

# Instruction Manual for AC Generators **QAS14 Yds**

PAGE

Instruction manual.....3

From following serial number onwards - Geldig vanaf volgend serienummer - Gültig ab Seriennummer - Valable à partir de numéro de série suivant - A partir del siguiente número de serie - Dal seguente numero di serie in avanti - A partir do seguinte número de série - Fr.o.m. tillverkningsnummer - Gældende fra flg. serienummer - Για κωδικούς προϊόντων από

AIP - 225 885

## Registration code

Collection : APC Q

Tab : 38

Sequence : 0991

## Printed matter N°

2927 1208 00 EN

1994 - 09



ATLAS COPCO – PORTABLE AIR DIVISION  
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*Congratulations on the purchase of your QAS14 AC generator. It is a solid, safe and reliable machine, built according to the latest technology. Follow the instructions in this booklet and we guarantee you years of troublefree operation. Please read the following instructions carefully before starting to use your machine.*

*While every effort has been made to ensure that the information in this manual is correct, Atlas Copco does not assume responsibility for possible errors. Atlas Copco reserves the right to make changes without prior notice.*

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## SAFETY PRECAUTIONS FOR GENERATORS QAS



Everyone who uses or maintains Atlas Copco equipment is expected to read the following safety precautions attentively and to act accordingly before installing, operating or repairing the generators.

The operator must employ safe working practices and observe all relevant local safety requirements.

The owner is responsible for maintaining the unit in a safe operating condition. Parts and accessories shall be replaced if unsuitable for safe operation.

Installation, operation, maintenance and repair shall only be carried out by authorized, competent personnel.

Any modification on the unit shall only be performed in agreement with Atlas Copco and under supervision of authorized, competent personnel.

**If any statement in this book, especially with regard to safety, does not comply with local legislation, the stricter of the two shall apply.**

**Ignoring these safety precautions may result in injury or death of the operator and/or people in the vicinity.**

In addition to normal safety rules which must be observed with generators, the following safety precautions listed hereafter are stressed.

### INSTALLATION PRECAUTIONS

1. Generators shall be lifted only with adequate equipment in conformity with local safety rules. Loose or pivoting parts shall be securely fastened before lifting. It is forbidden to stay in the risk zone under a lifted load. Lifting acceleration and retardation shall be kept within safe limits.
2. The aspirated air shall be free from flammable or toxic fumes, e.g. paint solvents, that can lead to internal fire or explosion.
3. Generators shall be installed on an even, solid floor, in a clean location with sufficient ventilation. If the floor is not level or can vary in inclination, consult Atlas Copco. If the unit is installed on a trailer, immobilize the trailer and chock the wheels.
4. The engine exhaust is a lethal gas. Do not operate the unit in a confined, not-ventilated room.
5. Never remove or tamper with the safety devices, guards or insulations fitted on the machine.
6. The electrical connections shall correspond to the local codes. The machines shall be earthed and protected against short circuits by fuses or circuit breakers.
7. Damaged cables and insufficient tightening of connections may cause electric shocks. Replace damaged cables and make sure that all electric connections are securely tightened.

### OPERATION PRECAUTIONS

1. Operate the unit as described in the Instruction book to ensure safe, efficient operation.
2. Never operate the generator in excess of its limits as indicated in the technical specifications.
3. Never operate the generator in a humid atmosphere. Excessive moisture causes worsening of the generator insulation.
4. Never touch the power terminals during operation of the machine.
5. Keep all bodywork doors shut during operation. The doors may be opened for short periods only, e.g. to carry out routine checks. Wear ear protectors when opening a door.
6. People staying in environments or rooms where the sound pressure level reaches or exceeds 90 dB(A) shall wear ear protectors.
7. Periodically check that:
  - a. All guards are in place and securely fastened.
  - b. All hoses and/or pipes inside the generator are in good condition, secure and not rubbing.
  - c. There are no leaks.
  - d. All fasteners are tight.
  - e. All electrical wirings are secure and in good order.

8. Do not remove any of, or tamper with, the sound-damping material.
9. Whenever an abnormal condition arises, e.g. excessive vibration, noise, odour, etc., switch the circuit breakers to OFF and stop the engine. Correct the faulty condition before re-starting.
10. Never refill fuel while the machine is running. Keep fuel away from hot pipes. Never smoke while fuelling. Do not spill or leave fuel, oil, coolant or cleansing agent in or around the unit.
11. Keep flammable material away from the machine. If required, provide a spark arrestor to trap incendiary exhaust sparks.
12. Earth the generator as well as the load properly.
13. Check the electric cables regularly. Whenever damaged wires or dangerous conditions are observed, switch the circuit breakers to OFF and stop the engine. Replace the damaged wires or correct the dangerous condition before re-starting.
14. Avoid overloading the generator. The generator is provided with circuit breakers for overload protection. When a breaker has tripped, reduce the concerned load before re-starting.
15. If the generator is used as stand-by for the mains supply, it must not be operated without control system which automatically disconnects the generator from the mains when the mains supply is restored.
16. Never remove the cover of the output terminals during operation. Before connecting or disconnecting wires, switch off the load and the circuit breakers, stop the machine and make sure that the machine cannot be started inadvertently or there is any residual voltage on the power circuit.
17. Never connect the generator outlets to an installation which is also connected to a public mains.
18. Before connecting a load, switch off the corresponding circuit breaker, and check whether frequency, voltage, current and power factor comply with the ratings of the generator.

### MAINTENANCE PRECAUTIONS

1. Use only the correct tools for maintenance and repair work.
2. Use only genuine spare parts.
3. All maintenance work, other than routine attention, shall only be undertaken when the generator is stopped and when all loads are disconnected from the machine. Ensure that the machine cannot be started inadvertently.
4. Scrupulously observe cleanliness during maintenance and repair. Keep dirt away by covering the parts and exposed openings with a clean cloth, paper or tape.
5. Protect the air filter, electrical and regulating components, etc. to prevent moisture from entering them, e.g. when cleaning. Take care that moisture does not penetrate any component.
6. Never remove a filler cap of the cooling water system of a hot engine. Wait until the engine has sufficiently cooled down.
7. Never use flammable solvents or carbon tetrachloride for cleaning parts. Take safety precautions against toxic vapours of cleaning liquids.
8. Take precautions against fire. Handle fuel, oil and anti-freeze with care because they are inflammable substances. Do not smoke or approach with naked flame when handling such substances. Keep a fire-extinguisher in the vicinity.
9. Make sure that no tools, loose parts or rags are left in or on the generator. Never leave rags or loose clothing near the engine air intake.
10. Before clearing the generator for use after maintenance or overhaul, submit it to a testrun, check that the AC power performance is correct and that the control and shut-down devices function correctly.
11. When servicing batteries, always wear protecting clothing and glasses. The electrolyte is a sulphuric acid which can cause severe burns. When charging batteries, an explosive gas forms above the cells and escapes through the vents. Do not smoke near batteries being, or recently having been charged. Never break live circuits or battery terminals, because a spark usually occurs.
12. Make sure that all sound-damping material is in good condition. If damaged, replace it by genuine Atlas Copco material to prevent the sound pressure level from increasing.

