Instruction Manual

for AC Generators

QAS 150-200-250 Volvo

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Atlas Copco

ATLAS COPCO - PORTABLE AIR DIVISION
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Congratulations on the purchase of your 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.

Contents

1 Safety precautions for portable generators

To be read attentively and acted accordingly before towing, lifting, operating, performing maintenance or repairing the generator.

1.1 Introduction

The policy of Atlas Copco is to provide the users of their equipment with safe, reliable and efficient products. Factors taken into account are among others:

- the intended and predictable future use of the products, and the environments in which they are expected to operate,
- applicable rules, codes and regulations,
- the expected useful product life, assuming proper service and maintenance,
- providing the manual with up-to-date information.

Before handling any product, take time to read the relevant instruction manual. Besides giving detailed operating instructions, it also gives specific information about safety, preventive maintenance, etc.
Keep the manual always at the unit location, easy accessible to the operating personnel.

See also the safety precautions of the engine and possible other equipment, which are separately sent along or are mentioned on the equipment or parts of the unit.

These safety precautions are general and some statements will therefore not always apply to a particular unit.

Only people that have the right skills should be allowed to operate, adjust, perform maintenance or repair on Atlas Copco equipment. It is the responsibility of management to appoint operators with the appropriate training and skill for each category of job.

Skill level 1: Operator

An operator is trained in all aspects of operating the unit with the push-buttons, and is trained to know the safety aspects.

Skill level 2: Mechanical technician

A mechanical technician is trained to operate the unit the same as the operator. In addition, the mechanical technician is also trained to perform maintenance and repair, as described in the instruction manual, and is allowed to change settings of the control and safety system. A mechanical technician does not work on live electrical components.

Skill level 3: Electrical technician

An electrical technician is trained and has the same qualifications as both the operator and the mechanical technician. In addition, the electrical technician may carry out electrical repairs within the various enclosures of the unit. This includes work on live electrical components.

Skill level 4: Specialist from the manufacturer

This is a skilled specialist sent by the manufacturer or its agent to perform complex repairs or modifications to the equipment.

In general it is recommended that not more than two people operate the unit, more operators could lead to unsafe operating conditions. Take necessary steps to keep unauthorized persons away from the unit and eliminate all possible sources of danger at the unit.

When handling, operating, overhauling and/or performing maintenance or repair on Atlas Copco equipment, the mechanics are expected to use safe engineering practices and to observe all relevant local safety requirements and ordinances. The following list is a reminder of special safety directives and precautions mainly applicable to Atlas Copco equipment.

Neglecting the safety precautions may endanger people as well as environment and machinery:

- endanger people due to electrical, mechanical or chemical influences,
- endanger the environment due to leakage of oil, solvents or other substances,
- endanger the machinery due to function failures.

All responsibility for any damage or injury resulting from neglecting these precautions or by non-observance of ordinary caution and due care required in handling, operating, maintenance or repair, also if not expressly mentioned in this instruction manual, is disclaimed by Atlas Copco.

The manufacturer does not accept any liability for any damage arising from the use of non-original parts and for modifications, additions or conversions made without the manufacturer's approval in writing.

If any statement in this manual does not comply with local legislation, the stricter of the two shall be applied.

Statements in these safety precautions should not be interpreted as suggestions, recommendations or inducements that it should be used in violation of any applicable laws or regulations.

1.2 General safety precautions

1 The owner is responsible for maintaining the unit in a safe operating condition. Unit parts and accessories must be replaced if missing or unsuitable for safe operation.

2 The supervisor, or the responsible person, shall at all times make sure that all instructions regarding machinery and equipment operation and maintenance are strictly followed and that the machines with all accessories and safety devices, as well as the consuming devices, are in good repair, free of abnormal wear or abuse, and are not tampered with.

3 Whenever there is an indication or any suspicion that an internal part of a machine is overheated, the machine shall be stopped but no inspection covers shall be opened before sufficient cooling time has elapsed; this to avoid the risk of spontaneous ignition of oil vapour when air is admitted.

4 Normal ratings (pressures, temperatures, speeds, etc.) shall be durably marked.

5 Operate the unit only for the intended purpose and within its rated limits (pressure, temperature, speeds, etc.).

6 The machinery and equipment shall be kept clean, i.e. as free as possible from oil, dust or other deposits.

7 To prevent an increase in working temperature, inspect and clean heat transfer surfaces (cooler fins, intercoolers, water jackets, etc.) regularly. See the maintenance schedule.

8 All regulating and safety devices shall be maintained with due care to ensure that they function properly. They may not be put out of action.

9 Pressure and temperature gauges shall be checked regularly with regard to their accuracy. They shall be replaced whenever outside acceptable tolerances.

10 Safety devices shall be tested as described in the maintenance schedule of the instruction manual to determine that they are in good operating condition.

11 Mind the markings and information labels on the unit.

12 In the event the safety labels are damaged or destroyed, they must be replaced to ensure operator safety.

13 Keep the work area neat. Lack of order will increase the risk of accidents.

14 When working on the unit, wear safety clothing. Depending on the kind of activities these are: safety glasses, ear protection, safety helmet (including visor), safety gloves, protective clothing, safety shoes. Do not wear the hair long and loose (protect long hair with a hairnet), or wear loose clothing or jewellery.

15 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.

16a **Portable generators (with earthing pin):**

Earth the generator as well as the load properly.

16b **Portable generators IT:**

Note: This generator is built to supply a sheer alternating current IT network.

Earth the load properly.

1.3 Safety during transport and installation

To lift a unit, all loose or pivoting parts, e.g. doors and towbar, shall first be securely fastened.

Do not attach cables, chains or ropes directly to the lifting eye; apply a crane hook or lifting shackle meeting local safety regulations. Never allow sharp bends in lifting cables, chains or ropes.

Helicopter lifting is not allowed. It is strictly forbidden to dwell or stay in the risk zone under a lifted load. Never lift the unit over people or residential areas. Lifting acceleration and retardation shall be kept within safe limits.

1 Before towing the unit:
- check the towbar, the brake system and the towing eye. Also check the coupling of the towing vehicle,
- check the towing and brake capability of the towing vehicle,
- check that the towbar, jockey wheel or stand leg is safely locked in the raised position,
- ascertain that the towing eye can swivel freely on the hook,
- check that the wheels are secure and that the tyres are in good condition and inflated correctly,
- connect the signalisation cable, check all lights and connect the pneumatic brake couplers,
- attach the safety break-away cable or safety chain to the towing vehicle,
- remove wheel chocks, if applied, and disengage the parking brake.

2 To tow a unit use a towing vehicle of ample capacity. Refer to the documentation of the towing vehicle.

3 If the unit is to be backed up by the towing vehicle, disengage the overrun brake mechanism (if it is not an automatic mechanism).

4 Never exceed the maximum towing speed of the unit (mind the local regulations).

5 Place the unit on level ground and apply the parking brake before disconnecting the unit from the towing vehicle. Unclip the safety break-away cable or safety chain. If the unit has no parking brake or jockey wheel, immobilize the unit by placing chocks in front of and/or behind the wheels. When the towbar can be positioned vertically, the locking device must be applied and kept in good order.

6 To lift heavy parts, a hoist of ample capacity, tested and approved according to local safety regulations, shall be used.

7 Lifting hooks, eyes, shackles, etc., shall never be bent and shall only have stress in line with their design load axis. The capacity of a lifting device diminishes when the lifting force is applied at an angle to its load axis.

8 For maximum safety and efficiency of the lifting apparatus all lifting members shall be applied as near to perpendicular as possible. If required, a lifting beam shall be applied between hoist and load.

9 Never leave a load hanging on a hoist.

10 A hoist has to be installed in such a way that the object will be lifted perpendicular. If that is not possible, the necessary precautions must be taken to prevent load-swinging, e.g. by using two hoists, each at approximately the same angle not exceeding 30° from the vertical.

11 Locate the unit away from walls. Take all precautions to ensure that hot air exhausted from the engine and driven machine cooling systems cannot be recirculated. If such hot air is taken in by the engine or driven machine cooling fan, this may cause overheating of the unit; if taken in for combustion, the engine power will be reduced.

12 Generators shall be stalled 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.

13 The electrical connections shall correspond to local codes. The machines shall be earthed and protected against short circuits by fuses or circuit breakers.

14 Never connect the generator outlets to an installation which is also connected to a public mains.

15 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.

1.4 Safety during use and operation

1 When the unit has to operate in a fire-hazardous environment, each engine exhaust has to be provided with a spark arrestor to trap incendiary sparks.

2 The exhaust contains carbon monoxide which is a lethal gas. When the unit is used in a confined space, conduct the engine exhaust to the outside atmosphere by a pipe of sufficient diameter; do this in such a way that no extra back pressure is created for the engine. If necessary, install an extractor. Observe any existing local regulations. Make sure that the unit has sufficient air intake for operation. If necessary, install extra air intake ducts.

3 When operating in a dust-laden atmosphere, place the unit so that dust is not carried towards it by the wind. Operation in clean surroundings considerably extends the intervals for cleaning the air intake filters and the cores of the coolers.

4 Never remove a filler cap of the cooling water system of a hot engine. Wait until the engine has sufficiently cooled down.

5 Never refill fuel while the unit is running, unless otherwise stated in the Atlas Copco Instruction Book (AIB). Keep fuel away from hot parts such as air outlet pipes or the engine exhaust. Do not smoke when fuelling. When fuelling from an automatic pump, an earthing cable should be connected to the unit to discharge static electricity. Never spill nor leave oil, fuel, coolant or cleansing agent in or around the unit.

6 All doors shall be shut during operation so as not to disturb the cooling air flow inside the bodywork and/or render the silencing less effective. A door should be kept open for a short period only e.g. for inspection or adjustment.

7 Periodically carry out maintenance works according to the maintenance schedule.

8 Stationary housing guards are provided on all rotating or reciprocating parts not otherwise protected and which may be hazardous to personnel. Machinery shall never be put into operation, when such guards have been removed, before the guards are securely reinstalled.

9 Noise, even at reasonable levels, can cause irritation and disturbance which, over a long period of time, may cause severe injuries to the nervous system of human beings.
When the sound pressure level, at any point where personnel normally has to attend, is:
- below 70 dB(A): no action needs to be taken,
- above 70 dB(A): noise-protective devices should be provided for people continuously being present in the room,
- below 85 dB(A): no action needs to be taken for occasional visitors staying a limited time only,
- above 85 dB(A): room to be classified as a noise-hazardous area and an obvious warning shall be placed permanently at each entrance to alert people entering the room, for even relatively short times, about the need to wear ear protectors,
- above 95 dB(A): the warning(s) at the entrance(s) shall be completed with the recommendation that also occasional visitors shall wear ear protectors,
- above 105 dB(A): special ear protectors that are adequate for this noise level and the spectral composition of the noise shall be provided and a special warning to that effect shall be placed at each entrance.

10 Insulation or safety guards of parts the temperature of which can be in excess of 80°C and which may be accidentally touched by personnel shall not be removed before the parts have cooled to room temperature.

11 Never operate the unit in surroundings where there is a possibility of taking in flammable or toxic fumes.

12 If the working process produces fumes, dust or vibration hazards, etc., take the necessary steps to eliminate the risk of personnel injury.

13 When using compressed air or inert gas to clean down equipment, do so with caution and use the appropriate protection, at least safety glasses, for the operator as well as for any bystander. Do not apply compressed air or inert gas to your skin or direct an air or gas stream at people. Never use it to clean dirt from your clothes.

14 When washing parts in or with a cleaning solvent, provide the required ventilation and use appropriate protection such as a breathing filter, safety glasses, rubber apron and gloves, etc.

15 Safety shoes should be compulsory in any workshop and if there is a risk, however small, of falling objects, wearing of a safety helmet should be included.

16 If there is a risk of inhaling hazardous gases, fumes or dust, the respiratory organs must be protected and depending on the nature of the hazard, so must the eyes and skin.

17 Remember that where there is visible dust, the finer, invisible particles will almost certainly be present too; but the fact that no dust can be seen is not a reliable indication that dangerous, invisible dust is not present in the air.

18 Never operate the generator in excess of its limits as indicated in the technical specifications and avoid long no-load sequences.

19 Never operate the generator in a humid atmosphere. Excessive moisture causes worsening of the generator insulation.

20 Do not open electrical cabinets, cubicles or other equipment while voltage is supplied. If such cannot be avoided, e.g. for measurements, tests or adjustments, have the action carried out by a qualified electrician only, with appropriate tools, and ascertain that the required bodily protection against electrical hazards is applied.

21 Never touch the power terminals during operation of the machine.

22 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 restarting.

23 Check the electric cables regularly. Damaged cables and insufficient lightening of connections may cause electric shocks. 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 restarting. Make sure that all electric connections are securely tightened.

24 Avoid overloading the generator. The generator is provided with circuit breakers for overload protection. When a breaker has tripped, reduce the concerned load before restarting.

25 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.

26 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.

27 Running the generator at low load for long periods will reduce the lifetime of the engine.

1.5 Safety during maintenance and repair

Maintenance, overhaul and repair work shall only be carried out by adequately trained personnel; if required, under supervision of someone qualified for the job.

1 Use only the correct tools for maintenance and repair work, and only tools which are in good condition.

2 Parts shall only be replaced by genuine Atlas Copco replacement parts.

3 All maintenance work, other than routine attention, shall only be undertaken when the unit is stopped. Steps shall be taken to prevent inadvertent starting. In addition, a warning sign bearing a legend such as “work in progress; do not start” shall be attached to the starting equipment.
On engine-driven units the battery shall be disconnected and removed or the terminals covered by insulating caps.
On electrically driven units the main switch shall be locked in open position and the fuses shall be taken out. A warning sign bearing a legend such as “work in progress; do not supply voltage” shall be attached to the fuse box or main switch.

4 Prior to stripping an engine or other machine or undertaking major overhaul on it, prevent all movable parts from rolling over or moving.

5 Make sure that no tools, loose parts or rags are left in or on the machine. Never leave rags or loose clothing near the engine air intake.

6 Never use flammable solvents for cleaning (fire-risk).

7 Take safety precautions against toxic vapours of cleaning liquids.

8 Never use machine parts as a climbing aid.

9 Observe scrupulous cleanliness during maintenance and repair. Keep away dirt, cover the parts and exposed openings with a clean cloth, paper or tape.

10 Never weld on or perform any operation involving heat near the fuel or oil systems. Fuel and oil tanks must be completely purged, e.g. by steam-cleaning, before carrying out such operations. Never weld on, or in any way modify, pressure vessels. Disconnect the alternator cables during arc welding on the unit.

11 Support the towbar and the axle(s) securely if working underneath the unit or when removing a wheel. Do not rely on jacks.

12 Do not remove any of, or tamper with, the sound-damping material. Keep the material free of dirt and liquids such as fuel, oil and cleansing agents. If any sound-damping material is damaged, replace it to prevent the sound pressure level from increasing.

13 Use only lubricating oils and greases recommended or approved by Atlas Copco or the machine manufacturer. Ascertain that the selected lubricants comply with all applicable safety regulations, especially with regard to explosion or fire-risk and the possibility of decomposition or generation of hazardous gases. Never mix synthetic with mineral oil.

14 Protect the engine, alternator, air intake filter, electrical and regulating components, etc., to prevent moisture ingress, e.g. when steam-cleaning.

15 When performing any operation involving heat, flames or sparks on a machine, the surrounding components shall first be screened with non-flammable material.

16 Never use a light source with open flame for inspecting the interior of a machine.

17 When repair has been completed, the machine shall be barred over at least one revolution for reciprocating machines, several revolutions for rotary ones to ensure that there is no mechanical interference within the machine or driver. Check the direction of rotation of electric motors when starting up the machine initially and after any alteration to the electrical connection(s) or switch gear, to check that the oil pump and the fan function properly.

18 Maintenance and repair work should be recorded in an operator’s logbook for all machinery. Frequency and nature of repairs can reveal unsafe conditions.

19 When hot parts have to be handled, e.g. shrink fitting, special heat-resistant gloves shall be used and, if required, other body protection shall be applied.

20 When using cartridge type breathing filter equipment, ascertain that the correct type of cartridge is used and that its useful service life is not surpassed.

21 Make sure that oil, solvents and other substances likely to pollute the environment are properly disposed of.

22 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 shutdown devices function correctly.

1.6 Tool applications safety

Apply the proper tool for each job. With the knowledge of correct tool use and knowing the limitations of tools, along with some common sense, many accidents can be prevented.

Special service tools are available for specific jobs and should be used when recommended. The use of these tools will save time and prevent damage to parts.

1.7 Battery safety precautions

Batteries

When servicing batteries, always wear protecting clothing and glasses.

1 The electrolyte in batteries is a sulphuric acid solution which is fatal if it hits your eyes, and which can cause burns if it contacts your skin. Therefore, be careful when handling batteries, e.g. when checking the charge condition.

2 Install a sign prohibiting fire, open flame and smoking at the post where batteries are being charged.

3 When batteries are being charged, an explosive gas mixture forms in the cells and might escape through the vent holes in the plugs.
Thus an explosive atmosphere may form around the battery if ventilation is poor, and can remain in and around the battery for several hours after it has been charged. Therefore:
- never smoke near batteries being, or having recently been, charged,
- never break live circuits at battery terminals, because a spark usually occurs.

4 When connecting an auxiliary battery (AB) in parallel to the unit battery (CB) with booster cables: connect the + pole of AB to the + pole of CB, then connect the - pole of CB to the mass of the unit. Disconnect in the reverse order.

2 Leading particulars

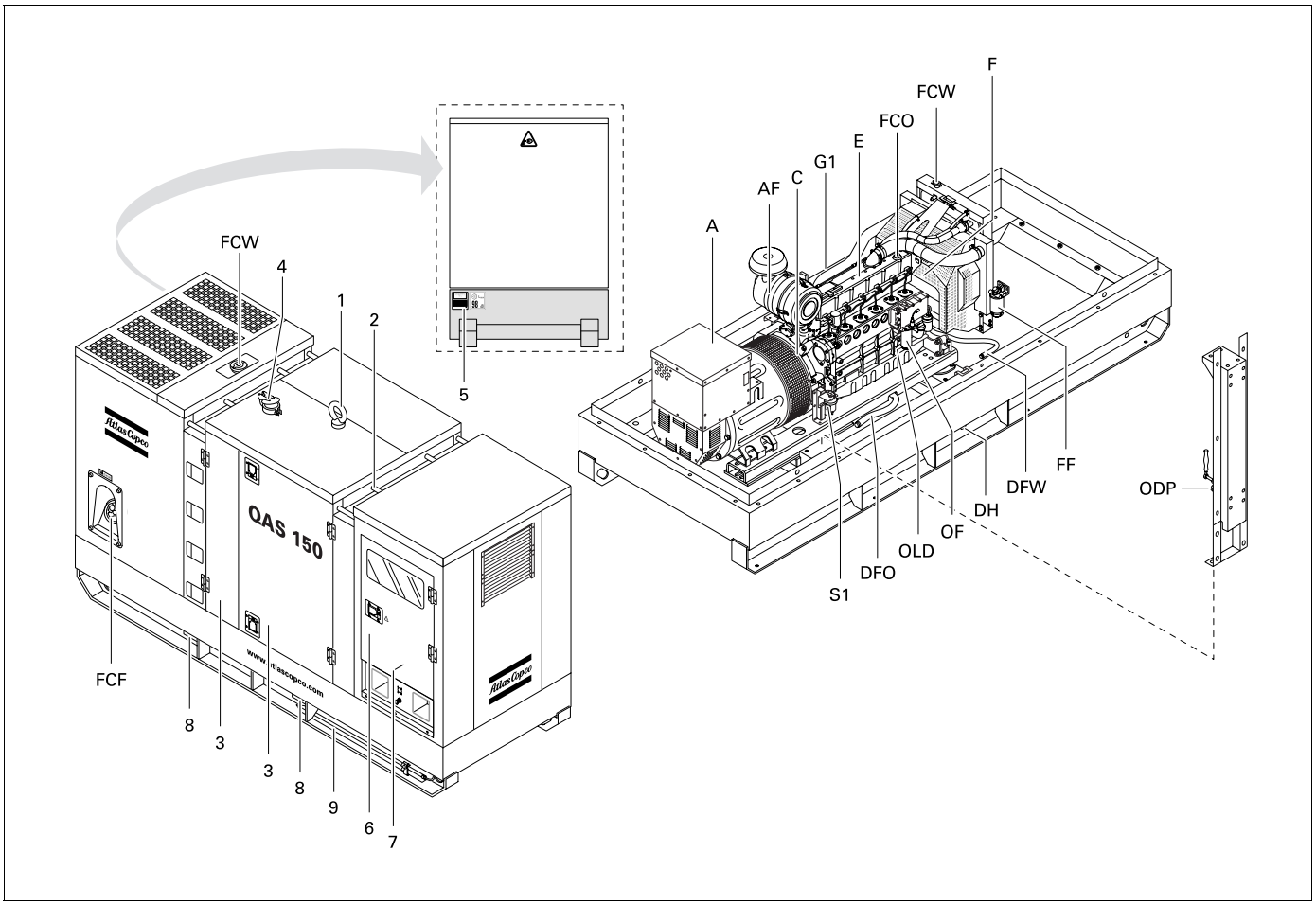
2.1 General description QAS 150 Volvo

The QAS 150 Volvo 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 generators operates at 50 Hz, 230 V - 3 phase, 50 Hz 400 V - 3 phase and 50 Hz 230-400 V - 3 phase.

Some parts of the unit are different, depending on which version.

The QAS 150 Volvo generator is driven by a water-cooled diesel engine, manufactured by VOLVO PENTA.

