NUT PG21	1.0	UN
165930	85408664	GLAND NUT SCREW PG16	1.0	UN
164350	85408672	GLAND NUT SCREW PG21	1.0	UN
165940	85408698	TERMINAL BLOCK 1x70mm2 GREY	1.0	UN
165960	85408722	TERMINAL BLOCK SEPARATOR	1.0	UN
166000	85408797	TERMINAL BLOCK 1x35mm2 Gr/Ye	1.0	UN
166020	85408847	CONNECTOR COVER	1.0	UN
166030	85408854	STOP	1.0	UN
183290	85409084	RECTANGULAR STICKER 25X50	1.0	UN
182900	85409175	TRIANGULAR STICKER 49x42	1.0	UN

Part numbers listed are the only parts used in this model.

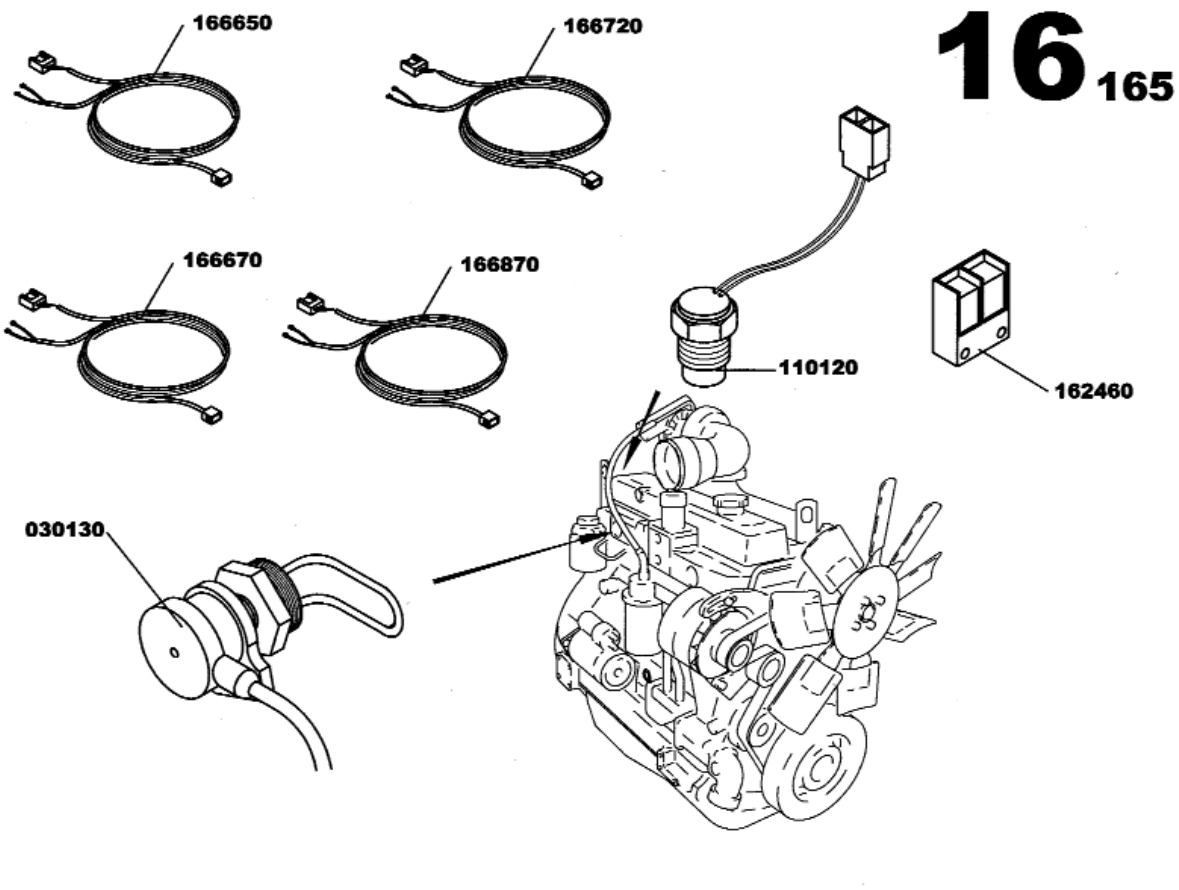
05 006


050130
680100
180180
180170
180220
180170
180180
680100
180200
180170
680100
180180
050180
680100
180190
180560
050570
180150
180180
180170
183090
180170
180180
180150
180170
180200
180150
180180
181480
180150
180190
180560

3 WAY FUEL VALVE OPTION

Item	Part Number	Description	Quantity	Units
F05006	85403574	3 WAY FUEL VALVE ASSEMBLY	1.0	UN
050180	85403566	3 WAY FUEL VALVE BRACKET ALL JD	1.0	UN
050180	85403566	3 WAY FUEL VALVE BRACKET ALL JD	1.0	UN
050570	85507861	3 WAY FUEL VALVE LEVER 3/8G	1.0	UN
180170	85409266	PIPE UNION REDUCER MAL/FEM 3/8G D8	6.0	UN
180560	85426377	PIPE UNION REDUCER MAL/MAL D8 D8	4.0	UN
180180	85409290	PIPE UNION ELBOW MAL/MAL D8	4.0	UN
180190	85409332	PIPE UNION FEM/FEM D8	2.0	UN
180200	85409464	HOSE CLAMP D36	4.0	UN
180150	85409514	SPRING CLAMP D13/15	12.0	UN
183090	85505006	3 WAY FUEL VALVE	2.0	UN
181480	85416436	FLEXIBLE HOSE D8x14	6.0	ML

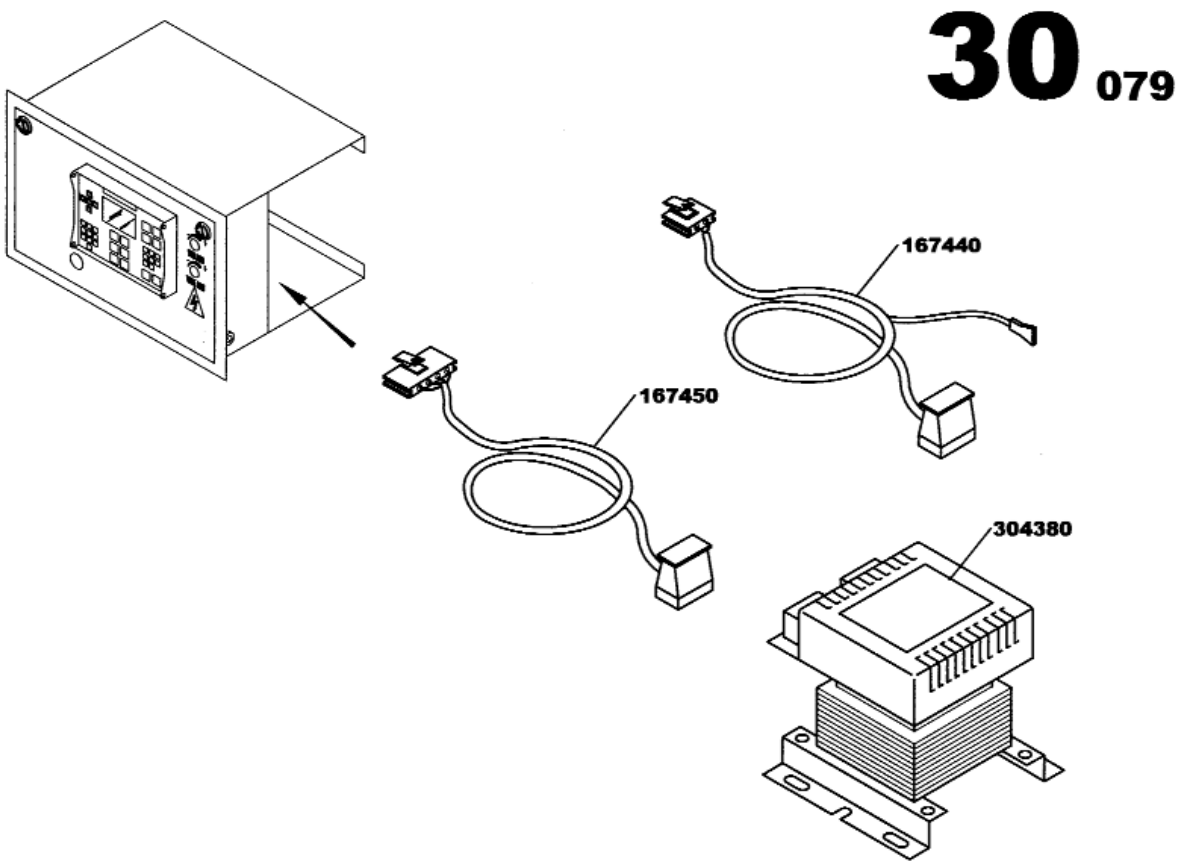
Part numbers listed are the only parts used in this model.



AUTO START OPTION

Item	Part Number	Description	Quantity	Units
F16165		AUTO START ASSEMBLY	1.0	UN
030130	85401081	COOLANT HEATER RESISTANCE 1000W 240V	1.0	UN
110120	85404655	TEMPERATURE SWITCH 35/45°	1.0	UN
162460	85408581	AUXILARY CONTACT	1.0	UN
166670	85411155	INTELLISYS WIRING LOOM 035	1.0	UN
166650	85410827	INTELLISYS WIRING LOOM 013	1.0	UN
166870	85426898	INTELLISYS WIRING LOOM 016	1.0	UN
166720	85426906	INTELLISYS WIRING LOOM 121	1.0	UN

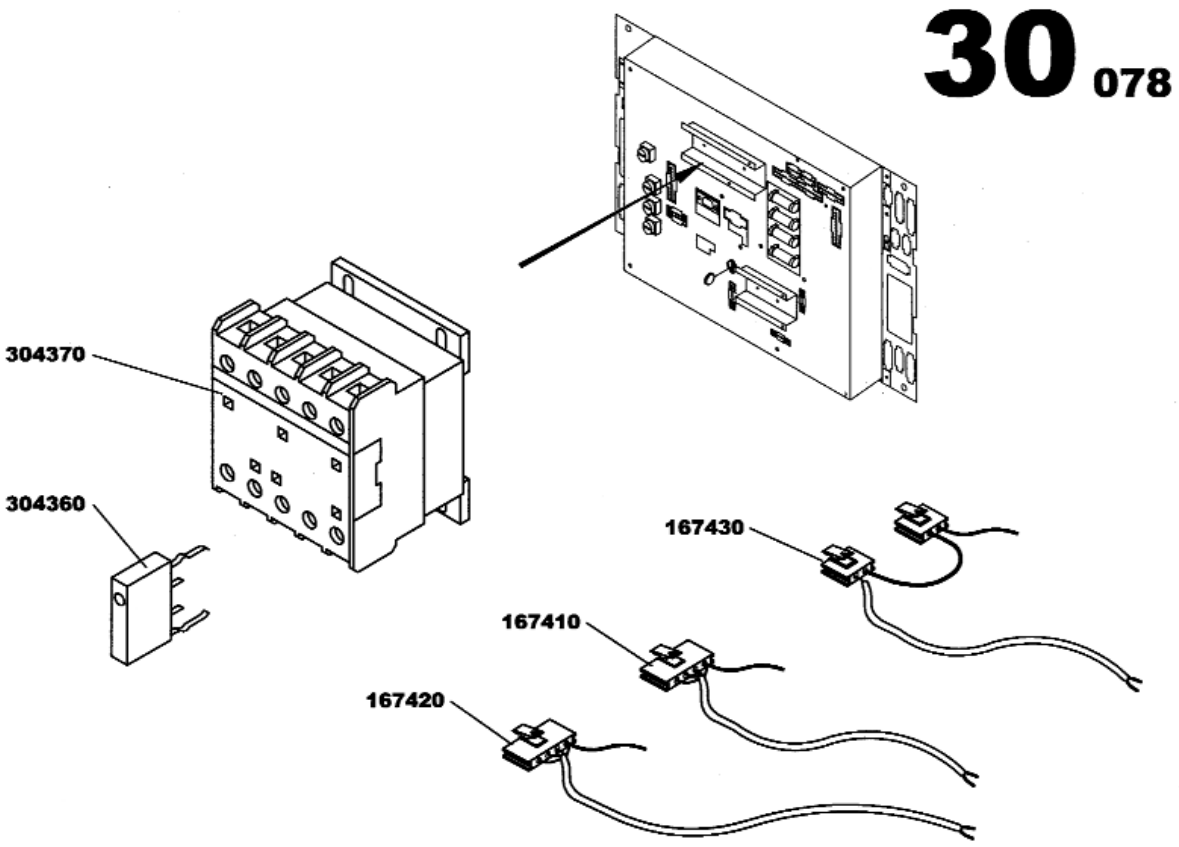
Part numbers listed are the only parts used in this model.



AUTO START OPTION

Item	Part Number	Description	Quantity	Units
F30079	85412054	INTELLISYS OPTION BATTERY CHARGER 12V/2.5A	1.0	UN
304380	85507622	CHARGER	1.0	UN
167440	85506541	INTELLISYS WIRING LOOM 022/024	1.0	UN
167450	85506558	INTELLISYS WIRING LOOM 009	1.0	UN

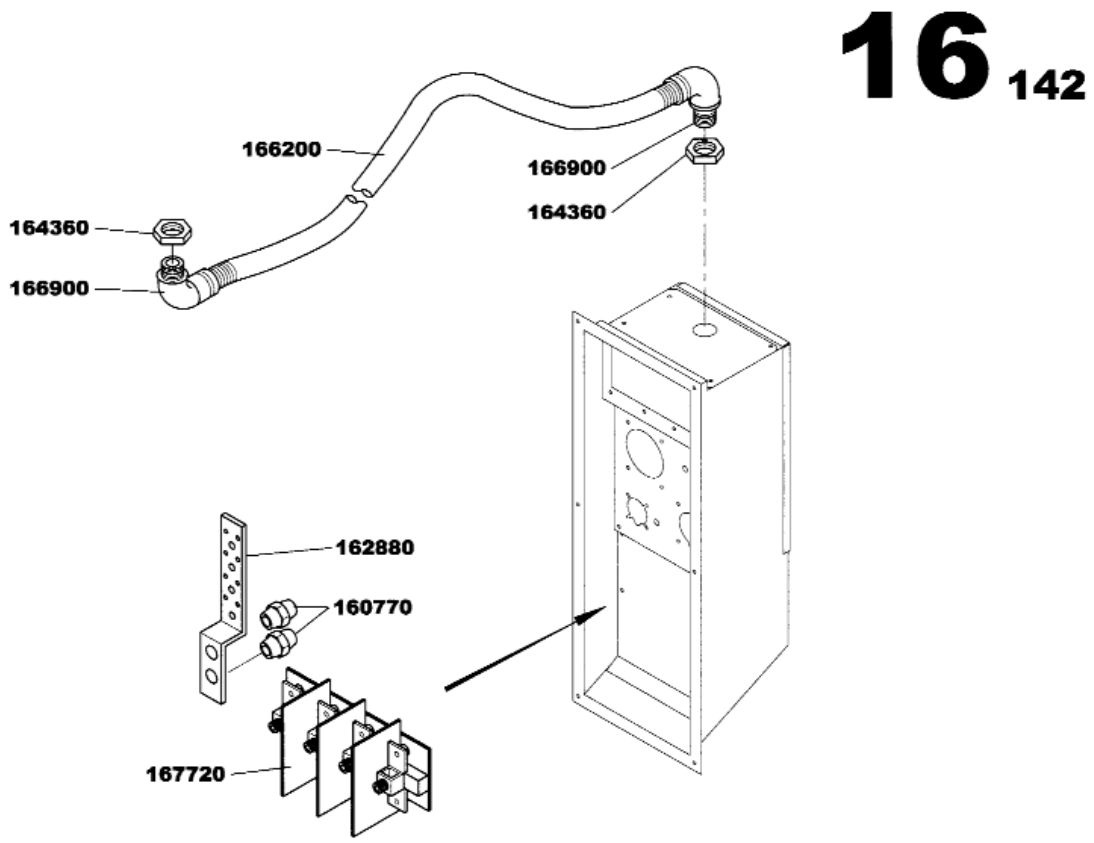
Part numbers listed are the only parts used in this model.