## LEADING PARTICULARS

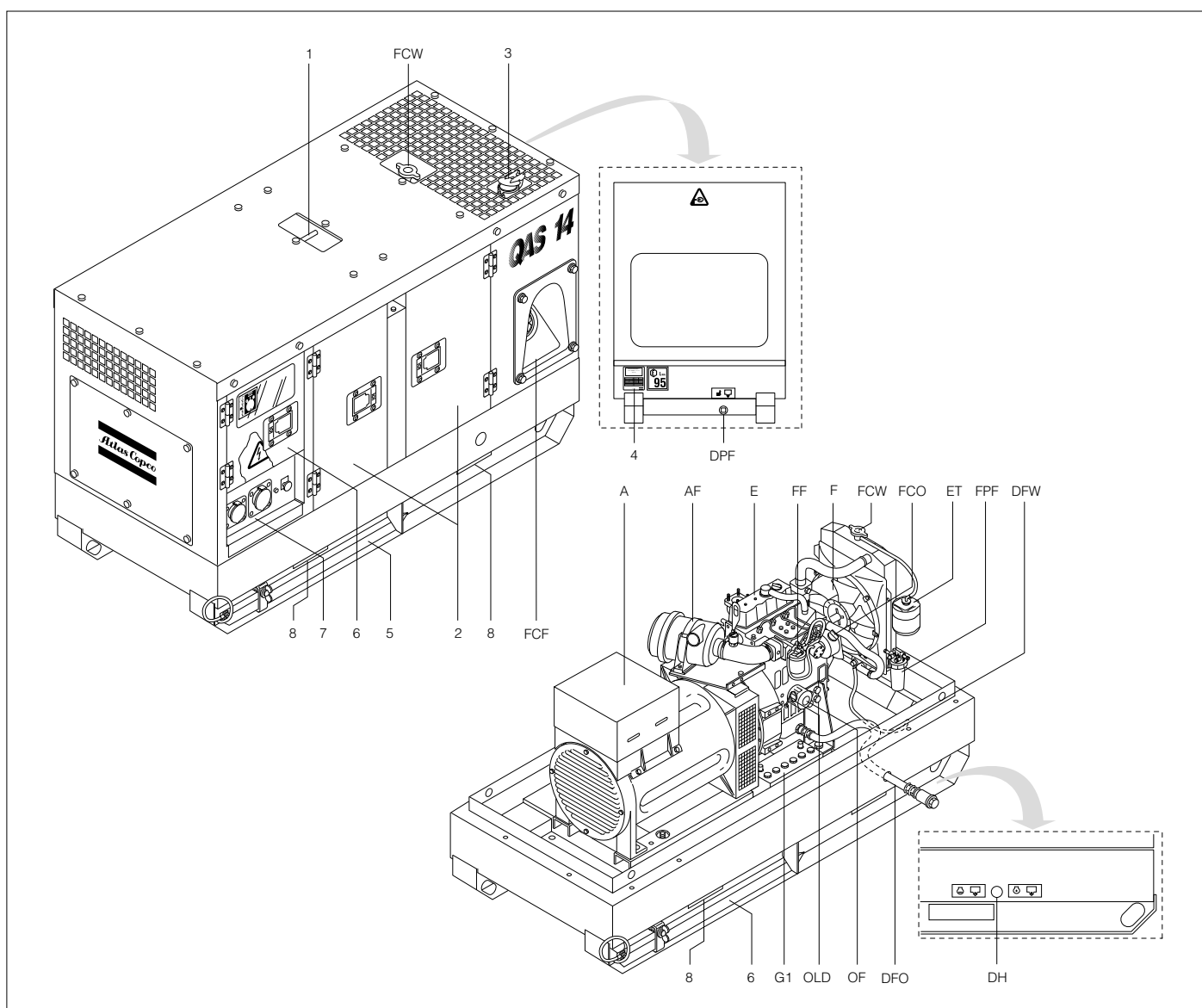
### GENERAL DESCRIPTION

The QAS14 is an AC generator, built for continuous running at sites where no electricity is available or as stand-by in cases of interruption of the mains.

The generator operates at 50 Hz, 230 V in line-to-neutral mode and 400 V in line-to-line mode. The rated output is 13 kVA.

The QAS14 generator is driven by a water-cooled diesel engine, manufactured by YANMAR.

An overview of the main parts is given in the diagram below.



- |   |                                                  |
|---|--------------------------------------------------|
| 1 | Lifting rod                                      |
| 2 | Side doors, access to engine and alternator      |
| 3 | Engine exhaust                                   |
| 4 | Data plate                                       |
| 5 | Earthing rod                                     |
| 6 | Side door, access to control and indicator panel |
| 7 | Output terminal board                            |
| 8 | Hole for forklift                                |

- |     |                                      |
|-----|--------------------------------------|
| A   | Alternator                           |
| AF  | Air filter                           |
| C   | Coupling                             |
| DFO | Drain flexible engine oil            |
| DFW | Drain flexible cooling water         |
| DH  | Drain and access hole (in the frame) |
| DPF | Drain plug fuel                      |
| E   | Engine                               |
| ET  | Expansion tank engine cooling system |

- |     |                           |
|-----|---------------------------|
| F   | Fan                       |
| FCF | Filler cap fuel           |
| FCO | Filler cap engine oil     |
| FCW | Filler cap cooling water  |
| FF  | Fuel filter               |
| FPF | Fuel pre-filter           |
| G1  | Battery                   |
| OF  | Oil filter                |
| OLD | Engine oil level dipstick |

BODYWORK


The alternator, the engine, the cooling system, etc. are enclosed in a sound-insulated bodywork that can be opened by means of side doors (and service plates).


The recess in the roof has a lifting rod in the middle.


To be able to lift the QAS14 by means of a forklift, rectangular holes are provided in the frame. The earthing rod, connected to the generator's earth terminal is located at the side of the frame.


MARKINGS


A brief description of all markings provided on the QAS14 is given hereafter.


- 


Indicates that an electric voltage, dangerous to life, is present.
- 


Indicates that the engine exhaust is a hot and harmful gas, which is toxic in case of inhalation. Always make sure that the unit is operated outside or in a well-ventilated room.
- 

Indicates that these parts can become very hot during operation (eg. engine, cooler, etc.). Always make sure that these parts are cooled down before touching them.
- 

Indicates that the generator may be refueled with diesel fuel only.
- 

Indicates the drain hole for the engine oil.
- 

Indicates the drain hole for the coolant.
- 


Indicates the drain plug for the engine fuel.
- 

Indicates the earth terminal XE on the output terminal board and the different earthing connections on the generator.

DRAIN PLUGS AND FILLER CAPS

The drain holes for the engine oil, the coolant and the plug for the fuel, are located and labelled on the frame; the fuel drain plug at the front, the others at the service side.

The drain flexible for engine oil can be brought to the outside of the generator through the drain hole.

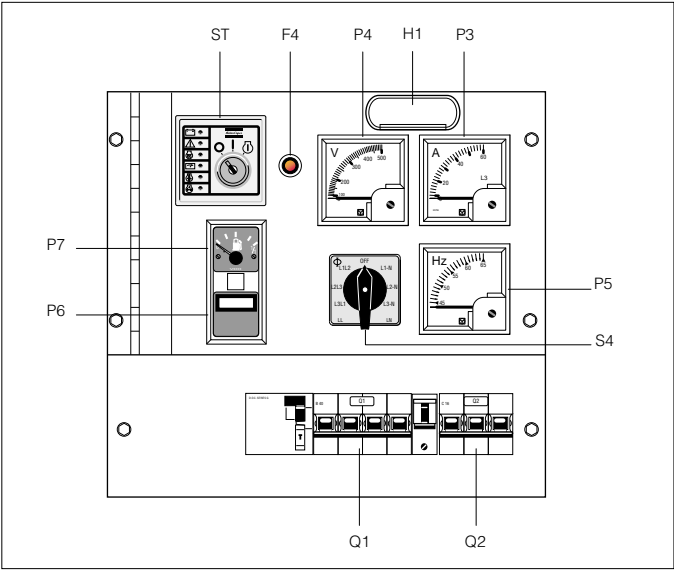


The drain hole can also be used to guide external fuel tank connections. When connecting an external fuel tank, be sure to bypass the fuel supply/return connection on the internal tank, to prevent spilling of fuel in the unit.

The filler cap for the engine coolant is accessible via an opening in the roof. The fuel filler cap is located in the side panel.

CONTROL AND INDICATOR PANEL


The control and indicator panel is located behind a door in the side panel. The hinged door is partly transparent and allows easy access to the parts mounted behind it. Panel lights H1 lights up as soon as the starter switch is turned into position I, indicating that the fuel solenoid is energised.



Engine gauges

P6 .....Hourmeter

P7 .....Fuel level gauge



P6 and P7 are combined in one instrument.

## Generator gauges

### P3 .....Ammeter line L3

Indicates the outgoing current in the third phase (L3).

### P4 .....Voltmeter

Indicates the voltage selected by means of voltage selector switch S4.

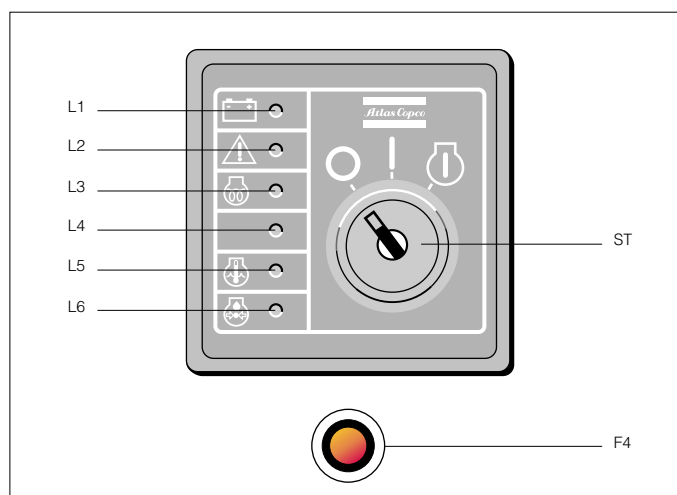
### P5 .....Frequency meter

Indicates the frequency of the supply voltage.