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



1	Lifting rod	DFW	Drain flexible cooling water
2	Guiding rod	DH	Drain and access hole (in the frame)
3	Side doors	E	Engine
4	Engine exhaust	F	Fan
5	Data plate	FCF	Filler cap fuel
6	Side door, access to control and indicator panel	FCO	Filler cap engine oil
7	Output terminal board	FCW	Filler cap cooling water
8	Hole for forklift	FF	Fuel filter
9	Earthing rod	G1	Battery
A	Alternator	ODP	Oil drain pump
AF	Air filter	OF	Oil filter
C	Coupling	OLD	Engine oil level dipstick
DFO	Drain flexible engine oil	S1	Battery switch

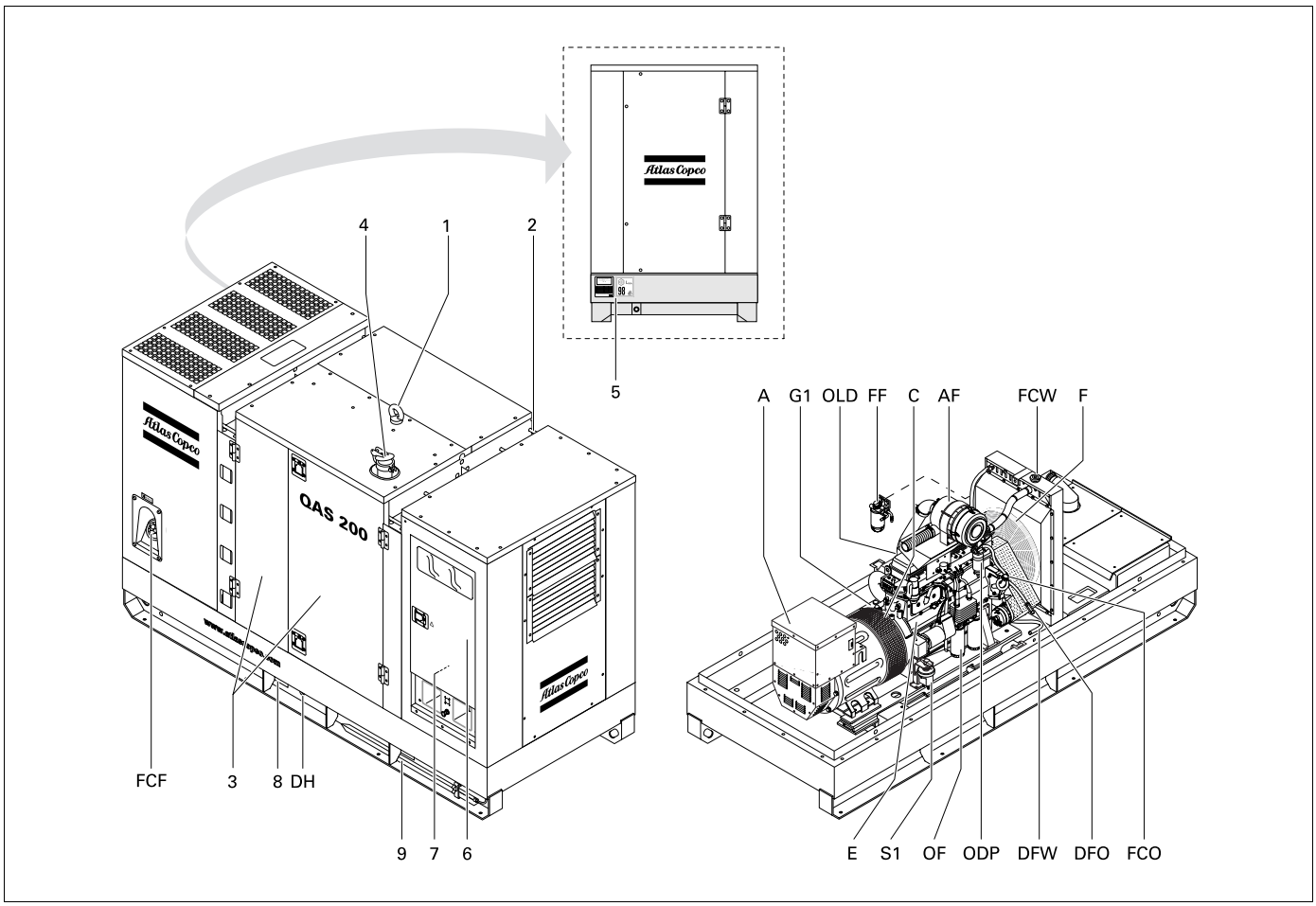
2.2 General description QAS 200 Volvo

The QAS 200 Volvo 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 generators operates at 50 Hz, 230 V - 3 phase and 50/60 Hz, 400 V - 3 phase and 50 Hz, 230-400 V - 3 phase.

Some parts of the unit are different, depending on which version.

The QAS 200 Volvo generator is driven by a water-cooled diesel engine, manufactured by VOLVO PENTA.

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



1	Lifting rod
2	Guiding rod
3	Side doors
4	Engine exhaust
5	Data plate
6	Side door, access to control and indicator panel
7	Output terminal board
8	Hole for forklift
9	Earthing rod
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)
E	Engine
F	Fan
FCF	Filler cap fuel
FCO	Filler cap engine oil
FCW	Filler cap cooling water
FF	Fuel filter
G1	Battery
ODP	Oil drain pump
OF	Oil filter
OLD	Engine oil level dipstick
S1	Battery switch

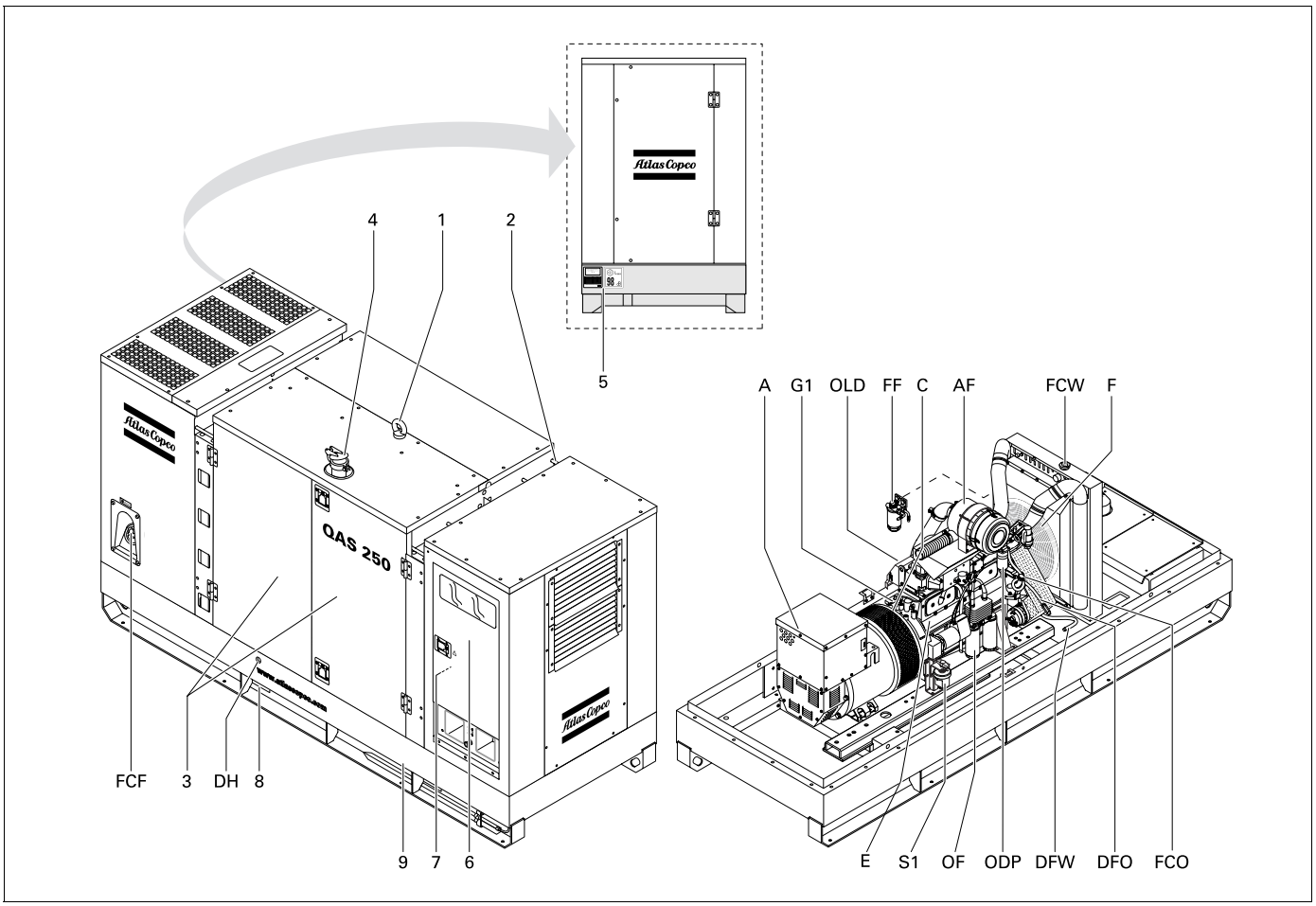
2.3 General description QAS 250 Volvo

The QAS 250 Volvo 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 generators operates at 50 Hz, 230 V - 3 phase and 50/60 Hz, 400 V - 3 phase and 50 Hz 230-400 V - 3 phase.

Some parts of the unit are different, depending on which version.

The QAS 250 Volvo generator is driven by a water-cooled diesel engine, manufactured by VOLVO PENTA.

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



1	Lifting rod
2	Guiding rod
3	Side doors
4	Engine exhaust
5	Data plate
6	Side door, access to control and indicator panel
7	Output terminal board
8	Hole for forklift
9	Earthing rod
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)
E	Engine
F	Fan
FCF	Filler cap fuel
FCO	Filler cap engine oil
FCW	Filler cap cooling water
FF	Fuel filter
G1	Battery
ODP	Oil drain pump
OF	Oil filter
OLD	Engine oil level dipstick
S1	Battery switch

2.4 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 generator's lifting eye is located in the middle of the roof. The recesses in the roof have guiding rods at both sides.

Never use the guiding rods to lift the generator.

To be able to lift the generator 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.

2.5 Markings

A brief description of all markings provided on your AC generator is given hereafter.

Indicates that an electric voltage, dangerous to life, is present. Never touch the electric terminals during operation.

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 (e.g. engine, cooler, etc.). Always make sure that these parts are cooled down before touching them.

Indicates that the guiding rods may not be used to lift the generator. Always use the lifting rod in the roof of the generator to lift it.

Indicates a lifting point of the generator.

Indicates that the alternator should not be cleaned with high pressurised water.

PAROIL 15W40 — Use 15W40 oil only.

diesel — Indicates that the generator may be refuelled with diesel fuel only.

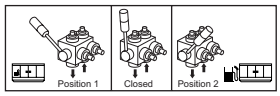
Indicates the drain for the engine oil.

Indicates the drain for the coolant.

Indicates the drain plug for the engine fuel.

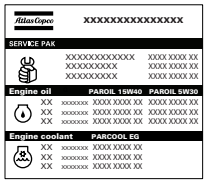
Indicates the different earthing connections on the generator.

Indicates the battery switch.



Indicates the 3-way valve.

Indicates that the unit may start automatically and that the instruction book has to be consulted prior to use.



Indicates the partnumbers of the different service paks and of the engine oil. These parts can be ordered to the factory.

2.6 Drain plugs and filler caps

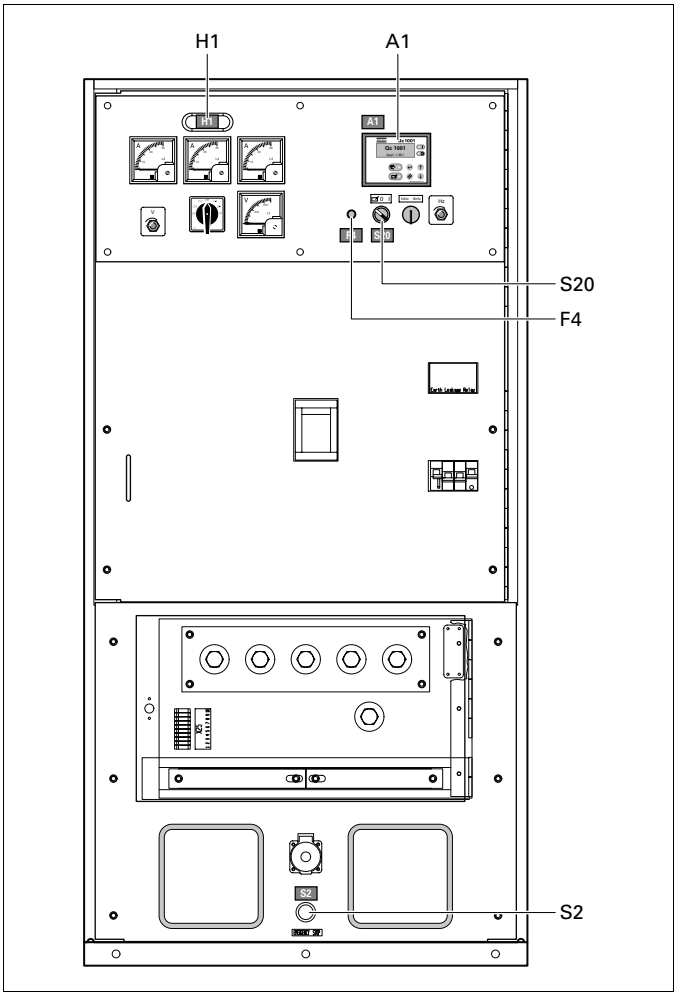
The drain holes for the engine oil, the coolant and the plug for the fuel, are located and labelled on the frame; the fuel drain plug at the front, the others at the service side.

The drain flexibles for the engine oil and the engine coolant 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 fueltank, use the 3-way valves. See "External fuel tank connection" on page 55.

2.7 Control and indicator panel Qc1001™

2.7.1 General description Qc1001™ control panel



A1..... Qc1001™ display

F4 ..... Fuse

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

H1..... Panel light

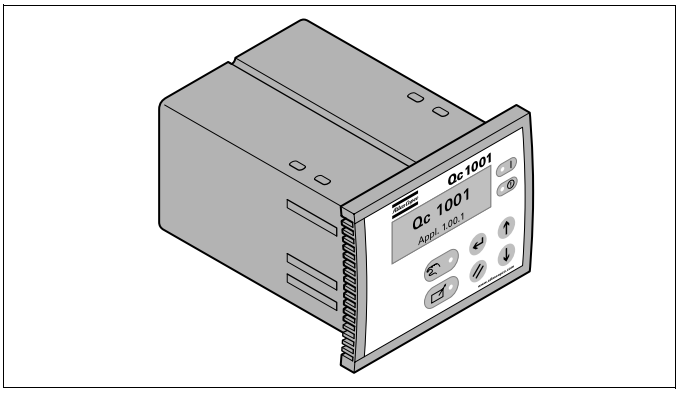
S2..... Emergency stop button

Push the button to stop the generator in case of an emergency. When the button is pressed, it must be unlocked, before the generator can be restarted. The emergency stop button can be secured in the locked position with the key, to avoid unauthorized use.

S20.... ON/OFF/REMOTE switch

To start up the unit (locally or remote).

2.7.2 Qc1001™ Module



The Qc1001™ module is located inside the control panel. This control module will carry out all necessary tasks to control and protect a generator, regardless of the use of the generator.

This means that the Qc1001™ module can be used for several applications.

2.7.3 Pushbutton and LED functions

Following pushbuttons are used on the Qc1001™

ENTER: Is used to select and confirm changed settings in the Configuration.

UP: Is used to scroll through the display information and to adjust parameter value upwards.

DOWN: Is used to scroll through the display information and to adjust parameter value downwards.

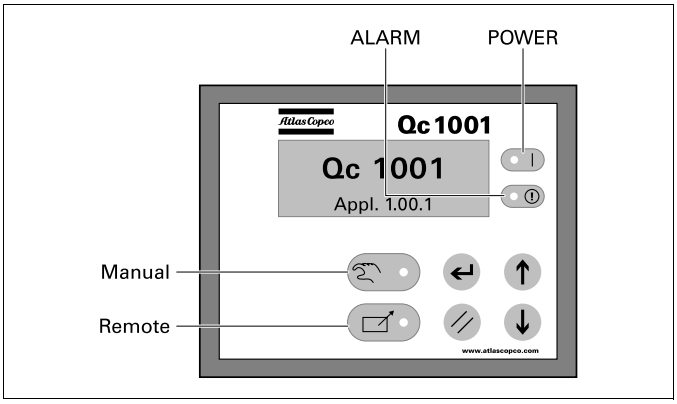
When **UP** & **DOWN** are pressed at the same time for 3s, Configuration Mode will be entered (see page 19).

BACK: Is used to leave/enter the Warnings pop-up window, to leave the Configuration Mode and to leave menu's without change.

REMOTE MODE: Is used to activate the remote mode. The LED indicates if the gen-set is put in Remote Mode.

MANUAL MODE: Is used to activate the manual mode. The LED indicates if the gen-set is put in Manual Mode.

Following LEDs are used on the Qc1001™



Power	Green LED indicates that the unit is powered up.
Manual	Green LED indicates that the Manual Mode is selected.
Remote	Green LED indicates that the Remote Mode is selected.
Alarm	Flashing red LED indicates that a shutdown is present. Continuous red LED indicates a warning. The exact warning/shutdown is shown at the display.

2.7.4 Qc1001™ Menu Overview

At Qc1001™, the LCD will show following information:

– in **Normal** condition (scroll through the information using **UP** and **DOWN**):
  - Status (eg: preheat, crank, run, cooldown, extended stop time, …)
  - Running hours
  - Battery Voltage
  - Service Timer 1
  - Service Timer 2
  - Generator Frequency

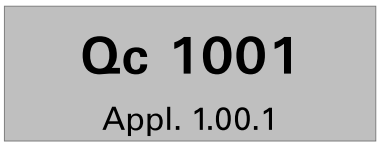
– in **Warning** condition (scroll through the information using **UP** and **DOWN**):
  - a list of all active Warnings

– in **Shutdown** condition:
  - the cause of shutdown

It's possible to scroll through the views, using the **UP** and **DOWN** buttons. The scrolling is continuous.

If a Special status comes up, the Status Display is shown.
If a Warning comes up, the Warning Display is shown.
If a Shutdown comes up, the Shutdown Display is shown.

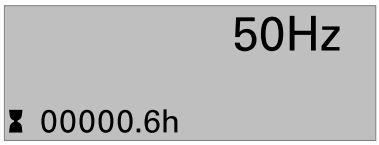
View 0



This view will show the ASW version number.

When there has been no button activity for three minutes, the display will return to the Default View.

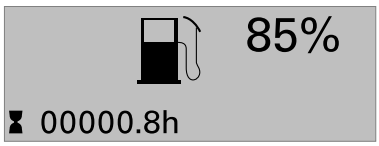
View 1 (Qc1001™-Default Display)



The frequency value is centered in the top-right corner area.

The running hours value is at the bottom-left corner. The service timer indication(s) are shown in the bottom-right corner when the service timer(s) have run out. They will disappear when the service timer(s) have been resetted.

View 2 (Fuel Level Display)

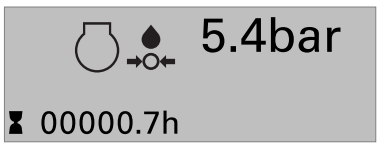


This view shows the fuel level icon.

When the English text view is selected, this view will mention: “FUEL LEVEL ***%”.

When there has been no button activity for three minutes, the display will return to the Default View.

View 3 (Engine Oil Pressure Display)



This view shows the oil pressure icons.

When the English text view is selected, this view will mention: “OIL PRESSURE **.*bar”.

When there has been no button activity for three minutes, the display will return to the Default View.

See also “Configuration Mode View” on page 19 for selection between bar and psi.

View 4 (Engine Coolant Temperature Display)

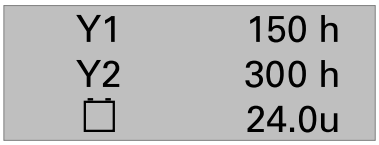
This view shows the coolant temperature icons.

When the English text view is selected, this view will mention: “COOLANT TEMP. ***°C”.

When there has been no button activity for three minutes, the display will return to the Default View.

See also “Configuration Mode View” on page 19 for selection between °C and °F.

View 5 (Service Timers and Battery Voltage)



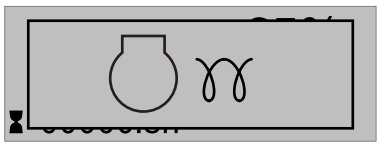
The service timer indications count upwards and give an alarm when the configured value is reached.

Resetting of the Service Timers is possible through a display Configuration Menu.

View 10 (reserved for normal English text)

In case that normal English text is selected i.s.o. icons, views 2 & 3 & 4 are changed into this three-row display format.

Status Display (pop-up window)

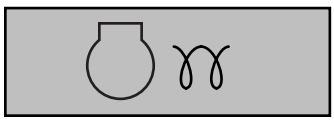


In case special statuses are entered, a pop-up window will automatically be entered for as long as the status is active.

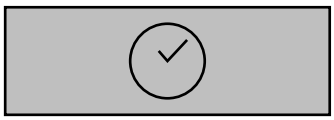
The background screen is not updated when the status pop-up window is active.

These special statuses are:

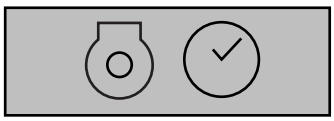
PREHEAT



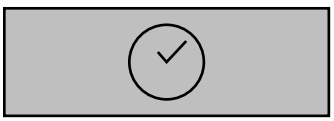
START OFF



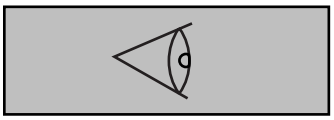
COOLDOWN



EXTENDED STOP TIME

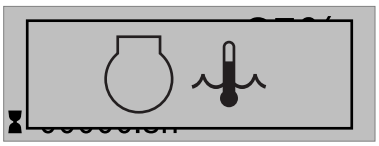


DIAGNOSTIC



If a special status has elapsed, the default view will be entered again automatically.
If a Warning comes up, the Warning Display is shown.
If a Shutdown comes up, the Shutdown Display is shown.

Warning Display (pop-up window)



In case a Warning occurs, a pop-up window will automatically be entered for as long as the warning is active, no matter which view is active. The warning icons will be shown (together with a continuous lit alarm LED at the fascia), which is centered at the display. The Warning Display can always be left or entered again by pushing the BACK button.

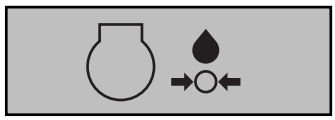
If more than one warning comes up, it's possible to scroll through the warning messages with the UP and DOWN pushbuttons. The newest warning will be placed at the bottom of the list (meaning that the older warning stays at the display when a newer warning comes up).

If one or more than one warning is present, an arrow at the right of the display will be shown.

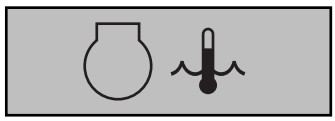
If a Shutdown comes up, the Shutdown Display is shown.

List of possible warnings:

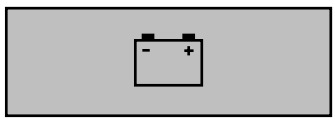
LOW OIL PRESSURE



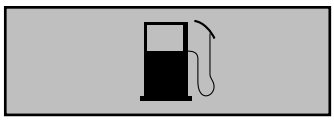
HIGH COOLANT TEMPERATURE



CHARGING ALTERNATOR

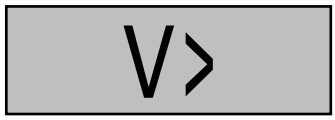


LOW FUEL LEVEL



LOW COOLANT LEVEL

GENERATOR OVERVOLTAGE



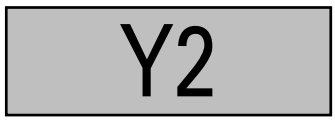
GENERATOR UNDERVOLTAGE

GENERATOR OVERFREQUENCY

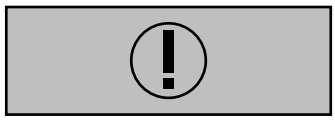
GENERATOR UNDERFREQUENCY

SERVICE TIMER 1

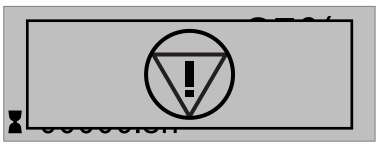
SERVICE TIMER 2



ALARM



Shutdown Display (pop-up window)



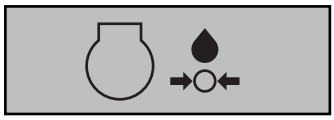
In case a Shutdown occurs, a pop-up window will automatically be entered, no matter which view is active.

