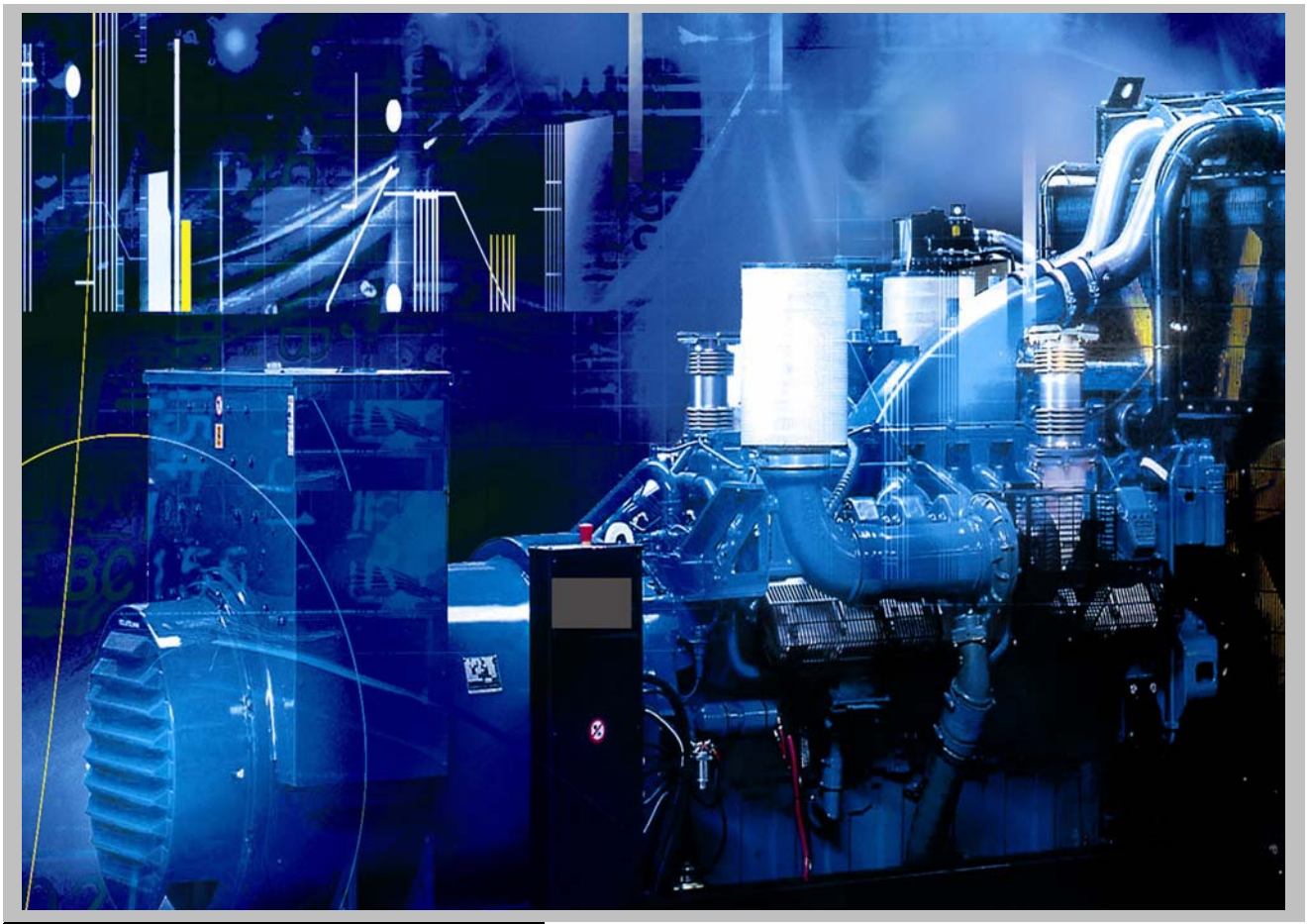
Users guide and maintenance manual for the generating sets

Model(s) : G550

Control device : Intellisys



Réf. constructeur : 33501193901

Réf. GPAO : 33501193901NE

Revised (10-12)

Users guide and maintenance manual

All generating sets

General considerations

Safety instructions

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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.

■

- 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.

■

- 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.

■

- 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.

■

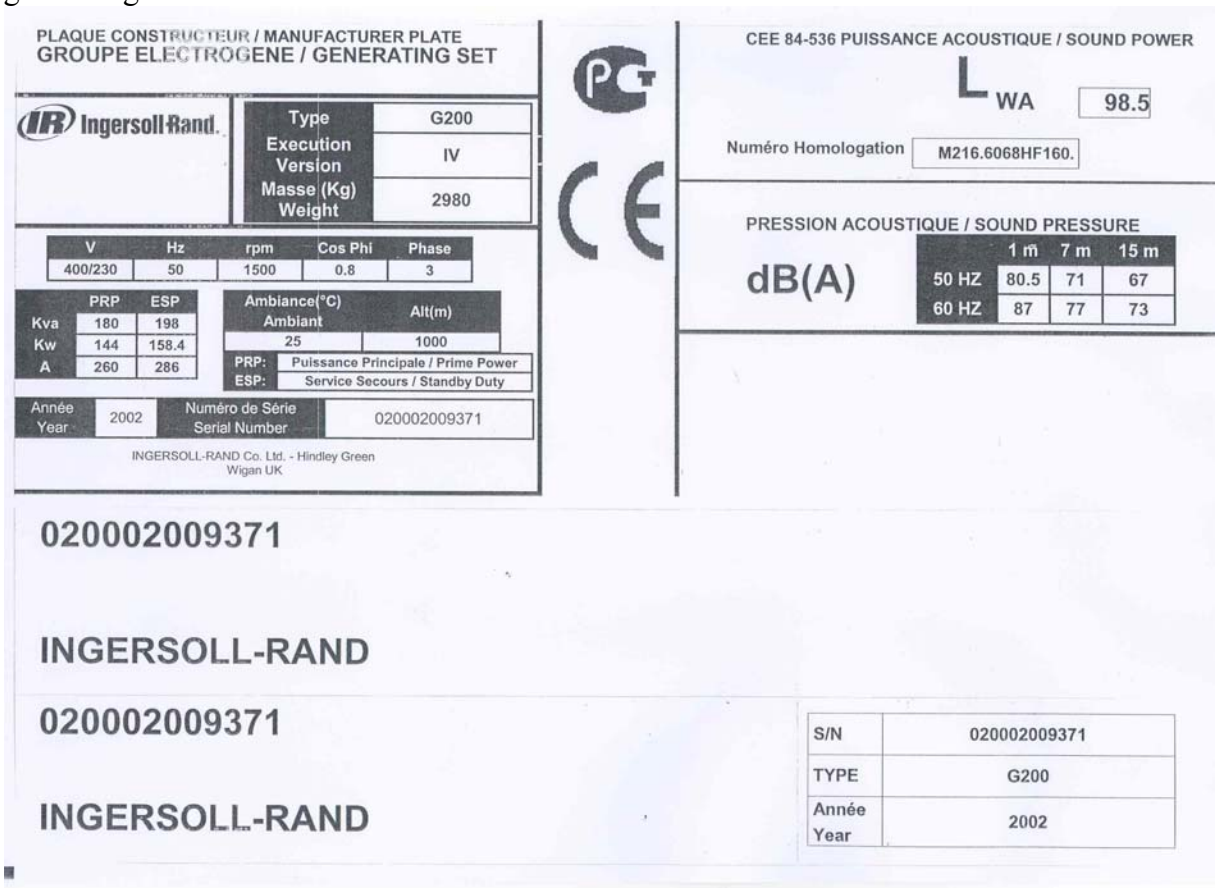
- Manufacturers' notes should be available to technical staff, on site if possible.
- Written operating instructions must be available for operations that involve dangerous handling procedures and driving installations. In particular, these instructions prescribe:
    - Operating modes
    - Frequency 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

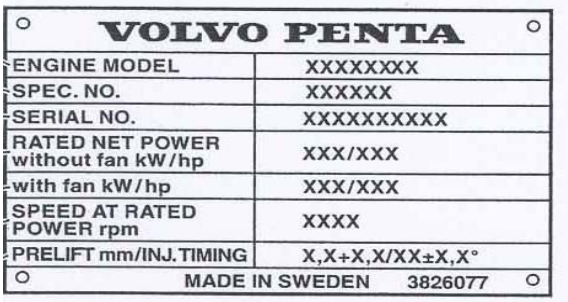
generating sets and their components are identified by means of identification plates.
The precise rules for identifying each major component (engine, alternator etc.) are set out in each manufacturer's documents contained in this manual.

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.

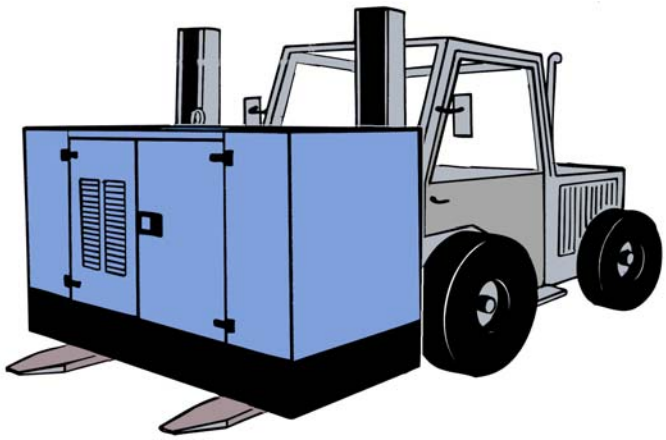
2.1.3 Instructions for unloading

2.1.3.1 Slings

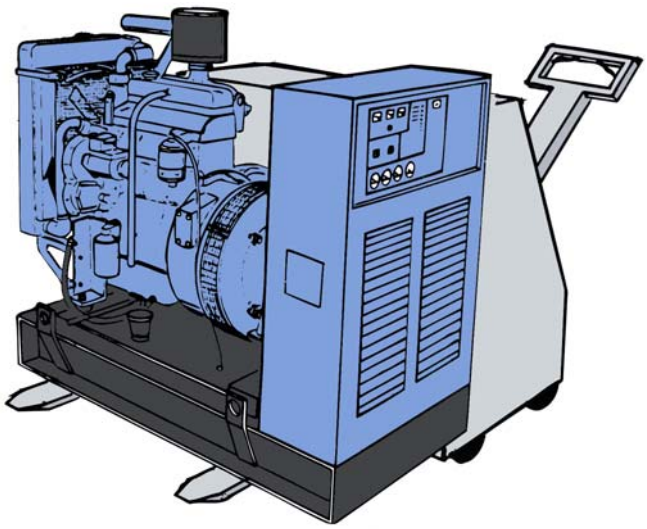
- attach the lifting vehicle slings to the rings on the generating set designed for this procedure.
- hang the slings carefully.
- check that the slings are correctly attached and the equipment is solid.
- lift the generating set carefully.
- direct and stabilise the set towards the chosen position.
- 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

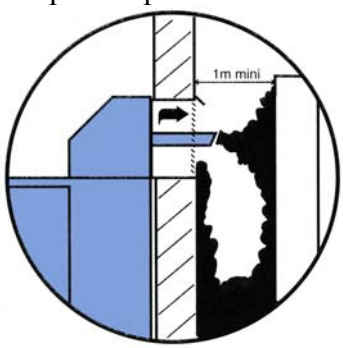


3. INSTALLATION OF MOBILE SITE SETS

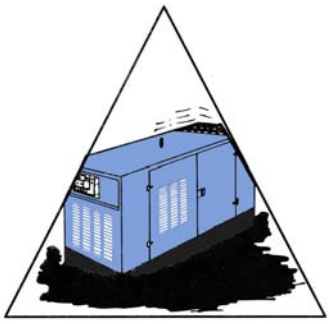
3.1 Specific arrangements

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).

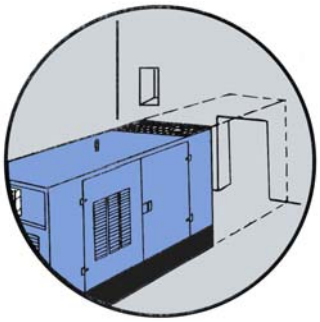
Examples of problems that may be encountered :



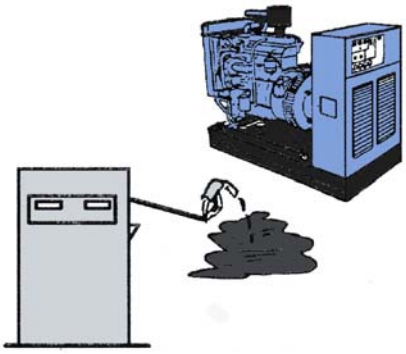
Incorrect exhaust and ventilation



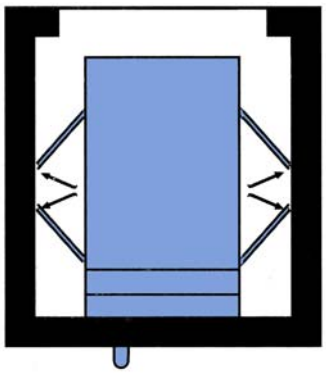
Ground too uneven or soft. Set incorrectly positioned



Reduced access



Fuel filling impossible



Opening cover doors impossible

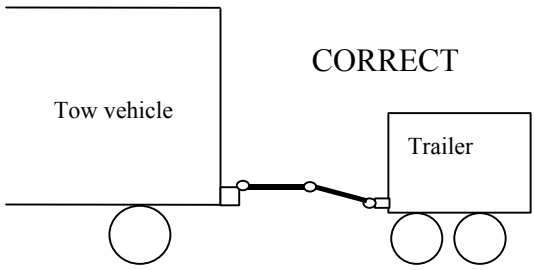
4. ROAD TRAILER

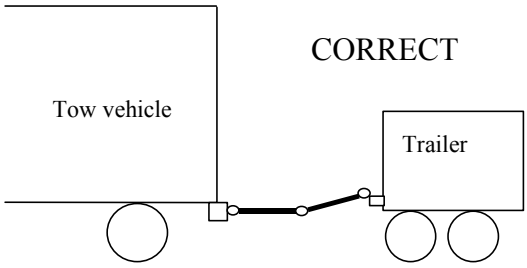
4.1 Trailer linkage

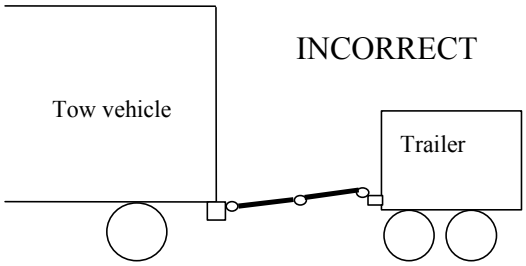
Before attaching the trailer, check the trailer hook on the tow vehicle; it should fit the trailer ring perfectly.

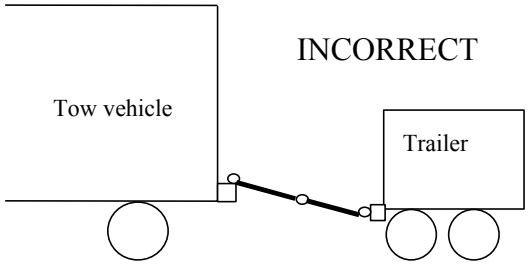
WARNING – DANGER
Trying to tow a trailer with a non-matching device (bar, wires, cords, etc.) could lead to serious accidents.
Also check:
- no incipient fractures or excessive wear on the hitching system.
- locking system is operating properly

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.

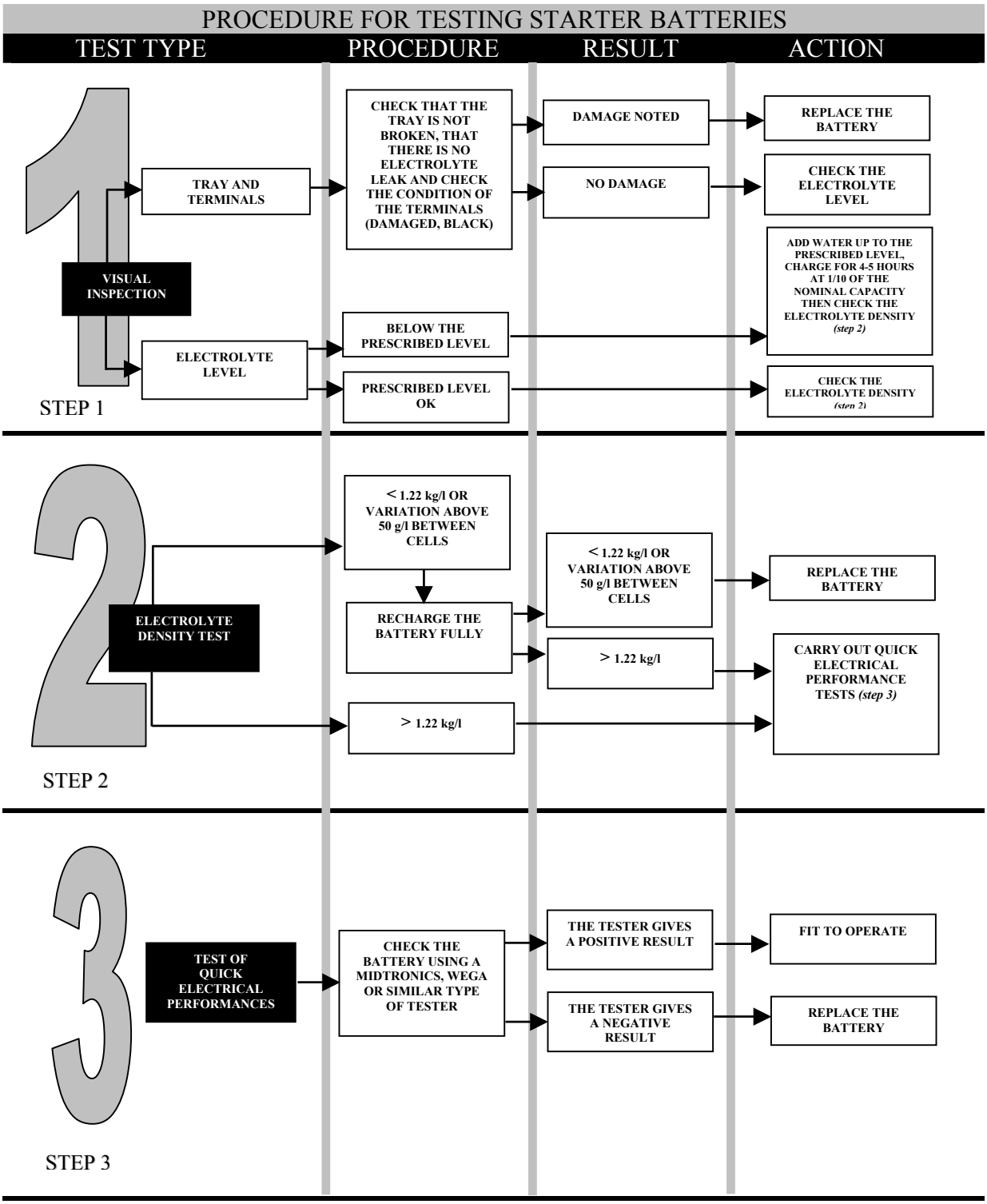
4.5 Implementation for installation

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

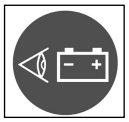

Earth


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

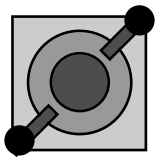
MACHINERY DIRECTIVE 98/37/CE INSTRUCTION FOR GENERATING SETS

- 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.

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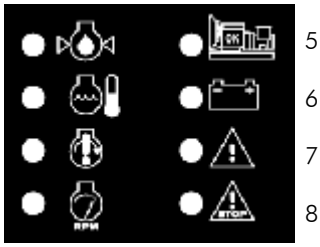
PRESENTATION AND TECHNICALS CHARACTERISTICS



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).

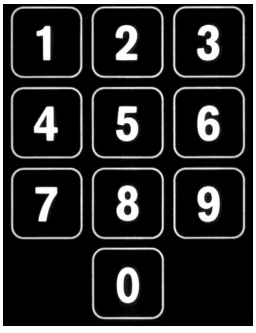
Power on after automatic shutdown (with LED).

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

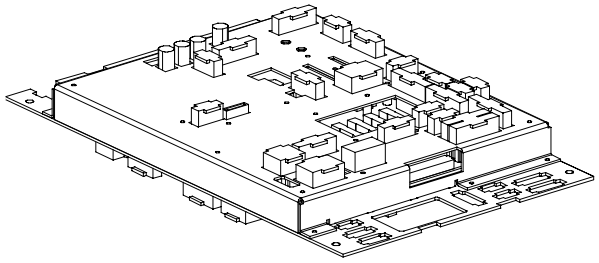


Fig. 1 - CB12 board

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)

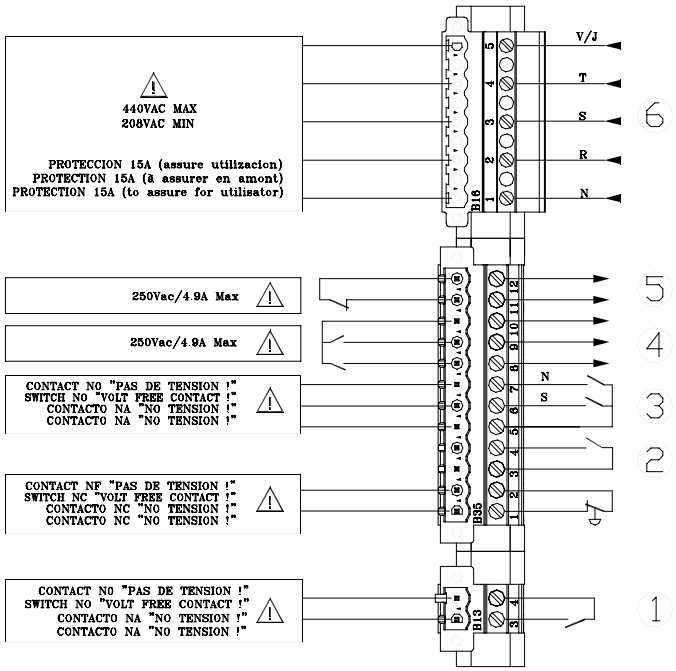
❑ **Generating set with manual start only** (from the control unit keyboard)
No external connection to make.

❑ **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.

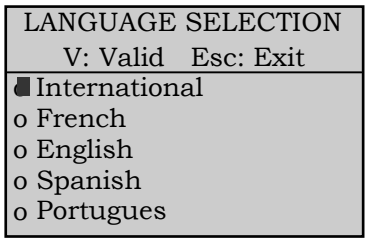
- This screen is visible for eight seconds. All LEDs are lit and will go out after 3 seconds except the **Power** button LED. When initialisation is complete, the **Stop** button LED comes on again.
- If other LEDs are lit or flashing, refer to paragraph 6.

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.

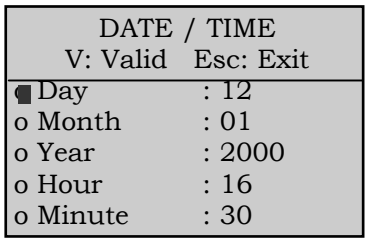
Not until the appearance of the " overview " screen will it be possible to start the generating set, however all inputs stay active (example: appearance of a fault).

- 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

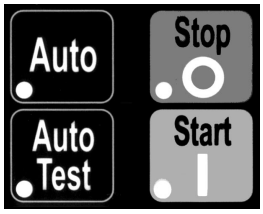
- Two extra lines are inserted to display the malfunctions (alarms and/or faults).
- Engine parameters and electric values appear on screen in a shortened form.
- The two lower lines stay unchanged.

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**



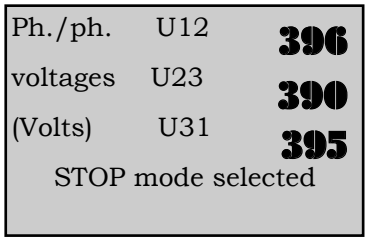
2.1. Stop Mode

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).

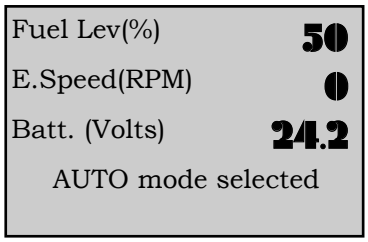
Note: if the engine is equipped with a water heater, the latter is not powered in **Stop** mode.

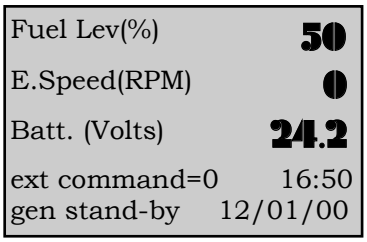
2.2. Manu Mode

• 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.





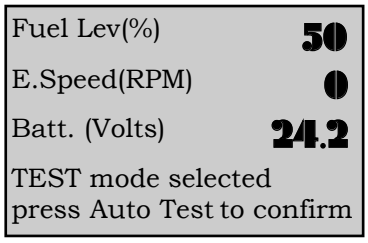
• From the waiting screen, the generating set start-up is conditioned by:
① Logical status change of the 'external command' input
② Logical status change of the 'EJP advance warning' or 'EJP start-up' inputs (France only)
③ Activation of the clock mode built into (if the mode is programmed).

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

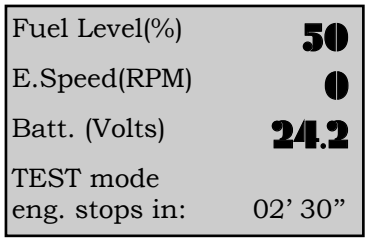
Test mode can only be accessed from **Auto** mode. If one of the inputs ; external command, EJP advance warning, EJP start-up, is in logical status 1 or if the clock is active, **Test** mode cannot be selected.
• If the inputs; external command, EJP advance warning, EJP start-up, are in logical status 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.

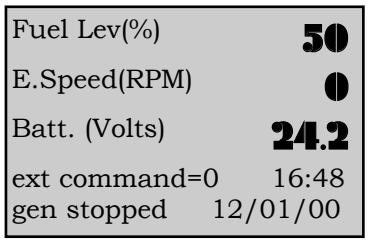
- During operation, if one of the inputs ; external command, EJP advance warning, EJP start-up, changes logical status (from 0 to 1) or if internal clock is activated, a screen message is displayed to indicate the status change or the clock activation. The **Test** mode timer is bypassed, automatically 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

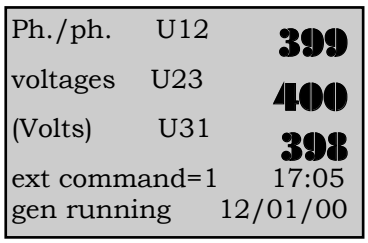
4.1. Voltages

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:

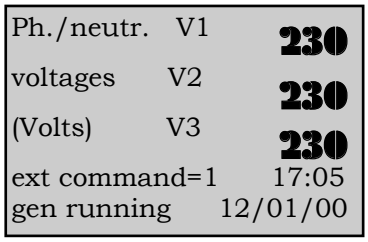
- 3 phase with neutral (3ph+N)
- 3 phase without neutral (3ph)
- 2 phase (2ph+N)
- 1 phase (1ph+N)

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

❑ 3 phase with neutral (3ph+N)

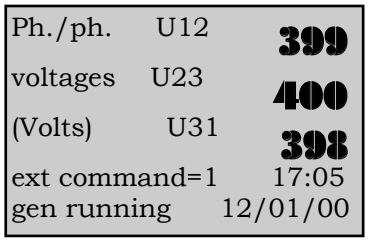


- Press **V** to get the three phase-to-phase voltages:
  U12 = voltage across phase 1 and phase 2
  U23 = voltage across phase 2 and phase 3
  U31 = voltage across phase 3 and phase 1



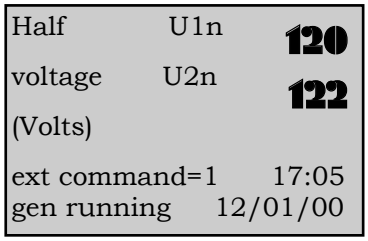
- Press **V** again to get the three phase-to-neutral voltages:
  V1 = voltage across phase 1 and neutral
  V2 = voltage across phase 2 and neutral
  V3 = voltage across phase 3 and neutral
- Press **V** again to bring up the first screen and so on...

❑ 3 phase without neutral (3ph)

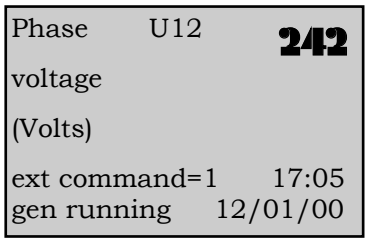


- Press **V** to get the three phase-to-phase voltages:
  U12 = voltage across phase 1 and phase 2
  U23 = voltage across phase 2 and phase 3
  U31 = voltage across phase 3 and phase 1
- If you press **V** nothing changes.

❑ 2 phase (2ph+N)

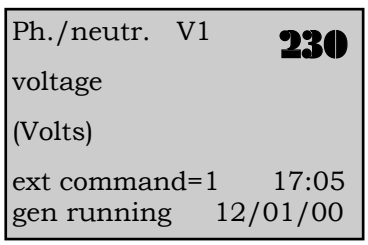


- Press **V** to get the two half voltages:
  U1n = voltage across phase 1 and neutral
  U2n = voltage across phase 2 and neutral



- 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.

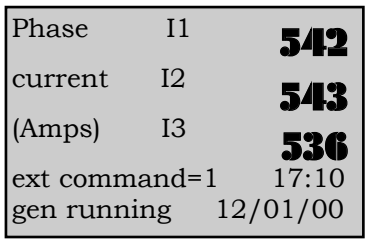
4.2. Currents

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:

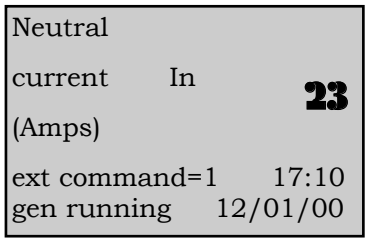
- 3 phase with neutral (3ph+N)
- 3 phase without neutral (3ph)
- 2 phase (2ph+N)
- 1 phase (1ph+N)

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

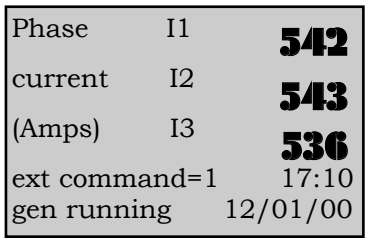


- Press **A** again to get the neutral current:
  In = current in the neutral

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

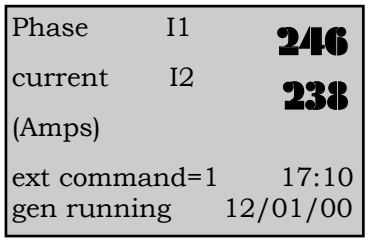
- Press **A** again to bring up the first screen and so on ...

❑ 3 phase without neutral (3ph)



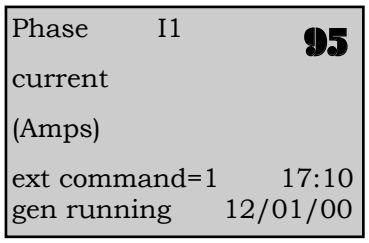
- Press **A** to get the three phase currents:
  I1 = current in phase 1
  I2 = current in phase 2
  I3 = current in phase 3
- If you press **A** again, nothing changes.

❑ 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.

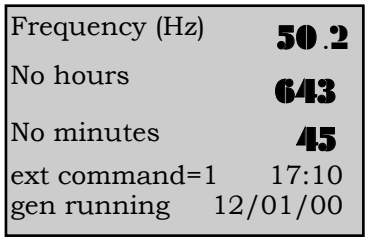
❑ 1 phase (1ph+N)



- 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.

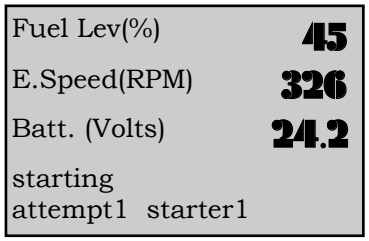
- An alarm message will automatically disappear when the alarm input is no longer in logical status 1.

9. DISPLAYING THE STATUS MESSAGES

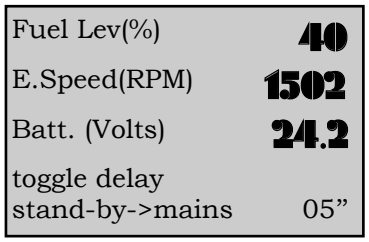
All status relating to the operation of the generating set and its auxiliaries are clearly viewed on the two lower lines.
As well as the date and time, the operator will be able to view:
- Operating mode selected (**Stop**, **Manu**, **Auto**, **Test**)
- Water heater control logical status (active or 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))

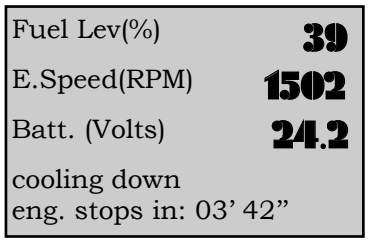
The three screens below show three examples of status messages displayed over the two last lines.



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.

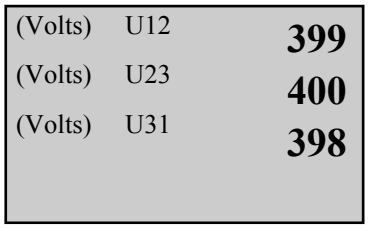
3 - Modifying display with international language

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

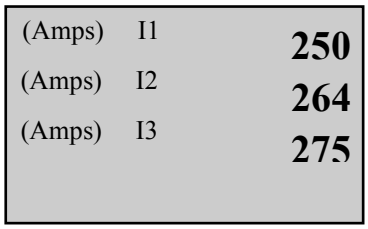
To facilitate understanding, the electrical values are not represented by pictograms.

■ 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.

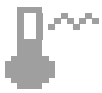
(symbol 6) (Bars)	6
(symbol 7) (°C)	90
(symbol 8) (°C)	75

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.

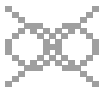
All the symbols related to the engine parameters are represented in the table below.

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.

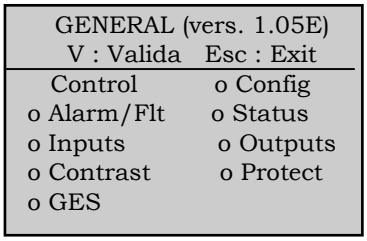
Wording	Alarm	Fault	Generated on
Generator set emergency stop	impossible	00-1	CB, CB12
External emergency stop	impossible	01-1	CB, CB12
Engine oil pressure	impossible	02-1	CB, CB12
Engine water temperature	impossible	03-1	CB, CB12
Daily fuel tank level low	04-0	04-1	CB, CB12
Radiator water level low	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

Volvo
Generating set and industrial engines
4 - 6 litre (non-EDC)
TAD 740 GE / 1032 GE / 1630 GE / 1631 GE - TWD 740 GE / 1210 GE / 1232 GE / 1630 GE

Réf. constructeur : 7739614

Réf. GPAO : 33522045201

Preface

Volvo Penta industrial engines are used all over the world, in both mobile and stationary applications, in all conceivable service conditions. This is not a coincidence.

After 90 years of manufacturing engines, the name Volvo Penta has come to symbolise reliability, technical innovation, first class performance and long life. We believe that this also reflects what you require and expect from your new Volvo Penta industrial engine.

In order to fully meet your expectations, we ask you to read this Instruction Book carefully before starting the engine.

Best regards

AB VOLVO PENTA

Engine data

Engine designation ..... Product number .....

Serial No. .....

Disengageable clutch, type/no. .....

Local Volvo Penta service workshop

Name ..... Tel .....

Address .....

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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.

Safety Information

Read this chapter carefully. It concerns your safety. This chapter describes how safety information is presented in the Instruction Manual and on the engine itself. It also gives a general account of basic safety precautions to be taken when maintaining the engine.

Check that you have the correct Instruction Manual before you read on. If this is not the case, please contact your Volvo Penta dealer.

If operations are performed incorrectly, this could result in personal injury, or damage to property or the engine. Read the Instruction Manual carefully before operating or servicing the engine. If anything is unclear, please contact your Volvo Penta dealer for assistance.

⚠ This symbol is used in the book and on the engine to make you aware of safety information. Always read these safety precautions very carefully.

In the Instruction Manual warning texts have the following priority:

⚠ **WARNING!** If these instructions are not followed, there is a danger of personal injury, extensive damage to the product or serious mechanical malfunction.

⚠ **IMPORTANT!** Used to draw your attention to something that can cause damage, product malfunction or damage to property.

NOTE! Used to draw your attention to important information that will facilitate work or operations.

This symbol is used in certain cases on our products and refers to important information in the Instruction Manual. Ensure that warning and information symbols on the engine and transmission are always visible and legible. Replace symbols that have been damaged or painted over.

Safety precautions for operation and maintenance

⚠ Daily checklist

Make a habit of checking the engine and engine compartment visually before operating (**before the engine is started**) and after operating (**after the engine has been stopped**). This will help you to quickly detect fuel, coolant or oil leaks and spot anything else unusual that has happened or is about to happen.

⚠ Refuelling

When refuelling, there is a danger of fire and explosion. Smoking is forbidden and the engine must be switched off.

Never overfill the tank. Close the fuel tank filler cap properly.

Only use the fuel recommended in the Instruction Manual. The wrong grade of fuel can cause operating problems or cause the engine to stop. On a diesel engine, poor quality fuel may cause the fuel injection pump to seize and the engine to overrev with a resultant risk of damage to the engine and personal injury.

⚠ Carbon monoxide poisoning

Start the engine only in a well-ventilated area. If operating the engine in an enclosed space, ensure that there is proper ventilation in order to remove exhaust gases and crankcase ventilation emissions from the working area.

⚠ Operation

The engine must not be run in areas where there are explosive materials or gases. Not all electrical and mechanical components are non-sparking.

Approaching a running engine is dangerous. Loose clothing, hair, fingers or a dropped tool may catch in the rotating parts of the engine and cause serious personal injury.

Engines are supplied without guards. After the engine is installed, all rotating and hot components must be protected where necessary for reasons of personal safety.

⚠ Starting lock

If the instrument panel does not have an ignition switch, the engine compartment must be lockable to prevent unauthorised persons from starting the engine. Alternatively, a lockable main switch can be used.

⚠ Maintenance and service

Knowledge

The Instruction Manual contains instructions on how to carry out general maintenance and service operations safely and correctly. Read the instructions carefully before starting work.

Service literature covering more complicated operations is available from your Volvo Penta dealer.

Never carry out any work on the engine if you are unsure of how it should be done. Contact your Volvo Penta dealer who will be glad to offer assistance.

Stop the engine

Stop the engine before opening or removing engine hatches. Unless otherwise specified, all maintenance and service must be carried out with the engine stopped.

To prevent accidental starting, remove the ignition key, turn off the power supply to the engine at the main switches and lock them in the OFF position before starting work. Put up a warning sign in the control position that work on the engine is being carried out.

Approaching or working on an engine that is running is a safety risk. Loose clothing, hair, fingers or a dropped tool may catch in the rotating parts of the engine and cause serious personal injury. Volvo Penta recommends that all servicing with the engine running be undertaken by an authorised Volvo Penta workshop.

Safety precautions for operation and maintenance (cont.)

Lifting the engine
When lifting the engine, use the lifting eyes installed on the engine. Always check that lifting equipment is in good condition and is strong enough for the lift (engine weight plus any extra equipment). For safety's sake lift the engine using an adjustable lifting beam. All chains and cables should run parallel to each other and as perpendicular as possible in relation to the top of the engine. Bear in mind that extra equipment installed on the engine may alter its centre of gravity. Special lifting equipment may then be required in order to maintain the correct balance and make the engine safe to handle. Never carry out work on an engine suspended on a hoist.

Before starting the engine
Reinstall all guards removed during service operations before starting the engine. Check that no tools or other items have been left on the engine.

Never start a turbocharger engine without installing the air filter. The rotating compressor in the turbocharger can cause serious personal injury. Foreign objects can also be sucked in and cause mechanical damage to the unit.

⚠ Fire and explosion

Fuel and lubrication oil
All fuel, most lubricants and many chemicals are inflammable. Read and follow the instructions on the packaging.

When carrying out work on the fuel system, make sure the engine is cold. A fuel spill onto a hot surface or electrical components can cause a fire.

Store fuel-soaked rags and other flammable material so that there is no danger of them catching fire. In certain conditions oil-soaked rags can spontaneously ignite.

Do not smoke when filling fuel or oil, or in proximity of a filling station or in the engine room.

Use of components other than Volvo Original replacement parts
Components used in the fuel and electrical systems on Volvo Penta products are designed and constructed to minimise the risk of fire and explosion.

Using non-original Volvo Penta parts can result in fire or explosion.

Batteries
The batteries contain and give off oxyhydrogen gas, especially during charging. This gas is easily ignited and highly flammable.

Do not under any circumstances smoke or use naked flame or allow sparks in the vicinity of the batteries or battery compartment.

Incorrectly connecting a battery terminal cable or jump-start cable can cause a spark which in turn can cause an explosion.

Start spray
Never use start spray or similar agents to start an engine equipped with air pre-heating (glow plugs / starter element). The starter element may cause an explosion in the inlet manifold. Danger of personal injury.

⚠ Hot surfaces and fluids

There is always a risk of burns when working with a hot engine. Beware of hot surfaces. For example: the exhaust pipe, turbocharger (TC), oil pan, charge air pipe, starter element, hot coolant and hot oil in oil lines and hoses.

⚠ Chemicals

Most chemicals such as anti-freeze, rustproofing agent, inhibiting oil, degreasing agent etc. are hazardous to health. Read and follow the instructions on the packaging.

Some chemicals such as inhibiting oil are inflammable and also dangerous if inhaled. Ensure good ventilation and use a protective mask when spraying. Read and follow the instructions on the packaging.

Store chemicals and other hazardous materials out of the reach of children. To protect the environment please dispose of used or leftover chemicals at a properly designated disposal point.

⚠ Lubrication system

Hot oil can cause burns. Avoid skin contact with hot oil. Ensure that the lubrication system is not under pressure before commencing work on it. Never start or operate the engine with the oil filler cap removed, as oil can spray out.

⚠ Cooling system

Avoid opening the coolant filler cap when the engine is hot. Steam or hot coolant can spray out and cause burns.

If work must be carried out with the engine at operating temperature and the coolant filler cap or a cock open or a coolant hose disconnected, open the coolant filler cap carefully and slowly to release pressure before removing the cap completely. Note that the coolant may still be hot and can cause burns.

⚠ Fuel injection system

Always use protective gloves when tracing leaks. Liquids ejected under pressure can penetrate body tissue and cause serious injury. There is a danger of blood poisoning.

Always cover the generator if it is located under the fuel filter. The generator can be damaged by spilled fuel.

⚠ Electrical system

Cutting off power

Always stop the engine and break the current using the main switches before working on the electrical system. Isolate external power to the engine block heater, battery charger, or accessories mounted on the engine.

Batteries

The batteries contain an extremely corrosive electrolyte. Protect your skin and clothes when charging or handling batteries. Always use protective goggles and gloves.

If battery electrolyte comes into contact with unprotected skin, wash off immediately using plenty of water and soap. If battery acid comes into contact with the eyes, flush immediately with plenty of water and obtain medical assistance without delay.

⚠ Welding

Remove the positive and negative leads from the batteries. Then remove all leads to the generator.

Always connect the weld clamp to the component to be welded and as close to the welding point as possible. The clamp should never be connected to the engine or in such a manner that the current is able to pass across any bearings.

When welding is complete: Always connect the leads to the generator **before** replacing the battery leads.

Introduction

This Instruction Manual has been compiled to help you get the most from your Volvo Penta industrial engine. It contains all the information you need in order to operate and maintain your engine safely and correctly. Please read the Instruction Manual carefully and learn how to operate the engine, controls and other equipment safely.

⚠ **IMPORTANT!** This Instruction Manual describes engines and equipment sold by Volvo Penta. For some applications there may be variations (appearance and function) of components such as controls and instrumentation. If this is the case, see the Instruction Manual for the relevant application.

Care of the environment

We all want to live in a clean and healthy environment. Where we can breathe clean air, see healthy trees, have clean water in our lakes and oceans and enjoy the sunshine without worrying about our health. Unfortunately this is no longer something we can take for granted. We must work hard together for the environment.

As a manufacturer of engines Volvo Penta has a particular responsibility. This is why concern for the environment is one of the cornerstones of our product development. Today great advances have been made in reducing exhaust emissions, fuel consumption and engine noise in Volvo Penta's wide range of engines.

We hope that you will take care to maintain these properties. Always follow the advice in the Instruction Manual about fuel grades, operation and service and you will avoid unnecessary damage to the environment. If you notice changes such as increased fuel consumption or exhaust smoke, please contact your Volvo Penta dealer.

Always dispose of environmentally harmful waste such as engine and transmission oil, coolant, old paint, degreasing agents, cleaning residue and old batteries at proper disposal points.

Together we can work to make a valuable contribution to a clean environment.

Running-in

The engine must be "run in" for its first 10 operating hours as follows:

Operate the engine normally. Do not operate it at full load except for short periods. Never run the engine at a constant engine speed for long periods during the running-in period.

The engine can be expected to use more engine oil during the running-in period (100–200 hours) than would otherwise be normal. Check the oil level more often than is normally recommended.

Make additional checks on the disengageable clutch (if installed) for the first few days. It may be necessary to adjust it to compensate for wear to the plates.

Fuel and oil types

Only use the fuel and oils recommended in this Instruction Manual (see the chapter "Service" under the heading fuel and lubrication systems). Using other grades of fuel and oil can cause operating problems, increased fuel consumption and, in the long term, a shorter engine service life.

Always change oil, oil filters and fuel filters at the recommended intervals.

Maintenance and replacement parts

Volvo Penta engines are designed for maximum service life and reliability. They are built to survive in challenging environments, but also to cause as little environmental impact as possible. Regular servicing and the use of Volvo Penta Genuine parts will maintain these properties.

Volvo Penta have a world-wide network of authorised dealers. They are specialists in Volvo Penta products and have accessories and the original replacement parts, test equipment and special tools necessary for high quality service and repair work.

Always follow the service intervals contained in this Instruction Manual and remember to quote the engine / transmission identification number when ordering service and replacement parts.

Certified engines

If you own an engine certified for any area where exhaust emissions are regulated by law, the following is important:

Certification means that an engine type is inspected and approved by the authorities. The engine manufacturer guarantees that all engines manufactured of that type correspond to the certified engine.

This places special requirements for maintenance and service as follows:

- The maintenance and service intervals recommended by Volvo Penta must be observed.
- Only genuine Volvo Penta replacement parts may be used.
- The service of injection pumps and injectors or pump settings must always be carried out by an authorised Volvo Penta workshop.
- The engine must not be modified in any way except with accessories and service kits developed for it by Volvo Penta.
- No modifications to the exhaust pipes and air supply ducts for the engine may be undertaken.
- Seals may only be broken by authorised personnel.

In addition the general instructions contained in the Instruction Manual concerning operation, service and maintenance must be followed.

⚠ **IMPORTANT!** Late or inadequate maintenance / service or the use of spare parts other than Volvo Penta original spare parts will invalidate AB Volvo Penta's responsibility for the engine specification being in accordance with the certified variant.

Volvo Penta accepts no responsibility or liability for any damage or costs arising due to the above.

Warranty

Your new Volvo Penta industrial engine is covered by a limited warranty according to the conditions and instructions contained in the Warranty and Service book.

Note that AB Volvo Penta's liability is limited to that contained in the Warranty and Service Book. Read this book as soon as you take delivery of the engine. It contains important information about warranty cards, service and maintenance which you, the owner, must be aware of, check and carry out. Otherwise, liability covered in the warranty may be refused by AB Volvo Penta.

Contact your Volvo Penta dealer if you have not received a Warranty and Service Book and a customer copy of the warranty card.

Presentation

The instruction book covers industrial and generator set engines from 4 to 16 liter swept volume.

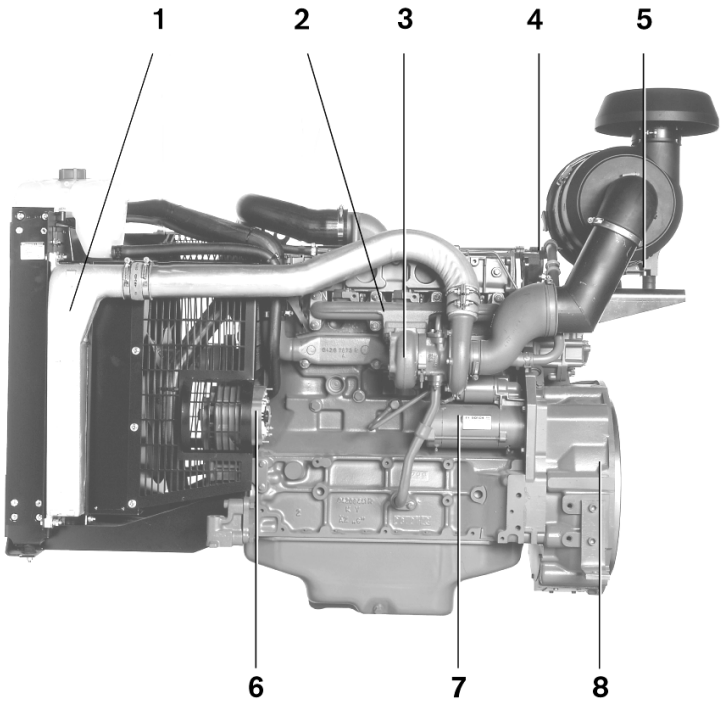
The engines are four-cycle, 6-cylinder in-line diesel engines with direct diesel injection (420/520 are 4-cylinder diesel engines). The engines have replaceable wet cylinder liners (the 420 does not have liners and the 620 has dry liners), and have turbochargers. All engines have piston cooling.

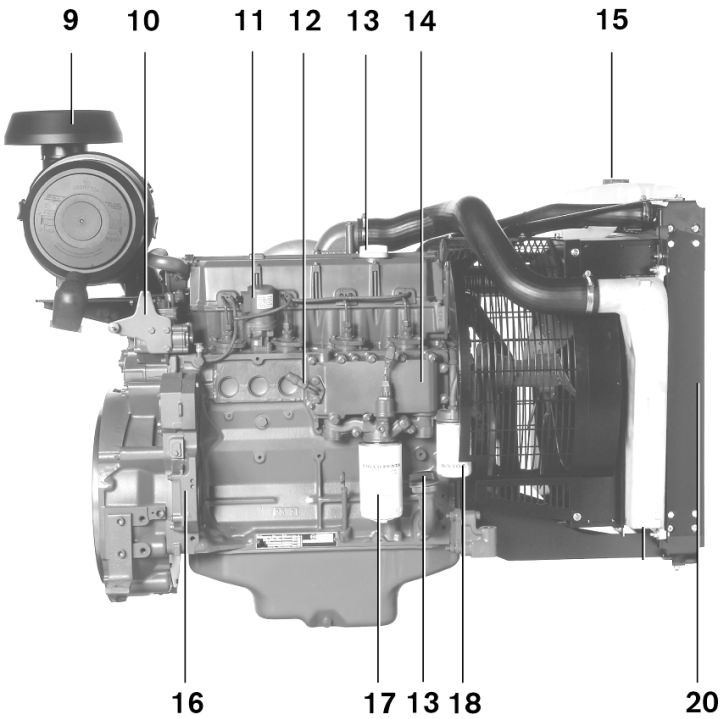
The TAD engines have an air-cooled intercooler, as distinct from the TWD engines, which have a water-cooled intercooler.

The charge air cooler (CAC) reduces the temperature of the intake air. This provides the cylinders with greater volumes of air. This makes a high power output possible while keeping the combustion and exhaust gas temperatures to appropriate levels. In addition, the emission of nitrous oxides is reduced.

The engines are equipped with an electrical starter element. This facilitates starting and reduces exhaust emissions in cold weather conditions. Does not apply for engines 520/720 (COM1).