### S4 .....Voltmeter selector switch

Allows to measure the voltage between each of the phases and between each phase and the neutral. It also allows to switch off the voltmeter.

## Engine controls and lamps




### ST .....Starter switch

The starter switch is a three-position switch which can be operated with its specific key only.

Position O : the key can be inserted or withdrawn. When withdrawn, the switch is locked and the voltage supply from the battery is switched off.

Position I : the electrical system of the engine, except the starting circuit, is energized. When the preheating system in the engine air inlet has reached the required temperature, the corresponding lamp (L3) goes out. The key may then be turned to the next position.

Position  : the starter motor of the engine is energized. As soon as the engine fires, the key can be released. The switch automatically returns to position I.

After approximately 20 seconds in position I without starting, the control system will automatically shut down (battery saving purpose) indicating a low oil pressure failure. In this case, a reset of the control system by putting the switch in position O is necessary.



### F4.....Fuse

The fuse activates when the current from the battery to the engine control circuit exceeds its setting. The fuse can be switched on and off by pushing the button.

### L1.....Alternator charging indicator

Goes out after starting, indicating that the alternator is charging. A failing alternator however will not shut the engine down.

### L2.....General failure indicator

Indicates that a shutdown appeared.

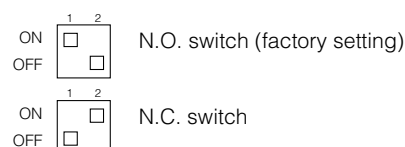
### L3.....Engine preheating system indicator

Lights up when the glow plugs in the engine, used to facilitate starting, are warming up. Extinguishes after approximately 10 seconds. Bypassing of the preheattime is allowed e.g. when starting a hot engine, but the preheat system remains active.

### L4 .....Spare shutdown indicator

Can be used to wire an extra shutdown, e.g. for low fuel level in case a switch is incorporated in the fuel tank.

Two DIP switches are foreseen on the back of the module to choose the mode of the switch (Normal Open or Normal Closed),



The connection of the extra shutdown has to be done on the back of the module, terminal 3.

### L5 .....Engine coolant temperature fault indicator

Lights up when the high engine coolant temperature was the cause of shutdown.

### L6 .....Engine oil pressure fault indicator

Lights up when the low engine oil pressure was the cause of shutdown.

## Circuit breakers

### Q1.....Main circuit breaker, earth leak detector and minimum voltage relay

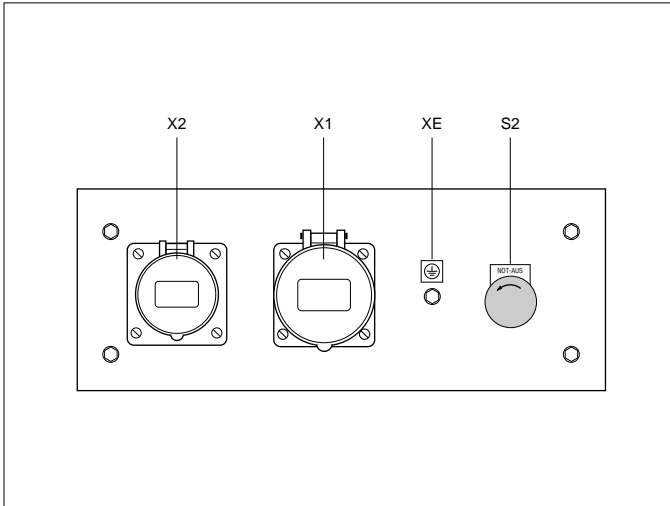
Interrupts the power supply to X1 and X2 when a short-circuit occurs at the load side, or when the earth leak detector (30 mA) or the overcurrent protection (20 A) is activated or when the DC hold coil is not energised. It must be reset manually after eliminating the problem and after each start.

### Q2.....Circuit breaker for X2

Interrupts the power supply X2 when a short-circuit occurs at the load side, or when the overcurrent protection (16 A) is activated. When activated, Q2 interrupts the three phases towards X2. It must be reset manually after eliminating the problem.

## OUTPUT TERMINAL BOARD

The output terminal board is situated below the control and indicator panel.



### *S2.....Emergency stop button*

Push the button to stop the generator in case of an emergency. When the button is pressed, it must be unlocked, by turning it anti-clockwise, before the generator can be re-started.

### *X1.....3-phase outlet socket (400 V AC)*

Provides phases L1, L2 and L3, neutral and earthing.

### *X2.....3-phase outlet socket (400 V AC)*

Provides phases L1, L2 and L3, neutral and earthing.

### *XE .....Earth terminal*

Connected to the earthing of outlet sockets X1 and X2 and to the earthing of the alternator.

## OPERATING INSTRUCTIONS

In your own interest, always strictly observe all relevant safety instructions.

Do not operate the generator in excess of the limitations mentioned in the Technical Specifications.

Local rules concerning the setting up of low voltage power installations (below 1,000 V) must be respected when connecting site distribution panels, switch gear or loads to the generator.

At each start-up and at any time a new load is connected, the earthing of the generator must be verified. Earthing must be done either by the earthing rod or, if available, by an existing, suitable earthing installation. The protective system against excessive contact voltage is not effective unless a suitable earthing is made.

The generator is wired for a TN-system to IEC 364-3, i.e. one point in the power source directly earthed - in this case the neutral. The exposed conductive parts of the electric installation must be directly connected to the functional earth.

If operating the generator in another power system, e.g. an IT-system, other protective devices required for these types must be installed. In any case only a qualified electrician is authorized to remove the connection between the neutral (N) and earth terminals in the terminal box of the alternator.



## INSTALLATION

- Place the generator on a horizontal, even and solid floor.
- Protect the generator against dust and rain if it is operated outside.
- Check that the engine exhaust is not directed towards people. If the generator is operated indoors, install an exhaust pipe of sufficient diameter to duct the engine exhaust towards the outside. Check for sufficient ventilation so that the cooling air is not recirculated. If necessary, consult Atlas Copco.
- Leave enough space for operation, inspection and maintenance (at least 1 meter at each side).
- Check that the inner earthing system is in compliance with the local legislation.
- Install the earthing rod as near as possible to the generator and measure its diffusion resistance (max. 1 K $\Omega$ ) in order not to have a contact voltage higher than 25 V at 30 mA leakage current.
- Check that the cable end of the earthing rod is connected to the earth terminal.
- Use soft water for the engine cooling system. If low temperatures are expected (close to 0 °C), the engine cooling system must be protected (refer to the Engine instruction book).
- Check the tightness of the bolts and nuts.



## CONNECTING THE GENERATOR

### Precautions for non-linear and sensitive loads



Non-linear loads draw currents with high contents in harmonics, causing distortion in the wave form of the voltage generated by the alternator.

The most common non-linear, 3-phase loads are thyristor/rectifier-controlled loads, such as convertors supplying voltage to variable speed motors, uninterruptable power supplies and Telecom supplies. Gas-discharge lighting arranged in single-phase circuits generate high 3rd harmonics and risk for excessive neutral current.

Loads most sensitive to voltage distortion include incandescent lamps, discharge lamps, computers, X-ray equipment, audio amplifiers and elevators.

Consult Atlas Copco for measures against the adverse influence of non-linear loads.

### Quality, minimum section and maximum length of cables

The cable connected to the terminal board of the generator must be selected in accordance with local legislation. The type of cable, its rated voltage and current carrying capacity are determined by installation conditions, stress and ambient temperature. For flexible wiring, rubber-sheathed, flexible core conductors of the type H07 RN-F (Cenelec HD.22) or better must be used.

The following table indicates the maximum allowable 3-phase currents (in A), in an ambient temperature of 40 °C, for cable types (multiple and single core PVC insulated conductors and H07 RN-F multiple core conductors) and wire sections as listed, in accordance with VDE 0298 installation method C3. Local regulations remain applicable if they are stricter than those proposed below.

Wire section (mm <sup>2</sup> )	2,5	4	6	10	16	25	35	50	70	95
Max. current (A)										
Multiple core	22	30	38	53	71	94	114	138	176	212
Single core	25	33	42	57	76	101	123	155	191	228
H07 RN-F	21	28	36	50	67	88	110	138	170	205

The lowest acceptable wire section and the corresponding maximum cable or conductor length for multiple core cable or H07 RN-F, at rated current (20 A), for a voltage drop  $e$  lower than 5 % and at a power factor of 0.80, are respectively 2.5 mm<sup>2</sup> and 144 m. In case electric motors must be started, oversizing the cable is advisable.