This pop-up window will stay present until the unit is put in OFF.

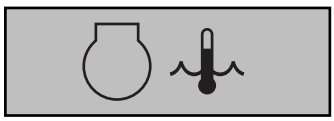
The shutdown icon will be shown (together with a flashing alarm LED at the fascia), which is centered at the display.

List of possible shutdowns:

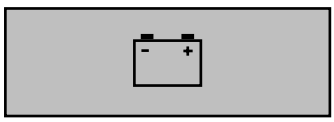
LOW OIL PRESSURE



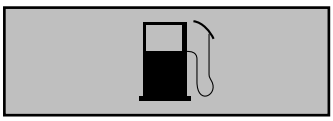
HIGH COOLANT TEMPERATURE



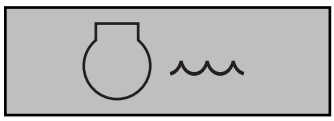
CHARGING ALTERNATOR



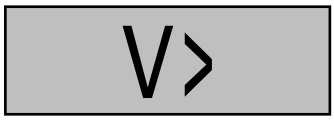
LOW FUEL LEVEL



LOW COOLANT LEVEL



GENERATOR OVERVOLTAGE



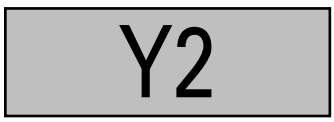
GENERATOR UNDERVOLTAGE

GENERATOR OVERFREQUENCY

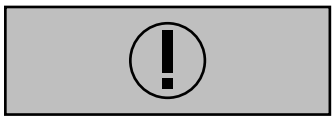
GENERATOR UNDERFREQUENCY

SERVICE TIMER 1

SERVICE TIMER 2



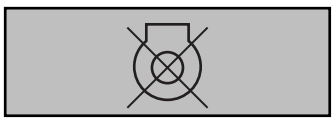
ALARM



EMERGENCY STOP

START FAILURE

STOP FAILURE



Configuration Mode View

The Configuration Menu's are pre-programmed!

The Configuration Mode is entered by detection of activation of pushbuttons UP and DOWN at the same time for 3s.

A password will be asked for when an attempt to change a setting is about to be done (user password = 2003).

By entering the configuration mode, pushbuttons MANUAL, REMOTE are disposed of their normal operations and will not perform any functionality.

Menu's shown on the LCD in Configuration Mode:

- Language selection
- Diagnostics Menu
- Running hours adjust
- Service Timer 2 reset
- Service Timer 1 reset
- Start Prepare Time
- Unit Menu
- Unit Type

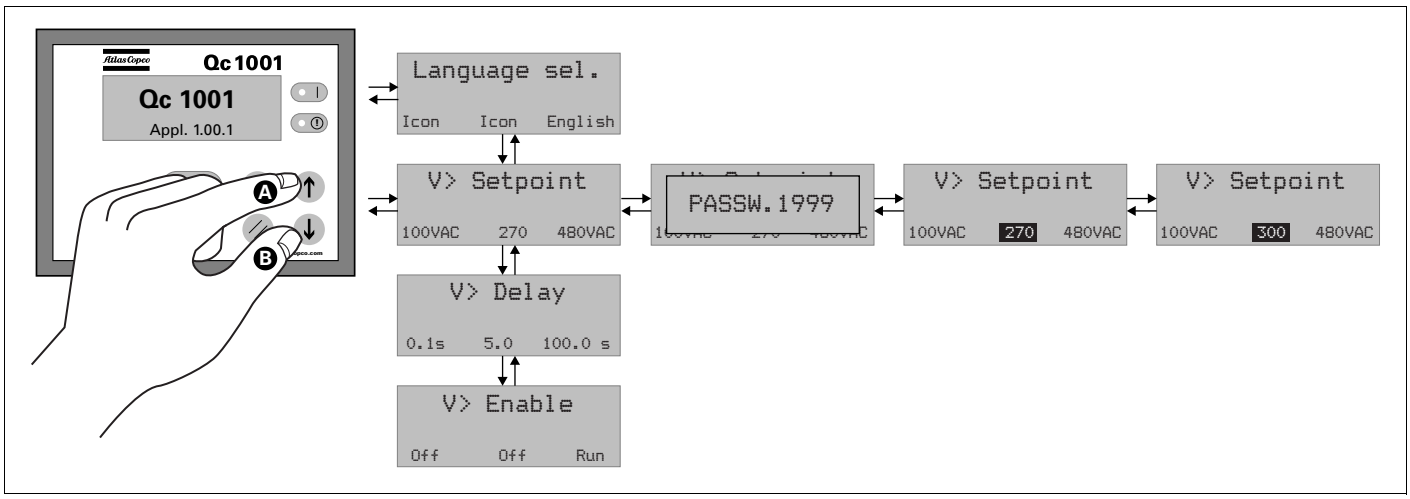
Unit type 2 for QAS 150-200-250 Volvo!

- Generator Underfrequency: failclass, enable, delay, setpoint
- Generator Overfrequency: failclass, enable, delay, setpoint
- Generator Undervoltage: failclass, enable, delay, setpoint
- Generator Overvoltage: failclass, enable, delay, setpoint

It's possible to scroll between configuration menu's by using the pushbuttons UP and DOWN.

Pushing the ENTER button activates the configuration menu which is shown at the display.

This is the described menu flow (push A and B together for 3 seconds):



2.7.5 Remote start operation

Installation wirings:

– X25.1 & X25.2 to be wired for the remote start switch.

– X25.3 & X25.4 to be wired for the remote contactor (open/close).

2.7.6 Fail classes

All the activated alarms of the Qc1001™ have their own pre-defined fail class.

All alarms are enabled according to one of these three statuses:

– disabled alarm, no supervision of alarm (OFF)

– enabled alarm, supervision of alarm all the time (ON)

– running alarm, only supervision when the machine is running (RUN)

2.7.7 Event Log

The unit will keep an event log of the latest 30 events.

Events are:

– shutdowns

– service timer 1 reset

– service timer 2 reset

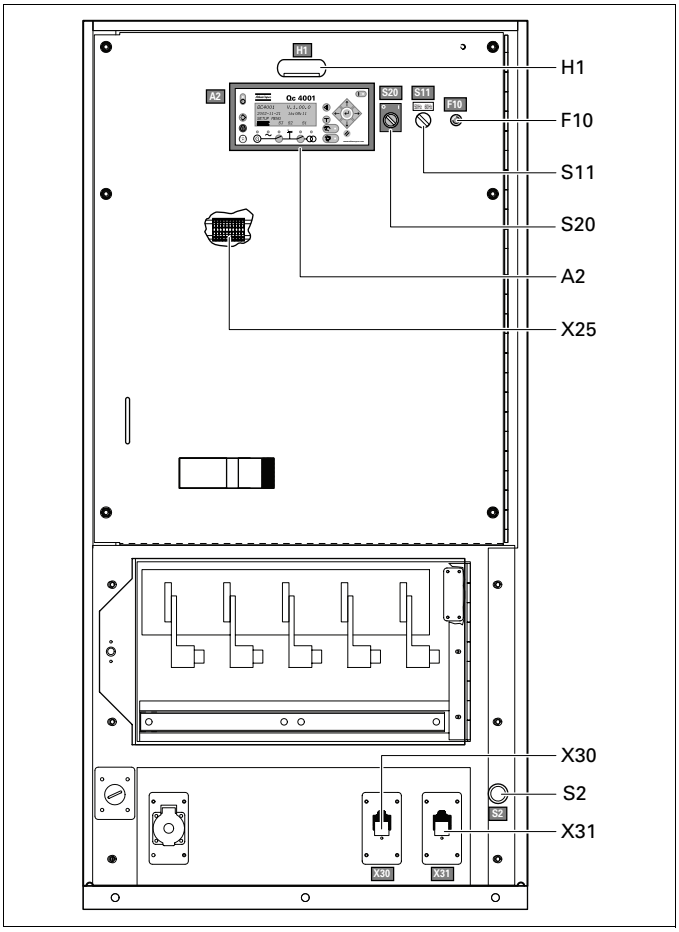
– unit type changes

Together with each event, the running hours at the time of the event will be stored.

The events can only be read by means of the QcUSW.

2.8 Control and indicator panel Qc4001™

2.8.1 General description Qc4001™ control panel



A2..... Qc4001™ display

H1..... Panel light

F10 .... Fuse

The fuse (10 A) activates when the current from the battery to the engine control circuit exceeds its setting. The fuse can be reset by pushing the button.

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, before the generator can be restarted. The emergency stop button can be secured in the locked position with the key, to avoid unauthorized use.

S11.... Frequency selector switch (50 Hz/OFF/60 Hz)

Allows to choose the frequency of the output voltage: 50 Hz or 60 Hz.

Changing the output frequency is only allowed after shutdown.

Frequency selector switch S11 is not available on QAS 150 Volvo units.

S20....ON/OFF switch

Position O: No voltage is applied to the Qc4001™ module, the generator will not start.

Position I: Voltage is applied to the Qc4001™ module, it is possible to start up the generator.

X25....Connection block

Inside the cubicle. Allows customer connections.

Refer to circuit diagram for the correct connection.

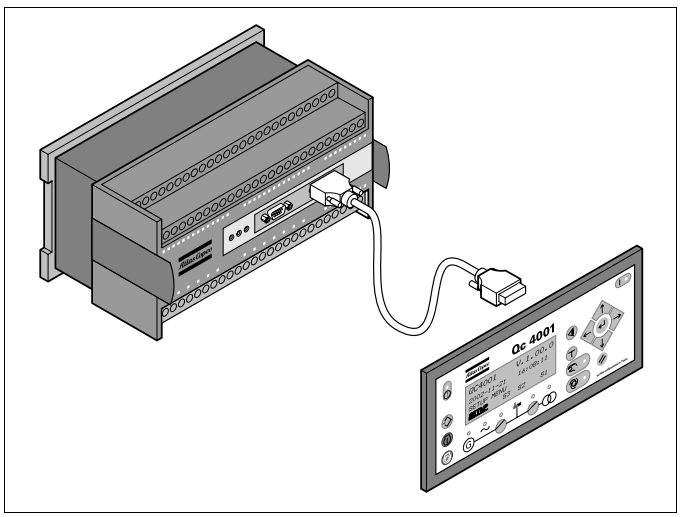
X30....Connector X30

Connector for communication with other generators with Qc4001™ when paralleling.

X31....Connector X31

Connector for communication with other generators with Qc4001™ when paralleling.

2.8.2 Qc4001™ Module



The Qc4001™ module is located inside the control panel, and communicates with a display unit, located in front of the control panel. This control module will carry out all necessary tasks to control and protect a generator, regardless of the use of the generator.

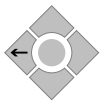
This means that the Qc4001™ module can be used for several applications.

2.8.3 Pushbutton and LED functions

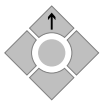
Following pushbuttons are used on the Qc4001™

ALARM: Shows the active alarm list (up to 30 alarms can be listed).

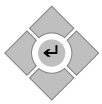
JUMP: Each programmable parameter has a channel number in the menu. Instead of navigating through the entire menu, the user can jump directly to the required parameter, if he knows the channel number of that specific parameter.E.g. if the user wants to change language, he can jump directly to channel 4240.



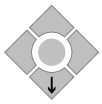
LEFT: Moves the cursor left for scrolling in the menus.



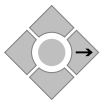
UP: Increases the value of the selected set-point (in the setting menus). Allows the user to scroll upwards (in the daily use display).



SELECT: Is used to select the chosen function. A function can be chosen by the cursor.



DOWN: Decreases the value of the selected set-point (in the setting menus). Allows the user to scroll downwards (in the daily use display).

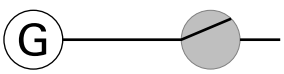


RIGHT: Moves the cursor right for scrolling in the menus.

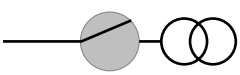
BACK: Jumps one step backwards in the menu (until the daily use display is reached).

START: Manual Start of the generator (only enabled if the SEMI-AUTO mode is selected).

STOP: Manual Stop of the generator (only enabled if the SEMI-AUTO mode is selected).



GB (Generator Breaker GB) ON: Manual activation of close breaker and open breaker sequence (only enabled if the SEMI-AUTO mode is selected).



MB (Mains Breaker MB) ON: Manual activation of close breaker and open breaker sequence (only enabled if the SEMI-AUTO mode is selected.

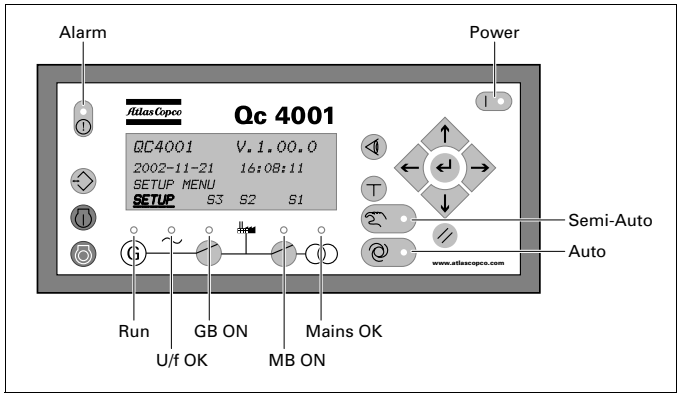
AUTO: Allows the user to set the generator in AUTO mode.

SEMI-AUTO: Allows the user to set the generator in SEMI-AUTO mode.

TEST: Allows the user to set the generator in TEST mode. To enter the TEST mode, a password needs to be entered.

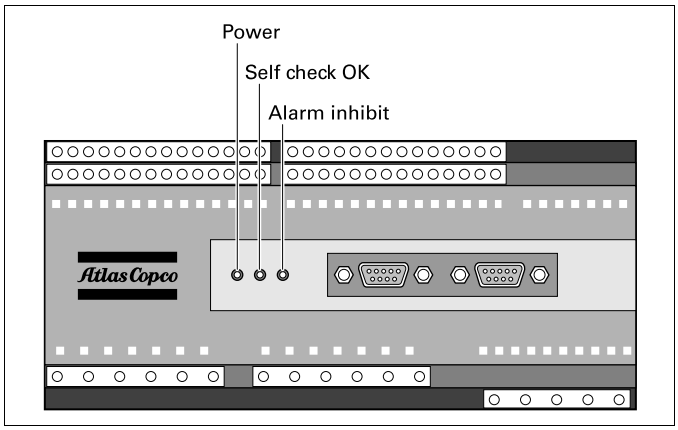
VIEW LOG: Shows the latest event. The user can scroll through the event & historical alarm list with the scroll buttons (up to 150 events & historical alarms can be listed).

Following LEDs are used on the Qc4001™



Alarm	Red LED flashing indicates that unacknowledged alarms are present.
	Red LED fixed indicates that ALL alarms are acknowledged.
Power	Green LED indicates that the voltage supply is switched on.
Run	Green LED indicates that the generator is running.
U/f OK	Green LED indicates that voltage/frequency is present and stable.
GB ON	Green LED indicates that the generator breaker is closed.
MB ON	Green LED indicates that the mains breaker is closed.
Mains OK	LED is green if the Mains is present and stable.
	LED is red when the Mains is not present.
	LED is flashing green when the Mains is present but not stable yet (during the "MAINS OK" delay time).
Auto	Green LED indicates that AUTO mode is selected.
Semi-Auto	Green LED indicates that SEMI-AUTO mode is selected.

The main Qc4001™ control unit includes 3 LEDs



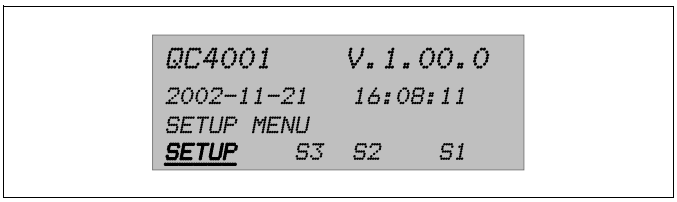
Power	Green LED indicates that the voltage supply is switched on.
Self check OK	Green LED indicates that the unit is OK.
Alarm inhibit	Green LED indicates that the inhibit input is ON.

2.8.4 Qc4001™ Menu Overview

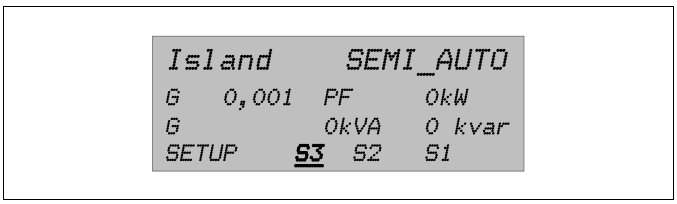
Main View

The display has 4 different lines. The information on these lines can change, depending on which view is used. There are 4 different main views possible: SETUP / S3 / S2 / S1.

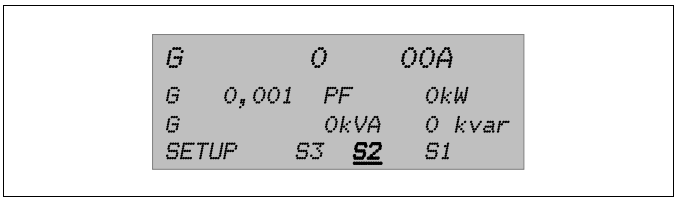
Setup view:



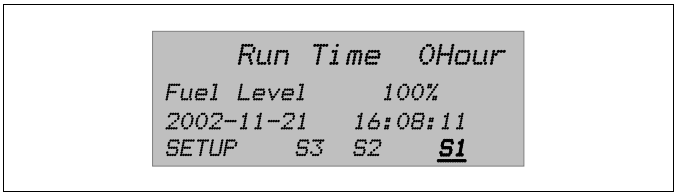
S3 view:



S2 view:



S1 view:



The user can scroll through these views with the scroll buttons:

– The SETUP view shows the module name, the software version, the date and the time.

– The S3 view shows the application type and the mode, and some generator measurements. During synchronisation the S3 view will show a synchronoscope in the first line.

– The S2 view shows some generator measurements.

– In the S1 view the user can scroll up and down to 15 configurable screens showing different measurements of the generator, the bus and the Mains.

SETUP menu

The control and protection parameters can be programmed according the application. This can be done by scrolling through the setup menu to the appropriate parameter. Each parameter has a specific channel number and is listed in one of the 4 main SETUP menus:

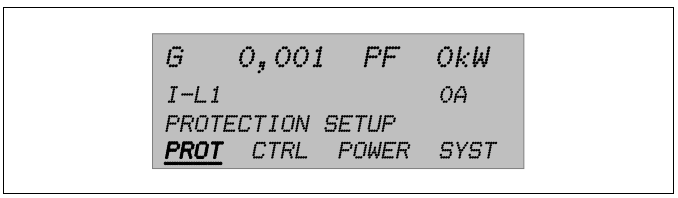
– Protection Setup (PROT): Channels from 1010 to 1890 (steps of 10)

– Control Setup (CTRL): Channels from 2010 to 2210 (steps of 10)

– Power Setup (POWER): Channels from 3010 to 3250 (steps of 10)

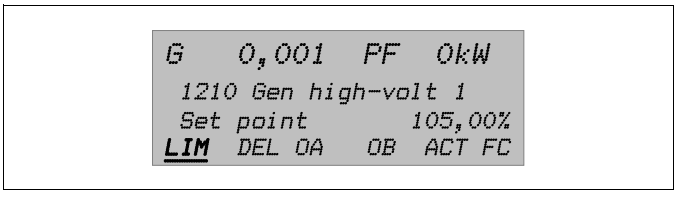
– System Setup (SYST): Channels from 4010 to 4790 (steps of 10)

If you select SETUP then you get the following view:



The fourth line is the entry selection for the Menu system. If the SELECT button is pressed, the menu indicated with an underscore will be entered.

If PROT is selected, the following view will appear (example of parameter):



For a protective function the first entry shows the “Gen high-volt 1” setting.

Scrolling down will give all the protection parameters.

– The first line shows some generator data.

– The second line shows the channel number and the name of the parameter.

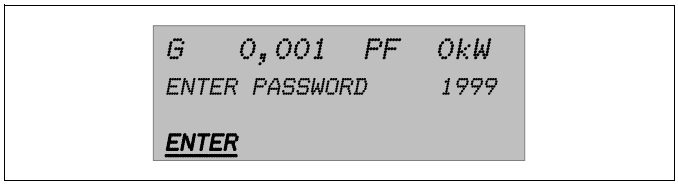
– The third line shows the value of a set point of this parameter.

– The fourth line shows the different possible set points. In this example:

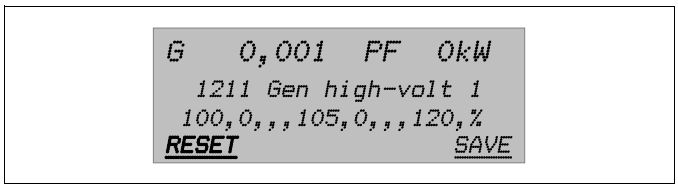
LIM	LIMIT, setting of switch point
DEL	DELAY, setting of time delay
OA	OUTPUT A, selection of which relay the function must activate
OB	OUTPUT B, selection of which relay the function must activate
ACT	ACTION, activate/de-activate the function
FC	FAIL CLASS, fail class setting.

The user can scroll to these choices and select one choice with the SELECT button.

After selection of LIM the following view will be visible:



If the correct password is entered, the following view appears:



Now the user can change the LIM of parameter “Gen high-volt 1”. This can be done with the scroll buttons. Then the user has to select SAVE to save the new settings.
To exit the user has to press the BACK button several times, until the main view appears.

The JUMP button

Instead of navigating through the entire menu, the user can jump directly to the required parameter, if he knows the channel number of that specific parameter.

If the JUMP button is pushed the password view will appear. Not all parameters can be changed by the end-user. The required password level for each parameter is given in the set point list.