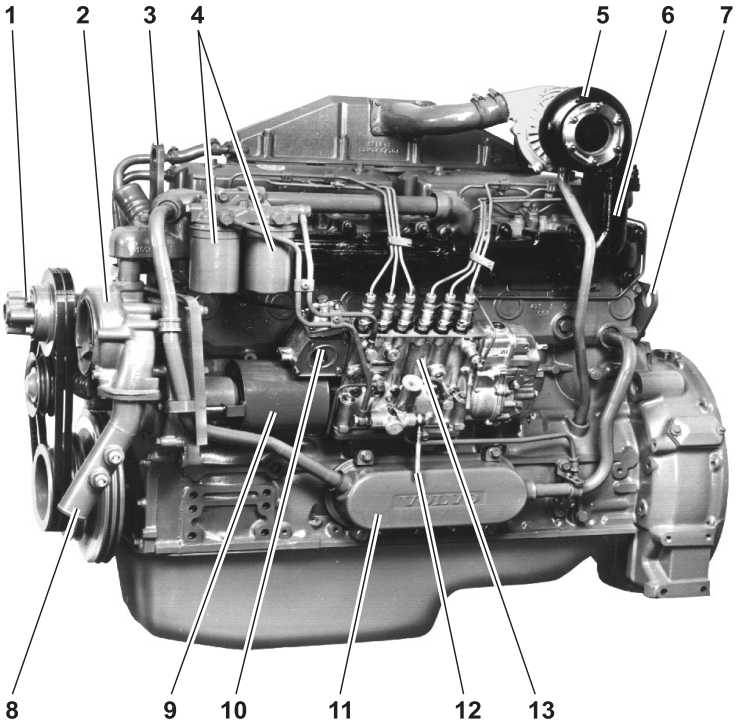
Examples of 4- and 5-litre engines

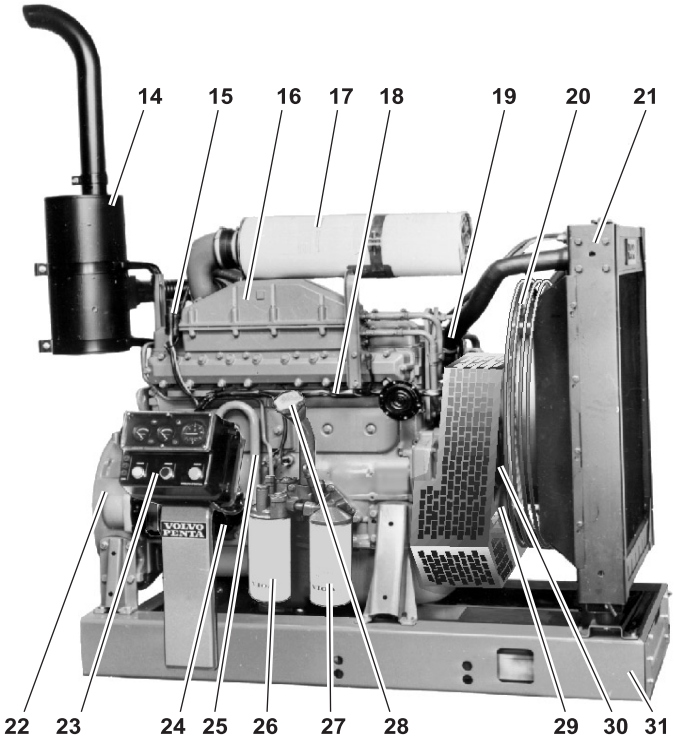




1. Charged air cooler
2. Exhaust manifold
3. Turbocharger
4. Closed crank case breather system
5. Air restriction indicator
6. Alternator
7. Starter motor
8. Flywheel housing SAE 3
9. Air filter
10. Fuel governor
11. Stop solenoid
12. Coolant heater (option)
13. Oil filling
14. Oil cooler
15. Exp. tank with filler cap
16. Engine transmission with PTO
17. Oil filter
18. Fuel filter
20. Radiator

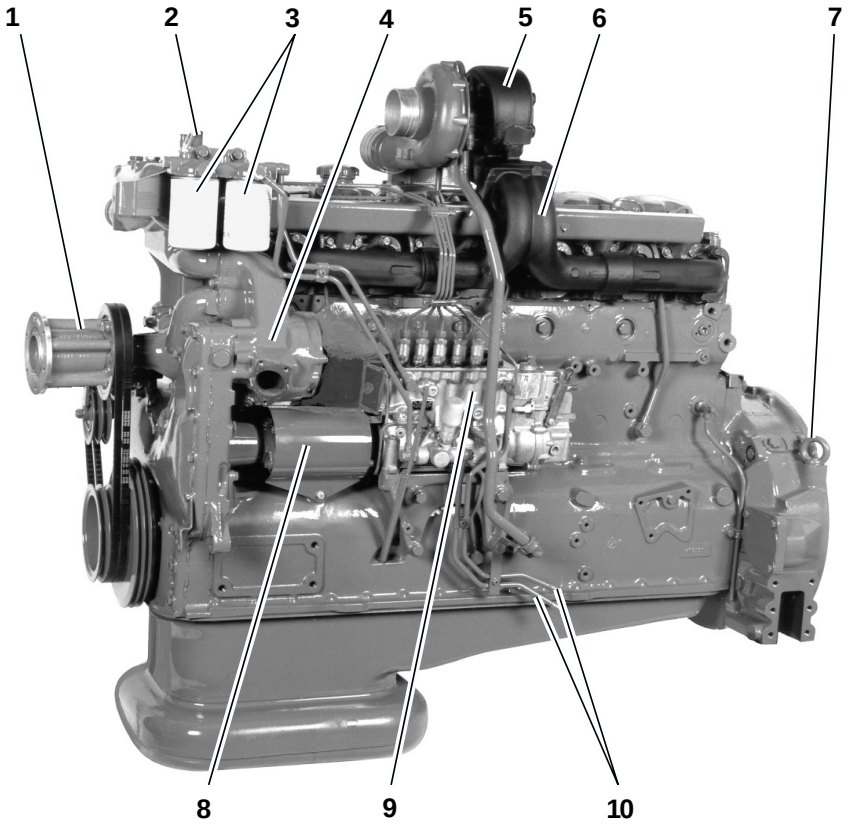
Examples of 6 and 7-litre engines



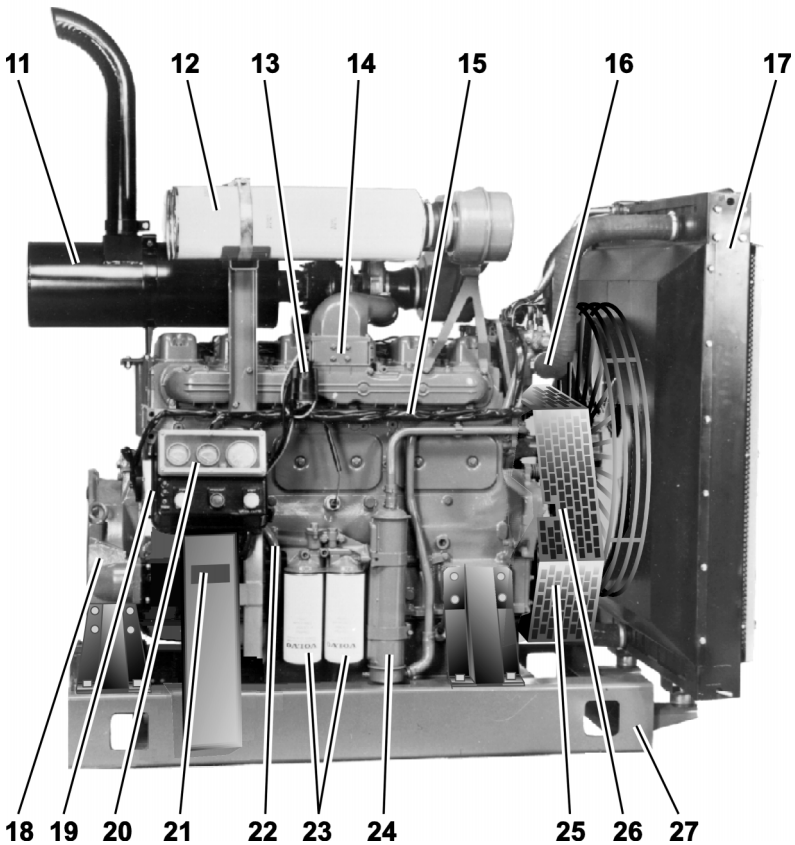


1. Fan hub
2. Gear-driven coolant pump
3. Lifting lug
4. Double fuel filter
5. Turbocharger
6. Air-cooled exhaust manifold
7. Lifting lug
8. Coolant pipe, inlet
9. Pump coupling guard
10. Smoke limiter
11. Oil cooler
12. Fuel line for tank connection
13. Injection pump
14. Muffler
15. Relay for electrical starter element
16. Electrical starter element
17. Air filter
18. Cable holder
19. Coolant pipe, outlet
20. Fan guard
21. Radiator
22. Flywheel cover
23. Instrument panel
24. Starter motor
25. Pipe for crankcase ventilation
26. Lubricating oil filter, full flow
27. Lubricating oil filter, part flow
28. Filler cap for lubricating oil
29. Vibration damper
30. Belt tensioner (automatic)
31. Frame

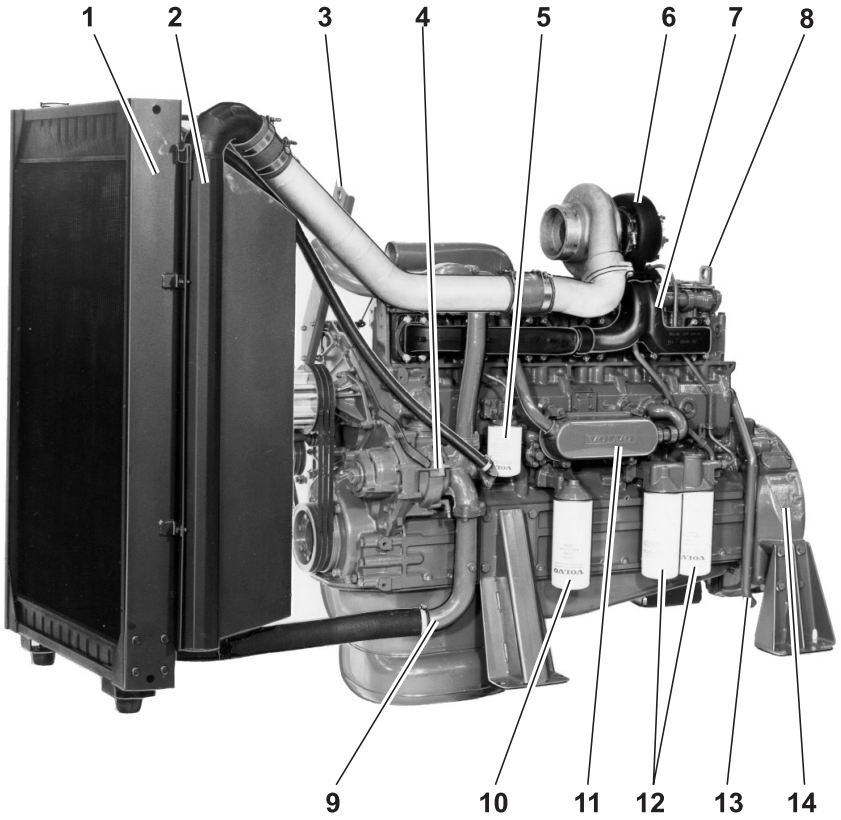
Examples of 10 and 12-litre engines



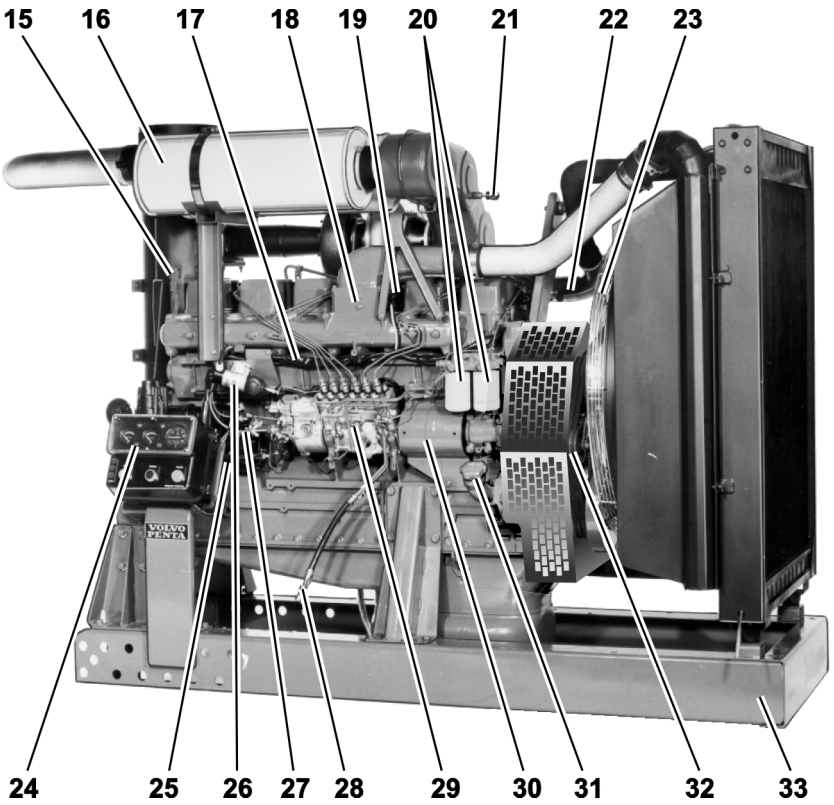
1. Fan hub
2. Lifting lug
3. Double fuel filter
4. Gear driven circulation pump
5. Turbocharger
6. Air-cooled exhaust manifold
7. Lifting lug
8. Pump coupling guard
9. Injection pump
10. Fuel line for tank connection
11. Muffler
12. Double air filters
13. Relay for electrical starter element
14. Electrical starter element
15. Cable holder
16. Coolant pipe, outlet
17. Radiator
18. Flywheel cover
19. Engine speed control
20. Instrument panel
21. Starter motor
22. Pipe for crankcase ventilation
23. Double lubricating oil filter, full flow
24. Oil cooler
25. Vibration damper
26. Belt tensioner (automatic)
27. Frame

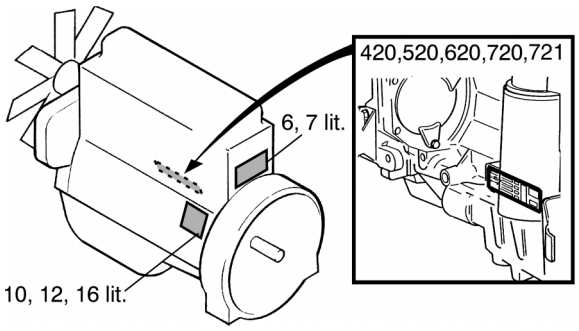


Examples of 16-litre engines



1. Radiator
2. Charge air cooler (CAC)
3. Bracket for radiator
4. Gear-driven coolant pump
5. Coolant filter
6. Turbocharger
7. Air-cooled exhaust manifold
8. Lifting lug
9. Coolant pipe, inlet
10. Lubricating oil filter, part flow
11. Oil cooler
12. Double lubricating oil filter, full flow
13. Pipe for crankcase ventilation
14. Flywheel cover
15. Muffler
16. Air filter
17. Cable holder
18. Electrical starter element
19. Relay for electrical starter element
20. Double fuel filter
21. Pressure drop indicator for air filter
22. Coolant pipe, outlet
23. Fan guard
24. Instrument panel
25. Starter motor
26. Stop solenoid
27. Engine speed control
28. Fuel line for tank connection
29. Injection pump
30. Pump coupling guard
31. Oil filler
32. Belt tensioner (automatic)
33. Frame

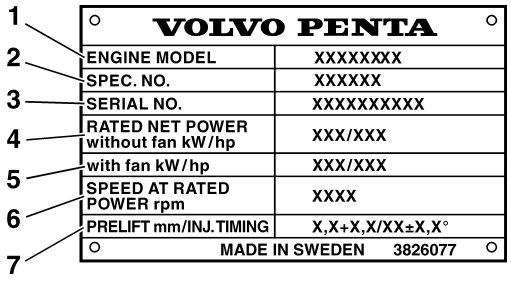




Identification numbers

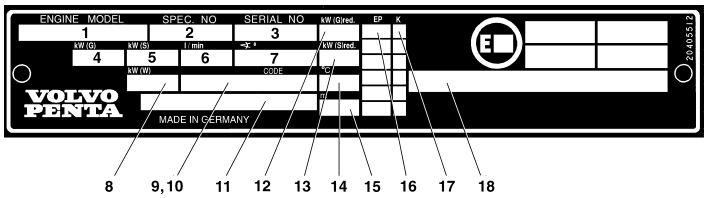
The engines are supplied with two engine identification plates. One of these is supplied uninstalled so that it can be mounted in a suitable site close to the engine. The other plate is riveted to the cylinder block (see illustration).

The engine identification plate contains the serial number and engine designation. This information should always be used as a reference when ordering a service and replacement parts and when contacting your Volvo Penta workshop.



1. Engine designation
2. Product number
3. Serial No.
4. Rated gross power (without fan)
5. Rated net power (with fan), T(A)D420–721:Empty
6. Maximum engine speed (RPM)
7. Prelift/injection timing

Identification plates: TD/TAD420–721



8. Empty
9, 10. Manufactor identifikation code
11. Indication of standard and/or regulation
12. Reduced "gross power", on-site conditions, items 14, 15
13. Reduced "continuous power", on-site conditions items 14, 15
14. Air temperature in °C. For the ambient conditions on site (but standard is 25°C)
15. Altitude above sea level in m. For the ambient conditions on site (but standard is 100 m)
16. Injection pump code
17. Piston class
18. kw (PRP), power

Engine designation

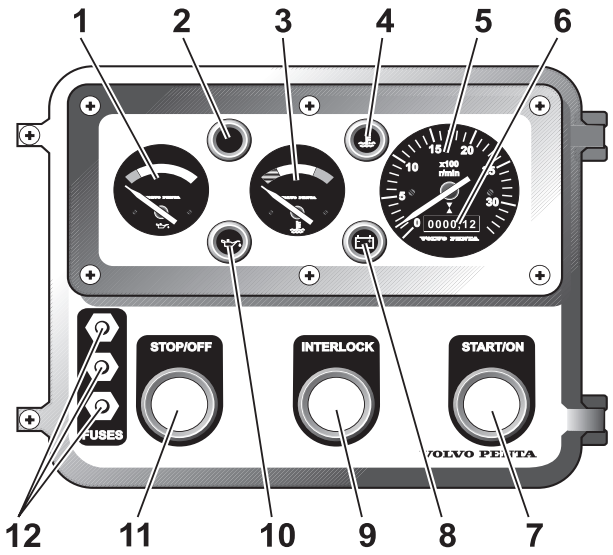
The following information can be read from the engine designation:

T = Turbocharged
A = Air-to-air charge air cooler (CAC)
W = Water-to-air charge air cooler (CAC)
D = Diesel engine
10 = Cylinder displacement, litres
3 = Generation
1 = Version
V = Engine for stationary and mobile application
G = Generating set engine
E = Emisson certified engine

Instrumentation

This chapter describes the instrument box and the instrumentation in Volvo Penta's range. Variations in the appearance of instrumentation may occur in certain applications (mobile for example). If this is the case, see the Instruction Manual for the relevant application.

⚠ **WARNING!** If the instrument box does not have an ignition switch, the engine / operator compartment must have a lock to prevent unauthorised persons starting the engine. (Alternatively a lockable main switch can be used.)

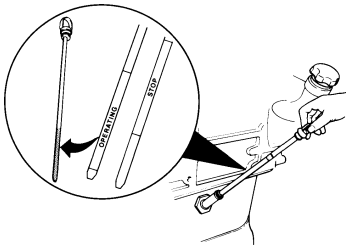


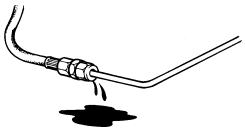
Instrument box

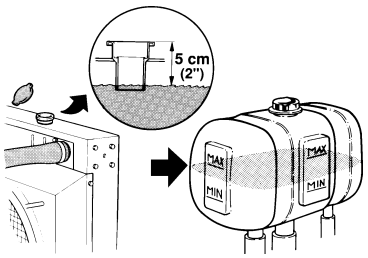
1. Oil pressure gauge. Normally within the green field (300–500 kPa).
2. Warning lamp: Low engine coolant level (accessory)
3. Engine coolant temperature gauge. Normally within the green field (70–95°C).
4. Warning lamp: High engine coolant temperature (accessory)
5. Tachometer
6. Operating hour counter
7. Starter button
8. Warning lamp: Generator not charging
9. Interlock: Press in the button to disengage the automatic stop for low oil pressure and to activate preheating.
10. Warning lamp: Low oil pressure (accessory)
11. Stop button
12. Semi-automatic fuses: Reset by pressing the button on the fuse

Starting the engine

Make a habit of checking the engine and engine compartment before starting the engine. This will help you to quickly detect anything unusual that has happened or is about to happen. Check that the instrument readings are normal after starting the engine.





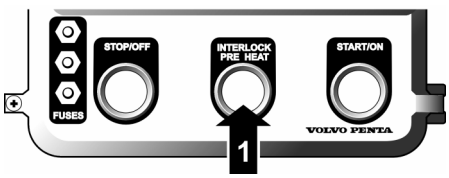


Before starting the engine

- Check that the oil level is between the MIN and MAX marks. See chapter “Maintenance, Lubrication system”.
- Open the fuel cocks
- Check that there are no coolant, fuel or oil leaks.
- Check the air filter pressure drop indicator. See chapter “Maintenance, Engine, general”.
- Check coolant level. Check that the outside of the radiator is not clogged. See chapter “Maintenance, Cooling system”.

  ⚠ **WARNING!** Do not open the engine coolant system filler cap when the engine is still hot. Steam or hot coolant may spray out.
- Switch on the main switches

  ⚠ **IMPORTANT!** Never break the circuit with the main switch while the engine is running. This could damage the generator.
- Set the engine speed control to idle. Disengage the disengageable clutch/transmission.

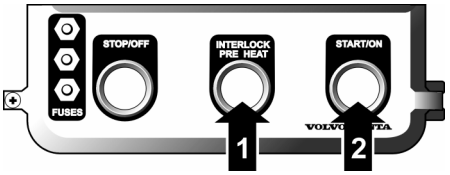


Starting method

⚠ **WARNING!** Never use start spray or similar to start the engine. The starter element may cause an explosion in the inlet manifold. There is a risk of serious personal injury.

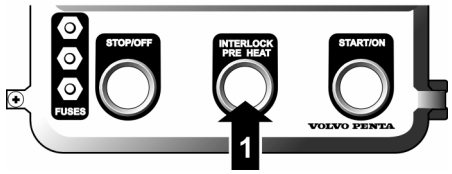
Instrument box:

1. Press the “Interlock button” (1) and check that the warning lamps in the instrument box are functioning. (This applies to engines equipped with alarm separators).



2. **If the engine is hot:** Press the “Interlock button” (1) and hold it in while pressing the Starter button (2).

   If the engine is cold: Press the Interlock button (1) and hold it in for approximately 50 seconds to preheat the engine. Then press the “Start button” (2) as well.



3. Release the Start button immediately when the engine starts.

   However the Interlock button must be held down for a further 5 seconds approximately. This is to allow the oil pressure to reach the correct level. Otherwise the automatic stop will engage and stop the engine.

   NOTE! In extreme cold, the preheating can be re-engaged for a few minutes after start if necessary. Hold the Interlock button (1) pressed in.

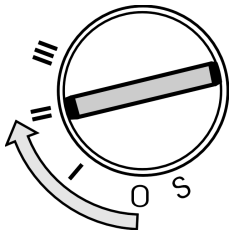
   ⚠ **IMPORTANT!** The start button must **never** be pressed in when the engine is running. The starter motor and starter gear on the flywheel may be seriously damaged.

4. Allow the engine to run at 500–700 rpm for the first 10 seconds. Then warm up the engine at low speed and low load.

   ⚠ **IMPORTANT!** Do not race the engine while it is cold.

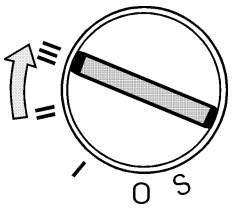
   NOTE! Generating set engines automatically rev up to the pre-set engine speed (1500 or 1800 rpm).

Volvo Penta starting lock:



1. **If the engine is hot:** Proceed directly to point 2.

   If the engine is cold: Turn the ignition key to position “**II**” to engage the preheating. Hold the key in this position for approximately 50 seconds. (If the engine is equipped with a time relay for preheating, the key can be released. Preheating stops automatically after 50 seconds).



2. Turn the key to position “**III**”. Release the key to position “**II**” immediately when the engine starts. Hold the key in this position for approximately 5 seconds. This is to allow the oil pressure to reach the correct level. Otherwise the automatic stop will engage and stop the engine.

   If the engine does not start, turn the key to the “O” position before trying again.

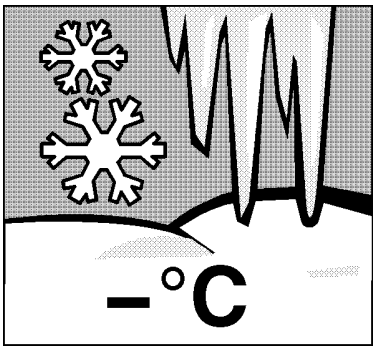
   NOTE! In extreme cold, the preheating can be re-engaged for a few minutes after start if necessary. Hold the ignition key in position “**II**”.

3. Allow the engine to run at 500–700 rpm for the first 10 seconds. Then warm up the engine at low speed and low load.

   ⚠ **IMPORTANT!** Do not race the engine while it is cold.

   NOTE! Generating set engines automatically rev up to the pre-set engine speed (1500 or 1800 rpm).

Starting the engine in extremely cold conditions



Preparations must be made to allow the engine to be started in extremely cold conditions.

Use a winter fuel (a proprietary brand) approved for the prevailing temperature. This reduces the risk of wax deposits in the fuel injection system. A fuel heater is recommended for extremely low temperatures.

Use a synthetic lubricating oil of a viscosity recommended for the prevailing temperature. See chapter “Lubrication system service”. Synthetic oils can withstand greater temperature ranges than mineral-based oils.

Preheat the engine coolant with a separate electrical engine block heater. In extreme cases a diesel engine block heater may be required. Ask your Volvo Penta service dealer for advice.

⚠ **IMPORTANT!** Ensure that the cooling system is filled with antifreeze. See chapter “Maintenance, Cooling system”.

Batteries must be in good condition. Cold reduces battery capacity. An increase in battery capacity may be necessary.

Starting the engine using auxiliary batteries

⚠ **WARNING!** The batteries (auxiliary batteries in particular) contain extremely explosive oxyhydrogen gas. One spark, which may be formed if the auxiliary batteries are connected incorrectly, is sufficient to cause a battery to explode and cause damage and injury.

1. Check that the auxiliary batteries are connected (in series or in parallel) so that their rated voltage is the same as the engine's system voltage.
2. First connect the red jump lead (+) to the auxiliary battery, then to the discharged battery. Then connect the black jump lead (–) to the auxiliary battery, then to a **spot a short distance from the discharged batteries**, for example at the main switch on the negative cable or at the negative cable's connection to the starter motor.
3. Start the engine.

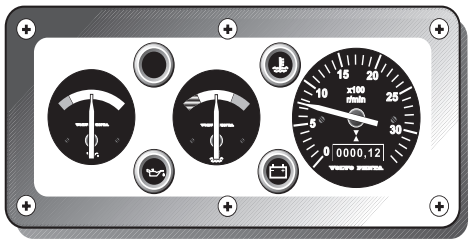
   ⚠ **WARNING!** Do not shift the connections when attempting to start the engine (spark risk) and do not lean over any of the batteries.
4. Remove the jump leads in exactly the opposite order to which you connected them.

   ⚠ **WARNING!** Do not under any circumstances move the normal leads to the standard batteries.

Operation

Correct operation is the key to fuel economy and engine service life. Always allow the engine to achieve normal operating temperature before running it at full power. Avoid opening the throttle too quickly and running the engine at high engine speeds.

⚠ **IMPORTANT!** An automatic shut-off for oil pressure and engine coolant temperature (ECT) must be installed during unattended operation where the Volvo Penta instrument box is **not** being used.



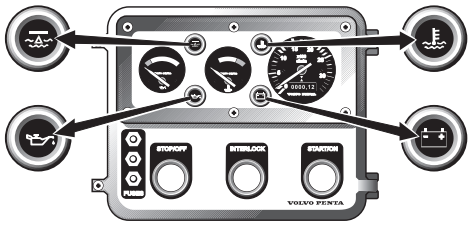
Checking instruments

Check the instruments directly after starting the engine and then at regular intervals while operating the engine. The needles should be within the green range.

Engine coolant temperature: 75–95°C (167–203°F)
420, 620 VE: 83–95°C (181–203°F)
520, 720 GE: 83–95°C (181–203°F)
520, 720, 721 VE: 87–102°C (189–216°F)

Oil pressure, engine at operating temperature: 300–500 kPa. At engine idle this is normally lower.

⚠ **IMPORTANT!** The lubricating oil level must be checked at least every eight hours if the engine is running continuously. See chapter “Maintenance, Lubricating system”.



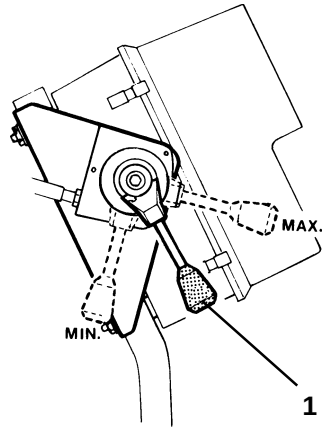
Alarms and fault indications

If the Volvo Penta instrument box is used, the following applies:

- If oil pressure is too low or engine coolant temperature (ECT) too high, the engine stops automatically and the acoustic alarm goes off.

  If the engine is equipped with an alarm separator, the relevant warning lamp also lights.
- If the engine coolant level is too low and the engine is equipped with an engine coolant level switch, the engine stops automatically and the acoustic alarm goes off. The warning lamp lights.
- If generator charging drops, the warning lamp lights.

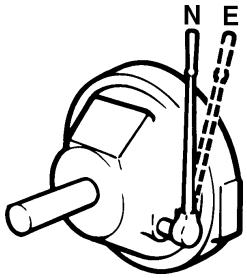
For other applications see the Instruction Manual for the relevant application.



Engine speed control

Power pack: The engine speed (RPM) is adjusted using the mechanical engine speed control (1). This is mounted on the instrument box.

Other engines: See the relevant instruction manual.



Disengageable clutch

The clutch is disengaged when the control lever is in position “**N**” and engaged when the lever is in position “**E**”.

⚠ **IMPORTANT!** The engine speed must not exceed 1000–1200 rpm during engagement and disengagement.

Operation at low loads

Avoid running the engine at idling speed or low loads for long periods. This can cause increased oil consumption and oil leakage from the exhaust manifold. (Oil passes the turbocharger seals and is drawn into the intake manifold with the charge air when turbocharger pressure is low.)

This leads to soot deposits on valves, piston crowns, exhaust outlets and the exhaust turbine.

At low loads the temperature of combustion is so low that fuel is not burnt up properly. This can lead to contamination of the lubricating oil with fuel and eventually leakage from the exhaust manifold.

In addition to normal inspections follow the points below to avoid operating problems caused by running the engine at low loads.

- Operate the engine at low loads as little as possible. (If the engine is tested without load each week, limit running time to approximately five minutes).
- Operate the engine at full load for approximately four hours once a year. This will burn off soot deposits in the engine and exhaust system.

Stopping the engine

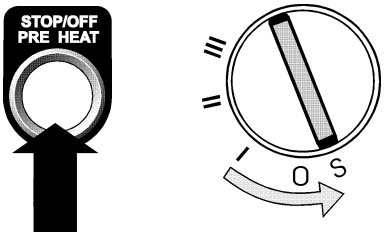
In the case of extended inactivity, the engine must be run to operating temperature at least once every 14 days. This prevents corrosion in the engine. If the engine will not be used for more than two months, inhibiting should be carried out: Refer to chapter “Shut down”.

⚠ **IMPORTANT!** If there is a risk of frost, the cooling system coolant must have sufficient antifreeze. See chapter “Maintenance, Cooling system”. A poorly charged battery may burst as a result of freezing.

Before stopping the engine

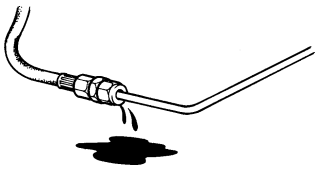
Let the engine run without load at 1300–1500 rpm for a few minutes before stopping. This will even out the engine temperature and prevent overheating.

⚠ **IMPORTANT!** This is especially important if the engine has been operated at high engine speeds and/or loads.



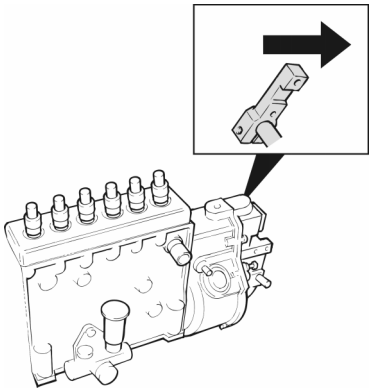
Stopping

- Disengage the engine (if possible).
- Press in the stop button and hold it depressed until the engine has stopped. Alternatively, turn the key to stop position “S”. Release the key when the engine has stopped.



After stopping the engine

- Inspect the engine and engine compartment for any leaks.
- Close the fuel cocks.
- Switch off the main switch if the engine will not be used for some time.
- Read off the operating hour counter. Carry out the required service according to the maintenance schedule.



Emergency stop

If the engine cannot be stopped normally, it can be stopped by moving the lever on the fuel injection pump backwards.

⚠ **WARNING!** Approaching or working on a running engine is dangerous. Watch out for rotating components and hot surfaces.

Maintenance schedule

To achieve maximum operating safety and service life, it is vital that the engine is regularly serviced. By following the service recommendations, engine quality is retained and unnecessary environmental damage avoided.

⚠ **WARNING!** Read the chapter on “Maintenance” carefully before starting service work. It contains instructions on how to carry out the work safely and correctly.

⚠ **IMPORTANT!** Service operations marked ☐ must be carried out by an authorised Volvo Penta Service workshop.

DAILY BEFORE STARTING FOR FIRST TIME

- Engine oil. Level checks [1] ..... page 27
- Coolant. Level checks ..... page 30
- Radiator. External check and cleaning ..... page 33
- Air filter indicator. Check [1, 2, 3] ..... page 23
- Leakage check. Engine ..... not shown

[1] When in continuous use the oil level should be checked every 8 hours.
[2] The air filter should be replaced when the gauge remains in the red field after the engine has been stopped.
[3] When operating in extremely dirty conditions special air filters must be used.

AFTER THE FIRST 100–200 OPERATING HOURS [1]

- ☐ Valve clearance. Check ..... not shown
- ☐ Injectors. Post tightening (50 Nm) ..... not shown

[1] 300 operational hours apply for TAD / TWD 1630 and 1631.

EVERY 50 HOURS

- Fuel pre-filter. Drain water ..... page 35
- Battery. Check electrolyte level ..... page 38
- Disengagement bearing. Lubricating [1] ..... page 45

[1] Applies to disengageable clutch when clutch operations exceed 15–20 operations per day. Otherwise every 400 hours.

EVERY 6 MONTHS

- Coolant filter. Replace [1] ..... page 33

[1] The filter should not be changed when replacing coolant.

EVERY 50-600 HOURS OR AT LEAST EVERY 12 MONTHS

- Engine oil and oil filter. Replace [1] ..... page 26–27
- Disengageable clutch. Lubricaton [2] ..... page 45
- Disengageable clutch. Adjustment [2] ..... page 45

[1] Variable replacement intervals depending on oil quality and fuel sulphur content. See page 26.
[2] Every 200 hour.

EVERY 400 HOURS (420–720, EVERY 500 HOURS)

- Drive belts. Checking and adjusting ..... not shown
- Fuel tank (sludge collector). Drain ..... not shown

EVERY 500 HOURS

- Coolant (Anti-corrosion mixture). Addition [1] ..... page 28–29

[1] Add half a litre of anti-corrosion agent if the cooling system is filled with an anti-corrosion mixture.

EVERY 800 HOURS (420–720, EVERY 1000 HOURS)

- Fuel filter. Replace ..... page 34
- Fuel pre-filter. Replace ..... page 35
- Air lines. Leakage check. ..... page 23

EVERY 1200 HOURS (420–720, EVERY 1500 HOURS)

- ☐ Valve clearance. Adjustment ..... not shown

EVERY 2000 HOURS OR AT LEAST EVERY 12 MONTHS

- Air filter for air compressor. Replace ..... page 45
- Charge air cooler. Cleaning (TAD-engines) [2] ..... page 33
- Coolant (Anti-corrosion mixture). Replace ..... page 28–29

EVERY 2400 HOURS

- ☐ Injectors. Check [3] ..... not shown
- ☐ Turbocharger. Check ..... not shown
- ☐ Engine and equipment. General check ..... not shown

EVERY 5000 HOURS OR AT LEAST EVERY TWO YEARS

- Coolant (Glycol mixture). Replace [1] ..... page 28–29

[1] If the engine is equipped with coolant filters, extended intervals apply between replacement. See pages 28-33.

[2] When operating in extremely dirty conditions, must cleaning be carried out often.

[3] 420–721 Every 3000 hours.

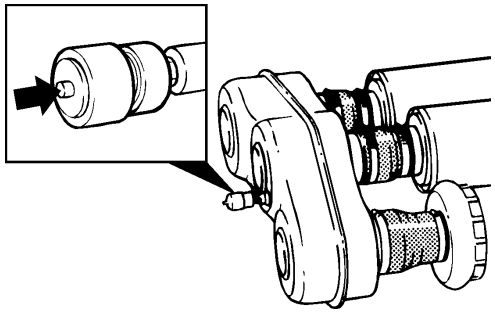
Maintenance

This chapter describes how to carry out the above maintenance. Read the instructions carefully before starting work. Maintenance intervals are contained in the chapter above. Maintenance schedule

⚠ **WARNING!** Read the safety precautions for maintenance and service in the chapter: Safety Information, before starting work.

⚠ **WARNING!** Unless otherwise specified all maintenance and service must be carried out with the engine stopped. Immobilise the engine by removing the ignition key, turning off the power supply with the main switch. Approaching or working on a running engine is dangerous. Watch out for rotating components and hot surfaces.

Engine, general



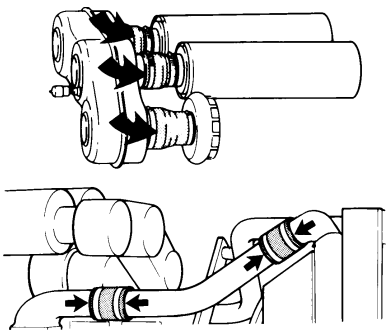
Air filter. Check / replace.

The air filter should be replaced when the indicator remains in the red field when the engine has stopped. Reset the gauge after replacing the indicator by pressing the button.

NOTE! The filter should not be touched until the indicator displays the red field. Scrap the old filter. Do not clean or reuse.

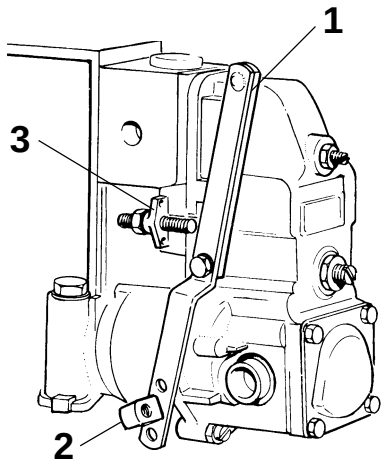
⚠ **IMPORTANT!** In continuous use the air cleaner should be checked every 8 hours.

When running in extremely dirty environments, coal mines and quarries for example, special air cleaners are required (not available from Volvo Penta).



Air lines. Leakage check.

Check the air lines for cracks or other damage. Replace if required. Checking all hose clamps.

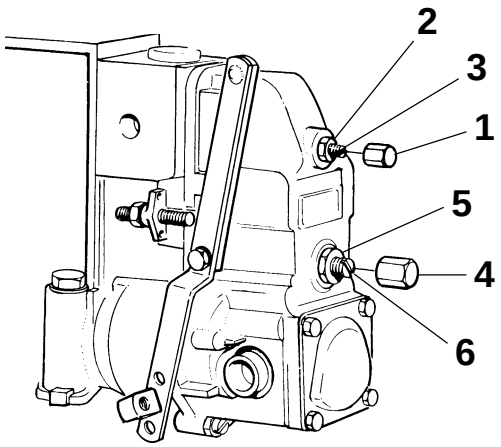


Idling speed. Adjustment

First check that the air filter is not clogged and that the throttle arm (1) on the fuel injection pump is against the idling speed stop (2) when the throttle mechanism is in idling position. Check also that the throttle arm presses against the max stop (3) when the throttle control is in the wide open throttle (WOT) position. Adjust the control if necessary.

Idling speed must only be checked and adjusted when the engine has reached normal operating temperature. For the correct idling speed, see the “Technical data” chapter.

⚠ **WARNING!** Approaching or working on a running engine is dangerous. Watch out for rotating components and hot surfaces.

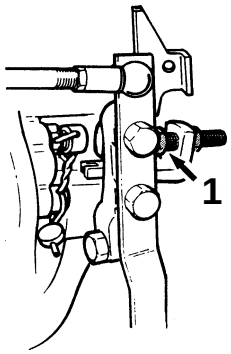


RSV governor

1. Allow the engine to operate at low idling speed.
2. If necessary, adjust the engine speed by removing the domed nut (1), slackening off the locknut (2) and adjusting the engine speed with the screw (3).

If the engine speed is uneven, the idle speed damping should be adjusted as follows:

1. Remove the domed nut (4) and slacken off the locknut (5). Carefully turn the damping screw (6) clockwise until the engine speed stabilises.
2. Check that the high idling speed has not changed. If it has changed, the damping screw (6) has been screwed in too far.
3. Lock the damping screw (6) and install the domed nut (4) when the adjustment is complete.



RQV, RQ governor

1. Allow the engine to operate at low idling speed.
2. If necessary, adjust the engine speed with the screw for low idling speed (1).

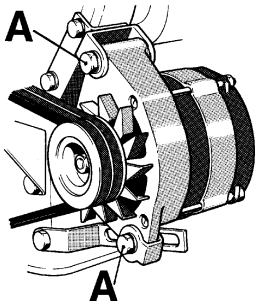
GAC governor

To adjust the idling speed on Generating set engines with GAC governor, refer to the separate documentation supplied with the GAC equipment.

Governor (Heinzmann)

The governors of the T(A)D 420–721 GE series engines are mechanical variable-speed governors with centrifugal measuring element of M/s Heinzmann.

All governor settings may only be conducted by trained specialists on a specifically laid out governor test bench.



Drive belts. Checking and adjusting

Inspection and adjustment should be carried out after running the engine when the belts are warm.

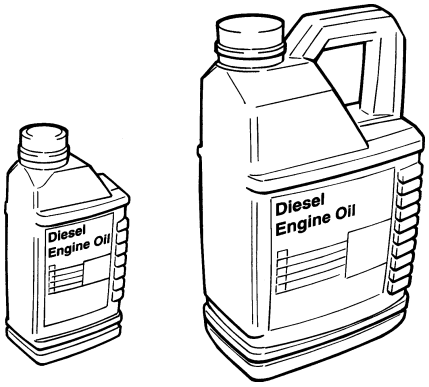
Undo the screws (A) before tensioning the generator belts. It should be possible to depress the belts 10 mm between the pulleys. Worn belts which work in pairs should be replaced at the same time.

The fan belts have an automatic belt tensioner and do not need adjusting. However, the condition of the belts must be checked. Replace if required.

Lubrication system

Oil change intervals can vary between **40 and 500 hours** depending on the quality of the lubricant and the sulphur content of the fuel. **Note that the oil change interval should never be longer than 12 months.**

If longer intervals are required than those stated in the table below, the condition of the oil must be tested regularly by the oil manufacturer.

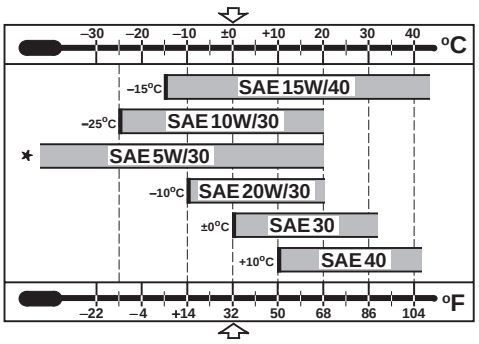


Oil grade	Fuel sulphur content, % by weight		
	up to 0.5 %	0.5 – 1.0 %	more than 1.0 %
	Oil change interval: When running, first achieved		
VDS–2	**400** hours or 12 months.	**200** hours or 12 months.	**100** hours or 12 months.
(T(A)D420–721)	**500** hours or 12 months.	**250** hours or 12 months.	**125** hours or 12 months.
VDS	**300** hours or 12 months.	**150** hours or 12 months.	**75** hours or 12 months. [1]
(T(A)D420–721)	**500** hours or 12 months.	**250** hours or 12 months.	**125** hours or 12 months. [1]
ACEA E3, E2	**150** hours or 12 months.	**175** hours or 12 months.	**40** hours or 12 months. [1]
API CD, CE, CF, CF–4, CG–4			
(T(A)D420–721)	**500** hours or 12 months.	**250** hours or 12 months.	**125** hours or 12 months. [1]

NOTE! Mineral-based and semi and fully synthetic oils may be used as long as they fulfil the above requirements.
If the 6 and 7-litre engines are equipped with low profile type oil pans, the oil change interval must be halved.

[1] Oil with TBN 14–20 must be used.

VDS = Volvo Drain Specification
ACEA = Association des Constructeurs Européenne d'Automobiles
API = American Petroleum Institute



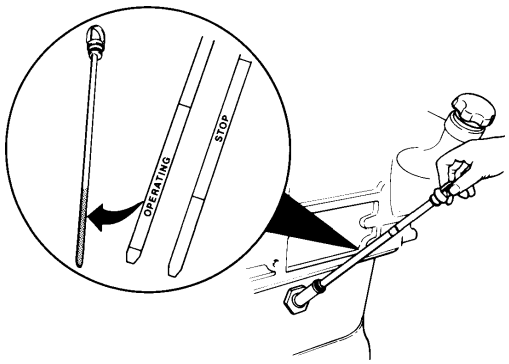
Viscosity

In a stable outside temperature viscosity should be selected from the table alongside.

*Refers to synthetic or semi-synthetic oil.

Oil change volumes

See chapter "Technical Data".



Oil level. Check

Ensure that the level lies between MIN and MAX markings.

⚠ **IMPORTANT!** In continuous use the oil level should be checked every 8 hours.

When checking the oil level on a stationery engine, read off the side of the dip stick marked “STOP” (**at earliest 3 minutes after engine stop**).

A check can also be carried out when the engine is running. Read off the dip stick side marked “OPERATING”. (Does not apply for engines: TAD/TWD740GE, TD/TAD420–721, TAD1030GE)

⚠ **WARNING!** Approaching or working on a running engine is dangerous. Watch out for rotating components and hot surfaces.

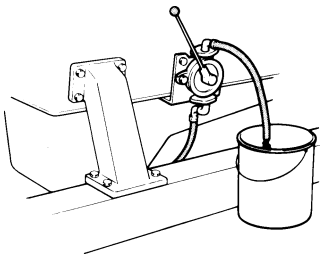
Oil and oil filters. Replace

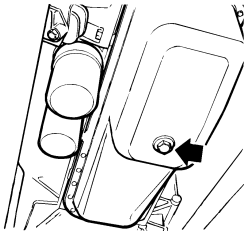
Always follow the recommended oil change interval and always replace the oil filter at the same time. On stationary engines do **not** remove the bottom plug. Use an oil draining pump to suck up the oil.

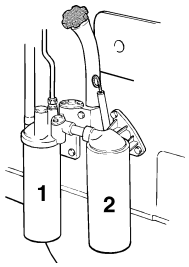
1. Clean the oil filter bracket thoroughly to avoid dirt ingress when the new filter/s are installed.
2. Run engine to normal operating temperature.

   ⚠ **WARNING!** Hot oil and hot surfaces can cause burns.
3. Remove the bottom plug. Drain out engine oil.
4. Install the bottom plug together with a new gasket.
5. Remove the filters (1) and the bypass filter (2).where applicable. Check that the gaskets do not remain on the engine.
5. Fill the new filters with engine oil and spread oil on the gaskets. Screw the filter into place by hand until the gasket touches. Then twist a further half turn. **No more!**
6. Top up oil to correct level. **Do not fill above the MAX level.**
7. Start the engine and let it idle. Check that the oil pressure is normal.
8. Stop the engine. Check that there is no oil leakage around the filter. Top up if required.

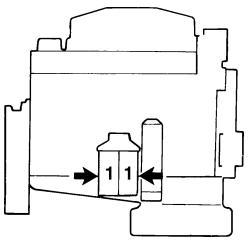
Collect the old oil and oil filter and dispose of them at a proper disposal point.



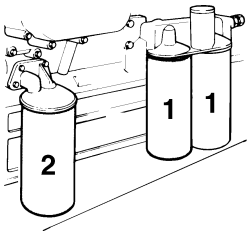




6, 7 lit.



10, 12 lit.



16 lit.

Cooling system

The cooling system must be filled with a coolant that protects the engine against internal corrosion and from freezing if the climate requires it. **Never use water alone.**

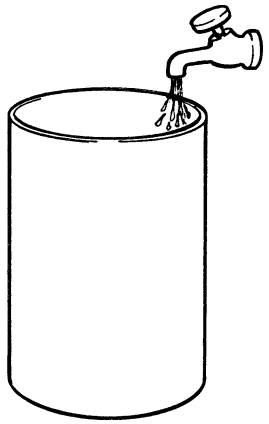
The anti-corrosion additives become less effective over time. The coolant must be therefore be replaced. On the condition that Volvo Penta coolant recommendations are followed, the following replacement intervals apply.

Coolant	Replacement intervals
Volvo Penta coolant (glycol mixture) **with** coolant filter	Every 4 years or at least every 10.000 hours
Volvo Penta coolant (glycol mixture) **without** coolant filter	Every other year or at least every 5000 hours
Volvo Penta anti-corrosion agent	Every year

⚠ **IMPORTANT!** The cooling system must be flushed through when the coolant is replaced. See under heading “Cooling system Flushing”. The coolant filter (accessory) must not be changed at the same time as the coolant. It must be replaced 6 months after the first coolant replacement and then every six months. See under heading “Coolant filter. Replace”.

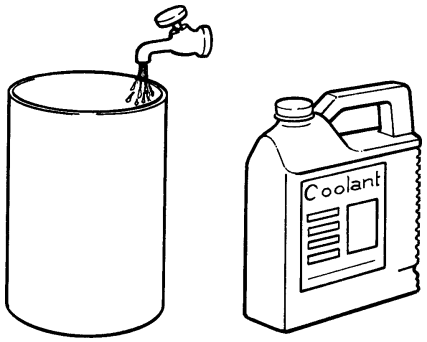
Coolant. General

⚠ **IMPORTANT!** To avoid blockage and / or damage caused by freezing / corrosion to the engine and cooling system the following recommendations must be followed:



Water quality
Always use clean water which fulfils the requirements in ASTM D4985. If these requirements are not fulfilled, the cooling system will become blocked again with diminished cooling effect as a direct result. If water cannot be cleaned so these requirements are fulfilled, distilled water or ready mixed coolant **must** be used.

Total fixed particles	< 340 ppm
Total hardness	< 9.5° dH
Chloride	< 40 ppm
Sulphate	< 100 ppm
pH value	5.5–9
Silicon	< 20 mg SiO_2 per l
Iron	< 0.10 ppm
Manganese	< 0.05 ppm
Conductivity	< 500 uS per cm
Organic content, COD_{Mn}	< 15mg $kMnO_4$ per l



If there is a risk of freezing
Use a mixture of 50% Volvo Penta antifreeze (glycol) and 50% pure water (according to ASTM D4985). This mixture will protect against freezing to a temperature of approx. –40°C and should be used all year round.

⚠ **IMPORTANT!** Even if the temperature is never as low as –40°C, the above mixture ratios must be used. This is to ensure maximum anti-corrosion protection.

Mix the glycol with the water in a separate container before filling the cooling system.

⚠ **WARNING!** Glycol is harmful to health (dangerous if ingested).

⚠ **IMPORTANT!** Alcohol must not be used in the cooling system.

If there is no risk of freezing
When there is never a risk of freezing, water may (according to ASTM D4985) be used as coolant with the addition of the Volvo Penta anti-corrosion agent.

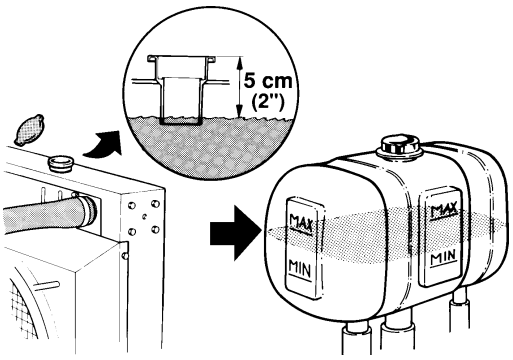
However, we recommend that a mixture of Volvo Penta glycol and pure water is used all year, regardless of the climate.

Mixture ratio 1:30. Run the engine to operating temperature after filling. This is to allow the additive to work as efficiently as possible.

If the operation time exceeds 500 hours per annum, the anti-corrosion agent for the coolant must be complemented with ½ litre anti-corrosion agent every 500 hours.

⚠ **WARNING!** Anti-corrosion agents are harmful to health (dangerous if ingested).

⚠ **IMPORTANT!** Never mix antifreeze (glycol) and anti-corrosion agents. The two combined can produce foam and drastically reduce the coolant's effectiveness.



Coolant. Checking and topping up

⚠ **WARNING!** Except in an emergency, do not open the engine coolant system filler cap when the engine is still hot. Steam or hot coolant may spray out.

Check the coolant level daily before starting. Top up coolant if necessary. Fill to 5 cm below the filler cap sealing surface or between the MIN and MAX markings if a separate expansion tank is installed.

⚠ **IMPORTANT!** When topping up, use the same coolant mixture as is already in the cooling system.

Filling an empty system
Check that all the drain cocks are closed. Opening the bleed cock(s). 4–7 litre engines are self-airing. Therefore they have no bleed cock.

The locations of the drain and bleed cocks are displayed on the next page.

The engine must be stopped when filling. Fill slowly so that air is able to stream out through the bleed cock(s) and the filler opening.

If a heater system is connected to the engine's cooling system, the heater control valve must be opened and the unit vented during filling.

Fill with coolant to the correct level. **The engine must not be started until the system has been vented and completely filled.**

Start the engine and run it until the thermostat opens (this takes approximately 20 minutes). After start, open any bleed cocks briefly. This releases any trapped air. Check the coolant level and top up if necessary.

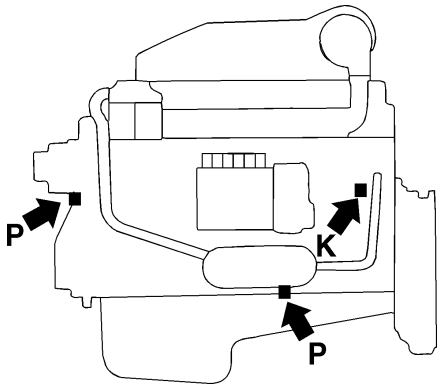
Coolant. Draining

Before draining the coolant, the engine must be stopped and the filler cap unscrewed.

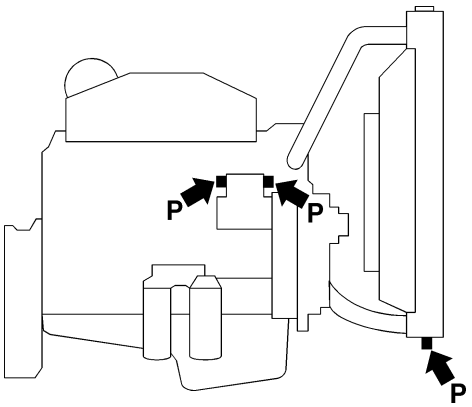
⚠ **WARNING!** Except in an emergency, do not open the engine coolant system filler cap when the engine is still hot. Steam or hot coolant may spray out.

Open the drain cocks and remove the drain plugs (location is shown below). Unscrew and remove the coolant filter if one is installed.

⚠ **IMPORTANT!** There may be deposits inside the cocks/plugs. These must be removed. Check that all the coolant has drained out.



Drain/bleed cocks. Location



4–7 litre engines

Drain cock (K):

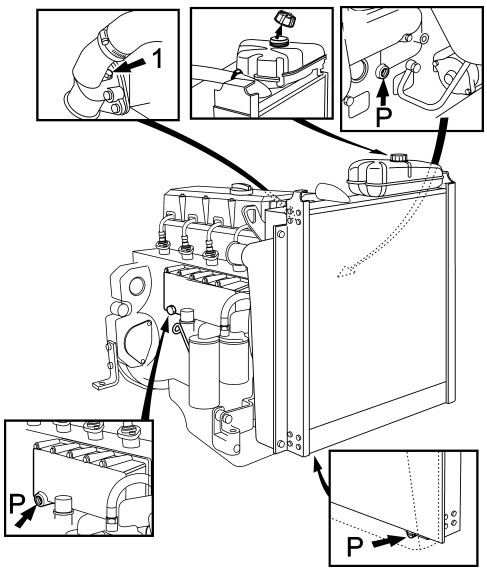
– on the left-hand side of the cylinder block, rear section (Does not apply for engine 420–721.)