AUTO START OPTION

Item	Part Number	Description	Quantity	Units
F30078	85412179	INTELLISYS OPTION WATER PREHEATING	1.0	UN
167410	85506517	INTELLISYS WIRING LOOM 031/33/34	1.0	UN
167420	85506525	INTELLISYS WIRING LOOM 100	1.0	UN
167430	85506533	INTELLISYS WIRING LOOM 027	1.0	UN
304360	85506640	SURGE SUPRESSOR BLOCK	1.0	UN
304370	85507598	RELAY	1.0	UN

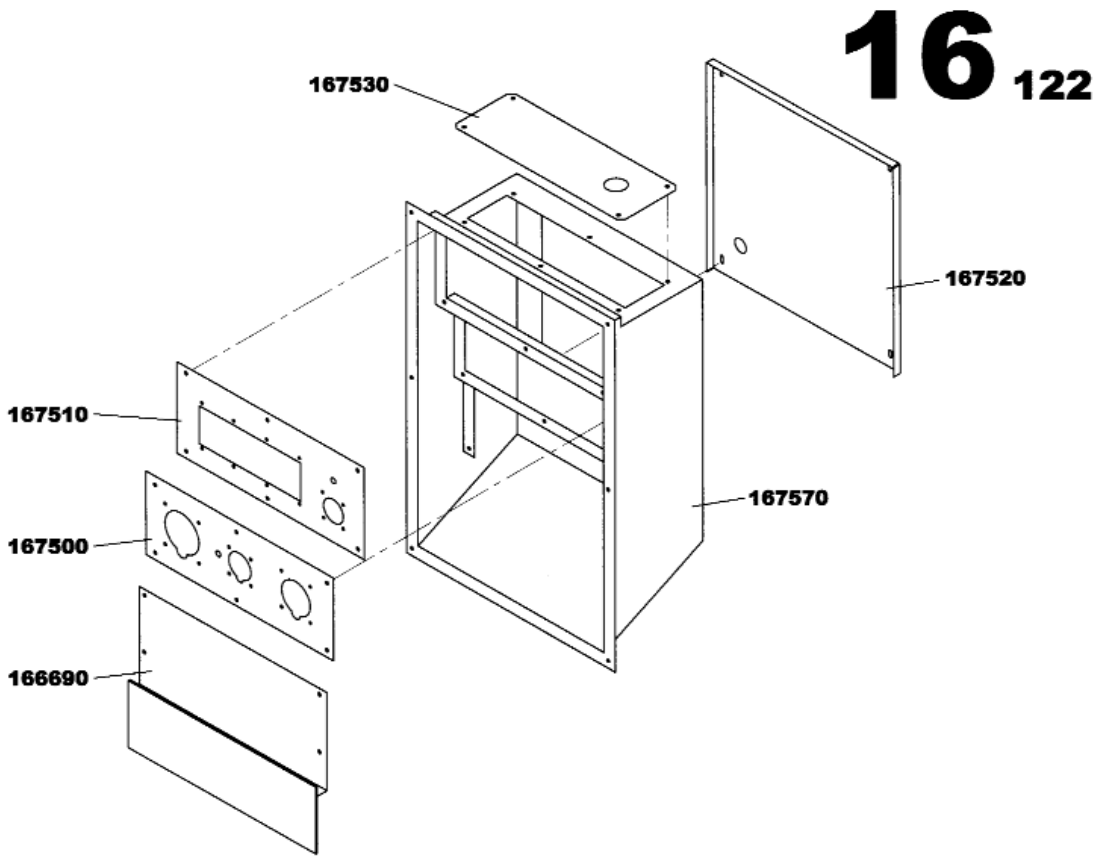
Part numbers listed are the only parts used in this model.



SOCKET OPTION TYPE 4

Item	Part Number	Description	Quantity	Units
F16142	85507036	SOCKET PANEL FR M214 TYPE 4 ASSEMBLY	1.0	UN
162880	85406429	COPPER BAR 5x25	1.0	UN
165630	85407062	POWER CABLE SINGLE CORE 30mm2 L1100	4.0	UN
166200	85499440	ELECTRICAL SHAFT D36	0.5	ML
160770	85408342	INSULATION PIN	2.0	UN
167720	85408607	POWER CONNECTION BLOCK	1.0	UN
164360	85408680	GLAND NUT SCREW PG36	2.0	UN
166900	85499689	PIPE UNION ELBOW 90° PG36	2.0	UN
183290	85409084	RECTANGULAR STICKER 25X50	1.0	UN
182900	85409175	TRIANGULAR STICKER 49x42	1.0	UN

Part numbers listed are the only parts used in this model.

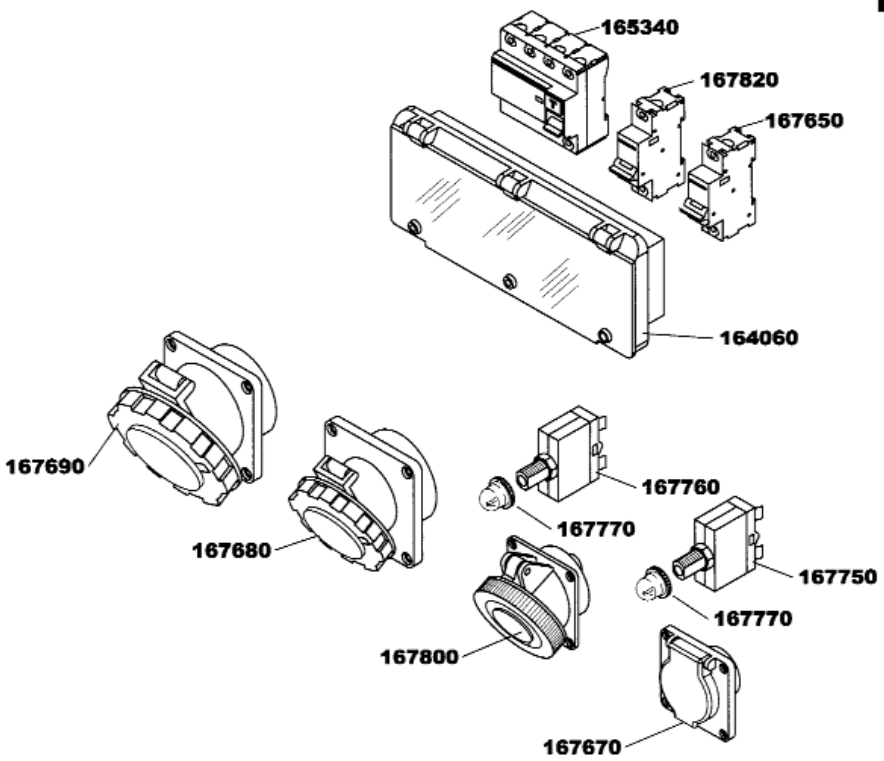


SOCKET OPTION TYPE 4

Item	Part Number	Description	Quantity	Units
F16122	85505782	SOCKETS PANEL T4 M214 ASSEMBLY	1.0	UN
166690	85407609	REAR PANEL M214 CONTROL PANEL HOUSING	1.0	UN
167500	85505725	SOCKETS BRACKET PANEL	1.0	UN
167510	85505733	CIRCUIT BREAKER BRACKET PANEL BRACKET M214	1.0	UN
167520	85505741	REAR PANEL M214 CONTROL PANEL HOUSING	1.0	UN
167530	85505758	GLAND NUT PLATE CONTROL PANEL M214	1.0	UN
167570	85505816	SOCKETS PANEL EC M214	1.0	UN

Part numbers listed are the only parts used in this model.

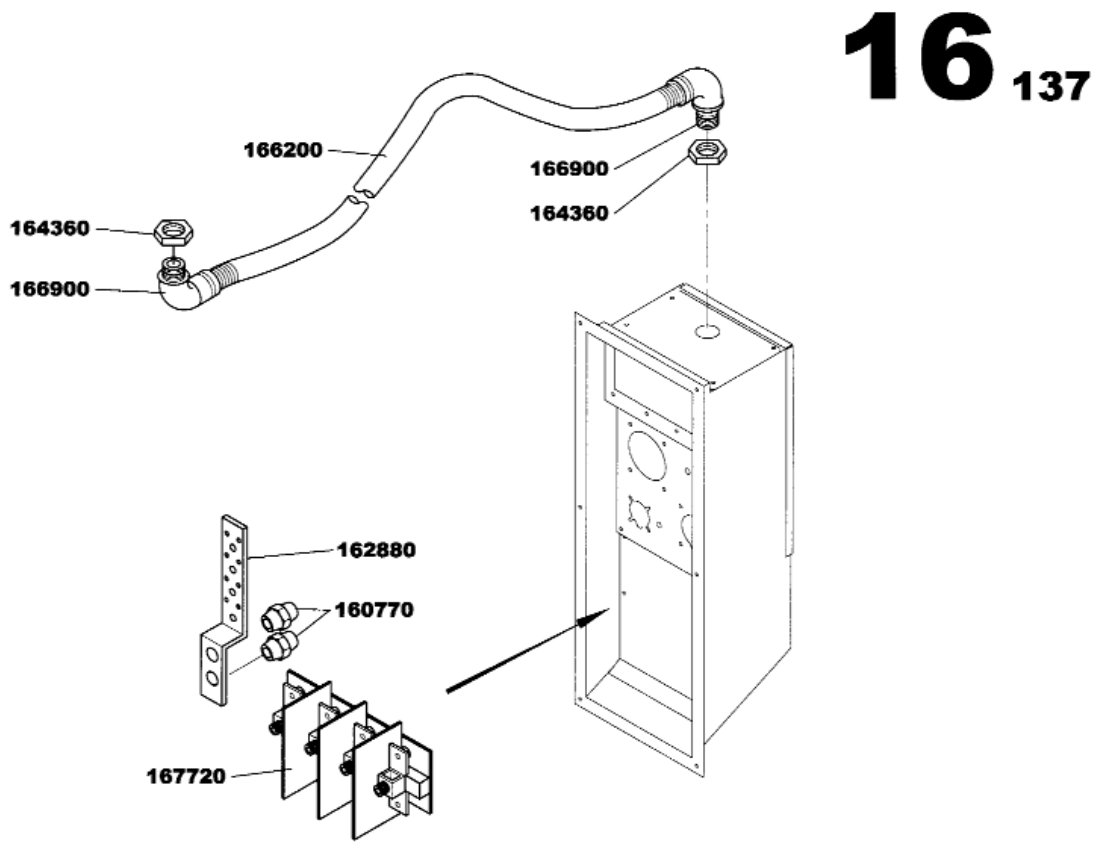
16131



SOCKET OPTION TYPE 4

Item	Part Number	Description	Quantity	Units
F16131	85505964	SOCKETS ASSEMBLY	1.0	UN
167750	85408748	COMPACT CIRCUIT BREAKER 1x10A	1.0	UN
167770	85408763	CIRCUIT BREAKER PROTECTION	1.0	UN
167760	85413169	COMPACT CIRCUIT BREAKER 1x15A	1.0	UN
167770	85408763	CIRCUIT BREAKER PROTECTION	1.0	UN
167650	85506020	MOULDED CASE CIRCUIT BREAKER 4x32A	1.0	UN
164060	85408284	CIRCUIT BREAKER SUPPORT PLATE 12 MODULES	1.0	UN
167670	85408300	SOCKET GERMAN 230V 16A 2S+G	1.0	UN
167680	85408318	EC SOCKET 400V 16A 3S+N+G	1.0	UN
167690	85408326	EC SOCKET 400V 32A 3S+N+G	1.0	UN
165340	85413599	DIFFERENTIAL SWITCH 4P 25A 30mA	1.0	UN
167800	85506103	SOCKET EC 230V 16A 2S+G	1.0	UN
167820	85506434	MOULDED CASE CIRCUIT BREAKER 4x16A	1.0	UN

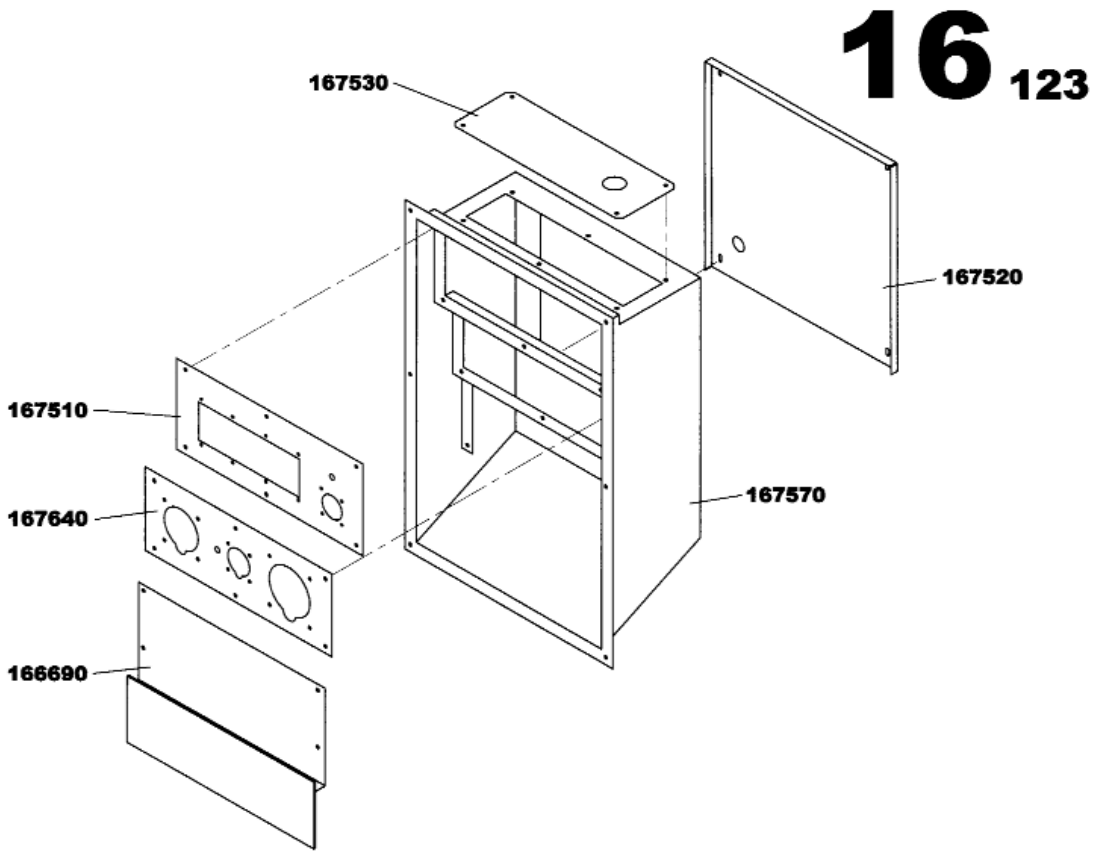
Part numbers listed are the only parts used in this model.



SOCKET OPTION TYPE 2

Item	Part Number	Description	Quantity	Units
F16137	85506897	SOCKET PANEL EU M214 TYPE 2 ASSEMBLY	1.0	UN
162880	85406429	COPPER BAR 5x25	1.0	UN
165630	85407062	POWER CABLE SINGLE CORE 30mm2 L1100	4.0	UN
166200	85499440	ELECTRICAL SHAFT D36	0.5	ML
160770	85408342	INSULATION PIN	2.0	UN
167720	85408607	POWER CONNECTION BLOCK	1.0	UN
164360	85408680	GLAND NUT SCREW PG36	2.0	UN
166900	85499689	PIPE UNION ELBOW 90° PG36	2.0	UN
183290	85409084	RECTANGULAR STICKER 25X50	1.0	UN
182900	85409175	TRIANGULAR STICKER 49x42	1.0	UN

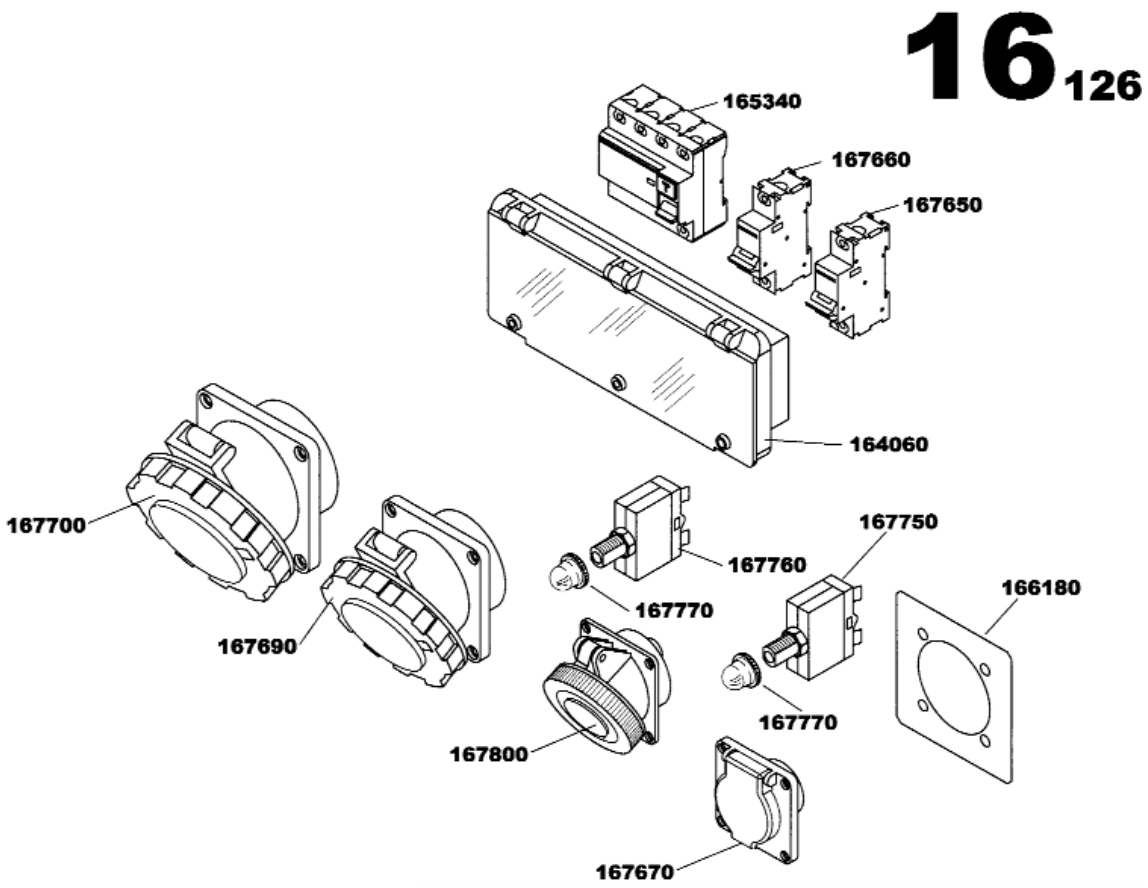
Part numbers listed are the only parts used in this model.