The following menus can only be reached using the JUMP button:

– 4910 Service Timer 1

– 4920 Service Timer 2

– 4930 Diagnostics Menu

– 4940 Reset Eventlog

– 4950 Single/Split/Three phase

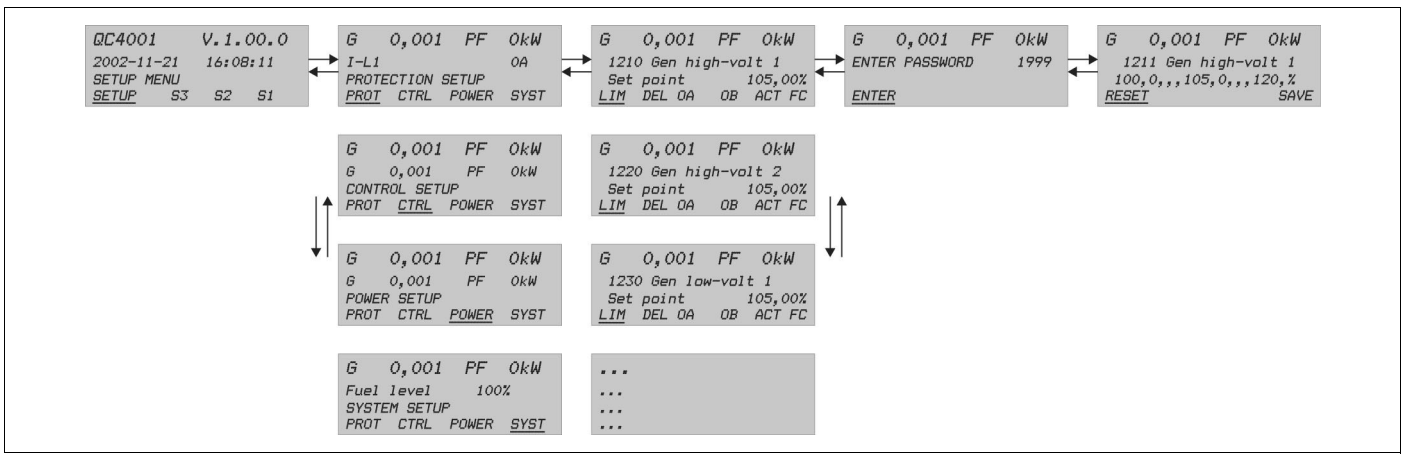
– 4971 User Password Change

  Level 2 and Level 3 passwords can only be set through the Atlas Copco Utility Software' PC Software.

– 4980 Service Menu

Use the up and down buttons to change the settings and the SELECT button to store the new setting.

This is the described menu flow:



The menu flow is similar in the CONTROL SETUP, POWER SETUP and SYSTEM SETUP.

For more details on the Setup menu we refer to the Qc4001™ User manual.

Protection setup: overview of parameters *(for correct values refer to controller)*

1010	Bus High Voltage 1	*CUSTOMER LEVEL*
1011	Setpoint	***103,0%***
1012	Delay	***10.00s***
1013	Output Relay A	***R0***
1014	Output Relay B	***R0***
1015	Enable	***OFF***
1016	Fail Class	***Warning***

1020	Bus High Voltage 2	*SERVICE LEVEL*
1021	Setpoint	***108,0%***
1022	Delay	***5.00s***
1023	Output Relay A	***R0***
1024	Output Relay B	***R0***
1025	Enable	***OFF***
1026	Fail Class	***Trip***

1030	Bus Low Voltage 1	*CUSTOMER LEVEL*
1031	Setpoint	***97,0%***
1032	Delay	***10.00s***
1033	Output Relay A	***R0***
1034	Output Relay B	***R0***
1035	Enable	***OFF***
1036	Fail Class	***Warning***

1040	Bus Low Voltage 2	*SERVICE LEVEL*
1041	Setpoint	***92,0%***
1042	Delay	***5.00s***
1043	Output Relay A	***R0***
1044	Output Relay B	***R0***
1045	Enable	***OFF***
1046	Fail Class	***Trip***

1050	Bus High Frequency 1	*CUSTOMER LEVEL*
1051	Setpoint	***103,0%***
1052	Delay	***10.00s***
1053	Output Relay A	***R0***
1054	Output Relay B	***R0***
1055	Enable	***OFF***
1056	Fail Class	***Warning***

1060	Bus High Frequency 2	*SERVICE LEVEL*
1061	Setpoint	***105,0%***
1062	Delay	***5.00s***
1063	Output Relay A	***R0***
1064	Output Relay B	***R0***
1065	Enable	***OFF***
1066	Fail Class	***Trip***

1070	Bus Low Frequency 1	*CUSTOMER LEVEL*
1071	Setpoint	***97,0%***
1072	Delay	***10.00s***
1073	Output Relay A	***R0***
1074	Output Relay B	***R0***
1075	Enable	***OFF***
1076	Fail Class	***Warning***

1080	Bus Low Frequency 2	*SERVICE LEVEL*
1081	Setpoint	***95,0%***
1082	Delay	***5.00s***
1083	Output Relay A	***R0***
1084	Output Relay B	***R0***
1085	Enable	***OFF***
1086	Fail Class	***Trip***

1090	Reverse Power	*SERVICE LEVEL*
1091	Setpoint	***-20,0%***
1092	Delay	***5.00s***
1093	Output Relay A	***R0***
1094	Output Relay B	***R0***
1095	Enable	***ON***
1096	Fail Class	***Trip + Stop***

1100	Over Current 1	*CUSTOMER LEVEL*
1101	Setpoint	***110,0%***
1102	Delay	***60.00s***
1103	Output Relay A	***R0***
1104	Output Relay B	***R0***
1105	Enable	***ON***
1106	Fail Class	***Warning***

1110	Over Current 2	*SERVICE LEVEL*
1111	Setpoint	***120,0%***
1112	Delay	***30.00s***
1113	Output Relay A	***R0***
1114	Output Relay B	***R0***
1115	Enable	***ON***
1116	Fail Class	***Trip + Stop***

1120	Over Load 1	*CUSTOMER LEVEL*
1121	Setpoint	***110,0%***
1122	Delay	***60.00s***
1123	Output Relay A	***R0***
1124	Output Relay B	***R0***
1125	Enable	***ON***
1126	Fail Class	***Warning***

1130	Over Load 2	*SERVICE LEVEL*
1131	Setpoint	***120,0%***
1132	Delay	***30.00s***
1133	Output Relay A	***R0***
1134	Output Relay B	***R0***
1135	Enable	***ON***
1136	Fail Class	***Trip + Stop***

1140	Current Unbalance	*SERVICE LEVEL*
1141	Setpoint	***30,0%***
1142	Delay	***10.00s***
1143	Output Relay A	***R0***
1144	Output Relay B	***R0***
1145	Enable	***OFF***
1146	Fail Class	***Trip + Stop***

1150	Voltage Unbalance	*SERVICE LEVEL*
1151	Setpoint	***10,0%***
1152	Delay	***10.00s***
1153	Output Relay A	***R0***
1154	Output Relay B	***R0***
1155	Enable	***OFF***
1156	Fail Class	***Trip + Stop***

1160	var Import	*SERVICE LEVEL*
1161	Setpoint	***50,0%***
1162	Delay	***10.00s***
1163	Output Relay A	***R0***
1164	Output Relay B	***R0***
1165	Enable	***ON***
1166	Fail Class	***Warning***

1170	var Export	*SERVICE LEVEL*
1171	Setpoint	***50,0%***
1172	Delay	***10.00s***
1173	Output Relay A	***R0***
1174	Output Relay B	***R0***
1175	Enable	***ON***
1176	Fail Class	***Warning***

1180	Df/Dt (ROCOF)	*SERVICE LEVEL*
1181	Setpoint	***5.0Hz/s***
1182	Delay	***6 periods***
1183	Output Relay A	***R0***
1184	Output Relay B	***R0***
1185	Enable	***OFF***

1190	Vector Jump	*SERVICE LEVEL*
1191	Setpoint	***10.0 deg***
1192	Output Relay A	***R0***
1193	Output Relay B	***R0***
1194	Enable	***OFF***

1210	Gen High Voltage 1	*CUSTOMER LEVEL*
1211	Setpoint	***110,0%***
1212	Delay	***5.0s***
1213	Output Relay A	***R0***
1214	Output Relay B	***R0***
1215	Enable	***ON***
1216	Fail Class	***Warning***

1220	Gen High Voltage 2	*MASTER LEVEL*
1221	Setpoint	***120,0%***
1222	Delay	***1.0s***
1223	Output Relay A	***R0***
1224	Output Relay B	***R0***
1225	Enable	***ON***
1226	Fail Class	***Shutdown***

1230	Gen Low Voltage 1	*CUSTOMER LEVEL*
1231	Setpoint	***90,0%***
1232	Delay	***10.0s***
1233	Output Relay A	***R0***
1234	Output Relay B	***R0***
1235	Enable	***RUN***
1236	Fail Class	***Warning***

1240	Gen Low Voltage 2	*SERVICE LEVEL*
1241	Setpoint	***80,0%***
1242	Delay	***5.0s***
1243	Output Relay A	***R0***
1244	Output Relay B	***R0***
1245	Enable	***RUN***
1246	Fail Class	***Trip + Stop***

1250	Gen High Frequency 1	*CUSTOMER LEVEL*
1251	Setpoint	***110,0%***
1252	Delay	***5.0s***
1253	Output Relay A	***R0***
1254	Output Relay B	***R0***
1255	Enable	***ON***
1256	Fail Class	***Warning***

1260	Gen High Frequency 2	MASTER LEVEL
1261	Setpoint	120,0%
1262	Delay	1.0s
1263	Output Relay A	R0
1264	Output Relay B	R0
1265	Enable	ON
1266	Fail Class	Shutdown

1270	Gen Low Frequency 1	CUSTOMER LEVEL
1271	Setpoint	90,0%
1272	Delay	10.0s
1273	Output Relay A	R0
1274	Output Relay B	R0
1275	Enable	RUN
1276	Fail Class	Warning

1280	Gen Low Frequency 2	SERVICE LEVEL
1281	Setpoint	80,0%
1282	Delay	5.0s
1283	Output Relay A	R0
1284	Output Relay B	R0
1285	Enable	RUN
1286	Fail Class	Trip + Stop

1310	4...20mA Input 1.1	CUSTOMER LEVEL
1311	Setpoint	10.0mA
1312	Delay	15.0s
1313	Output Relay A	R0
1314	Output Relay B	R0
1315	Enable	OFF
1316	Fail Class	Warning
USW	Alarm Type	High

1320	4...20mA Input 1.2	CUSTOMER LEVEL
1321	Setpoint	10.0mA
1322	Delay	15.0s
1323	Output Relay A	R0
1324	Output Relay B	R0
1325	Enable	OFF
1326	Fail Class	Warning
USW	Alarm Type	High

1330	4...20mA Input 2.1	CUSTOMER LEVEL
1331	Setpoint	10.0mA
1332	Delay	15.0s
1333	Output Relay A	R0
1334	Output Relay B	R0
1335	Enable	OFF
1336	Fail Class	Warning
USW	Alarm Type	High

1340	4...20mA Input 2.2	CUSTOMER LEVEL
1341	Setpoint	10.0mA
1342	Delay	15.0s
1343	Output Relay A	R0
1344	Output Relay B	R0
1345	Enable	OFF
1346	Fail Class	Warning
USW	Alarm Type	High

1350	Oil Pressure	SERVICE LEVEL
1351	Setpoint	4.0 bar
1352	Delay	5.0s
1353	Output Relay A	R0
1354	Output Relay B	R0
1355	Enable	OFF
1356	Fail Class	Warning
USW	Sensor Type	0

1360	VDO 1.2	SERVICE LEVEL
1361	Setpoint	5.0 bar
1362	Delay	5.0s
1363	Output Relay A	R0
1364	Output Relay B	R0
1365	Enable	OFF
1366	Fail Class	Warning

1370	High Coolant Temperature	SERVICE LEVEL
1371	Setpoint	110 deg 1)
	Setpoint	100 deg 2) 3) 4)
1372	Delay	3.0s
1373	Output Relay A	R0
1374	Output Relay B	R0
1375	Enable	ON
1376	Fail Class	Warning
USW	Sensor Type	0

1380	VDO 2.2	SERVICE LEVEL
1381	Setpoint	108 deg
1382	Delay	5.0s
1383	Output Relay A	R0
1384	Output Relay B	R0
1385	Enable	OFF
1386	Fail Class	Warning

1390	Fuel Level 1	CUSTOMER LEVEL
1391	Setpoint 1	10,0%
1392	Delay	10.0s
1393	Output Relay A	R0
1394	Output Relay B	R0
1395	Enable	ON
1396	Fail Class	Warning
USW	Sensor Type	1

1400	Fuel Pump Logic	CUSTOMER LEVEL
1401	Setpoint 2	20,0%
1402	Setpoint 3	80.0%
1403	Pump Relay	R4
1404	Enable	OFF
1405	Fill Check Delay	60.0s

1410	Fuel High Level	CUSTOMER LEVEL
1411	Setpoint 4	98,0%
1412	Delay	5.0s
1413	Output Relay A	R0
1414	Output Relay B	R0

1420	Overspeed	MASTER LEVEL
1421	Setpoint	1980rpm
1422	Delay	3.0s
1423	Output Relay A	R0
1424	Output Relay B	R0
1425	Enable	ON
1426	Fail Class	Shutdown

1430	Overspeed	MASTER LEVEL
1431	Overspeed S2	1980rpm
1432	Overspeed S3	1980rpm
1433	Overspeed S4	1980rpm

1440	Engine Failure	SERVICE LEVEL
1441	Delay	1.0s
1442	Output Relay A	R0
1443	Output Relay B	R0
1444	Enable	ON
1445	Fail Class	Shutdown
USW	Type	High

1450	Emergency Stop	MASTER LEVEL
1451	Delay	0.0s
1452	Output Relay A	R0
1453	Output Relay B	R0
1454	Enable	ON
1455	Fail Class	Shutdown
USW	Type	High

1460	Coolant Temperature 1	SERVICE LEVEL
1461	Setpoint	100 deg
1462	Delay	3.0s
1463	Output Relay A	R0
1464	Output Relay B	R0
1465	Enable	OFF
1466	Fail Class	Warning
USW	Alarm Type	High

1470	Coolant Temperature 2	SERVICE LEVEL
1471	Setpoint	108 deg
1472	Delay	3.0s
1473	Output Relay A	R0
1474	Output Relay B	R0
1475	Enable	OFF
1476	Fail Class	Shutdown
USW	Alarm Type	High

1480	Oil Pressure	SERVICE LEVEL
1481	Setpoint	3.0 bar
1482	Delay	5.0s
1483	Output Relay A	R0
1484	Output Relay B	R0
1485	Enable	OFF
1486	Fail Class	Warning
USW	Alarm Type	Low

1490	Fuel Level 2	CUSTOMER LEVEL
1491	Setpoint	5,0%
1492	Delay	20.0s
1493	Output Relay A	R0
1494	Output Relay B	R0
1495	Enable	ON
1496	Fail Class	Trip + Stop

1700	Digital Input 21	CUSTOMER LEVEL
1701	Delay	10.0s
1702	Output Relay A	R0
1703	Output Relay B	R0
1704	Enable	OFF
1705	Fail Class	Warning
1706	Type	High

1710	Digital Input 22	CUSTOMER LEVEL
1711	Delay	10.0s
1712	Output Relay A	R0
1713	Output Relay B	R0
1714	Enable	OFF
1715	Fail Class	Warning
1716	Type	High

1720	Digital Input 23	CUSTOMER LEVEL
1721	Delay	10.0s
1722	Output Relay A	R0
1723	Output Relay B	R0
1724	Enable	OFF
1725	Fail Class	Warning
1726	Type	High

1730	Digital Input 24	CUSTOMER LEVEL
1731	Delay	10.0s
1732	Output Relay A	R0
1733	Output Relay B	R0
1734	Enable	OFF
1735	Fail Class	Warning
1736	Type	High

1740	Digital Input 25	CUSTOMER LEVEL
1741	Delay	10.0s
1742	Output Relay A	R0
1743	Output Relay B	R0
1744	Enable	OFF
1745	Fail Class	Warning
1746	Type	High

1750	Digital Input 26	CUSTOMER LEVEL
1751	Delay	10.0s
1752	Output Relay A	R0
1753	Output Relay B	R0
1754	Enable	OFF
1755	Fail Class	Warning
1756	Type	High

1760	Low Fuel Warning	SERVICE LEVEL
1761	Delay	3.0s
1762	Output Relay A	R0
1763	Output Relay B	R0
1764	Enable	ON
1765	Fail Class	Warning
1766	Type	High

1770	Low Oil Pressure	SERVICE LEVEL
1771	Delay	3.0s
1772	Output Relay A	R0
1773	Output Relay B	R0
1774	Enable	RUN
1775	Fail Class	Shutdown
1776	Type	Low

1780	Coolant Temp. & Cool. Level	SERVICE LEVEL
1781	Delay	7.5s
1782	Enable Output Relay	R0
1783	Disable Output Relay	R0
1784	Enable	RUN
1785	Fail Class	Shutdown
1786	Type	Low

1790	Digital Input 30	CUSTOMER LEVEL
1791	Delay	10.0s
1792	Enable Output Relay	R0
1793	Disable Output Relay	R0
1794	Enable	OFF
1795	Fail Class	Warning
1796	Type	High

1860	Run Status	SERVICE LEVEL
1861	Delay	5.0s
1862	Output Relay A	R0
1863	Output Relay B	R0
1864	Enable	OFF

1870	W/L Input	SERVICE LEVEL
1871	Delay	3.0s
1872	Output Relay A	R0
1873	Enable	RUN
1874	Type	Low

1880	Static Charger	CUSTOMER LEVEL
1881	Delay	10.0s
1882	Output Relay A	R0
1883	Enable	OFF
1884	Type	High

1890	MDEC Run Signal	SERVICE LEVEL
1891	Delay	10.0s
1892	Output Relay A	R0
1893	Output Relay B	R0
1894	Enable	OFF

Control setup: overview of parameters

2010	**Synchronisation Type**		***SERVICE LEVEL***
	2011	Sync. Type	***Dynamic Sync.***
2020	**Dynamic Sync.**		***SERVICE LEVEL***
	2021	Df max.	***0.3Hz***
	2022	Df min.	***0.0Hz***
	2023	DU max.	***5%***
	2024	Breaker Delay	***75ms***
2030	**Static Sync.**		***SERVICE LEVEL***
	2031	GB Close Time	***1.0s***
	2032	Close Window	***10.0 deg***
	2033	Phase Gain	***40***
	2034	Frequency Gain	***40***
2050	**f/U Limits**		***SERVICE LEVEL***
	2051	Df max.	***3.0Hz***
	2052	DU max.	***8%***
2060	**GB Synchr. Failure**		***SERVICE LEVEL***
	2061	Delay	***60.0s***
	2062	Output Relay A	***R0***
	2063	Output Relay B	***R0***
2070	**MB Synchr. Failure**		***SERVICE LEVEL***
	2071	Delay	***60.0s***
	2072	Output Relay A	***R0***
	2073	Output Relay B	***R0***
2090	**Frequency Control**		***CUSTOMER LEVEL***
	2091	Deadband	***0.2%***
	2092	Frequency KP	***15***
	2093	Frequency KI	***120***
2100	**Power Control**		***CUSTOMER LEVEL***
	2101	Deadband	***0.2%***
	2102	Power KP	***10***
	2103	Power KI	***45***
2110	**Power Ramp Up**		***CUSTOMER LEVEL***
	2111	Speed	***10%/s***
	2112	Delay Point	***10%***
	2113	Delay Time	***0.0s***
2120	**Power Ramp Down**		***CUSTOMER LEVEL***
	2121	Speed	***10%/s***
	2122	Breaker Open	***5%***

2130	**P/f Control Mix**		***CUSTOMER LEVEL***
	2131	Mix Factor	***50%***
	2132	PF Control KP	***250***
	2133	PF Control KI	***160***
2140	**Voltage Control**		***CUSTOMER LEVEL***
	2141	Deadband	***0.2%***
	2142	KP	***150***
	2143	KI	***320***
2150	**Var Control**		***CUSTOMER LEVEL***
	2151	Deadband	***0.2%***
	2152	KP	***25***
	2153	KI	***80***
2160	**Q/U Control Mix**		***SERVICE LEVEL***
	2161	Mix Factor	***50%***
2170	**PF Control**		***CUSTOMER LEVEL***
	2171	Deadband	***5***
2180	**Gov. Reg. Failure**		***SERVICE LEVEL***
	2181	Deadband	***30.0%***
	2182	Delay	***60.0s***
	2183	Output Relay A	***R0***
	2184	Output Relay B	***R0***
2190	**AVR Reg. Failure**		***SERVICE LEVEL***
	2191	Deadband	***30.0%***
	2192	Delay	***60.0s***
	2193	Output Relay A	***R0***
	2194	Output Relay B	***R0***
2200	**Breaker Type**		***CUSTOMER LEVEL***
	2201	GB Type	***Pulse***
	2202	MB Type	***Pulse***
2210	**Static Sync.**		***SERVICE LEVEL***
	2211	Df max.	***0.1Hz***
	2212	DU max.	***5%***
	2213	Close Window	***10.0 deg***
	2214	KP	***80***
	2215	KI	***80***
	2216	Delay	***1.0s***

Power setup: overview of parameters

3010	**Mains Power**		***CUSTOMER LEVEL***
	3011	Day	***5000kW***
	3012	Night	***5000kW***
	3013	Transducer Scale	***5000kW***
3020	**Daytime Period**		***CUSTOMER LEVEL***
	3021	Start Hour	***8***
	3022	Start Minute	***0***
	3023	Stop Hour	***16***
	3024	Stop Minute	***0***
3030	**Start Generator**		***CUSTOMER LEVEL***
	3031	Setpoint	***80%***
	3032	Delay	***10.0s***
	3033	Minimum Load	***10%***
3040	**Stop Generator**		***CUSTOMER LEVEL***
	3041	Setpoint	***60%***
	3042	Delay	***600.0s***
3050	**Load Dependent Start**		***CUSTOMER LEVEL***
	3051	Setpoint	***50kW***
	3052	Delay	***1.0s***
	3053	Minimum Load	***20kW***
3060	**Load Dependent Stop**		***CUSTOMER LEVEL***
	3061	Setpoint	***100kW***
	3062	Delay	***30.0s***
3070	**Test**		***CUSTOMER LEVEL***
	3071	Setpoint	***50%***
	3072	Delay	***300.0s***
	3073	Test Synchron.	***OFF***
3080	**Fixed Power Setpoint**		***CUSTOMER LEVEL***
	3081	Power Set	***80%***
	3082	PF Set	***0.95***
3100	**PMS Configuration**		***CUSTOMER LEVEL***
	3101	# Gen-sets Available	***1***
	3102	Mains Available	***OFF***
	3103	PMS Active	***OFF***
	3104	Command Unit	***ON***
	3105	Enable Start/Stop	***Local***
3110	**Internal Communication ID**		***CUSTOMER LEVEL***
	3111	Intern. Comm. ID	***1***