Drain plugs (P):

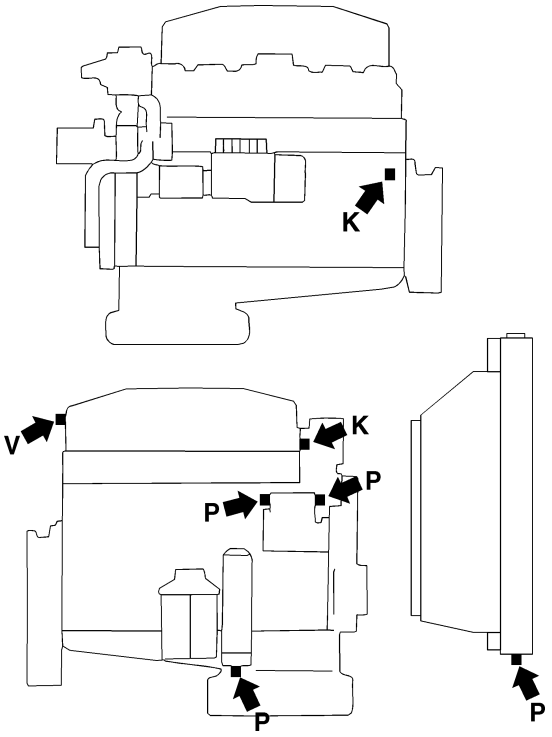
– under the radiator
– beside cyl. 3 (TD/TAD420–721)
– under the coolant pump (Does not apply for 420–721)
– under the oil cooler
– 2 (at front and rear) on the air compressor, if installed (accessory) (Does not apply for 420–721)
– remove bottom radiator hose (Does not apply for 420–721)

Bleed cock (1):

– The engines are self-airing. Therefore they have no vent cock. (Does not apply for 420–721)
– On the coolant pump (TD/TAD420–721)



TD/TAD420–721



10–12 litre engines

Drain cocks (K):

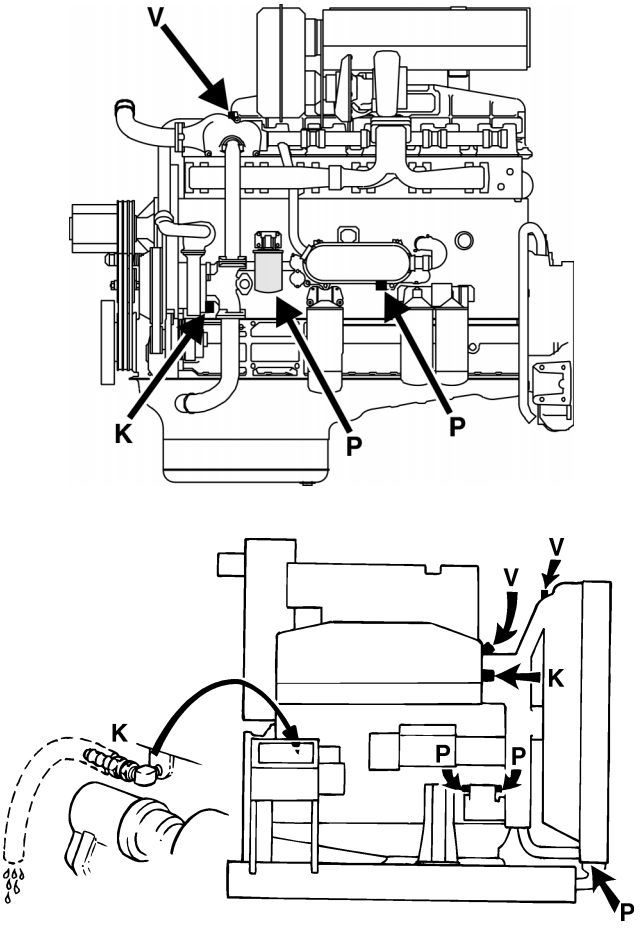
– at the rear of the left-hand side of the cylinder block
– charge air cooler, front (only TWD)

Drain plugs (P):

– under the radiator
– under the oil cooler
– 2 (at front and rear) on the air compressor, if installed (accessory)

Bleed cock (V):

– charge air cooler, rear (only TWD)



16 litre engines

Drain cocks (K):

– on the cylinder block above the starter motor
– under the rear edge of the coolant pump
– Charge air cooler, front end (only TWD)

Drain plugs (P):

– under the radiator
– under the oil cooler
– 2 (at front and rear) on the air compressor, if installed

Coolant filter:

– behind the coolant pump

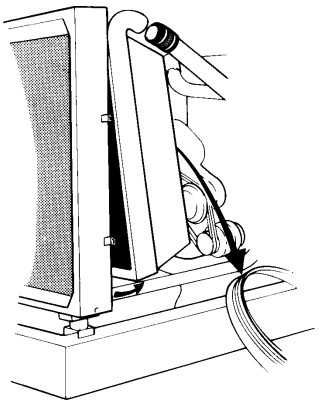
Bleed cock (V):

– TWD1630: Charge air cooler, at front
– TWD1630, TAD1630/1631: Radiator hose connection
– TAD1630/1631: Thermostat housing

Cooling system. Flushing

Cooling performance is reduced by deposits in the radiator and cooling channels. The cooling system must therefore be flushed through when the coolant is replaced.

1. Drain the coolant as above.
2. Insert a hose in the radiator filler opening and rinse out with freshwater until the water which runs out is completely clear.
3. Close the drain cock and plugs. Fill with new coolant according to the instructions in the section “Coolant. Checking and topping up”

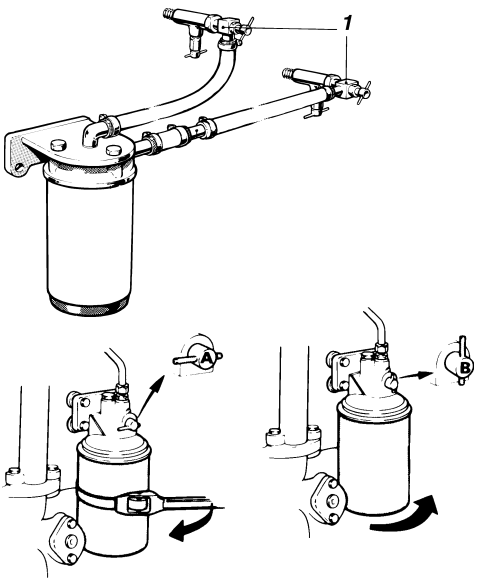


Cooler (charge air cooler TAD). External cleaning

Remove the required guards to access the radiator.

Clean with water and a mild cleaning agent. Use a soft brush. Take care not to damage the cooling vanes. Reinstall components

⚠ **IMPORTANT!** Do not use a high pressure hose.



Coolant filter. Replace

The coolant filter is only standard on 16-litre engines. For other engines, it is available as an optional extra. It has the task of filtering the coolant and providing anti-corrosion protection.

⚠ **IMPORTANT!** To prevent overdoses of anti-corrosion protection subsequently causing a blockage, the filter should **not** be replaced at the same time as the coolant, but 6 months after the first coolant replacement and then every 6 months.

Close the cocks (1) or turn the cock to position “A” (16-litre). Remove the filter with a suitable filter puller. Dampen the gasket and screw on new filter by hand. Tighten by 1/2 turn once the gasket is tight. Open the cocks (1) or turn the cock to position “B” (16-litre).

Fuel injection system

Only use recommended quality fuels according to the specifications below Always observe strict cleanliness when refuelling and working on the fuel injection system.

All work on the engine injection pump or injectors must be carried out at an authorised workshop. **If the injection pump lead seal is broken, all warranties are invalid.**

⚠ **WARNING!** Fire risk. When carrying out work on the fuel system, make sure the engine is cold. A fuel spill onto a hot surface or an electrical component can cause a fire. Store fuel-soaked rags so that they cannot cause a fire.

Fuel specification

Fuel must meet national and international standards for marketed fuel, for example:

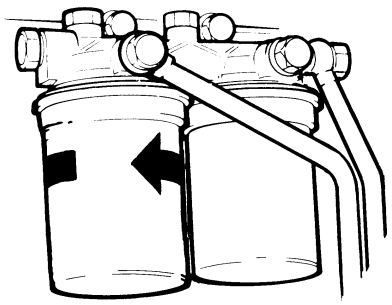
EN590 (with national environmental and cold weather standards)

ASTM-D975-No 1-D, 2-D

JIS KK 2204

Sulphur content: According to relevant national statutory requirement. If the sulphur content exceeds 0.5 % by weight the **oil change interval** should be changed, see section “Lubricating system”.

Fuels with extremely low sulphur contents (“urban diesel” in Sweden and “city diesel” in Finland) may cause a drop in output of 5% and an increase in fuel consumption of 2–3%.



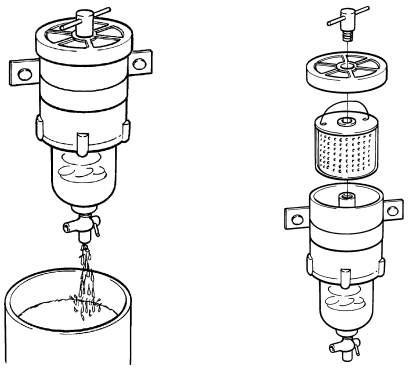
Fuel filter. Replace

Cleanliness! No dirt or contaminants may enter the fuel injection system.

⚠ **WARNING!** Fuel filter replacement should be carried out on a cold engine to avoid the risk of fire caused by fuel spilling onto hot surfaces.

Remove the filters. Moisten the new filter gasket with a little oil. Screw the filter into place by hand until the gasket touches. And then a further half turn **but no more!** Bleed fuel system. **Take the old filter to a suitable disposal point.**

Start the engine and check for leaks.



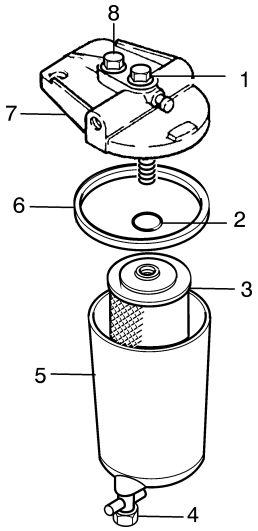
Fuel pre-filter. Drain water (standard on 420–721)

The fuel pre-filter is an optional extra. Position a container under the fuel filter. Drain off water and contaminants using the cock/plug at the bottom.

⚠ **IMPORTANT!** Wait a few hours after the engine has been turned off before draining the filter.

Cleaning: (Engines 420–721)

- Close fuel stopcock.
- Place the fuel pan beneath the preliminary fuel filter.
- Remove drain plug 4 and drain off fuel.
- Unscrew clamping screw 1, remove filter housing 5 with filter insert 3.
- Clean sealing surface of the filter bracket 7 and filter insert housing 5 of any dirt.
- Insert new sealing ring 6 and filter insert 3 (change as necessary).
  – Push the filter insert up to approx. 3 cm over the edge of the housing onto the guide in the filter housing 5.
- Press filter housing 5 with filter insert 3 and sealing ring 6 against the filter console 7 and screw into place with clamping screw 1 (tightening torque 25 Nm).
  Note: it must be possible to push the upper seal 2 on filter insert 3 over the guide bracket on filter console 7.
- Tighten drain plug 4.
- Open fuel stopcock.
- Check for leaks after the engine has been started.



Fuel pre-filter. Filter insert replacement

Close fuel cock at the fuel tank. Position a container under the fuel filter.

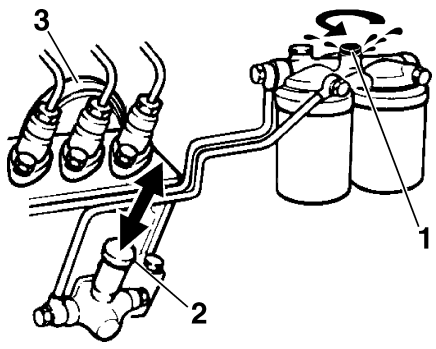
Unscrew the screw (1) to remove the cover. Replace insert and reinstall cover. Open fuel cock. Bleed fuel system. **Take the old filter to a suitable disposal point.**

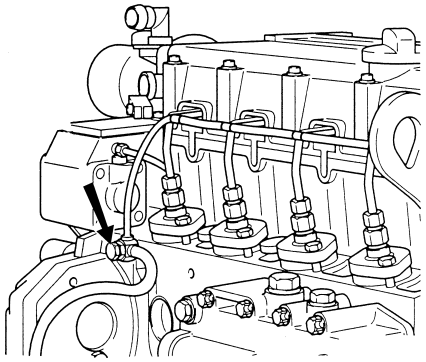
Start the engine and check for leaks.

NOTE! Engines 420–721 have a fuel pre-filter that is possible to clean.

Changing

- Replace defective filter insert 3.





TD/TAD520/720

Fuel system Venting

The fuel system must be vented after fuel filters have been replaced or after refilling the fuel tank after it has been run dry.

Venting engines with stop solenoid/fuel shut-off valve connected to supply voltage at stop:

Ensure that the engine is in operational mode. Open the bleed screw (1). Pump with hand pump (2) until fuel containing no air flows out. Close screw while fuel is flowing out.

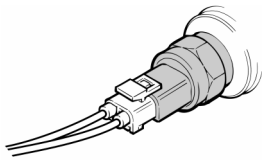
Then pump a further 15–20 times. Check for leaks.

NOTE! For engines equipped with a fuel shut-off valve, the fuel injection pump often requires venting as well. This is done by slackening off the fuel injection pump pressure equaliser (3) (27 mm narrow U wrench). Pump with hand pump (2) until fuel containing no air flows out.

Engines 420–721:
Open the air-venting plug in the overflow valve. (See fig.) Crank the engine on the starter motor or use the manual feedpump (optional equip.) until the fuel flow is free from air. Close the plug while the fuel is still flowing.

NOTE! Do not loosen the injectors delivery pipes.

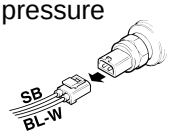
Venting engines with fuel shut-off valve connected to supply voltage during operation:



Is there “automatic stop in the event of too low oil pressure” with a Volvo Penta oil pressure switch? When the engine is off, this switch is closed (“Nc”- Normally closed).

Yes

Disconnect the connector at the oil pressure switch.
SB= black
BL-W= blue-white



Is the engine equipped with a Volvo Penta instrument box?

Yes

Engines with a Volvo Penta instrument box

1. If there is a coolant level alarm – check the level. If the level is too low, the level alarm stops the engine.
2. Briefly press the “Starter button”. The instrumentation is now activated and the charge lamp lights. If there is a coolant level alarm: Hold in the “Interlock button” for approximately 4 seconds.
3. Vent the fuel system according to the instructions on the previous page.
4. Press the “Stop button”
5. Reconnect the connector
6. The engine is now operational

No

Is there “automatic stop in the event of too low oil pressure” with a non-Volvo Penta oil pressure switch that is open when the engine is off. (“No” = Normally open)

Yes

Short-circuit the connector for the oil pressure switch with a loop.

No

Engines with ignition switch

1. Turn the ignition switch to operating position / ignition. In Volvo Penta ignition switch position 1 (15+)
2. The solenoid valve is now activated for operation (not stop position)
3. Vent the fuel system according to the standard procedures (see the previous page).
4. The engine is now operational

Electrical system

⚠ **WARNING!** Always stop the engine and break the current using the main switch before working on the electrical system. Isolate battery charger, or other accessories mounted on the engine.

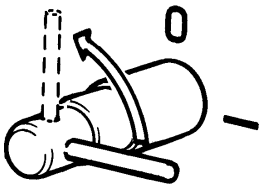
NOTE! NO ELECTRICAL SYSTEM AVAILABLE FOR ENGINES 420–721.

Fuses

The engine has automatic fuses located in the junction box. The fuses break the current when there is an overload in the electrical system.

If the engine cannot be started or the instruments stop operating during operation, the fuse may have tripped. Reset the fuse by pressing on the button on the fuse.

⚠ **IMPORTANT!** Always investigate the cause of an overload before resetting the fuse!



Main switch

The main switch must never be turned off before the engine has stopped. If the circuit between the generator and the battery is cut off when the engine is running the generator can be seriously damaged.

⚠ **IMPORTANT!** Never break the circuit with the main switch while the engine is running.

Electrical connections

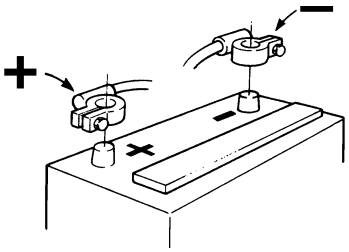
Also check that all electrical connections are dry and free of oxidation and that there are no loose connections. If necessary, spray these connections with a water-repellent spray (Volvo Penta Universal oil).

Battery. Maintenance and care

⚠ **WARNING!** Risk of fire and explosion. Never allow an open flame or electric sparks near the battery or batteries.

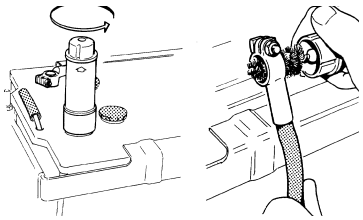
⚠ **WARNING!** Never mix up battery positive and negative terminals. This may cause sparks and an explosion.

⚠ **WARNING!** The battery electrolyte contains extremely corrosive sulphuric acid. Protect your skin and clothes when charging or handling batteries. Always use protective goggles and gloves. If battery electrolyte comes into contact with unprotected skin, wash off immediately using plenty of water and soap. If battery acid comes into contact with the eyes, flush immediately with plenty of water and obtain medical assistance without delay.

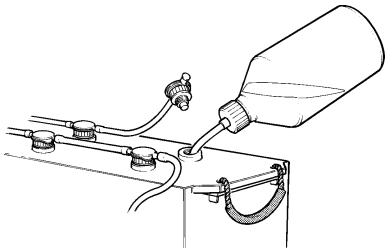


Connecting and disconnecting
First connect the red battery lead + to the battery + terminal. Then connect the black battery lead – to the battery – terminal.

When disconnecting the battery, disconnect the – lead (black) first and then the + lead (red).



Cleaning
Keep batteries dry and clean. Oxidation or dirt on the battery and battery terminals can cause short-circuits, voltage drop and discharge especially in damp weather. Clean the battery terminals and leads to remove oxidation using a brass brush. Tighten the cable terminals well and grease them with terminal grease or petroleum jelly.



Topping up
The electrolyte should be 5 – 10 mm over the plates in the battery. Top up using **distilled water** if necessary. Charge the battery after topping up for at least 30 minutes by running the engine at fast idle. NOTE! Certain maintenance-free batteries have special instructions which must be followed.

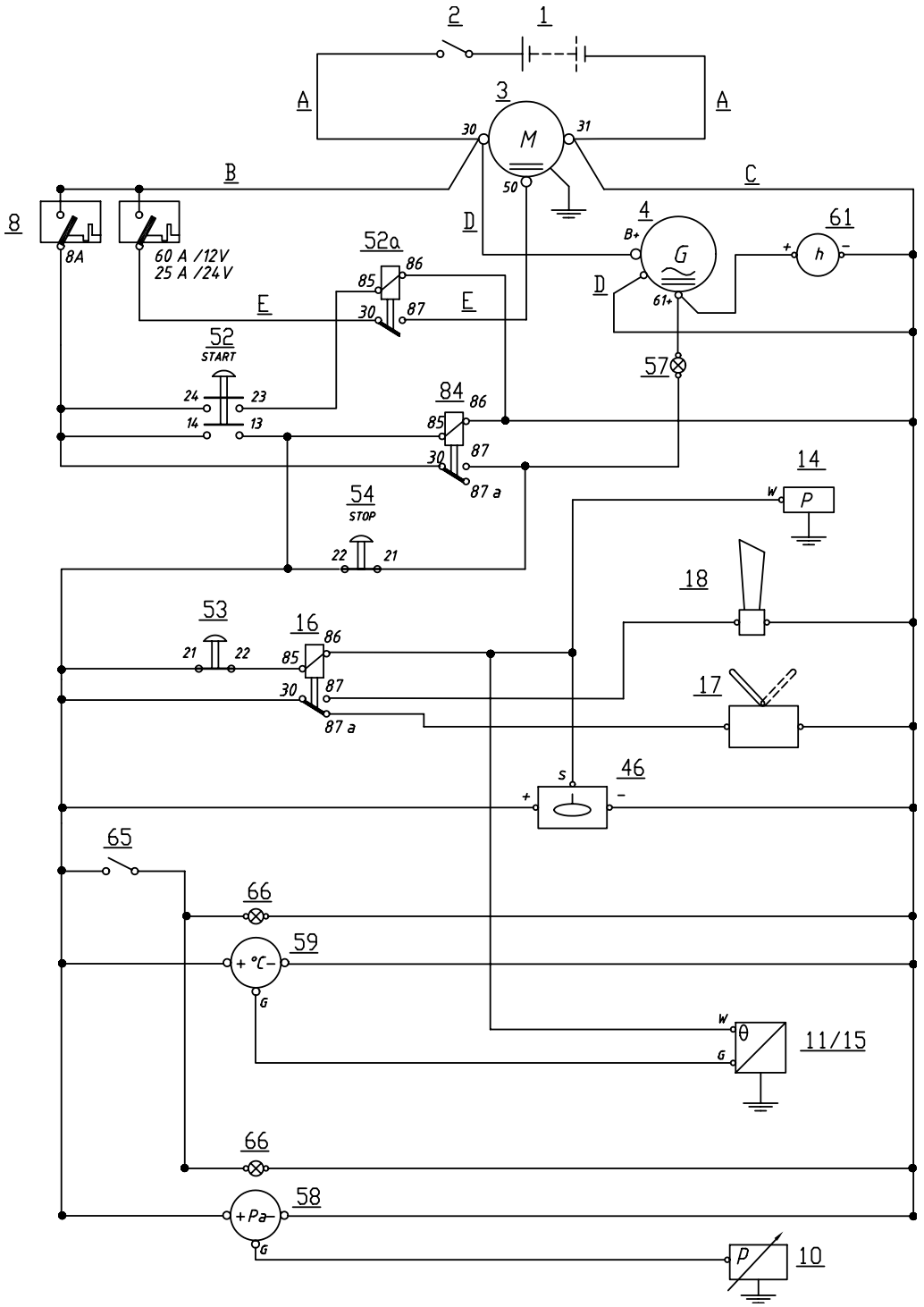
Wiring diagram, proposal (TD/TAD520, 720 engines)

1. Battery
2. Main switch
3. Starter motor
4. Alternator
8. Fuse
10. Oil pressur sender
11. Temp sender/switch engine
14. Oil pressure switch
15. Temp sender/switch engine
16. Relay
17. Stop solenoid
18. Signal horn
46. Water level switch (720-models)
52. Start button
52a. Start relay
53. Interlocking button
54. Stop button
57. Charging control lamp
58. Oil pressure gauge
59. Water temperature gauge
61. Hourmeter
65. Switch for instrument light
66. Instrument light
84. Holding current relay

Cable area

	12V	24V
A.	90 mm^2	70 mm^2
B.	10 mm^2	2.5 mm^2
C.	2.5 mm^2	2.5 mm^2
D.	10 mm^2	6 mm^2
E.	6 mm^2	2.5 mm^2

Not specified cable area 1 mm^2

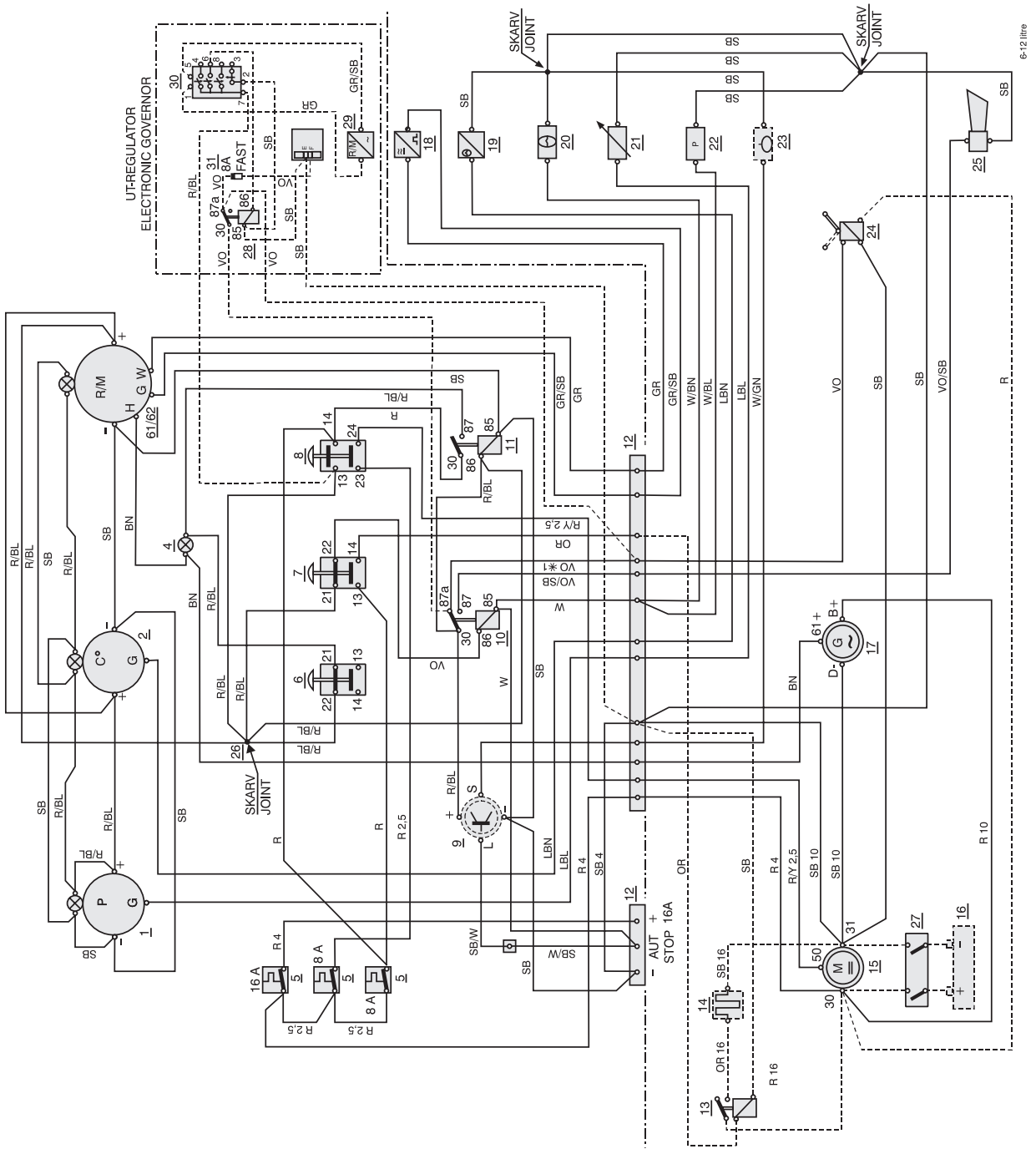


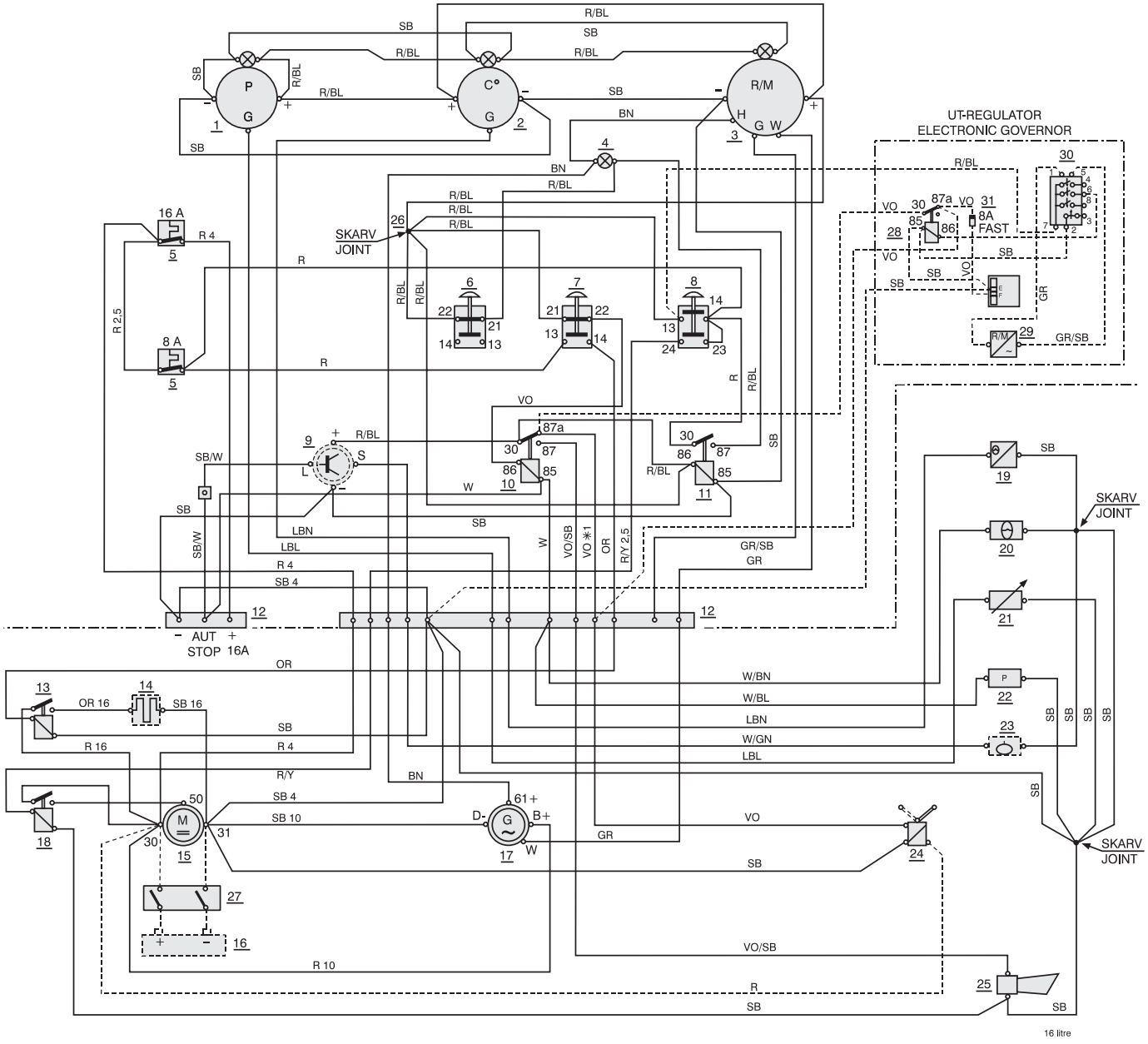
Wiring diagram (6–12 litre engines)

"Not for TD/TAD720"

1. Oil pressure gauge
2. Engine coolant temperature gauge
3. Tachometer with built-in hours run meter
4. Charge warning lamp
5. Semi-automatic fuses (manual resetting)
6. Stop button
7. Interlock
8. Starter button
9. Relay for engine coolant level switch (accessory)
10. Relay for engine coolant temperature (ECT) switch, oil pressure switch
11. Holding current relay (operating current and instruments)
12. Terminal block (auxiliary power output, with 16A fuse, output for automatic stop, closes in the event of a fault).
13. Relay for starter element
14. Starter element
15. Starter motor
16. Batteries
17. Generator
18. Engine speed (rpm) sensor
19. Engine coolant temperature sensor
20. Engine coolant temperature (ECT) switch (normally open)
21. Oil pressure sensor
22. Oil pressure switch (normally open)
23. Engine coolant level switch (accessory)
24. Stop solenoid (current bearing during operation)
25. Horn
26. Joint splice
27. Main switch
28. Engine speed (rpm) sensor
29. Relay
30. Engine speed governor
31. Fuse

*1 Remove when setting the UT governor





Cable areas in mm² (indicated after the colour codes in the wiring diagrams).

If no cable area is stated, the default is 1.5 mm²

Cable colour

BL = Blue
LBL = Light blue
BN = Brown
LBN = Light brown
GN = Green
GR = Grey
OR = Orange
VO = Violet
R = Red
SB = Black
W = White
Y = Yellow

The area of the battery leads depends on the location of the battery.

Distance starter motor – batteries

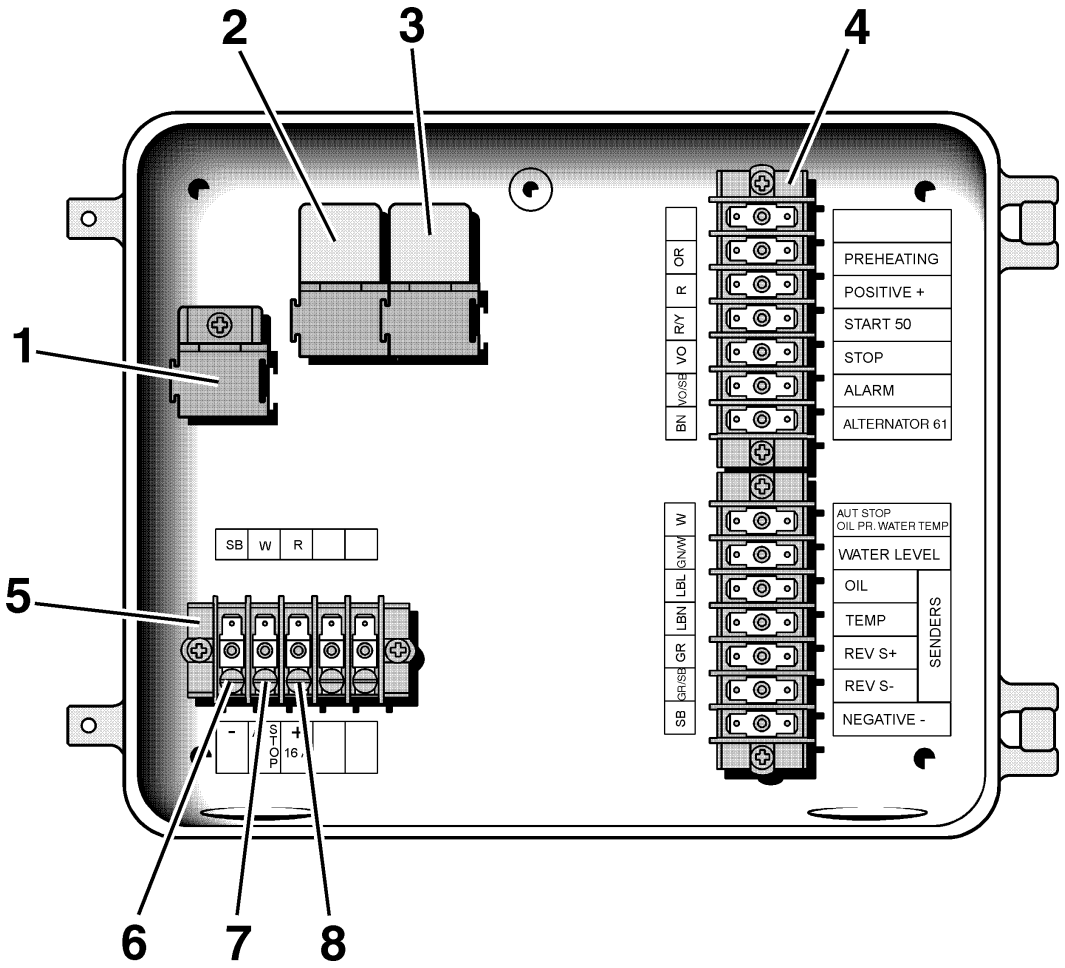
max. 2 m, area = 70 mm²
max. 4 m, area = 120 mm²

Conversions mm² / AWG*

*American Wiring Gauge

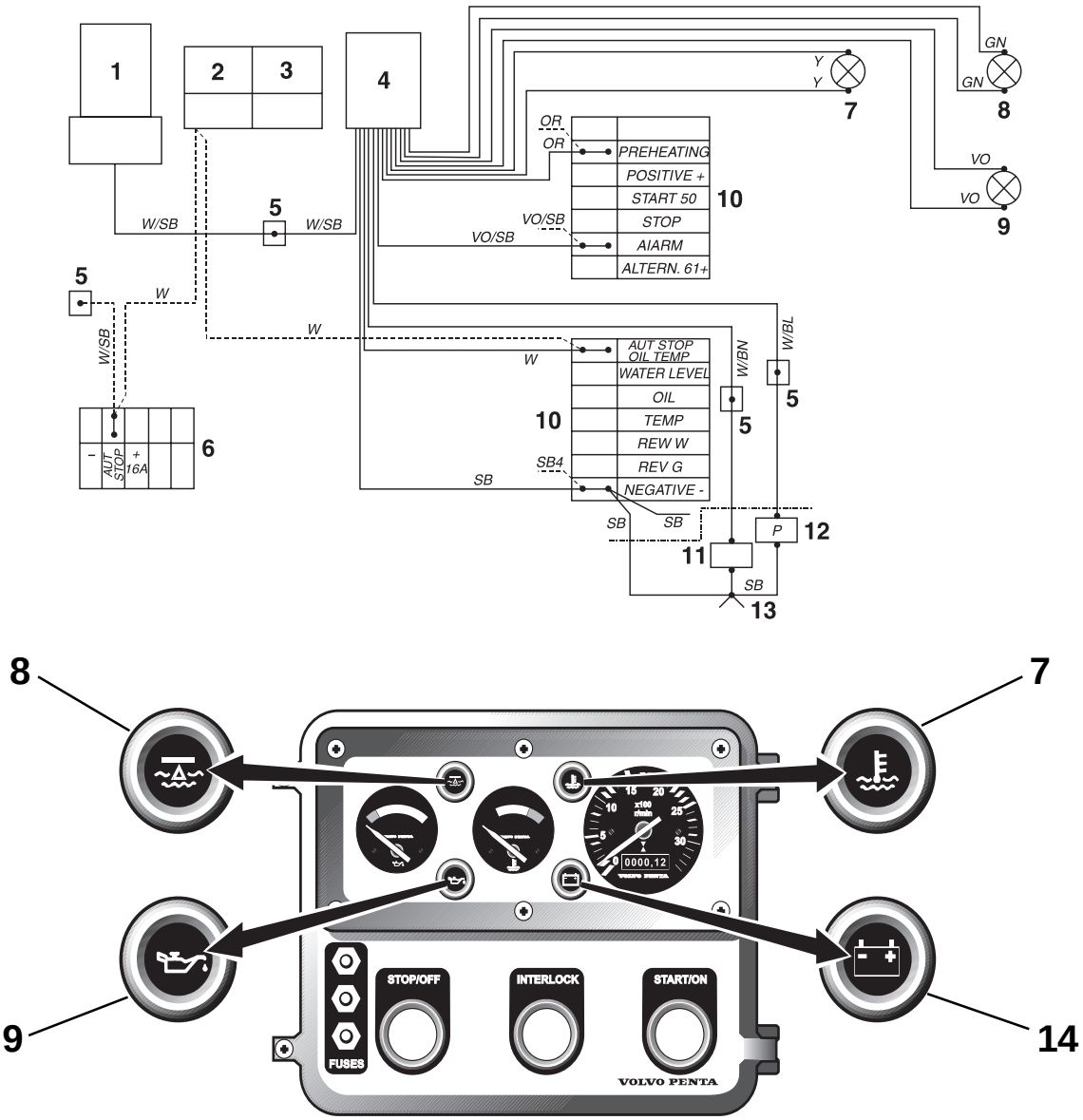
mm²	AWG
1.0	16 (17)
1.5	15 (16)
2.5	13
10	7
16	5

Instrument box



1. Location for level switch relay: coolant (accessory)
2. Relay for automatic stop: engine coolant temperature (ECT) switch, oil pressure switch and low coolant temperature switch (accessory).
3. Holding current relay (operating current and instruments)
4. Terminal block for engine cable harness
5. Terminal block for automatic stop and extra power output (maximum 16 A)
6. Negative (–) for extra power output (black cable)
7. Connection for any extra switches – automatic stop (white cable)
8. Positive (+) for extra power output (red cable) Maximum 16 A

Alarm separator for the instrument box (accessory)

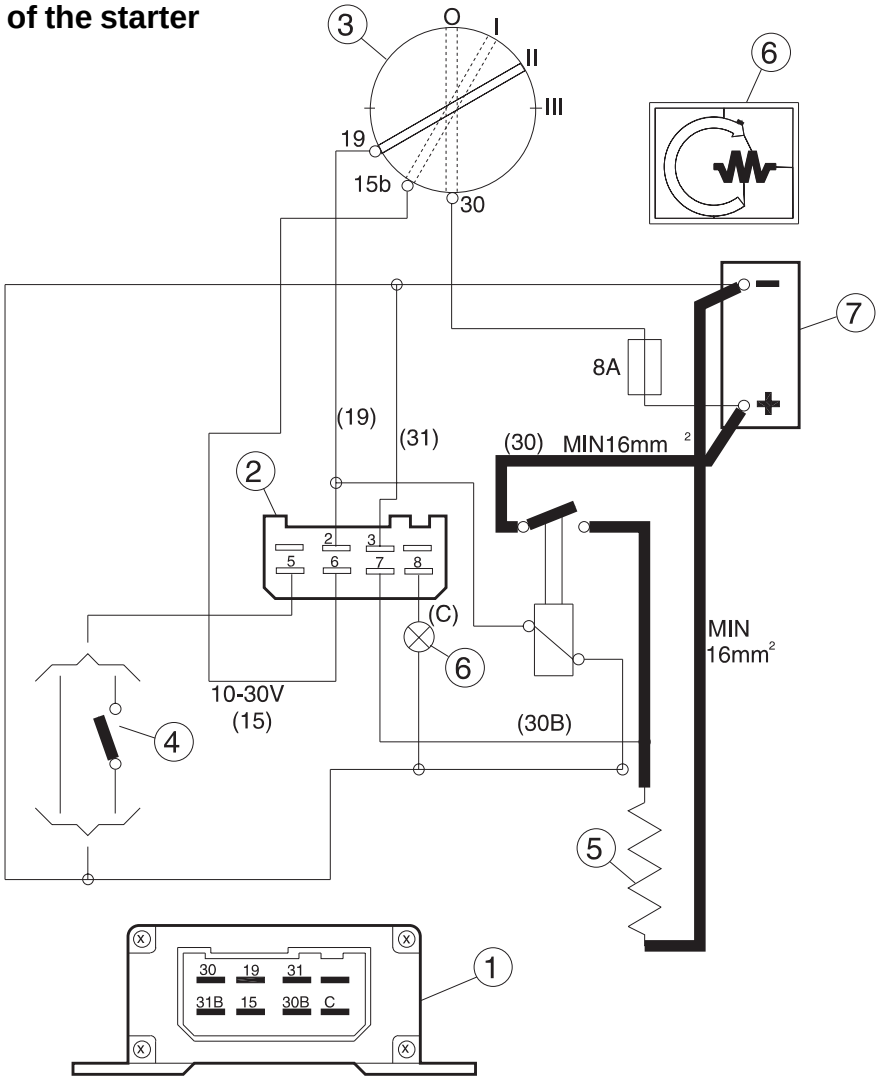


1. Relay for engine coolant level switch (accessory)
2. Relay for engine coolant temperature (ECT) switch, oil pressure switch
3. Holding current relay (operating current and instruments)
4. Alarm separator
5. Splice section
6. Terminal block for auxiliary power output (16 A fuse) and output for automatic stop, (closes in the event of a fault).
7. Warning lamp, high engine coolant temperature (accessory)
8. Warning lamp, low engine coolant level (accessory)
9. Warning lamp, low lubrication oil pressure (accessory)
10. Terminal block for engine cable harness
11. Engine coolant temperature (ECT) switch (normally open)
12. Oil pressure switch (normally open)
13. Joint splice
14. Warning lamp, generator not charging

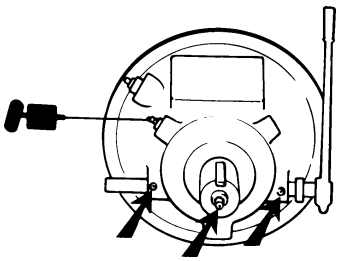
Cables displayed as a dashed lines are existing cables

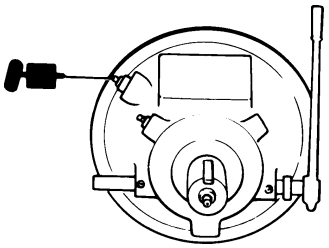
Time relay kit for engagement of the starter element (accessory)

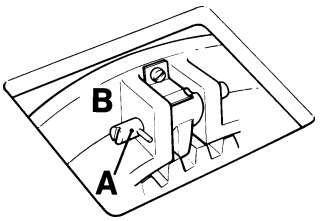
1. Time relay
2. Connector. 8 pin
3. Ignition switch
4. Temperature switch (accessory)
5. Starter element
6. Indicator lamp (engaged starter element)
7. Battery



Disengageable clutch and compressor







Disengageable clutch

Lubrication
Use lithium based grease, Mobilux EP2, Statoil Uniway EP2N, Texaco Multifak EP2, Q8 Rembrandt EP2 for example

Main bearing and clutch mechanism
Lubricate inner support bearing (when a grease nipple is installed), main bearings, disengaging shaft and moving parts of clutch. Lubricate sparingly (20–30 g for main bearings).

Lubricate the inner control arms with a few drops of oil.

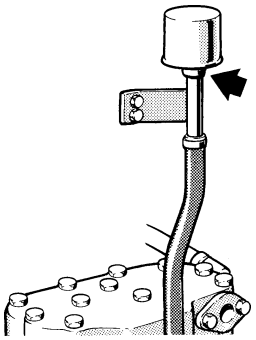
Disengagement bearing
Lubricate sparingly so that no grease is squeezed out. Use a grease recommended above.

Checking and adjusting

⚠ **WARNING!** Adjustments may only be made on a stopped engine.

The clutch force at the end of the lever must be 34–41 kp (double clutch plates) or 36–45 kp (triple clutch plates) during engagement.

Adjustment: Remove the inspection cover. Disconnect catch (A) and turn the red adjuster (B) clockwise. Engage the catch. The clutch plates must not slip after engagement!



Air Compressor

Air filter. Replace
Slacken off hose clamp, remove the filter for disposal. Install a new filter and tighten the clamp.

Shut down

Inhibition should be carried out to ensure that the engine and other equipment are not damaged while shut down. It is important that this is done properly and that nothing is forgotten. We have therefore provided a checklist covering the most important points.

Before shutting down for a long period, an authorised Volvo Penta workshop should inspect the engine and other equipment. Have any necessary repairs or service work carried out so that the equipment is in good condition for the next time it is started.

⚠ **WARNING!** Read the chapter “Maintenance” carefully before starting work. It contains instructions on how to carry out the work safely and correctly.

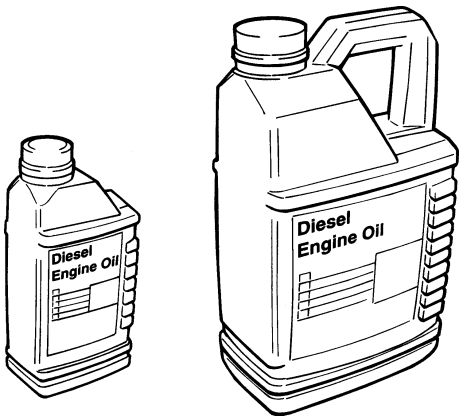
Storage

- Change engine oil and replace oil filter.
- Replace fuel filter. Replace fuel pre-filter if installed.
- Run engine to normal operating temperature.
- Check the condition of the engine coolant antifreeze. Top up if required.

  ⚠ **IMPORTANT!** An anti-corrosion mixture in the engine coolant system provides no protection against freezing. If there is any possibility the engine will be subjected to freezing temperatures, the system must be drained.
- Drain any water and contaminants from the fuel tank. Fill the tank completely with fuel to avoid condensation.
- Clean the outside of the engine. Do not use a high pressure spray to clean the engine. Touch up any damaged areas of paintwork with Volvo Penta original paint.
- Disconnect the battery leads. Clean and charge the batteries. NOTE! A poorly charged battery may burst as a result of freezing.
- Spray electrical system components with moisture-repellent spray.

Bringing out of storage

- Check the engine oil level. Top up if necessary. If there is inhibiting oil in the system, drain and fill with new oil, change oil filter. For correct oil grade: See chapter “Maintenance”, lubrication system.
- Close/tighten drain cocks/plugs.
- Check drive belts.
- Check the condition of rubber hoses and tighten hose clamps.
- Check engine coolant level and antifreeze protection. Top up if necessary.
- Connect the fully charged batteries.
- Start the engine. Check that there are no fuel, engine coolant or exhaust gas leaks and that all control functions are operating.



Fault tracing

A number of symptoms and possible reasons for engine problems are described in the table below. In case of faults or mishaps which you cannot solve, always contact the Volvo Penta dealership.

In the event of engine interference related to the GAC governor (Generating set engines), refer to the documentation delivered with the GAC governor.

⚠ **WARNING!** Read the safety precautions for maintenance and service in the chapter: “Safety Information”, before starting work.