SOCKET OPTION TYPE 2

Item	Part Number	Description	Quantity	Units
F16123	85505790	SOCKETS PANEL T2 M214 ASSEMBLY	1.0	UN
166690	85407609	REAR PANEL M214 CONTROL PANEL HOUSING	1.0	UN
167510	85505733	CIRCUIT BREAKER BRACKET PANEL BRACKET M214	1.0	UN
167520	85505741	REAR PANEL M214 CONTROL PANEL HOUSING	1.0	UN
167530	85505758	GLAND NUT PLATE CONTROL PANEL M214	1.0	UN
167570	85505816	SOCKETS PANEL EC M214	1.0	UN
167640	85506012	SOCKETS BRACKET PANEL	1.0	UN

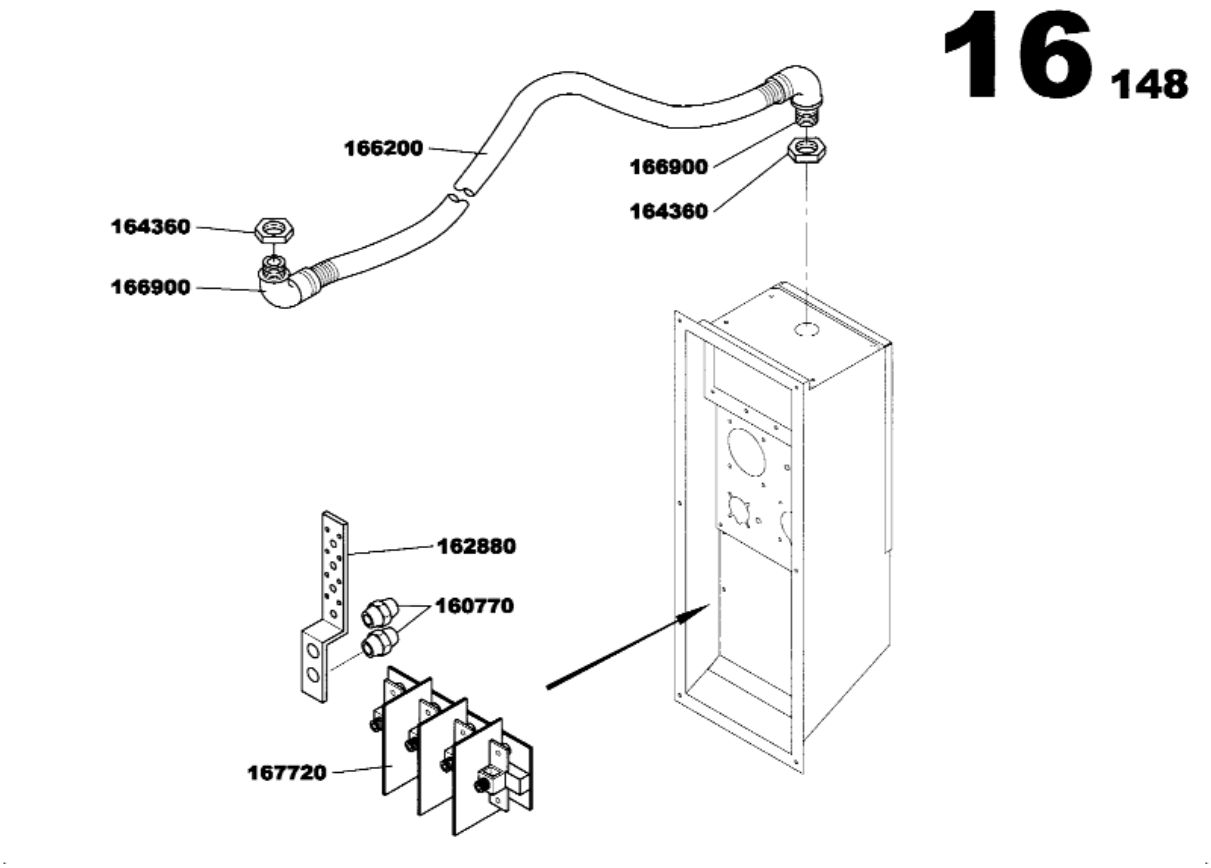
Part numbers listed are the only parts used in this model.



SOCKET OPTION TYPE 2

Item	Part Number	Description	Quantity	Units
F16126	85505881	SOCKETS ASSEMBLY	1.0	UN
167750	85408748	COMPACT CIRCUIT BREAKER 1x10A	1.0	UN
167770	85408763	CIRCUIT BREAKER PROTECTION	1.0	UN
167760	85413169	COMPACT CIRCUIT BREAKER 1x15A	1.0	UN
167770	85408763	CIRCUIT BREAKER PROTECTION	1.0	UN
166180	85501542	SOCKETS ADAPTATION PLATE	2.0	UN
167650	85506020	MOULDED CASE CIRCUIT BREAKER 4x32A	1.0	UN
167660	85506038	MOULDED CASE CIRCUIT BREAKER 4x63A	1.0	UN
164060	85408284	CIRCUIT BREAKER SUPPORT PLATE 12 MODULES	1.0	UN
167670	85408300	SOCKET GERMAN 230V 16A 2S+G	1.0	UN
167690	85408326	EC SOCKET 400V 32A 3S+N+G	1.0	UN
167700	85506046	EC SOCKET 400V 63A 3S+N+G	1.0	UN
165340	85413599	DIFFERENTIAL SWITCH 4P 25A 30mA	1.0	UN
167800	85506103	SOCKET EC 230V 16A 2S+G	1.0	UN

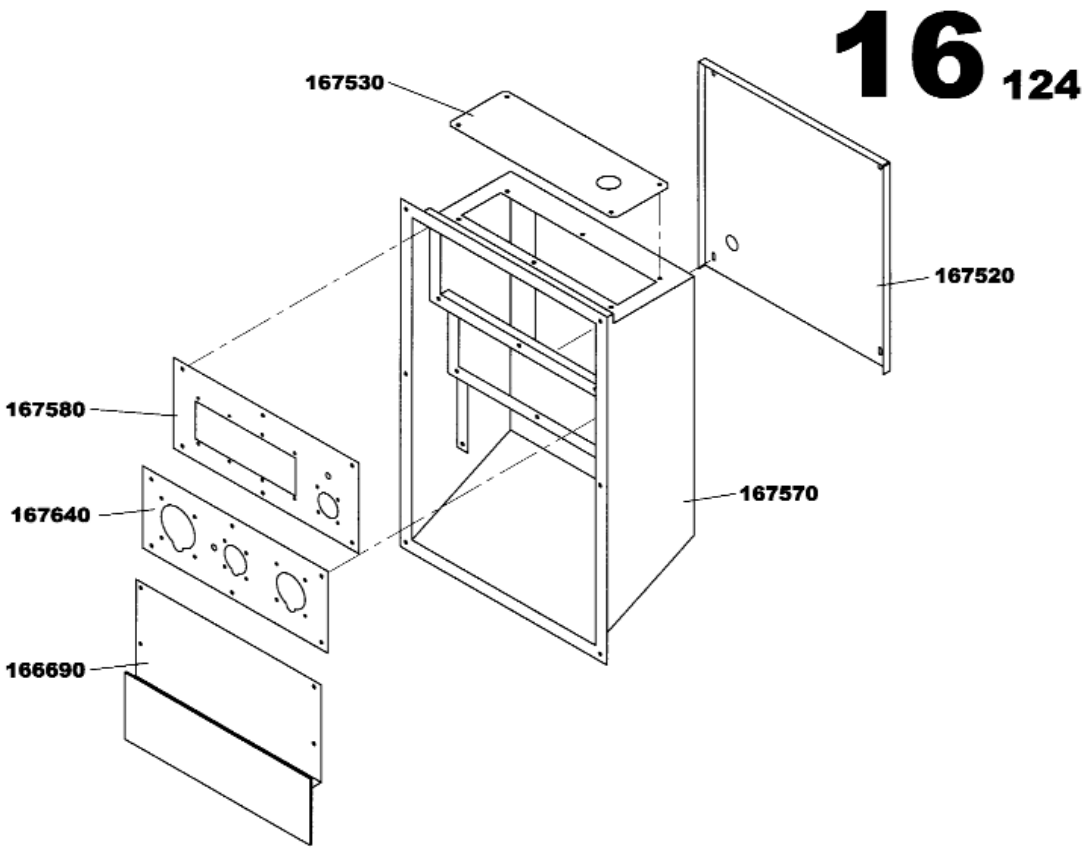
Part numbers listed are the only parts used in this model.



SOCKET OPTION TYPE 6

Item	Part Number	Description	Quantity	Units
F16148	85507234	SOCKET PANEL FR M214 TYPE 6 ASSEMBLY	1.0	UN
162880	85406429	COPPER BAR 5x25	1.0	UN
166200	85499440	ELECTRICAL SHAFT D36	0.5	ML
160770	85408342	INSULATION PIN	2.0	UN
167720	85408607	POWER CONNECTION BLOCK	1.0	UN
164360	85408680	GLAND NUT SCREW PG36	2.0	UN
166900	85499689	PIPE UNION ELBOW 90° PG36	2.0	UN
183290	85409084	RECTANGULAR STICKER 25X50	1.0	UN
182900	85409175	TRIANGULAR STICKER 49x42	1.0	UN

Part numbers listed are the only parts used in this model.

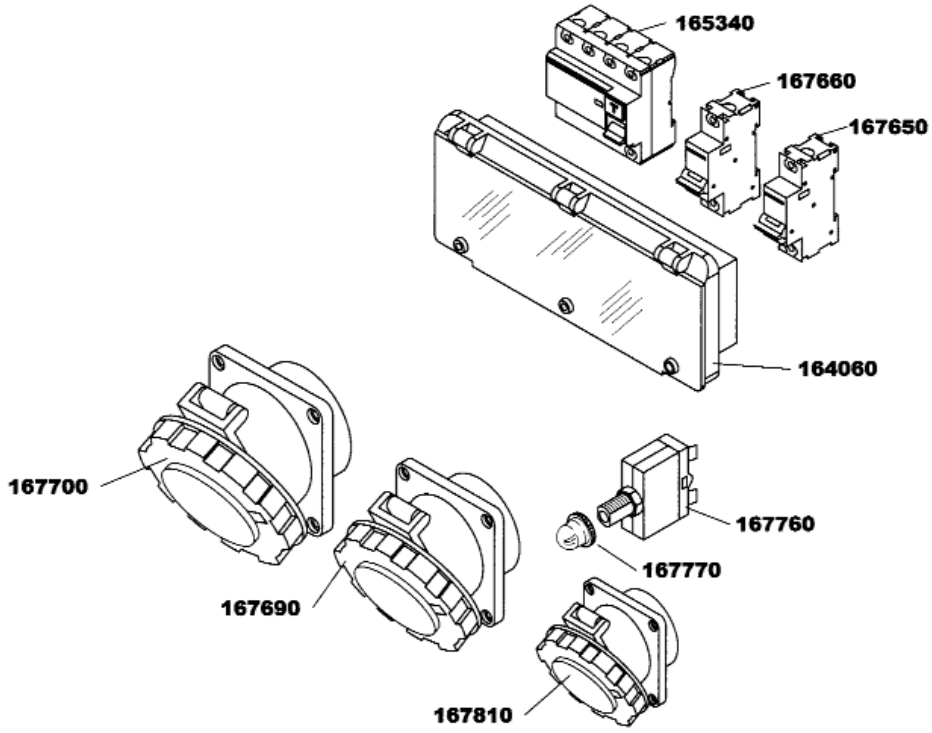


SOCKET OPTION TYPE 6

Item	Part Number	Description	Quantity	Units
F16124	85505808	SOCKETS PANEL T6-T9 M214 ASSEMBLY	1.0	UN
166690	85407609	REAR PANEL M214 CONTROL PANEL HOUSING	1.0	UN
167520	85505741	REAR PANEL M214 CONTROL PANEL HOUSING	1.0	UN
167530	85505758	GLAND NUT PLATE CONTROL PANEL M214	1.0	UN
167570	85505816	SOCKETS PANEL EC M214	1.0	UN
167580	85505824	CIRCUIT BREAKER BRACKET PANEL BRACKET M214	1.0	UN
167640	85506012	SOCKETS BRACKET PANEL	1.0	UN

Part numbers listed are the only parts used in this model.

16128



SOCKET OPTION TYPE 6

Item	Part Number	Description	Quantity	Units
F16128	85505915	SOCKETS ASSEMBLY	1.0	UN
167760	85413169	COMPACT CIRCUIT BREAKER 1x15A	1.0	UN
167770	85408763	CIRCUIT BREAKER PROTECTION	1.0	UN
167650	85506020	MOULDED CASE CIRCUIT BREAKER 4x32A	1.0	UN
167660	85506038	MOULDED CASE CIRCUIT BREAKER 4x63A	1.0	UN
164060	85408284	CIRCUIT BREAKER SUPPORT PLATE 12 MODULES	1.0	UN
167690	85408326	EC SOCKET 400V 32A 3S+N+G	1.0	UN
167700	85506046	EC SOCKET 400V 63A 3S+N+G	1.0	UN
165340	85413599	DIFFERENTIAL SWITCH 4P 25A 30mA	1.0	UN
167810	85506111	SOCKET EC 110V 16A 2S+G	2.0	UN

Part numbers listed are the only parts used in this model.

Use and maintenance manual

Leroy Somer
Alternators
LSA 43.2/44.2 – 4 - Pole

Réf. constructeur :
3434 GB - 4.33/a - 03.01

Réf. GPAO : 33522016401 ind1

LSA 43.2/44.2 - 4-POLE
ALTERNATORS

This manual concerns the alternator which you have just purchased.

The latest addition to a whole new generation of alternators, this range benefits from the experience of the world's leading manufacturer, using advanced technology and incorporating strict quality control.

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 alternator, 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 risk of accident. It is vital that you understand and take notice of the different warning symbols used.

CAUTION

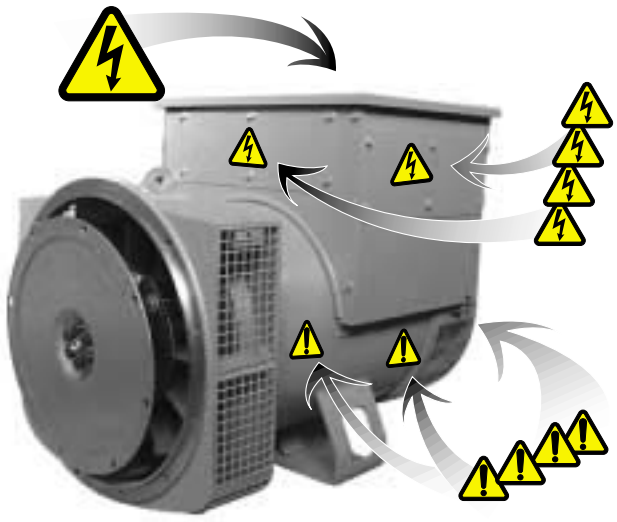
Warning symbol for an operation capable of damaging or destroying the machine or surrounding equipment.

Warning symbol for general danger to personnel.

Warning symbol for electrical danger to personnel.

WARNING SYMBOLS

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.



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.

LSA 43.2 / 44.2 - 4-POLE
ALTERNATORS

CONTENTS

LSA 43.2 / 44.2 - 4-POLE
ALTERNATORS
RECEIPT

1 - RECEIPT

1.1 - Standards and safety measures

Our alternators comply with most international standards and are compatible with:
- the recommendations of the
International Electrotechnical Commission
IEC 34-1, (EN 60034)
- the recommendations of the
International Standards Organisation ISO 8528
- the European Community directive 89/336/EEC on Electromagnetic Compatibility (EMC)
- the European Community directives
73/23/EEC and 93/68/EEC (Low Voltage Directive)
They are CE marked with regard to the LVD (Low Voltage Directive) in their role as a machine component. A declaration of incorporation can be supplied on request.
Before using your generator for the first time, read carefully the contents of this installation and maintenance manual, supplied with the machine. All operations performed on the generator should be undertaken by qualified personnel trained in the commissioning, servicing and maintenance of electrical and mechanical components. This maintenance manual should be retained for the whole of the machine's life and be handed over with the contractual file.
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 different warning symbols used.