3120	**Priority Select**		***CUSTOMER LEVEL***
	3121	Priority Select	***Manual***
3130	**Number of ID's**		***CUSTOMER LEVEL***
	3131	Enable Mains	***OFF***
	3132	Enable ID1	***ON***
	3133	Enable ID2	***OFF***
	3134	Enable ID3	***OFF***
	3135	Enable ID4	***OFF***
	3136	Enable ID5	***OFF***
3140	**Number of ID's**		***CUSTOMER LEVEL***
	3141	Enable ID6	***OFF***
	3142	Enable ID7	***OFF***
	3143	Enable ID8	***OFF***
	3144	Enable ID9	***OFF***
	3145	Enable ID10	***OFF***
	3146	Enable ID11	***OFF***
3160	**Priority of ID's**		***CUSTOMER LEVEL***
	3161	Priority ID1	***1***
	3162	Priority ID2	***2***
	3163	Priority ID3	***3***
	3164	Priority ID4	***4***
	3165	Priority ID5	***5***
	3166	Transmit	***OFF***
3170	**Priority of ID's**		***CUSTOMER LEVEL***
	3171	Priority ID6	***6***
	3172	Priority ID7	***7***
	3173	Priority ID8	***8***
	3174	Priority ID9	***9***
	3175	Priority ID10	***10***
	3176	Priority ID11	***11***
3230	**Ground Relay**		***CUSTOMER LEVEL***
	3231	Output Relay A	***R0***
	3232	Output Relay B	***R0***
	3233	Enable	***OFF***
3240	**Stop Noncon. Gen-sets**		***CUSTOMER LEVEL***
	3241	Delay	***60.0s***
3250	**Power Capacity**		***CUSTOMER LEVEL***
	3251	Power Capacity	***50kW***

System setup: overview of parameters

4010	Nominal Settings	CUSTOMER LEVEL
4011	Frequency	50Hz
4012	Generator Power	120kW 1)
	Generator Power	160kW 2)
	Generator Power	200kW 3)
	Generator Power	240kW 4)
4013	Generator Current	216A 1)
	Generator Current	289A 2)
	Generator Current	361A 3)
	Generator Current	433A 4)
4014	Generator Voltage	400V

4020	Nominal Settings 2	CUSTOMER LEVEL
4021	Frequency	50Hz 1)
	Frequency	60Hz 2) 3) 4)
4022	Generator Power	120kW 1)
	Generator Power	190kW 2)
	Generator Power	210kW 3)
	Generator Power	239kW 4)
4023	Generator Current	216A 1)
	Generator Current	286A 2)
	Generator Current	315A 3)
	Generator Current	360A 4)
4024	Generator Voltage	400V 1)
	Generator Voltage	480V 2) 3) 4)

4030	Nominal Settings 3	CUSTOMER LEVEL
4031	Frequency	50Hz
4032	Generator Power	120kW 1)
	Generator Power	160kW 2)
	Generator Power	200kW 3)
	Generator Power	240kW 4)
4033	Generator Current	216A 1)
	Generator Current	289A 2)
	Generator Current	361A 3)
	Generator Current	433A 4)
4034	Generator Voltage	400V

4040	Nominal Settings 4	CUSTOMER LEVEL
4041	Frequency	50Hz
4042	Generator Power	120kW 1)
	Generator Power	160kW 2)
	Generator Power	200kW 3)
	Generator Power	240kW 4)
4043	Generator Current	216A 1)
	Generator Current	289A 2)
	Generator Current	361A 3)
	Generator Current	433A 4)
4044	Generator Voltage	400V

4050	Transformer Gen-set	SERVICE LEVEL
4051	Volt. Prim.	440V
4052	Volt. Sec.	440V
4053	Current Prim.	300A 1) 2)
	Current Prim	600A 3) 4)
4054	Current Sec.	5A

4060	Transformer Bus	SERVICE LEVEL
4061	Volt. Prim.	440V
4062	Volt. Sec.	440V

4100	Engine Comms.	SERVICE LEVEL
4101	Type	OFF

4110	Date & Time (internal clock)	CUSTOMER LEVEL
4110	Date	dd/mm/yyyy
4110	Time	hh:mm

4120	Counters	MASTER LEVEL
4121	Running Time	0
4122	GB Operations	0
4123	MB Operations	0
4124	Reset kWh	OFF

4220	Battery Low	SERVICE LEVEL
4221	Setpoint	18.0V
4222	Delay	3.0s
4223	Output Relay A	R0
4224	Output Relay B	R0
4225	Enable	ON

4230	Battery High	SERVICE LEVEL
4231	Setpoint	30.0V
4232	Delay	0.5s
4233	Output Relay A	R0
4234	Output Relay B	R0
4235	Enable	ON

4240	Language	CUSTOMER LEVEL
4241	Language	English

4250	Loadshare Out	CUSTOMER LEVEL
4251	Loadshare Out	4.0V

4260	Loadshare Type	CUSTOMER LEVEL
4261	Loadshare Type	Qc4001

4270	Battery Low 2	CUSTOMER LEVEL
4271	Setpoint	18.0V
4272	Delay	10.0s
4273	Output Relay A	R0
4274	Output Relay B	R0
4275	Enable	OFF

4280	Battery High 2	CUSTOMER LEVEL
4281	Setpoint	30.0V
4282	Delay	10.0s
4283	Output Relay A	R0
4284	Output Relay B	R0
4285	Enable	OFF

4290	Mode Relay	CUSTOMER LEVEL
4291	Test	R0
4292	Auto	R0
4293	Semi	R0

4300	Engine Type	MASTER LEVEL
4301	Engine Type	Diesel

4320	Gen-Set Mode	CUSTOMER LEVEL
4321	Gen-Set Mode	Island

4330	CAN Unit	CUSTOMER LEVEL
4331	CAN Unit	bar-celsius

4350	Tacho Configuration	SERVICE LEVEL
4351	Setpoint	400rpm
4352	Teeth	129 1)
		140 2) 3)
		156 4)

4360	Starter	CUSTOMER LEVEL
4361	Start Prepare	1.0s
4362	Start ON Time	12.0s
4363	Start OFF Time	12.0s
4364	Prepare	Normal

4370	Start Attempts	SERVICE LEVEL
4371	Attempts	3
4372	Output Relay A	R0
4373	Output Relay B	R0

4380	f/U OK	SERVICE LEVEL
4381	Delay	3.0s

4390	f/U failure	SERVICE LEVEL
4391	Delay	30.0s
4392	Output Relay A	R0
4393	Output Relay B	R0

4400	Stop	SERVICE LEVEL
4401	Cool Down Time	60.0s
4402	Extended Stop	15.0s
4403	Coil Type	RUN

4410	Stop Failure	SERVICE LEVEL
4411	Delay	20.0s
4412	Output Relay A	R0
4413	Output Relay B	R0

4420	Mains V Failure	CUSTOMER LEVEL
4421	Fail Delay	1.0s
4422	Mains OK Delay	60.0s
4423	Low Voltage	75%
4424	High Voltage	120%
4425	Mains Fail Control	Start+Open MB

4430	Mains Hz Failure	CUSTOMER LEVEL
4431	Fail Delay	1.0s
4432	Mains OK Delay	60.0s
4433	Low Frequency	95%
4434	High Frequency	105%

4440	MB Control	CUSTOMER LEVEL
4441	Function	Mode Shift OFF
4442	MB Close Delay	0.5s
4443	Back Sync.	OFF
4444	Synchr. Timer	75ms

4450	Alarm Horn	CUSTOMER LEVEL
4451	Delay	20.0s

4460	GB Control	CUSTOMER LEVEL
4461	GB Close Delay	1.0s

4610	Relay 1	SERVICE LEVEL
4611	Function	Alarm
4612	Off Delay	0.0s

4620	Relay 2	SERVICE LEVEL
4621	Function	*Alarm*
4622	Off Delay	*0.0s*

4630	Relay 3	SERVICE LEVEL
4631	Function	*Alarm*
4632	Off Delay	*0.0s*

4640	Relay 4	SERVICE LEVEL
4641	Function	*Alarm*
4642	Off Delay	*0.0s*

4710	Start/Stop Cmd. 1	CUSTOMER LEVEL
4711	Enable	*OFF*
4712	START/STOP	*STOP*
4713	Day(s)	*10*
4714	Hour	*10*
4715	Minute	*0*

4720	Start/Stop Cmd. 2	CUSTOMER LEVEL
4721	Enable	*OFF*
4722	START/STOP	*STOP*
4723	Day(s)	*10*
4724	Hour	*10*
4725	Minute	*0*

4730	Start/Stop Cmd. 3	CUSTOMER LEVEL
4731	Enable	*OFF*
4732	START/STOP	*STOP*
4733	Day(s)	*10*
4734	Hour	*10*
4735	Minute	*0*

4740	Start/Stop Cmd. 4	CUSTOMER LEVEL
4741	Enable	*OFF*
4742	START/STOP	*STOP*
4743	Day(s)	*10*
4744	Hour	*10*
4745	Minute	*0*

4750	Start/Stop Cmd. 5	CUSTOMER LEVEL
4751	Enable	*OFF*
4752	START/STOP	*STOP*
4753	Day(s)	*10*
4754	Hour	*10*
4755	Minute	*0*

4760	Start/Stop Cmd. 6	CUSTOMER LEVEL
4761	Enable	*OFF*
4762	START/STOP	*STOP*
4763	Day(s)	*10*
4764	Hour	*10*
4765	Minute	*0*

4770	Start/Stop Cmd. 7	CUSTOMER LEVEL
4771	Enable	*OFF*
4772	START/STOP	*STOP*
4773	Day(s)	*10*
4774	Hour	*10*
4775	Minute	*0*

4780	Start/Stop Cmd. 8	CUSTOMER LEVEL
4781	Enable	*OFF*
4782	START/STOP	*STOP*
4783	Day(s)	*10*
4784	Hour	*10*
4785	Minute	*0*

4790	GSM Pin Code	CUSTOMER LEVEL
4791	Pin code	*0000*

4910	Service Timer 1	SERVICE LEVEL
4911	Enable	*ON*
4912	Run Hours	*500h*
4913	Elapsed Days	*365 days*
4914	Fail Class	*Warning*
4915	Output Relay A	*R0*
4916	Reset	

4920	Service Timer 2	SERVICE LEVEL
4921	Enable	*ON*
4922	Run Hours	*1000h*
4923	Elapsed Days	*365 days*
4924	Fail Class	*Warning*
4925	Output Relay A	*R0*
4926	Reset	

4930	Diagnostics Mode	CUSTOMER LEVEL
4930	Diagnostics	*Normal*

4940	Reset Eventlog	MASTER LEVEL
4940	Reset	*OFF*

4971	Level 1 Password	CUSTOMER LEVEL
4971	Setting	*2003*

4972	Level 2 Password	SERVICE LEVEL
4972	Setting	****

4973	Level 3 Password	MASTER LEVEL
4973	Setting	****

0	Parameter ID	MASTER LEVEL
USW	ID	*1) 9822 2002 63_00*
USW	ID	*2) 9822 2002 64_00*
USW	ID	*3) 9822 2002 65_00*
USW	ID	*4) 9822 2002 66_00*

5010	VDO 1	SERVICE LEVEL
5011	VDO 1 @ 0,0bar	*10*
5012	VDO 1 @ 2,5bar	*44,9*
5013	VDO 1 @ 5,0bar	*81*
5014	VDO 1 @ 6,0bar	*134,7*

5020	VDO 1	SERVICE LEVEL
5021	VDO 1 @ 7,0bar	*184*
5022	VDO 1 @ 8,0bar	*200*
5023	VDO 1 @ 9,0bar	*210*
5024	VDO 1 @ 10,0bar	*220*

5030	VDO 2	SERVICE LEVEL
5031	VDO 2 @ 40°C	*292*
5032	VDO 2 @ 50°C	*197*
5033	VDO 2 @ 60°C	*134*
5034	VDO 2 @ 70°C	*97*

5040	VDO 2	SERVICE LEVEL
5041	VDO 2 @ 80°C	*70*
5042	VDO 2 @ 90°C	*51*
5043	VDO 2 @ 100°C	*39*
5044	VDO 2 @ 110°C	*29*

5050	VDO 3	CUSTOMER LEVEL
5051	VDO 3 @ 0%	*78,8*
5052	VDO 3 @ 40%	*47,9*
5053	VDO 3 @ 50%	*40,2*
5054	VDO 3 @ 60%	*32,5*

5060	VDO 3	CUSTOMER LEVEL
5061	VDO 3 @ 70%	*24,8*
5062	VDO 3 @ 80%	*17*
5063	VDO 3 @ 90%	*9,3*
5064	VDO 3 @ 100%	*1,6*

0	Password Language Page	SERVICE LEVEL
USW	Level	*Service*

0	Password Log Page	SERVICE LEVEL
USW	Level	*Service*

0	Password Control Page	SERVICE LEVEL
USW	Level	*Service*

Notes:

1) Only applicable for QAS 150 Volvo units.

2) Only applicable for QAS 200 Volvo units.

3) Only applicable for QAS 250 Volvo units.

2.8.5 Passwords

Changing different parameters requires different password levels. Some parameters cannot be changed by the end-customer because of safety reasons.

There are 4 different password levels:

– No password

– User password (default setting 2003)

– Service password

– Master password

Once the password has been entered, the user can change all the accessible set points.

The user can change the User password (go with JUMP button to channel 4971).

2.8.6 Fail Classes

All the activated alarms of the module are configured with a fail class. The fail class defines the category of the alarm and the subsequent action.

4 different fail classes can be used:

Fail Class	*Action*				
	Alarm horn relay	*Alarm display*	*GB Trip*	*Gen-Set stop*	*Shutdown*
1. Warning		X			
2. Trip of GB	X	X	X		
3. Trip & Stop	X	X	X	X	
4. Shutdown	X	X	X		X

All alarms can be disabled or enabled as following:

– OFF: disabled alarm, inactive supervision.

– ON: enabled alarm, supervision of alarm all the time.

– RUN: generator running alarm, only supervision when the generator is running.

2.8.7 Languages

English is the default language ex-factory, but all the 12 European languages can be selected in channel 4240. It is possible to edit and/ or add text and to edit and/or add languages.

2.8.8 Standard modes

The following modes can be selected (push the dedicated button on the display unit).

Test mode

Enables the user to test the generator on a regular basis. The generator will follow a predefined sequence of actions.

Semi-Auto mode

Enables the user to have manual control and activation of the sequences with the buttons on the Qc4001™ control panel (A2). The generator can be started/stopped manually. The breakers can be closed/opened manually, but the module will check automatically synchronizing sequences.

Auto mode

The module controls the generator and the circuit breakers (generator breaker GB and mains breaker MB) automatically according to the operational state.

Diagnostics menu

This diagnostics menu can only be entered using the JUMP pushbutton, and going to channel 4930. This menu is used for engine diagnostics situations.

If diagnostics is selected in this menu, the fuel solenoid relay output will be de-energized for 30 seconds (to make sure that the unit is completely stopped), and then gets energized again. Then engine diagnostics can take place.

To leave this status, normal operation has to be selected again in this menu.

It's only possible to start the generator when Normal is selected.

2.8.9 Standard applications

In the Qc4001™ module 5 application types can be selected (in channel 4320). A combination of each application type with the running mode results in a specific application.

Depending on the application the user has to connect extra wirings to terminal blocks X25. These terminal blocks can be found inside the control box on a DIN-rail. We refer to the circuit diagram 9822 0889 74/07 A for the correct connections.

Island operation

This operation type is selected for installations with one or more generators, but always without the Mains (= stand-alone). In practice up to 16 generators can be installed in parallel.

– Combined with Semi-auto mode = Local Start operation.

  The sequences start/stop/close GB/open GB can be activated manually.

– Combined with Auto mode = Remote Start operation.

  The remote start signal can be given with an external switch or with the internal real time clock (8 start/stop commands can be defined in channels 4710-4780). After the generator has been started, the generator breaker will close automatically.

The generator cannot be started with an external signal, if the internal real time clock commands are enabled!

Installation wirings

– Terminals X25.10/X25.11 have to be linked. The module always needs a feedback signal from the Mains Breaker MB. In Island mode there is no MB in the system. In this case the MB opened signal is simulated with this link.

– The busbar sensing lines have to be wired to the corresponding control module inputs.

  Place bridges between:

  – X25.33 (L1) => X25.3

  – X25.34 (L2) => X25.4

  – X25.35 (L1) => X25.5

  (The bus bar = power cables between GB and load).

– For Remote Start operation: wire the RS switch between X25.9 & X25.10.

– For Paralleling applications with other generators: see “Parallelling” section to set up generator for paralleling.

Automatic Mains Failure (AMF) operation

This application is only possible in combination with the Auto mode. If the Semi-auto mode is selected the AMF operation will NOT function!

When the Mains exceeds the defined voltage/frequency/current/ speed limits for a defined delay time, the generator will take over the load automatically.

When the mains is restored within the defined limits for a defined time, the generator will synchronise to the mains and unload before disconnecting (only if back-synchronisation feature is enabled).

The generator will then go into cool down and stop.

It is possible to enable/disable the back synchronisation feature (in channel 4440).

Installation wirings

– The link between X25.10/X25.11 has to be removed.

– Mains breaker feedback lines have to be wired to X25.10/X25.11/ X25.12.

– Mains breaker control lines have to be wired to X25.13/X25.14/ X25.15/X25.16. These terminals are voltage free contacts. The power for the MB has to be supplied by the customer (24 Vdc/230 Vac) (max. contact rating K11, K12 = 250 V/16 A).

– Make sure the connections between X25.33 & X25.3, X25.34 & X25.4, X25.35 & X25.5 are removed.

– The Mains sensing lines L1/L2/L3 have to be wired to terminals X25.3/X25.4/X25.5 (mains neutral is not sensed).

– If back synchronisation is enabled, all settings for paralleling set up (see “Parallelling”) must be verified also.

Peak Shaving (PS) operation

This application is normally used in combination with the Auto mode.

The generator will start up when the mains imported power (measured through an optional Power Transducer = PT) exceeds a defined level. The generator will synchronise with the bus, and will take load until the defined allowable mains imported power level is reached.

When the mains imported power decreases below the defined mains imported power level for a defined time, the generator will unload and disconnect from the bus. Then the generator will go into cool down.

Installation wirings

– The link between X25.10/X25.11 has to be removed.

– Mains breaker feedback lines have to be wired to X25.10/X25.11/ X25.12.

– Mains breaker control lines have to be wired to X25.13/X25.14/ X25.15/X25.16. These terminals are voltage free contacts. The power for the MB has to be supplied by the customer (24 Vdc/230 Vac) (max. contact rating K11, K12 = 250 V/16 A).

– The Mains sensing lines L1/L2/L3 have to be wired to terminals X25.3/X25.4/X25.5 (mains neutral is not sensed).

– Make sure the connections between X25.33 & X25.3, X25.34 & X25.4, X25.35 & X25.5 are removed.

– Power Transducer lines have to be wired to X25.21 (input) and X25.22 (GND).

Verify al settings for paralleling set up (see “Parallelling”).

Fixed Power (FP) operation

This application is normally used in combination with Semi-auto mode in installations with the Mains. The generator will deliver a defined fixed power to the load or to the Mains.

Installation wirings

– The link between X25.10/X25.11 has to be removed.

– Mains breaker feedback lines have to be wired to X25.10/X25.11/ X25.12.

– Mains breaker control lines have to be wired to X25.13/X25.14/ X25.15/X25.16. These terminals are voltage free contacts. The power for the MB has to be supplied by the customer (24 Vdc/ 230 Vac) (max. contact rating K11, K12 = 250 V/16 A)

– The Mains sensing lines L1/L2/L3 have to be wired to terminals X25.3/X25.4/X25.5 (Mains neutral is not sensed).

– Make sure the connections between X25.33 & X25.3, X25.34 & X25.4, X25.35 & X25.5 are removed.

– Verify al settings for paralleling set up (see “Parallelling”).

Load Take Over (LTO) operation

This application is normally used in combination with Semi-auto or Auto mode in installations with the Mains. The generator will start-up, synchronise and take over the load from the Mains gradually, before opening the Mains Breaker. To know if the load is completely taken over from the mains, an optional Power Transducer is necessary.

Installation wirings

– The link between X25.10/X25.11 has to be removed.

– Mains breaker feedback lines have to be wired to X25.10/X25.11/ X25.12.

– Mains breaker control lines have to be wired to X25.13/X25.14/ X25.15/X25.16. These terminals are voltage free contacts. The power for the MB has to be supplied by the customer (24 Vdc/230 Vac) (max. contact rating K11, K12 = 250 V/16 A).

– The Mains sensing lines L1/L2/L3 have to be wired to terminals X25.3/X25.4/X25.5 (mains neutral is not sensed).

– Make sure the connections between X25.33 & X25.3, X25.34 & X25.4, X25.35 & X25.5 are removed.

– Power Transducer lines have to be wired to X25.21 (input) and X25.22 (GND).

– Verify al settings for paralleling set up (see “Parallelling”).

2.8.10 Parallelling

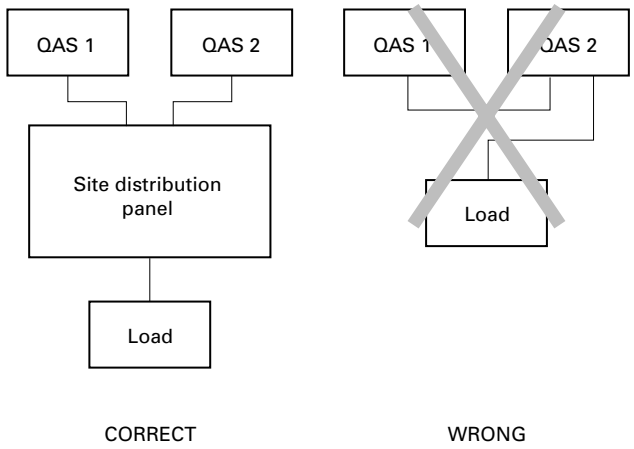
Prior to starting parallel operation of two generators, following connections need to be made:

– Connect the communication cable between the generators (sockets X30 & X31).

Each dedicated generator or SAPE has two of these connections, to enable paralleling more than two generators.

– Connect the load with the generator.

Go via the site distribution panel (to be installed by the customer) to connect the generator(s) and/or the SAPE unit(s) with the load. Always connect generator with the load, and never directly with second generator.



When paralleling, make sure to disable the Earth leakage relay by putting switch S13 into off position.

2.8.11 Option Power Management System

PMS (= Power Management System) is a system that will automatically start & stop generators based on the actual load dependency. This will be done through a PMS communication between the different units connected.

PMS applications are always in combination with AUTO mode. The Qc4001™ controllers from the gensets need to be programmed as PMS in AUTO mode. When a Qc Mains controller is installed this needs to be programmed in the application that is required (AMF, LTO, Fixed power) and AUTO mode.