Symptoms and possible causes

Starter motor not turning (or turning slowly)	1, 2, 3, 21, 22, 23, 24
Engine will not start	4, 5, 6, 7, 25, 26, 31
Engine starts but stops again	4, 6, 7, 8, 25, 26
Engine difficult to start	4, 5, 6, 7, 25, 26, 31
Engine does not reach correct speed at wide open throttle (WOT)	4, 5, 6, 7, 8, 9, 29, 30, 31
Engine knocks	4, 5, 6, 7
Engine runs unevenly	4, 5, 6, 7, 8, 9, 31
Engine vibrates	13, 14
High fuel consumption	8, 10
Black exhaust smoke	8, 28
Blue or white exhaust smoke	10, 19, 28
Low oil pressure	11, 12
Engine coolant temperature too high	15, 16, 17, 18, 27, 28
No or poor charging	2, 20

1. Discharged battery
2. Loose connection / open-circuit
3. Fuse tripped
4. Lack of fuel
5. Fouled fuel filter.
6. Air in the fuel injection system
7. Water / contaminants in the fuel
8. Insufficient air supply
9. Engine coolant temperature too high
10. Engine coolant temperature is too low
11. Lubricating oil level too low.
12. Blocked fuel filter
13. Defective engine mounting
14. Worn clutch
15. Too little coolant
16. Radiator blocked
17. Circulation pump defective
18. Defective / incorrect thermostat
19. Lubricating oil level too high
20. Generator drive belt slipping
21. Defective ignition switch / starter button
22. Defective start relay
23. Defective starter motor / solenoid
24. Water in the engine
25. Preheating insufficient
26. Starter element defective / not connected
27. Defective temperature gauge / sensor
28. Faulty injection timing
29. Engine overloaded
30. Excessive back pressure in exhaust system
31. Fault in the GAC unit (generating set engines)

Technical Data

General

Designation	No. of cylinders	Cylinder displacement (litres)	Weight (kg)*
TD420VE	4	4,04	380**
TAD420VE	4	4,04	380**
TD520GE	4	4,76	550**
TD520VE	4	4,76	430**
TAD520GE	4	4,76	575**
TAD520VE	4	4,76	532**
TAD620VE	6	5,07	495**
TWD630VE	6	5,48	665
TD640VE	6	5,48	655
TD71A	6	6,73	760
TWD710V	6	6,73	770
TD730VE	6	6,73	760
TWD731VE	6	6,73	770
TAD730V	6	6,73	876
TD710G	6	6,73	785
TWD710G	6	6,73	795
TD720GE	6	7,15	750**
TD720VE	6	7,15	570**
TAD720GE	6	7,15	760**
TAD720VE	6	7,15	572**
TAD721VE	6	7,15	572**
TWD740GE/VE	6	7,28	795
TAD740GE	6	7,28	901**
TAD741GE	6	7,28	901**
TD100G	6	9,6	945
TD1030VE	6	9,6	945
TWD1031VE	6	9,6	975
TAD1030V	6	9,6	1062
TAD1030GE	6	9,6	1107
TAD1031/32GE	6	9,6	1107
TD121G	6	11,98	1075
TWD1210V	6	11,98	1105
TWD1211V	6	11,98	1105
TWD1230VE	6	11,98	1105
TAD1230V	6	11,98	1215
TD1210G	6	11,98	1110
TWD1210G	6	11,98	1140
TWD1211G	6	11,98	1140
TAD1230G	6	11,98	1250
TAD1231GE	6	11,98	1250
TAD1232GE	6	11,98	1250
TD164KAE	6	16,12	1430
TWD1630V	6	16,12	1409
TAD1630V	6	16,12	1515
TWD1630G	6	16,12	1428
TWD1630GE	6	16,12	1428
TAD1630GE	6	16,12	1538
TAD1631G/GE	6	16,12	1538

* Engine only (without coolant and oil)
**Including radiator and charge air cooler (CAC)

General

Designation	Low idling speed (rpm)	Valve clearance, intake/exhaust (mm)*
TD420VE	875±50	0,35/0,55
TAD420VE	875±50	0,35/0,55
TD520GE	875±50	0,35/0,55
TD520VE	875±50	0,35/0,55
TAD520GE	875±50	0,35/0,55
TAD520VE	875±50	0,35/0,55
TAD620VE	875±50	0,35/0,55
TWD630VE	725±25	0,40/0,55
TD640VE	700±10	0,40/0,55
TD71A	600±25	0,40/0,55
TWD710V	600±25	0,40/0,55
TD730VE	650±25	0,40/0,55
TWD731VE	650±25	0,40/0,55
TAD730V	600±25	0,40/0,55
TD710G	1300±50	0,40/0,55
TWD710G	1300±50	0,40/0,55
TD720GE	875±50	0,35/0,55
TD720VE	875±50	0,35/0,55
TAD720GE	875±50	0,35/0,55
TAD720VE	875±50	0,35/0,55
TAD721VE	875±50	0,35/0,55
TWD740GE/VE	1300±50	0,50/0,65
TAD740GE	1300±50	0,50/0,65
TAD741GE	1300±50	0,50/0,65
TD100G	550±50	0,40/0,70
TD1030VE	600±25	0,40/0,70
TWD1031VE	675±25	0,40/0,70
TAD1030V	600±25	0,40/0,70
TAD1030GE	1300±50	0,40/0,70
TAD1031/32GE	1300±50	0,40/0,70
TD121G	600±50	0,40/0,70
TWD1210V	600±25	0,40/0,70
TWD1211V	600±25	0,40/0,70
TWD1230VE	600±25	0,40/0,70
TAD1230V	600±25	0,40/0,70
TD1210G	1300±50	0,40/0,70
TWD1210G	1300±50	0,40/0,70
TWD1211G	1300±50	0,40/0,70
TAD1230G	1300±50	0,40/0,70
TAD1231GE	1300±50	0,40/0,70
TAD1232GE	1300±50	0,40/0,70
TD164KAE	850±50	0,30/0,60
TWD1630V	500±25	0,30/0,60
TAD1630V	500±25	0,30/0,60
TWD1630G	1300±50	0,30/0,60
TWD1630GE	1300±50	0,30/0,60
TAD1630GE	1300±50	0,30/0,60
TAD1631G/GE	1300±50	0,30/0,60

* Applies to cold engine or at operating temperature (stopped)

Oil pressure*

Desigantion	At normal running engine speed (kPa)	At idling speed (kPa)
TD420VE	450	min. 80
TAD420VE	450	min. 80
TD520GE	400	min. 150
TD520VE	450	min. 80
TAD520GE	400	min. 150
TAD520VE	450	min. 80
TAD620VE	450	min. 80
TWD630VE	300-500	min. 150
TD640VE	300-500	min. 150
TD71A	300-500	min. 150
TWD710V	300-500	min. 150
TD730VE	250-550	min. 150
TWD731VE	250-550	min. 150
TAD730V	300-500	min. 150
TD710G	300-500	min. 150
TWD710G	300-500	min. 150
TD720GE	420	min. 150
TD720VE	450	min. 80
TAD720GE	420	min. 150
TAD720VE	450	min. 80
TAD721VE	450	min. 80
TWD740GE/VE	300-500	min. 150
TAD740GE	300-500	min. 150
TAD741GE	300-500	min. 300
TD100G	300-500	min. 150
TD1030VE	400-600	min. 150
TWD1031VE	400-600	min. 150
TAD1030V	300-500	min. 150
TAD1030GE	300-500	min. 150
TAD1031/32GE	300-500	min. 300
TD121G	300-500	min. 150
TWD1210V	300-500	min. 150
TWD1211V	300-500	min. 150
TWD1230VE	300-500	min. 150
TAD1230V	300-500	min. 150
TD1210G	300-500	min. 150
TWD1210G	300-500	min. 150
TWD1211G	300-500	min. 150
TAD1230G	300-500	min. 150
TAD1231GE	300-500	min. 150
TAD1232GE	300-500	min. 150
TD164KAE	300-500	min. 150
TWD1630V	300-500	min. 150
TAD1630V	300-500	min. 150
TWD1630G	300-500	min. 150
TWD1630GE	300-500	min. 150
TAD1630GE	300-500	min. 150
TAD1631G/GE	300-500	min. 150

* Applies to engine at operating temperature

Oil change capacity* for standard oil pan

Designation	Without oil filter (litres)	With oil filter (litres)	Volume difference (MIN-MAX)**
TD420VE	8	10	2
TAD420VE	8	10	2
TD520GE	11	13	2
TD520VE	11	13	2
TAD520GE	11	13	2
TAD520VE	11	13	2
TAD620VE	14	16	3
TWD630VE	20	24	6
TD640VE	20	24	6
TD71A	24	29	8
TWD710V	22	27	7
TD730VE	24	29	8
TWD731VE	24	29	8
TAD730V	22	27	7
TWD710G	24	29	7
TD720GE	18	20	3
TD720VE	18	20	3
TAD720GE	18	20	3
TAD720VE	18	20	3
TAD721VE	18	20	3
TAD730G	24	29	8
TWD740GE/VE	24	29	8
TAD740GE	24	29	8
TAD741GE	24	29	8
TD100G	21	25	9
TD1030VE	32	36	10
TWD1031VE	32	36	10
TAD1030V	30	34	8
TAD1030GE	32	36	10
TAD1031/32GE	32	36	10
TD121G	34	38	9
TWD1210V	34	38	9
TWD1211V	34	38	9
TWD1230VE	34	38	9
TAD1230V	34	38	9
TD1210G	34	38	9
TWD1210G	34	38	9
TWD1211G	34	38	9
TAD1230G	34	38	9
TAD1231GE	34	38	9
TAD1232GE	34	38	9
TD164KAE	57	64	3
TWD1630V	57	64	17
TAD1630V	57	64	17
TWD1630G	57	64	17
TWD1630GE	57	64	17
TAD1630GE	57	64	17
TAD1631G/GE	57	64	17

* Information about oil quality and viscosity can be found in the “Maintenance” chapter under the heading Lubrication system

** Difference in volume in litres between the MIN and MAX markings on the dipstick

Oil change capacity* for (shallow 10°) oil Pan

Designation	Without oil filter (litres)	With oil filter (litres)	Volume difference (MIN-MAX)**
TD610V	12	16	5
TD630VE	12	16	5
TWD630VE	12	16	5
TD71A	14	19	7
TID71A	14	19	7
TD730VE	14	19	7
TWD731VE	14	19	7

Oil change capacity* for (shallow) oil pan for large inclinations

Designation	Without oil filter (litres)	With oil filter (litres)	Volume difference (MIN-MAX)**
TD610V	15	19	3
TD630VE	15	19	3
TWD630VE	15	19	3
TD71A	19	24	3
TID71A	19	24	3
TD730VE	19	24	3
TWD731VE	19	24	3
TWD1230VE	30	34	12

Oil change capacity* for (deep) oil pan for large inclinations

Designation	Without oil filter (litres)	With oil filter (litres)	Volume difference (MIN-MAX)**
TD610V	18	22	6
TD630VE	18	22	6
TWD630VE	18	22	6
TD100G	27	31	9
TD1030VE	27	31	11
TWD1031VE	27	31	11
TD121G	30	34	12
TWD1230VE	30	34	12

* Information about oil quality and viscosity can be found in the “Maintenance” chapter under the heading Lubrication system

** Difference in volume between the MIN and MAX markings on the dipstick

Oil change capacity* for (vehicle type) oil pans

Designation	Without oil filter (litres)	With oil filter (litres)	Volume difference (MIN-MAX)**
TD71A	22	27	7
TID71A	22	27	7
TD730VE	22	27	7
TWD731VE	22	27	7

Oil change capacity* for (laminated) oil pan (soundproofed)

Designation	Without oil filter (litres)	With oil filter (litres)	Volume difference (MIN-MAX)**
TD630VE	20	24	6
TWD630VE	20	24	6
TD730VE	22	27	7
TWD731VE	22	27	7
TD1030VE	32	36	10
TWD1031VE	32	36	10
TWD1230VE	34	38	12

* Information about oil quality and viscosity can be found in the “Maintenance” chapter under the heading Lubrication system

** Difference in volume between the MIN and MAX markings on the dipstick

Cooling system

Designation	Coolant volume (litres)*	Thermostat begins to open/fully open at (°C)
TD420VE	17	83/95**
TAD420VE	17	83/95**
TD520GE	18	83/95**
TD520VE	18	87/102**
TAD520GE	20	83/95**
TAD520VE	20	87/102**
TAD620VE	21	83/95**
TWD630VE	22	75/88**
TD640VE	22	75/88**
TD71A	25	75/88**
TWD710V	34	75/88**
TD730VE	25	75/88**
TWD731VE	26	75/88**
TAD730V	37	75/88**
TWD710G	42	75/88**
TD720GE	22	83/95**
TD720VE	22	87/102**
TAD720GE	24	83/95**
TAD720VE	24	87/102**
TAD721VE	24	87/102**
TAD730G	37	75/88**
TWD740GE/VE	42	75/88**
TAD740GE	37	75/88**
TAD741GE	37	75/88**
TD100G	27	82/95**
TD1030VE	30	82/95**
TWD1031VE	30	75/88**
TAD1030V	38	82/95**
TAD1030GE	38	86/96**
TAD1031/32GE	38	86/96**
TD121G	34	82/95**
TWD1210V	49	75/88**
TWD1211V	55	82/95**
TWD1230VE	37	82/95**
TAD1230V	48	82/95**
TD1210G	49	75/88**
TWD1210G	52	75/88**
TWD1211G	59	75/88**
TAD1230G	48	82/95**
TAD1231GE	48	82/95**
TAD1232GE	48	82/95**
TD164KAE	90	82/95**
TWD1630V	59	75/88***
TAD1630V	52	82/95***
TWD1630G	59	75/88***
TWD1630GE	59	75/88***
TAD1630GE	52	82/95***
TAD1631G/GE	56	82/95***

* The coolant volumes listed apply to the use of Volvo Penta original coolants
** Number of thermostats: 1
*** Number of thermostats: 2

Fuel system*. Injectors

Designation	Opening pressure (MPa)	Adjusting pressure (MPa)	Nozzle hole diameter (mm)
TD420VE	22,0	23,0 +0,8	6 st 0,203
TAD420VE	22,0	23,0 +0,8	6 st 0,203
TD520GE	25,0	26,0 +0,8	5 st 0,30
TD520VE	25,0	26,0 +0,8	5 st 0,30
TAD520GE	25,0	26,0 +0,8	5 st 0,30
TAD520VE	25,0	26,0 +0,8	5 st 0,30
TAD620VE	22,0	23,0 +0,8	6 st 0,203
TWD630VE	25,0	26,0 +0,8	6 st 0,226
TD640VE	25,0	26,0 +0,8	6 st 0,226
TD71A	25,0	25,5 +0,8	4 st 0,34
TWD710V	25,0 +0,8	25,5 +0,8	4 st 0,38
TD730VE	25,5	26,0 +0,8	7 st 0,235
TWD731VE	25,0	26,0 +0,8	6 st 0,258
TAD730V	30,0 +0,8	30,5 +0,8	5 st 0,35
TWD710G	25,0 +0,8	25,5 +0,8	4 st 0,38
TD720GE	27,5 +0,8	28,0 +0,8	5 st 0,30
TD720VE	27,5 +0,8	28,0 +0,8	5 st 0,30
TAD720GE	27,5 +0,8	28,0 +0,8	5 st 0,30
TAD720VE	27,5 +0,8	28,0 +0,8	5 st 0,30
TAD721VE	27,5 +0,8	28,0 +0,8	5 st 0,30
TAD730G	30,0 +0,8	30,5 +0,8	5 st 0,32
TWD740GE/VE	29,0 +0,8	29,5 +0,8	6 st 0,29
TAD740GE	29,0 +0,8	29,5 +0,8	6 st 0,29
TAD741GE	29,0 +0,8	29,5 +0,8	6 st 0,29
TD100G	26,0 +0,8	26,5 +0,8	4 st 0,38
TD1030VE	25,0	26,0 +0,8	7 st 0,27
TWD1031VE	25,0	26,0 +0,8	6 st 0,25
TAD1030V	27,5 +0,8	28,0 +0,8	5 st 0,30
TAD1030GE	27,5	28,0	5 st 0,30
TAD1031GE	25,0 + 0,8	25,5 + 0,8	6 st 0,24
TAD1032GE	25,0 + 0,8	25,5 + 0,8	6 st 0,27
TD121G	27,0	27,5 +0,8	5 st 0,36
TWD1210V	27,0 +0,8	27,5 +0,8	5 st 0,38
TWD1211V	27,0 +0,8	27,5 +0,8	5 st 0,38
TWD1230VE	25,0	26,0 +0,8	6 st 0,28
TAD1230V	25,5 +0,8	26,0 +0,8	5 st 0,38
TD1210G	26,5	27,0	5 st 0,36
TWD1210G	27,0 +0,8	27,5 +0,8	5 st 0,38
TWD1211G	27,0	27,5 +0,8	5 st 0,38
TAD1230G	25,5	26,0 +0,2	5 st 0,38
TAD1231GE	25,5	26,0 +0,2	6 st 0,34
TAD1232GE	25,5	26,0 +0,2	6 st 0,34
TD164KAE	23,5	24,0 +0,2	7 st 0,31
TWD1630V	26,0	26,5 +0,2	7 st 0,31
TAD1630V	26,0	26,5 +0,2	7 st 0,31
TWD1630G	26,0	26,5 +0,2	7 st 0,31
TWD1630GE	26,0	26,5 +0,2	7 st 0,31
TAD1630GE	26,0	26,5 +0,2	7 st 0,31
TAD1631G/GE	28,5	29,0 +0,2	7 st 0,35

* Refer to the engine identification plate for information about injection timing and stroke position. See the chapter “Presentation”, identification number.

Electrical system

Designation	System voltage (V)	Maximum battery capacity 24 V/12 V (Ah)
TD420VE	24 alt. 12	2x110/2x88
TAD420VE	24 alt. 12	2x110/2x88
TD520GE	24 alt. 12	2x110/2x88
TD520VE	24 alt. 12	2x110/2x88
TAD520GE	24 alt. 12	2x110/2x88
TAD520VE	24 alt. 12	2x110/2x88
TAD620VE	24 alt. 12	2x110/2x88
TWD630VE	24 alt. 12	2x135/2x110
TD640VE	24 alt. 12	2x135/2x110
TD71A	24 alt. 12	2x135/2x110
TWD710V	24 alt. 12	2x135/2x110
TD730VE	24 alt. 12	2x135/2x110
TWD731VE	24	2x135/ –
TAD730V	24	2x135/ –
TWD710G	24	2x143/ –
TD720GE	24 alt. 12	2x110/2x88
TD720VE	24 alt. 12	2x110/2x88
TAD720GE	24 alt. 12	2x110/2x88
TAD720VE	24 alt. 12	2x110/2x88
TAD721VE	24 alt. 12	2x110/2x88
TAD730G	24	2x143/ –
TWD740GE/VE	24	2x143/ –
TAD740GE	24	2x143/ –
TAD741GE		
TD100G	24	2x143/ –
TD1030VE	24	2x143/ –
TWD1031VE	24	2x143/ –
TAD1030V	24	2x143/ –
TAD1030GE	24	2x143/ –
TAD1031/32GE	24	2x143/ –
TD121G	24	2x143/ –
TWD1210V	24	2x143/ –
TWD1211V	24	2x143/ –
TWD1230VE	24	2x143/ –
TAD1230V	24	2x143/ –
TD1210G	24	2x152/ –
TWD1210G	24	2x152/ –
TWD1211G	24	2x152/ –
TAD1230G	24	2x152/ –
TAD1231GE	24	2x152/ –
TAD1232GE	24	2x152/ –
TD164KAE	24	2x176/–
TWD1630V	24	2x176/ –
TAD1630V	24	2x176/ –
TWD1630G	24	2x176/ –
TWD1630GE	24	2x176/ –
TAD1630GE	24	2x176/ –
TAD1631G/GE	24	2x176/ –

Generator. Voltage/Amperage/Power (V/A/W)

Designation	Alt. 1*	Alt. 2*	Alt. 3*	Alt. 4*	Alt. 5*
TD420VE	14/55/770	28/35/980	–	–	–
TAD420VE	14/55/770	28/35/980	–	–	–
TD520GE	14/55/770	28/35/980	–	–	–
TD520VE	14/55/770	28/35/980	–	–	–
TAD520GE	14/55/770	28/35/980	–	–	–
TAD520VE	14/55/770	28/35/980	–	–	–
TAD620VE	14/55/770	28/35/980	–	–	–
TWD630VE	28/55/1550	28/60/1700	28/80/2240	14/60/840	–
TD640VE	28/55/1550	28/60/1700	28/80/2240	14/60/840	–
TD71A	28/55/1550	28/60/1700	28/80/2240	–	14/90/1260
TWD710V	–	28/60/1700	–	–	14/90/1260
TD730VE	28/55/1550	28/60/1700	28/80/2240	–	14/90/1260
TWD731VE	28/55/1550	28/60/1700	28/80/2240	–	–
TAD730V	–	28/60/1700	–	–	–
TWD710G	–	28/60/1700	–	–	–
TD720GE	14/55/770	28/35/980	–	–	–
TD720VE	14/55/770	28/35/980	–	–	–
TAD720GE	14/55/770	28/35/980	–	–	–
TAD720VE	14/55/770	28/35/980	–	–	–
TAD721VE	14/55/770	28/35/980	–	–	–
TAD730G	–	28/60/1700	–	–	–
TWD740GE/VE	–	28/60/1700	–	–	–
TAD740GE	–	28/60/1700	–	–	–
TAD741GE	–	28/60/1700	–	–	–
TD100G	28/55/1550	28/60/1700	28/80/2240	–	–
TD1030VE	28/55/1550	28/60/1700	28/80/2240	–	–
TWD1031VE	28/55/1550	28/60/1700	28/80/2240	–	–
TAD1030V	–	28/60/1700	–	–	–
TAD1030GE	–	28/60/1700	–	–	–
TAD1031/32GE	–	28/60/1700	–	–	–
TD121G	28/55/1550	28/60/1700	28/80/2240	–	–
TWD1210V	–	28/60/1700	–	–	–
TWD1211V	–	28/60/1700	–	–	–
TWD1230VE	28/55/1550	28/60/1700	28/80/2240	–	–
TAD1230V	–	28/60/1700	–	–	–
TD1210G	–	28/60/1700	–	–	–
TWD1210G	–	28/60/1700	–	–	–
TWD1211G	–	28/60/1700	–	–	–
TAD1230G	–	28/60/1700	–	–	–
TAD1231GE	–	28/60/1700	–	–	–
TAD1232GE	–	28/60/1700	–	–	–
TD164KAE	–	28/60/1700	–	–	–
TWD1630V	–	28/60/1700	–	–	–
TAD1630V	–	28/60/1700	–	–	–
TWD1630G	–	28/60/1700	–	–	–
TWD1630GE	–	28/60/1700	–	–	–
TAD1630GE	–	28/60/1700	–	–	–
TAD1631G/GE	–	28/60/1700	–	–	–

* Alt.1=Generator 55 A/28 V, Alt.2=Generator 60 A/28 V, Alt.3=Generator 80 A/28 V, Alt.4=Generator 60 A/14 V, Alt.5=Generator 90 A/14 V

Disengageable clutch (accessory)

Desigantion	Type	Gear ratio	Size (mm)	Weight (kg)
AP S11A2	Single plate	1:1	292 (11 1/2")	66
AP D11A2	Double plate	1:1	292 (11 1/2")	83
AP T14A2	Triple plate	1:1	355 (14")	209

7739614-1 English 04-2002

GENERATOR PARTS LISTS

GENERATOR MODEL G550

EDITION: JUNE2002 CPN 85623049 33519009701 ind1

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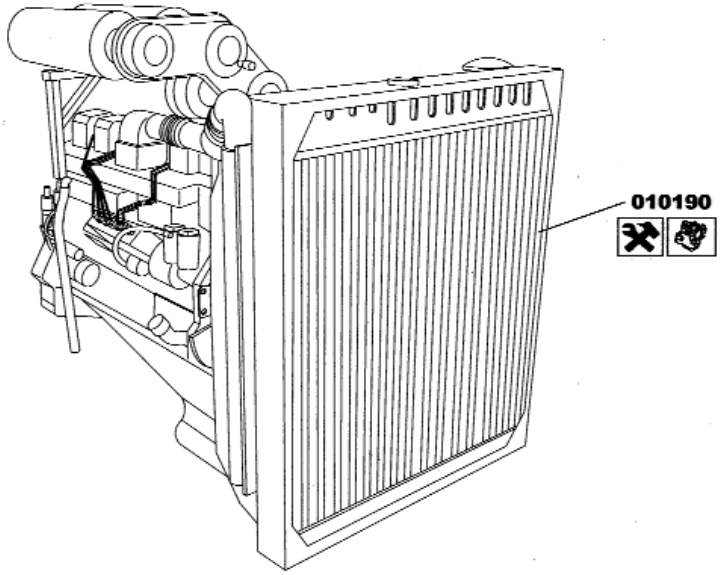
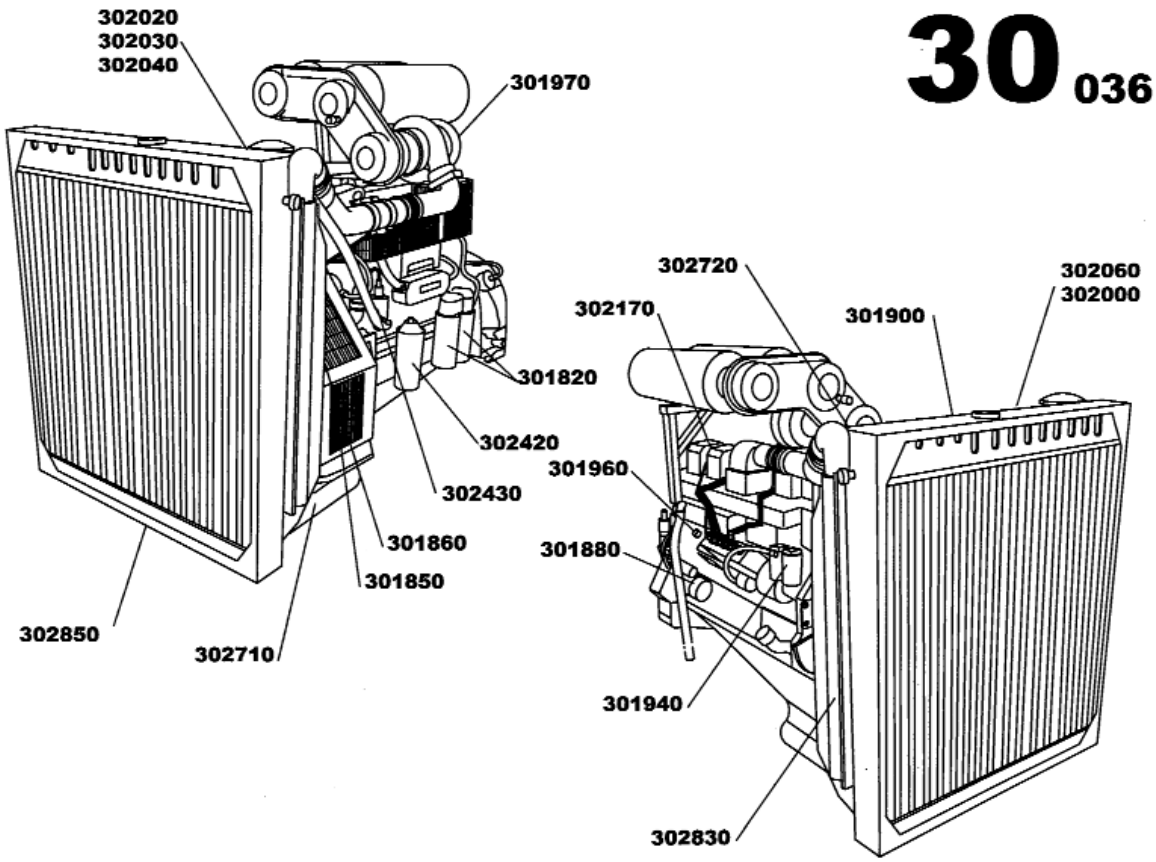
01 050



Item	Part Number	Description	Quantity	Units
F01050		ENGINE FUNCTION TAD1631	1.0	UN
010190	85422012	ENGINE VOLVO TAD1631 SAE 1/14	1.0	UN

Part numbers listed are the only parts used in this model

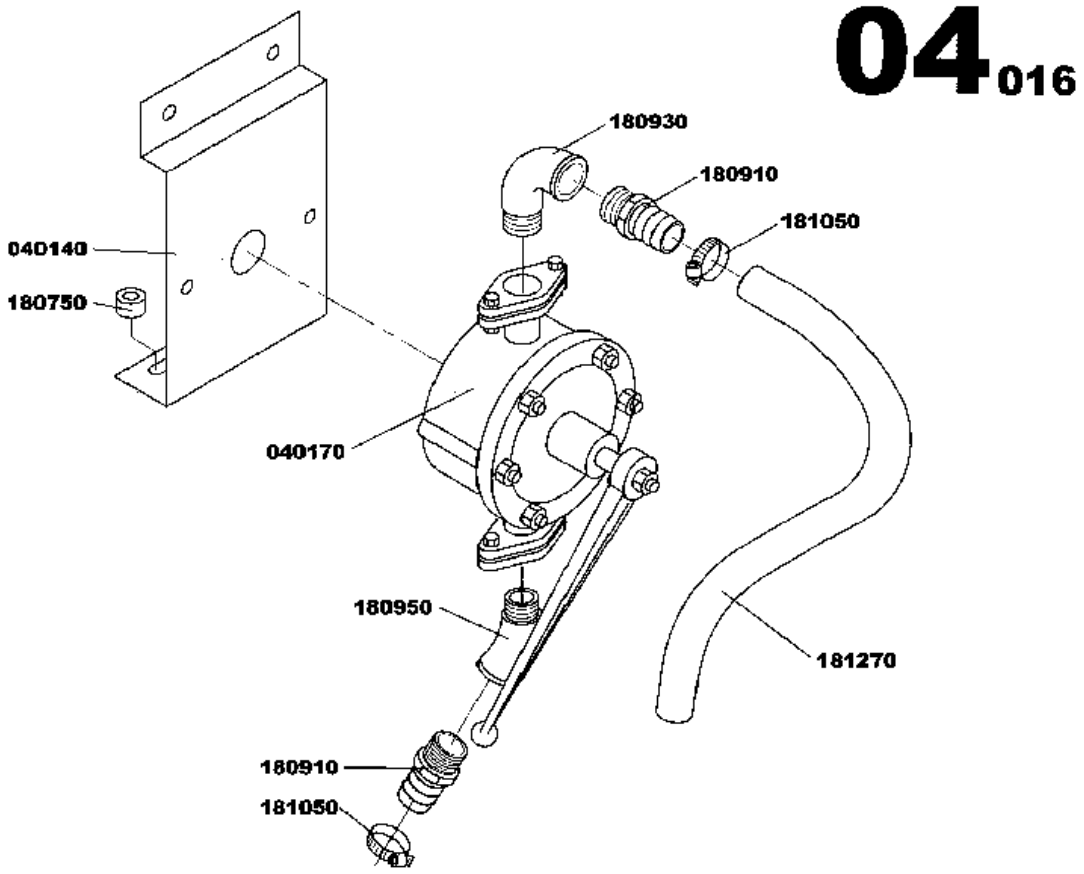
30 036



Item	Part Number	Description	Quantity	Units
F30036		ENGINE VO TAD1631 DETAIL	1.0	UN
301820	85401347	OIL FILTER	2.0	UN
302420	85426864	BY PASS OIL FILTER	1.0	UN
301940	85401636	FUEL FILTER	2.0	UN
301900	85401586	FAN BELT	1.0	UN
301850	85401396	ALTERNATOR BELT	1.0	UN
302430	85402311	COOLANT FILTER	1.0	UN
302170	85425494	INJECTOR	6.0	UN
301880	85401479	ELECTRIC STARTER	1.0	UN
301860	85401404	CHARGING ALTERNATOR	1.0	UN
302060	85402329	WATER PUMP	1.0	UN
301960	85401990	PRESSURE SWITCH	1.0	UN
302000	85402147	TEMPERATURE SWITCH	1.0	UN
302040	85402188	THERMOSTAT SEAL	1.0	UN
302030	85402170	THERMOSTAT SEAL	1.0	UN
302020	85402162	THERMOSTAT	1.0	UN
301970	85402030	ROCKER COVER GASKET	6.0	UN
302850	85425619	RADIATOR TAD 1631	1.0	UN
302720	85425627	HOSE	1.0	UN
302710	85425635	HOSE	1.0	UN
302830	85425643	CHARGE AIR COOLER TAD1631	1.0	UN

Part numbers listed are the only parts used in this model

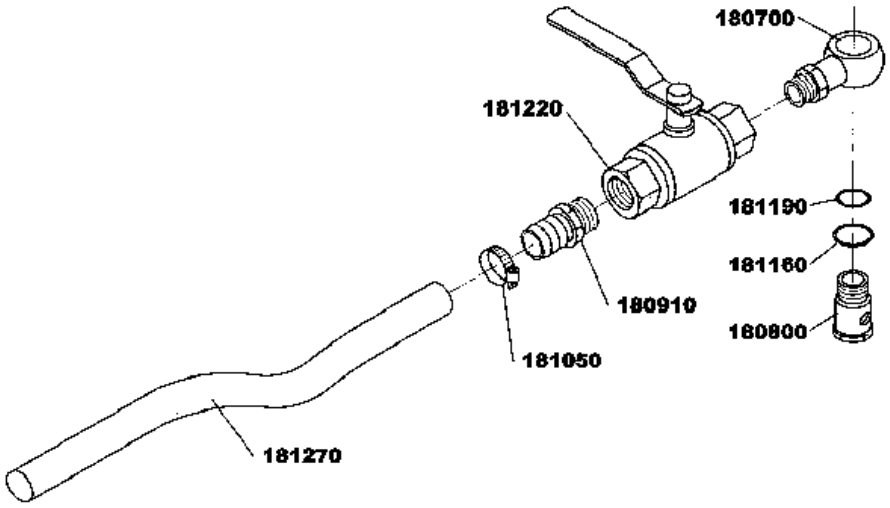
04 016



Item	Part Number	Description	Quantity	Units
F04016	85622223	OIL SUMP DRAIN PUMP ASSEMBLY	1.0	UN
040140	85424026	OIL SUMP PUMP BRACKET VO 16L	1.0	UN
040170	85422616	HYDRAULIC MANUAL PUMP	1.0	UN
180750	85421204	SPACER Th10 D15	2.0	UN
180910	85423242	PIPE UNION MAL/MAL 3/4G	2.0	UN
180930	85423093	PIPE UNION ELBOW 90° MAL/FEM 3/4G	1.0	UN
180950	85423044	PIPE UNION ELBOW 45° MAL/FEM 3/4G	1.0	UN
181050	85417749	HOSE CLIP D25/40	2.0	UN
181270	85622181	FLEXIBLE HOSE D25x32	1.0	ML

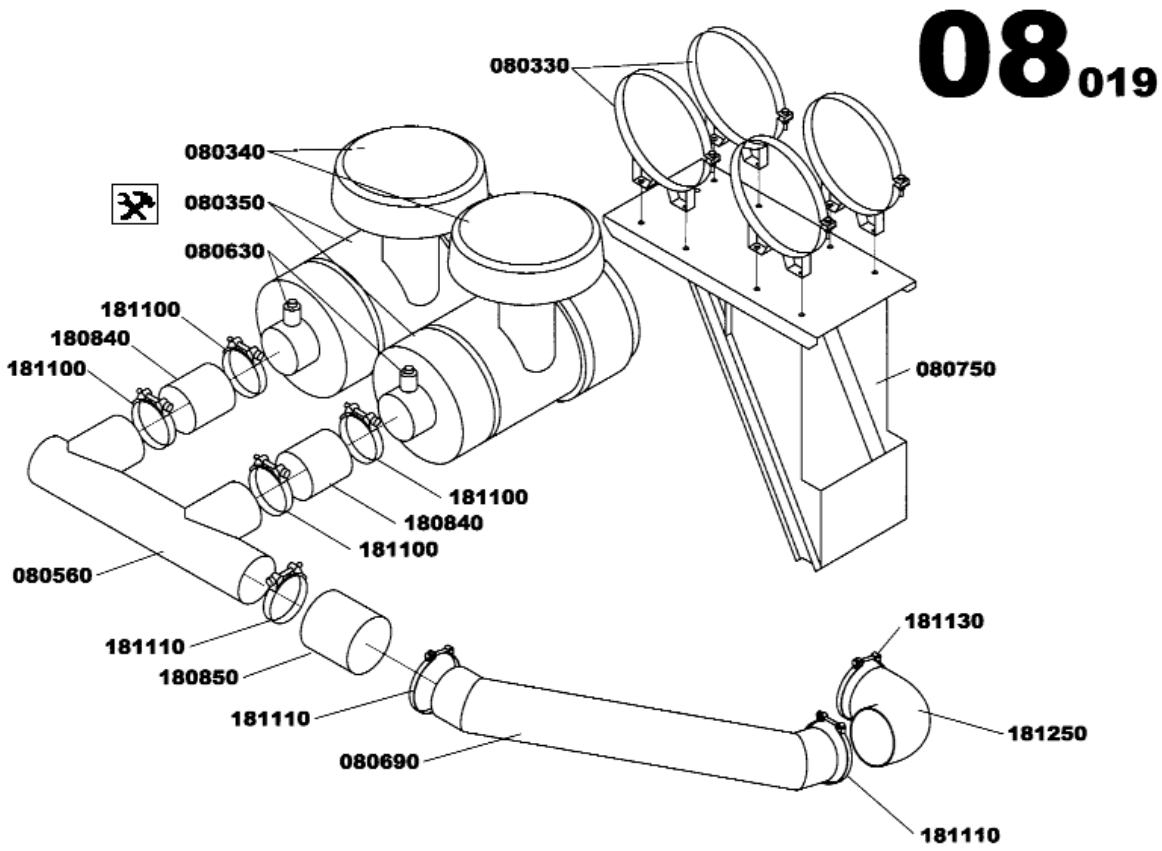
Part numbers listed are the only parts used in this model

04 008



Item	Part Number	Description	Quantity	Units
F04008	85501930	OIL SUMP DRAIN TAP ASSEMBLY	1.0	UN
180700	85423119	PIPE UNION ELBOW 90° 3/4BSP	1.0	UN
180800	85424901	BANJO SCREW M24x1.5 L45	1.0	UN
180910	85423242	PIPE UNION MAL/MAL 3/4G	1.0	UN
181050	85417749	HOSE CLIP D25/40	1.0	UN
181160	85421758	GASKET D26x32	1.0	UN
181190	85421741	GASKET D24x32	1.0	UN
181220	85424885	2 WAY VALVE	1.0	UN
181270	85622181	FLEXIBLE HOSE D25x32	1.0	ML

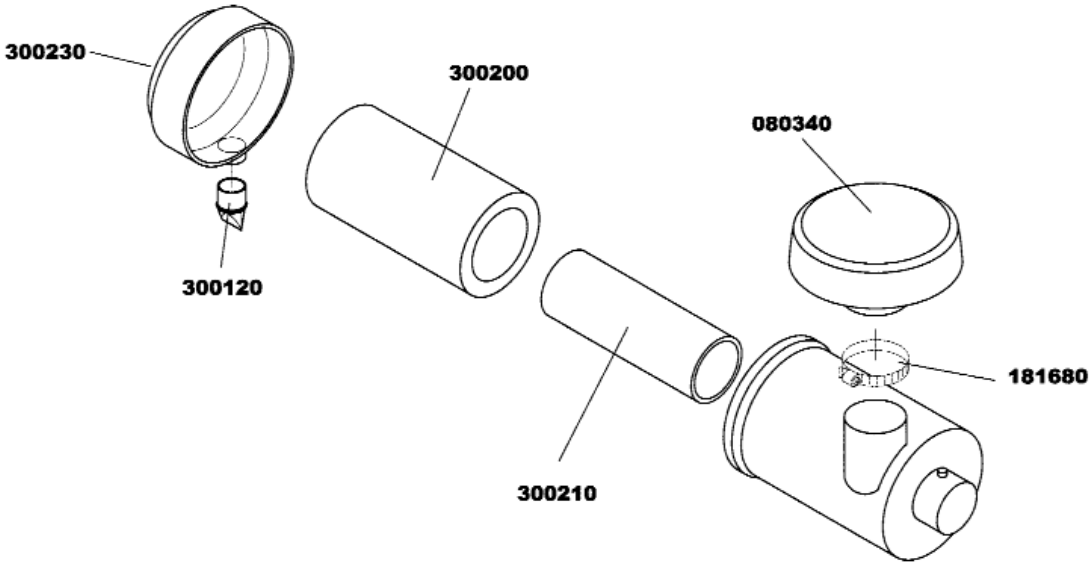
Part numbers listed are the only parts used in this model



Item	Part Number	Description	Quantity	Units
F08019	85419539	AIR FILTER HEAVY DUTY ASSEMBLY	1.0	UN
080560	85417673	AIR INLET PIPE	1.0	UN
080630	85413581	AIR RESTRICTION INDICATOR	2.0	UN
080330	85403848	AIR CLEANER CLAMP D330	4.0	UN
080340	85403863	RAIN CAP	2.0	UN
080350	85403921	AIR FILTER HEAVY DUTY	2.0	UN
080690	85424810	HEAVY DUTY AIR FILTER INLET PIPE	1.0	UN
080750	85425247	AIR FILTER BRACKET VO 16L	1.0	UN
180840	85417962	RUBBER HOSE D127	2.0	UN
180850	85417970	RUBBER HOSE D140	1.0	UN
181100	85417731	T BOLT CLAMP D131/139	4.0	UN
181110	85417715	T BOLT CLAMP D149/161	3.0	UN
181130	85417723	T BOLT CLAMP D162/174	1.0	UN
181250	85417947	RUBBER HOSE ELBOW 90° D140x152	1.0	UN

Part numbers listed are the only parts used in this model

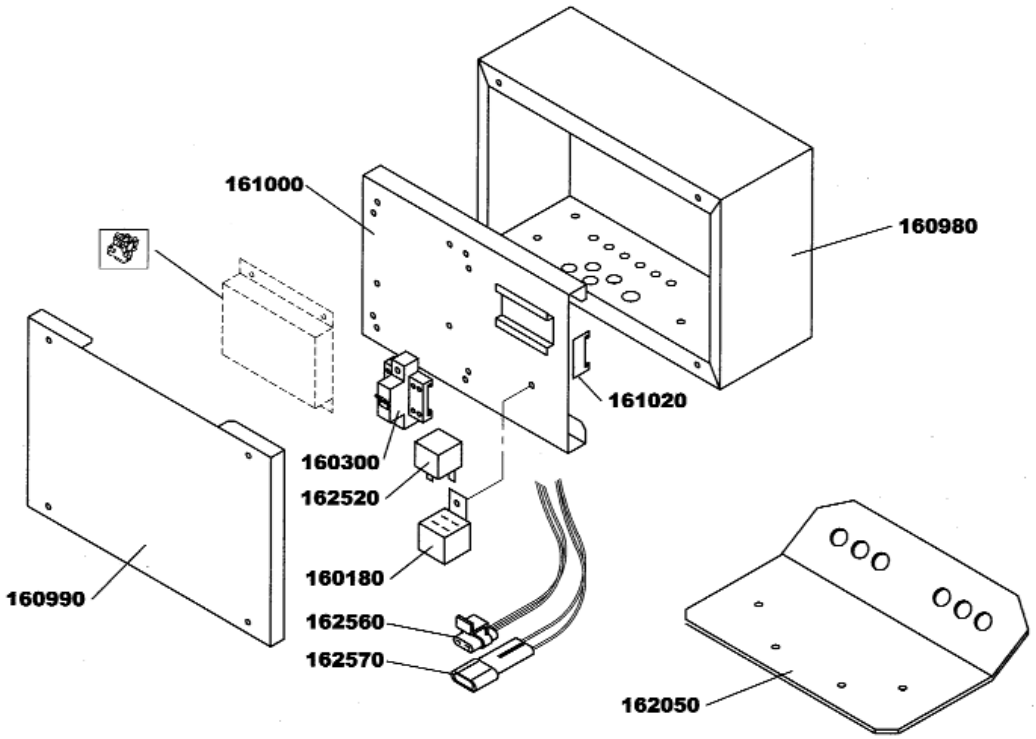
30014



Item	Part Number	Description	Quantity	Units
F30014		AIR FILTER 080350 DETAIL	1.0	UN
300200	85400737	FILTER CARTRIDGE	1.0	UN
300210	85400786	FILTER CARTRIDGE	1.0	UN
300120	85501229	VACUATOR VALVE	1.0	UN
300230	85501294	DUST CUP	1.0	UN
080340	85403863	RAIN CAP	1.0	UN
181680	85501872	HOSE CLIP D140/160	1.0	UN

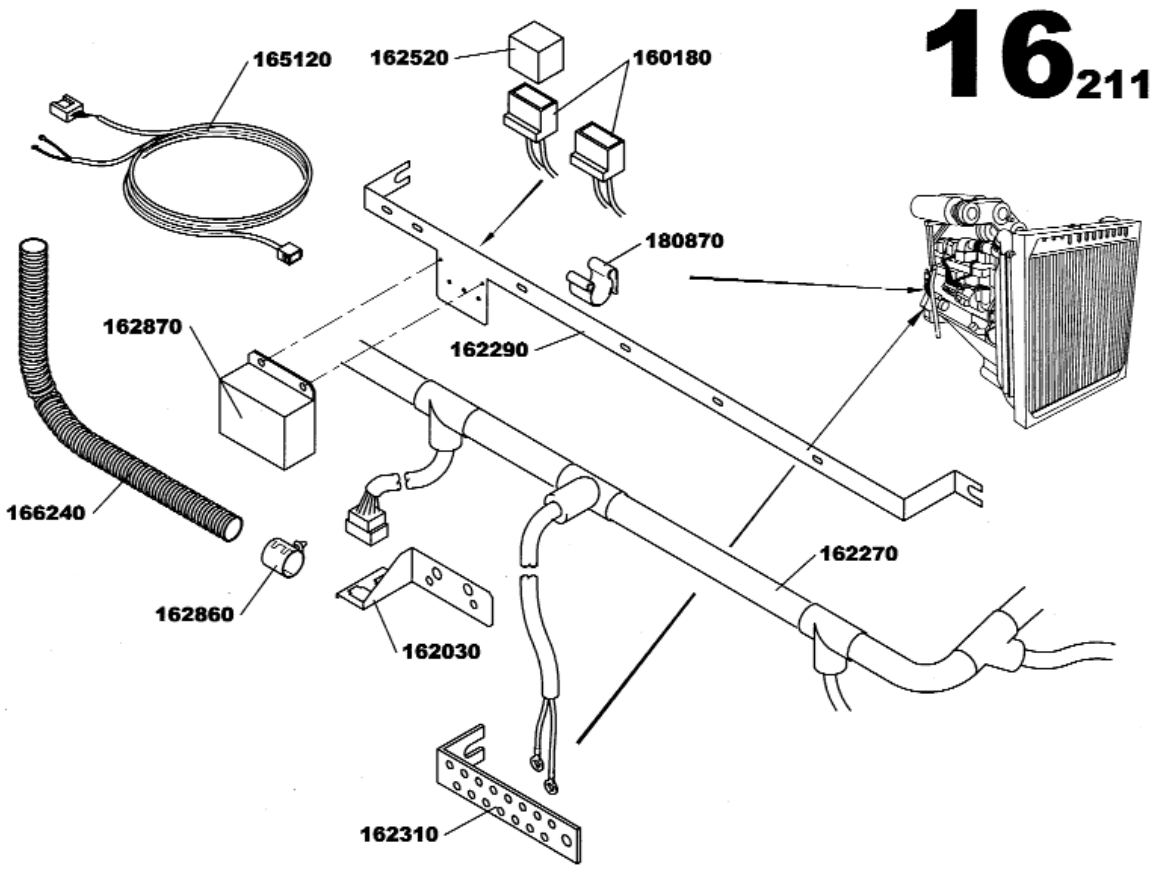
Part numbers listed are the only parts used in this model

06 018



Item	Part Number	Description	Quantity	Units
F06018		GOVERNOR FUNCTION TAD1631	1.0	UN
162050	85425270	ELECTRONIC REGULATOR HOUSING BRACKET	1.0	UN
160980	85407237	ELECTRONIC REGULATION HOUSING	1.0	UN
160990	85407245	HOUSING ELECTRONIC REGULATION	1.0	UN
161000	85407336	ELECTRONIC REGULATOR BRACKET	1.0	UN
161020	85408706	STOP	1.0	UN
162520	85423366	RELAY 24V 10/20A	1.0	UN
160180	85408912	AUTOMOBILE RELAY BASE	1.0	UN
160300	85408920	MOULDED CASE CIRCUIT BREAKER 1x16A	1.0	UN
162560	85412989	CONNECTOR 2 POLE	1.0	UN
162570	85412997	CONNECTOR 2 POLE	1.0	UN

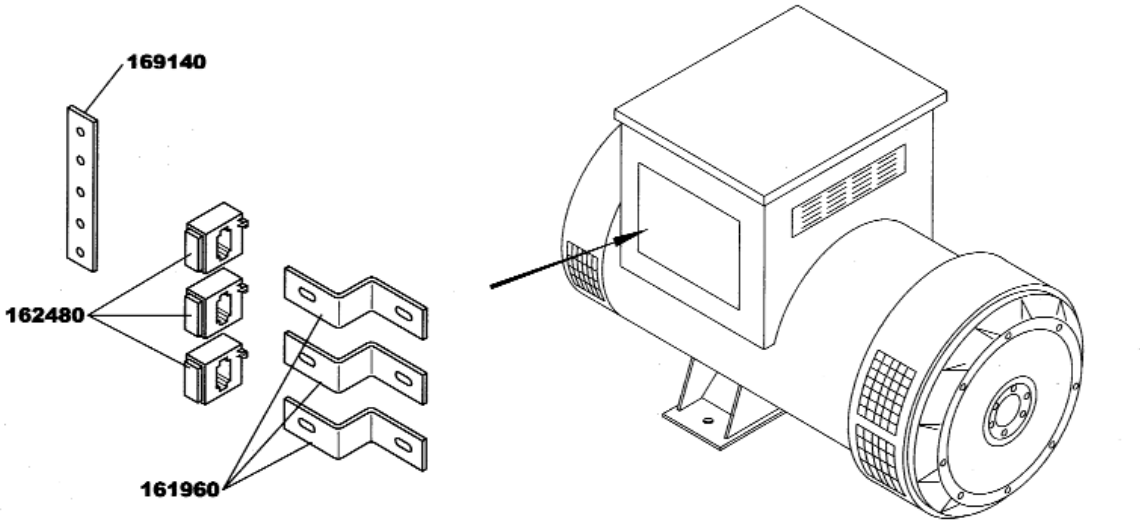
Part numbers listed are the only parts used in this model



Item	Part Number	Description	Quantity	Units
F16211		ENGINE WIRING LOOM TAD1631	1.0	UN
162030	85423788	CONNECTOR BRACKET	1.0	UN
162270	85421329	ENGINE WIRING LOOM VOLVO TAD1631	1.0	UN
162290	85423689	WIRING BRACKET VO TAD1631G	1.0	UN
162310	85416907	COPPER BAR 5x25	1.0	UN
162870	85428100	STARTING RELAY PROTECTION PANEL	1.0	UN
162520	85423366	RELAY 24V 10/20A	2.0	UN
160180	85408912	AUTOMOBILE RELAY BASE	2.0	UN
180870	85416584	CLIP-ON BRACKET	2.0	UN
165120	85410603	INTELLISYS WIRING LOOM 010	1.0	UN
166240	85427268	ELECTRICAL SHAFT D29	4.5	ML
162860	85427276	CLIP D29	6.0	UN

Part numbers listed are the only parts used in this model

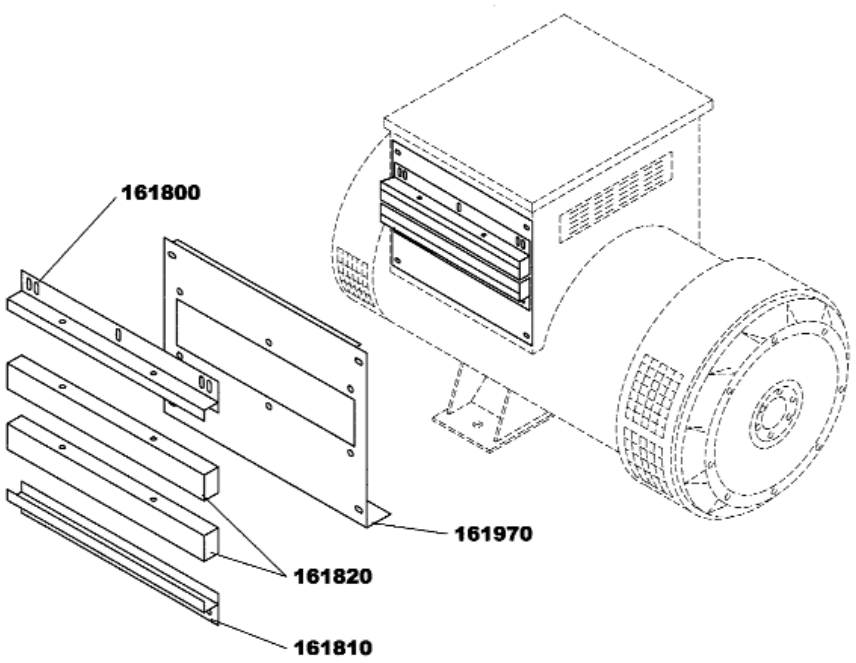
16106



Item	Part Number	Description	Quantity	Units
F16106	85421055	CURRENT TRANSFORMER PROTECTION 800A ASSEMBLY	1.0	UN
161960	85417087	COPPER BAR 40x5	3.0	UN
169140	85622645	COPPER BAR 5x50	1.0	UN
162480	85424687	CURRENT TRANSFORMER 400/5	3.0	UN

Part numbers listed are the only parts used in this model

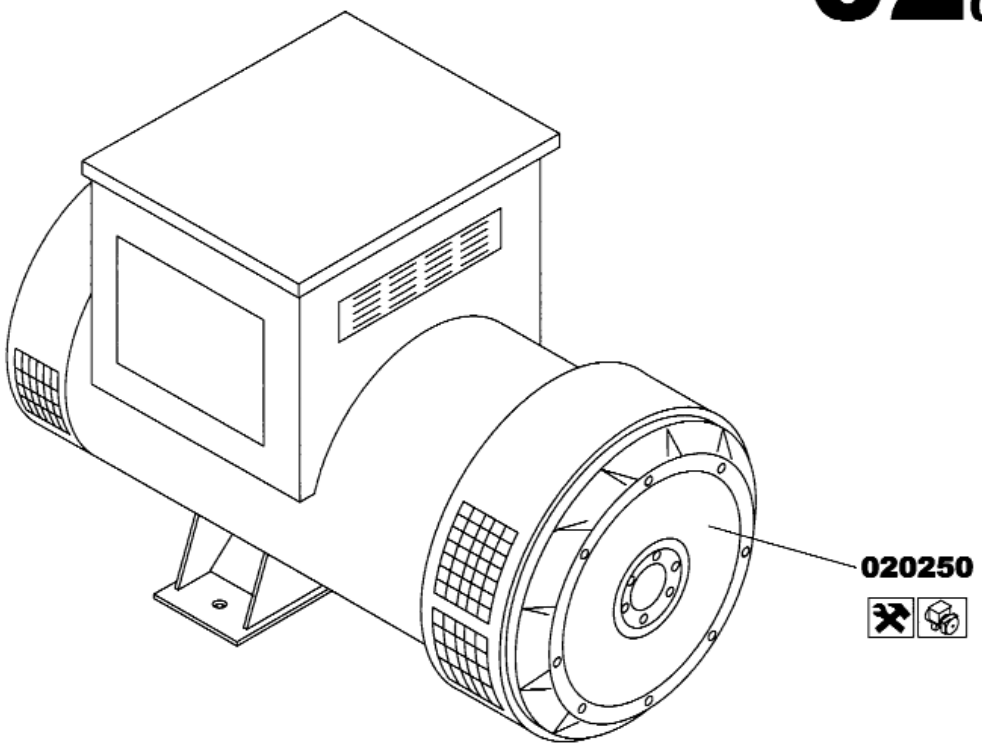
16 017



Item	Part Number	Description	Quantity	Units
F16017	85420990	OUTPUT CABLES ALTERNATOR ASSEMBLY	1.0	UN
161800	85421261	MCPS CABLES COLLAR T923B (STANDING)	1.0	UN
161810	85421279	MCPS CABLES COLLAR T923B (MOBILE)	1.0	UN
161820	85416840	FOAM BAND	2.0	UN
161970	85424638	CABLE OUTLET PLATE	1.0	UN

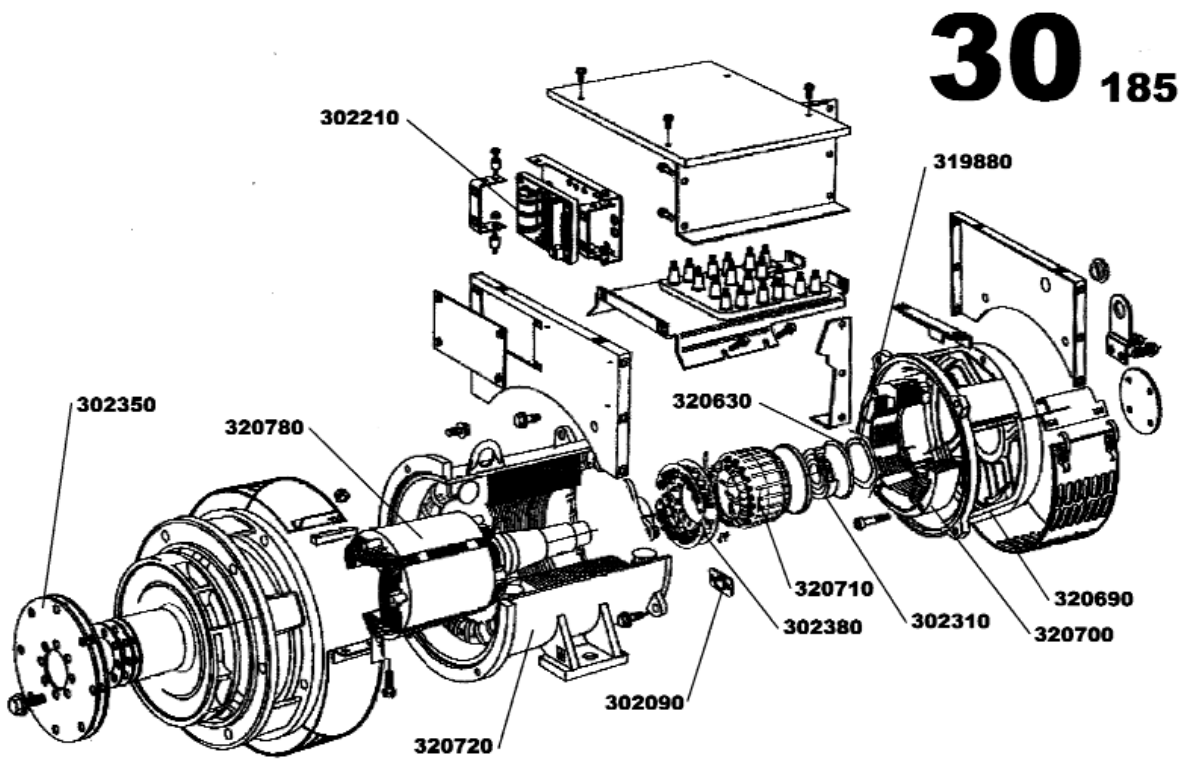
Part numbers listed are the only parts used in this model

02018



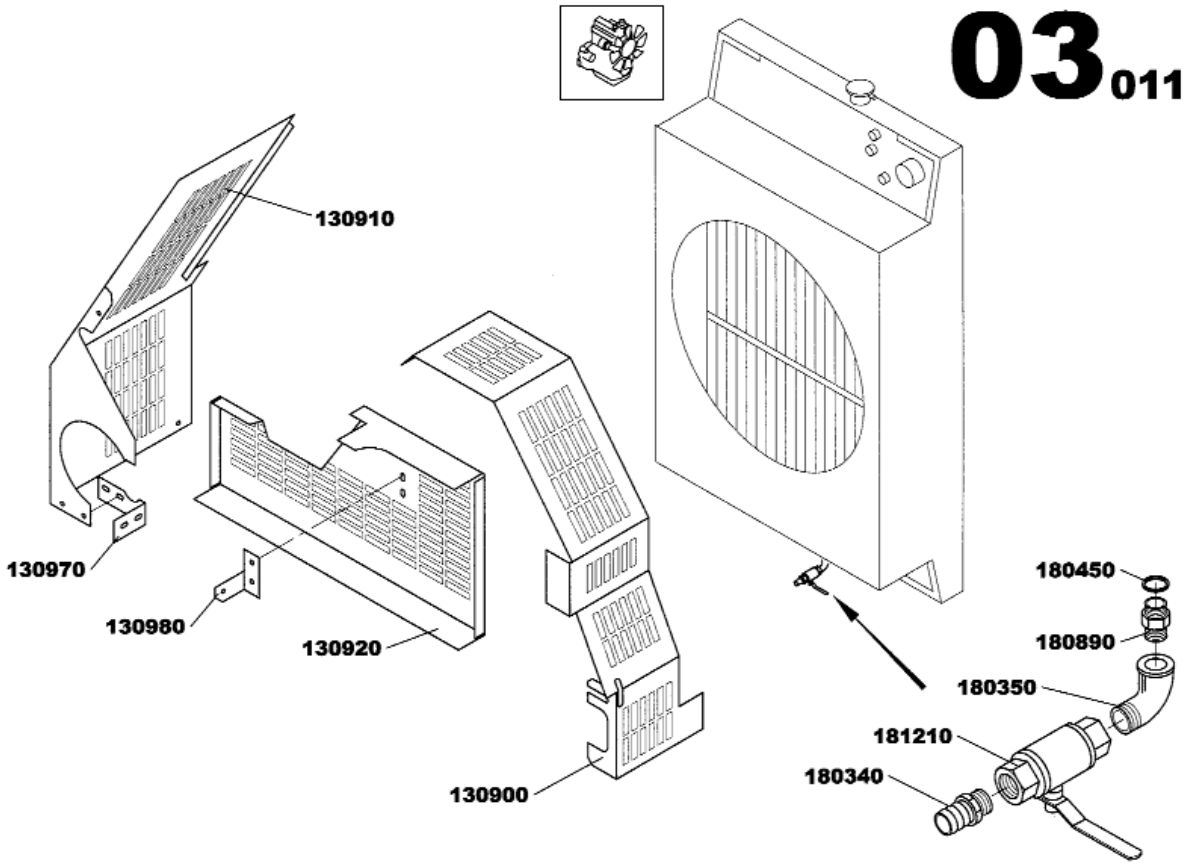
Item	Part Number	Description	Quantity	Units
F02018		ALTERNATOR LS 471VL ASSEMBLY	1.0	UN
020250	85416683	ALTERNATOR LS 471VL	1.0	UN