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 able to claim on their insurance) and after a visual check, turn the machine by hand to detect any malfunction.

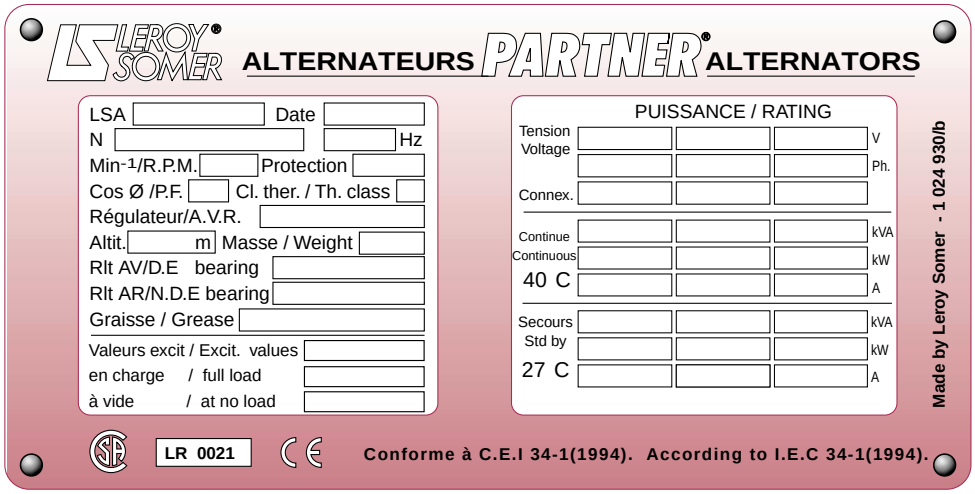
1.3 - Identification

The alternator is identified by means of a nameplate glued to the frame.
Make sure that the nameplate on the machine conforms to your order.
The machine name is defined according to various criteria (see below).
Example of description: **LSA 43.2 M4 J6/4**
- LSA: Name used in the PARTNER range
- M: Marine
- C: Cogeneration
- T: Telecommunications
- 43.2: Machine type
- M4: Model
- J: Excitation system (C: AREP/J: SHUNT or PMG/ E: COMPOUND)
- 6/4: Winding number/number of poles

Nameplate
So that you can identify your machine quickly and accurately, we suggest you fill in its specifications on the nameplate below.

1.4 - Storage

Prior to commissioning, machines should not be stored in humid conditions: at relative humidity levels greater than 90%, the machine insulation can drop very rapidly, to just above zero at around 100%. The state of the anti-rust protection on unpainted parts should be monitored.
For storage over an extended period, the machine can be placed in a sealed enclosure (heatshrunk plastic for example) with dehydrating sachets inside, away from significant and frequent variations in temperature to avoid the risk of condensation during storage.
If the area is affected by vibration, try to reduce the effect of these vibrations by placing the generator on a damper support (rubber disc or similar) and turn the rotor a fraction of a turn once a fortnight to avoid marking the bearing rings.



LSA 43.2/44.2 - 4-POLE
ALTERNATORS
TECHNICAL CHARACTERISTICS

2 - TECHNICAL CHARACTERISTICS

2.1 - Electrical characteristics

PARTNER LSA 43.2/44.2 alternators are machines without sliprings or revolving field brushes, wound as "2/3 pitch", 12-wire; the insulation is class H and the field excitation system is available in either "SHUNT", "AREP" or "PMG" versions (see sections 2.3, 2.4, 2.5). Interference suppression conforms to standard EN 55011, group 1, class B.

2.1.1 - Options

- Stator temperature detection probes
- Space heaters

2.2 - Mechanical characteristics

- Steel frame
- End shields in cast iron
- Protected ball bearings, greased for life
- Mounting arrangements

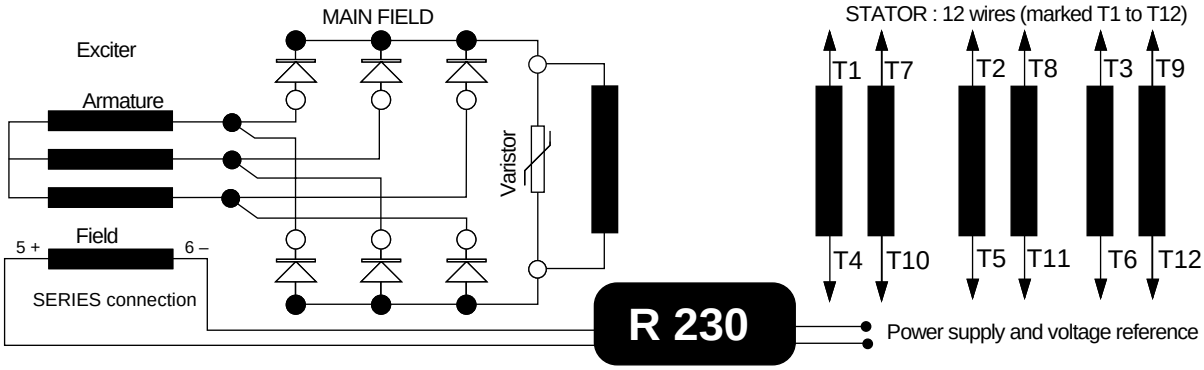
MD 35 STANDARD: Single-bearing with standard feet and SAE flanges/coupling discs
B 34 STANDARD: standard feet with SAE flange and standard cylindrical shaft extension
- Drip-proof machine, self-cooled
- Degree of protection: IP 23

2.2.1 - Options

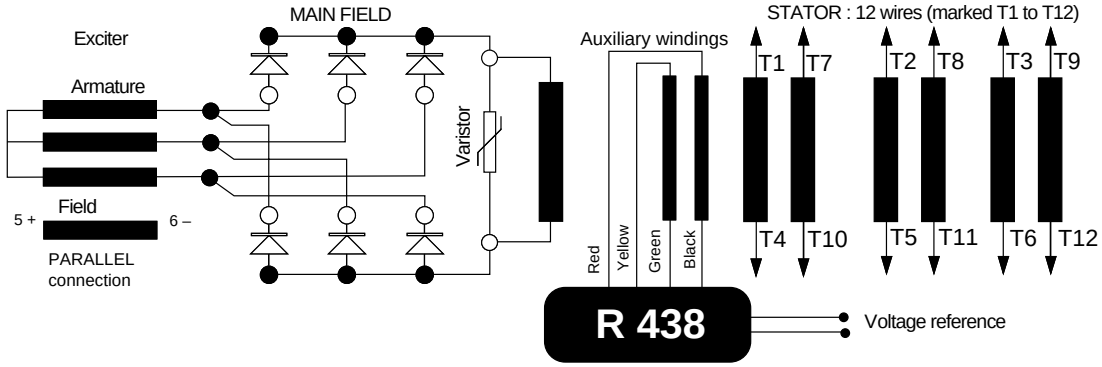
- Protection against harsh environments
- Air inlet filter, air outlet labyrinth seals

Alternators fitted with air inlet filters should be derated by 5% (power)
To prevent excessive temperature rise caused by clogged filters, it is advisable to fit the stator winding with thermal sensors (PTC or PT100)

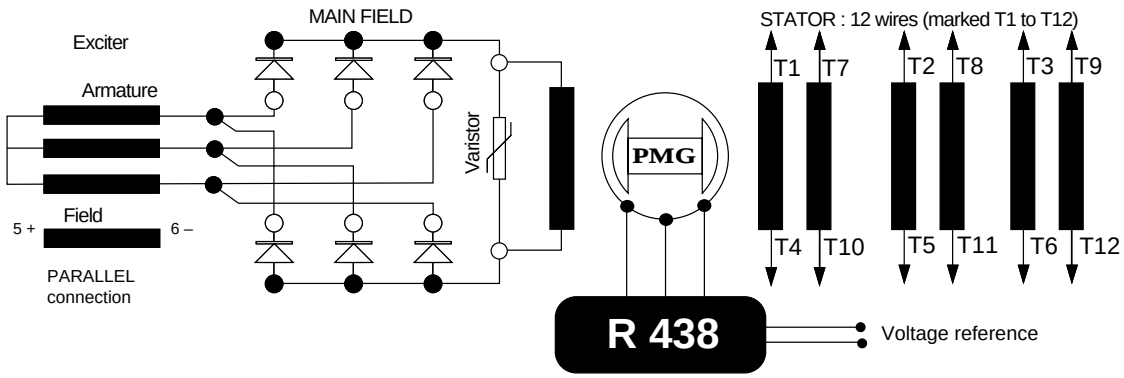
2.1.2 - SHUNT system with R 230 AVR



2.1.3 - AREP system with R 438 AVR



2.1.4 - PMG system with R 438 AVR



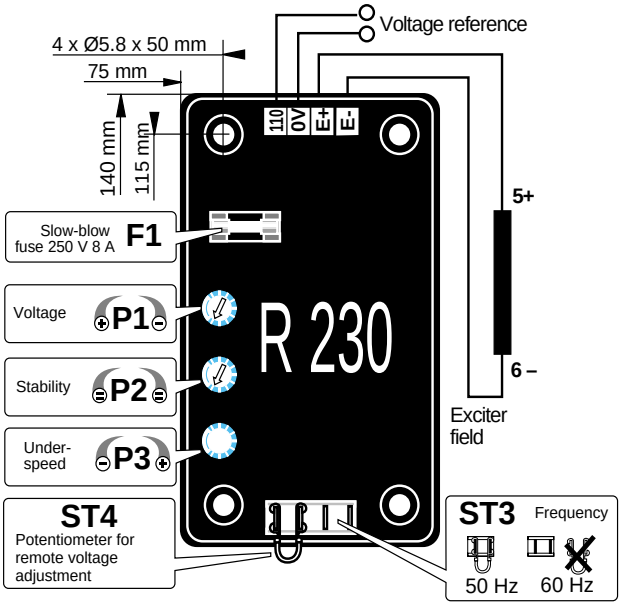
LSA 43.2 / 44.2 - 4-POLE
ALTERNATORS
TECHNICAL CHARACTERISTICS

2.3 - SHUNT excitation system

The alternator with Shunt excitation is self-excited with an **R 230** voltage regulator. The regulator monitors the exciter excitation current as a function of the alternator output voltage. Very simple in design, the alternator with shunt excitation has no sustaining short-circuit capacity.

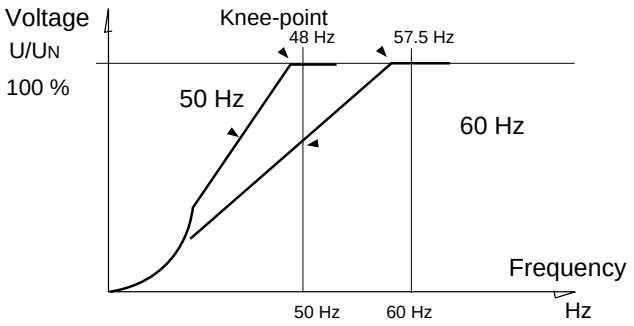
2.3.1 - R 230 AVR

- Voltage regulation: around ± 0.5%.
- Voltage sensing range 85 to 139 V (50/60 Hz)
- Rapid response time (500 ms) for a transient voltage variation amplitude of ± 20%
- Voltage setting **P1**
- Stability setting **P2**
- Power supply protected by 8 A fuse, slow-blow action (tolerates 10 A for 10 s)
- Frequency: 50 Hz with **ST3** jumper - 60 Hz without ST3 jumper
- Factory-set underspeed protection **P3**.



2.3.2 - R 230 AVR options

Potentiometer for remote voltage adjustment, 1000 Ω / 0.5 W min: adjustment range ± 5%.
Remove the **ST4** jumper.

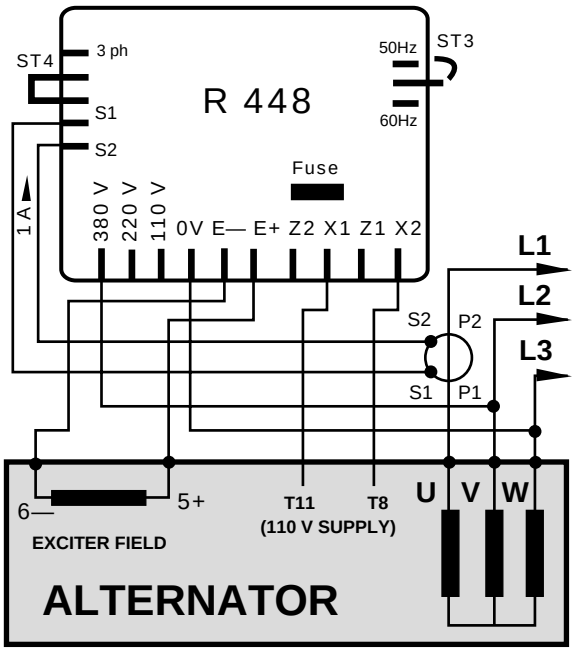


2.3.3 - R 231 AVR for dedicated single-phase

With an M or M1 dedicated single-phase winding, the alternator works with an R 231 voltage regulator. The R 231 is an R 230 with a specific excitation ceiling setting for the dedicated single-phase alternator. See the R 230 for connections, setting up and troubleshooting.

2.3.4 - Additional functions with the R 448

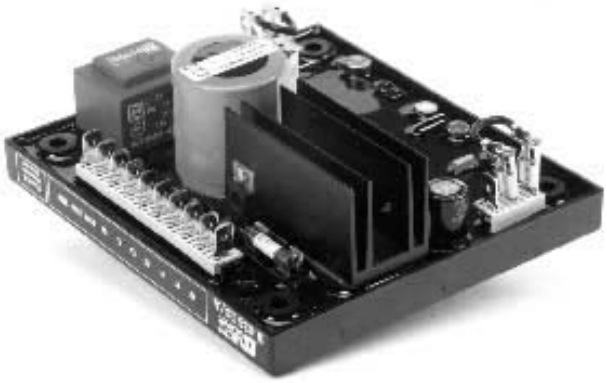
As an option, the LSA 43.2/44.2 SHUNT alternator can work with the R 448 AVR in order to obtain the following functions:
- Parallel operation between alternators with C.T.
- Parallel operation with the mains with C.T. and R 726 module
- 3-phase sensing (R 731 module)
- LAM function integrated in the R 448 AVR

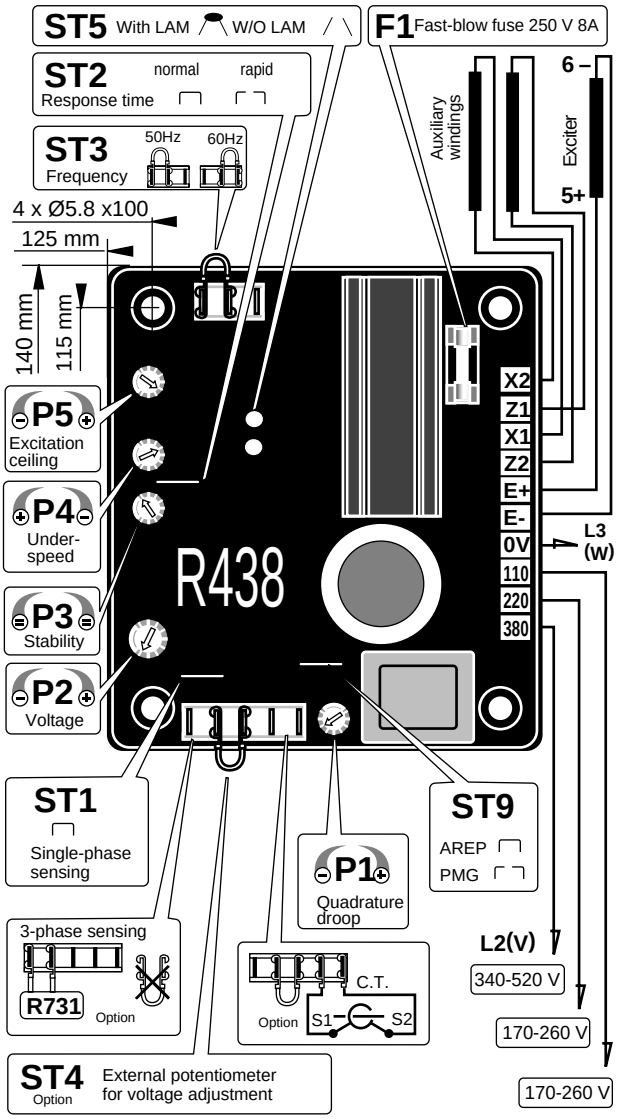


The AVR and its modules need to be mounted outside the terminal box.
In this case, the R 448 AVR replaces the R 230.
For settings and maintenance, see section 4.5 of this manual (the R 448 functions are identical to those for the R 438, & 2.4).