The voltage drop across a cable can be determined as follows:

$$e = \frac{\sqrt{3} \cdot I \cdot L \cdot (R \cdot \cos\phi + X \cdot \sin\phi)}{1000}$$

$e$  = Voltage drop (V)

$I$  = Rated current (A)

$L$  = Length of conductors (m)

$R$  = Resistance ( $\Omega$ /km to VDE 0102)

$X$  = Reactance ( $\Omega$ /km to VDE 0102)

### Connecting the load

#### Site distribution panel

If more outlet sockets than installed on the generator are required, they must be mounted on a site distribution panel supplied from the terminal board of the generator and in compliance with local regulations for power installations on building sites.

#### Protection




For safety reasons, it is necessary to provide an isolating switch or circuit breaker in each load circuit. Local legislation may impose the use of isolating devices which can be locked.

- Check whether frequency, voltage and current comply with the ratings of the generator.
- Provide for the load cable, with the proper plug and without excessive length. Lay out the cable in a safe way without forming coils.
- Fit the cable plug into the corresponding socket X1 or X2.

### BEFORE STARTING

- With the generator standing level, check the engine oil level and top up if necessary. The oil level must be near to, but not exceed the high mark on the engine oil level dipstick.
- Check the coolant level in the expansion tank of the engine cooling system. The water level must be near to the FULL mark. Add coolant if necessary.
- Drain any water and sediment from the fuel pre-filter. Check the fuel level and top up if necessary. It is recommended to fill the tank after the day's operation to prevent waterdamp in a nearly empty tank from condensing.
- Check the vacuum indicator of the air filter. If the red part shows completely, replace or clean the filter element.
- Press the vacuator valve of the air filter to remove dust.
- Check the generator for leakage, tightness of wire terminals, etc. Correct if necessary.
- Check that the circuit breakers Q1 and Q2 are switched off.
- Check that fuse F4 is not activated and that the emergency stop is in the "OUT" position.
- Check that the load is switched off.

### STARTING

- Insert the key in the starter switch and turn it to position I. Wait until the preheat lamp goes out. Turn the key to position  and release it as soon as the engine fires. The switch automatically returns to position I.

Do not keep the key in its utmost position for more than 10 seconds (maximum 20 seconds in extremely cold conditions). Wait two minutes between each starting attempt.



If the engine fails to start and for starting in extremely cold conditions, consult your local Atlas Copco dealer.

- Check that the warning lamps on the control and indicator panel are out.
- Run the engine for approximately 5 minutes to warm up.
- Check the voltmeter P4 (with voltmeter selector switch S4 in different positions) and the frequency meter P5.
- Switch on circuit breaker Q1, together with trip coil. If power supply is done by means of X2, switch on Q2 as well.
- Switch on the load and check ammeter P3, voltmeter P4 (voltmeter selector switch in different positions) and frequency meter P5.

### DURING OPERATION

Following points should be carried out regularly:

- Check the engine gauges and the lamps for normal readings.



Avoid to let the engine run out of fuel. If it happened, priming will speed up the starting.

- Check for leakage of oil, fuel or cooling water.
- Avoid long low-load periods. In this case, an output drop and higher oil consumption of the engine could occur.
- Check, by means of the generator gauges, that the voltage between the phases is identical and that the rated current in the third phase (L3) is not exceeded.
- When single-phase loads are connected to the generator output terminals, keep all loads well-balanced.

If the circuit breakers are activated during operation, switch off the load and stop the generator. Check and, if necessary, decrease the load.

The generator's side doors may only remain opened for short periods during operation, to carry out checks for example.

### STOPPING

- Switch off the load.
- Switch off the circuit breakers.
- Let the engine run for about 5 minutes.
- Stop the engine by turning the starter key to position O. Withdraw the key.
- Lock the side doors and the door of the indicators and control panel to avoid unauthorized access.

## MAINTENANCE



Before carrying out any maintenance activity, check that the start switch is in position O.

MAINTENANCE SCHEDULE	Daily	Initial	Small	Normal	Yearly
		50 hours	250 hours	500 hours	2000 hours
<b>SERVICE PAK</b>	–	<b>With unit</b>	<b>2912 4112 05</b>	<b>2912 4113 06</b>	<b>2912 4114 07</b>
Coolant level	Check	Check	Check	Check	Check
Tension and condition of drive belt(s)		Check	Check	Check	Replace
Radiator fins		Check/Clean	Check/Clean	Check/Clean	Check/Clean
Fuel pre-filter/Water separator	Check/Drain	Check/Drain	Check/Drain	Check/Drain	Check/Drain
Fuel filter element		Replace	Replace	Replace	Replace
Fuel injectors					Check
Oil level in sump	Check	Check	Check	Check	Check
Oil pressure on gauge	Check	Check	Check	Check	Check
Lubrication oil		Change	Change	Change	Change
Oil filter(s)		Replace	Replace	Replace	Replace
Air cleaner and dust bowl		Clean	Clean	Clean	Clean
Air filter element <sup>(1)</sup>			Clean	Replace	Replace
Safety cartridge					Replace
Valve clearance		Check/adjust	Check/adjust	Check/adjust	Check/adjust
Oil, fuel and water leaks		Check	Check	Check	Check
Mechanical links (e.g. fuel solenoid link)			Grease	Grease	Grease
Level battery electrolyte <sup>(2)</sup>		Check	Check	Check	Check
Condition of vibration dampers		Check	Check	Check	Check
Alternator insulation resistance (*)		Measure	Measure	Measure	Measure
Tightness of nuts and bolts		Check			Check
Door hinges		Grease			Grease
Locks		Lubricate			Lubricate
<b>Inspection by Atlas Copco Service technician</b>					

(1) More frequently when operating in a dusty environment.

(2) A Service Bulletin (ASB) dealing elaborately with batteries and due care is available on request.

### (\*) MEASURING THE ALTERNATOR INSULATION RESISTANCE

A 500-V megger is required to measure the alternator insulation resistance.

If the N-terminal is connected to the earthing system, it must be disconnected from the earth terminal. Disconnect the AVR.

Connect the megger between the earth terminal and terminal L1 and generate a voltage of 500 V. The scale must indicate a resistance of at least 5 MΩ.

Refer to the alternator operating and maintenance instructions for more details.

### ENGINE MAINTENANCE

Refer to the engine's operator manual for full maintenance, including instructions for changing the oil and cooling water and replacing the fuel, oil and air filters.

### STORAGE OF THE GENERATOR

#### STORAGE

- Store the generator in a dry, frost-free room which is well ventilated.
- Run the engine regularly, e.g. once a week, until it is warmed up. If this is impossible, extra precautions must be taken:
  - Consult the engine's operator manual.
  - Remove the battery. Store it in a dry, frost-free room. Keep the battery clean and its terminals lightly covered with petroleum jelly. Recharge the battery regularly.
  - Clean the generator and protect all electrical components against moisture.
  - Place silica gel bags, VCI paper (Volatile Corrosion Inhibitor) or another drying agent inside the generator and close the doors.
  - Stick sheets of VCI paper with adhesive tape on the bodywork to close off all openings.
  - Enclose the generator, except the bottom, with a plastic bag.

#### PREPARING FOR OPERATION AFTER STORAGE

Before operating the generator again, remove the wrapping, VCI paper and silicagel bags and check the generator thoroughly (go through the checklist "Before starting").

- Consult the engine's operator manual.
- Check that the insulation resistance of the generator exceeds 5 M $\Omega$ .
- Replace the fuel filter and fill the fuel tank. Vent the fuel system.
- Reinstall and connect the battery, if necessary after being recharged.
- Submit the generator to a test run.

### CHECKS AND TROUBLE SHOOTING

**Never perform a test run with connected power cables. Never touch an electrical connector without a voltage check.**

When a failure occurs, always report what you experienced before, during and after the failure. Information with regard to the load (type, size, power factor, etc.), vibrations, exhaust gas colour, insulation check, odors, output voltage, leaks and damaged parts, ambient temperature, daily and normal maintenance and altitude might be helpful to quickly locate the problem. Also report any information regarding the humidity and location of the generator (eg. close to sea).



#### CHECKING VOLTMETER P4

- Put a voltmeter in parallel with voltmeter P4 on the control panel.
- Check that the read-out of both voltmeters is the same.
- Stop the generator and disconnect one terminal.
- Check that the internal resistance of the voltmeter is high.