Part numbers listed are the only parts used in this model



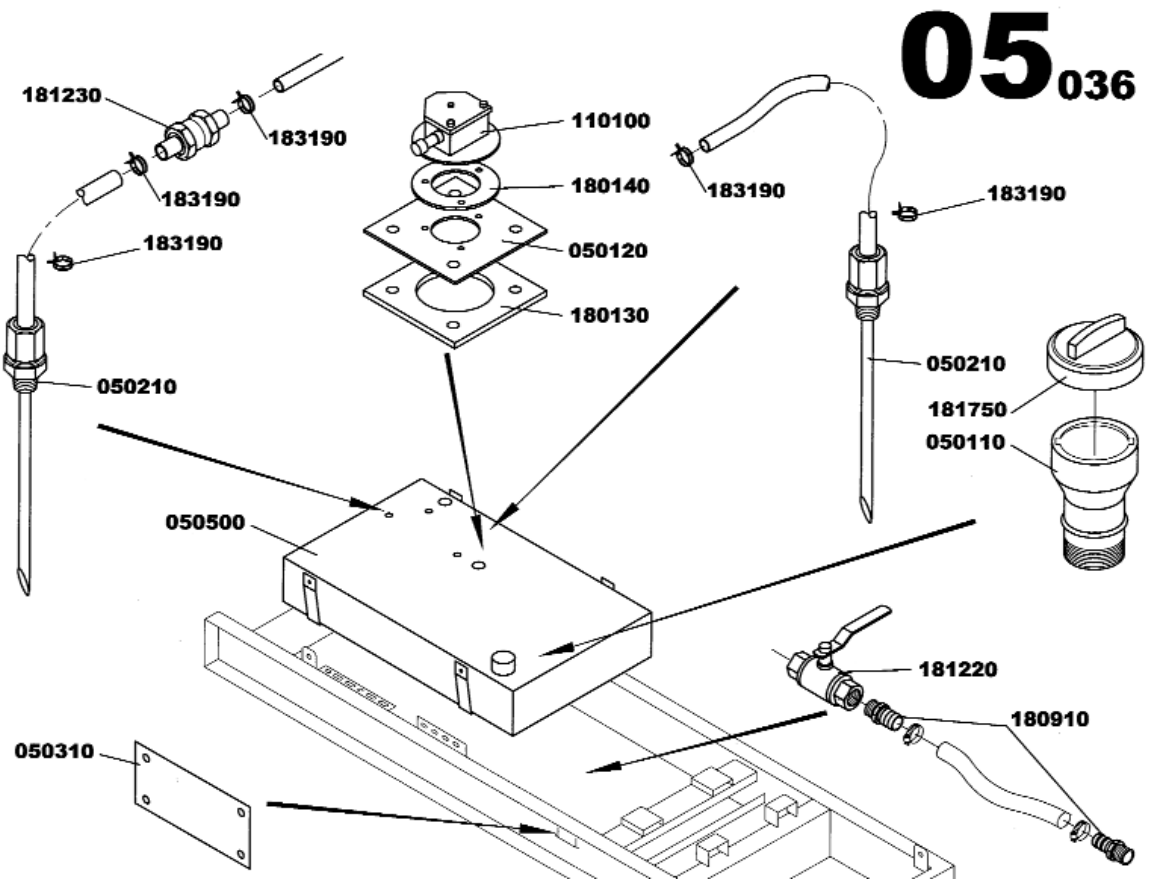
Item	Part Number	Description	Quantity	Units
F30185		ALTERNATOR LS 471VL12 SAE 1/14 DETAIL	1.0	UN
320720	85508844	WOUND STATOR ASSEMBLY	1.0	UN
320780	85509131	WOUND ROTOR ASSEMBLY	1.0	UN
320690	85508885	N.D.E BRACKET	1.0	UN
302310	85425916	BEARING LSA 462/471	1.0	UN
319880	85509065	WAVY WASHER	1.0	UN
320700	85508935	WOUND EXCITER FIELD	1.0	UN
320710	85508984	WOUND EXCITER ARMATURE	1.0	UN
302210	85425577	GOVERNOR	1.0	UN
302350	85425957	DRIVE DISC LSA 471 and 462L6/VL12	1.0	UN
302380	85426179	DIODE BRIDGE	1.0	UN
302090	85402444	SURGE SURPRESSOR	1.0	UN
320630	85509016	O RING	1.0	UN

Part numbers listed are the only parts used in this model



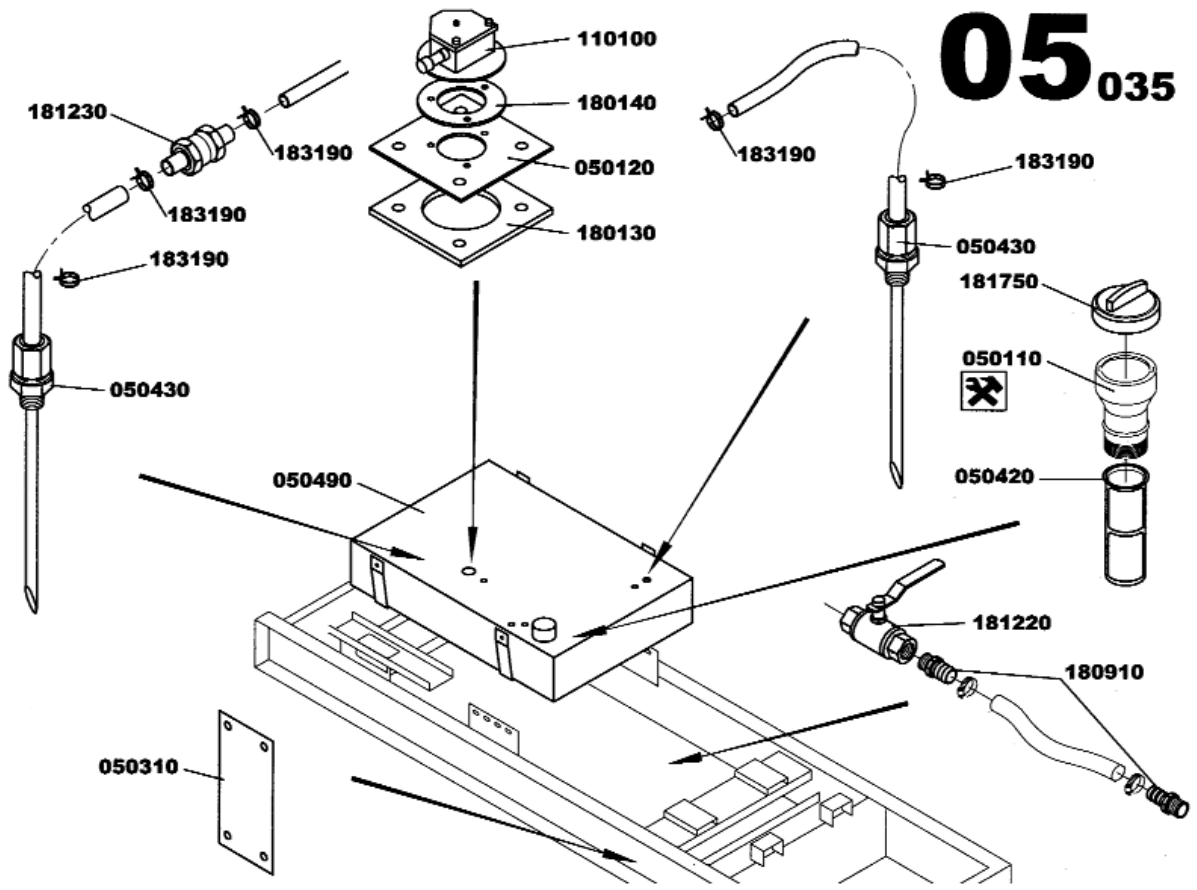
Item	Part Number	Description	Quantity	Units
F03011	85419885	RADIATOR VO TAD1630G ASSEMBLY	1.0	UN
180890	85415701	PIPE UNION REDUCER MAL/MAL M14x150 3/8G	1.0	UN
180340	85409258	PIPE UNION MAL/MAL 3/8G	1.0	UN
180350	85409308	PIPE UNION ELBOW 90° MAL/FEM 3/8G	1.0	UN
180450	85410298	GASKET D14x18	1.0	UN
181210	85416451	2 WAY VALVE	1.0	UN
130900	85422905	RADIATOR FAN GUARD FRONT VO TAD 16L	1.0	UN
130910	85422913	RADIATOR FAN GUARD FRONT VO TAD 16L	1.0	UN
130920	85422921	RADIATOR FAN GUARD FRONT VO TAD 16L	1.0	UN
130970	85424109	FAN BELT GUARD BRACKET VO TAD16L	1.0	UN
130980	85424117	FAN BELT GUARD BRACKET VO TAD16L	1.0	UN

Part numbers listed are the only parts used in this model



Item	Part Number	Description	Quantity	Units
F05036	85503274	FUEL TANK M426 ASSEMBLY	1.0	UN
050210	85417434	FUEL SUCCION PIPE L410 D10 1/2G	2.0	UN
050310	85422517	FUEL FILLING CUTOUT FRAME CLOSING PANEL	1.0	UN
050110	85403517	FUEL FILLING FUNNEL BASE TANK	1.0	UN
181750	85509222	PLUG TANK	1.0	UN
050500	85503266	TANK 36L	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
180910	85423242	PIPE UNION MAL/MAL 3/4G	2.0	UN
183190	85509727	SPRING CLAMP D17/19	6.0	UN
181220	85424885	2 WAY VALVE	1.0	UN
181230	85417632	NON RETURN VALVE D10	1.0	UN

Part numbers listed are the only parts used in this model

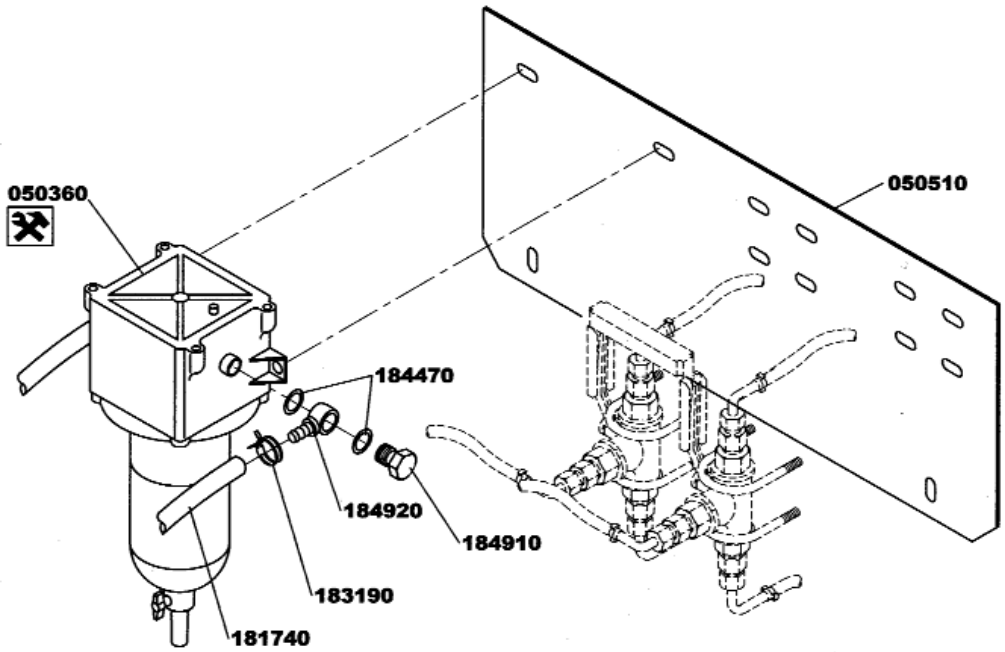


Item	Part Number	Description	Quantity	Units
F05035	85496677	FUEL TANK M426 ASSEMBLY	1.0	UN
050430	85496628	FUEL SUCCION PIPE L330 D10 1/2G	2.0	UN
050310	85422517	FUEL FILLING CUTOUT FRAME CLOSING PANEL	1.0	UN
050110	85403517	FUEL FILLING FUNNEL BASE TANK	1.0	UN
181750	85509222	PLUG TANK	1.0	UN
050420	85431120	FUEL FILTER	1.0	UN
050490	85496669	TANK 36L	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
180910	85423242	PIPE UNION MAL/MAL 3/4G	2.0	UN
181220	85424885	2 WAY VALVE	1.0	UN
181230	85417632	NON RETURN VALVE D10	1.0	UN

Part numbers listed are the only parts used in this model

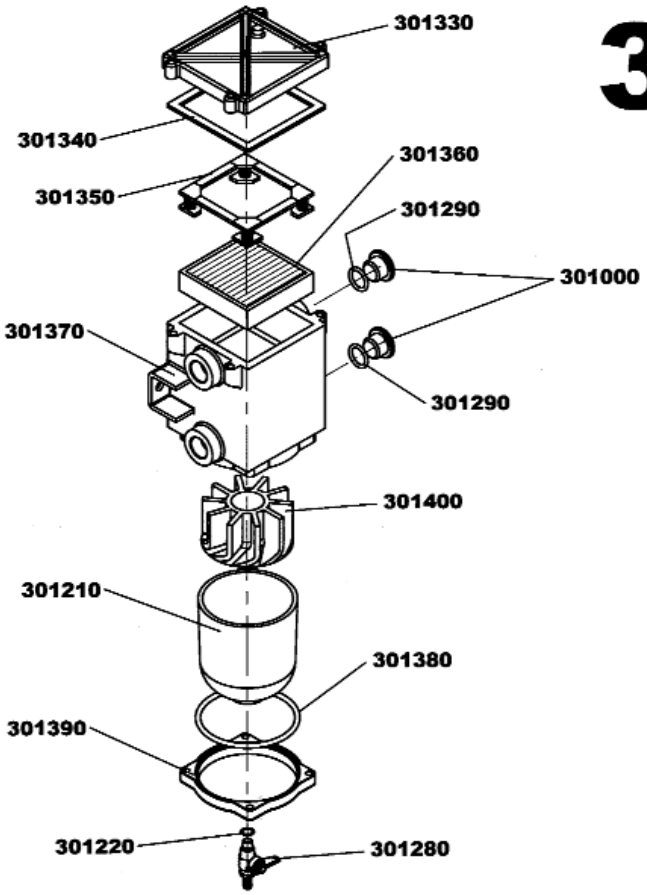
Fuel tank assembly only use with simplified retention bund and single base plate option

05 037



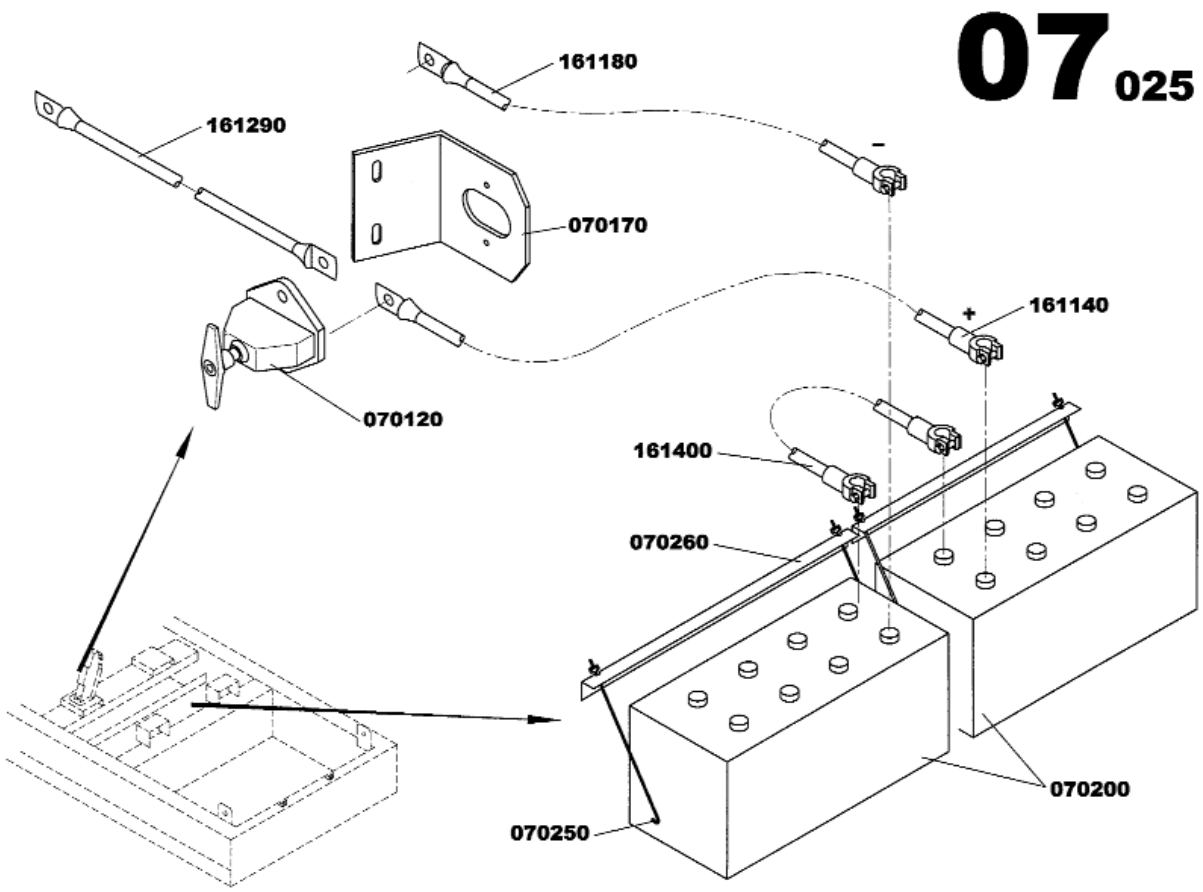
Item	Part Number	Description	Quantity	Units
F05037	85503282	FUEL PREFILTER KIT ASSEMBLY	1.0	UN
050360	85421451	DECANTATION CARTRIDGE FILTER	1.0	UN
050510	85430676	3 WAY FUEL VALVE/SEPARATOR FILTER BRACKET	1.0	UN
184920	85507937	BANJO CONNECTOR MALE D10	2.0	UN
184910	85507945	BANJO SCREW M16X150 L28	2.0	UN
183190	85509727	SPRING CLAMP D17/19	2.0	UN
184470	85507952	GASKET D16x22	4.0	UN
181740	85430643	FLEXIBLE HOSE D9x15	1.6	ML

Part numbers listed are the only parts used in this model



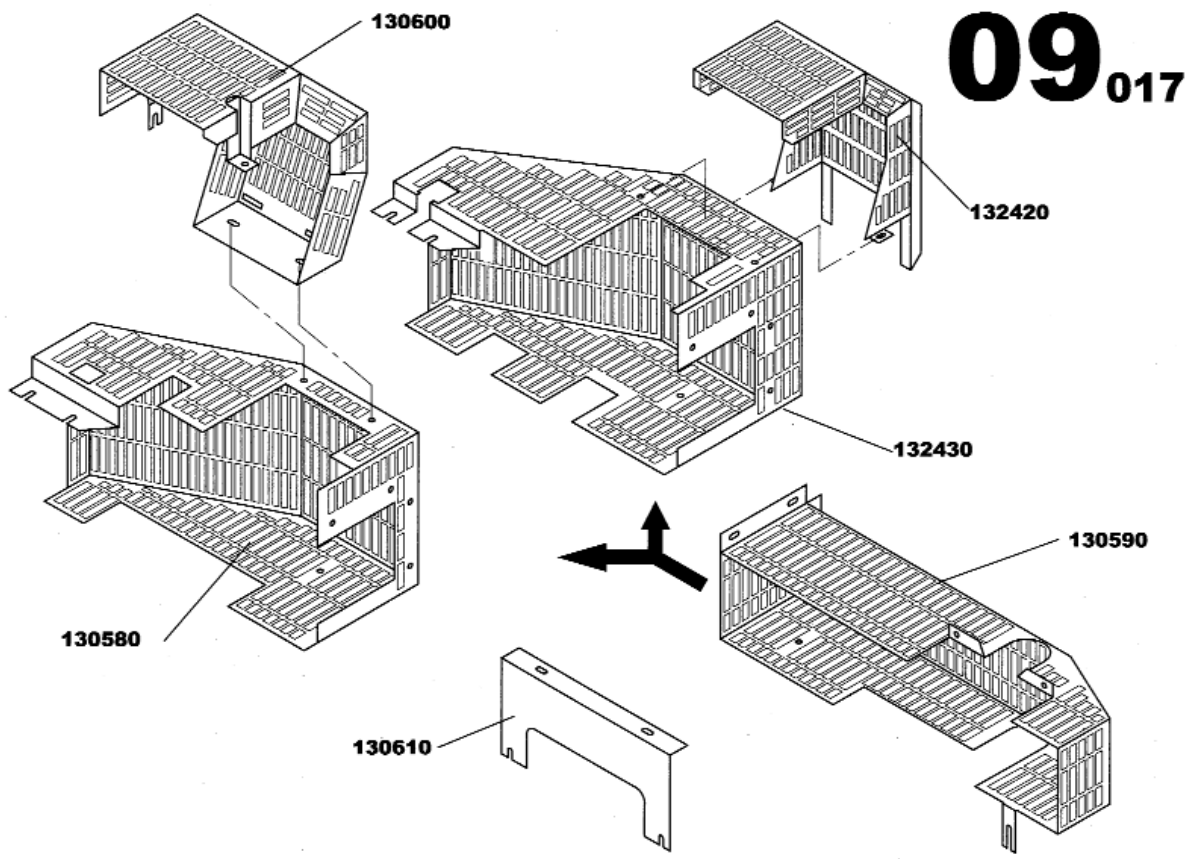
Item	Part Number	Description	Quantity	Units
F30018		DECANTATION CARTRIDGE FILTER 050360 DETAIL	1.0	UN
301330	85502557	SEPARATOR FILTER LID	1.0	UN
301340	85502581	SEPARATOR FILTER LID GASKET	1.0	UN
301350	85502599	SEPARATOR FILTER SPRING CASSETTE	1.0	UN
301360	85401644	SEPARATOR FILTER CARTRIDGE	1.0	UN
301370	85502946	SEPARATOR FILTER HOUSING	1.0	UN
301380	85502953	SEPARATOR FILTER BOWL GASKET	1.0	UN
301390	85502961	SEPARATOR FILTER BOWL RETAINER RING	1.0	UN
301400	85502979	SEPARATOR FILTER CENTRIFUGE	1.0	UN
301000	85502987	SEPARATOR FILTER BLIND SCREW	2.0	UN
301210	85502995	SEPARATOR FILTER BOWL	1.0	UN
301220	85503001	SEPARATOR FILTER O-RING	1.0	UN
301280	85503019	SEPARATOR FILTER DRAIN COCK	1.0	UN
301290	85425551	GASKET D16x20	2.0	UN

Part numbers listed are the only parts used in this model



Item	Part Number	Description	Quantity	Units
F07025	85496693	ELECTRIC STARTER ISOLATED ASSEMBLY	1.0	UN
070170	85403707	BATTERY ISOLATOR BRACKET	1.0	UN
070200	85416568	STARTING BATTERY 12V 160Ah 650A	2.0	UN
070250	85424349	ACCUMULATOR FIXING STRETCH	4.0	UN
070260	85417806	STARTING BATTERY BRACKET ANGLE BAR 2 HOLE	2.0	UN
070120	85403723	BATTERY ISOLATOR SWITCH	1.0	UN
161140	85417277	BATTERY CABLE(+) 50mm2 L700 RED	1.0	UN
161180	85417236	BATTERY CABLE(-) 70mm2 L1500 BLACK	1.0	UN
161290	85417210	BATTERY CABLE 70mm2 L1100 RED	1.0	UN
161400	85417251	BATTERY CABLE(+)(-) 70mm2 L1500 BLACK	1.0	UN

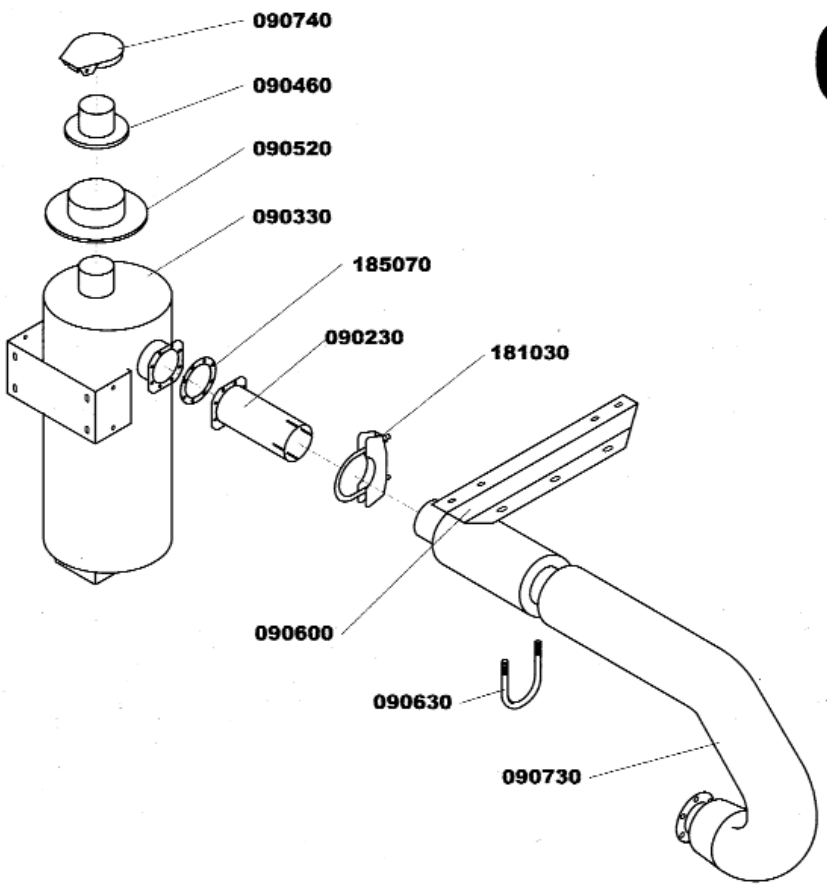
Part numbers listed are the only parts used in this model



Item	Part Number	Description	Quantity	Units
F09017	85420206	HOT SPOT GUARDS ASSEMBLY	1.0	UN
130590	85422830	HOT SPOT GUARD VO 16L	1.0	UN
130610	85424091	HOT SPOT GUARD BRACKET VO 16L	1.0	UN
132420	85622348	HOT SPOT GUARD VO	1.0	UN
132430	85622355	HOT SPOT GUARD VO	1.0	UN

Part numbers listed are the only parts used in this model

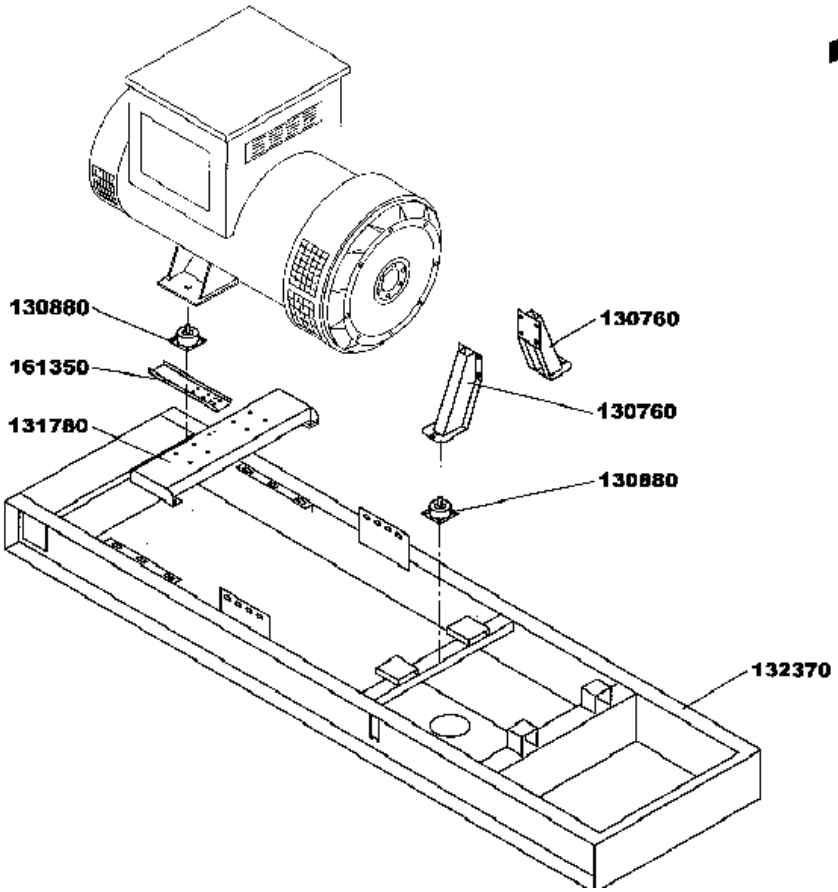
09053



Item	Part Number	Description	Quantity	Units
F09053	85622231	EXHAUST MUFFLER M426 ASSEMBLY	1.0	UN
090230	85422780	MUFFLER EXTENSION D141	1.0	UN
090460	85496768	MUFFLER EXTENSION D194	1.0	UN
090520	85496792	CLOSING SHEET PLATE DN175	1.0	UN
090330	85423614	40dB MUFFLER	1.0	UN
090600	85496875	EXHAUST HOSE BRACKET	1.0	UN
090730	85622249	EXHAUST PIPE D140 VOLVO	1.0	UN
090740	85622256	EXHAUST RAIN FLAP D193	1.0	UN
185070	85622652	ROUND FLANGE GASKET	1.0	UN
181030	85417780	HOSE CLAMP D140	1.0	UN
181070	85417764	HOSE CLAMP D140	1.0	UN

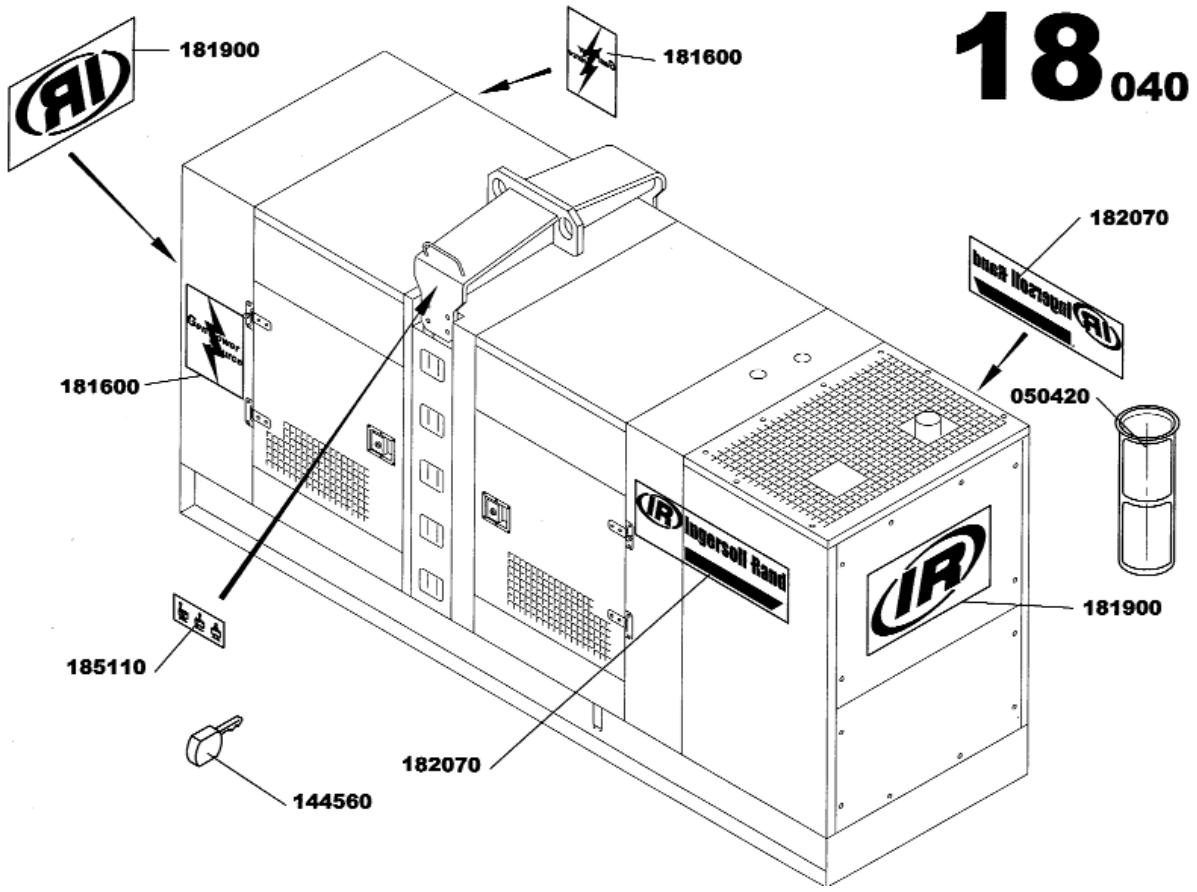
Part numbers listed are the only parts used in this model

13 080



Item	Part Number	Description	Quantity	Units
F13080	85622264	FRAME M426 VO TAD16L ASSEMBLY	1.0	UN
130760	85423986	ENGINE SUPPORT VO 16L LEFT RIGHT SIDE	2.0	UN
132370	85622272	FRAME M426	1.0	UN
130880	85401875	ANTI-VIBRATION MOUNT 0800daN 8.5mm	4.0	UN
131780	85497352	ALTERNATOR TRAVERSE LSA471 M426	1.0	UN
161350	85423853	ELECTRIC WIRING BRACKET	1.0	UN

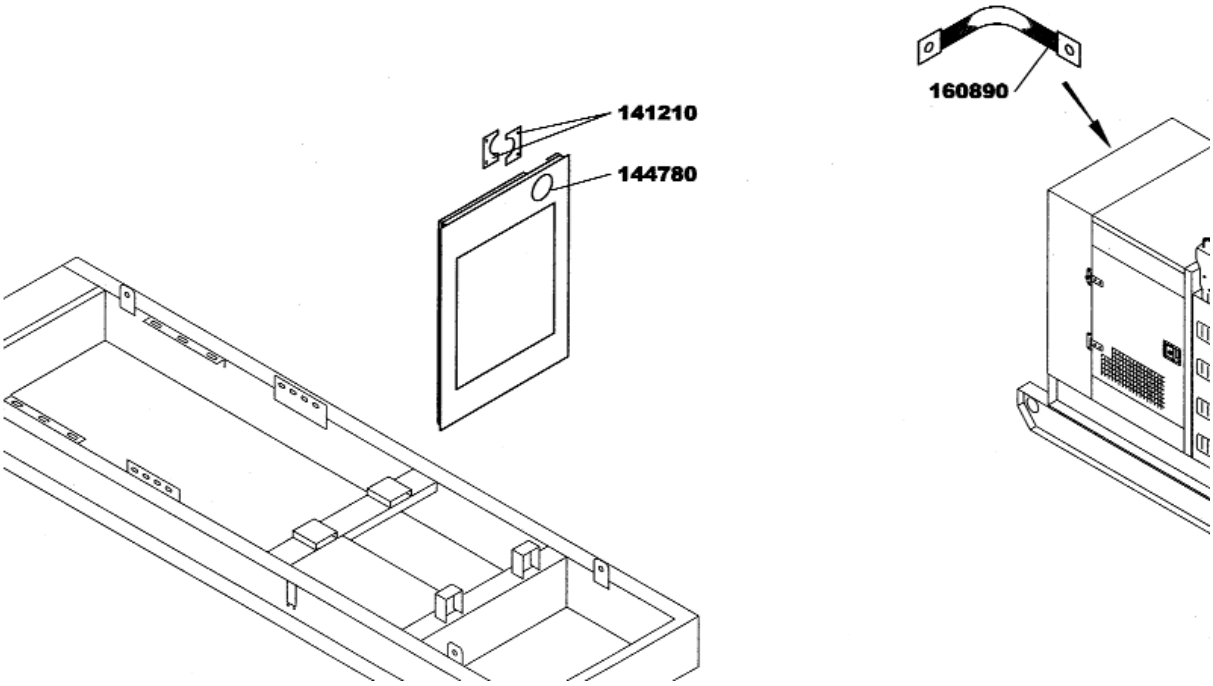
Part numbers listed are the only parts used in this model



Item	Part Number	Description	Quantity	Units
F18040	85501856	G550 ACCESSORY ASSEMBLY	1.0	UN
050420	85431120	FUEL FILTER	1.0	UN
144560	85509263	WBH LATCHE KEY	1.0	UN
182070	85503894	RECTANGULAR STICKER 1100x325	2.0	UN
181600	85428019	RECTANGULAR STICKER 450x600	2.0	UN
181900	85500213	ROUND STICKER D385	2.0	UN

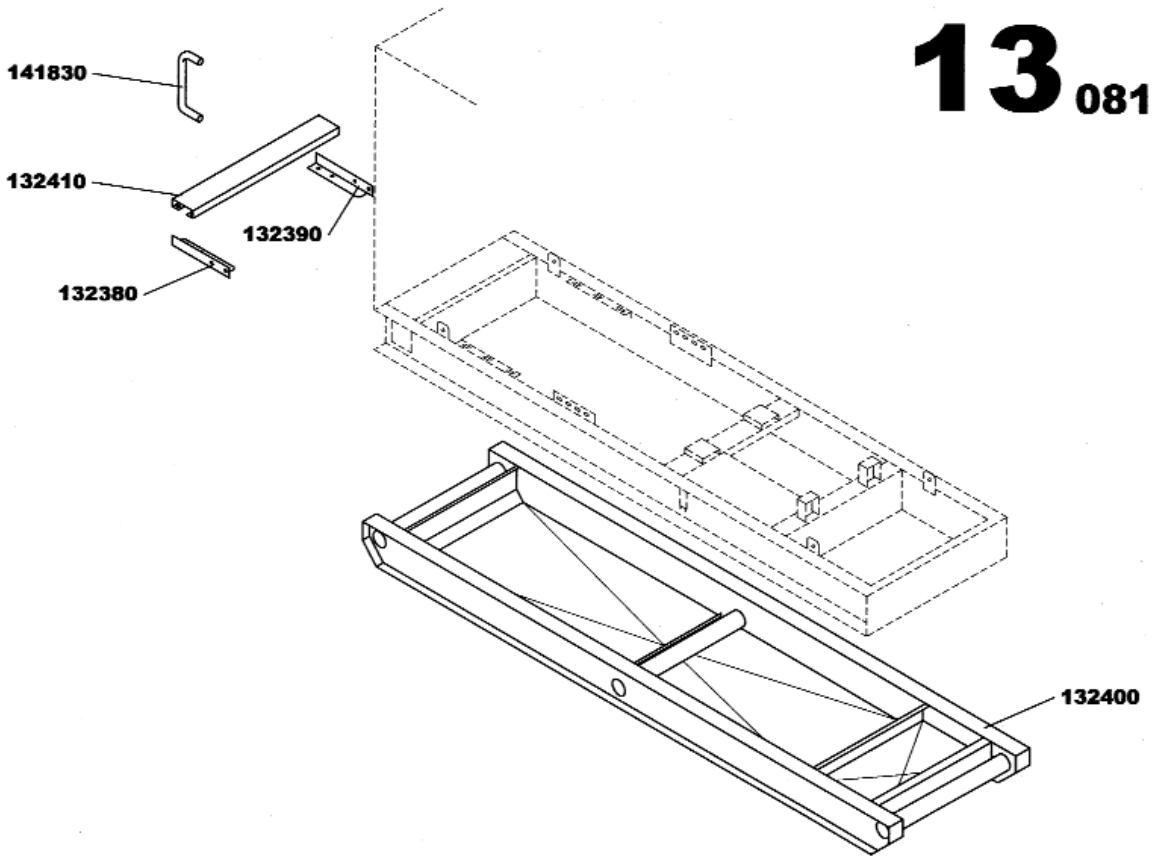
Part numbers listed are the only parts used in this model

13 082



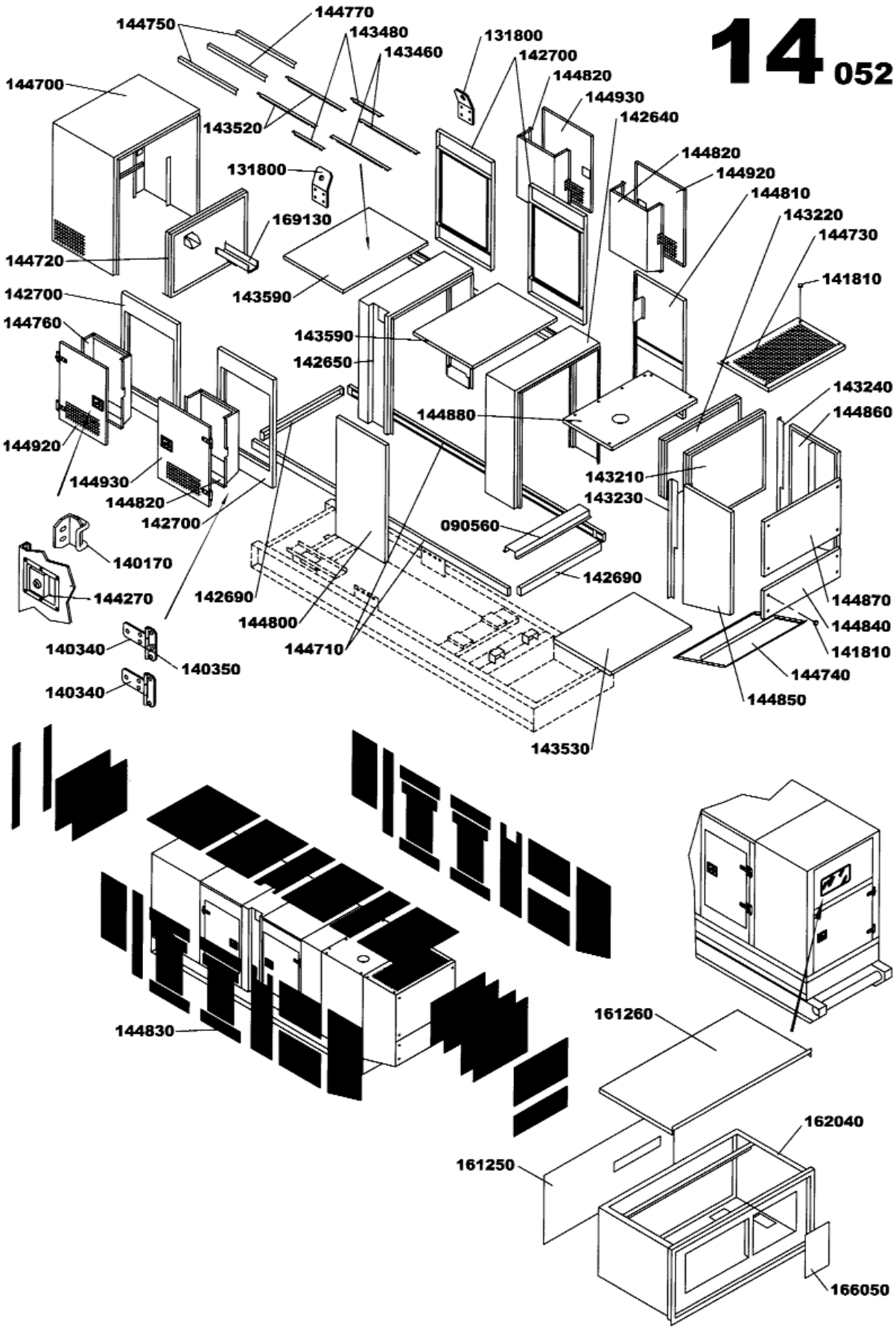
Item	Part Number	Description	Quantity	Units
F13082	85622280	M426 MISCELLANEOUS ASSEMBLY	1.0	UN
141210	85424505	EXHAUST PASSAGE PANEL M406/407	2.0	UN
144780	85622454	RADIATOR PANEL M426 VO TAD1631G	1.0	UN
160890	85406460	GROUND WIRES 16mm2	4.0	UN

Part numbers listed are the only parts used in this model



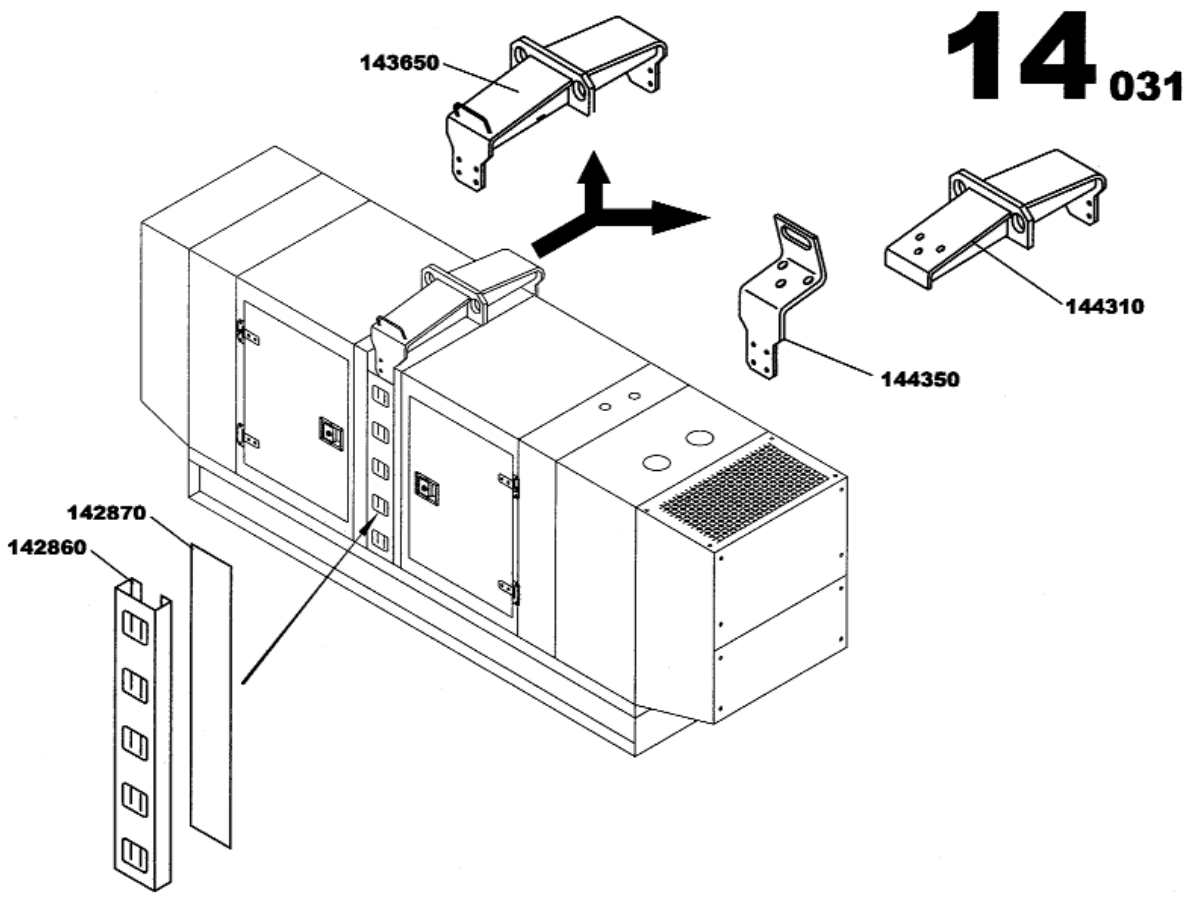
Item	Part Number	Description	Quantity	Units
F13081	85622314	RETENTION BUND ASSEMBLY	1.0	UN
132400	85622322	RETENTION BUND	1.0	UN
132380	85622298	LEFT FOOTBOARD BRACKET	1.0	UN
132390	85622306	FOOTBOARD BRACKET	1.0	UN
132410	85622330	FOOTBOARD M426	1.0	UN
141830	85422590	PULLING HANDLE	1.0	UN

Part numbers listed are the only parts used in this model


14 052
144750
144770
143480
143460
131800
142700
144820
144930
142640
144700
143520
144820
144920
144810
143220
144730
141810
131800
169130
144720
143590
142700
144760
143590
142650
143240
144860
144880
144920
144930
144820
142700
143210
143230
090560
140170
142690
144270
142690
144800
144710
144870
144840
141810
144740
140340
140350
140340
144850
143530
144830
161260
162040
161250
166050

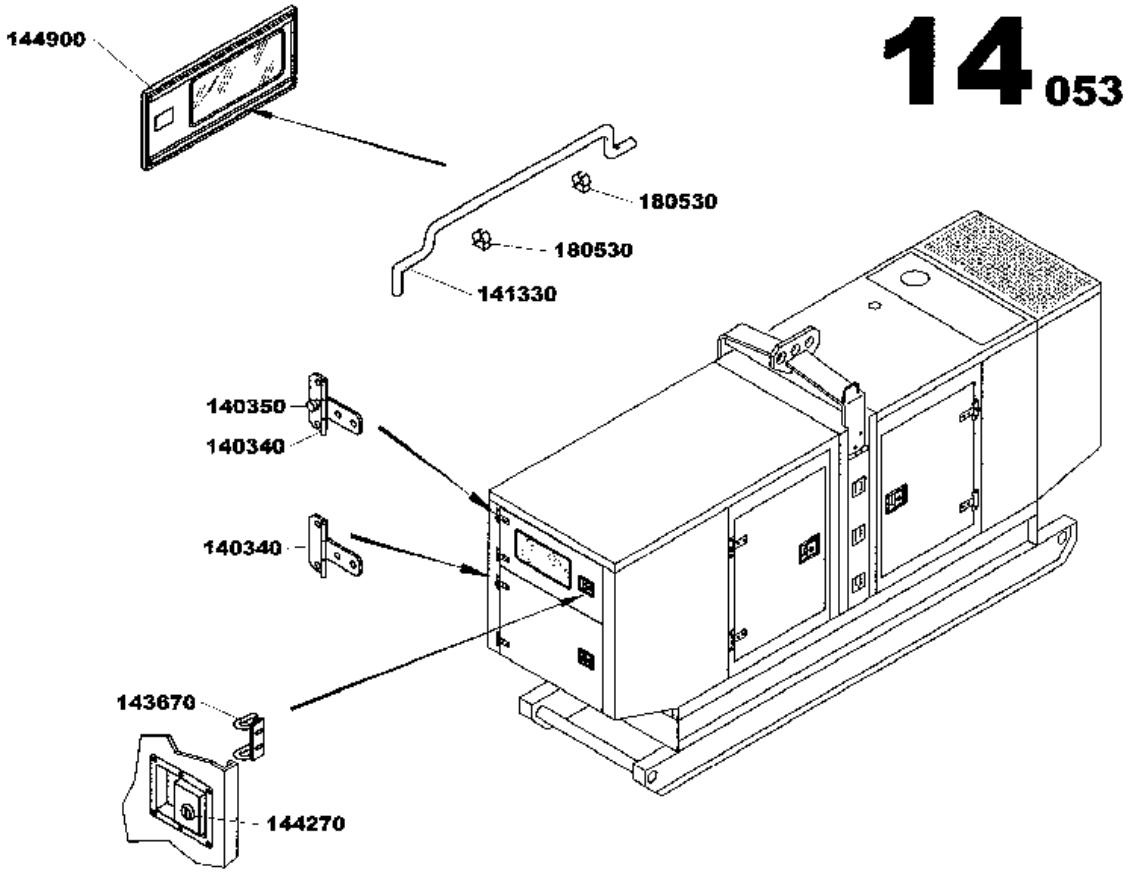
Item	Part Number	Description	Quantity	Units
F14052	85622389	CANOPY M426 ASSEMBLY	1.0	UN
090560	85496834	40dB MUFFLER BRACKET M426	1.0	UN
131800	85497386	LIFTING BRACKET M424/425/426	2.0	UN
142640	85497535	FRONT SUPPORT ARCH M426	1.0	UN
142650	85497543	CENTRAL SUPPORT ARCH M426	1.0	UN
142690	85497584	BASEFRAME FRONT/REAR M426	1.0	UN
142700	85497592	DOOR SCOPE M426	4.0	UN
144700	85622363	REAR SUPPORT ARCH M426	1.0	UN
144710	85622371	BASEFRAME SIDE M426	2.0	UN
143210	85498111	SOUND SHIELD M426	1.0	UN
143220	85498129	SOUND SHIELD M426	1.0	UN
143460	85498368	CANOPY TOP ISOLATION BRACKET M425	2.0	UN
143480	85498384	CANOPY ARCH ISOLATION BRACKET M426	2.0	UN
143520	85498442	CANOPY TOP ISOLATION BRACKET M426	2.0	UN
143530	85498459	HOOD FRONT UNDERSHEETING M426	1.0	UN
144720	85622397	SOUND SHIELD M426	1.0	UN
144730	85622405	AIR OUTLET LOUVER M426	1.0	UN
144740	85622413	AIR OUTLET HOOD UNDERSHEETING M426	1.0	UN
144750	85622421	CANOPY REAR PANEL ISOLATION BRACKET M426	3.0	UN
144760	85622439	AIR DEFLECTOR DOOR M420	1.0	UN
144770	85622447	CANOPY REAR PANEL ISOLATION BRACKET M426	1.0	UN
144800	85622470	RIGHT FORWARD PLENUM PANEL M426	1.0	UN
144810	85622488	LEFT FORWARD PLENUM PANEL M426	1.0	UN
143230	85498137	RIGHT SHAFT BRACKET ANGLE BAR	1.0	UN
143240	85498145	LEFT SHAFT BRACKET ANGLE BAR	1.0	UN
144820	85622496	AIR DEFLECTOR DOOR M420	3.0	UN
144830	85622504	SOUNDPROOF PANELS BATCH M426	1.0	UN
144840	85622512	LOW FORWARD PLENUM PANEL M426	1.0	UN
144850	85622520	RIGHT FORWARD PLENUM PANEL M426	1.0	UN
144860	85622538	LEFT FORWARD PLENUM PANEL M426	1.0	UN
144870	85622546	HIGH FORWARD PLENUM PANEL M426	1.0	UN
143590	85498525	CANOPY TOP M426	2.0	UN
144880	85622553	CANOPY FRONT TOP PANEL M426	1.0	UN
140340	85406155	DOOR HINGE	8.0	UN
140350	85406189	ANTI-VIBRATION MOUNT 140daN 15mm	4.0	UN
144270	85509305	CANOPY DOOR LOCK KEY LOCK	4.0	UN
141810	85417186	PLUG D22.8	18.0	UN
140170	85492460	STRIKER PLATE M400 CANOPY DOOR	4.0	UN
144920	85622603	CANOPY DOOR M426 HINGE ON LEFT	2.0	UN
144930	85622611	CANOPY DOOR M426 HINGE ON RIGHT	2.0	UN
161250	85424422	REAR PANEL M404/407 CONTROL PANEL HOUSING	1.0	UN
161260	85424661	CONTROL PANEL HOUSING M404/407	1.0	UN
166050	85498780	FRONT PANEL M404/5/6/7 CONTROL PANEL HOUSING	1.0	UN
162040	85422558	CONTROL PANEL HOUSING INTELLISYS M404/407	1.0	UN
169130	85622629	POWER CABLE BRACKET M426	1.0	UN

Part numbers listed are the only parts used in this model



Item	Part Number	Description	Quantity	Units
F14031	85498590	CENTRAL LIFTING ARCH ASSEMBLY	1.0	UN
142860	85497741	LADDER M426	1.0	UN
142870	85497758	LADDER PROTECTION PANEL M426	1.0	UN
144310	85509503	LIFTING FRAME 6500daN M426 CANOPY	1.0	UN
144350	85509537	LIFTING BRACKET M426	1.0	UN