By programming the parameters in AUTO mode, the generator can start up immediately. It is recommended to place the generator in SEMI-AUTO mode while programming all the PMS parameters !

In an application with PMS it is important to program correctly the Start & Stop signals between the different generators because of the following reasons:

– The maximum load step needs to be programmed in the Qc4001™ controllers. This never may exceeds the power reserve of the running generators. Otherwise the gensets will go in overload with a sudden max. load increase before the next generator is started up and connected to the busbar.

– To prevent the gensets to run in a start - stop loop.

The start signal is the value of the maximum required load step.

The stop signal is the value when the generator should be stopped automatically.

Example: Installation with 3 gensets

G1 = 300 kW; G2 = 200 kW; G3 = 200 kW.

– Start signal is set at 90 kW (maximum load step < 90 kW).

  Start signal if:

  Total Power needed > (total available power of running gensets -set point start signal).

  – Only G1 is running; at 210 kW load (300 kW - 90 kW) => G2 will be started.

  – G1 & G2 are running; at 410 kW load (200 kW + 300 kW - 90 kW) => G3 will be started.

– Stop signal is set at 100 kW and priority is set as (high) G1 > G2 > G3 (low).

  Stop signal if:

  Total Power needed < (Total available power of running gensets - Power of generator with lowest priority - set point stop signal).

  – G1 & G2 & G3 are running; at 400 kW (700 kW - 200 kW - 100 kW) => G3 will be stopped.

  – G1 & G3 are running; at 200 kW (500 kW - 200 kW - 100 kW) => G2 will be stopped.

The priority on starting & stopping the generators can be chosen on priority settings or on the amount of running hours. In manual mode the start & stop sequence is determent by the chosen priority between the generators. The generator with the lowest priority will start as the latest genset and will stop as first. If running hours are chosen as priority the start & stop sequence will be defined based on the actual running hours of the different generators. The lowest running hours will get the highest priority.

When paralleling generators with PMS, it is no longer necessary to use the analogue load sharing lines. This will be done through the PMS communication lines. Use a screened CAN communication cable with a maximum total distance of 200 meters. Do not connect the cable screen to the ground! Use a 120 Ohm resistor at both end controllers of the PMS.

For more information on this option, see User Manual Qc4001™.

2.8.12 Overview of applications

Installations with only 1 generator		
Application type	**Mode**	**Comments**
Island operation	SEMI-AUTO mode	= Local start
	AUTO mode	= Remote start
AMF operation	(SEMI-AUTO mode)	AMF Function will not work!
	AUTO mode	= Emergency start @ Mains Failure
Peak shaving	SEMI-AUTO mode	Only with Power Transducer (*)
	AUTO mode	Only with Power Transducer (*)
Fixed Power	SEMI-AUTO mode	
	AUTO mode	
Load Take Over	SEMI-AUTO mode	Only with Power Transducer (*)
	AUTO mode	Only with Power Transducer (*)

(*) A Power Transducer is a device that measures the actual power of the mains and which translates this into a 4...20 mA signal towards the Qc4001™ module. For details, please contact Atlas Copco.

Installations with more generators		
Application type	**Mode**	**Comments**
Island operation	SEMI-AUTO mode	= Manual paralleling between generators
	AUTO mode	= Remote paralleling between generators
AMF operation	(SEMI-AUTO mode)	AMF Function will not work!
	AUTO mode	Only with PMS option + Qc4001™ Mains module (**)
Peak shaving	SEMI-AUTO mode	Only with PMS option + Qc4001™ Mains module (**)
	AUTO mode	Only with PMS option + Qc4001™ Mains module (**)
Fixed Power	SEMI-AUTO mode	Only with PMS option + Qc4001™ Mains module (**)
	AUTO mode	Only with PMS option + Qc4001™ Mains module (**)
Load Take Over	SEMI-AUTO mode	Only with PMS option + Qc4001™ Mains module (**)
	AUTO mode	Only with PMS option + Qc4001™ Mains module (**)

(**) It is possible to have an optional power management system (PMS) that allows communication between the Qc4001™ modules over CAN-bus. It has a fully intelligent system, which will start/load/stop the generator according to the actual load and to the status of each generator. The installation can contain up to 16 Qc4001™ modules (all equipped with this PMS option). If the Mains is included in the installation, then an extra Qc4001™ module is required. The installation can be monitored and controlled via the PMS Software Package. For details on this option, please contact Atlas Copco.

1. **Each installation has to be prepared and reviewed very carefully before start-up. Wrong or incomplete wirings can damage the installation brutally!**
2. **Each application requires a specific combination of the following parameters:**
   - **Test / Semi-auto / Auto mode**
   - **Island / AMF / PS / FP / LTO application type**
   - **Back synchronising enabled/disabled**

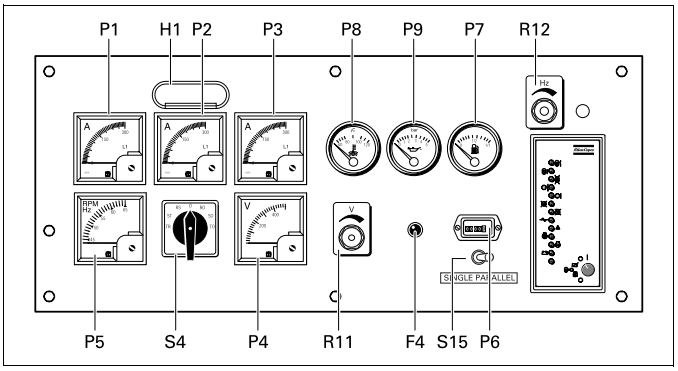
   Wrong parameter settings can damage the installation brutally!
3. **To be able to start up in cold conditions, parameter 4361 (Start prepare) can be changed to a higher value to have some preheating. Do not put this value above 60 seconds to avoid any possible damage.**
4. **For more information on the Qc4001™ module and its applications, we refer to the Qc4001™ User Manual. If you need more assistance, please contact Atlas Copco.**

2.9 Control and indicator panel - Automatic mains failure

2.9.1 General

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 light H1 goes on as soon as the starter switch is turned into position I, indicating that the fuel solenoid is energized..

The controlpanel for automatic mains failure operations has an AMF module, plus additional timers, connection block and DIP switches installed.



F4..... Fuse

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

Engine gauges

P6..... Hourmeter

P7..... Fuel level gauge

P8..... Engine coolant temperature gauge

P9..... Engine oil pressure gauge

Generator gauges

P1..... Ammeter line L1

Indicates the outgoing current in the first phase (L1).

P2..... Ammeter line L2

Indicates the outgoing current in the second phase (L2).

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/RPM meter

Indicates the frequency of the supply voltage and the speed of the engine.

S4..... Voltage 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.

Potentiometer

R11.... Voltage adjust potentiometer

Allows to adjust the output voltage.

R12.... Frequency adjust potentiometer

Allows to adjust the frequency of the output voltage.

Parallel operation

S15.... Single/Parallel switch

Enables the generator (combined with the SAPE unit) to operate in parallel mode. For details refer to the SAPE unit instruction manual. Always put this switch in single position for stand alone use.

2.9.2 Features available with AMF

Automatic mains failure offers the following features:

- continuous monitoring of four input lines
- a connection block for monitoring
- an extended control module
- a remote start possibility
- an automatic battery charger, trickle charge (option)
- an engine cooling water heater (option)

Continuous monitoring

Automatic mains failure continuously monitors four input lines of the main power supply: the three phases and the neutral.

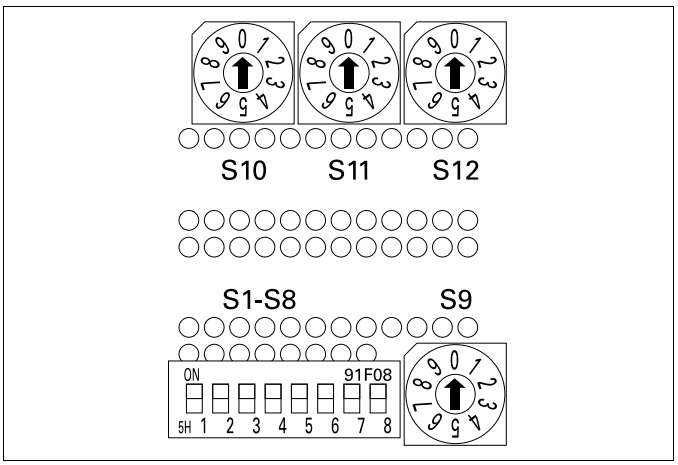
When the mains (one or all phases) is not available for approximately 0.5 seconds, the following timing sequence occurs:

- The mains contactor opens and disconnects the load from the mains.
- The unit starts 3 seconds (crank delay) after the mains failure. If the unit does not start immediately, it will carry out another 3 starting attempts, each consisting of 10 seconds cranking and 5 seconds interval (crank time).
- After 10 seconds generator stabilisation time (plant settle time), the generator contactor is energized and the generator supplies power towards the load.

When the mains (all phases) is available again for at least 10 seconds (mains restore time), the following timing applies:

- The generator contactor opens and the mains contactor closes (1 second change over time).
- The generator shuts down 1 minute later (delay run on time).

The timing can be adjusted by means of the potentiometers located at the back of the AMF control module:



S1-8...DIP switches

S9.....Crank timer

S10....Plant settle timer

S11....Mains restore timer

S12....Delay run on timer

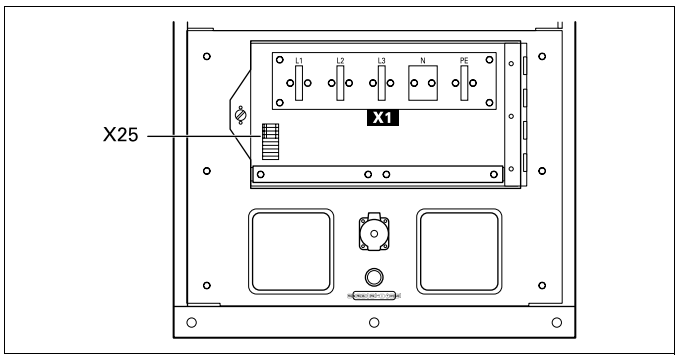
The table below summarises the relation between the position of the potentiometers and the value of the timers.

Potentiometer	S9		S10
Position	Crank delay	Crank time	Plant settle time
0	3 sec	10 sec	10 sec
1	10 sec	10 sec	15 sec
2	10 sec	15 sec	20 sec
3	15 sec	10 sec	25 sec
4	15 sec	15 sec	30 sec
5	25 sec	10 sec	35 sec
6	25 sec	15 sec	40 sec
7	25 sec	25 sec	45 sec
8	50 sec	15 sec	50 sec
9	50 sec	25 sec	60 sec

Potentiometer Position	S11 Mains restore time	S12 Delay run on
0	10 sec	1 min
1	20 sec	2 min
2	40 sec	3 min
3	1 min	4 min
4	2 min	5 min
5	3 min	6 min
6	4 min	7.5 min
7	7.5 min	10 min
8	10 min	12.5 min
9	15 min	15 min

The timers are factory set at position O.

Connection block for monitoring



X25....Connection block

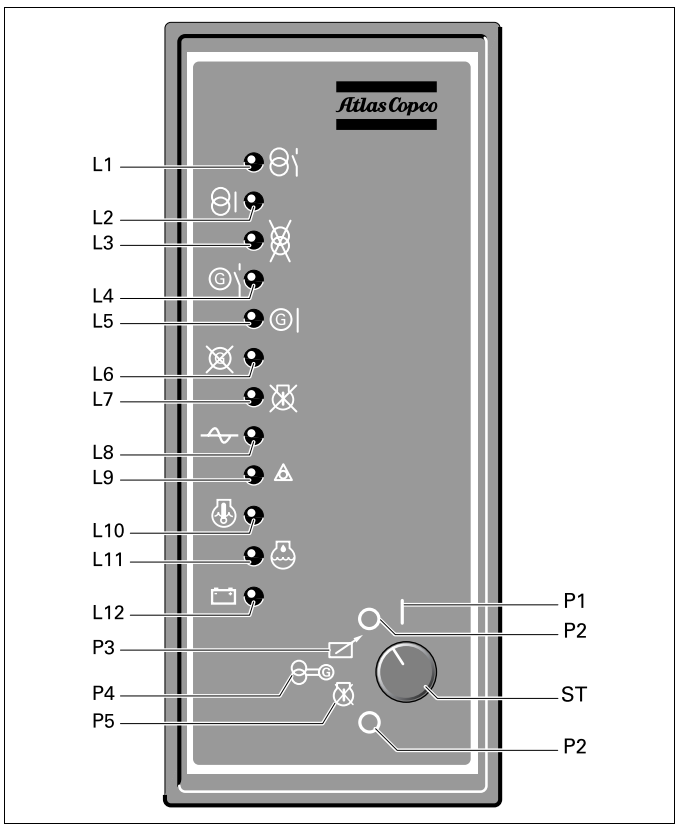
Allows easy connection for a remote start switch, for sensing of mains voltage and control of the mains and the plant contactor.

Refer to circuit diagram of Automatic mains failure for the correct connection.

Extended control module

The standard control module is replaced by an extended module which allows more detailed control of the unit.

The controls and indicators on the AMF control module are:



L1..... Mains available

Lights up when the mains is available.

L2..... Mains on load

Lights up when the mains supplies power towards the load.

L3..... Mains failed

Lights up when a failure occurred on the mains.

L4..... Plant available

Lights up when the generator is running.

L5..... Plant on load

Lights up when the generator supplies power towards the load.

L6..... Plant fail

Lights up when a failure occurred on the generator.

L7..... Start fail

Indicates that four start attempts were not sufficient to start up the engine.

L8..... Undervoltage shut down

Lights up when AC input interruption or failure was the cause of shut down.

L9..... Emergency stop indicator

Lights up when an emergency stop was the cause of shut down.

L10.... Engine coolant temperature shut down

Lights up when the high engine oil temperature was the cause of shut down.

L11.... Engine oil pressure shut down

Lights up when the low oil pressure was the cause of shut down.

L12.... Charge fail indicator

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

ST..... Starter switch

P1..... Position P1

The generator starts immediately. The load will be transferred if a mains failure occurs.

P2..... Position P2

The generator will never start.

P3..... Position P3

The generator will start when the remote start/stop contact is closed.

P4..... Position P4

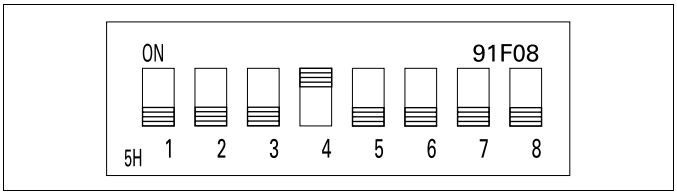
The generator will take over when a mains failure occurs.

P5..... Position P5

The generator will not start when a mains failure occurs. Nevertheless, the mains remains monitored and the mains contactor will trip in case of a mains failure.

The contactors between the mains, the unit and the load are not included in the option but should be sized according to the load. Nevertheless, they are also available as sales kit at Atlas Copco. Refer to circuit diagram 9822 0889 59 of Automatic mains failure for the correct connection.

For correct functioning of the module, the DIP switches at the back of the module should be positioned as follows:



1	Spare	5	Charge fail
2	Oil pressure	6	W/L input
3	Oil temperature	7	N/A
4	Static charge	8	Start delay

Besides dipswitch S8, located at the back of the control module and used for long/short preheating, dipswitch S1 can be used for enabling or disabling a spare shut down contact.

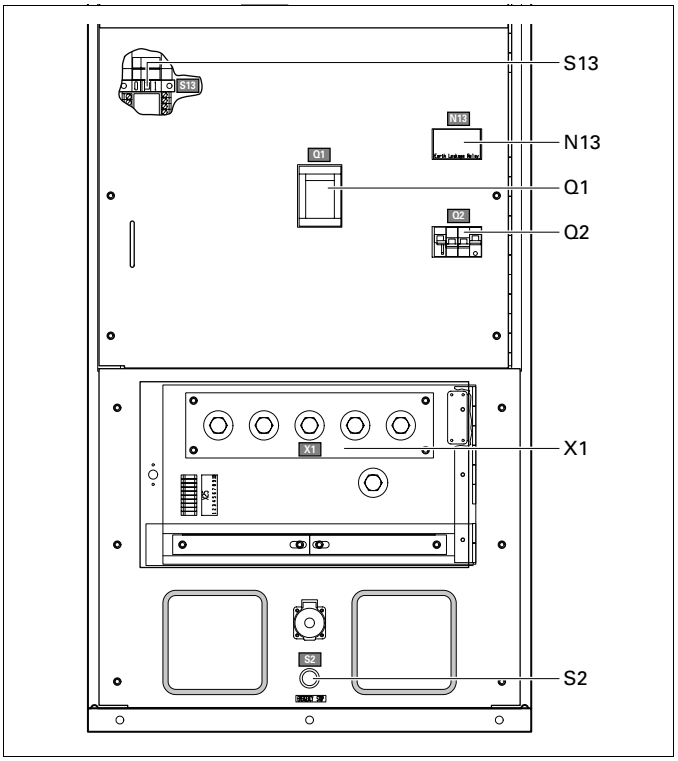
Remote start possibility

The Remote start feature of Automatic mains failure allows to switch the unit on or off without using the control panel located on the unit. For this purpose, the control module provides a voltage free contact for the connection of the remote start/stop switch (to be installed by the customer).

The unit will start in case the contact is closed (start/stop switch in position start) and the starter switch of the control module is in position ⊘ (position P3).

2.10 Output terminal board (TB)

The Terminal board provides a terminal board for more easy connection of cables. It is situated below the control and indicator panel.



N13....Earth leak detector

Detects and indicates an earth fault current and activates the main circuit breaker Q1. The detection level can be set at 30 mA fixed with instantaneous trip but can also be adjusted between 30 mA and 250 mA with time delayed (0 - 1 sec) trip. N13 has to be reset manually after eliminating the problem (reset button marked R). It can be overridden by means of the earth leak switch (S13, labelled IΔN) but has to be tested monthly by pushing test button T13.

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 restarted. The emergency stop button can be secured in the locked position with the key, to avoid unauthorized use. When the emergency button is pressed the control module needs to be reset.

S13....Lock-out switch for earth fault protection (N13)

This switch is located inside the cubicle and is labelled IΔN.

Position O: No de-energising of the main circuit breaker Q1 when an earth fault occurs.

Position 1: De-energising of the main circuit breaker Q1 when an earth fault occurs.

Q1.....Circuit breaker for X1

Interrupts the power supply X1 when a short-circuit occurs at the load side, or when the overcurrent protection is activated. When activated, Q1 interrupts the three phases towards X1. It must be reset manually after eliminating the problem.

Q2.....Circuit breaker for X2

Interrupts the power supply X2 when a short-circuit occurs at the load side, or when the overcurrent protection is activated. When activated, Q2 interrupts phase L3 and the neutral towards X2. It must be reset manually after eliminating the problem.

X1.....Main power supply

Terminals L1, L2, L3, N (= neutral) and PE (= earthing), behind a small transparent door.

Position O on switch S13 will only be used in conjunction with an external earth fault protection unit (e.g. integrated in a distribution board) or when the generator is used in parallel.
The earth fault protection on the single phase outlet socket is not affected by the switch S13.
If S13 is in position O, proper earthing is of the utmost importance for the safety of the user. Eliminating any earth fault protection can lead to serious injury or even death for anybody touching the unit or the load.

2.11 Battery switch

The battery switch is situated inside the sound-insulated bodywork. It allows to open or to close the electrical connection between the battery and the engine circuits.

Never turn the battery switch to OFF during operation.

3 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 1000 V) must be respected when connecting site distribution panels, switch gear or loads to the generator.

3.1 Installation

For information about indoor installation, consult your local Atlas Copco dealer.

- Place the generator on a horizontal, even and solid floor. The generator can operate in a slant position not exceeding 15° (in both senses: front/rear and left/right).
- 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.
- Use coolant for the engine cooling system. Refer to the Engine instruction book for the proper coolant mixture.
- Check the tightness of the bolts and nuts.
- Install the earthing rod as near as possible to the generator and measure its diffusion resistance (max. 1 kΩ) 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.

3.2 Connecting the generator

3.2.1 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.

3.2.2 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-Fmultiple 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	*Max. current (A)*		
(mm^2)	*Multiple core*	*Single core*	*H07 RN-F*
25	*94*	*101*	*88*
35	*114*	*123*	*110*
50	*138*	*155*	*138*
70	*176*	*191*	*170*
95	*212*	*228*	*205*
120	*245*	*273*	*239*
150	*282*	*314*	*275*
185	*323*	*358*	*313*
240	*379*	*421*	*371*
300	*429*	*477*	*428*

The lowest acceptable wire section and the corresponding maximum cable or conductor length for multiple core cable or H07 RN-F, at rated current (216 A), for a voltage drop e lower than 5% and at a power factor of 0.80, are respectively 120 mm^2 and 370 m. In case electric motors must be started, oversizing the cable is advisable.

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

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

e = Voltage drop (V)

I = Rated current (A)

L = Length of conductors (m)

R = Resistance (Ω/km to VDE 0102)

X = Reactance (Ω/km to VDE 0102)

3.2.3 Connecting the load

Site distribution panel

If outlet sockets 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, without excessive length, and lay it out in a safe way without forming coils.
- Open the door of the control and indicator panel and the transparent door in front of the terminal board X1.
- Provide the wire ends with cable lugs suited for the cable terminals.
- Loosen the cable clamp and push the wire ends of the load cable through the orifice and clamp.
- Connect the wires to the proper terminals (L1, L2, L3, N and PE) of X1 and tighten the bolts securely.
- Tighten the cable clamp.
- Close the transparent door in front of X1.

3.3 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 coolant level must be near to the FULL mark. Add coolant if necessary.
- Drain any coolant 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 coolantdamp in a nearly empty tank from condensing.
- Check the vacuum indicator of the air filter. If the red part shows completely, replace 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 circuit breaker Q1 is 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.
- Check that the earth fault protection (N13) has not tripped (reset if necessary).
- Check that the selector switch Single/Paralles (S15) on the generators is in the Single position, when not paralleling.

3.4 Operating Qc1001™

3.4.1 Starting Qc1001™

To start up the unit locally, proceed as follows:

- Switch on the battery switch.
- Switch off circuit breaker Q1. This is not necessary when a plant contactor is installed between Q1 and the load.
- Put the starter switch S20 in position I (ON). The unit starts a preheating cycle which takes 12 seconds.
- After the preheating period, the unit will start. The starting attempt will take maximum 12 seconds.
- Switch on circuit breaker Q1 in case no contactor is installed.

To start up the unit from a remote location, proceed as follows:

- Put the starter switch S20 in position ⊡ .
- Switch on circuit breaker Q1.
- Put the remote start/stop switch in position start. The unit starts a preheating cycle which takes 12 seconds.
- After the preheating period, the unit will start. The starting attempt will take maximum 12 seconds.