#### CHECKING FREQUENCYMETER P5

- Run the unit at normal speed.
- Put a voltmeter in parallel with frequencymeter P5.
- If the measured voltage is higher than 200 V, the frequencymeter has to work properly.

If not, remove the frequencymeter, connect it with the mains (230 V) and check that it indicates 50 Hz.

#### CHECKING AMMETER P3

- Measure during the load, by means of a clamp-on probe, the outgoing current in the third phase (L3).
- Compare the measured current with the current indicated on ammeter P3. Both readings should be the same.

**ALTERNATOR TROUBLE SHOOTING**

<i>Symptom</i>	<i>Possible cause</i>	<i>Corrective action</i>
<i>Alternator does not excite.</i>	Blown fuse. Insufficient residual voltage. No residual voltage.	Replace fuse. Increase the speed by 15 %. For an Instant apply on the + and – terminals of the electronic regulator a 12 V battery voltage with a 30 $\Omega$ resistor in series respecting the polarities.
<i>After being excited alternator does not excite.</i>	Connections are interrupted.	Check connection cables as per attached drawings.
<i>Low voltage at no load.</i>	Voltage potentiometer out of setting. Intervention of protection. Winding failure.	Reset voltage. Check rpm. Check windings.
<i>High voltage at no load.</i>	Voltage potentiometer out of setting. Failed regulator.	Reset voltage. Substitute regulator.
<i>Lower than rated voltage at load.</i>	Voltage potentiometer out of setting. Intervention by protection.  Failed regulator. Rotating bridge failure.	Reset voltage potentiometer. Current too high, power factor lower than 0.8; speed lower than 4% of rated speed. Substitute regulator. Check diodes, disconnect cables.
<i>Higher than rated voltage at load.</i>	Voltage potentiometer out of setting. Failed regulator.	Reset voltage potentiometer. Substitute regulator.
<i>Unstable voltage.</i>	Speed variation in engine. Regulator out of setting.	Check regularity of rotation. Regulate stability of regulator by acting on "STABILITY" potentiometer.

**ENGINE TROUBLE SHOOTING**

The table below gives an overview of the possible engine problems and their possible causes.

*The starter motor turns the engine too slowly*

- Battery capacity too low.
- Bad electrical connection.
- Fault in starter motor.
- Wrong grade of lubricating oil.

*The engine does not start or is difficult to start*

- Starter motor turns engine too slowly.
- Fuel tank empty.
- Fault in fuel control solenoid.
- Restriction in a fuel pipe.
- Fault in fuel lift pump.
- Dirty fuel filter element.
- Air in fuel system.
- Fault in atomisers.
- Cold start system used incorrectly.
- Fault in cold start system.

- Restriction in fuel tank vent.
- Wrong type or grade of fuel used.
- Restriction in exhaust pipe.

*Not enough power*

- Restriction in a fuel pipe.
- Fault in fuel lift pump.
- Dirty fuel filter element.
- Restriction in air filter/cleaner or induction system.
- Air in fuel system.
- Fault in atomisers or atomisers of an incorrect type.
- Restriction in fuel tank vent.
- Wrong type or grade of fuel used.
- Restricted movement of engine speed control.
- Restriction in exhaust pipe.
- Engine temperature is too high.
- Engine temperature is too low.

### *Misfire*

- Restriction in a fuel pipe.
- Fault in fuel lift pump.
- Dirty fuel filter element.
- Air in fuel system.
- Fault in atomisers or atomisers of an incorrect type.
- Fault in cold start system.
- Engine temperature is too high.
- Incorrect valve tip clearances.

### *The pressure of the lubricating oil is too low*

- Wrong grade of lubricating oil.
- Not enough lubricating oil in sump.
- Defective gauge.
- Dirty lubricating oil filter element.

### *High fuel consumption*

- Restriction in air filter/cleaner or induction system.
- Fault in atomisers or atomisers of an incorrect type.
- Fault in cold start system.
- Wrong type or grade of fuel used.
- Restricted movement of engine speed control.
- Restriction in exhaust pipe.
- Engine temperature is too low.
- Incorrect valve tip clearances.

### *Black exhaust smoke*

- Restriction in air filter/cleaner or induction system.
- Fault in atomisers or atomisers of an incorrect type.
- Fault in cold start system.
- Wrong type or grade of fuel used.
- Restriction in exhaust pipe.
- Engine temperature is too low.
- Incorrect valve tip clearances.
- Engine overload.

### *Blue or white exhaust smoke*

- Wrong grade of lubricating oil.
- Fault in cold start system.
- Engine temperature is too low.

### *The engine knocks*

- Fault in fuel lift pump.
- Fault in atomisers or atomisers of an incorrect type.
- Fault in cold start system.
- Wrong type or grade of fuel used.
- Engine temperature is too high.
- Incorrect valve tip clearances.

### *The engine runs erratically*

- Fault in fuel control.
- Restriction in a fuel pipe.
- Fault in fuel lift pump.
- Dirty fuel filter element.
- Restriction in air filter/cleaner or induction system.
- Air in fuel system.
- Fault in atomisers or atomisers of an incorrect type.
- Fault in cold start system.
- Restriction in fuel tank vent.
- Restricted movement of engine speed control.
- Engine temperature is too high.
- Incorrect valve tip clearances.

### *Vibration*

- Fault in atomisers or atomisers of an incorrect type.
- Restricted movement of engine speed control.
- Engine temperature is too high.
- Fan damaged.
- Fault in engine mounting or flywheel housing.

### *The pressure of the lubricating oil is too high*

- Wrong grade of lubricating oil.
- Defective gauge.

### *The engine temperature is too high*

- Restriction in air filter/cleaner or induction system.
- Fault in atomisers or atomisers of an incorrect type.
- Fault in cold start system.
- Restriction in exhaust pipe.
- Fan damaged.
- Too much lubricating oil in sump.
- Restriction in air or water passages of radiator.
- Insufficient coolant in system.

### *Crankcase pressure*

- Restriction in breather pipe.
- Vacuum pipe leaks or fault in exhauster.

### *Bad compression*

- Restriction in air filter/cleaner or induction system.
- Incorrect valve tip clearances.

### *The engine starts and stops*

- Dirty fuel filter element.
- Restriction in air filter/cleaner or induction system.
- Air in fuel system.

### *The engine shuts down after approximately 15 seconds*

- Bad connection towards oil pressure switch/coolant temperature switch.
- DIP switch on back of module wrong positioned.

## TECHNICAL SPECIFICATIONS

### READINGS ON GAUGES

<i>Gauge</i>	<i>Reading</i>	<i>Unit</i>
Ammeter (P3)	Below max. rating	A
Voltmeter (P4)	Depends upon selector switch	V
Frequencymeter (P5)	Between 52.5 and 50	Hz
Hourmeter (P6)	Adding up	h
Fuel level (P7)	Above 0	Fuel tank full