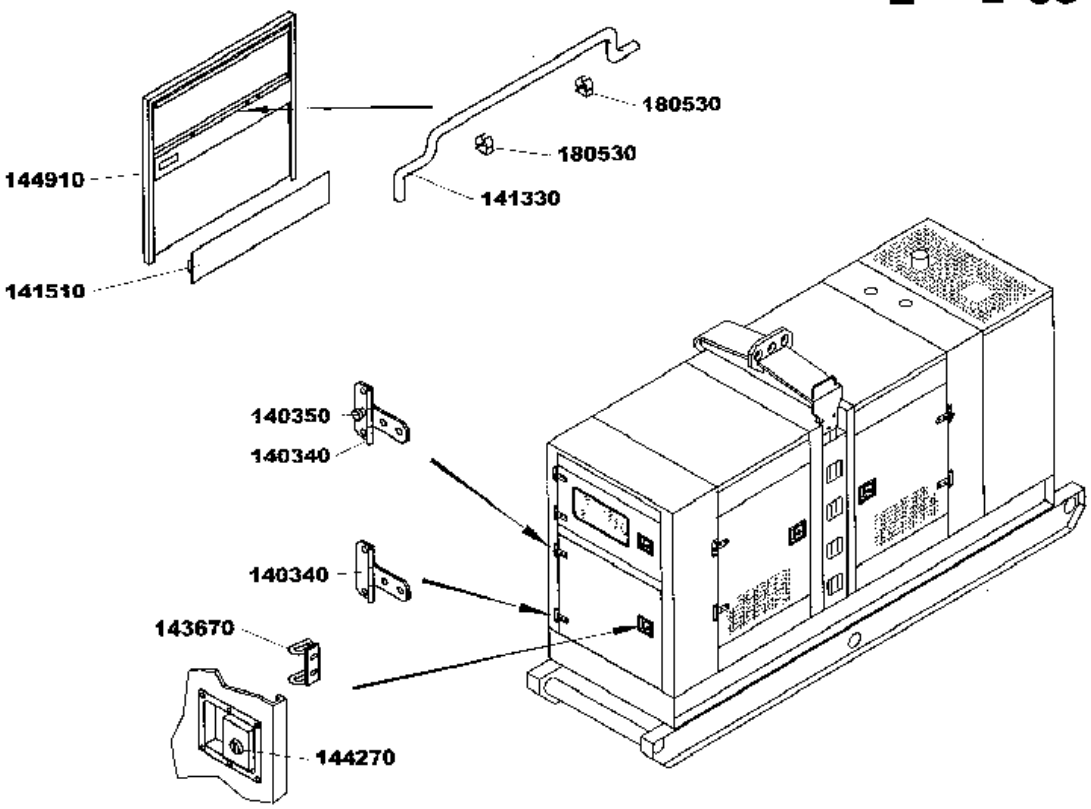
Part numbers listed are the only parts used in this model



Item	Part Number	Description	Quantity	Units
F14053	85622587	PANEL WINDOW M404/407 ASSEMBLY	1.0	UN
141330	85416790	DOOR STOP	1.0	UN
140340	85406155	DOOR HINGE	2.0	UN
140350	85406189	ANTI-VIBRATION MOUNT 140daN 15mm	1.0	UN
143670	85501765	STRIKER PLATE M400 CANOPY MCPS DOOR	1.0	UN
144270	85509305	CANOPY DOOR LOCK KEY LOCK	1.0	UN
144900	85622561	CONTROL PANEL DOOR M404/405/406/407	1.0	UN
180530	85409498	CLIP-ON BRACKET	2.0	UN

Part numbers listed are the only parts used in this model

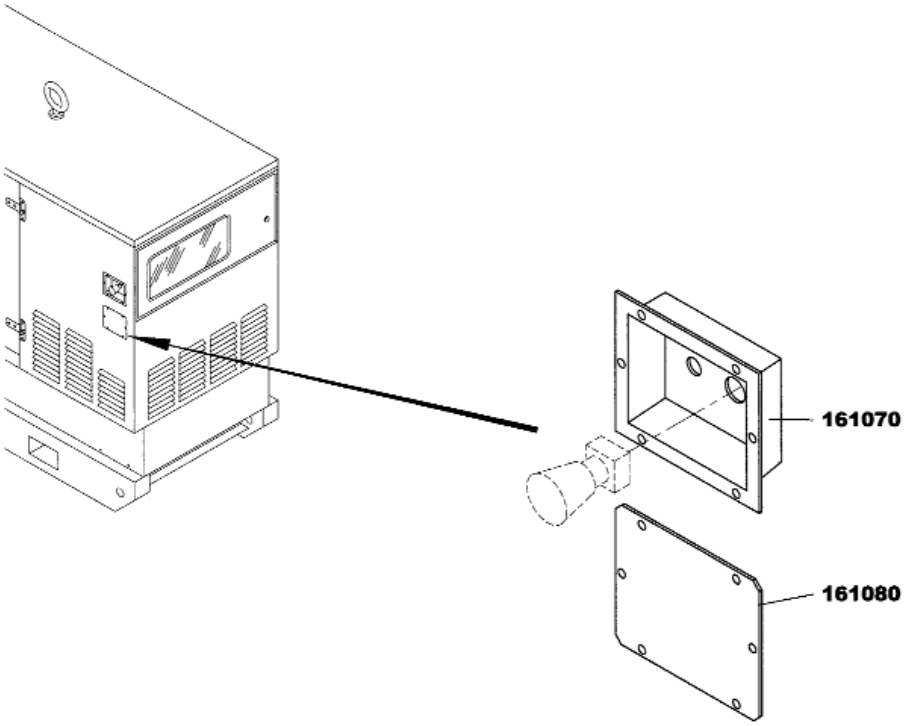
14 054



Item	Part Number	Description	Quantity	Units
F14054	85622595	PANEL DOOR M426 ASSEMBLY	1.0	UN
141330	85416790	DOOR STOP	1.0	UN
141510	85422640	DOCUMENT FILE M406	1.0	UN
140340	85406155	DOOR HINGE	2.0	UN
140350	85406189	ANTI-VIBRATION MOUNT 140daN 15mm	1.0	UN
143670	85501765	STRIKER PLATE M400 CANOPY MCPS DOOR	1.0	UN
144270	85509305	CANOPY DOOR LOCK KEY LOCK	1.0	UN
144910	85622579	TERMINAL CONNECTION DOOR M426	1.0	UN
180530	85409498	CLIP-ON BRACKET	2.0	UN

Part numbers listed are the only parts used in this model

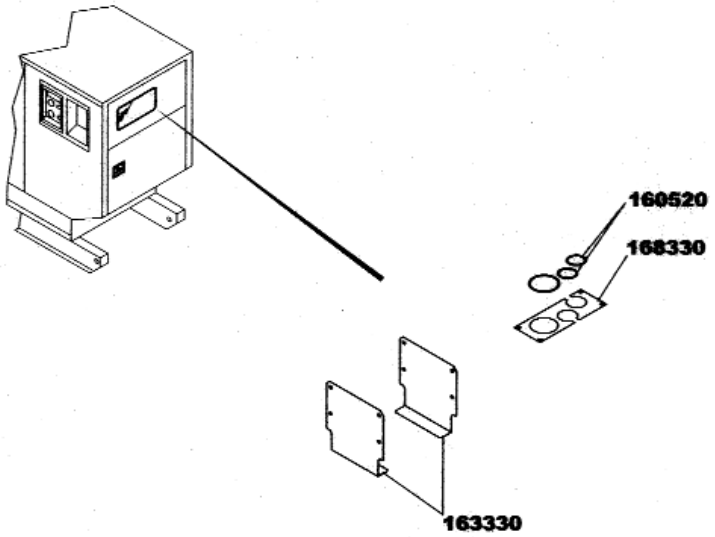
16 015



Item	Part Number	Description	Quantity	Units
F16015	85407187	EMERGENCY STOP PANEL ASSEMBLY	1.0	UN
161080	85406726	SOCKET BRACKET CLOSURE PANEL	1.0	UN
161070	85407294	EMERGENCY STOP PANEL	1.0	UN

Part numbers listed are the only parts used in this model

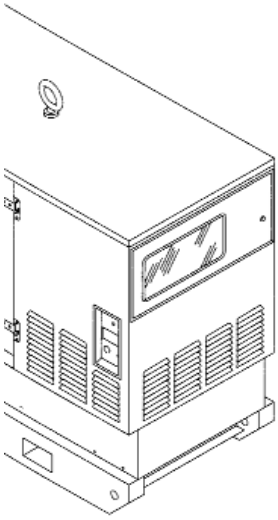
16 216

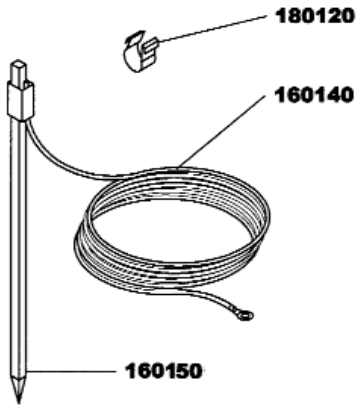


Item	Part Number	Description	Quantity	Units
F16216	85427862	R3000 BRACKET ASSEMBLY	1.0	UN
168330	85427177	RUBBER GROMET SUPPORT	2.0	UN
163330	85427193	INTELLISYS RACK BRACKET	2.0	UN
160520	85408391	RUBBER GROMMET D47	4.0	UN

Part numbers listed are the only parts used in this model

16 006

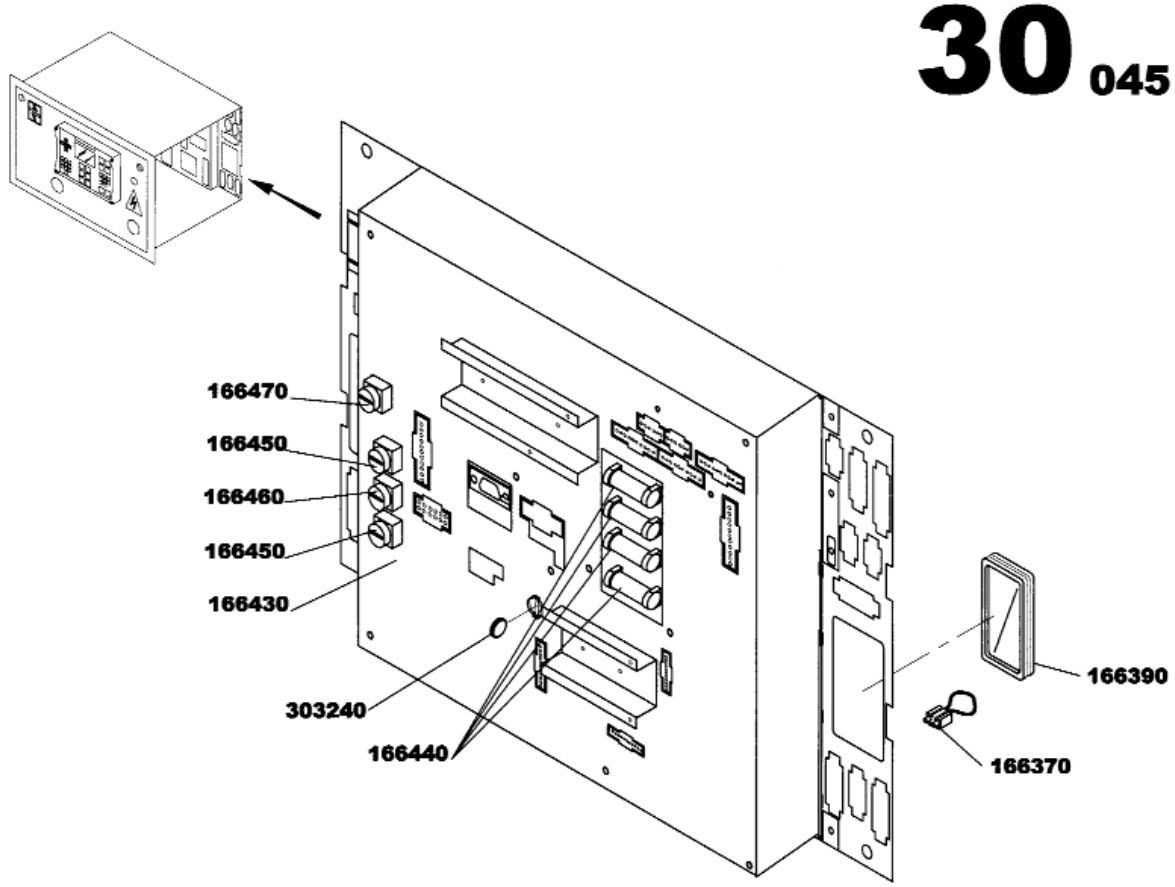




Item	Part Number	Description	Quantity	Units
F16006	85407906	EARTH ROD WITH CABLE CANOPY ASSEMBLY	1.0	UN
160140	85408227	NEUTRAL/EARTH SYSTEM CABLE 25mm2 L10000 Gr/Ye	1.0	UN
160150	85408334	EARTH ROD L1000	1.0	UN
180120	85409191	CLIP-ON BRACKET	2.0	UN

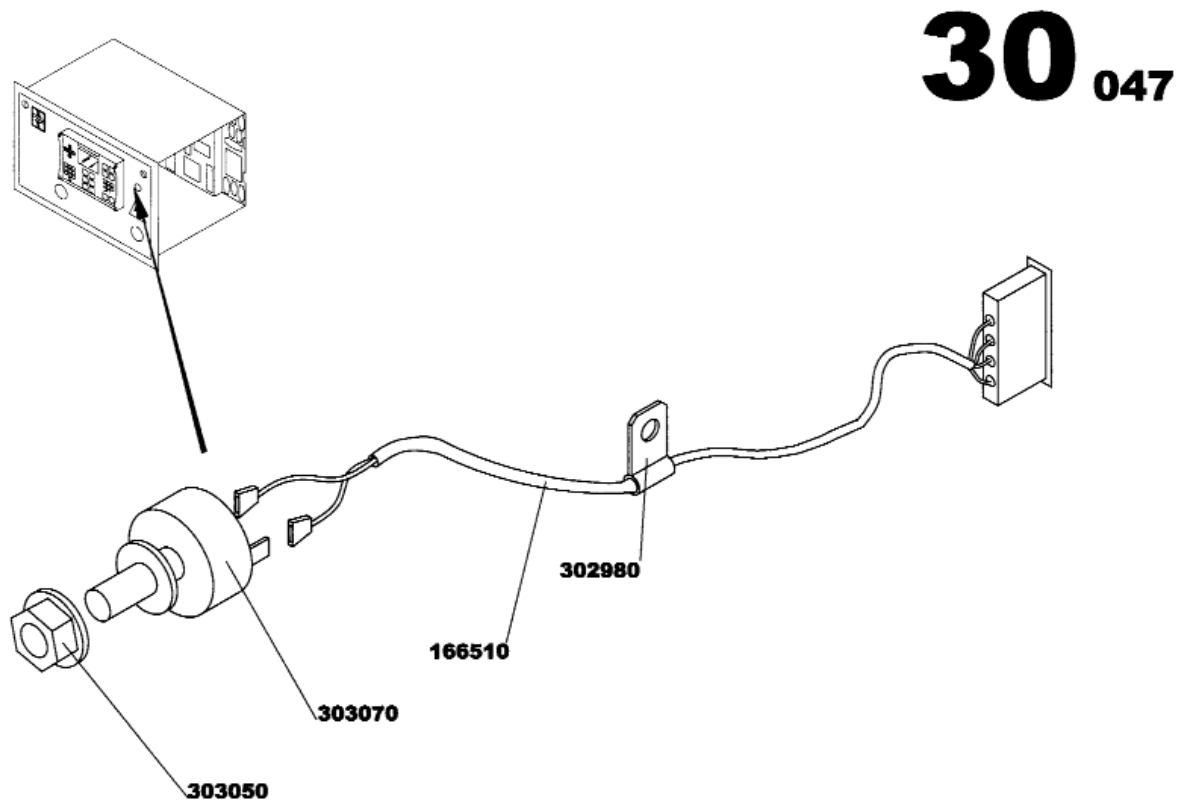
Part numbers listed are the only parts used in this model

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	85508604	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

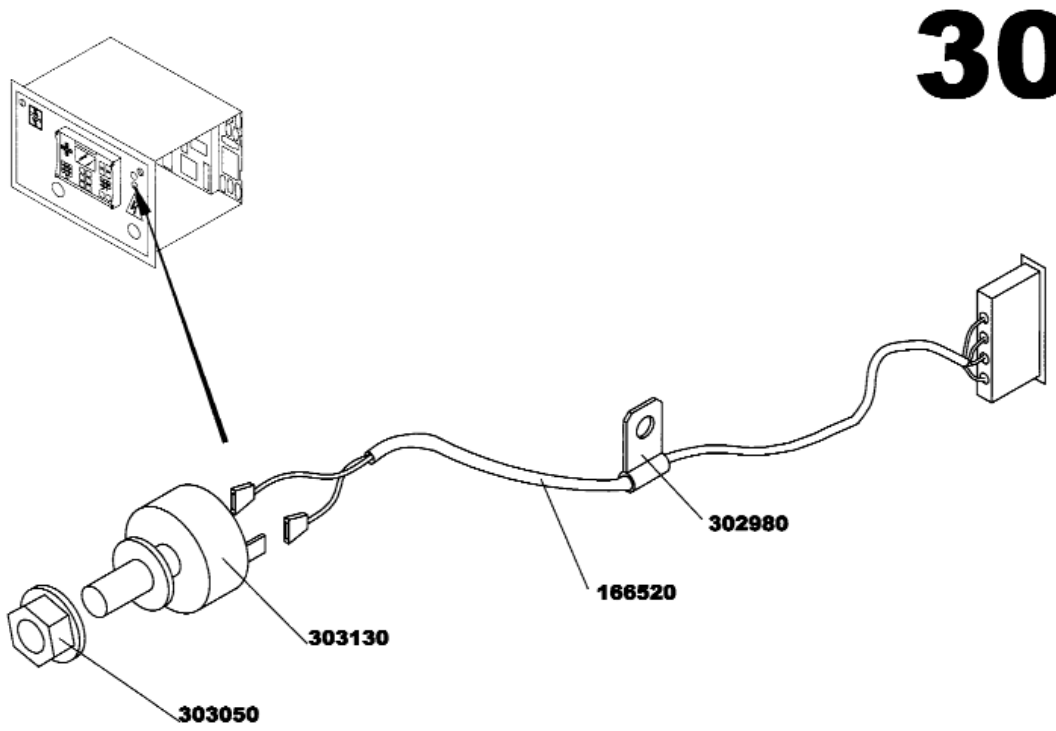
Part numbers listed are the only parts used in this model



Item	Part Number	Description	Quantity	Units
F30047	85412161	INTELLISYS OPTION SPEED POTENTIOMETER	1.0	UN
302980	85504207	CLAMP D4.7	1.0	UN
303050	85504215	LOCK AXE SYSTEM	1.0	UN
166510	85503993	INTELLISYS WIRING LOOM C105 L540	1.0	UN
303070	85504223	POTENTIOMETER 4.7kOHMS	1.0	UN

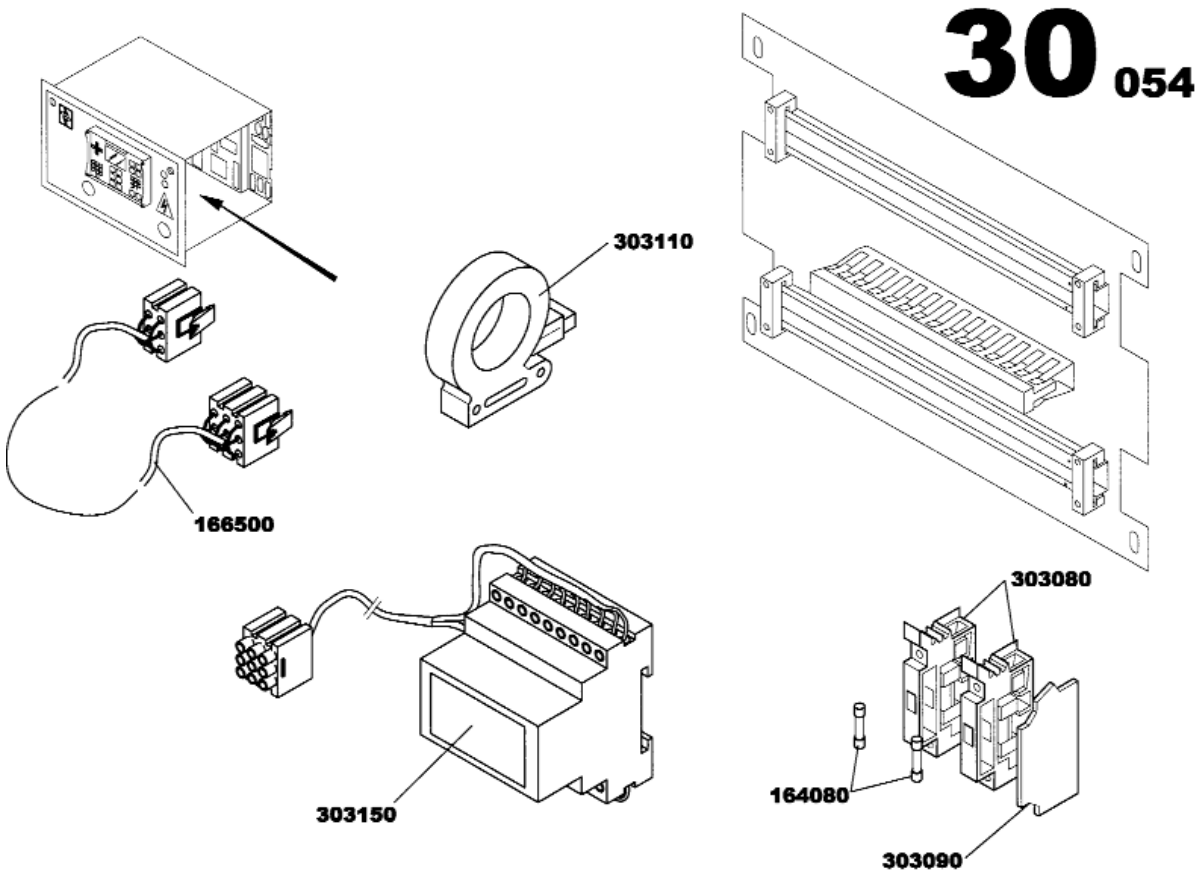
Part numbers listed are the only parts used in this model

30 052



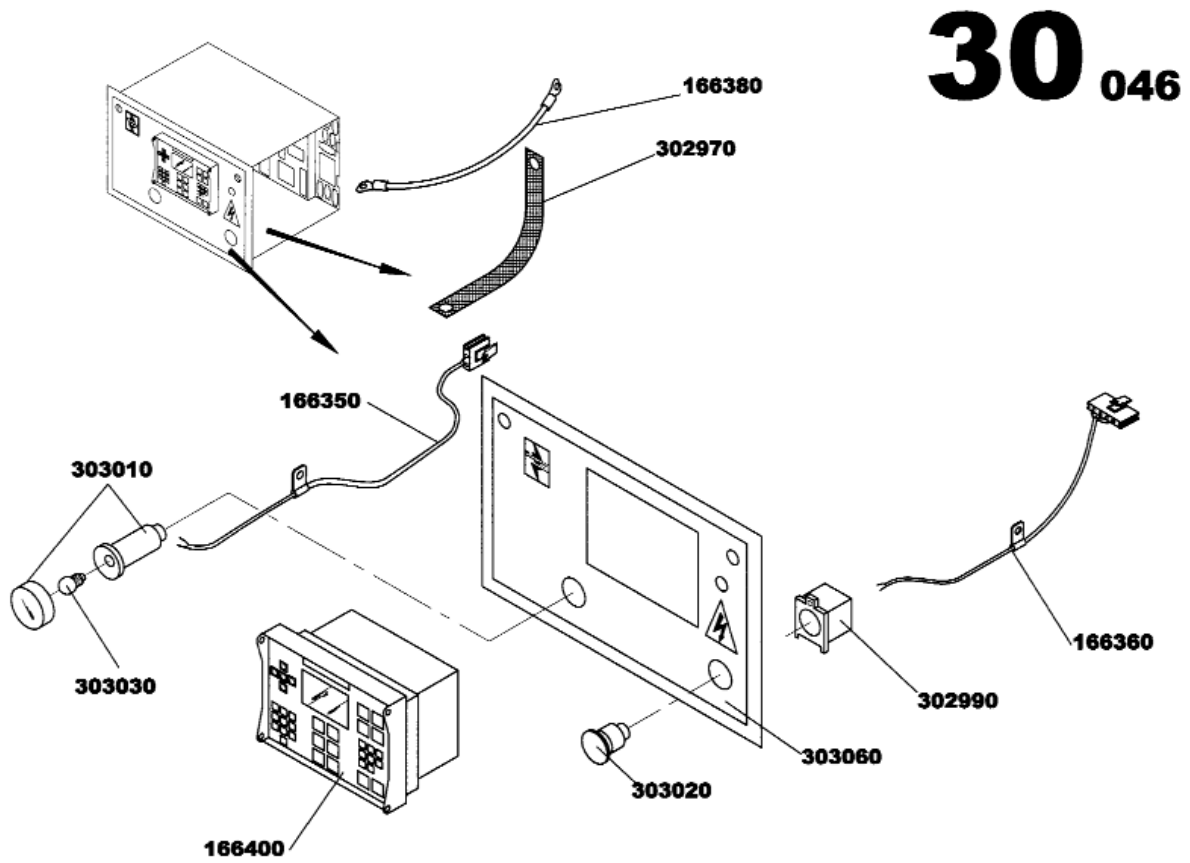
Item	Part Number	Description	Quantity	Units
F30052	85427987	INTELLISYS OPTION ELECTRIC PACK 24V	1.0	UN
302980	85504207	CLAMP D4.7	1.0	UN
303050	85504215	LOCK AXE SYSTEM	1.0	UN
166520	85504009	INTELLISYS WIRING LOOM C106 L560	1.0	UN
303130	85504264	POTENTIOMETER 1kOHMS	1.0	UN

Part numbers listed are the only parts used in this model



Item	Part Number	Description	Quantity	Units
F30054	85412278	INTELLISYS OPTION EARTH LEAHAGE RELAY	1.0	UN
303090	85504249	FLASK	1.0	UN
164080	85413482	FUSE CYLINDRICAL 5A	2.0	UN
166500	85503985	INTELLISYS WIRING LOOM C39 L2000	1.0	UN
303150	85504280	EARTH LEAHAGE RELAY 24V	1.0	UN
303110	85423473	TORE	1.0	UN
303080	85504231	FUSE HOUSING	2.0	UN

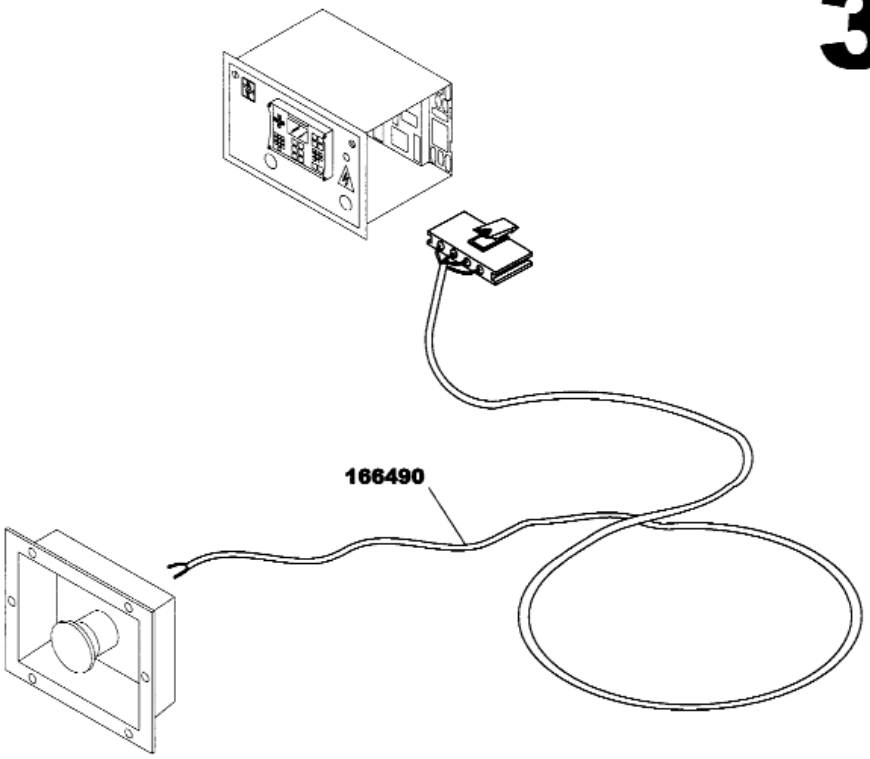
Part numbers listed are the only parts used in this model



Item	Part Number	Description	Quantity	Units
F30046	85412047	INTELLISYS PANEL 24VDC ASSEMBLY	1.0	UN
303010	85503522	WARNING LIGHT CYLINDRIC D22	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
166380	85504041	EARTHING INTELLISYS WIRING LOOM	1.0	UN
166400	85412021	INTELLISYS DISPLAY LEXAN IR	1.0	UN
303060	85504983	INTELLISYS PLASTIC PLATE	1.0	UN
303030	85504090	LAMP 30V	1.0	UN
302990	85426781	EMERGENCY STOP SWITCH	1.0	UN
303020	85426773	EMERGENCY STOP BUTTON	1.0	UN

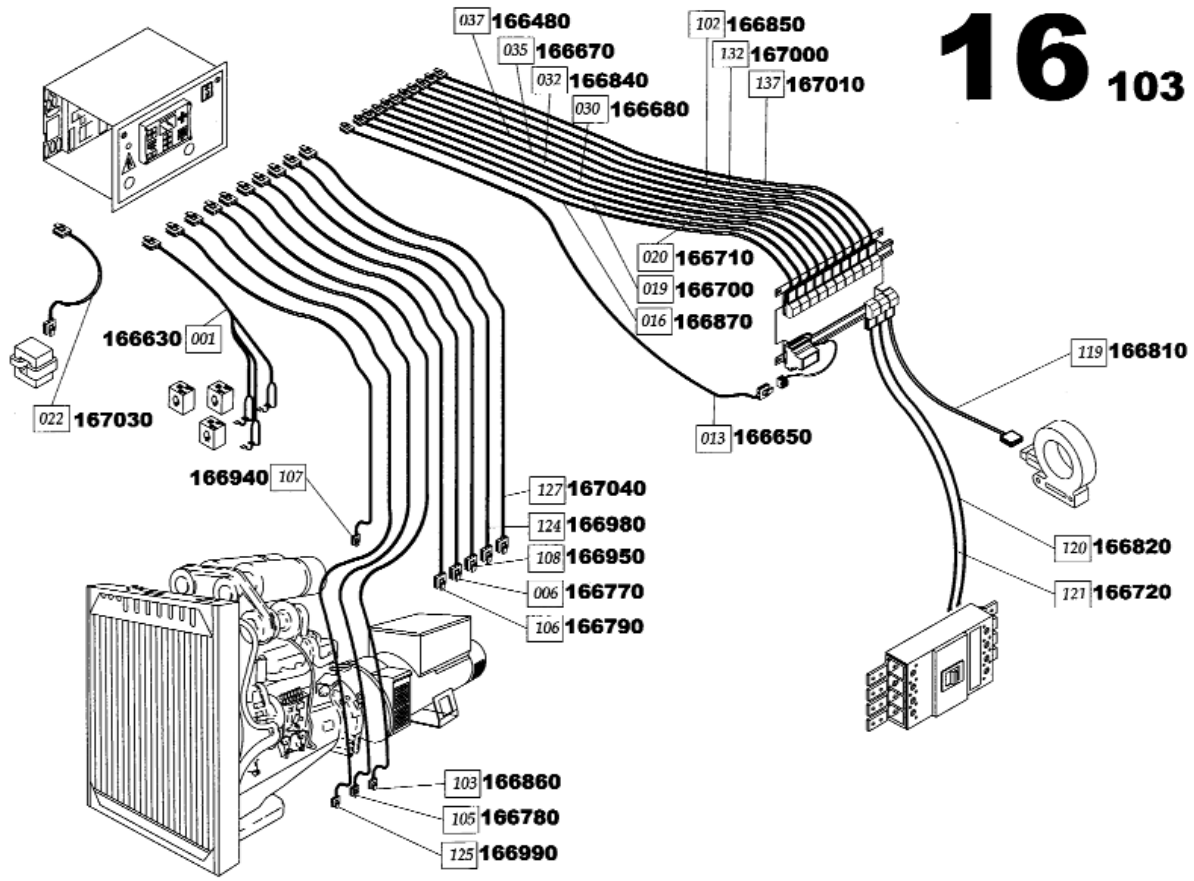
Part numbers listed are the only parts used in this model

30 055



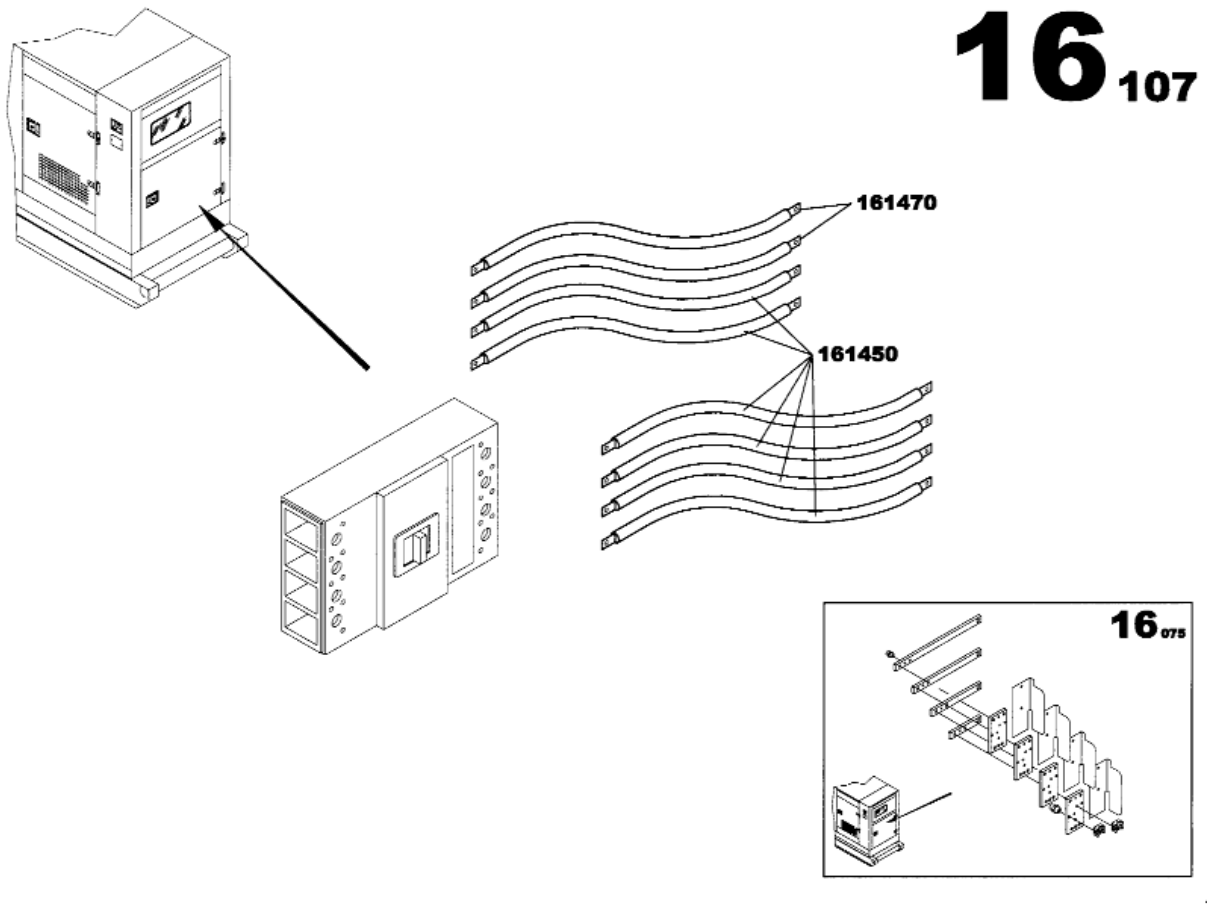
Item	Part Number	Description	Quantity	Units
F30055	85411676	INTELLISYS OPTION EMERGENCY STOP	1.0	UN
166490	85503977	INTELLISYS WIRING LOOM C11 L2000	1.0	UN

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	85411221	INTELLISYS WIRING LOOM 037/041	1.0	UN
166770	85410488	INTELLISYS WIRING LOOM 006	1.0	UN
166780	85499416	INTELLISYS WIRING LOOM 105	1.0	UN
166790	85509321	INTELLISYS WIRING LOOM 106	1.0	UN
166810	85411452	INTELLISYS WIRING LOOM 119	1.0	UN
166820	85411460	INTELLISYS WIRING LOOM 120	1.0	UN
166630	85410561	INTELLISYS WIRING LOOM 001	1.0	UN

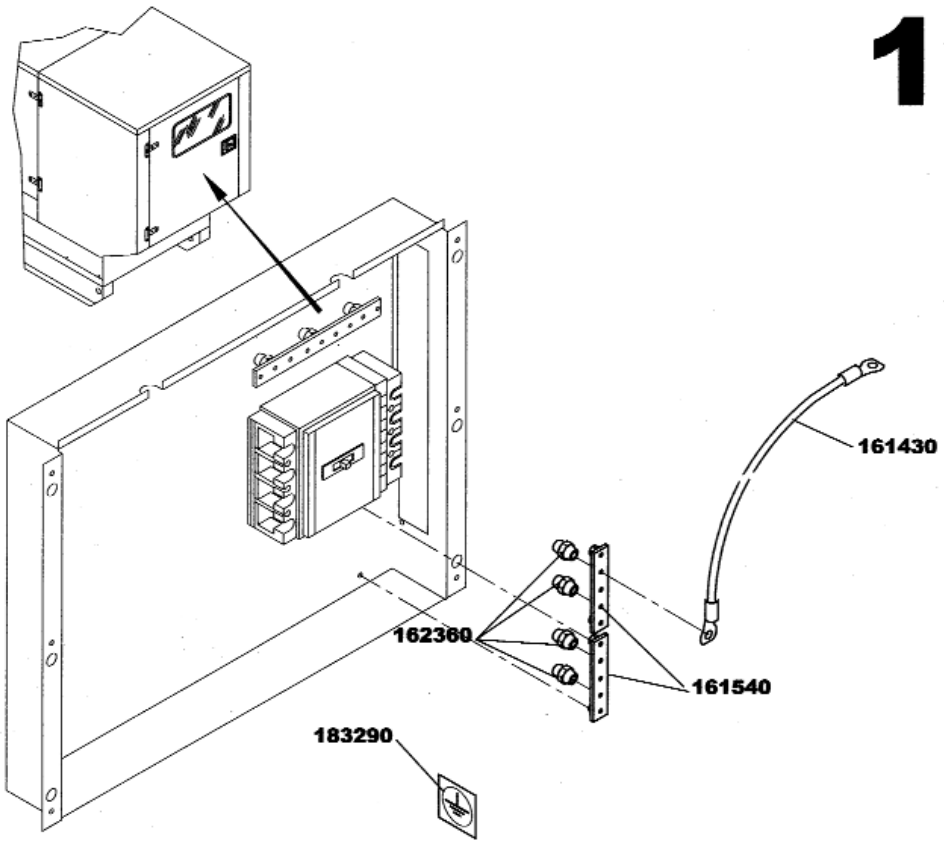
Part numbers listed are the only parts used in this model



Item	Part Number	Description	Quantity	Units
F16107	85420297	ELECTRIC CONNECTION 800A ASSEMBLY	1.0	UN
161450	85417343	POWER CABLE SINGLE CORE 150mm2 L1500	6.0	UN
161470	85417350	POWER CABLE SINGLE CORE 150mm2 L2000	2.0	UN

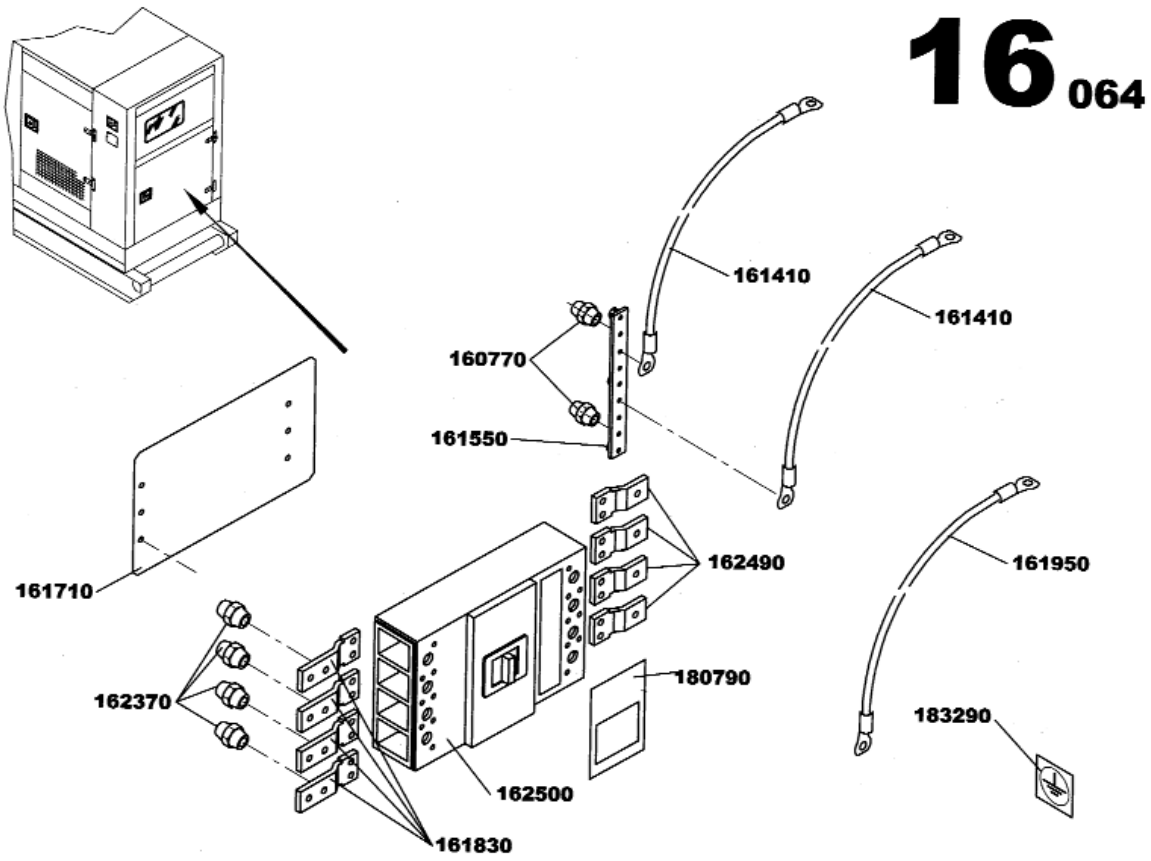
Part numbers listed are the only parts used in this model

16 187



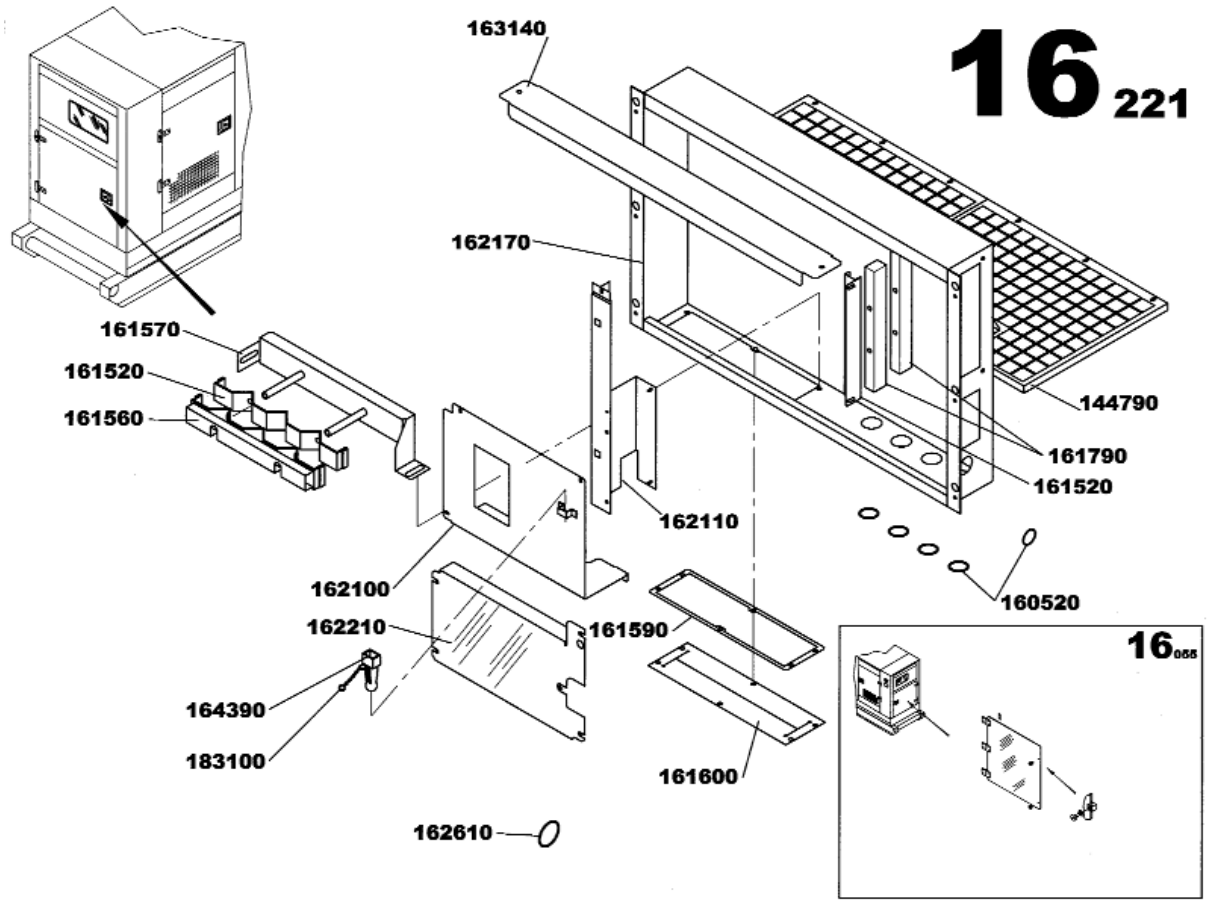
Item	Part Number	Description	Quantity	Units
F16187	85420867	EDF BLOCK HOUSING M400B-LOC ASSEMBLY	1.0	UN
161430	85417376	NEUTRAL/EARTH SYSTEM CABLE 25mm2 L125 Gr/Ye	1.0	UN
161540	85416881	COPPER BAR 5x25	2.0	UN
162360	85413706	INSULATION PIN	4.0	UN
183290	85409084	RECTANGULAR STICKER 25X50	1.0	UN

Part numbers listed are the only parts used in this model



Item	Part Number	Description	Quantity	Units
F16064	85419810	POWER TERMINAL CONNECTIONS 800A ASSEMBLY	1.0	UN
161410	85417319	EARTHING CABLE D8xD10 25mm2 L2500 Gr/Ye	2.0	UN
161550	85416899	COPPER BAR 5x25	1.0	UN
161710	85417384	CIRCUIT BREAKER SHIM	1.0	UN
161830	85417095	COPPER BAR 50x10	4.0	UN
161950	85417368	NEUTRAL/EARTH SYSTEM CABLE 25mm2 L800 Gr/Ye	1.0	UN
160770	85408342	INSULATION PIN	2.0	UN
162370	85421675	INSULATION PIN	3.0	UN
162490	85416865	COPPER BAR KIT (4 PARTS)	1.0	UN
162500	85417921	COMPACT CIRCUIT BREAKER 4x800A	1.0	UN
183290	85409084	RECTANGULAR STICKER 25X50	1.0	UN
180790	85421790	PLASTIC PLATE L130xh190	1.0	UN

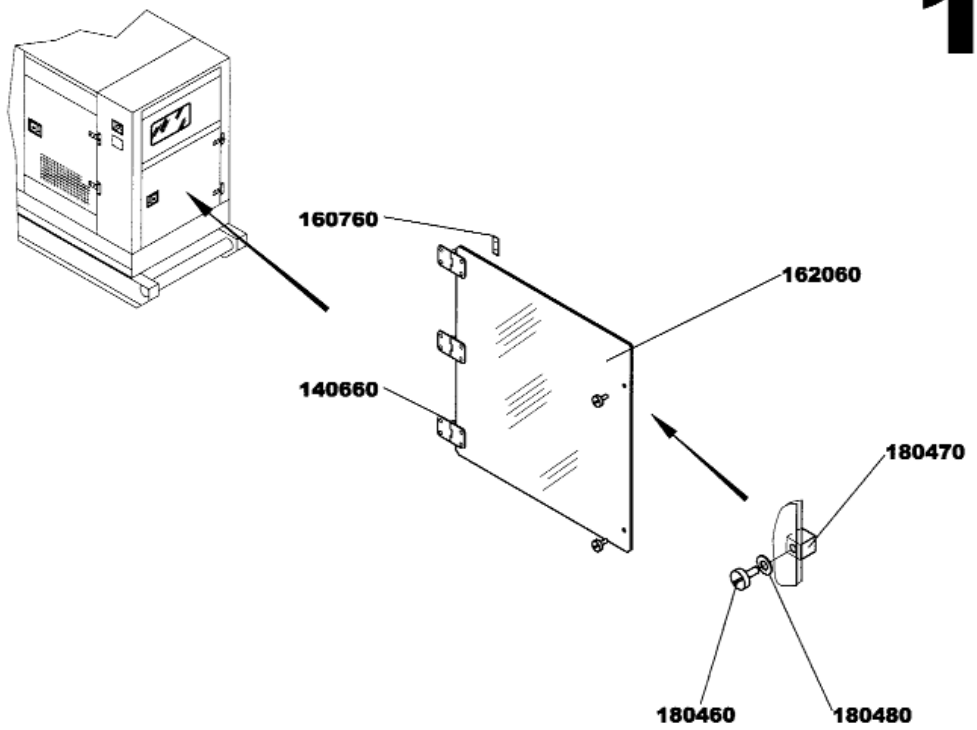
Part numbers listed are the only parts used in this model



Item	Part Number	Description	Quantity	Units
F16221	85622637	TERMINAL BLOCK HOUSING 800<I<=630A ASSEMBLY	1.0	UN
144790	85622462	AIR INLET LOUVER M426	1.0	UN
161520	85421253	MCPS CABLES COLLAR M404 (MOBILE)	1.0	UN
163140	85493435	MCPS CABLES COLLAR M406/407 (MOBILE)	1.0	UN
161590	85423721	WIRE BIB OUTPUT BRACKET M400	1.0	UN
161600	85417103	CABLE OUTPUT RUBBER SCREEN	1.0	UN
161790	85416832	FOAM BAND	2.0	UN
162100	85424406	CIRCUIT BREAKER PROTECTION PANEL	1.0	UN
162110	85424604	ISOLATION PANEL MCPS 800/1250A	1.0	UN
162170	85423804	CIRCUIT BREAKER BRACKET M404/407	1.0	UN
161560	85423895	CABLE FIXING BRACKET MCPS M400	1.0	UN
161570	85423911	CABLE FIXING BRACKET MCPS M400	1.0	UN
161620	85423929	CABLE FIXING BRACKET MCPS M400	1.0	UN
162210	85425353	CIRCUIT BREAKER PROTECTION PLATE	1.0	UN
160520	85408391	RUBBER GROMMET D47	5.0	UN
164390	85509636	CIRCUIT BREKER 3VF7 LEVER	1.0	UN
183100	85509719	CHAIN	1.0	UN
162610	85422442	RUBBER GROMMET D79	1.0	UN

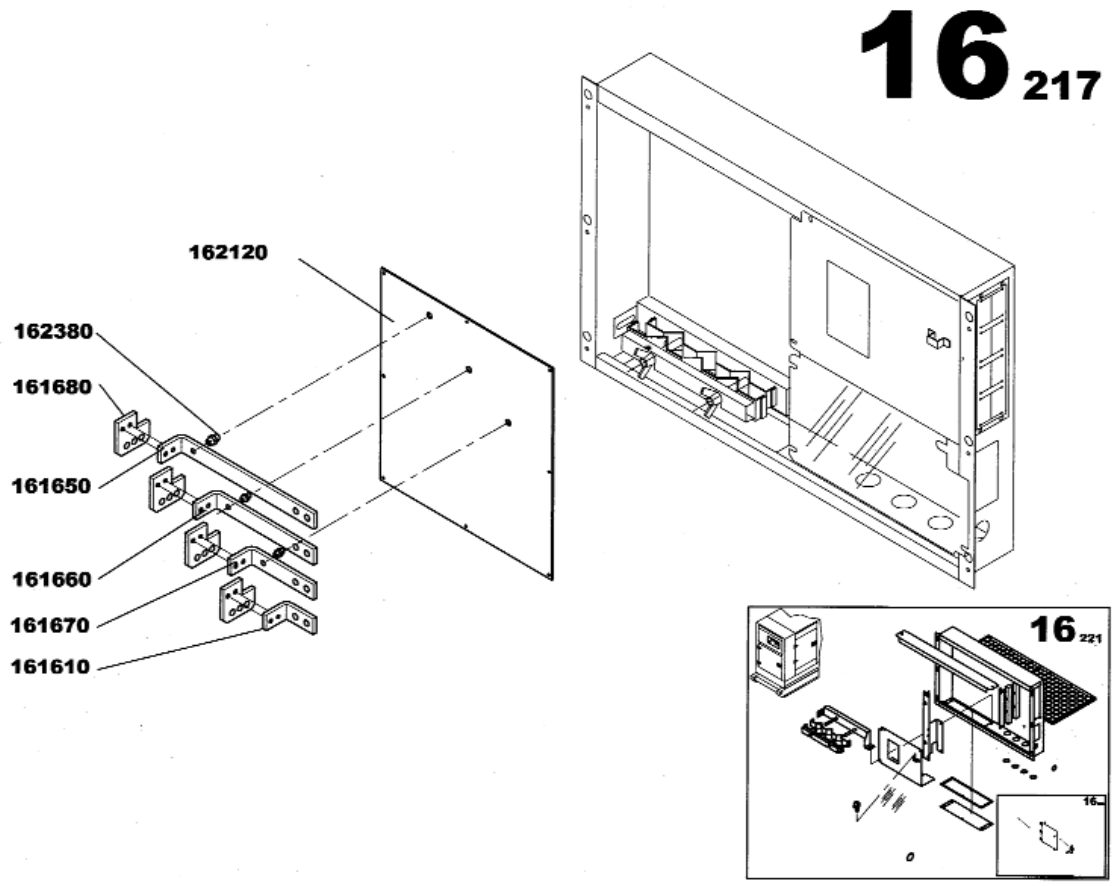
Part numbers listed are the only parts used in this model