2.4 - AREP excitation system

With AREP excitation, the **R 438** electronic AVR is powered by two auxiliary windings which are independent of the voltage sensing circuit. The first winding has a voltage in proportion to that of the alternator (shunt characteristic), the second has a voltage in proportion 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 principle ensures that regulation is not affected by distortions generated by the load.





2.4.1 - R 438 AVR

- Short-circuit current = 3 IN for 10 seconds
- Standard power supply; 2 auxiliary wdgs
- Shunt power supply; max. 48 V - 50/60 Hz
- Rated overload current: 8 A - 10 s
- Electronic protection (overload, short-circuit on opening of voltage sensing circuit): excitation overload current for 10 seconds then return to approximately 1A

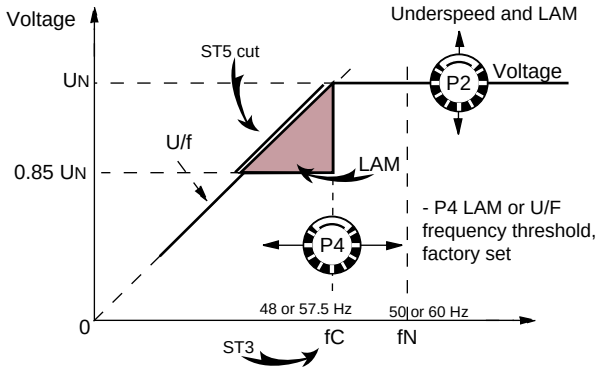
CAUTION

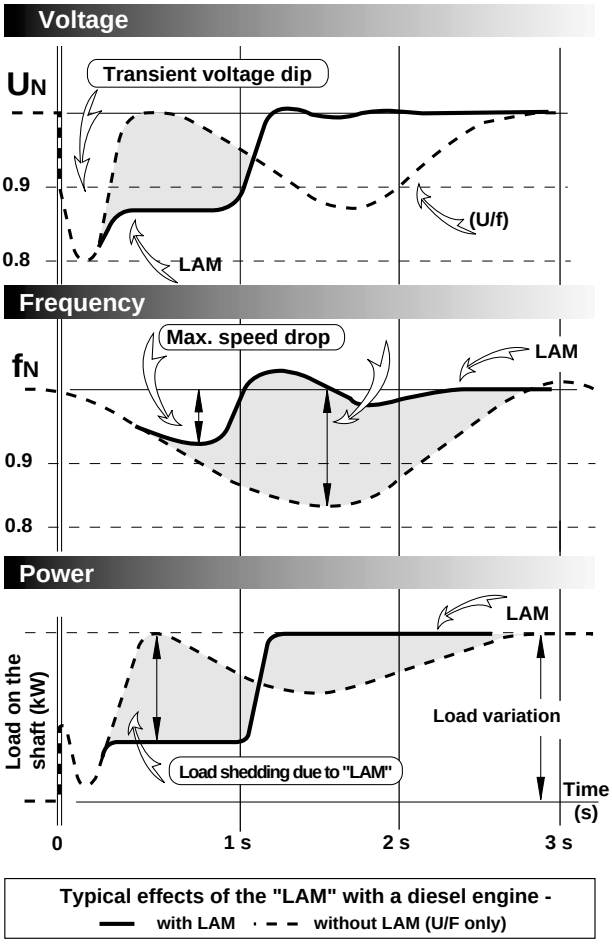
The alternator must be stopped (or the power switched off) in order to reset the protection.

- Fuses:
  - F1 on the input of auxiliary windings X1, X2
- Voltage sensing: 5 VA isolated via transformer:
  0-110 V terminals = 95 to 140 V
  0-220 V terminals = 170 to 260 V
  0-380 V terminals = 340 to 520 V
- Voltage regulation ± 0.5%
- Normal or rapid response time via the **ST2** jumper
- Voltage adjustment via potentiometer **P2**
  (Other voltages via adapter transformer)
- Current sensing (parallel operation): C.T. 2.5 VA cl1, secondary 1A (optional)
- Quadrature droop adjustment via potentiometer **P1**
- Underspeed protection (U/f) and LAM: frequency threshold adjustable via potentiometer **P4**
- Max. excitation current adjustment via **P5**: 4.5 to 8 A
- 50/60 Hz selection via the **ST3** jumper

2.4.2 - LAM characteristics

The LAM system is integrated in the R 438 AVR as standard.
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 15% and consequently the amount of active load applied is reduced by approximately 25%, 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 the same 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.
- LAM: action eliminated by cutting the ST5 jumper





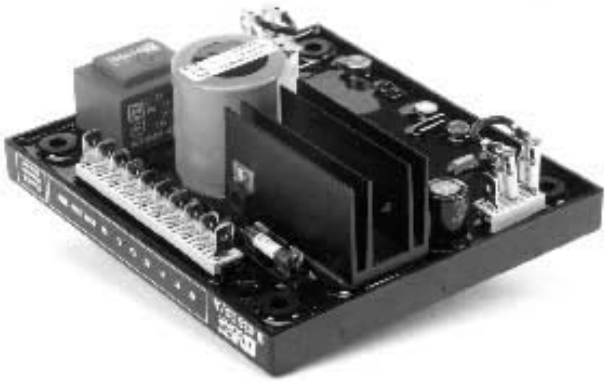
Typical effects of the "LAM" with a diesel engine -
with LAM **without LAM (U/F only)**

2.4.3 - R 438 AVR options

- **Current transformer** for parallel operation.
- **Remote voltage adjustment potentiometer**: 470 Ω, 0.5 W min: adjustment range ± 5% (range limited by internal voltage potentiometer **P2**). Remove ST4 to connect the potentiometer. (A 1 kΩ potentiometer can also be used to extend the adjustment range)
- **R 731 external module**: sensing of 3-phase voltage 200 to 500 V, compatible with parallel operation. Disconnect ST1 to connect the module; set the voltage via the module potentiometer. (The R 730 module is not compatible with parallel operation.)
- **R 726 module**: 3 functions (mounted externally)
• P.F. regulation (2F) and voltage sensing circuit before paralleling (3 F).
• C.T. of ...../1A. 5 VA CL 1. (See the diagram included with this manual.)

2.5 - PMG excitation system

This excitation system consists of a SHUNT alternator and a "PMG" (permanent magnet generator). This is fitted at the rear of the machine and connected to the LS R 438 AVR.
The PMG supplies the AVR with constant voltage which is independent of the main alternator winding. As a result the machine has a short-circuit current capacity and good immunity to distortions generated by the load.
The AVR monitors and corrects the alternator output voltage by adjusting the excitation current.



2.5.1 - R 438 AVR

- Short-circuit current = 3 IN for 10 seconds
- Standard power supply: PMG
- Rated overload current: 8 A - 10 s
- Electronic protection (overload, short-circuit on opening of voltage sensing circuit): excitation overload current for 10 seconds then return to approximately 1A

CAUTION

The alternator must be stopped (or the power switched off) in order to reset the protection.

- Fuses:
  - F1 on X1, X2
- Voltage sensing: 5 VA isolated via transformer:
  0-110 V terminals = 95 to 140 V
  0-220 V terminals = 170 to 260 V
  0-380 V terminals = 340 to 520 V
- Voltage regulation ± 1%
- Normal or rapid response time via **ST2**. jumper
- Voltage adjustment via potentiometer **P2**
  Other voltages via adapter transformer
- Current sensing (parallel operation): C.T. 2.5 VA cl1, secondary 1 A (optional)
- Quadrature droop adjustment via potentiometer **P1**
- Underspeed protection (U/f) and LAM: frequency threshold adjustable via potentiometer **P4**
- Max. excitation current adjustment via **P5**: 4.5 to 8 A
- 50/60 Hz selection via the **ST3** jumper

2.5.2 - R438 AVR options

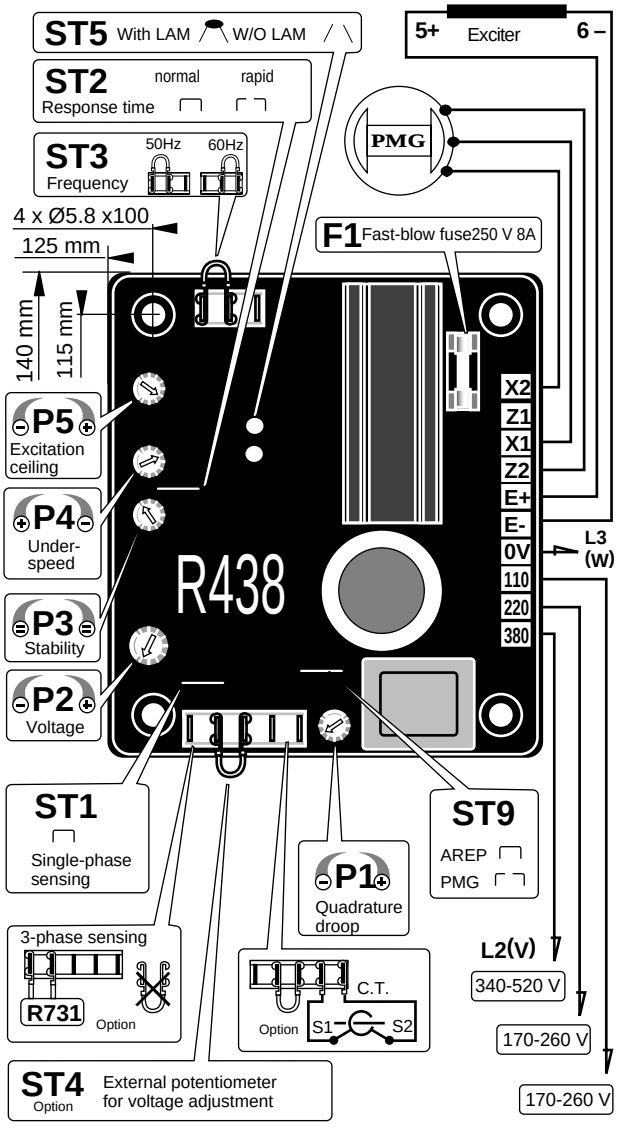
- See section 2.4.2.

2.5.3 - LAM characteristics

- See section 2.4.3.

CAUTION

The ST9 jumper must be disconnected for operation using the PMG system.



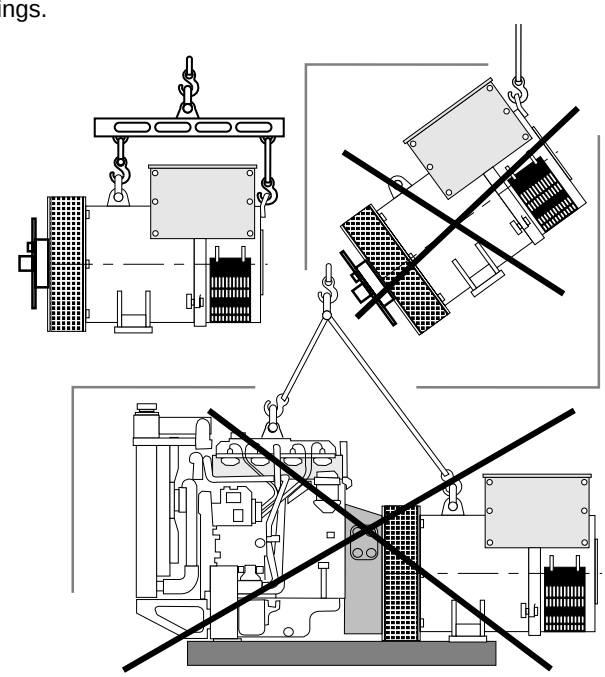
3 - INSTALLATION

3.1 - Assembly

All mechanical handling operations must be undertaken using approved equipment.
Whilst being handled, the machine should remain horizontal.

3.1.1 - Handling

The generously-sized lifting rings are for handling the alternator alone. They must not be used to lift the genset. Choose a lifting system which respects the positioning of the rings.



3.1.2 - Coupling

3.1.2.1 - Single-bearing alternator

Before coupling the two machines, check that both are compatible by:
- undertaking a torsional analysis of the transmission on both units
- checking the dimensions of the flywheel and its housing, the flange, coupling discs and offset

CAUTION

When coupling the alternator to the prime mover, the holes of the coupling discs should be aligned with the flywheel holes by cranking the engine.
Do not use the alternator fan to turn the rotor.
Tighten the coupling disc screws to the recommended torque (see section 4.6.2) and check that there is lateral play on the crankshaft.

3.1.2.2 - Two-bearing alternator

- Semi-flexible coupling

Careful alignment of the machines is recommended, checking that the concentricity and parallelism of both parts of the coupling does not exceed 0.1 mm.

CAUTION

This alternator has been balanced with a half-key.

3.1.3 - Location

Ensure that the ambient temperature in the room where the alternator is placed cannot exceed 40 °C for standard power ratings (for temperatures > 40 °C, apply a derating coefficient). Fresh air, free from damp and dust, must be able to circulate freely around the air intake grilles on the opposite side from the coupling. It is essential to prevent not only the recycling of hot air from the machine or engine, but also exhaust fumes.

3.2 - Inspection 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.
There are three possible methods for restoring the above minimum values.
a) Dry out the machine for 24 hours in a drying oven at a temperature of approximately 110 °C (without the AVR).
b) Blow hot air into the air inlet, having made sure that the machine is rotating with the exciter field disconnected.
c) Run in short-circuit mode (disconnect the AVR):
- Short-circuit the three output terminals (power) using connections capable of supporting the rated current (try not to exceed 6 A/ mm^2)
- Insert a clamp ammeter to monitor the current passing through the short-circuit connections
- Connect a 48 Volt battery in series with a rheostat of approximately 10 ohms (50 W) to the exciter field terminals, respecting the polarity
- Open all the alternator openings fully
- Run the alternator at its rated speed, and adjust the exciter field current using the rheostat to obtain the rated output current in the short-circuit connections

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.

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INSTALLATION

3.2.2 - Mechanical checks

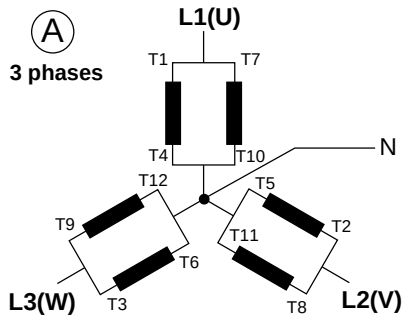
Before starting the machine for the first time, check that:
- the fixing bolts on the feet are tight
- the cooling air is drawn in freely
- the protective grilles and housing are correctly in place
- the standard direction of rotation is clockwise as seen from the shaft end (phase rotation in order 1-2-3). 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 terminal cables. The winding code is specified on the nameplate.

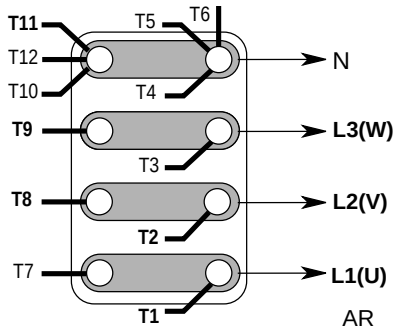
Any intervention on the alternator terminals during reconnection or checks should be performed with the machine stopped.