3.4.2 During operation Qc1001™

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 coolant.

– Avoid long low-load periods (< 30%). 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 circuit breakers are activated during operation, switch off the load and stop the generator. Check and, if necessary, decrease the load.

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

3.4.3 Stopping Qc1001™

To stop the unit locally, proceed as follows:

– Switch off the load.

– Switch off circuit breaker Q1.

– Let the engine run for about 5 minutes.

– Stop the engine by putting the starter switch S20 in position O (OFF).

– Lock the side doors and the door of the indicators and control panel to avoid unauthorized access.

To stop the unit when the starter switch is in position ⊘, proceed as follows:

– Switch off the load.

– Stop the engine by putting the remote start/stop switch in position stop or by putting the starter switch in position O.

– Cooldown period default 15 sec.

– Lock the side doors and the door of the indicators and control panel to avoid unauthorized access.

3.5 Operating Qc4001™

3.5.1 Starting Qc4001™

– Turn the optional battery switch to ON.

– Turn the S20 button to the ON position, this will activate the Qc4001™ Controller.

– Select the correct application type and the correct mode on the Qc4001™ module (see "Overview of applications" on page 35 for the possible selections).

– Make the correct wirings and program the applicable parameters (see "Standard applications" on page 32 for more details).

– When in SEMI-AUTO mode, use the START button to start-up the generator. The GB button cannot be used to close the generator breaker.

– When in AUTO mode, the generator will start-up automatically and close the contactors depending on the selected application.

The START button, the GB-close button and the MB-close button cannot be used in AUTO mode.

3.5.2 During operation Qc4001™

Following points should be carried out regularly:

– Check the display for normal readings.

Avoid letting the engine run out of fuel. If this happens, priming will speed up the starting.

– Check for leakage of oil, fuel or cooling water.

– Avoid long low-load periods (< 30%). In this case, an output power drop and higher oil consumption of the engine could occur. It is recommended to operate the generator at full load capacity immediatly after any low load operating period.

– When single-phase loads are connected to the generator output terminals, keep all loads well-balanced.

Never turn the optional battery switch to OFF during operation.

If circuit breaker Q1 trips off during operation, switch off the load and stop the generator. Check and, if necessary, decrease the load.

3.5.3 Stopping Qc4001™

– When in SEMI-AUTO mode, use the STOP button to stop the generator. The GB button will work to open the GB.

– When in AUTO mode, the STOP and GB button will not function. The generator shuts down automatically depending on the selected application

If you want to stop the generator manually, use the S20 button or the emergency stop button.

3.6 Operating Automatic mains failure

3.6.1 Starting

– Turn the battery switch to ON.

– Put the starter switch in position I.

– 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 engine oil pressure (P9) and the cooling water temperature (P8).

– Check the voltmeter P4 (with voltmeter selector switch S4 in different positions) and the frequency meter (P5).

– Switch circuit breaker Q1 on by pushing the lever fully down from TRIPPED (mid-position/white flag) to OFF (0/green flag) followed by pushing the lever fully up to ON (1/red flag).

– Switch on the load and check the ammeter P1, P2 and P3, voltmeter P4 (with voltmeter selector switch S4 in different positions) and frequency meter P5.

3.6.2 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 (< 30%). In this case, an output power 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 per phase is not exceeded.

– When single-phase loads are connected to the generator output terminals, keep all loads well-balanced.

Never turn the battery switch to OFF during operation.

If circuit breaker Q1 is 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.

3.6.3 Stopping

– Switch off the load.

– Switch off circuit breaker Q1.

– Let the engine run for about 5 minutes.

– Stop the engine by putting the starter switch in position O.

– Turn the battery switch to OFF.

– Lock the side doors and the door of the indicators and control panel to avoid unauthorized access.

4 Maintenance

4.1 Maintenance schedule for QAS 150 Volvo

Before carrying out any maintenance activity, check that the start switch is in position O and that no electrical power is present on the terminals.

Maintenance schedule	Daily	Initially Every 50 hours	Small Every 500 hours	Normall Every 1000 hours	Yearly Every 2000 hours
Service pak	-	-	2912 4363 05	2912 4364 06	2912 4365 07
For the most important subassemblies, Atlas Copco has developed service kits that combine all wear parts. These service kits offer you the benefits of genuine parts, save on administration costs and are offered at reduced price, compared to the loose components. Refer to the parts list for more information on the contents of the service kits.					
Coolant level	Check	Check	Check	Check	Check
Tension and condition of drive belt(s)		Check	Check	Check	Replace
Radiator and intercooler fins		Check/Clean	Check/Clean	Check/Clean	Check/Clean
Fuel pre-filter/Water separator	Check/Drain	Check/Drain	Check/Drain	Replace/Drain	Replace/Drain
Fuel filter element				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
Oil filter(s)			Replace	Replace	Replace
Crankcase pressure				Check	Check
Vacuum indicator	Check	Check	Check	Check	Check
Air cleaner and dust bowl		Clean	Clean	Clean	Clean
Air filter element (1)			Replace	Replace	Replace
Safety cartridge					Replace
Turbocharger impeller and housing					Clean/Inspect
Fan hub bearings					Lubricate
Oil, fuel and water leaks		Check	Check	Check	Check
Mechanical links (e.g. fuel solenoid link)			Grease	Grease	Grease
Valve clearance		(3)			Check/Adjust
Level battery electrolyte (2)		Check	Check	Check	Check
Condition of vibration dampers		Check	Check	Check	Check
Alternator insulation resistance (See (*) Measuring the alternator insulation resistance)		Measure	Measure	Measure	Measure
Tightness of nuts and bolts		Check			Check
Door hinges and locks		Grease			Grease
Fixation of hoses, cables and pipes				Check	Check
Inspection by Atlas Copco Service technician		**Generators in standby application have to be tested on a regular basis. At least once a month the engine should run for one hour. If possible a high load (> 30%) should be applied so that the engine reaches its operating temperature.**			

4.2 Maintenance schedule for QAS 200 Volvo

Before carrying out any maintenance activity, check that the start switch is in position O and that no electrical power is present on the terminals.

Maintenance schedule	Daily	Initially Every 50 hours	Small Every 500 hours	Normall Every 1000 hours	Yearly Every 2000 hours
Service pak	-	-	2912 4367 05	2912 4368 06	2912 4369 07
For the most important subassemblies, Atlas Copco has developed service kits that combine all wear parts. These service kits offer you the benefits of genuine parts, save on administration costs and are offered at reduced price, compared to the loose components. Refer to the parts list for more information on the contents of the service kits.					
Coolant level	Check	Check	Check	Check	Check
Tension and condition of drive belt(s)		Check	Check	Check	Replace
Radiator and intercooler fins		Check/Clean	Check/Clean	Check/Clean	Check/Clean
Fuel pre-filter/Water separator	Check/Drain	Check/Drain	Check/Drain	Replace/Drain	Replace/Drain
Fuel filter element				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
Oil filter(s)			Replace	Replace	Replace
Crankcase pressure				Check	Check
Vacuum indicator	Check	Check	Check	Check	Check
Air cleaner and dust bowl		Clean	Clean	Clean	Clean
Air filter element (1)			Replace	Replace	Replace
Safety cartridge					Replace
Turbocharger impeller and housing					Clean/Inspect
Fan hub bearings					Lubricate
Oil, fuel and water leaks		Check	Check	Check	Check
Mechanical links (e.g. fuel solenoid link)			Grease	Grease	Grease
Valve clearance		(3)			Check/Adjust
Level battery electrolyte (2)		Check	Check	Check	Check
Condition of vibration dampers		Check	Check	Check	Check
Alternator insulation resistance (See (*) Measuring the alternator insulation resistance)		Measure	Measure	Measure	Measure
Tightness of nuts and bolts		Check			Check
Door hinges and locks		Grease			Grease
Fixation of hoses, cables and pipes				Check	Check
Inspection by Atlas Copco Service technician		**Generators in standby application have to be tested on a regular basis. At least once a month the engine should run for one hour. If possible a high load (> 30%) should be applied so that the engine reaches its operating temperature.**			

4.3 Maintenance schedule for QAS 250 Volvo

Before carrying out any maintenance activity, check that the start switch is in position O and that no electrical power is present on the terminals.

Maintenance schedule	Daily	Initially Every 50 hours	Small Every 500 hours	Normall Every 1000 hours	Yearly Every 2000 hours
Service pak	-	-	2912 4367 05	2912 4368 06	2912 4370 07
For the most important subassemblies, Atlas Copco has developed service kits that combine all wear parts. These service kits offer you the benefits of genuine parts, save on administration costs and are offered at reduced price, compared to the loose components. Refer to the parts list for more information on the contents of the service kits.					
Coolant level	Check	Check	Check	Check	Check
Tension and condition of drive belt(s)		Check	Check	Check	Replace
Radiator and intercooler fins		Check/Clean	Check/Clean	Check/Clean	Check/Clean
Fuel pre-filter/Water separator	Check/Drain	Check/Drain	Check/Drain	Replace/Drain	Replace/Drain
Fuel filter element				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
Oil filter(s)			Replace	Replace	Replace
Crankcase pressure				Check	Check
Vacuum indicator	Check	Check	Check	Check	Check
Air cleaner and dust bowl		Clean	Clean	Clean	Clean
Air filter element (1)			Replace	Replace	Replace
Safety cartridge					Replace
Turbocharger impeller and housing					Clean/Inspect
Fan hub bearings					Lubricate
Oil, fuel and water leaks		Check	Check	Check	Check
Mechanical links (e.g. fuel solenoid link)			Grease	Grease	Grease
Valve clearance		(3)			Check/Adjust
Level battery electrolyte (2)		Check	Check	Check	Check
Condition of vibration dampers		Check	Check	Check	Check
Alternator insulation resistance (See (*) Measuring the alternator insulation resistance)		Measure	Measure	Measure	Measure
Tightness of nuts and bolts		Check			Check
Door hinges and locks		Grease			Grease
Fixation of hoses, cables and pipes				Check	Check
Inspection by Atlas Copco Service technician		**Generators in standby application have to be tested on a regular basis. At least once a month the engine should run for one hour. If possible a high load (> 30%) should be applied so that the engine reaches its operating temperature.**			

Notes:

(1) More frequently when operating in a dusty environment. Evacuate dust from the airfilter valve daily.

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

(3) After first initial 500 running hours it is required to check/adjust the valve clearance. When opening the rocker cover it is necessary to replace the gasket. This gasket can be ordered with AC partnumber:
QAS 150 Volvo: partnumber 2914 9585 00
QAS 200 Volvo: partnumber 2914 9588 00
QAS 250 Volvo: partnumber 2914 9588 00

4.4 Engine maintenance

Refer to the engine's operator manual for full maintenance schedule.

4.5 (*) 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 PE 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.

4.6 Engine oil specifications

It is strongly recommended to use Atlas Copco branded lubrication oils.

High-quality, mineral, hydraulic or synthesized hydrocarbon oil with rust and oxidation inhibitors, anti-foam and anti-wear properties is recommended.
The viscosity grade should correspond to the ambient temperature and ISO 3448, as follows:

Engine	Type of lubricant
between -15°C and 40°C	PAROIL 15W40
between -25°C and 30°C	PAROIL 5W30

Never mix synthetic with mineral oil.
Remark:
When changing from mineral to synthetic oil (or the other way around), you will need to do an extra rinse.
After doing the complete change procedure to synthetic oil, run the unit for a few minutes to allow good and complete circulation of the synthetic oil. Then drain the synthetic oil again and fill again with new synthetic oil. To set correct oil levels, proceed as in normal instruction.

4.6.1 Specifications PAROIL

PAROIL from Atlas Copco is the ONLY oil tested and approved for use in all engines built into Atlas Copco compressors and generators.
Extensive laboratory and field endurance tests on Atlas Copco equipment have proven PAROIL to match all lubrication demands in varied conditions. It meets stringent quality control specifications to ensure your equipment will run smoothly and reliably.
The quality lubricant additives in PAROIL allow for extended oil change intervals without any loss in performance or longevity.

PAROIL provides wear protection under extreme conditions. Powerful oxidation resistance, high chemical stability and rust-inhibiting additives help reduce corrosion, even within engines left idle for extended periods.

PAROIL contains high quality anti-oxidants to control deposits, sludge and contaminants that tend to build up under very high temperatures.
PAROIL's detergent additives keep sludge forming particles in a fine suspension instead of allowing them to clog your filter and accumulate in the valve/rocker cover area.

PAROIL releases excess heat efficiently, whilst maintaining excellent bore-polish protection to limit oil consumption.
PAROIL has an excellent Total Base Number (TBN) retention and more alkalinity to control acid formation.

PAROIL prevents Soot build-up.

PAROIL is optimized for the latest low emission EURO -3 & -2, EPA TIER II & III engines running on low sulphur diesel for lower oil and fuel consumption.

4.6.2 PAROIL 5W30 and PAROIL 15W40

Synthetic engine oil PAROIL 5W30

PAROIL 5W30 is a Synthetic ultra high performance diesel engine oil with a high viscosity- index. Atlas Copco PAROIL 5W30 is designed to provide excellent lubrication from start-up in temperatures as low as -25°C.

	Liter	US gal	Imp gal	cu.ft	Order number
can	5	1.3	1.1	0.175	1604 6060 00
barrel	210	55.2	46	7.35	1604 6059 00

Mineral engine oil PAROIL 15W40

PAROIL 15W40 is a mineral based high performance diesel engine oil with a high viscosity- index. Atlas Copco PAROIL 15W40 is designed to provide a high level of performance and protection in standard ambient conditions as from -15°C.

	Liter	US gal	Imp gal	cu.ft	Order number
can	5	1.3	1.1	0.175	1615 5953 00
can	20	5.3	4.4	0.7	1615 5954 00
barrel	210	55.2	46	7.35	1615 5955 00

4.7 Engine oil level check

Consult the Engine Operation Manual for the oil specifications, viscosity recommendations and oil change intervals.

For intervals, see section “Maintenance schedule” on page 44.

Check engine oil level according to the instructions in the Engine Operation Manual and if necessary top up with oil.

4.8 Engine oil and oil filter change

See section “Maintenance schedule” on page 44.

4.9 Engine coolant specifications

Never remove the cooling system filler cap while coolant is hot.
The system may be under pressure. Remove the cap slowly and only when coolant is at ambient temperature. A sudden release of pressure from a heated cooling system can result in personal injury from the splash of hot coolant.
It is strongly recommended to use Atlas Copco branded coolant.

The use of the correct coolant is important for good heat transfer and protection of liquid-cooled engines. Coolants used in these engines must be mixtures of good quality water (distilled or de-ionised), special coolant additives and if necessary freeze protection. Coolant that is not to manufacturer's specification will result in mechanical damage of the engine.

The freezing point of the coolant must be lower than the freezing point that can occur in the area. The difference must be at least 5°C. If the coolant freezes, it may crack the cylinder block, radiator or coolant pump.

Consult the engine's operation manual and follow the manufacturer's directions.

Never mix different coolants and mix the coolant components outside the cooling system.

4.9.1 Specifications PARCOOL EG

PARCOOL EG is the only coolant that has been tested and approved by all engine manufacturers currently in use in Atlas Copco compressors and generators.

Atlas Copco's PARCOOL EG extended life coolant is the new range of organic coolants purpose designed to meet the needs of modern engines. PARCOOL EG can help prevent leaks caused by corrosion. PARCOOL EG is also fully compatible with all sealants and gasket types developed to join different materials used within an engine.

PARCOOL EG is a ready to use Ethylene Glycol based coolant, premixed in an optimum 50/50 dilution ratio, for antifreeze protection guaranteed to -40°C.

Because PARCOOL EG inhibits corrosion, deposit formation is minimized. This effectively eliminates the problem of restricted flow through the engine coolant ducts and the radiator, minimizing the risk for engine overheating and possible failure.

It reduces water pump seal wear and has excellent stability when subjected to sustained high operating temperatures.

PARCOOL EG is free of nitride and amines to protect your health and the environment. Longer service life reduces the amount of coolant produced and needing disposal to minimise environmental impact.

	Liter	US gal	Imp gal	cu.ft	Order number
can	5	1.3	1.1	0.175	1604 5308 00
can	20	5.3	4.4	0.7	1604 5307 01
barrel	210	55.2	46	7.35	1604 5306 00

To ensure protection against corrosion, cavitation and formation of deposits, the concentration of the additives in the coolant must be kept between certain limits, as stated by the manufacturer's guidelines. Topping up the coolant with water only, changes the concentration and is therefore not allowed.

Liquid-cooled engines are factory-filled with this type of coolant mixture.

4.10 Coolant check

4.10.1 Monitoring coolant condition

In order to guarantee the lifetime and quality of the product, thus to optimise engine protection, regular coolant-condition-analysis is advisable.

The quality of the product can be determined by three parameters.

Visual check

– Verify the outlook of the coolant regarding colour and make sure that no loose particles are floating around.

pH measurement

– Check the pH value of the coolant using a pH-measuring device.

– The pH-meter can be ordered from Atlas Copco with part number 2913 0029 00.

– Typical value for EG = 8.6.

– If the pH-level is below 7 or above 9.5, the coolant should be replaced.

Glycol concentration measurement

– To optimise the unique engine protection features of the PARCOOL EG the concentration of the Glycol in the water should be always above 33 vol.%.

– Mixtures with more than 68 vol.% mix ratio in water are not recommended, as this will lead to high engine operating temperatures.

– A refractometer can be ordered from Atlas Copco with part number 2913 0028 00.

In case of a mix of different coolant products this type of measurement might provide incorrect values.

4.10.2 Topping up of coolant

– Verify if the engine cooling system is in a good condition (no leaks, clean,...).

– Check the condition of the coolant.

– If the condition of the coolant is outside the limits, the complete coolant should be replaced (see section “Replacing the coolant”).

– Always top-up with PARCOOL EG.

– Topping up the coolant with water only, changes the concentration of additives and is therefore not allowed.

4.10.3 Replacing the coolant

Drain

– Completely drain the entire cooling system.

– Used coolant must be disposed or recycled in accordance with laws and local regulations.

Flush

– Flush twice with clean water. Used coolant must be disposed or recycled in accordance with laws and local regulations.

– From the Atlas Copco Instruction book, determine the amount of PARCOOL EG required and pour into the radiator top tank.

– It should be clearly understood that the risk for contamination is reduced in case of proper cleaning.

– In case a certain content of ‘other’ coolant remains in the system, the coolant with the lowest properties influences the quality of the ‘mixed’ coolant.

Fill

– To assure proper operation and the release of trapped air, run the engine until normal engine operation temperature is reached. Turn off the engine and allow to cool.

– Recheck coolant level and add if necessary.

5 Storage of the generator

5.1 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 silicagel 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.

  – Wrap the generator, except the bottom, in a plastic bag.

5.2 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" on page 41).

– Consult the engine's operator manual.

– Check that the insulation resistance of the generator exceeds 5 MΩ.

– Replace the fuelfilter and fill the fuel tank. Vent the fuelsystem.

– Reinstall and connect the battery, if necessary after being recharged.

– Submit the generator to a test run.

6 Checks and troubleshooting

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, odours, 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 (e.g. close to sea).

6.1 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.

6.2 Checking frequencymeter P5

Only applicable with AMF.

– 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 the mains frequency (50 Hz).

6.3 Checking ammeters P1, P2 and P3

– Measure by means of a clamp-on probe the current, during the load.

– Compare the measured current with the current indicated on the ammeter. Both readings should be the same.

6.4 Alternator troubleshooting

Symptom	Possible cause	Corrective action
Alternator does not excite	Blown fuse.	Replace fuse.
	Insufficient residual voltage.	Increase the speed by 15%.
	No residual voltage.	For an instant apply on the + and – terminals of the electronic regulator a 12 V battery voltage with a 30 Ω resistor in series respecting the polarities.
After being excited alternator does not excite	Connections are interrupted.	Check connection cables as per attached drawings.
Low voltage at no load	Voltage potentiometer out of setting.	Reset voltage.
	Intervention of protection.	Check frequency/voltage regulator.
	Winding failure.	Check windings.
High voltage at no load	Voltage potentiometer out of setting.	Reset voltage.
	Failed regulator.	Substitute regulator.
Lower than rated voltage at load	Voltage potentiometer out of setting.	Reset voltage potentiometer.
	Intervention by protection.	Current too high, power factor lower than 0.8; speed lower than 10% of rated speed.
	Failed regulator.	Substitute regulator.
	Rotating bridge failure.	Check diodes, disconnect cables.
Higher than rated voltage at load	Voltage potentiometer out of setting.	Reset voltage potentiometer.
	Failed regulator.	Substitute regulator.
Unstable voltage	Speed variation in engine.	Check regularity of rotation.
	Regulator out of setting.	Regulate stability of regulator by acting on STABILITY potentiometer.

6.5 Engine troubleshooting

Refer to the engine's operator manual for the engine troubleshooting. An extensive Engine troubleshooting manual is available at Volvo Penta. For more information contact Volvo Penta.

7 Options available for QAS 150-200-250 Volvo units

7.1 Circuit diagrams

The engine control circuit diagrams and the power circuit diagrams for the standard QAS 150-200-250 Volvo units, for the units with options and for the units with combined options are:

Unit	*Power circuit*	*Engine control circuit*
QAS 150-200-250 Qc1001™	9822 0889 51	9822 0889 57
QAS 150-200-250 Qc4001™	9822 0889 74	9822 0889 74
QAS 150-200-250 AMF	9822 0889 51	9822 0889 59
		9822 0889 69
QAS 150-200-250 Low voltage	9822 0889 60	9822 0889 57
QAS 150-200-250 Dual voltage	9822 0889 76	9822 0889 57
QAS 150-200-250 EDF	9822 0889 53	-
QAS 150-200-250 OUR	9822 0889 63	-
	9822 0888 89	

7.2 Overview of the electrical options

The following electrical options are available:

– Automatic battery charger

– Engine coolant heater

– Outlet sockets (S)

– Dual voltage (DV)

– “Electricité de France” (EDF)

– Over and under voltage relay (O.U.R)

– Dual frequency

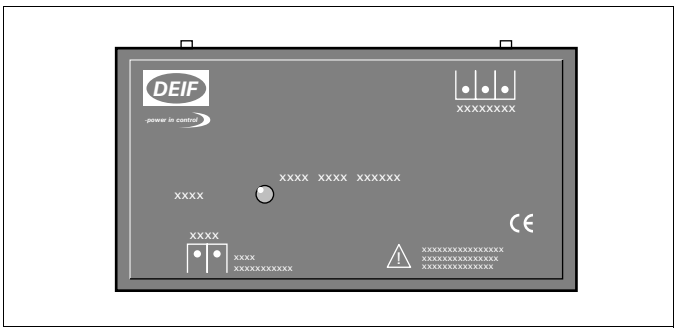
7.3 Description of the electrical options

7.3.1 Automatic battery charger

The automatic battery charger charges the battery completely and is disconnected once the unit starts up.