16055



Item	Part Number	Description	Quantity	Units
F16055	85420099	PANEL DOOR M404/406 ASSEMBLY	1.0	UN
140660	85406130	DOOR HINGE	3.0	UN
162060	85422749	TERMINAL CONNECTION PERSPEX DOOR M400	1.0	UN
160760	85407708	HINGE FIXING PLATE M214	3.0	UN
180460	85409225	1/4 TURN SCREW D9	2.0	UN
180470	85409233	CAPTIVE NUT FOR 1/4 TURN BOLT	2.0	UN
180480	85409241	WASHER FOR 1/4 TURN FASTENER	2.0	UN

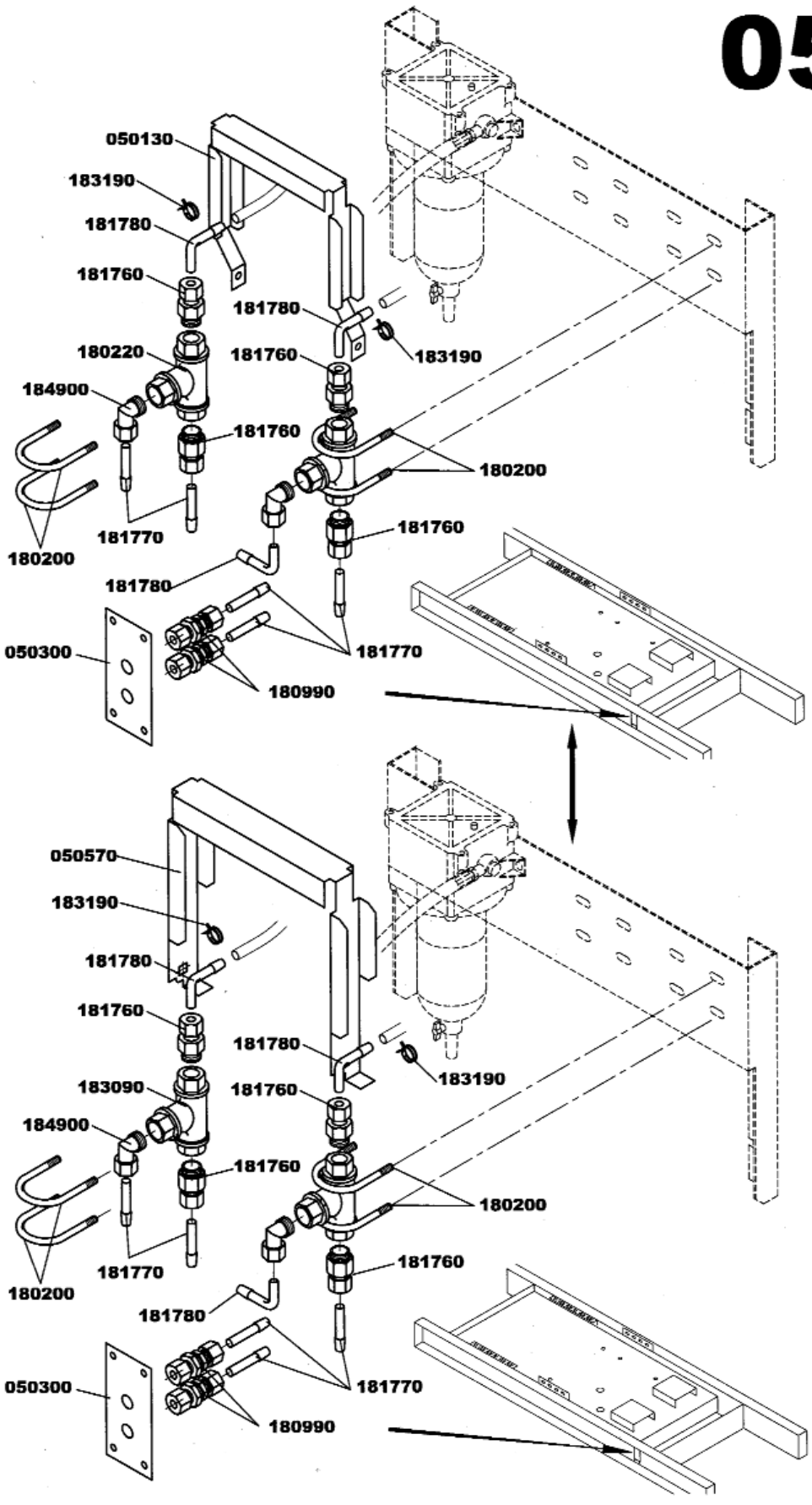
Part numbers listed are the only parts used in this model



Item	Part Number	Description	Quantity	Units
F16217	85418168	TERMINAL CONNECTION BLOCK ASSEMBLY	1.0	UN
161610	85417053	COPPER BAR 10x40	1.0	UN
161650	85417012	COPPER BAR 10x40	1.0	UN
161660	85417020	COPPER BAR 10x40	1.0	UN
161670	85417038	COPPER BAR 10x40	1.0	UN
161680	85416873	COPPER BAR	4.0	UN
162120	85418010	BACKGROUND SHIELD M400	1.0	UN
162380	85421683	INSULATION PIN	3.0	UN

Part numbers listed are the only parts used in this model

05 008


050130
183190
181780
181760
181780
183190
180220
181760
184900
181760
180200
181770
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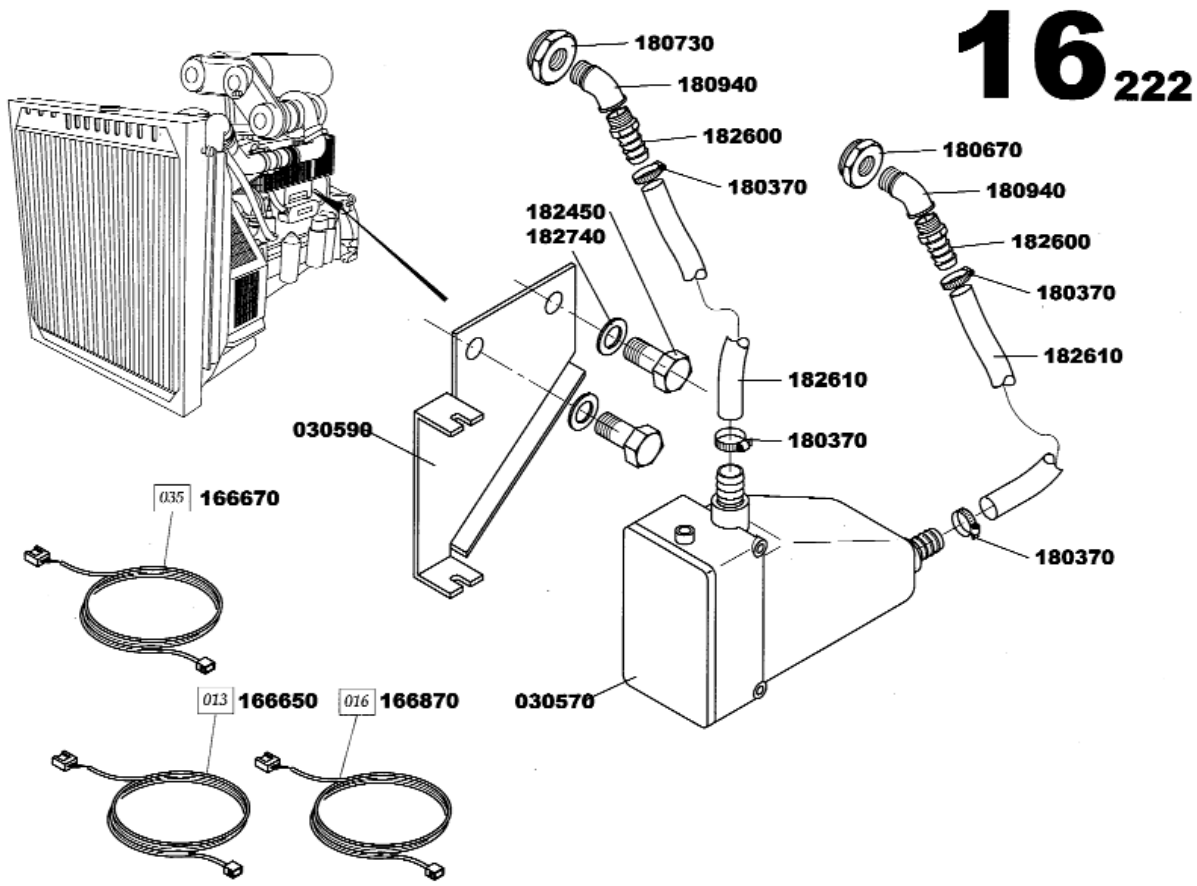
181760
181780
181770
050300
180990
050570
183190
181780
181760
181780
183190
183090
181760
184900
181760
180200
181770
180200
181760
181780
181770
050300
180990

3 WAY FUEL VALVE OPTION

Item	Part Number	Description	Quantity	Units
F05008	85421097	3 WAY FUEL VALVE ASSEMBLY	1.0	UN
050300	85424174	EXTERIOR FILLING CONNECTION BRACKET	1.0	UN
050570	85507861	3 WAY FUEL VALVE LEVER 3/8G	1.0	UN
182720	85429793	WASHER 6x14	4.0	UN
181760	85430619	PIPE UNION REDUCER MAL/FEM 3/8G D10	4.0	UN
184900	85622660	PIPE UNION ELBOW 90° MAL/FEM 3/8G	2.0	UN
181770	85430627	PIPE UNION MAL/MAL D10	7.0	UN
181780	85430635	PIPE UNION ELBOW MAL/MAL D10	3.0	UN
180990	85423283	PIPE UNION FEM/FEM D10	2.0	UN
180370	85409423	HOSE CLIP D20/32	4.0	UN
180200	85409464	HOSE CLAMP D36	4.0	UN
183190	85509727	SPRING CLAMP D17/19	14.0	UN
183090	85505006	3 WAY FUEL VALVE	2.0	UN
181740	85430643	FLEXIBLE HOSE D9x15	8.9	ML

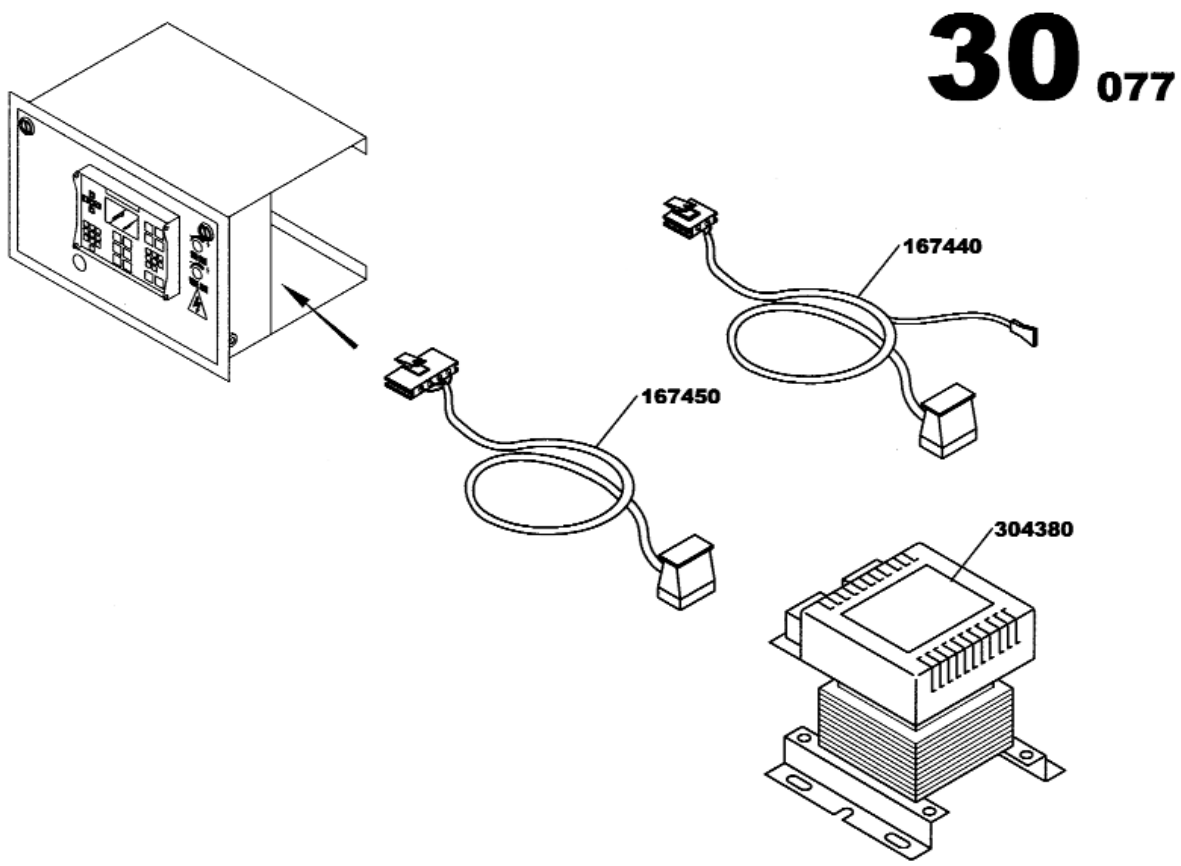
Part numbers listed are the only parts used in this model



AUTO START OPTION

Item	Part Number	Description	Quantity	Units
F16222		AUTO START OPTION	1.0	UN
030590	85430312	PREHEATER HOUSING BRACKET VOLVO 16L	1.0	UN
180670	85423192	PIPE UNION REDUCER MAL/FEM M30x150 3/4G	1.0	UN
180730	85423218	PIPE UNION REDUCER MAL/FEM 1-3/4UNF 1/2G	1.0	UN
182450	85430346	SCREW H M16x35	2.0	UN
182740	85430353	WASHER 16x32	2.0	UN
182600	85430254	PIPE UNION MAL/MAL 1/2G	2.0	UN
180370	85409423	HOSE CLIP D20/32	4.0	UN
182610	85430262	FLEXIBLE HOSE D19x30	1.8	ML
166670	85411163	INTELLISYS WIRING LOOM 035	1.0	UN
166650	85410835	INTELLISYS WIRING LOOM 013	1.0	UN
166870	85426948	INTELLISYS WIRING LOOM 016	1.0	UN

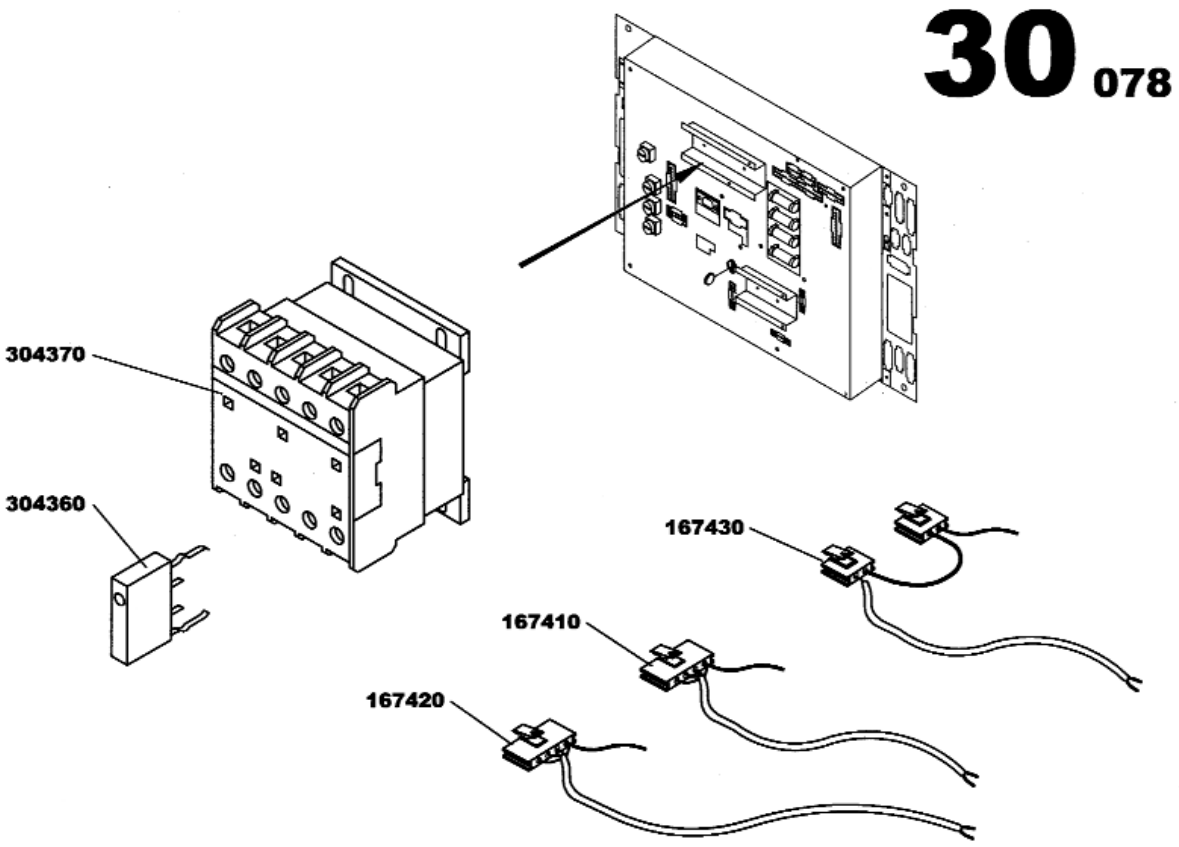
Part numbers listed are the only parts used in this model



AUTO START OPTION

Item	Part Number	Description	Quantity	Units
F30077	85412062	INTELLISYS OPTION BATTERY CHARGER 24V/3A	1.0	UN
304380	85506665	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

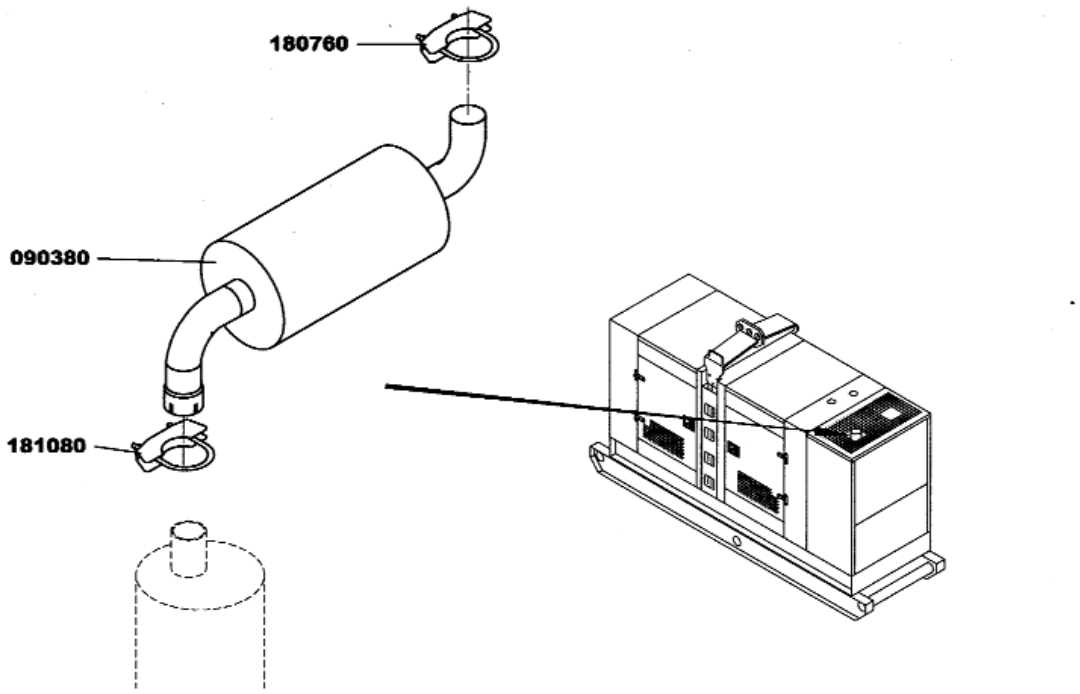


AUTO START OPTION

Item	Part Number	Description	Quantity	Units
F30078	85412187	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

09024

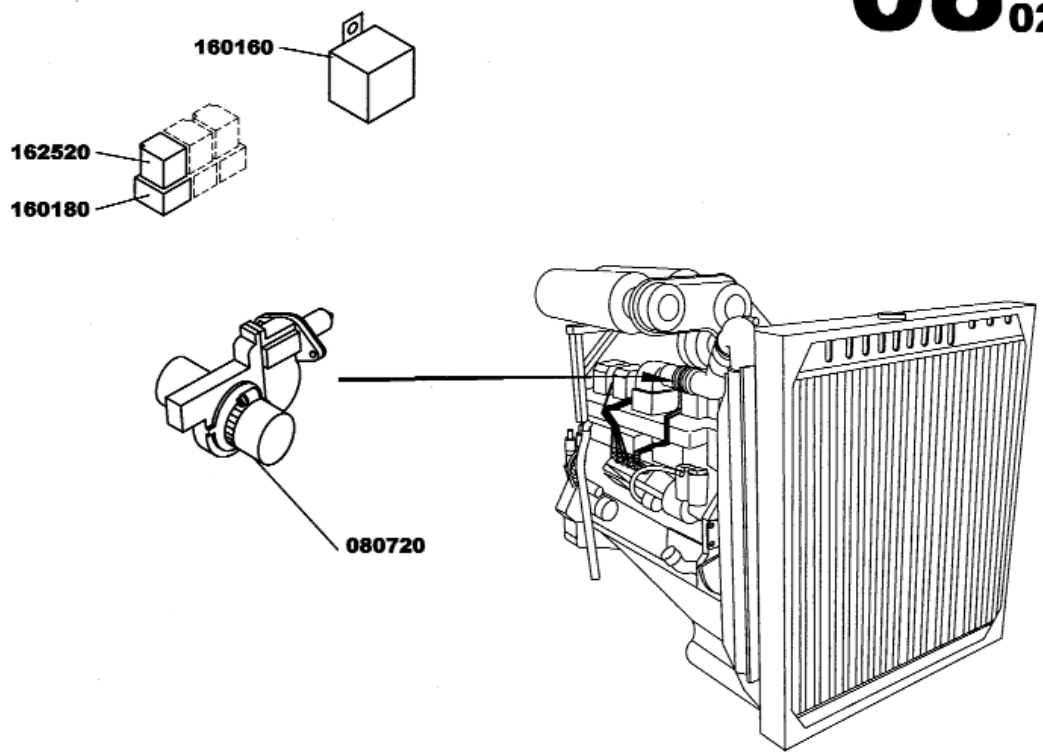


EXPLOSIVE ATMOSPHERE OPTION

Item	Part Number	Description	Quantity	Units
F09024	85425312	SPARK ARRESTER INERIS DN175 ASSEMBLY	1.0	UN
090380	85425320	INERIS SPARK ARRESTER DN175	1.0	UN
180760	85425114	HOSE CLAMP D203	1.0	UN
181080	85425122	HOSE CLAMP D203	1.0	UN

Part numbers listed are the only parts used in this model

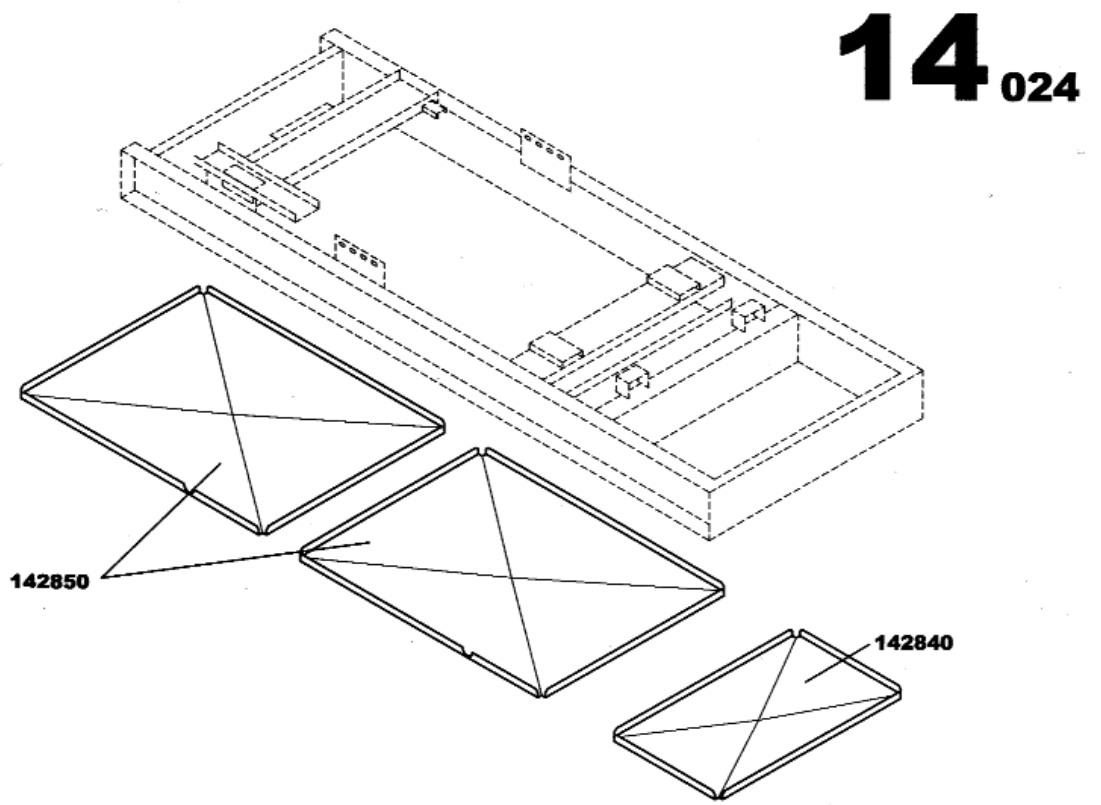
08027



EXPLOSIVE ATMOSPHERE OPTION

Item	Part Number	Description	Quantity	Units
F08027	85425304	AIR SHUT OFF VALVE VO TAD16L ASSEMBLY	1.0	UN
080720	85417657	AIR SHUT OFF VALVE D76	1.0	UN
160160	85408367	RELAY 12V/24V 75A	1.0	UN
162520	85423366	RELAY 24V 10/20A	1.0	UN
160180	85408912	AUTOMOBILE RELAY BASE	1.0	UN

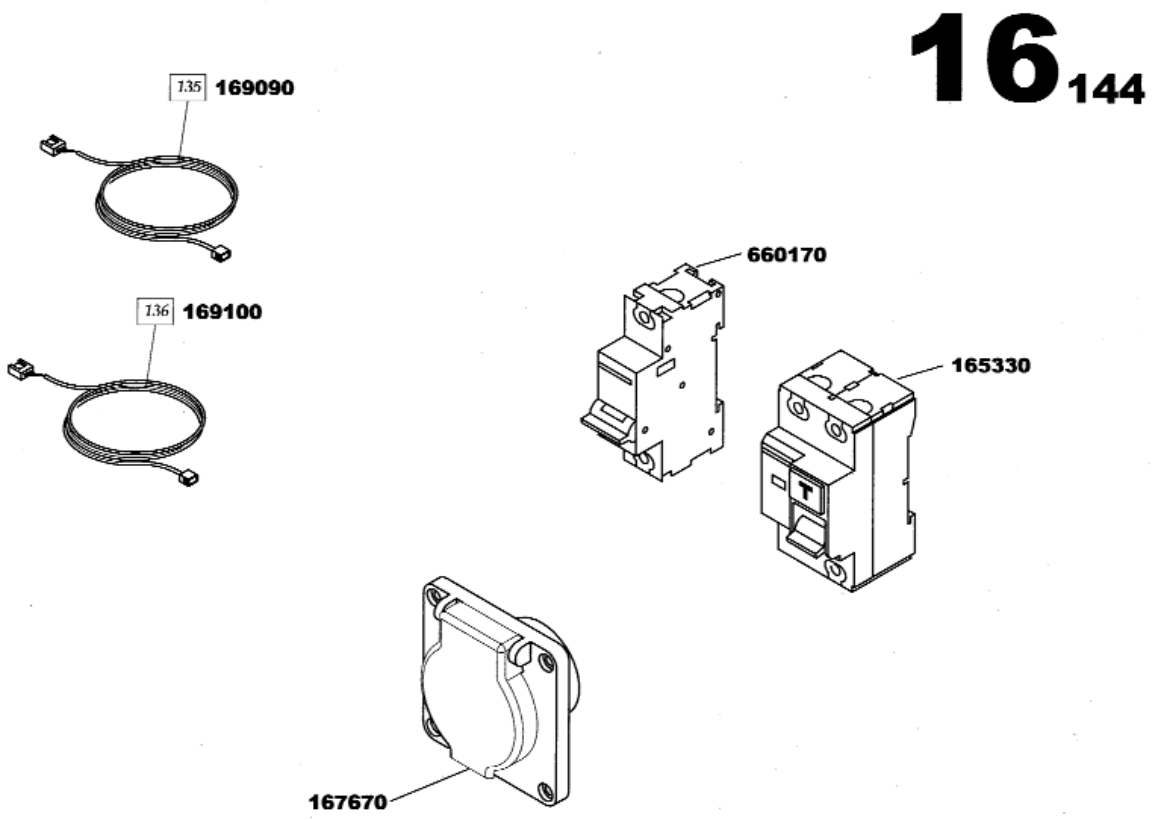
Part numbers listed are the only parts used in this model



SINGLE BASE PLATE OPTION

Item	Part Number	Description	Quantity	Units
F14024	85424992	SINGLE BASE PLATE ASSEMBLY	1.0	UN
142840	85429710	HOOD UNDERSHEETING M426	1.0	UN
142850	85429777	HOOD UNDERSHEETING M426	2.0	UN

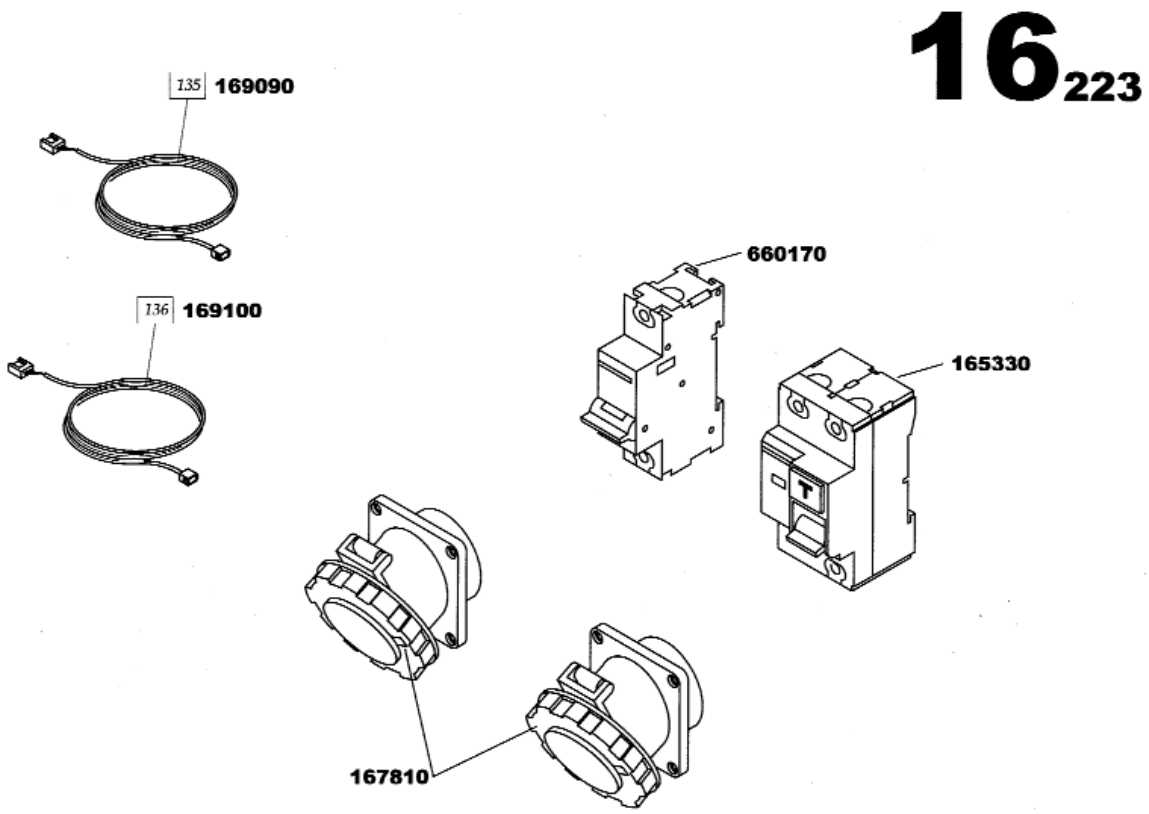
Part numbers listed are the only parts used in this model



SOCKET OPTION TYPE 3

Item	Part Number	Description	Quantity	Units
F16144	85507036	SOCKET PANEL FR M214 TYPE 4 ASSEMBLY	1.0	UN
169090	85622678	INTELLISYS WIRING LOOM 135	1.0	UN
169100	85622686	INTELLISYS WIRING LOOM 136	1.0	UN
167670	85408300	SOCKET GERMAN 230V 16A 2S+G	1.0	UN
165330	85622694	DIFFERENTIAL SWITCH 2P 40A 30mA	1.0	UN
660170	85506459	MOULDED CASE CIRCUIT BREAKER 2x16A	1.0	UN

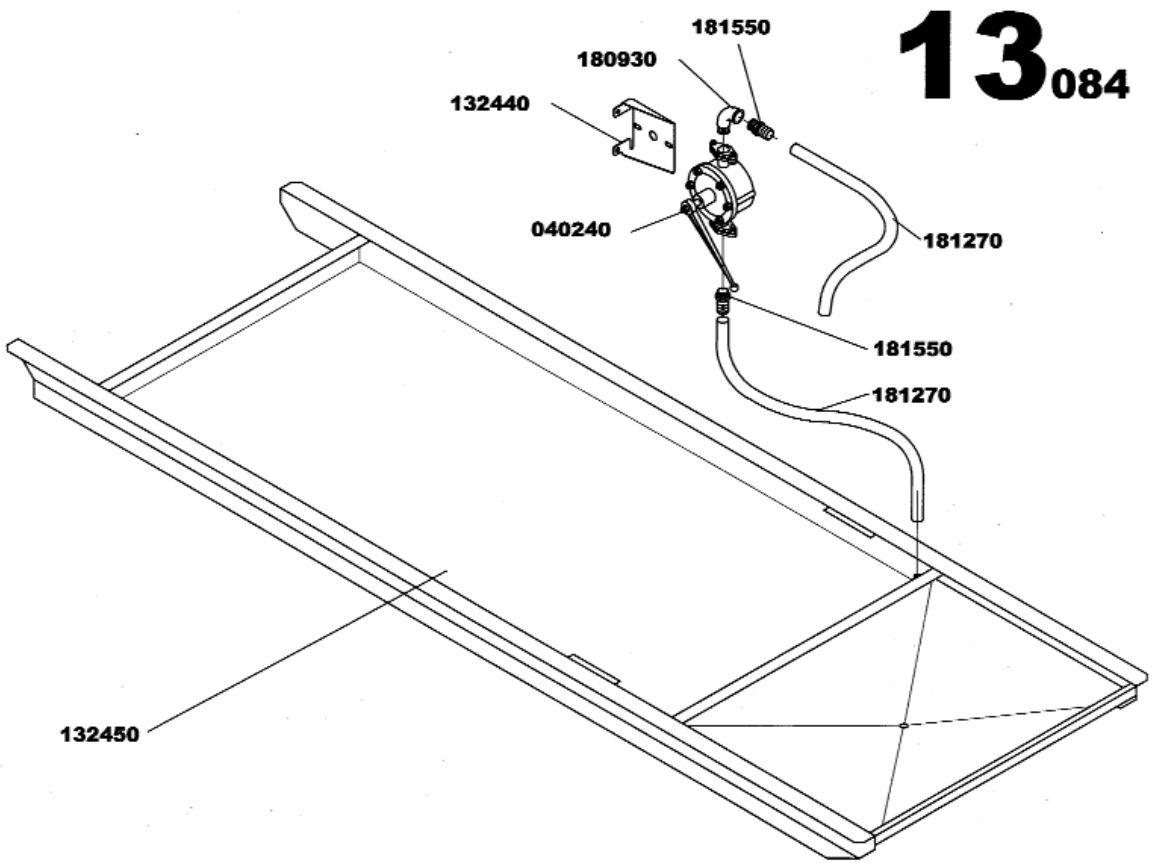
Part numbers listed are the only parts used in this model



SOCKET OPTION TYPE 7

Item	Part Number	Description	Quantity	Units
F16223	85505923	SOCKETS ASSEMBLY TYPE 7	1.0	UN
169090	85622678	INTELLISYS WIRING LOOM 135	1.0	UN
169100	85622686	INTELLISYS WIRING LOOM 136	1.0	UN
165330	85622694	DIFFERENTIAL SWITCH 2P 40A 30mA	1.0	UN
167810	85506111	SOCKET EC 110V 16A 2S+G	2.0	UN
660170	85506459	MOULDED CASE CIRCUIT BREAKER 2x16A	1.0	UN

Part numbers listed are the only parts used in this model



SIMPLIFIED RETENTION BUND AND BASE PLATE OPTION

Item	Part Number	Description	Quantity	Units
F13084	85622934	RETENTION BUND ASSEMBLY M426	1.0	UN
040240	85622942	HYDRAULIC MANUAL PUMP	1.0	UN
132440	85622959	OIL SUMP PUMP BRACKET	1.0	UN
181550	85622967	PIPE UNION MAL/MAL 3/4G	2.0	UN
180930	85423093	PIPE UNION ELBOW 90° MAL/FEM 3/4G	1.0	UN
181270	85622181	FLEXIBLE HOSE D25x32	1.0	ML
181270	85622181	FLEXIBLE HOSE D25x32	1.0	ML
132450	85622975	RETENTION BUND M426	1.0	UN

Part numbers listed are the only parts used in this model

Users guide and maintenance manual

Leroy Somer Alternators LSA 46.2 / 47.1

Réf. constructeur : 2981 GB - 4.33/a - 04.00

Réf. GPAO : 33522035901

LSA 46.2 / 47.1
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 work on this machine must be performed by a qualified technician.

Our technical support service will be pleased to provide any additional information you may require.

The various operations described in this manual are accompanied by recommendations or symbols to alert the user to potential risks of accidents. It is vital that you understand and take notice of the following warning symbols.

WARNING

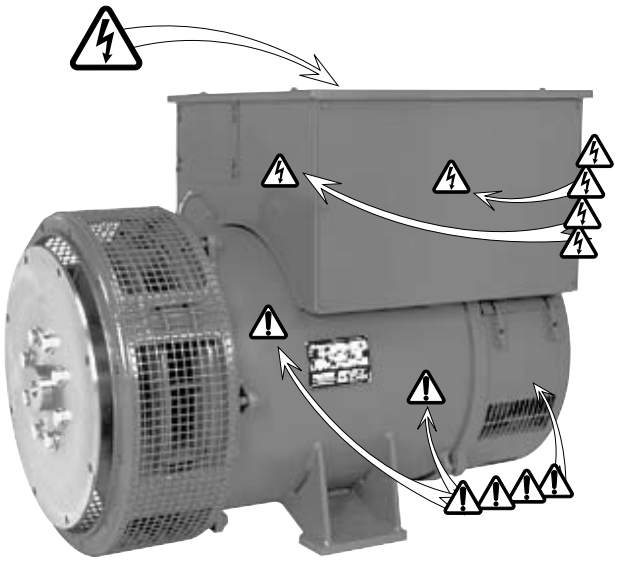
Warning symbol for an operation which may damage or destroy the machine or surrounding equipment.

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 46.2 / 47.1
ALTERNATORS

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LSA 46.2 / 47.1
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 with specialist training in the commissioning, servicing and maintenance of electrical and mechanical machinery. 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.

1.2 - Inspection

On receipt of your alternator, check that it has not suffered any damage in transit. If there are obvious signs of damage, contact the carrier (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

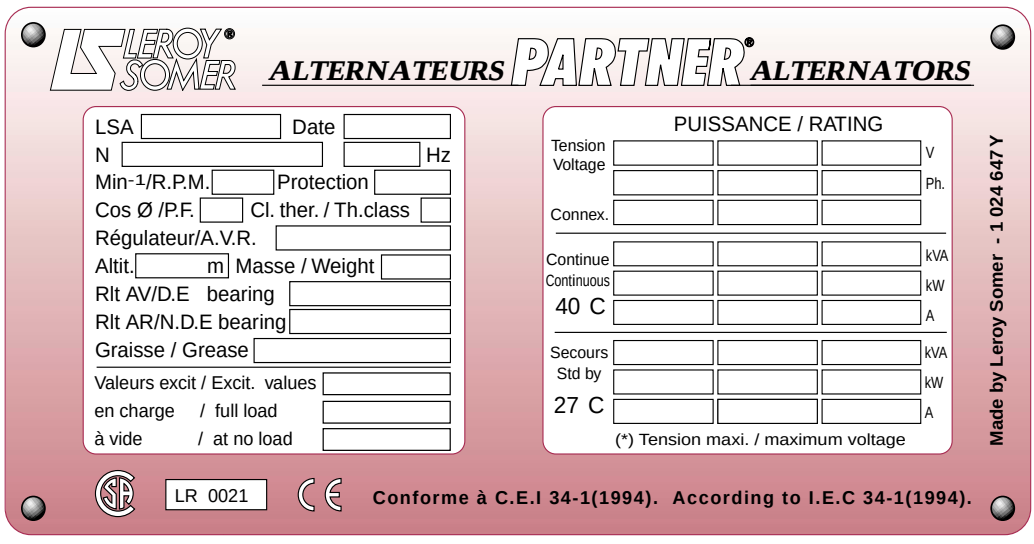
The alternator is identified by means of a nameplate fixed on the frame (see drawing).
Make sure that the nameplate on the machine conforms to your order.
The machine name is defined according to various criteria, for example : LSA 46.2 M6 C6/4 -
• LSA : name used in the PARTNER range
M : Marine
C : Cogeneration
T : Telecommunications.
• 46.2 : machine type
• M5 : model
• C : excitation system
(C : AREP / J : SHUNT or PMG / E : COMPOUND)
• 6/4 : winding number / number of poles.

1.3.1 - Nameplate

So that you can identify your machine quickly and accurately, we suggest you fill in its specifications on the nameplate below.

1.4 - Storage

Prior to commissioning, machines should be stored :
- Away from humidity : in conditions of relative humidity of more than 90%, the machine insulation can drop very rapidly, to just above zero at around 100%; monitor the state of the anti-rust protection on unpainted parts. 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.

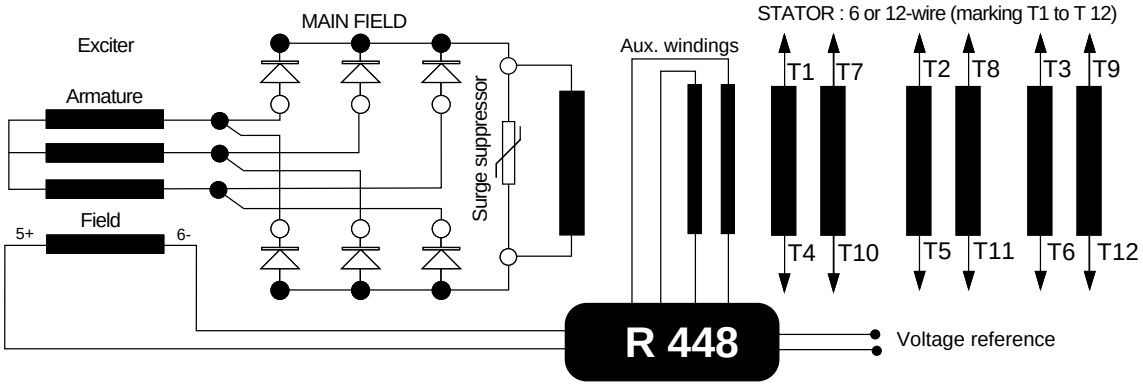


2 - TECHNICAL CHARACTERISTICS

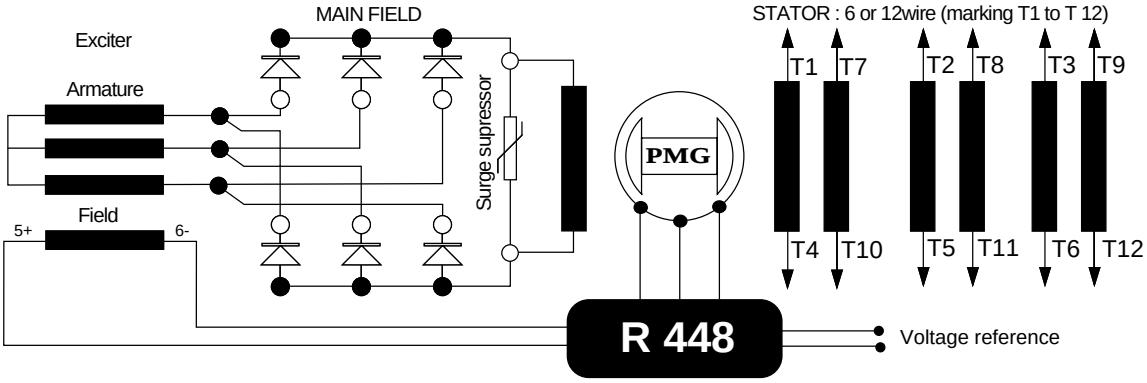
2.1 - Electrical characteristics

LSA 46.2/47.1 alternators are machines without sliprings or revolving field brushes, wound as « 2/3 pitch»; 6 or 12-wire, with class H insulation and a field excitation system available in either AREP or "PMG" version (see diagrams).

AREP system with R 448



PMG system with R 448



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
- Cast iron end shields
- Ball bearings greased for life
- Mounting arrangement

MD 35 :
single bearing with standard feet and SAE flanges/coupling discs.

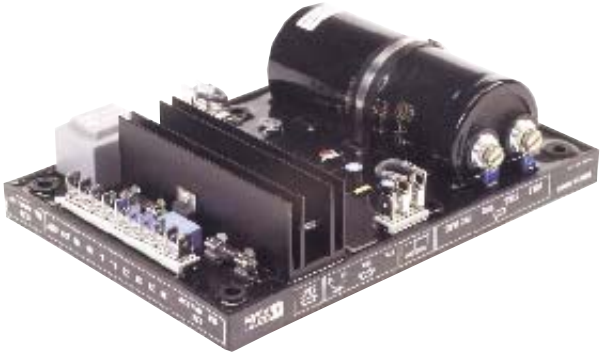
B 34 :
two-bearing with SAE flange and standard cylindrical shaft extension.
- Drip-proof machine, self-cooled
- Degree of protection : IP 21

2.2.1 - Options

- IP 23,
- Air inlet filter,
- Greasable ball bearings,
- IP 44,
- Bearing probes,
- PT 100 stators.

2.3 - Excitation system

For both the AREP & PMG excitation systems, the alternator voltage regulator is the R 448.



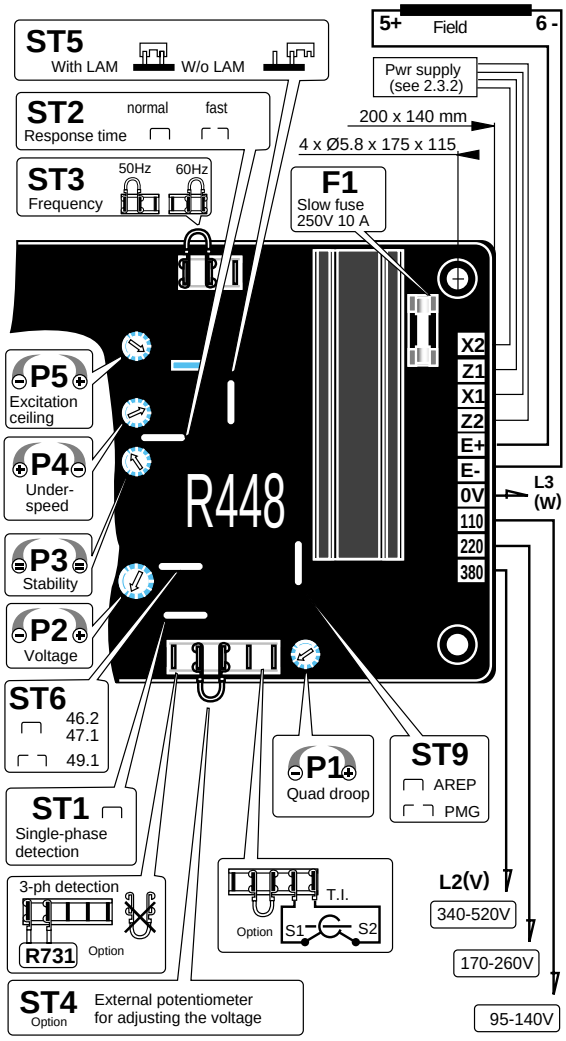
With **AREP** excitation, the electronic AVR is powered by two auxiliary windings which are independent of the voltage detection circuit. The first winding (X1, X2) has a voltage proportional to that of the alternator (Shunt characteristic), the second (Z1, Z2) has a voltage in proportion with the stator current (compound characteristic : Booster effect). The power supply voltage is rectified and filtered before being used by the AVR monitoring transistor. As a result the machine has a short-circuit current capacity of 3 IN for 10 s, and good immunity to distortions generated by the load.

With **PMG** excitation, a permanent magnet generator (PMG) is added to the alternator. This is fitted at the rear of the machine and connected to the AVR. The PMG supplies the AVR with voltage which is independent of the main alternator winding. As a result the machine has a short-circuit current capacity of 3 IN for 10 s, and good immunity to distortions generated by the load.

The AVR monitors and corrects the alternator output voltage by adjusting the excitation current.

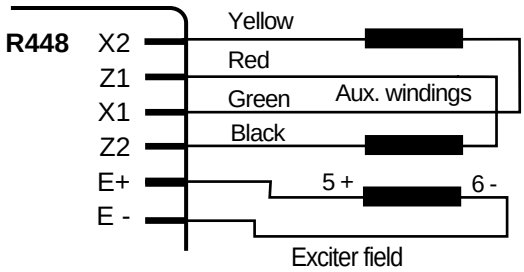
2.3.1 - R448 AVR characteristics

- shunt power supply : max 140V - 50/60 Hz
- rated overload current : 10A - 10s
- electronic protection (overload, voltage detection opening short-circuit): excitation overload current for 10 s then return to approximately 1A
The alternator must be stopped (or the power switched off, see section 3.5.3.) in order to reset the protection.
- Fuse :
  - F1 on X1,X2.
- voltage detection : 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 strap ST2
- voltage adjustment via potentiometer P2
other voltages via adapter transformer
- current detection : (parallel operation) :
C.T. 2.5 VA cl1, secondary 1A (Option)
- 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 to 10A
- 50/60 Hz selection via strap ST3.

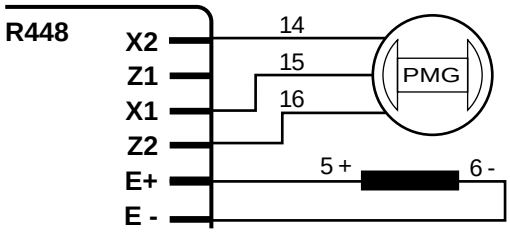


2.3.2 - R 448 power supply connection

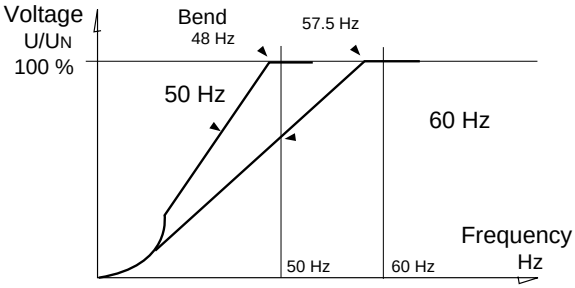
AREP excitation



PMG excitation

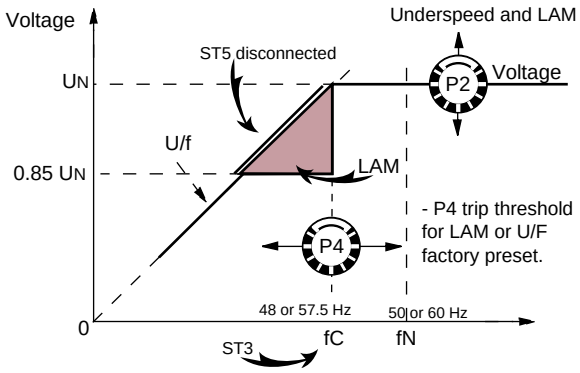


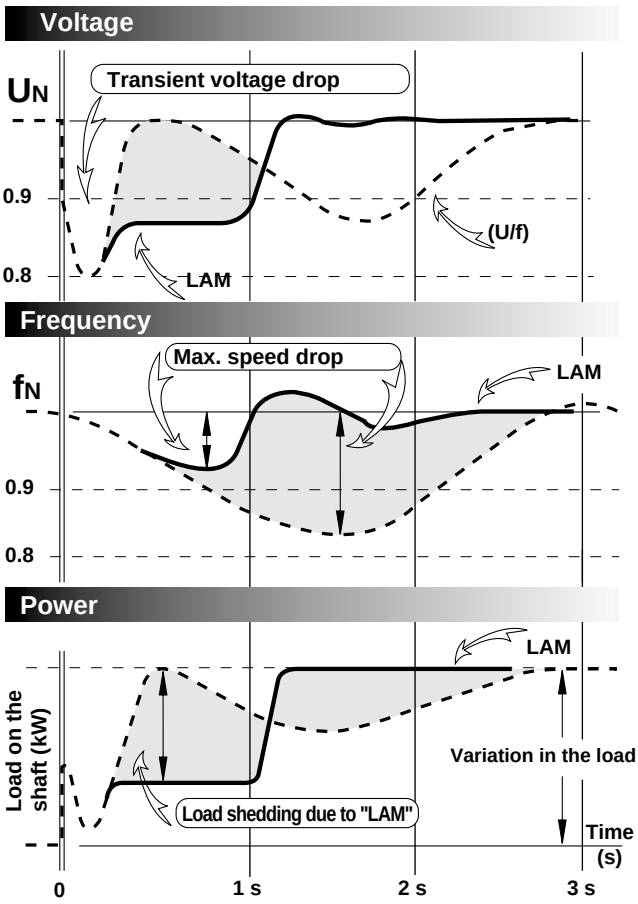
2.3.3 - Frequency compared with voltage (without LAM)



2.3.4 - LAM characteristics

The LAM system is integrated in the regulator, as standard it is active (ST5 with bridge). It can be deactivated by removing the ST5 bridge.
- 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 one speed variation (turbo-charged engine).
To avoid voltage oscillations, the trip threshold for the LAM function should be set approximately 2 Hz below the lowest frequency in steady state.





Typical effects of the "LAM" with a diesel engine -
with LAM **without LAM (U/F only)**

2.3.5 - R 448 AVR options

- Current transformer for parallel operation
of...../1 A -2.5 VA CL 1 (See the diagram included with this manual).
- Remote voltage adjustment potentiometer :
470 Ω, 3 W min. : adjustment range ± 5% (range limited by internal voltage potentiometer P2). Remove ST4 to connect the potentiometer. (A 1 k Ω potentiometer can also be used to extend the adjustment range by ± 10%)
- R 731 module : detection of 3-phase voltage 200 to 500V, compatible with parallel operation. Cut ST1 to connect the module; set the voltage via the module potentiometer.
- R 726 module : regulation system changed to “4-function” (See the maintenance manual and connection diagram).
- PF regulation (2F)
- equalization of voltages before paralleling (3 F).
- possibility of coupling alternators, already running in parallel, to the mains (4F).