Connection code A — 3 phases

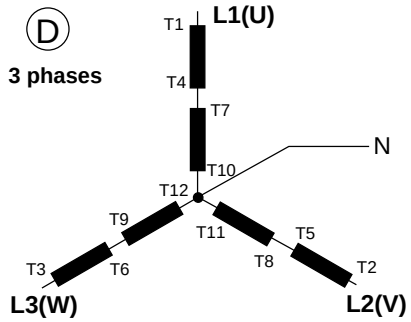


Winding	50 Hz	60 Hz
6	190 - 208	190 - 240
7	220 - 230	-
8	-	190 - 208

R 230 voltage sensing:
0 => (T8) / 110 V => (T11)
R 438 LS voltage sensing:
0 => (T3) / 220 V => (T2)

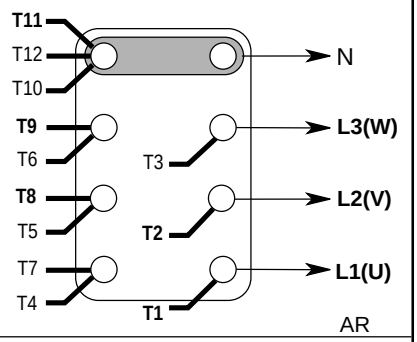


Connection code D — 3 phases

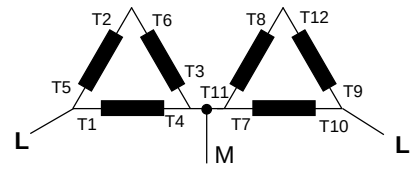


Winding	50 Hz	60 Hz
6	380 - 415	380 - 480
7	440 - 460	-
8	-	380 - 416

R 230 voltage sensing:
0 => (T8) / 110 V => (T11)
R 438 LS voltage sensing:
0 => (T3) / 380 V => (T2)



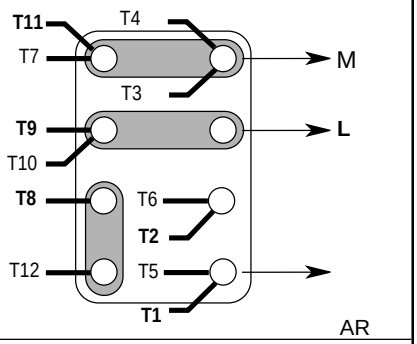
Connection code FF — 1 phase



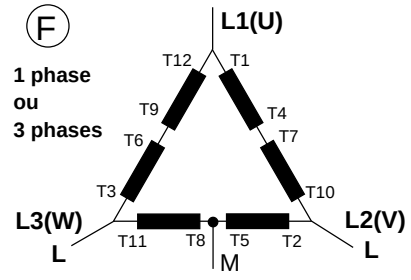
LM voltage = 1/2 LL voltage

Winding	50 Hz	60 Hz
6	220 - 240	220 - 240
7	250 - 260	-
8	200	220 - 240

R 230 voltage sensing:
0 => (T1) / 110 V => (T4)
R 438 LS voltage sensing:
0 => (T10) / 220 V => (T1)



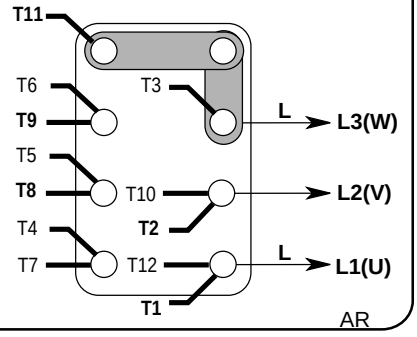
Connection code F — 1 phase ou 3 phases



LM voltage = 1/2 LL voltage

Winding	50 Hz	60 Hz
6	220 - 240	220 - 240
7	250 - 260	-
8	200	220 - 240

R 230 voltage sensing:
0 => (T8) / 110 V => (T11)
R 438 LS voltage sensing:
0 => (T3) / 220 V => (T2)



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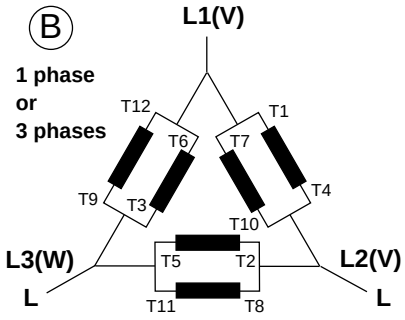
Connection codes

Ⓑ **1 phase or 3 phases**

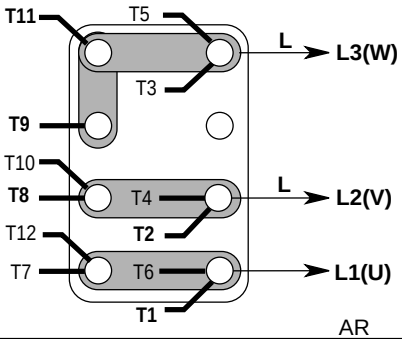


L.L voltage

Winding	50 Hz	60 Hz
6	110 - 120	120
7	120 - 130	-
8	-	110 - 120

R 230 voltage sensing:
0 => (T8) / 110 V => (T11)
R 438 LS voltage sensing:
0 => (T3) / 110 V => (T2)

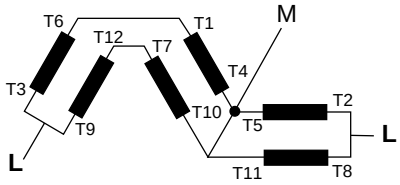
Factory connection



AR

Ⓖ Connection not recommended

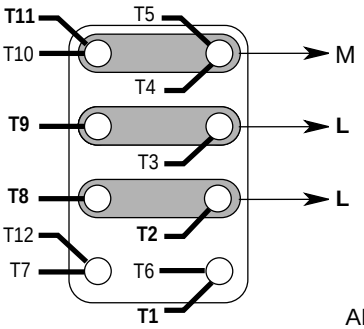
1 PH



LM voltage = 1/2 LL voltage

Winding	50 Hz	60 Hz
6	220 - 240	220 - 240
7	250 - 260	-
8	200	220 - 240

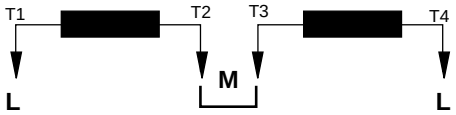
R 230 voltage sensing:
0 => (T8) / 110 V => (T11)
R 438 LS voltage sensing:
0 => (T3) / 220 V => (T2)



AR

SINGLE-PHASE 4-WIRE - type M or M1 DEDICATED WINDING

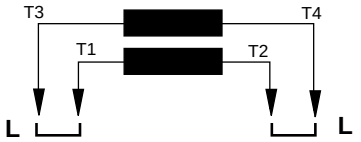
SERIAL CONNECTION



Voltage 50/60 Hz			Output		
L - L	L - M	Link	L	L	M
220 230 240	110 115 120	T2 - T3	T1	T4	T2 - T3

R 230 voltage sensing: 0 => (T1) / 110 V => (T2)

PARALLEL CONNECTION (Not possible with LSA 44.2)

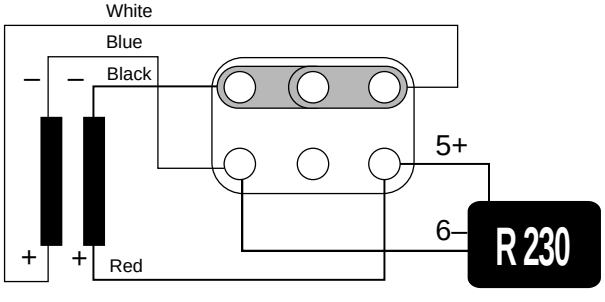


Voltage 50/60 Hz			Output		
L - L	L - M	Link	L	L	M
110 115 120	- - -	T1 - T3 T2 - T4	T1-T3	T2 - T4	-

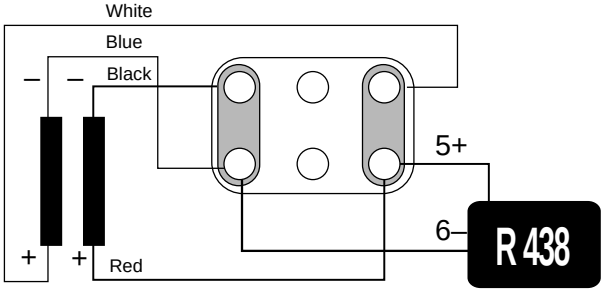
R 230 voltage sensing: 0 => (T1) / 110 V => (T2)

3.3.1 - Exciter field connection

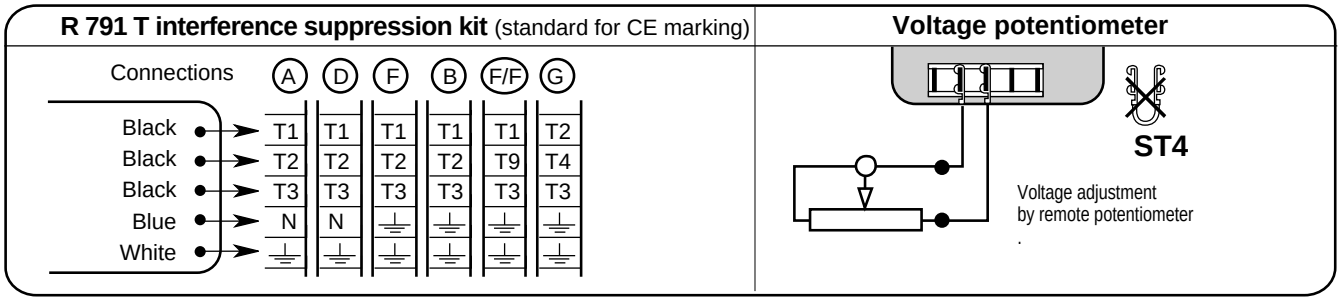
Series connection (shunt excitation)



Parallel connection (AREP or PMG excitation)



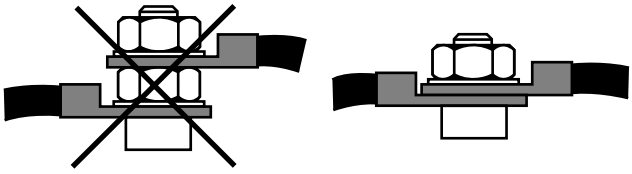
3.3.2 - Option connection diagram



3.3.3 - Connection checks

Electrical installations must comply with the current legislation in force in the country of use.

Check that:
- The residual circuit-breaker complies with 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 blue wire of the R 791 interference suppression module linking the neutral)
- Any protective devices in place have not tripped
- If there is an external AVR, the connections between the alternator and the cubicle are made in accordance with the connection diagram
- There is no short-circuit between phase or phase-neutral between the alternator output terminals and the generator set control cabinet (part of the circuit not protected by circuit-breakers or cubicle relays)
- The machine has been connected with the busbar separating the terminals as shown in the terminal connection diagram



3.3.4 - Electrical checks on the AVR

- Check that all connections have been made properly as shown in the attached wiring diagram.
- Check that the "ST3" frequency selection jumper is on the correct frequency setting
- Check whether the ST4 jumper or the remote adjustment potentiometer have been connected
- Optional operating modes (LS R 438)
• ST1 jumper: disconnected to connect the R 731 3-phase sensing module
• ST2 jumper: cut for rapid response time
• ST5 jumper: cut to suppress the function

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 at the factory. When first used with no load, make sure that the drive speed is correct and stable (see the nameplate). 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: see 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. Take care 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.

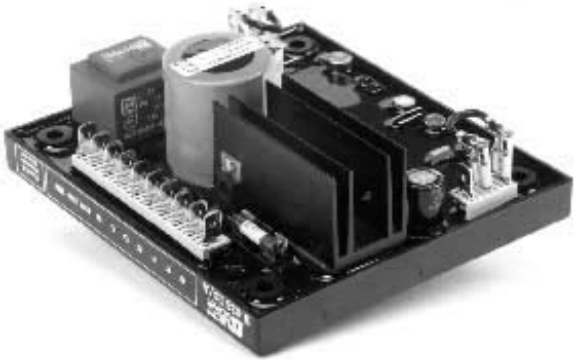
3.5.1 - R 230 adjustments (shunt system)

Initial potentiometer settings
- **P1** potentiometer (AVR voltage adjustment): fully anti-clockwise.
- Remote voltage adjustment potentiometer: centre position.
Run the alternator at its rated speed. If the voltage does not increase, the magnetic circuit should be remagnetized (see section 4.5)
- Turn the AVR voltage adjustment potentiometer **P1** slowly until the output voltage rated value is obtained
- Adjust the stability setting using **P2**
- Sealed potentiometer **P3** is factory set at 48 Hz for 50 Hz and 57.5 Hz for 60 Hz

3.5.2 - LS R 438 adjustments (AREP or PMG system)

CAUTION

Before any intervention on the AVR, make sure that the ST9 jumper is closed with AREP excitation and disconnected with PMG excitation.



a) Initial potentiometer settings (see table below)
- Remote voltage adjustment potentiometer: centre (ST4 jumper removed).

Action	Factory setting	Pot.
Voltage minimum fully anti-clockwise	400V - 50 Hz (Input 0 - 380 V)	
Stability	Not set (centre position)	
Threshold/LAM or U/F Threshold for underspeed protection and Max. frequency "LAM" tripping, fully anti-clockwise	If ST3 = 50 Hz (factory) = 48 Hz If ST3 = 60 Hz (factory) = 58 Hz	
Voltage quadrature droop (Parallel operation with C.T.) - 0 quadrature droop fully anti-clockwise.	Not set (fully anti-clockwise)	
Excitation ceiling Limiting of excitation current and short-circuit current, minimum fully anti-clockwise	10 A maximum	

b) Install a D.C. analogue voltmeter (needle dial) cal. 50 V on terminals E+, E- and an A.C. voltmeter cal 300, 500 or 1000 V on the alternator output terminals.

c) Make sure that the **ST3** jumper is positioned on the desired frequency (50 or 60 Hz).

d) Voltage potentiometer **P2** at minimum, fully anti-clockwise.

e) Turn the V/Hz potentiometer **P4** fully clockwise.

f) Stability potentiometer **P3** to around 1/3 of the anti-clockwise limit.

g) Start the engine and set its speed to a frequency of 48 Hz for 50 Hz, or 58 for 60 Hz.

h) Set the output voltage to the desired value using **P2**.
- rated voltage UN 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 P3 to make adjustments (try both directions) observing the voltage between E+ and E- (approx. 10 V D.C.). The best response times are obtained at the limit of the instability. If no stable position can be obtained, try disconnecting or replacing the ST2 jumper (normal/rapid).

i) Check LAM operation: **ST5** closed

j) Turn potentiometer **P4** slowly anti-clockwise until there is a significant voltage drop (approximately 15%)

k) 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%).

l) Readjust the speed of the unit to its rated no-load value.

Adjustments in parallel operation

Before any intervention on the alternator, make sure that the speed droop is identical for all engines.

m) Preset for parallel operation (with C.T. connected to S1, S2 on connector J2)
Potentiometer P1 (quadrature droop) in centre position.
Apply the rated load (P.F. = 0.8 inductive).
The voltage should drop by 2 to 3%. If it increases, swap the 2 incoming wires of the C.T. secondary.

n) 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 P2 or Rhe on one of the machines, try to cancel (or minimize) **the current** circulating between the machines
From now on, do not touch the voltage settings.

o) 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 **P1**, match or divide the **currents**

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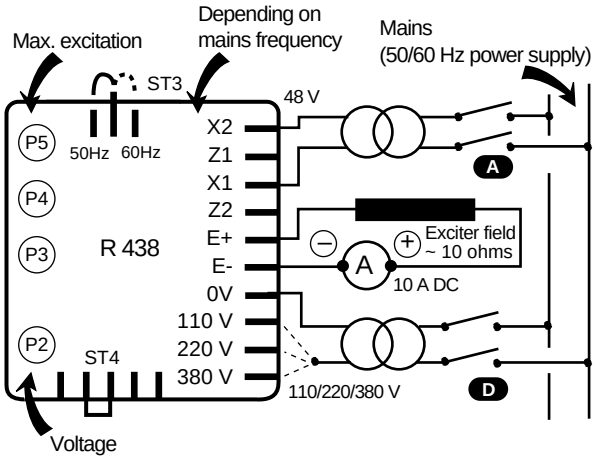
3.5.3 - Max. excitation setting (excitation ceiling)

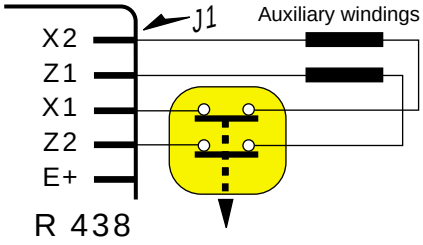


Static adjustment of the current limit, potentiometer P5 (factory setting: 7.5 A, fuse rating: 8 A - 10 seconds).
The factory setting corresponds to that of the excitation current required to obtain a 3-phase short-circuit current of approximately 3 IN at 50 Hz for industrial power, unless otherwise specified (*).
A static method can be used to reduce this value or adapt the Isc to the actual operating power (derated machine), which is safer for the alternator and the installation. Disconnect power supply wires X1, X2 and Z1, Z2, and the voltage reference (0-110 V-220V-380 V) on the alternator.
Connect the mains power supply (200-240 V) as indicated (X1, X2): 48 V). Install a 10A D.C. ammeter in series with the exciter field. Turn P5 fully anti-clockwise and activate the power supply. If there is no output current from the AVR, turn potentiometer P2 (voltage) clockwise until the ammeter indicates a stable current. Switch the power supply off, then on again, turn P5 clockwise until the required max. current is obtained (no more than 8 A).

Checking the internal protection:
Open switch (D): the excitation current should increase to its preset ceiling, remain at that level for ≥ 10 seconds and then drop to < 1 A.
To reset, switch off the power supply by opening switch (A).
Note: After setting the excitation ceiling as described, adjust the voltage again (see section 3.5.2)
(*) In some countries it is a legal requirement to have a short-circuit current of 3 IN, so as to offer selective protection.