### SETTINGS OF SWITCHES

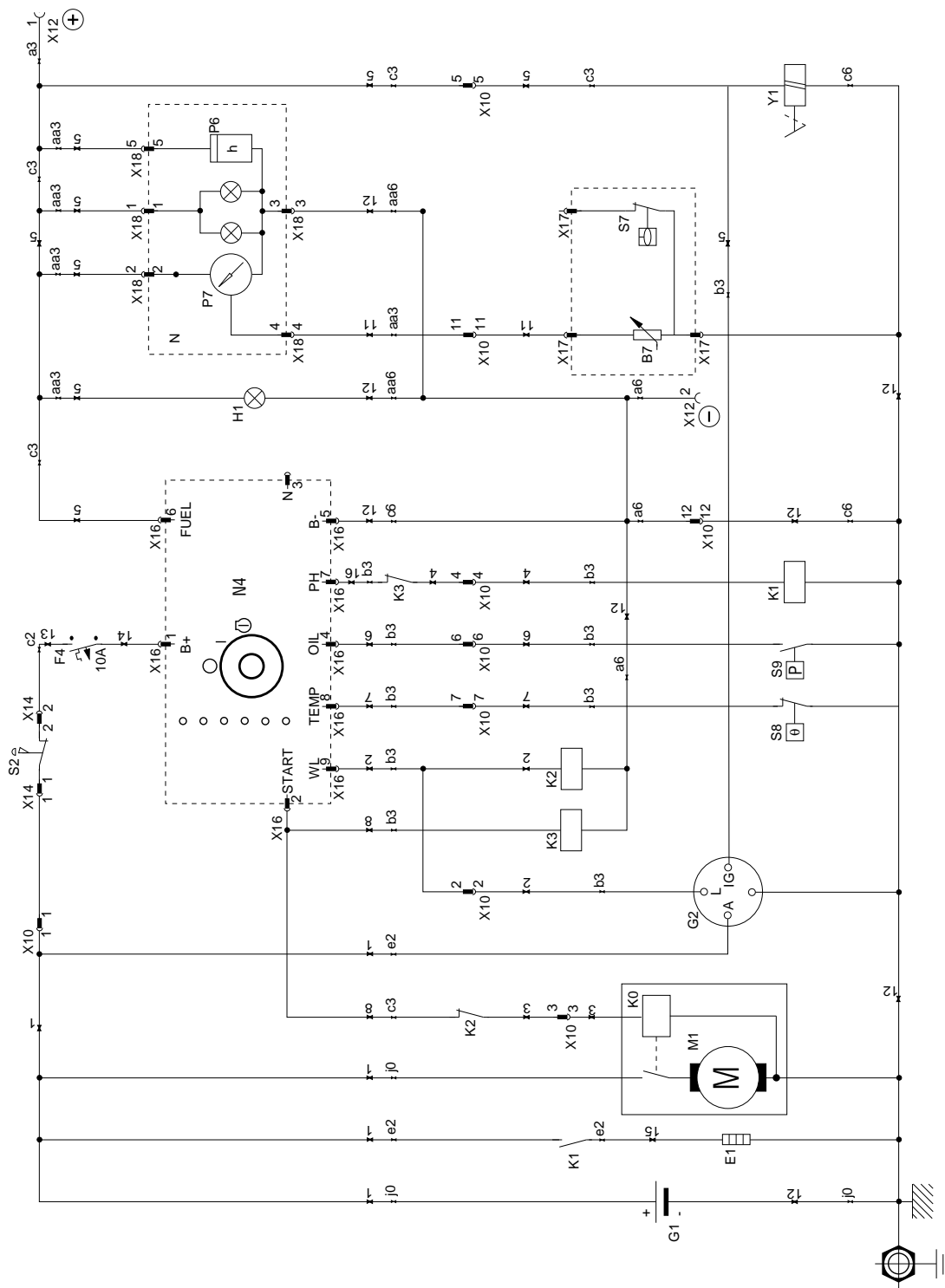
<i>Switch</i>	<i>Function</i>	<i>Activates at</i>
Engine oil pressure	Shut-down	0.5 bar
Engine coolant temperature	Shut-down	105 °C

### SPECIFICATIONS OF THE ENGINE/ALTERNATOR/UNIT

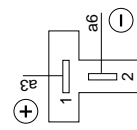
<i>Reference values</i>	Absolute air inlet pressure	1 bar
	Air inlet temperature	27 °C
	Relative air humidity	60 %
	Generator load	Continuous
<i>Limitations without derating</i>	Maximum ambient temperature	35 °C
	Maximum altitude	1000 m
	Maximum relative air humidity	85 %
	Minimum starting temperature	-18 °C
<i>Engine</i>	Type YANMAR	3TNE88-ACG
	Rated net output	12.8 kW
	Load speed	1500 rpm
	Electrical system	12 V
	Battery	12 V / 66 Ah
	Oil circuit capacity	7 l
	Cooling circuit capacity	3 + 1 l
	Fuel tank capacity	85 l
	Fuse F4	10 A
	Fuel consumption at full load/no load	2.7/0.8 kg/h
	Maximum run time with fuel tank	26 h
<i>Alternator</i>	Type	EC 28 LB-4
	Rated net output	15 kVA
	Voltage line-to-neutral	230 V
	Voltage line-to-line	400 V
	Frequency	50 Hz
	Speed	1500 rpm
	Power factor	0.8
	Number of phases	3 + neutral
	Winding connections	Star
	Insulation armature winding, class	H
	Insulation field winding, class	H
	Sensitivity of earth leak detector	30 mA
	Setting of Q1	20 A
	Setting of Q2	16 A
	Fuses F1, F2 and F3 for voltmeter selector switch	4 A
	Maximum diffusion resistance of earthing rod	1 kΩ
<i>Unit</i>	Dimensions (LxWxH)	1860x811x957mm
	Weight net mass	670 kg
	Weight wet mass	750 kg







Connector X 12 as seen from  
wire inserting side



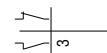
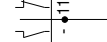
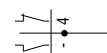
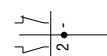
Colour code :

1 = brown  
2 = red  
3 = orange  
4 = yellow  
5 = green  
6 = blue  
7 = purple  
8 = grey  
9 = white  
0 = black

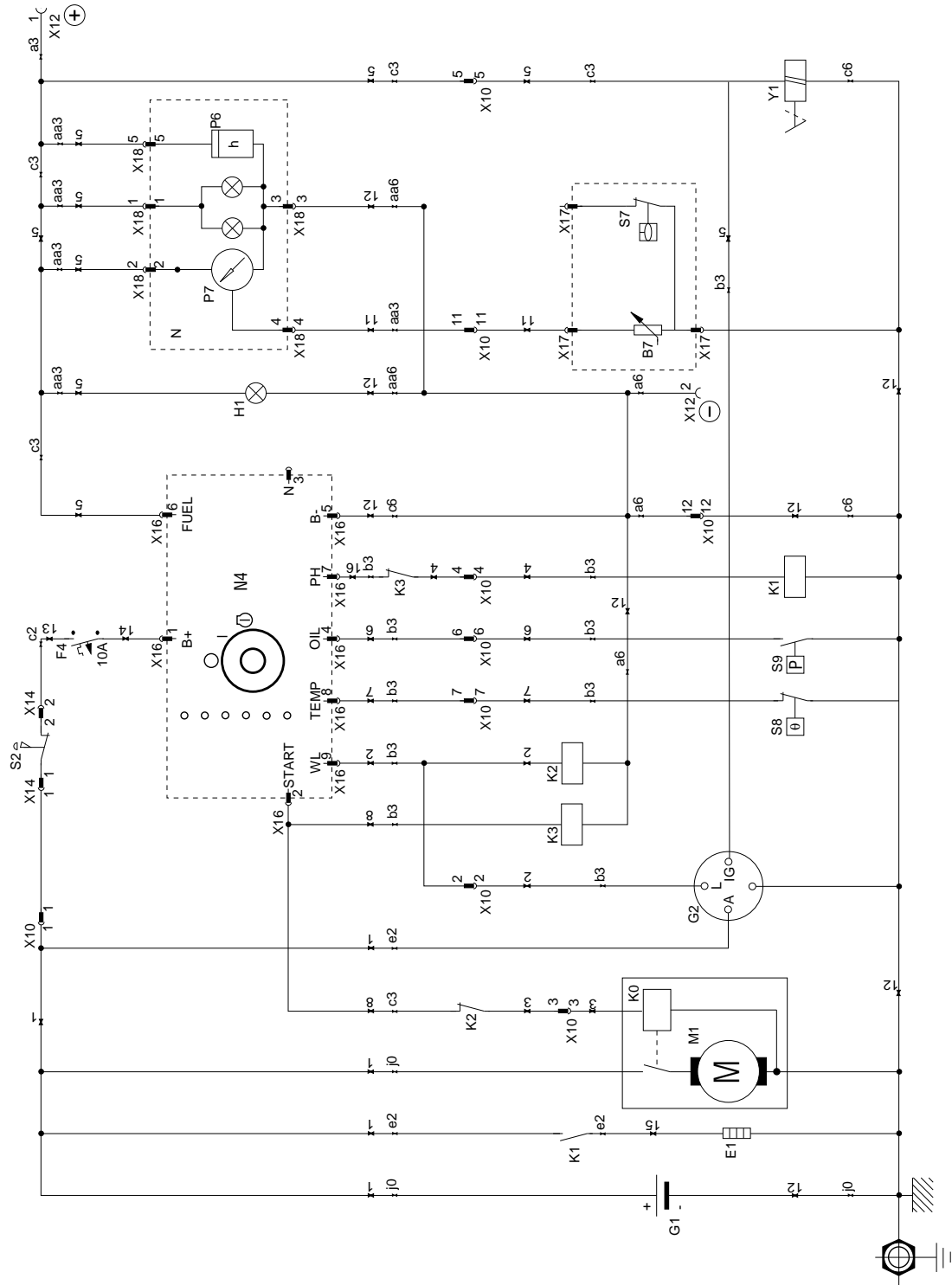
Wire size :

aa = 0.5 mm<sup>2</sup>  
a = 1 mm<sup>2</sup>  
b = 1.5 mm<sup>2</sup>  
c = 2.5 mm<sup>2</sup>  
d = 4 mm<sup>2</sup>  
e = 6 mm<sup>2</sup>  
f = 10 mm<sup>2</sup>  
g = 16 mm<sup>2</sup>  
h = 20 mm<sup>2</sup>  
i = 35 mm<sup>2</sup>  
j = 50 mm<sup>2</sup>