R 726 module connected in place of ST4.

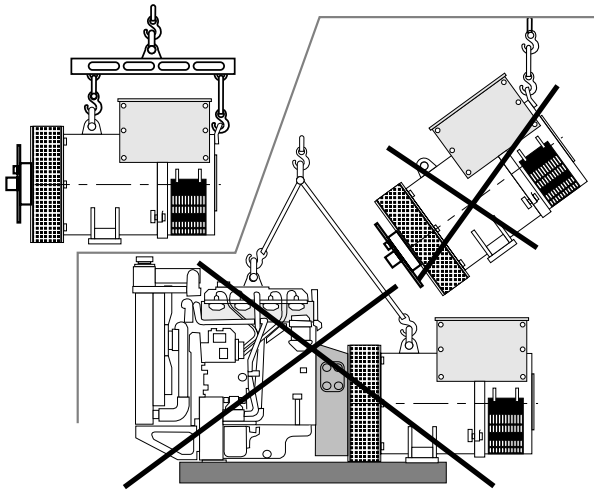
3 - INSTALLATION

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. Use 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
- checking the dimensions of the flywheel and its housing, the flange, coupling discs and the offset of the alternator

WARNING

When coupling the alternator to the prime mover, the holes of the coupling discs should be aligned with the flywheel holes by rotating the primary pulley on the thermal 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.

WARNING

This alternator has been balanced with a 1/2 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 isolation is less than 1 megohm for the stator and 100,000 ohms for the other windings.
There are three possible methods for restoring these minimum values.
a) Dry out the machine for 24 hours in a drying oven at a temperature of 110 °C (without the AVR)
b) Blow hot air into the air intake, 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 power terminals using connections capable of supporting the rated current (try not to exceed 6 A/mm2)
- Insert a clamp ammeter to monitor the current passing through the short-circuit connections.
- Connect a 24 Volt battery in series with a rheostat of approximately 10 ohms (50 W) to the exciter field terminals, respecting the polarity.
- Open fully all the alternator openings.
- 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.

3.2.2 - Mechanical checks

Before starting the machine for the first time, check that :
- all fixing bolts and screws are tight
- cooling air is drawn in freely
- the protective louvres and housing are correctly positioned
- 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)

LSA 46.2 / 47.1
ALTERNATORS
INSTALLATION

3.3 - Terminal connection diagrams

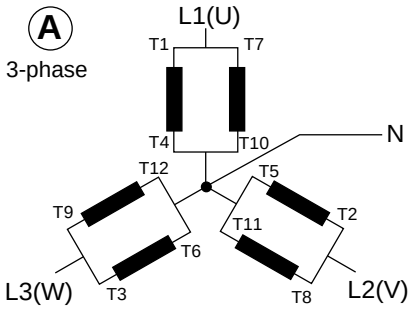
To modify the connections, change the position of the terminal links or shunts. The winding code is specified on the nameplate.

Any intervention on the alternator terminals during reconnection or checks should be performed with the machine stopped.

3.3.1 - Terminal connection : LSA 46.2/47.1 - 12-wire

The connection accessories are detailed in section 5.3.3.

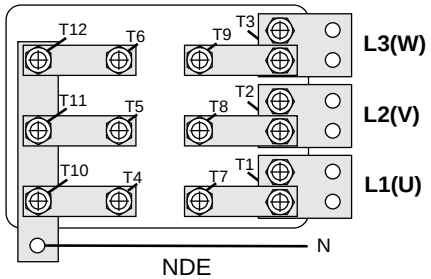
Connection code A — 3-phase



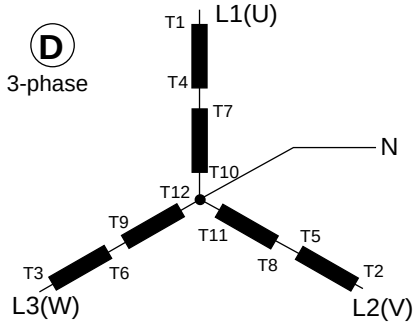
Winding	50 Hz	60 Hz
6	190 - 208	190 - 240
7	220	-
8	-	190 - 208

R 448 voltage detection :
0 => (T3) / 220 V => (T2)

LSA 46.2/47.1 - 12-WIRE



Connection code D — 3-phase



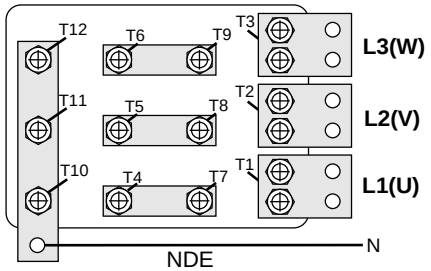
Winding	50 Hz	60 Hz
6	380 - 415	380 - 480
7	440	-
8	-	380 - 416

R 448 voltage detection :
0 => (T3) / 380 V => (T2)

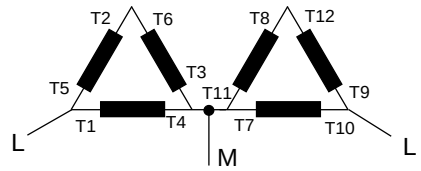
9		600

Winding 9 : R 448 voltage detection + transformer (See specific diagram)

LSA 46.2/47.1 - 12-WIRE



Connection code FF — 1 phase

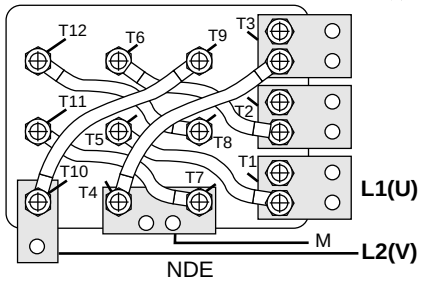


Voltage LM = 1/2 voltage LL

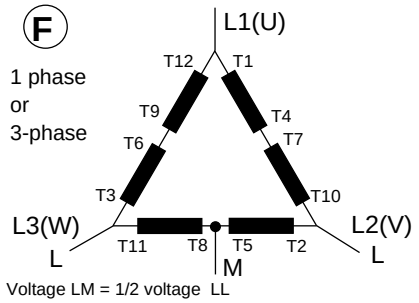
Winding	50 Hz	60 Hz
6	220 - 240	220 - 240
7	240 - 254	-
8	-	220 - 240

R 448 voltage detection :
0 => (T10) / 220 V => (T1)

LSA 46.2 - 12-WIRE (*)



Connection code F — 1 phase or 3-phase

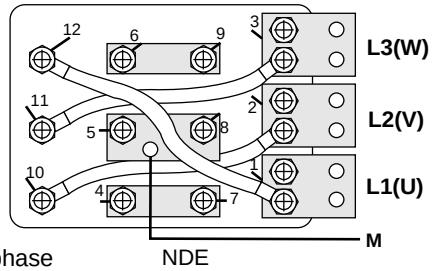


Voltage LM = 1/2 voltage LL

Winding	50 Hz	60 Hz
6	220 - 240	220 - 240
7	240 - 254	-
8	-	220 - 240

R 448 voltage detection :
0 => (T3) / 220 V => (T2)
Operating phases L2 (V), L3 (W) single phase

LSA 46.2/47.1 - 12-WIRE (*)



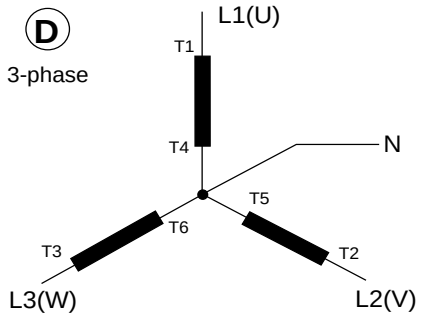
In case of reconnection, ensure that AVR voltage detection is correct !

LSA 46.2 / 47.1
ALTERNATORS
INSTALLATION

3.3.2 - Terminal connection :
LSA 46.2/47.1 - 6-wire

Connection codes

D 3-phase



Voltage L.L

Winding	50 Hz	60 Hz
7S	440	-
8S	-	380 - 416

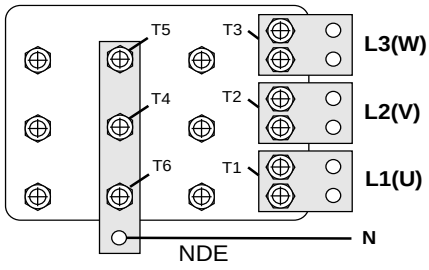
⚠ R 448 voltage detection :
0 => (T3) / 380 V => (T2)

9S		600

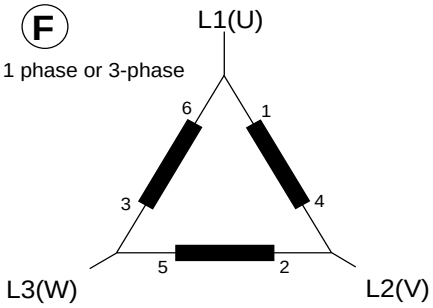
Winding 9 : R 448 voltage detection + transformer (See specific diagram)

Factory connection

LSA 46.2 - 6-WIRE



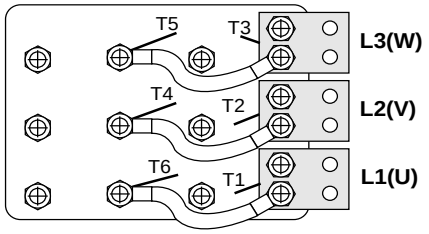
F 1 phase or 3-phase



Winding	50 Hz	60 Hz
7S	240 - 254	-
8S	-	220 - 240

⚠ R 448 voltage detection :
0 => (T3) / 220 V => (T2)
Operating phases : L2 (V), L3 (W) single phase

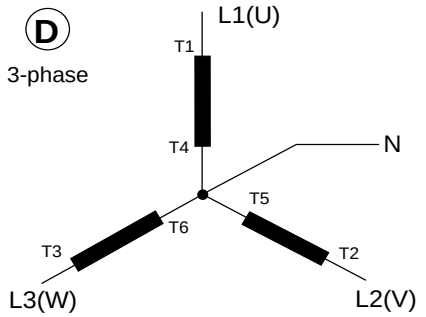
LSA 46.2 - 6-WIRE



(*)

Connection codes

D 3-phase



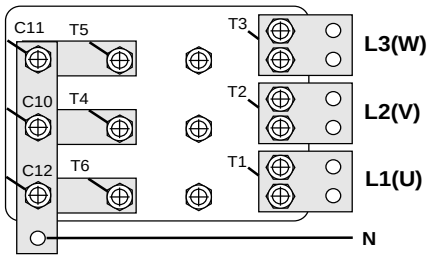
Voltage L.L

Winding	50 Hz	60 Hz
6S	380 - 415	380 - 480
7S	440	-
8S	-	380 - 416

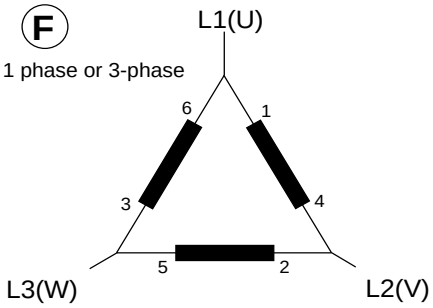
⚠ R 448 voltage detection :
0 => (T3) / 380 V => (T2)

Factory connection

LSA 47.1 - 6-WIRE



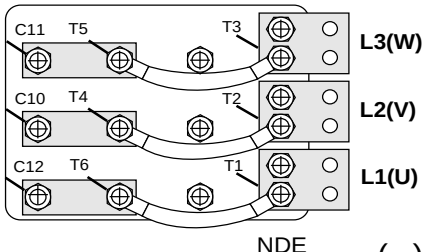
F 1 phase or 3-phase



Winding	50 Hz	60 Hz
6S	220 - 240	220 - 277
7S	240 - 254	-
8S	-	220 - 240

⚠ R 448 voltage detection :
0 => (T3) / 220 V => (T2)
Operating phases : L2 (V), L3 (W) single phase

LSA 47.1 - 6-WIRE



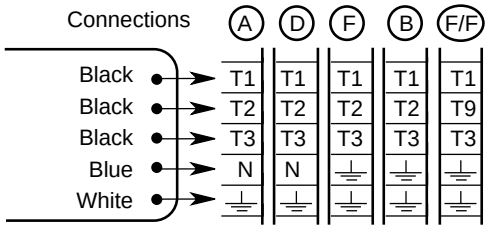
(*)

⚠ **In case of reconnection, ensure that the AVR voltage detection is correct !**

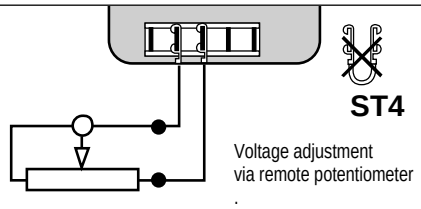
(*) The factory can supply a set of flexible shunts and special connection links as an option for making these connections. The standard alternator is fitted with 3 starting ranges, 6 connection links and one neutral link.

3.3.3 - Option connection diagram

R 791 T interference suppression kit (standard for CE marking)

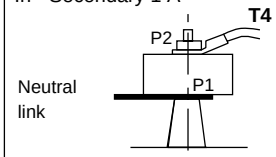


Remote voltage potentiometer



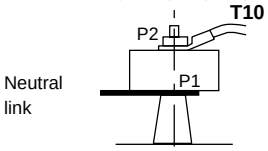
Current transformer connection (optional)

Coupling D - PH 1
In - Secondary 1 A



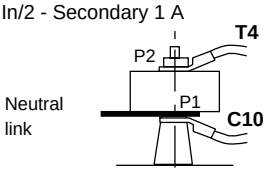
LSA 46.2 - 6-wire

Coupling D & A
In - Secondary 1A (coupl. D)



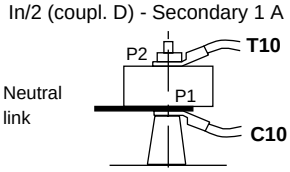
LSA 46.2 - 12-wire

Coupling D - PH 1
In/2 - Secondary 1 A



LSA 47.1 - 6-wire

Coupling D & A
In/2 (coupl. D) - Secondary 1 A



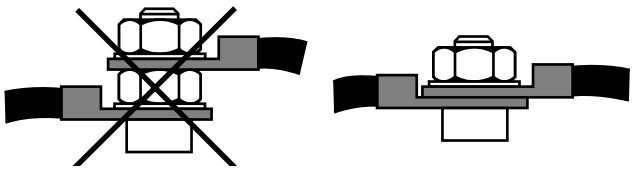
LSA 47.1 - 12-wire

3.3.4 - Connection checks

Electrical installations must comply with the current legislation in the country of use.

Check that :

- the residual circuit-breaker conforms to legislation on protection of personnel, in force in the country of use, and has been correctly installed on the alternator power output as close as possible to the alternator. (In this case, disconnect the wire of the interference suppression module linking the neutral).
- Any protective devices in place have not been 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 should be connected with the busbar separating the terminals as shown in the terminal connection diagram.



3.3.5 - Electrical checks on the AVR

- Check that all connections have been made properly as shown in the attached connection diagram.

- Check that the frequency selection strap “ST3” is on the correct frequency setting.
- Check whether strap ST4 or the remote adjustment potentiometer have been connected.
- Optional operating modes
  - Strap ST1 : cut to connect the R 731 3-phase detection module.
  - Strap ST2 : cut for rapid response time
  - Strap ST5 : cut to suppress the LAM function.

3.4 - Commissioning

The machine can only be started up and used if the installation has been set up 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). With the greaseable ball bearings option, we recommend greasing the bearings at the time of commissioning (see 4.2.3).
On application of the load, the machine should achieve its rated speed and voltage; however, in the event of abnormal operation, the machine setting can be altered (follow the adjustment procedure in section 3.5). If the machine still operates incorrectly, the cause of the malfunction must be located (see section 4.4).

3.5 - Settings

The various adjustments during tests must be made by a qualified engineer.

WARNING

Take care that the drive speed specified on the nameplate is reached before commencing adjustment

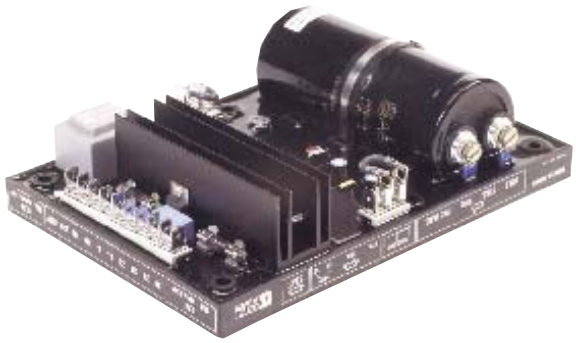
1500 min^{-1}/ 50Hz or 1800 min^{-1} / 60 Hz.

Do not try to set the voltage if the frequency or speed is not correct (risk of irreparable rotor damage).

After operational testing, replace all access panels or covers.

The AVR should be used to make any adjustments to the machine.

3.5.1 - R 448 settings



a) Initial potentiometer settings (see table below)
- Remote voltage adjustment potentiometer : centre (strap ST4 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 Underspeed protection and "LAM" trip threshold Maximum frequency fully anti-clockwise	If ST3 = 50 Hz (factory) = 48 Hz If ST3 = 60 Hz (factory) = 58 Hz	
Voltage quadrature droop (// operation with C.T.) - 0 quadrature droop fully anti-clockwise.	Not set (fully anti-clockwise)	
Excitation ceiling Limit of excitation and short-circuit current, minimum fully anti-clockwise	10 A maximum	

Adjustments in standalone operation

b) Install a D.C. analogue voltmeter (needle dial) cal. 100V on terminals E+, E- and an A.C. voltmeter cal 300 - 500 or 1000V on the alternator output terminals.

c) Make sure that strap ST3 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 approximately 1/3 anti-clockwise turn.
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 UN + 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. 10V D.C.). The best response times are obtained at the limit of the instability. If no stable position can be obtained, try cutting or replacing strap ST2 (normal/fast).

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 (approximately 15%).

l) Readjust the speed of the unit to its rated no-load value.

Adjustments in parallel operation

WARNING

Before any intervention on the alternator, make sure that the speed droop is identical for all engines.

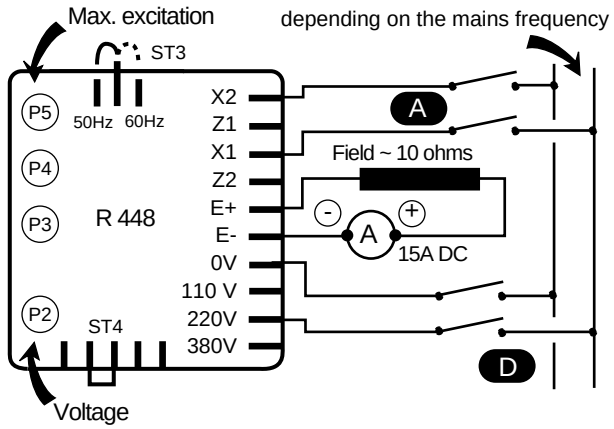
m) Preset for parallel operation (with C.T. connected to S1, S2 on connector J2)
- Potentiometer P1 (quadrature droop) in centre position.
Apply the rated load (cos Ø = 0.8 inductive).
The voltage should drop by 2 to 3%. If it increases, swap the 2 incoming wires from the C.T. secondary.

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 minimise) 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, equalise the KW (or divide the rated power of the units proportionally)
- By altering the quadrature droop potentiometer P1, equalise or divide the currents.

3.5.2 - Max. excitation setting (excitation ceiling)



Adjustment of the current limit

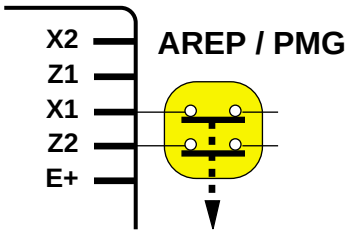
via potentiometer P5 (fuse rating : 8A-10 seconds).
The maximum factory setting corresponds to that of the excitation current required to obtain a 3-phase short-circuit current of approximately 3 IN at 50 Hz for industrial power, unless otherwise specified(*).
A static method can be used to reduce this value or adapt the Isc to the actual max. 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 (0-110V-220V-380V) on the alternator. Connect the mains power supply (200-240V) as indicated (X1,X2). 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 10 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 < 1A.
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.) via P2.
(*): In some countries it is a legal requirement to have a short-circuit current, so as to offer discriminating protection.

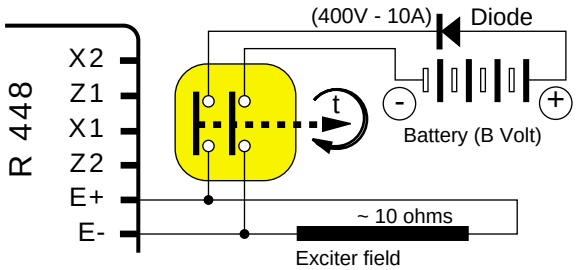
3.5.3 - Special type of use

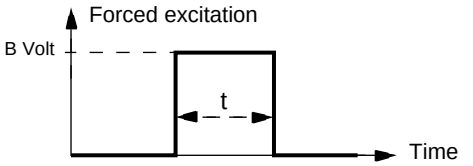
- Field weakening



The exciter is switched off by disconnecting the AVR power supply (1 wire on each auxiliary winding) – contact rating 16 A - 250V A.C.
Connection is identical for resetting the AVR internal protection

- Field forcing





Applications	B volts	Time t
Guaranteed voltage build-up	12 (1A)	1 - 2 s
Parallel operation, de-energized	12 (1A)	1 - 2 s
Parallel operation, at standstill	24 (2A)	5 - 10 s
Frequency starting	48 (4A)	5 - 10 s
Sustained voltage on overload	48 (4A)	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 condition.

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 understand how the operating system works.

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 condition 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 greasable (option). It is advisable to lubricate the machine during operation. Time intervals and quantity of grease are given in the table below.

DE bearing - LSA 46.2	6316 C3
Quantity of grease	33 g
Lubrication interval	4000 H

NDE bearing - LSA 46.2/ 47.1	6315 C3
Quantity of grease	30 g
Lubrication interval	4500 H

DE bearing - LSA 47.1	6318 C3
Quantity of grease	41 g
Lubrication interval	3500 H

Lubrication intervals are given for a grease of grade
LITHIUM - standard - NLGI 3.

The factory lubrication is performed with grease :
SHELL - ALVANIA G3.
Before using another grease, check for compatibility with the original one. Monitor the temperature rise in the bearings, which should not exceed 50°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

WARNING

Do not use : trichlorethylene, perchlorethylene, trichloroethane or any alkaline products.

Certain strictly defined pure volatile degreasing products can be used, such as :
- Normal petrol (without additives)
- 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 above list of authorised 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

WARNING

Cleaning the machine using water or a high-pressure washer is strictly prohibited.
Any problems arising from such treatment are not covered by our warranty.

Degreasing : Use a brush and detergent (suitable for paintwork).
Dusting : Use an air gun.
If 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 is 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 chlorethylene 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 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 (bearing temperature 50°C above the ambient temperature) (With or without abnormal bearing noise)	- If the bearing has turned blue or if the grease has turned black, change the bearing. - Bearing not fully locked (abnormal play in the bearing cage). - End shields incorrectly aligned.
Abnormal temperature	Excessive overheating of alternator frame (more than 40° C above the ambient temperature)	- Air flow (inlet-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
Vibrations	Too much vibration	- Misalignment (coupling) - Defective mounting or play in coupling - Rotor balancing fault (Engine - Alternator)
	Excessive vibration and humming noise coming from the machine	- Phase imbalance - 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 a new battery of 4 to 12 volts to terminals E- and E+, respecting the polarity, for 2 to 3 seconds	The alternator builds up and its voltage is still correct when the battery is removed.	- Lack of residual magnetism
		The alternator builds up but its voltage does not reach the rated value when the battery is removed.	- Check the connection of the voltage reference to the AVR - Faulty diode - Armature short-circuit
		The alternator builds up but its voltage disappears when the battery is removed	- Faulty AVR - Field windings open circuit (check winding) - Main field winding open circuit (check the resistance)
Voltage too low	Check the drive speed	Correct speed	Check the AVR connections (possible AVR failure) - 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 / fast 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+ et E- on the AVR	Voltage between E+ and E- (DC) AREP / PMG < 10V	- Check the speed (or LAM set too high)
		Voltage between E+ and E- AREP / PMG > 15V	- Faulty rotating diodes - Short-circuit in the main field. Check the resistance- Faulty exciter armature. Check the resistance.
Voltage disappears during operation	Check the AVR, the surge suppressor, the rotating diodes, and replace any defective components	The voltage does not return to the rated value.	- Exciter winding open circuit - Faulty exciter armature - Faulty AVR - Main field open circuit or short-circuited

4.5.1 - Checking the winding

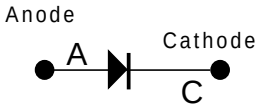
You can check the winding insulation by performing a high voltage test. In this case, you must disconnect all AVR wires.

WARNING

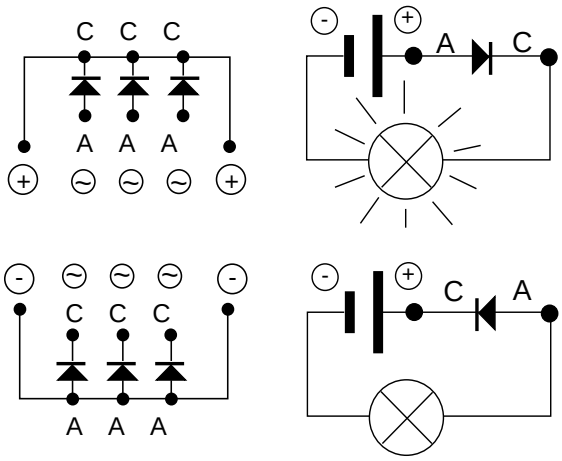
Damage caused to the AVR in such conditions is not covered by our warranty.

4.5.2 - Checking the diode bridge

DIODE BRIDGE



A diode in good working order must allow the current to flow from the anode to the cathode only.

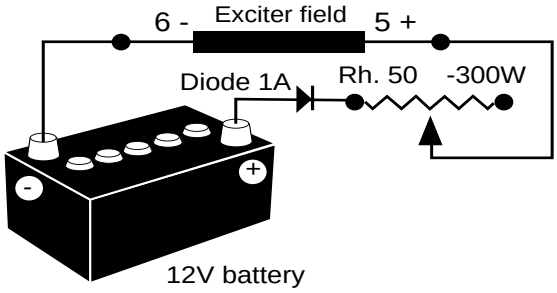


4.5.3 - Checking the windings and rotating diodes using separate excitation

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-).

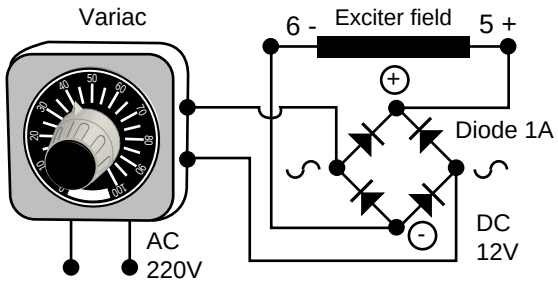
Both these systems should have characteristics which are compatible with the machine field excitation power (see the nameplate).

3) Run the unit at its rated speed.

4) Gradually increase the exciter field current by adjusting the rheostat or the variac and measure the output voltages on L1 - L2 - L3, checking the excitation voltage and current at no load and on load (see the machine nameplate or ask for the factory test report).

When the output voltage is at its rated value and balanced within < 1 % for the rated excitation level, the machine is in good working order. The fault therefore comes from the AVR or its associated wiring (ie. sensing, auxiliary windings).

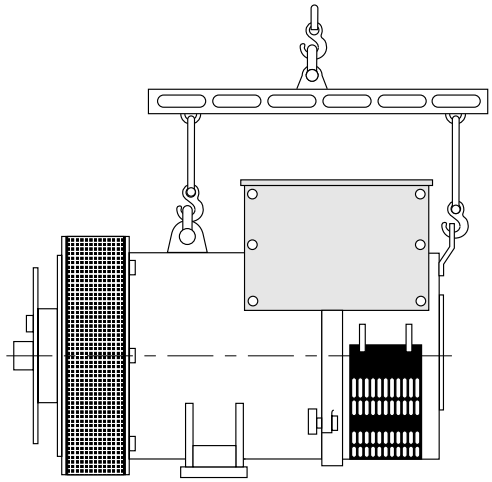
ASSEMBLY B



4.6 - Dismantling, reassembly (see sections 5.4.1. & 5.4.2.)

WARNING

During the warranty period, this operation should only be carried out in an approved LEROY-SOMER 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 : 8 mm, 10 mm, 18 mm,
- 1 socket set : 8, 10, 13, 16, 18, 21, 24, 30 mm
- 1 socket with male ferrule : 5 mm,
- 1 puller.

4.6.2 - Screw tightening torque

IDENTIFICATION	Screw Ø	Torque N.m
Exciter screw	M 6	10
Star diode bridge	M 6	10
Diode nut	M 6	4
Flange / Frame screw (46.2 S, M)	M 14	80
Flange / Frame screw (46.2 L, VL)	M 14	190
Flange / Frame screw (47.1)	M 16	190
NDE bracket / frame screw	M 12	50
Discs / Sleeve screw	M 16	230
Earth screw	M 10	20
Grille screws	M 6	5
Cover screws	M 6	5
Terminal block nut	M 12	35

4.6.3 - Access to diodes

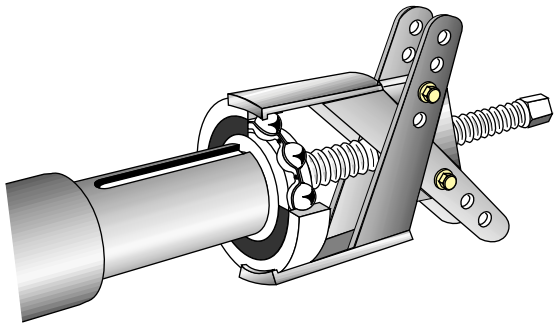
- Open the air inlet louvre (51)
- Disconnect the diodes.
- Check the diodes using an ohmmeter or a battery lamp (see section 4-5)
If the diodes are faulty
- Remove the surge suppressor (347).
- Remove the 6 "H" mounting nuts for the diode bridges on the support.
- Change the crescents, respecting the polarity.

4.6.4 - Access to connections and the regulation system

Access directly by removing the box lid (48) or the AVR access door (466).

4.6.5 - Replacing the NDE bearing on single bearing machines

- Remove the box lid (48) and the NDE panel (365) and remove the 2 screws from the part (122).
- Disconnect the stator outputs (T1 to T12).
- Disconnect the auxiliary winding wires with AREP (X1,X2,Z1,Z2).
- Disconnect the exciter wires (5+,6-).
- Remove the air inlet louvre (51)
- Remove the 2 bearing thrust screws (78).
- Remove all 4 screws (37).
- Remove the bearing (36).
- Remove the ball bearing (70) using a puller with a central screw (see drawing below).



- Check the condition of the "O" ring seal (349) and, if necessary, change it.
- Fit the new bearing, after heating it by induction to approximately 80°C.

WARNING

When dismantling the machine, always change the bearings.

4.6.6 - Replacing the DE bearing on two-bearing machines

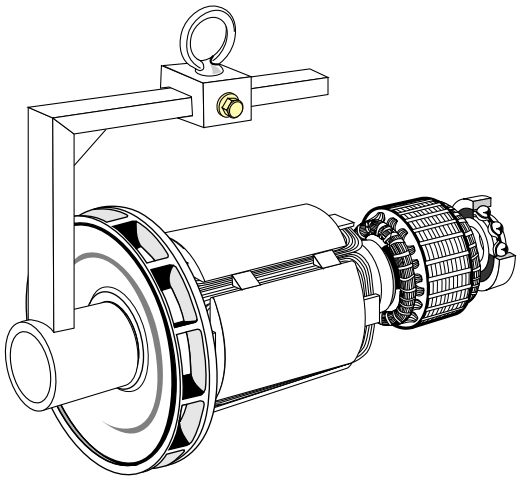
- Remove the screws (31) and (62).
- Remove the shield (30).
- Remove the circlips (284).
- Remove the ball bearing (60) using a puller with a central screw.
- Fit the new bearing, after heating it by induction to approximately 80°C.

WARNING

When dismantling the machine, always change the bearings.

4.6.7 - Complete dismantling

- Remove the DE shield (30) as described in section 4.6.6.
- Support the DE rotor (4) with a strap or a support constructed as shown in the drawing below.



- Remove the NDE shield bearing cover.
- Tap the shaft end lightly on the opposite side from the coupling using a small mallet.
- Pull the strap in order to move the rotor and ensure its weight is evenly supported.
- Remove the NDE shield following the instructions in section 4.6.5.

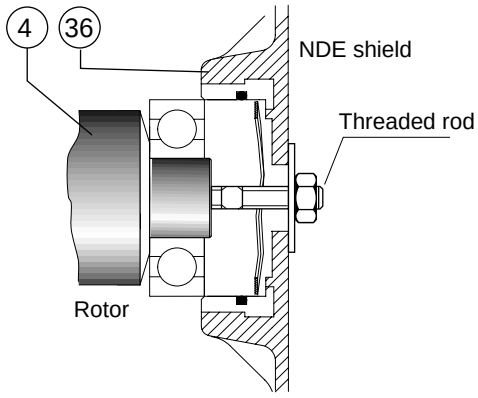
4.6.8 - Reassembling the end shields

- Place the “O” ring seal (349) and the preloading wavy washer (79) in the bearing seat (36).
- Position shields (30) and (36) on the stator (1).
- Tighten screws (31) and (37).
- Reconnect all the exciter wires, auxiliary windings, stator, etc.
- Fit the 2 support screws (122).
- Fit the air inlet louvre (51)
- Replace the cover.

4.6.9 - Reassembling the rotor

On single bearing machines :
- Mount the rotor (4) in the stator (1) (see drawing below)
- Check that the machine is correctly assembled and that all screws are tightened.

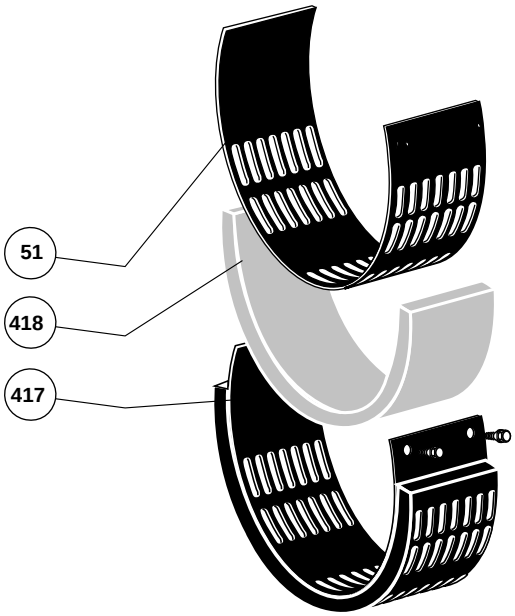
On two-bearing machines :
- Mount the rotor (4) in the stator (1).
- Position shield (30) on the stator (1).
- Tighten screws (31).
- Mount the inner bearing retainer (68) using the screws (62).



- Mount the circlips (284)
- Check that the machine is correctly assembled and that all screws are tightened.

4.6.10 - Dismantling and reassembly of the filters

- Remove the grille (417) then take out the filter (418) . Change the filter, if necessary, please refer to section 4.2.5 for cleaning the filter. To replace follow instructions in reverse order.



WARNING

When removal of the rotor involves changing parts or rewinding, the rotor must be rebalanced.

After operational testing, replace all access panels or covers.

4.7 - Installation and maintenance of the PMG

In LSA 46.2 / 47.1, the PMG reference is : PMG 2.

4.7.1 - Mechanical characteristics

The components are :
- an adaptation shaft (to position the rotor on the alternator shaft).
- an M16 tie rod and nut for assembling the rotor on the shaft.
- a rotor with 16 magnets.
- A housing + wound stator + plastic connection sleeve assembly + plastic ferrules.
- the housing cover (4 CBLXS M5 screws).
- 4 HM6 screws (mounting housing on the NDE shield).

If mounting in kit form, follow the instructions below.
1 - Remove the PMG cover [297] and the seal (71) on the alternator NDE shield.
2 - Mount the PMG housing assembly [290] on the shield using the 4 HM6 screws.
3 - Put adhesive on the tie rod [295] and screw it fully into the tapped hole in the alternator shaft extension.
4 - Mount the magnetised rotor on the adaptation shaft, then using 2 M10 threaded rods screwed into the rotor slide the assembly onto the tie rod.
5 - Once the rotor is in position, remove the 2 M10 rods.
6 - Fit the cable gland washer [296].
7 - Tighten the assembly with the M16 nut.
8 - Close the PMG with the cover [297].
9 - Remove the plastic plug on the NDE panel and fit the plastic sleeve and its ferrule.
10 - Connect the PMG to the AVR (section 4.7.2.).

4.7.2 - Electrical connection

- Connect the 3 PMG wires (14/15/16), the 2 exciter wires (5/6) and the 2 previously mentioned voltage detection wires (2/3) in accordance with the connection diagram (see section 2.3.2).

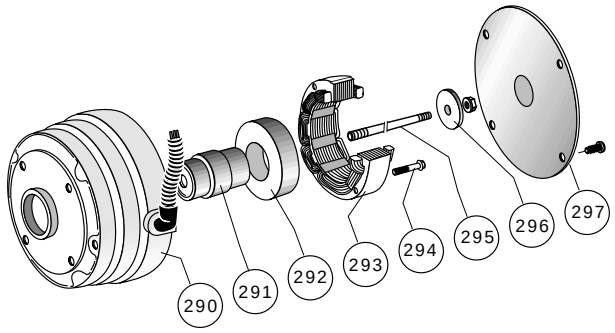
Mounting the PMG on an AREP machine
- Connect the 3 PMG wires (14/15/16), to terminals X1,X2,Z2 on the AVR. The 4 auxiliary winding wires X1.X2.Z1.Z2 should be isolated using the domino fitting supplied with the kit. Both exciter field wires (5/6) and the voltage sensing wires (2/3) remain in place.

Electrical characteristics of the PMG 2
Stator phase/phase resistance 20°C : 2.1 Ω
No-load A.C. voltage between phases at 1500 rpm : 125 V.

ATTENTION

With the PMG, check that strap ST9 has been disconnected.

4.7.3 - Exploded view of the PMG



4.8 - Table of characteristics

Table of average values
Alternator - 4 poles - 50 Hz - Standard winding No. 6.
(400V for the excitation values)
The voltage and current values are given for no-load operation and operation at rated load with separate field excitation. All values are given at ± 10% and may be changed without prior notification (for exact values, consult the test report).

4.8.1 - Average values for LSA 46.2

Resistances at 20°C (Ω)

LSA 46.2	Stator L/N	Rotor	Field	Armature
M3	0.022	0.23	8.8	0.035
M5	0.0182	0.24	8.8	0.035
L6	0.0148	0.264	8.8	0.035
L9	0.012	0.295	8.8	0.035
VL12	0.0085	0.343	10	0.037

Resistance of AREP auxiliary windings at 20°C (Ω)

LSA 46.2	Auxil wdg : X1, X2	Auxil wdg : Z1, Z2
M3	0.24	0.4
M5	0.215	0.36
L6	0.185	0.36
L9	0.19	0.32
VL12	0.17	0.32

Field excitation current i exc (A)
Symbols : “i exc”: excitation current of the exciter field.

LSA 46.2	No load	At rated load
M3	1.1	4
M5	1.1	3.8
L6	1.1	4.1
L9	1.2	4
VL12	1.1	3.5

For 60 Hz machines, the “i exc” values are approximately 5 to 10 % lower.

4.8.2 - Average values for LSA 47.1

Resistances at 20°C (Ω)

LSA 47.1	Stator L/N	Rotor	Field	Armature
M4	0.0108	0.8	10.2	0.13
M6	0.0081	0.9	10.2	0.13
L9	0.006	1.04	10.2	0.13
L10	0.0053	1.1	10.2	0.13
L11	0.0053	1.1	10.2	0.13
VL 12	0.0028	1.13	10.2	0.13

Resistance of AREP auxiliary windings at 20°C (Ω)

LSA 47.1	Auxil wdg : X1, X2	Auxil wdg : Z1, Z2
M4	0.23	0.405
M6	0.21	0.335
L9	0.175	0.34
L10	0.173	0.29
L11	0.173	0.29
VL 12	0.18	0.325

Field excitation current i exc (A)
Symbols : “i exc”: excitation current of the exciter field.

LSA 47.1	No load	At rated load
M4	0.9	3.8
M6	0.9	3.5
L9	0.9	3.2
L10	0.9	3.4
L11	0.9	3.7
VL 12	0.9	3.45

For 60 Hz machines, the “i exc” values are approximately 5 to 10 % lower.

4.8.3 - Voltage of auxiliary windings at no load

LSA 46.2	Auxil wdg : X1, X2	Auxil wdg : Z1, Z2
50 Hz	70 V	10 V
60 Hz	85 V	12 V

LSA 47.1	Auxil wdg : X1, X2	Auxil wdg : Z1, Z2
50 Hz	70 V	5 V
60 Hz	85 V	6 V

5 - SPARE PARTS

5.1 - First maintenance parts

Emergency repair kits are available as an option.
They contain the following items :

Ref.	Description	Qty	LSA 46.2	Part ref
	Emergency kit	1		
198	AVR	1	R 448	**ESC 220 CV019**
343	Diode bridge assembly	1	LSA 471. 9. 07 LSA 471.9 / 0.08	**ADE 461 EQ 004**
347	Surge suppressor	1	LSA 461.9.01	**CII 111 PM 005**
	AVR fuse	2	250 V - 10 A	**PEL 010 FG 008**
	Other spare parts			
60	DE bearing	1	6316 2RS/C3	**RLT 080 TS030**
70	NDE bearing	1	6315 2RS/C3	**RLT 075 TS030**

Ref.	Description	Qty	LSA 47.1	Part ref
	Emergency kit	1		
198	AVR	1	R 448	**ESC 220 CV019**
343	Diode bridge assembly	1	LSA 471. 9. 07 LSA 471,90.08	**ADE 471 EQ 007**
347	Surge suppressor	1	LSA 461.9.01	**CII 111 PM 005**
	AVR fuse	2	250 V - 10 A	**PEL 010 FG 008**
	Other spare parts			
60	DE bearing	1	6318 2RS/C3	**RLT 090 TS030**
70	NDE bearing	1	6315 2RS/C3	**RLT 075 TS030**

5.2 - Technical support service

Our technical support service will be pleased to provide any additional information you may require.

When ordering spare parts, you should indicate the complete machine type, its serial number and the information given on the nameplate.

Address your enquiry to your usual contact.

Part numbers should be identified from the exploded views and their description from the parts list.
Our extensive network of service centres can dispatch the necessary parts without delay.
To ensure correct operation and the safety of our machines, we recommend the use of original manufacturer spare parts. In the event of failure to comply with this advice, the manufacturer cannot be held responsible for any damage.

5.3 - Accessories

5.3.1 - Space heater for use when stopped

The space heater must start up as soon as the alternator stops. It is installed at the rear of the machine. Its standard power is 250W with 220V or 250W with 110V on request.

Warning : the power supply is present when the machine has stopped.

5.3.2 - Stator thermistor temperature probes (PTC)

These are thermistor triplets with a positive temperature coefficient installed in the stator winding (1 per phase). There can be a maximum of 2 triplets in the windings (at 2 levels : warning and trip) and 1 or 2 thermistors in the shields.
These probes must be linked to appropriate detection relays (supplied optionally)
Cold resistance of thermistor probes:
100 to 250 Ω per probe.

5.3.3 - Connection accessories

- 6-wire machines
Requirements for coupling (F) :
- 3 flexible shunts

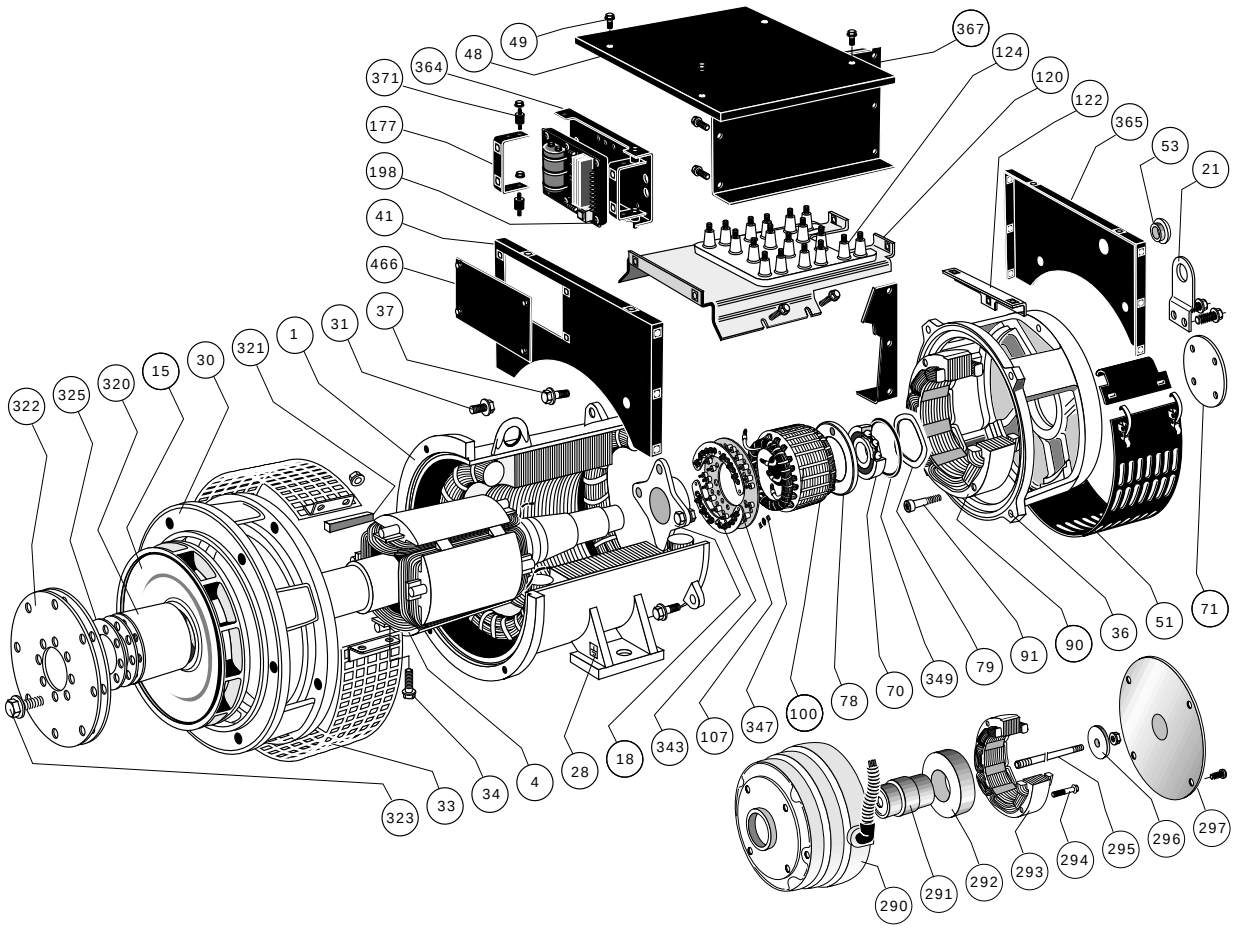
- 12-wire machines
Requirements for coupling (A) :
- 6 links
- 1 link for the neutral

Requirements for coupling (F.F) :
- 4 flexible shunts
- 2 flexible shunts
- 1 link for the central point
- 1 additional starting range
- 1 additional terminal

Requirements for coupling (F) :
- 3 flexible shunts
- 1 link for the central point

5.4 - Exploded view, parts list

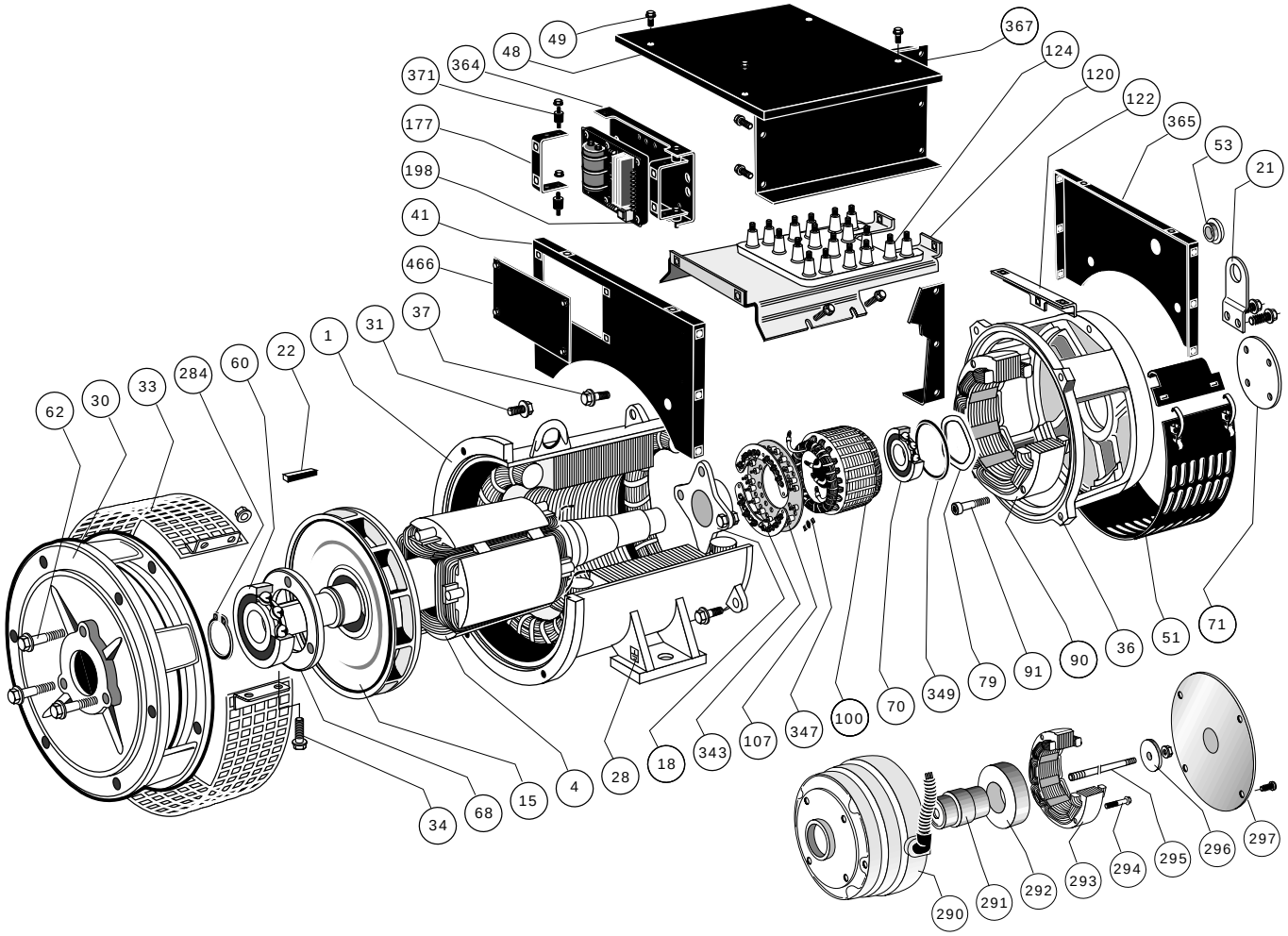
5.4.1 - Single bearing



Ref.	Qty	Description	Ref.	Qty	Description
1	1	Stator assembly	124	1	Terminal block with terminals
4	1	Rotor assembly	177	2	AVR support bracket
15	1	Turbine	198	1	Voltage regulator (AVR)
18	1	Balancing disc	290	1	PMG housing
21	1	Lifting ring	291	1	Adaptation shaft
28	1	Earth terminal	292	1	Magnetic rotor
30	1	DE shield	293	1	Stator
31	6 or 4	Fixing screw	294	2	Fixing screw
33	1	Fan guard	295	1	Tie rod
34	2	Fixing screw	296	1	Cable gland washer + nut
36	1	Exciter end shield	297	1	End plate
37	4	Fixing screw	320	1	Coupling sleeve
41	1	Cover front panel	321	1	Sleeve key
48	1	Cover top panel	322	3	Coupling disc
49	-	Cover screws	323	6	Fixing screw
51	1	Air intake louvre	325	-	Spacer shim
53	1	Plug	343	1	Diode bridge assembly
70	1	NDE bearing	347	1	Protection varistor (+ PCB)
71	1	Outer bearing retainer	349	1	“O” ring
78	1	Inner bearing retainer	364	1	AVR support
79	1	Preloading wavy washer	365	1	Cover rear panel
90	1	Exciter field	367	2	Side panel
91	4	Fixing screw	371	4	Damper
100	1	Exciter armature	416	1	Filter
107	1	Crescent support	417	1	Filter support
120	1	Terminal support	466	2	AVR inspection door
122	1	Console support			

LSA 46.2 / 47.1
ALTERNATORS
SPARE PARTS

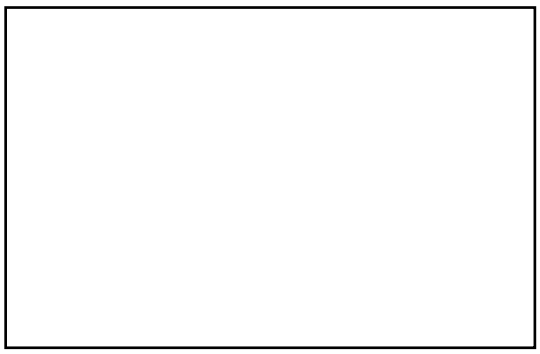
5.4.2 - Two-bearing



Ref.	Qty	Description	Ref.	Qty	Description
1	1	Stator assembly	100	1	Exciter armature
4	1	Rotor assembly	107	1	Crescent support
15	1	Turbine	120	1	Terminal support
18	1	Balancing disc	122	1	Console support
21	1	Lifting ring	124	1	Terminal block with terminals
22	1	Shaft extension key	177	2	AVR support bracket
28	1	Earth terminal	198	1	Voltage regulator (AVR)
30	1	DE shield	284	1	Circlips
31	6 or 4	Fixing screw	290	1	PMG housing
33	1	Fan guard	291	1	Adaptation shaft
34	2	Fixing screw	292	1	Magnetic rotor
36	1	Exciter end shield	293	1	Stator
37	4	Fixing screw	294	2	Fixing screw
41	1	Cover front panel	295	1	Tie rod
48	1	Cover top panel	296	1	Cable gland washer + nut
49	-	Cover screws	297	1	End plate
51	1	Air intake louvre	343	1	Direct diode crescent
53	1	Plug	347	1	Protection varistor (+ PCB)
60	1	DE bearing	349	1	“O” ring
62	3 or 4	Fixing screw	364	1	AVR support
68	1	Inner bearing retainer	365	1	Cover rear panel
70	1	NDE bearing	367	2	Side panel
71	1	Outer bearing retainer	371	4	Damper
79	1	Preloading wavy washer	416	1	Filter
90	1	Exciter field	417	1	Filter support
91	4	Fixing screw	466	2	AVR inspection door

LSA 46.2 / 47.1
ALTERNATORS
SPARE PARTS

LSA 46.2 / 47.1
ALTERNATORS
SPARE PARTS



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