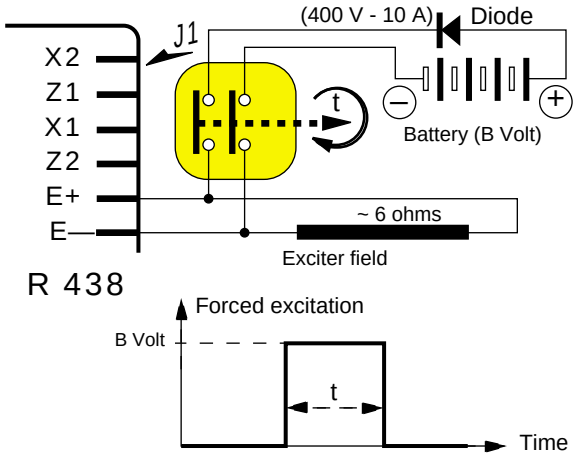
3.5.4 - Special type of use

- **Field weakening**



The exciter is switched off by disconnecting the AVR power supply (1 wire on each auxiliary winding) - contact rating 10 A - 250 V A.C.
Connection is identical for resetting the AVR internal protection.

- **Field forcing**



Applications	B volts	Time t
Guaranteed voltage build-up	6 (1 A)	1 - 2 s
Parallel operation, de-energized	6 (1 A)	1 - 2 s
Parallel operation, at standstill	12 (2 A)	5 - 10 s
Frequency starting	24 (4 A)	5 - 10 s
Sustained voltage on overload	24 (4 A)	5 - 10 s

4 - SERVICING / MAINTENANCE

4.1 - Safety measures

Servicing 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.
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 - Regular 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 - Cooling circuit

It is advisable to check that circulation of air is not reduced by partial blocking of the air intake and outlet grilles: mud, fibre, grease, etc.

4.2.3 - Bearings

The bearings are permanently greased: approximate life of the grease (depending on use) = 20,000 hours or 3 years. Monitor the temperature rise in the bearings, which must not exceed 60 °C above the ambient temperature. Should this value be exceeded, the machine must be stopped and checks carried out.

4.2.4 - Electrical servicing

Cleaning product for the windings

CAUTION

Do not use: trichlorethylene, perchlorethylene, trichloroethane or any alkaline products.

Certain strictly defined pure volatile degreasing agents can be used, such as:
- Normal petrol (without additives); inflammable
- Toluene (slightly toxic); inflammable
- Benzene (or benzine, toxic); inflammable
- Ciclohexare (non toxic); inflammable

Cleaning of the stator, rotor, exciter and diode bridge

The insulating components and the impregnation system are not at risk of damage from solvents (see the list of authorized products).
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.

4.2.5 - Mechanical servicing

CAUTION

Cleaning the machine using a water spray or a high-pressure washer is strictly prohibited.
Any problems arising from such treatment are not covered by our warranty.
The machine should be cleaned with a degreasing agent, applied using a brush. Check that the degreasing agent will not affect the paint.
Compressed air should used to remove any dust.
If filters have been added to the machine after manufacture and do not have thermal protection, the service personnel should clean the air filters periodically and systematically, as often as necessary (every day in very dusty atmospheres).
Cleaning can be performed using water for dry dust or in a bath containing soap or detergent in the case of greasy dust. Petrol or chloroethylene can also be used.
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.
To do this, check that:
- the protective devices are fitted correctly
- the connections comply with the diagrams in the manuals supplied with the machine
- the speed of the unit is correct (see section 1.3)

Repeat the operations defined in section 3

4.4 - Mechanical defects

Fault		Action
Bearing	Excessive overheating of one or both bearings (temperature > 80 °C on the bearing retainers with or without abnormal noise)	- If the bearing has turned blue or if the grease has turned black, change the bearing. - Bearing not properly seated. - End shields misaligned (flanges not properly fitted).
Temperature abnormal	Excessive overheating of alternator frame (more than 40° C above the ambient temperature)	- 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	- Misalignment (coupling) - Defective mounting or play in coupling - Rotor balancing fault
	Excessive vibration and humming noise coming from the machine	- Alternator operating in single-phase mode (single-phase load or faulty contactor or installation fault) - Stator short-circuit
Abnormal noise	Alternator damaged by a significant impact, followed by humming and vibration	- System short-circuit - Mis-paralleling Possible consequences - Broken or damaged coupling - Broken or bent shaft end - Shifting and short-circuit of main field - Fan fractured or coming loose on shaft - Irreparable damage to rotating diodes or AVR

4.5 - Electrical faults

Fault	Action	Effect	Check/Cause
No voltage at no load on start-up	Connect between E- and E+ a new battery of 4 to 12 volts, respecting the AVR polarities, 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 - Main field winding open circuit. Check the resistance
Voltage too low	Check the drive speed	Correct speed	Check the AVR connections (AVR 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 AVR voltage pot. (P2) before running at the correct speed.)
Voltage too high	Adjust AVR voltage potentiometer	Adjustment ineffective	Faulty AVR
Voltage oscillations	Adjust AVR stability potentiometer	If no effect: try normal/rapid recovery modes (ST2)	- Check the speed: possibility of cyclic irregularity - Loose connections - Faulty AVR - Speed too low when on load (or 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- SHUNT < 20 V - AREP/PMG < 10 V	- Check the speed (or LAM set too high)
		Voltage between E+ and E- SHUNT > 30 V - AREP/PMG > 15 V	- Faulty rotating diodes - Short-circuit in the main field. 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 - Main field open circuit or short-circuited
(**) Caution: Internal protection may be activated (overload, open circuit, short-circuit)			

4.5.1 - Checking the winding

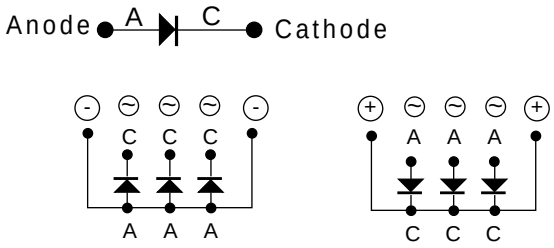
You can check the winding insulation by performing a high voltage test. In this case, you must disconnect all AVR wires.

CAUTION

Damage caused to the AVR in such conditions is not covered by our warranty.

4.5.2 - Checking the diode bridge

LSA 43.2 / 44.2 Diode bridge



A diode in good working condition allows the current to flow in only one direction, from anode to cathode.

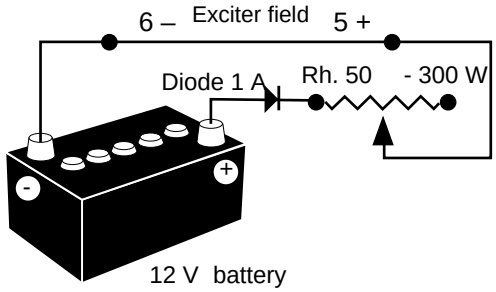
4.5.3 - Checking the windings and rotating diodes using separate excitation

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 A



Assembly B: Connect a "Variac" variable power supply and a diode bridge on both exciter field wires (5+) and (6-).

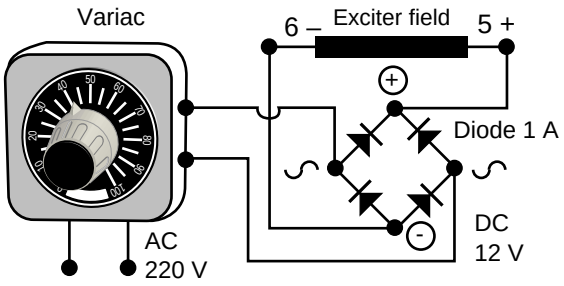
Both these systems should have characteristics which are compatible with the field excitation power of the machine (see the nameplate).

3) Run the unit at its rated speed.

4) Gradually increase the exciter field supply current by adjusting the rheostat or the Variac and measure the output voltages on L1 - L2 - L3, checking the excitation voltage at no load and at full load (see machine nameplate or ask for the factory test report).

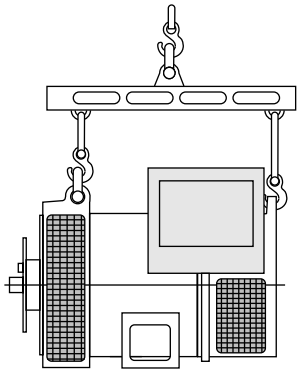
When the output voltage is at its rated value and balanced within 1% for the rated excitation level, the machine is in good working order. The fault therefore comes from the AVR or its associated wiring (ie. sensing, auxiliary windings).

ASSEMBLY B



4.6 - Dismantling, reassembly (see sections 5.5.1/5.5.2)

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 when moved).



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: 7 mm, 8 mm, 10 mm, 12 mm
- 1 socket set: 8 mm, 10 mm, 13 mm, 16 mm, 18 mm, 21 mm, 22 mm, 24 mm
- 1 size 5 Allen key (eg. Facom: ET5)
- 1 size 6 Allen key (eg. Facom: ET6)
- 1 size 10 Allen key (eg. Facom: ET6)
- 1 size 12 Allen key (eg. Facom: ET6)
- 1 T20 and T30 TORX bit
- 1 puller (eg. Facom: U35)
- 1 puller (eg. Facom: U32/350).

4.6.2 - Screw tightening torque

IDENTIFICATION	screw Ø	Torque N.m
Field terminal block screw	M4	4 N.m
Field screw	M6	10 N.m
Diode bridge/RP	M6	5 N.m
Diode nut	M5	4 N.m
43.2 tie rod	M12	57 Nm
44.2 tie rod	M14	90 Nm
Earth screw	M8	26 Nm
43.2 disc/shaft screw	M12	110 Nm
44.2 disc/shaft screw	M14	180 Nm
44.2 turbine screw	M6	5 Nm
Grille screws	M6	5 Nm
Cover screws	M6	5 Nm
Terminal block nut	M10	20 Nm

4.6.3 - Access to connections and the regulation system

The terminals are accessed directly by removing the terminal box lid [48].
To access the AVR adjustment potentiometers, the side plate [367] should be removed.

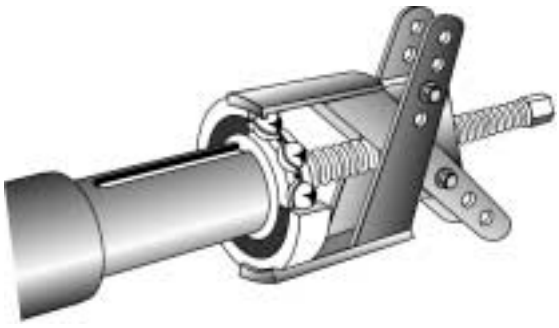
4.6.4 - Accessing, checking and replacing diodes

4.6.4.1 - Dismantling
- Remove the air intake grille [51]
- Remove the surge suppressor [347]
- Disconnect the 6 diodes using an ohmmeter or a battery lamp (see section 4.5.2)

4.6.4.2 - Reassembly
- Replace the bridges, respecting the polarity (see section 4.5.1)
- Replace the surge suppressor [347]
- Refit the air intake grille [51]
- Replace the terminal box lid [48]

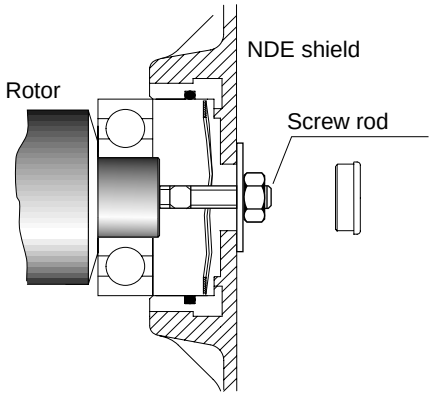
4.6.5 - Replacing the NDE bearing on single-bearing machines

4.6.5.1 - Dismantling
- Remove the terminal box lid [48]
- Remove the air intake grille [51]
- Unscrew the fixing clamps on the power output cables, remove the connector from the exciter and the R 791 module.
- Remove the 4 nuts on the tie rods
- Remove the NDE shield [36] using a puller: eg. U.32 - 350 (FACOM)
- Remove the ball bearing [70] using a screw puller



4.6.5.2 - Reassembly
- Heat the inner slipring of a new bearing by induction or in a drying oven at 80 °C (do not use an oil-bath) and fit it to the machine.
- Place the preloading wavy washer [79] in the shield and fit a new O ring seal [349].
Refit the NDE shield and pass the bundle of wires between the top bars of the shield.
- Refit the fixing clamps on the cables, the R 791 module and the exciter connector.

- Refit the air intake grille [51].
- Replace the terminal box lid [48].



4.6.6 - Replacing the bearings on two-bearing machines

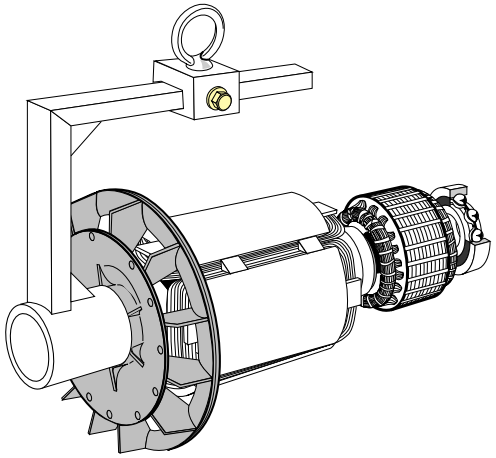
4.6.6.1 - Dismantling
- Uncouple the alternator from the prime mover.
- Remove the 8 assembly screws.
- Remove the DE shield [30].
- Remove the NDE shield (see section 4.6.5.1)
- Remove both ball bearings [60] and [70] using a puller with a central screw.

4.6.6.2 - Reassembly
- Heat the new bearings by induction or in a drying oven at 80 °C (do not use an oil-bath) and fit them to the machine.
- Check that both the preloading wavy washer [79] and the new O ring seal [349] have been fitted on the NDE shield [36]. Refit the NDE shield and pass the bundle of wires between the top bars of the shield.
- Refit the DE shield [30] and tighten the 4 fixing screws.
- Check that the machine assembly is correctly mounted and that all screws are tightened.

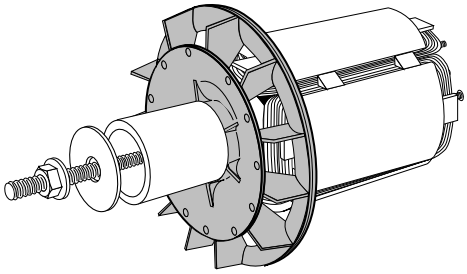
4.6.7 - Accessing the main field and stator

4.6.7.1 - Dismantling
Follow the procedure for dismantling the bearings (see sections 4.6.5.1 and 4.6.6.1)
- Remove the coupling disc (single-bearing machine) or the DE end shield (two-bearing machine) and insert a tube of the corresponding diameter on the shaft end or a support made according to the following diagram.
- Rest the rotor on one of its poles, then slide it out. Use the tube as a lever arm to assist dismantling.
- After extraction of the rotor, be careful not to damage the fan. If the fan is dismantled, it is essential that it is replaced for the 43.2.

NOTE: If intervention is required on the main field (rewinding, replacement of components), the rotor assembly must be rebalanced.



4.6.7.2 - Reassembling the main field
- Follow the dismantling procedure in reverse order.
Take care not to knock the windings when refitting the rotor in the stator.
- If the fan is being replaced on the 43.2, assemble the parts as shown in the following diagram. Fit a tube and a threaded screw. On the 44.2 the fan is fixed by screws on the hub.



Follow the procedure for reassembling the bearings (see sections 4.6.5.2 and 4.6.6.2).

After operational testing, replace all access panels or covers.

4.7 - Installation and maintenance of the PMG

For the LSA 43.2 and LSA 44.2, the PMG reference is PMG 1.

4.7.1 - Mechanical characteristics

The components are:
- An adaptation shaft (to position the rotor on the shaft extension)
- A tie rod and nut for assembling the rotor on the shaft
- A rotor with 16 magnets
- An assembly consisting of: housing + wound stator + plastic connection sheath + plastic ferrules
- The housing closure cover (4 CBLXS M5 screws)

- 4 HM6 screws (for fixing the housing to the NDE shield)
If mounting in kit form, follow the following instructions (see section 5.4):
1 - Remove the PMG cover [297] and the alternator NDE shield seal.
2 - Mount the PMG housing assembly [290] on the shield using the 4 HM6 screws.
3 - Put a coating of anti-vibration adhesive on the tie rod [295] and fix it on the alternator shaft extension.
4 - Mount the magnetized rotor on the adaptation shaft, then using 2 threaded rods screwed into the rotor, slide the assembly onto the tie rod.
5 - Install the cable gland washer [296].
6 - Tighten the assembly with the M10 nut.
7 - Close the PMG with the cover [297].
8 - Pierce the cover (Ø 21 hole) and insert the plastic sheath and its ferrule.
9 - Connect the PMG to the AVR (see sections 2.5 and 4.7.2).

4.7.2 - Electrical connection

Mounting the PMG-1 on a SHUNT machine
(when using an R438):
- Disconnect the connection wires from the R 230/A and remove the AVR.
- Take out both the R 230/A voltage reference wires, marked 2 and 3, by removing them from the terminals (T8 and T11) in which they are inserted.
- Use these same wires for voltage sensing on the R 438 by inserting them in terminals T2 (wire 2) and T3 (wire 3).
- Fit the AVR support plate fitted with the R 438 (2 HM6 screws tightened to 10 Nm).
- Connect the 3 PMG wires (14/15/16), the 2 exciter field wires (5/6) and the 2 previously mentioned voltage sensing wires (2/3) according to the connection diagram no. 2725-02-98.
- Modify the connection by replacing the single jumper on the connector located on the terminal box rear panel with 2 jumpers (see internal connection diagram).