LEGEND :



	ENGLISH	NEDERLANDS	DEUTSCH	FRANCAIS	ESPAÑOL
B7	Fuel level sensor	Sensor, brandstofpeil	Kraftstoffstandfühler	Captreur, niveau de carburant	Sensor del nivel de combustible
E1	Preheat resistor	Voorverwarmingssweerstand	Vorwärmwiderstand	Résistance de préchauffage	Resistencia de precalentamiento
F4	Fuse	Zekering	Sicherung	Fusible	Fusible
G1	Battery 12V	Batterij 12V	Batterie 12 V	Batterie	Batería de 12V
G2	Charging generator	Laad alternator	Lademmaschine	Alternateur, charge	Generador de carga
H1	Panel light	Paneelverlichting	Instrumentenleuchte	Eclairage panneau	Luz de panel
K0	Starter solenoid	Startersolenoid	Startermagnet	Solénoid du démarreur	Solenoido de arranque
K1	Preheat relay	Relais voorverwarmingssysteem	Vorwärmrelais	Relais de préchauffage	Relé, sistema de precalentamiento
K2	Start prevention relay	Startpreventierelais	Startverhinderungsrelais	Relais inhibiteur de démarrage	Relé de prevención de arranque
K3	Preheat shut-off relay	Uitschakelrelais voorverwarmingssysteem	Vorwärme-Abschaltrelais	Relais d'arrêt de préchauffage	Relé, desconexión sist. precalentamiento
M1	Starter motor	Startermotor	Startmotor	Démarrreur	Motor de arranque
N4	Control module	Stuurmodule	Steuermodul	Module de commande	Módulo de control
N5	Instrument cluster	Instrumentengeheel	Instrumentensatz	Instrumentation	Grupo de instrumentos
P6	Hourmeter	Urenteller	Stundenzähler	Compteur d'heures	Cuentahoras
P7	Fuel level gauge	Brandstofpeilindicator	Messinstrument für Kraftstoffstand	Indicateur de niveau de carburant	Indicador del nivel de combustible
S2	Emergency stop button	Noodstopknop	Not-Aus-Taste	Bouton arrêt d'urgence	Botón de parada de emergencia
S7	Low fuel level switch	Schakelaar, laag brandstofpeil	Schalter für niedrigen Kraftstoffstand	Interrupteur niveau de carburant bas	Interruptor bajo nivel de combustible
S8	Coolant high temperature switch	Schakelaar, hoge koelwatertemperatuur	Schalter für hohe Temperatur	Thermostat, basse température eau de refroidissement	Interruptor alta temperatura de refrigerante
S9	Engine oil low pressure switch	Schakelaar, lage motoroliedruk	Schalter für geringen Motoröldruck	Interrupteur basse pression d'huile moteur	Interruptor baja presión aceite del motor
X10	12-pole connector	Konektor, 12 stiften	Zwölfpoliger Stecker	Connecteur 12 broches	Conector de 12 polos
X12, 14	2-pole connector	Konektor, 2 stiften	Zweipoliger Stecker	Connecteur 2 broches	Conector bipolar
X16	Module connector	Modulekonektor	Modulestecker	Connecteur de module	Conector de módulo
X17	Fuel level unit connector	Konektor brandstofpeil module	Stecker für Kraftstoffstandeinheit	Connecteur du module de niveau d'huile	Conector unidad nivel de combustible
X18	Instrument cluster connector	Konektor instrumentengeheel	Stecker für Instrumentensatz	Connecteur d'instrumentation	Conector del grupo de instrumentos
Y1	Fuel stop solenoid	Brandstofsluitsolenoid	Kraftstoffabspermmagnet	Electrovalve d'arrêt carburant	Solenoido de cierre de combustible



Connector X 12 as seen from wire inserting side

Colour code :

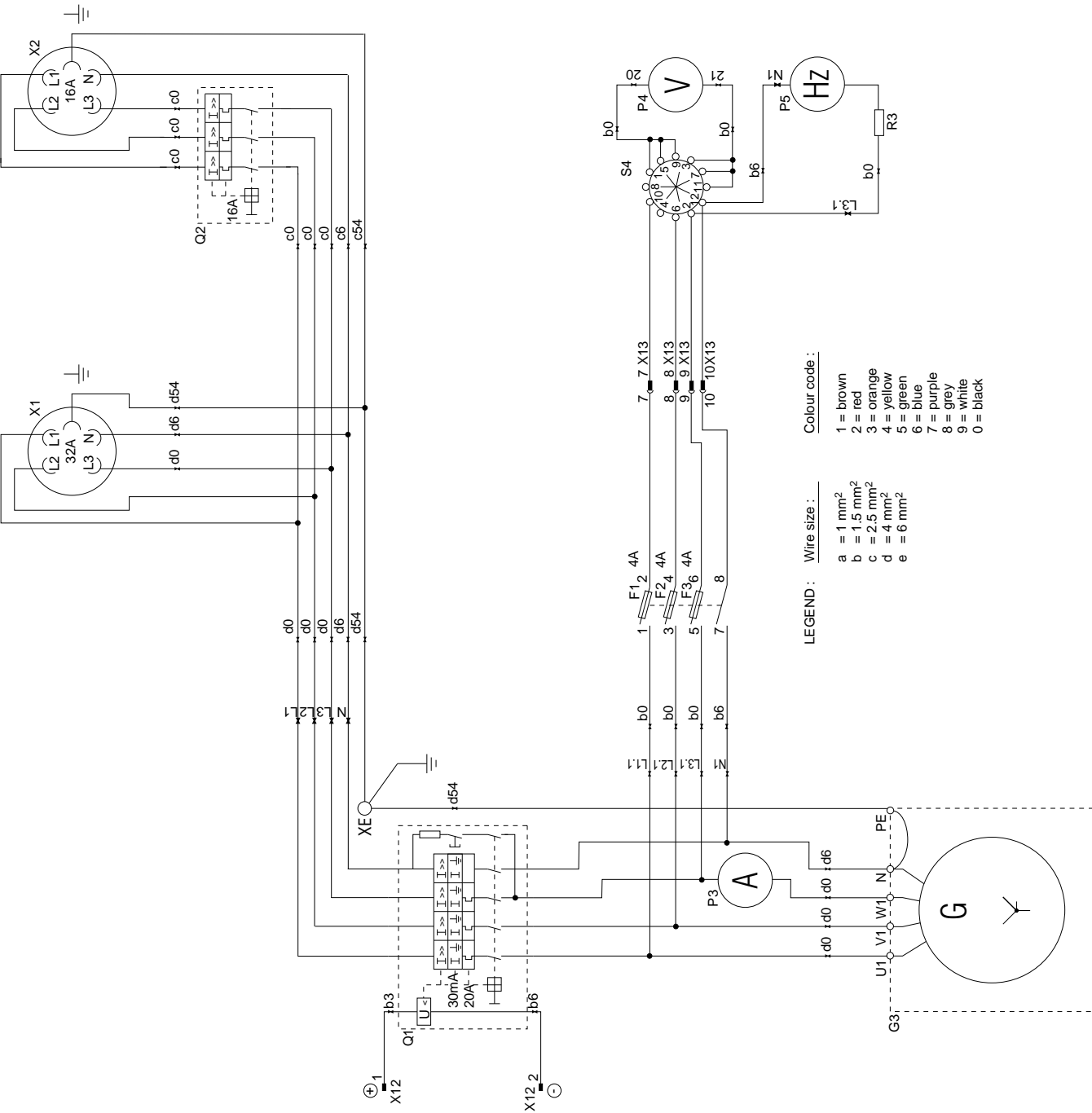
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j = 50 mm<sup>2</sup>