Mounting the PMG-1 on an AREP machine
- Connect the 3 PMG wires (14/15/16), to terminals X1, X2, Z2 on the AVR. The 4 auxiliary winding wires X1.X2.Z1.Z2 should be isolated using the domino fitting supplied with the kit. Both exciter field wires (5/6) and the voltage sensing wires (2/3) remain in place.

Electrical characteristics of the PMG
Stator phase/phase resistance 20 °C: 0.7 Ω
No-load voltage : 73 V

4.8 - Electrical characteristics

Table of average values:
Alternator - 2 and 4 poles - 50 Hz/60 Hz - Winding n° 6 and M or M1 connected in dedicated single-phase. (400 V 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 at ± 10% (for exact values, consult the test report) and are subject to change without prior warning. For 60 Hz machines, the resistance values are the same and the excitation current "i exc" is approximately 5 to 10% weaker.

4.8.1 - 3-phase LSA 43.2: 4-pole, SHUNT excitation

Resistances at 20 °C (Ω)

LSA 43.2	S1	S2	S3	M4	L6	L7
Stator L/N	0.155	0.155	0.128	0.105	0.083	0.063
Rotor	1.35	1.35	1.41	1.57	1.76	1.96
Field	19.5	19.5	19.5	19.5	19.5	19.5
Armature	0.23	0.23	0.23	0.23	0.23	0.23

Field excitation current i exc (A) - 400 V - 50 Hz
"i exc": excitation current of the exciter field

LSA 43.2	S1	S2	S3	M4	L6	L7
No load	0.5	0.5	0.5	0.5	0.4	0.5
On load	1.6	1.6	1.7	1.6	1.5	1.6

4.8.2 - 3-phase LSA 43.2: 4-pole, AREP excitation

Resistances at 20 °C (Ω)

LSA 43.2	S1	S2	S3	M4	L6	L7
Stator L/N	0.155	0.155	0.128	0.105	0.083	0.063
Rotor	1.35	1.35	1.41	1.57	1.76	1.96
X1, X2 auxil. wdgs	0.32	0.32	0.29	0.26	0.26	0.21
Z1, Z2 auxil. wdgs	0.52	0.52	0.5	0.51	0.44	0.4
Field	4.9	4.9	4.9	4.9	4.9	4.9
Armature	0.23	0.23	0.23	0.23	0.23	0.23

Field excitation current i exc (A) -240 V -60 Hz
"i exc": excitation current of the exciter field

LSA 43.2	S1	S2	S3	M4	L6	L7
No load	1	1	1	1	0.9	1
On load	3.2	3.2	3.4	3.2	3	3.2

4.8.3 - Dedicated single-phase LSA 43.2: 4-pole, SHUNT excitation (60 Hz only)

Resistances at 20 °C (Ω)

LSA 43.2	S1	S2	S3	M4	L6	L7
Stator L/N	0.058	0.058	0.046	0.037	0.027	0.019
Rotor	1.35	1.35	1.41	1.57	1.76	1.96
Field	13.9	13.9	13.9	13.9	13.9	13.9
Armature	0.23	0.23	0.23	0.23	0.23	0.23

Field excitation current i exc (A) -240 V -60 Hz
"i exc": excitation current of the exciter field

LSA 43.2	S1	S2	S3	M4	L6	L7
No load	0.59	0.59	0.66	0.61	0.62	0.74
On load	1.44	1.68	1.65	1.48	1.48	1.46

4.8.4 - 3-phase LSA 44.2: 4-pole, SHUNT excitation

Resistances at 20 °C (Ω)

LSA 44.2	VS3	VS4	S7	M9	L11	L12
Stator L/N	0.046	0.046	0.036	0.024	0.019	0.019
Rotor	2,51	2,51	2,91	3.32	3.66	3.66
Field	19.5	19.5	19.5	19.5	19.5	19.5
Armature	0.5	0.5	0.5	0.5	0.5	0.5

Field excitation current i exc (A) - 400 V - 50 Hz
"i exc": excitation current of the exciter field

LSA 44.2	VS3	VS4	S7	M9	L11	L12
No load	0.5	0.5	0.5	0.6	0.6	0.6
On load	1.6	1.6	1.7	1.6	1.5	1.6

4.8.5 - 3-phase LSA 44.2: 4-pole, AREP excitation

Resistances at 20 °C (Ω)

LSA 44.2	VS3	VS4	S7	M9	L11	L12
Stator L/N	0.046	0.046	0.036	0.024	0.019	0.019
Rotor	2,51	2,51	2,91	3.32	3.66	3.66
X1, X2 auxil. wdgs	0.3	0.3	0.21	0.17	0.16	0.16
Z1, Z2 auxil. wdgs	0.5	0.5	0.32	0.28	0.21	0.21
Field	4.9	4.9	4.9	4.9	4.9	4.9
Armature	0.5	0.5	0.5	0.5	0.5	0.5

Field excitation current i exc (A) -240 V -60 Hz
"i exc": excitation current of the exciter field

LSA 44.2	VS3	VS4	S7	M9	L11	L12
No load	1	1	1	1015	1.2	1.2
On load	4	4.4	4.1	3.7	3.7	4

4.8.6 - Dedicated single-phase LSA 44.2: 4-pole, SHUNT excitation (60 Hz only)

Resistances at 20 °C (Ω)

LSA 44.2	VS3	VS4	S7	M9
Stator L/N	0.0194	0.0194	0.0140	0.0088
Rotor	2.51	2.51	2.91	3.32
Field	19.5	19.5	19.5	19.5
Armature	0.5	0.5	0.5	0.5

Field excitation current i exc (A) -240 V -60 Hz
"i exc": excitation current of the exciter field

LSA 44.2	VS3	VS4	S7	M9
No load	0.44	0.44	0.43	0.55
On load	1.18	1.25	1.2	1.28

5 - SPARE PARTS

5.1 - First maintenance parts

Emergency repair kits are available as an option.
They contain the following items:

Ref.	Designation	Qty	LSA 43.2/44.2 - SHUNT	Code
198	AVR	1	R 230	AEM 110 RE 001
343	Diode bridge assembly	1	LSA 432 9 03/04	ESC 040 MD 003
347	Surge suppressor	1	LSA 432 1 13	CII 111 PM 002
	AVR fuse	1	250 V - 8 A/slow-blow	

Ref.	Designation	Qty	LSA 43.2/44.2 - AREP 4 P	Code
198	AVR	1	R 438	AEM 110 RE 003
343	Diode bridge assembly	1	LSA 432 9 03/04	ESC 040 MD 003
347	Surge suppressor	1	LSA 432 1 13	CII 111 PM 002
	AVR fuse	2	250 V - 8 A/fast-blow	

5.2 - Bearing designations

Ref.	Designation	Qty	LSA 43.2	Code	LSA 44.2	Code
60	Bearing on shaft extension end	1	6312 2RS/C3	RLT060TS030	6315 2RS/C3	RLT075TS030
70	Bearing on exciter end	1	6307 2RS/C3	RLT080RB002	6309 2RS/C3	RLT100RB005

5.3 - 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, or to:

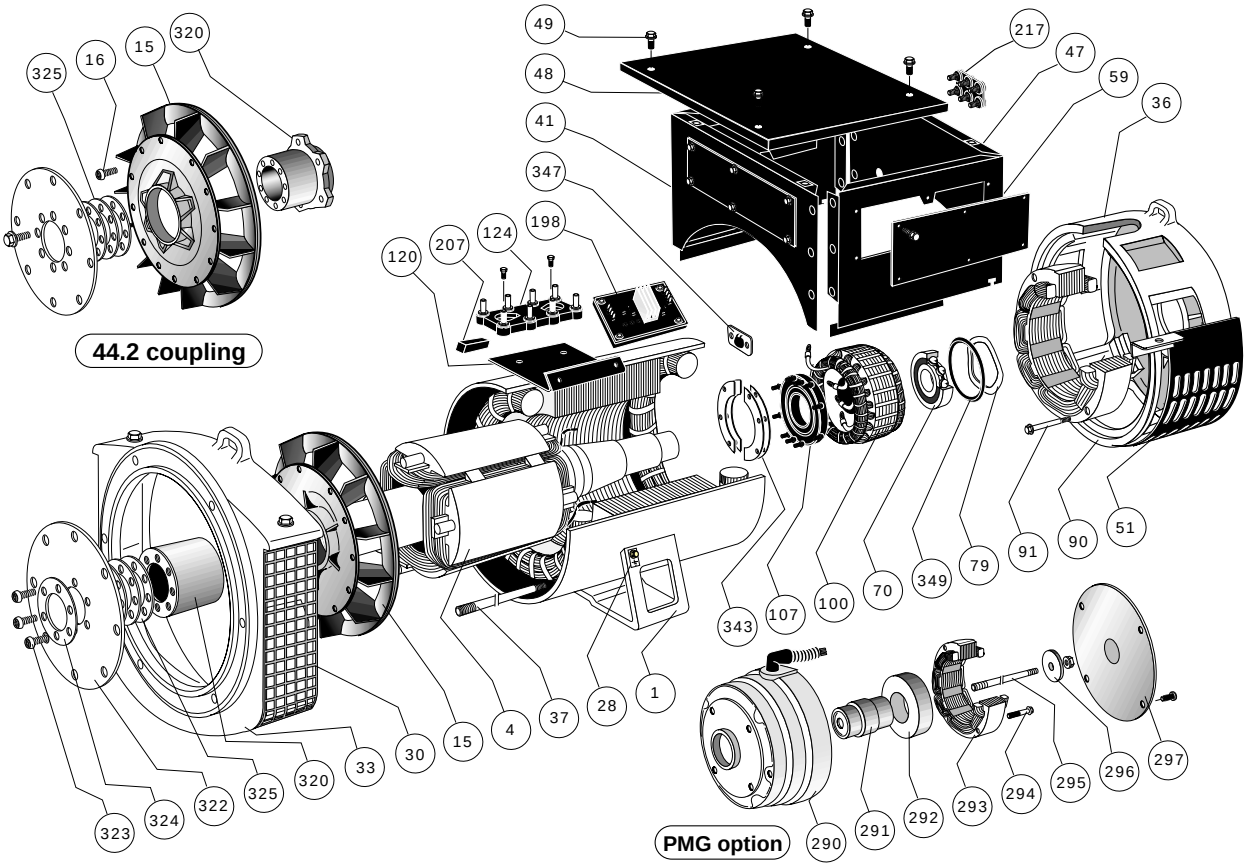
MOTEURS LEROY-SOMER
Usine de Sillac/Alternateurs
16015 ANGOULEME CEDEX - FRANCE
Tel.: (33) 05.45.64.45.64
Technical Support Service:
(33) 05.45.64.43.66 - (33) 05.45.64.43.67 -
(33) 05.45.64.43.68 - (33) 05.45.64.43.69
Fax: (33) 05.45.64.43.24
email: sat.sil@leroysomer.com

CAUTION

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.

5.4 - Exploded views, parts list

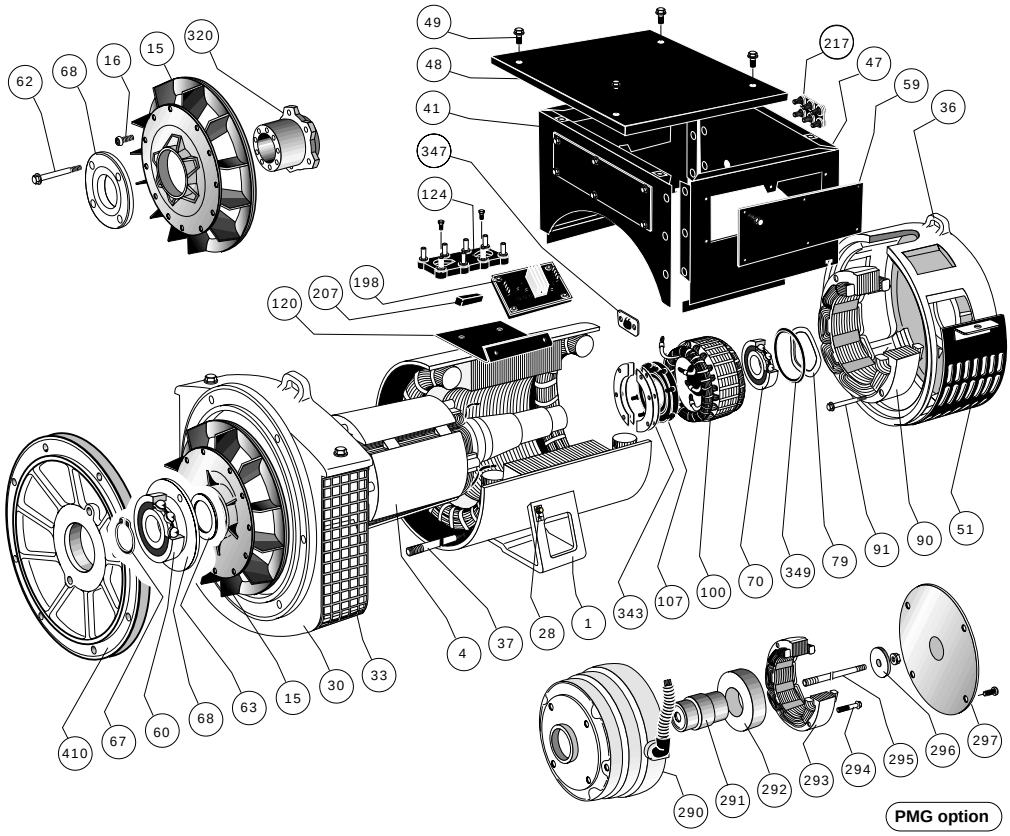
5.4.1 - Single-bearing LSA 43.2/44.2



N°	Nbr	Description	N°	Nbr	Description
1	1	Stator assembly	120	1	Terminal block support (AREP)
4	1	Rotor assembly	124	1	Terminal block
15	1	Fan	198	1	Voltage regulator (AVR)
16	6	Fixing screws (44.2 only)	207	1	AVR damper seal
28	1	Earth terminal	217	1	Terminal block
30	1	DE shield	290	1	PMG housing
33	1	Air outlet grille	291	1	Adaptation shaft
36	1	Shield on exciter end	292	1	Magnetic rotor
37	4	Tie rod	293	1	Stator
41	1	Cover front panel	294	2	Fixing screws
47	1	Cover rear panel	295	1	Tie rod
48	1	Cover top panel	296	1	Cable gland washer + nut
49	34	Fixing screws	297	1	End plate
51	1	Air intake grille	320	1	Hub (43.2 L7 & 44.2 only)
59	3	Inspection door	322	1	Coupling disc
70	1	NDE bearing	323	-	Fixing screws
79	1	Preloading wavy washer	324	1	Clamping washer
90	1	Exciter field	325	-	Spacer shim (43.2 L7 & 44.2 only)
91	4	Exciter field fixing screw	343	1	Diode bridge assembly
100	1	Exciter armature	347	1	Surge suppressor
107	1	Diode crescent support	349	1	"O" ring

LSA 43.2 / 44.2 - 4-POLE
ALTERNATORS
SPARE PARTS

5.4.2 - Two-bearing LSA 43.2/44.2



N°	Nbr	Description	N°	Nbr	Description
1	1	Stator assembly	91	4	Exciter field fixing screw
4	1	Rotor assembly	100	1	Exciter armature
15	1	Fan	107	1	Diode crescent support
16	6	Fixing screws (44.2 only)	120	1	Terminal block support (AREP)
28	1	Earth terminal	124	1	Terminal block
30	1	DE shield	198	1	Voltage regulator (AVR)
33	1	Air outlet grille	207	1	AVR damper seal
36	1	Shield on exciter end	217	1	Terminal block
37	4	Tie rod	290	1	PMG housing
41	1	Cover front panel	291	1	Adaptation shaft
47	1	Cover rear panel	292	1	Magnetic rotor
48	1	Cover top panel	293	1	Stator
49	34	Fixing screws	294	2	Fixing screws
51	1	Air intake grille	295	1	Tie rod
59	3	Inspection door	296	1	Cable gland washer + nut
60	1	DE bearing	297	1	End plate
62	2/4	Bearing retainer fixing screw	320	1	Hub (44.2 only)
63	1	Cable gland washer	343	1	Diode bridge assembly
67	1	Circlips	347	1	Surge suppressor
68	1	Inner bearing retainer	349	1	"O" ring
70	1	NDE bearing	410	1	End shield
79	1	Preloading wavy washer			
90	1	Exciter field			

LSA 43.2 / 44.2 - 4-POLE
ALTERNATORS
NOTES

MOTEURS LEROY-SOMER 16015 ANGOULÊME CEDEX - FRANCE

RCS ANGOULÊME N° B 671 820 223
Limited company with capital of 131,910,700 FF

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