	ITALIANO	PORTUGUÊS	SVENSKA	DANSK	ΕΛΛΗΝΙΚΑ
B7	Sensore del livello di combustibile	Sensor do nível de combustível	Sensor - bränslenivå	Brændstofniveauføler	Αισθητήρας στάθμης καυσίμου
E1	Resistenza di preriscaldamento	Resistência do pré-aquecimento	Föruppvärmingsresistor	Modstand i forvarmer system	Αντίσταση προθέρμανσης
F4	Fusibile	Fusível	Säkring	Sikring	Ασφάλεια
G1	Batteria a 12V	Bateria 12V	Batteri 12V	Batteri 12V	Μπαταρία 12 V
G2	Generatore di carica	Gerador de carga	Laddningsgenerator	Ladegenerator	Φορτιστής γεννήτριας
H1	Luci del pannello	Luz do painel	Panelljus	Lampe	Λυχνία πίνακα
K0	Solenóide dell'aviatore	Solenóide do motor de arranque	Startsolenoid	Startmagnet	Σωληνοειδές εκκίνησης
K1	Relé di preriscaldamento	Relé de corte do pré-aquecimento	Föruppvärmingsrelä	Relä, forvarmer system	Ρελέ προθέρμανσης
K2	Relé di blocco dell'avvio	Relé de prevenção do arranque	Startblockeringsrelä	Afbryderrelä	Ρελέ προστασίας εκκίνησης
K3	Relé di chiusura preriscaldamento	Relé de corte do pré-aquecimento	Föruppvärmings-avstängningsrelä	Forvarmer system spærre relä	Ρελέ κλεισίματος προθέρμανσης
M1	Motore dell'aviatore	Motor de arranque	Startmotor	Startmotor	Μίζα
N4	Modulo di controllo	Módulo de controlo	Kontrollmodul	Kontrollmodul	Σταθείο ελέγχου
N5	Gruppo degli strumenti	Grupo de instrumentos	Instrumentgrupp	Instrumentgruppe	Σύμπλεγμα οργάνων
P6	Contatore	Contador de horas	Timmätare	Timetæller	Ωρομετρητής
P7	Indicatore di livello del combustibile	Indicador do nível de combustível	Bränslenivåmätare	Brændstofniveauometer	Όργανο μέτρησης στάθμης καυσίμου
S2	Pulsante di arresto di emergenza	Botão de paragem de emergência	Knapp för nödstopp	Nødstopknop	Μπουτόν αθρίματος έκτακτης ανάγκης
S7	Interruttore di basso livello del combustibile	Comutador do nível baixo de combustível	Brytare för låg bränslenivå	Brændstofniveaukontakt	Διακόπτης χαμηλής στάθμης καυσίμου
S8	Interruttore di temperatura alta del refrigerante	Comutador da temperatura elevada do refrigerante	Brytare för hög kylväsketemperatur	Kontakt, høj kølevædsstemperatur	Διακόπτης υψηλής θερμοκρασίας ψυκτικού
S9	Interruttore di bassa pressione dell'olio	Comutador da pressão do óleo do motor	Brytare för lågt oljetryck	Kontakt, lavt oljetryk	Διακόπτης χαμηλής πίεσης λαδιού κινητήρα
X10	Connettore a 12 poli	Ligação em 12 polos	10-poligt kontaktkdon	12-faset kontaktkllemme	12-πολικός σύνδεσμος
X12, 14	Connettore a due poli	Ligação em 2 polos	2-poligt kontaktkdon	2-faset kontaktkllemme	2-πολικός σύνδεσμος
X16	Connettore del modulo	Ligação do módulo	Modul-kontaktkdon	Modulkontaktkllemme	Αναλογικός σύνδεσμος
X17	Connettore dell'unità livello del combustibile	Ligação da unidade do nível de combustível	Bränslenivåenhets kontaktkdon	Kontaktkllemme for brændstofniveau	Σύνδεσμος μονάδος στάθμης καυσίμου
X18	Connettore del gruppo degli strumenti	Ligação do grupo de instrumentos	Instrumentgruppens kontaktkdon	Kontaktkllemme for instrumentgruppen	Σύνδεσμος συμπλέγματος οργάνων
Y1	Solenóide di arresto del combustibile	Solenóide de paragem do combustível	Bränslestoppsolenoïd	Brændstofspærremagnet	Σωληνοειδές σταματήματος καυσίμου



ENGLISH		NETHERLANDS	DEUTSCH	FRANCAIS	ESPAÑOL
F1-3	Fuse 4A	Zekering 4A	Sicherung 4 A	Fusible 4A	Fusible 4A
G3	Generator	Generator	Generator	Groupe électrogène	Generador
P3	Amperemeter 0-30A	Amperemeter 0-30A	Amperemeter 0 - 30 A	Ampèremètre 0-30A	Amperímetro 0-30A
P4	Voltmeter 0-600V	Voltmeter 0-600V	Voltmeter 0 - 600 V	Voltmètre 0-600V	Voltímetro 0-600V
P5	Frequencymeter 45-65Hz	Frekwenfemeter 45-65Hz	Frequenzmesser 45 - 65 Hz	Fréquencemètre 45-65Hz	Frecuencímetro 45-65Hz
Q1	Circuit breaker 20A/4-pole	Vermogenschakelaar 20A/4-polig	Leistungsschalter 20 A / vierpolig	Disjoncteur 20A/4 pôles	Disyuntor 20A/cuadripolar
Q2	Circuit breaker 16A/4-pole	Vermogenschakelaar 16A/4-polig	Leistungsschalter 16 A / vierpolig	Disjoncteur 16A/4 pôles	Disyuntor 16A/cuadripolar
R3	Dropping resistor	Voorschakelweerstand	Vorwiderstand	Résistance série	Resistor reductor de voltaje
S4	Voltmeter selector switch	Voltmeter keuzeschakelaar	Voltmeter-Wahlschalter	Sélecteur de voltmètre	Selector de voltímetro
X1	3-phase outlet socket	Uitlaatpunt - 3 fasen	Dreiphasen-Steckdose	Prise - 3 phases	Caja de contacto trifásica
X2	2-phase outlet socket	Uitlaatpunt - 3 fasen	Dreiphasen-Steckdose	Prise - 3 phases	Caja de contacto trifásica
X12	2-pole connector	Konnektor, 2 stiften	Zweipoliger Stecker	Connecteur, 12 broches	Conector bipolar
X13	12-pole connector	Konnektor, 12 stiften	Zwölfpoliger Stecker	Connecteur, 2 broches	Conector de 12 polos
XE	Earth terminal	Aardingsklem	Erdungsklemme	Borne de terre	Borne de tierra
ITALIANO		PORTUGUÊS	SVENSKA	DANSK	ΕΛΛΗΝΙΚΑ
F1-3	Fusibile 4A	Fusível 4A	Säkring 4A	Sikring 4A	Ασφάλεια 4 A
G3	Generatore	Gerador	Generator	Generator	Γεννήτρια
P3	Amperometro 0-30A	Amperímetro 0-30A	Amperemätare 0-30A	Amperemeter 0-30A	Αμπερόμετρο 0 - 30 A
P4	Voltímetro 0-600V	Voltímetro 0-600 V	Spänningsmätare 0-600V	Voltmeter 0-600V	Βολτόμετρο 0 - 600 V
P5	Frequenziometro	Frequenciometro 45-65Hz	Frekvensmätare 45-65 Hz	Frekvensmätare 45-65Hz	Μετρητής συχνότητας 45 - 65 Hz
Q1	Interruttore 20 A/4 poli	Disyuntor 20A/tetrapolar	Strömbrytare 20A/4-polig	Ålbryder 20A/4-polig	Διακόπτης κυκλώματος 20 A - 4πολικός
Q2	Interruttore 16 A/4 poli	Disyuntor 16A/tetrapolar	Strömbrytare 16A/4-polig	Ålbryder 16A/4-polig	Διακόπτης κυκλώματος 16 A - 4πολικός
R3	Resistenza di gocciolamento	Resistência limitadora	Fränslagsresistor	Udgangsmodstand	Ρεζίστορ πτώσης
S4	Interruttore di selezione del voltímetro	Comutador selector do voltímetro	Spänningsmätarens kopplingsväljare	Voltmeterets omskifterknap	Διακόπτης επιλογής βολτομέτρου
X1	Presa trifásica	Tomada de saída trifásica	3-fas uttag	3-faset stikkontakt	Μηρίζα τριφασικού ρεύματος
X2	Presa trifásica	Tomada de saída trifásica	3-fas uttag	3-faset stikkontakt	Μηρίζα μονοφασικού ρεύματος
X12	Connettore a 2 poli	Ligação em 2 polos	2-poligt kontaktdon	2-faset kontaktklemme	2πολικός σύνδεσμος
X13	Connettore a 12 poli	Ligação em 12 polos	12-poligt kontaktdon	12-faset kontaktklemme	2πολικός σύνδεσμος
XE	Terminale di terra	Terminal de terra	Jorduttag	Jordklemme	Ακροδεκτης γείωσης