Besides the output terminals (secondary side) the automatic battery charger has a trim potentiometer for setting of the output voltage. By means of an insulated slotted screwdriver or adjusting pin the output voltage can be set in the range.

The LED on the front indicates that the unit is operational.



Setting:

– Lower output voltage = counterclockwise rotation

– Higher output voltage = clockwise rotation

To use the battery charger:

– Provide the X25 connector, located at the side of the output terminal board, with external power to use the automatic battery charger.

7.3.2 Engine coolant heater

To make sure that the engine can start and accept load immediately, an external cooling water heater (2000 W, 240 V) is provided which keeps the engine temperature between 38°C and 49°C.

The engine coolant heater is alwys included with the AMF option.

7.3.3 Outlet sockets (S)

The Outlet sockets option provides the following extra outlet sockets and circuit breakers:

Q1.....Circuit breaker for X1

Interrupts the power supply X1 when a short-circuit occurs at the load side, or when the overcurrent protection is activated. When activated, Q1 interrupts the three phases towards X1. It must be reset manuallly after eliminating the problem.

Q2.....Circuit breaker for X2

Interrupts the power supply to 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 can be activated again after eliminating the problem.

X1.....Main power supply (400 V AC)

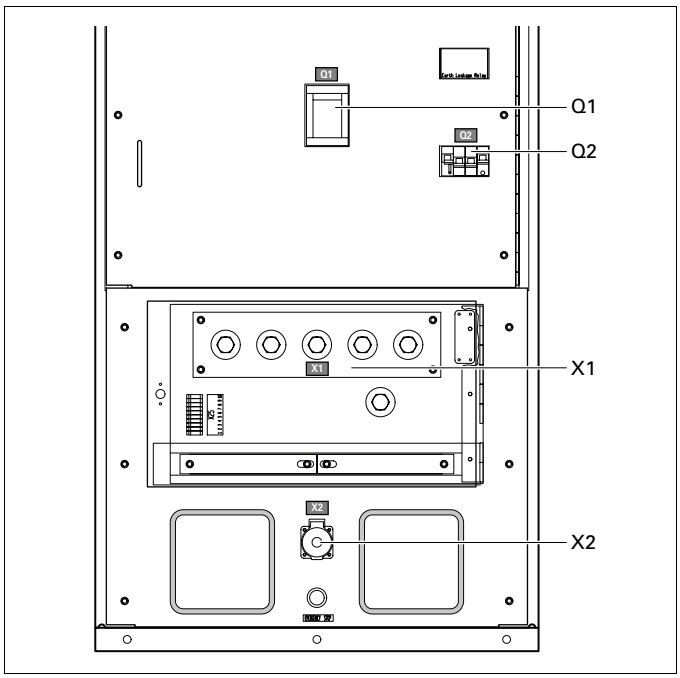
Terminals L1, L2, L3, N (= neutral) and PE (= earthing), hidden behind the control panel door and behind a small transparent door.

X2.....Socket 16 A Rim earthing

Provides lines L3, N (= neutral) and PE (= earthing).

Socket 16 A Pin earthing

Provides lines L3, N (= neutral) and PE (= earthing).



When the sockets-option is installed, circuit breaker Q1 does not only interrupt the power supply towards X1 but also towards X2.
Make sure to switch on circuit breakers Q1 and Q2 after starting the generator when power supply is done by means of X2.

7.3.4 Dual voltage (DV)

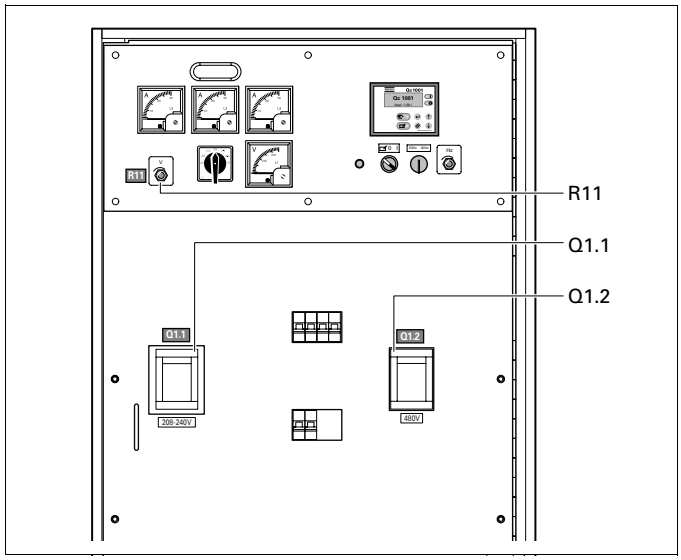
The generator can run in two different modes:

3 phase, lower voltage

When using this selection, the generator provides a 230 V (QAS 150) or 230/240 V (QAS 200-250) output voltage.

3 phase, higher voltage

When using this selection, the generator provides a 400 V (QAS 150) or 400/480 V (QAS 200-250) output voltage.



Q1.1...Circuit breaker for low voltage, high current

Interrupts the low voltage power supply towards X1 when a short-circuit occurs at the load side or when the overcurrent protection is activated. It must be reset manually after eliminating the problem.

Q1.2...Circuit breaker for high voltage, low current

Interrupts the high voltage power supply towards X1 when a short-circuit occurs at the load side or when the overcurrent protection is activated. It must be reset manually after eliminating the problem.

R11....Output voltage adjust potentiometer

Allows to adjust the output voltage.

AMF operation is not possible with a dual voltage generator.

Depending on which mode the generator is running in, circuit breaker Q1.1 or Q1.2 will be operational.

Circuit breakers Q1.1 and Q1.2 cannot be switched on at the same time. This is prevented by means of the auxiliary voltage selection relays S10b and S10c (refer to the circuit diagram).

The selection between the two modes is done by means of S10.

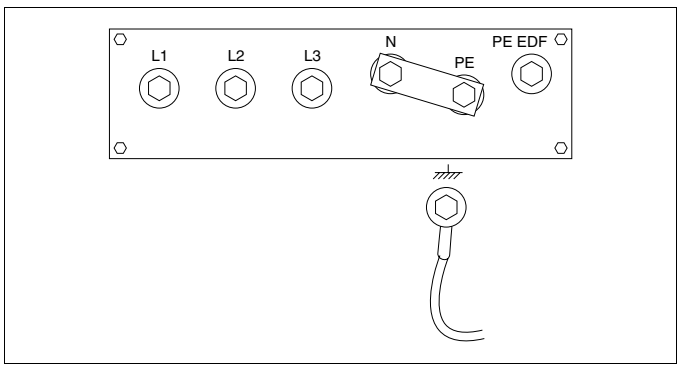
S10.... Output voltage selection switch

Allows to select a 3 phase high output voltage or a 3 phase low output voltage. Selector switch S10 is located on the alternator.

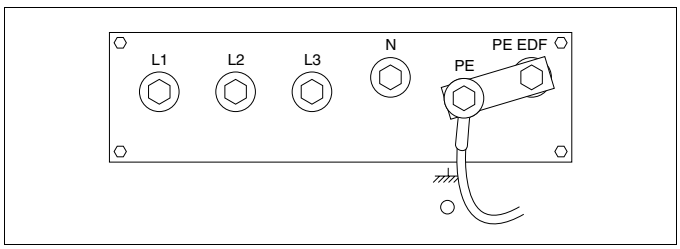
Changing the output voltage is only allowed after shutdown.
After changing the output voltage by means of the selection switch S10, adjust the output voltage by means of potentiometer R11 to the required value.

7.3.5 "Electricité de France" (EDF)

When the EDF-option is installed, the unit operates as a standard unit when the neutral and the PE terminals are connected to each other (see figure below). In this case, an earth leakage at the side of the generator or at the side of the load will switch off the circuit breaker.



When EDF-option is installed, the unit operates as EDF-unit when the earthing, the PE and the PE EDF terminals are connected to each other (see figure below). In this case, an earth leakage at the side of the generator will switch off the circuit breaker. An earth leakage at the side of the load will not switch off the circuit breaker.



Changing the operation mode from standard unit to EDF-unit or vice versa has to be carried out by a qualified person from "Electricité de France".

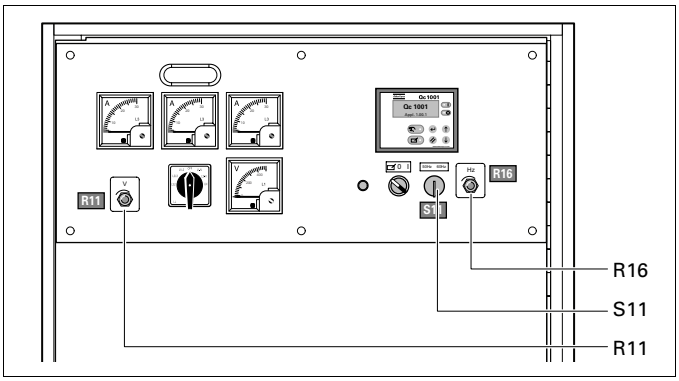
7.3.6 Over and under voltage relay (O.U.R)

The settings of this relay can be adjusted by the customer via the dedicated potentiometers. Factory settings are +8%/-8%/5 seconds. Outside these limits the generator will shut down (voltage LED of the module will light up).

7.3.7 Dual frequency

Not applicable for QAS 150 Volvo units.

The Dual frequency with electronic speed control option allows the unit to work at 50 Hz or at 60 Hz with an accuracy of constant load. The frequency selection is done by means of switch S11.



R11.... Voltage adjust potentiometer

Allows to adjust the output voltage

R16.... Frequency adjust potentiometer

Allows to adjust the frequency of the output voltage

S11.... Frequency selector switch (50 Hz/60 Hz)

Allows to choose the frequency of the output voltage: 50 Hz or 60 Hz.

Changing the output voltage is only allowed after shutdown.
After changing the output frequency, adjust the output voltage by means of potentiometer R11 to the required value.

7.4 Overview of the mechanical options

The following mechanical options are available:

– External fuel tank connection

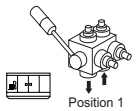
– Spillage free skid

7.5 Description of the mechanical options

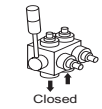
7.5.1 External fuel tank connection

The external fuel tank connection allows to bypass the internal fuel tank and to connect an external fuel tank to the unit.

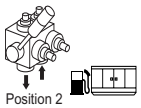
When using this option, make sure to connect the fuel supply line as well as the fuel return line. Always put both valves in the same position (either internal or external tank) and make sure that they are in the extreme (horizontal) position. Connections to fuellines ought to be air-tight to prevent air from entering the fuel system.



Position 1: Indicates that the fuel supply line to the engine is connected to the internal fueltank.



Position closed: Indicates that the fuel supply line to the engine is closed.



Position 2: Indicates that the fuel supply line to the engine is connected to the external fueltank.

7.5.2 Spillage free skid

A spillage free skid with forklift slots allows the customer to transport the generator easily with a forklift.

It avoids accidential spilling of engine fluids.

8 Technical specifications

8.1 Technical specifications for QAS 150 Volvo

8.1.1 Readings on gauges

Gauge	*Reading*	*Unit*
Ammeter L1-3 (P1-3)	Below max. rating	A
Voltmeter (P4)	Depends upon selector switch	V
Frequencymeter (P5) (only with AMF)	Between 50 and 52.5	Hz
Hourmeter (P6) (only with AMF)	Adding up	h
Fuel level gauge (P7) (only with AMF)	Above 0	fuel tank full
Engine coolant temperature gauge (P8) (only with AMF)	Below max. rating	°C
Engine oil pressure gauge (P9) (only with AMF)	Below max. rating	bar

8.1.2 Settings of switches

Switch	*Function*	*Activates at*
Engine oil pressure	Shut down	0.5 bar
Engine coolant temperature	Shut down	103°C

8.1.3 Specifications of the engine/alternator/unit

		50 Hz
Reference values 1) 4)	Rated frequency	50 Hz
	Rated speed	1500 rpm
	Generator service duty	PRP
	Absolute air inlet pressure	100 kPa
	Relative air humidity	30%
	Air inlet temperature	25°C
Limitations 2)	Maximum ambient temperature	50°C
	Altitude capability	4000 m
	Relative air humidity maximum	< 100%
	Minimum starting temperature unaided	-18°C
	Minimum starting temperature with heater	-25°C
Performance data 2) 3) 4) 5)	Rated active power (PRP) 3 phase	120 kW
	Rated power factor (lagging) 3 phase	0.8
	Rated apparent power (PRP) 3 phase	150 kVA
	Rated voltage 3 phase line to line	400 V
	Rated voltage 3 phase line to line, lower voltage	230 V
	Rated current 3 phase	216.5 A
	Rated current 3 phase, lower voltage	376.5 A
	Performance class (acc. to ISO 8528-5:1993)	G2
	Single step load acceptance (0-PRP)	100%
	Frequency droop	isochronous
	Fuel consumption at full load (PRP)	28.2 kg/h
	Specific fuel consumption at full load (PRP)	0.235 kg/kWh
	Fuel autonomy at full load (PRP)	16.2 h
	Max. oil consumption at full load (PRP)	0.1 l/h
	Max. sound power level (LWA @ 75% PRP load) measured according to REF 2000/14/EC OND	98 dB(A)
	Capacity of fuel tank	530 l
	Single step load capability (0-PRP)	100%
Application data	Mode of operation	PRP
	Site	land use
	Operation	single/parallel
	Start-up and control mode	manual/automatic
	Start-up time	unspecified
	Mobility/Config. acc. to ISO 8528-1:1993	transportable/D
	Mounting	fully resilient
	Climatic exposure	open air
	Degree of protection (cubicle)	IP40
	Status of neutral	earthed

Alternator	Standard	IEC 34-1 ISO 8528-3
	Make	MECC-ALTE
	Model	ECO 38 3L/N
	Rated output, class H temp. rise	350 kVA
	Rating type acc. ISO 8528-3	“BR” 125/40°C
	Degree of protection	IP21
	Insulation class stator	H
	Insulation class rotor	H
	Number of wires	12
Engine	Standard	ISO 3046 ISO 8528-2
	Type VOLVO	TAD720GE
	Rated net output	131.8 kW
	Rating type acc. ISO 3046-7	ICXN
	Production tolerance	0 to +2%
	Coolant	water
	Combustion system	direct injection
	Aspiration	turbocharged intercooled
	Number of cylinders	6
	Swept volume	7.15 l
	Speed governing	electronic
	Capacity of oil sump	17 l
	Capacity of cooling system	14 l
	Electrical system	24 Vdc
Power circuit	**Circuit-breaker, 3 phase**	
	Number of poles	4
	Thermal release It	215 A
	Magnetic release Im	3..10xIn
	Circuit-breaker, 3 phase, lower voltage	
	Number of poles	3
	Thermal release It	375 A
	Magnetic release Im	3..10xIn
	Residual current release IDn	0.025-25 A
	Outlet sockets (optional)	domestic (1x) 2p + E 16 A/230 V
Unit	Dimensions (L x W x H)	3470 x 1430 x 2130 mm
	Weight net mass	3005 kg
	Weight wet mass	3385 kg

Notes

1) Reference conditions for engine performance to ISO 3046-1.

2) See derating diagram or consult the factory for other conditions.

3) At reference conditions unless otherwise stated.

4) Rating definition (ISO 8528-1):
LTP: Limited Time Power is the maximum electrical power which a generating set is capable of delivering (at variable load), in the event of a utility power failure (for up to 500 hours per year of which a maximum of 300 hours is continuous running). No overload is permitted on these ratings. The alternator is peak continuous rated (as defined in ISO 8528-3) at 25°C.
PRP: Prime Power is the maximum power available during a variable power sequence, which may be run for an unlimited number of hours per year, between stated maintenance intervals and under the stated ambient conditions. A 10% overload is permitted for 1 hour in 12 hours. The permissible average power output during a 24h period shall not exceed the stated load factor of 80%.

5) Specific mass fuel used: 0.86 kg/l.

Derating table (in %, 100% is declarated power at "Performance data")

Height (m)	Temperature (°C)					
	25	**30**	**35**	**40**	**45**	**50**
1000	100	100	100	100	96	93
1500	96	96	96	96	92	89
2000	92	92	91	91	87	83
2500	88	88	85	85	81	78
3000	84	84	84	84	81	78
3500	78	78	78	78	74	71
4000	72	72	72	72	70	68

For use of generator outside these conditions, please contact Atlas Copco.

8.2 Technical specifications for QAS 200 Volvo

8.2.1 Readings on gauges

Gauge	*Reading*	*Unit*
Ammeter L1-3 (P1-3)	Below max. rating	A
Voltmeter (P4)	Depends upon selector switch	V
Frequencymeter (P5) (only with AMF)	Between 50 and 52.5	Hz
Hourmeter (P6) (only with AMF)	Adding up	h
Fuel level gauge (P7) (only with AMF)	Above 0	fuel tank full
Engine coolant temperature gauge (P8) (only with AMF)	Below max. rating	°C
Engine oil pressure gauge (P9) (only with AMF)	Below max. rating	bar

8.2.2 Settings of switches

Switch	*Function*	*Activates at*
Engine oil pressure	Shut down	0.5 bar
Engine coolant temperature	Shut down	103°C

8.2.3 Specifications of the engine/alternator/unit

		50 Hz	*60 Hz (DF)*
Reference values 1) 4)	Rated frequency	50 Hz	60 Hz
	Rated speed	1500 rpm	1800 rpm
	Generator service duty	PRP	PRP
	Absolute air inlet pressure	100 kPa	100 kPa
	Relative air humidity	30%	30%
	Air inlet temperature	25°C	25°C
Limitations 2)	Maximum ambient temperature	50°C	50°C
	Altitude capability	4000 m	4000 m
	Relative air humidity maximum	< 100%	< 100%
	Minimum starting temperature unaided	-18°C	-18°C
	Minimum starting temperature with heater	-25°C	-25°C
Performance data 2) 3) 4) 5)	Rated active power (PRP) 3 phase	160 kW	190.4 kW
	Rated power factor (lagging) 3 phase	0.8	0.8
	Rated apparent power (PRP) 3 phase	200 kVA	238 kVA
	Rated voltage 3 phase line to line	400 V	480 V
	Rated voltage 3 phase line to line, lower voltage	230 V	240 V
	Rated current 3 phase	288.7 A	286.3 A
	Rated current 3 phase, lower voltage	502 A	572.5 A
	Performance class (acc. to ISO 8528-5:1993)	G2	G2
	Single step load acceptance (0-PRP)	70%	90%
	Frequency droop	isochronous	isochronous
	Fuel consumption at full load (PRP)	34.1 kg/h	42.5 kg/h
	Specific fuel consumption at full load (PRP)	0.213 kg/kWh	0.223 kg/kWh
	Fuel autonomy at full load (PRP)	13.4 h	13.4 h
	Max. oil consumption at full load (PRP)	0.03 l/h	0.03 l/h
	Max. sound power level (LWA @ 75% PRP load) measured according to REF 2000/14/EC OND	98 dB(A)	-
	Capacity of fuel tank	530 l	530 l
	Single step load capability (0-PRP)	94%	100%
Application data	Mode of operation	PRP	PRP
	Site	land use	land use
	Operation	single/parallel	single/parallel
	Start-up and control mode	manual/automatic	manual/automatic
	Start-up time	unspecified	unspecified
	Mobility/Config. acc. to ISO 8528-1:1993	transportable/D	transportable/D
	Mounting	fully resilient	fully resilient
	Climatic exposure	open air	open air
	Degree of protection (cubicle)	IP54	IP54
	Status of neutral	earthed	earthed

Alternator	Standard	IEC 34-1 ISO 8528-3	IEC 34-1 ISO 8528-3
	Make	MECC-ALTE	MECC-ALTE
	Model	ECO 38 3S/4	ECO 38 3S/4
	Rated output, class H temp. rise	225 kVA	270 kVA
	Degree of protection	IP21	IP21
	Insulation class stator	H	H
	Insulation class rotor	H	H
	Number of wires	12	12
Engine	Standard	ISO 3046 ISO 8528-2	ISO 3046 ISO 8528-2
	Type VOLVO	TWD740GE	TWD740GE
	Rated net output	181 kW	207 kW
	Rating type acc. ISO 3046-7	ICXN	ICXN
	Production tolerance	0 to +2%	0 to +2%
	Coolant	water	water
	Combustion system	direct injection	direct injection
	Aspiration	turbocharged intercooled	turbocharged intercooled
	Number of cylinders	6	6
	Swept volume	7.28 l	7.28 l
	Speed governing	electronic	electronic
	Capacity of oil sump	24 l	24 l
	Capacity of cooling system	26 l	26 l
	Electrical system	24 Vdc	24 Vdc
Power circuit	**Circuit-breaker, 3 phase**		
	Number of poles	4	4
	Thermal release It	290 A	290 A
	Magnetic release Im	3..10xIn	3..10xIn
	Circuit-breaker, 3 phase, lower voltage		
	Number of poles	3	4
	Thermal release It	750 A	750 A
	Magnetic release Im	3..10xIn	3..10xIn
	Residual current release IDn	0.025-25 A	0.025-25 A
	Outlet sockets (optional)	domestic (1x) 2p + E 16 A/230 V	
Unit	Dimensions (L x W x H)	3470 x 1430 x 2130 mm	3470 x 1430 x 2130 mm
	Weight net mass	3300 kg	3300 kg
	Weight wet mass	3740 kg	3740 kg

Notes

1) Reference conditions for engine performance to ISO 3046-1.

2) See derating diagram or consult the factory for other conditions.

3) At reference conditions unless otherwise stated.

4) Rating definition (ISO 8528-1):
LTP: Limited Time Power is the maximum electrical power which a generating set is capable of delivering (at variable load), in the event of a utility power failure (for up to 500 hours per year of which a maximum of 300 hours is continuous running). No overload is permitted on these ratings. The alternator is peak continuous rated (as defined in ISO 8528-3) at 25°C.
PRP: Prime Power is the maximum power available during a variable power sequence, which may be run for an unlimited number of hours per year, between stated maintenance intervals and under the stated ambient conditions. A 10% overload is permitted for 1 hour in 12 hours. The permissible average power output during a 24h period shall not exceed the stated load factor of 80%.

5) Specific mass fuel used: 0.86 kg/l.

Derating table (in %, 100% is declarated power at "Performance data")

Height (m)	Temperature (°C)					
	25	**30**	**35**	**40**	**45**	**50**
1000	100	100	100	100	96	93
1500	96	96	96	96	92	89
2000	92	92	91	91	87	83
2500	88	88	85	85	81	78
3000	84	84	84	84	81	78
3500	78	78	78	78	74	71
4000	72	72	72	72	70	68

For use of generator outside these conditions, please contact Atlas Copco.

8.3 Technical specifications for QAS 250 Volvo

8.3.1 Readings on gauges

Gauge	*Reading*	*Unit*
Ammeter L1-3 (P1-3)	Below max. rating	A
Voltmeter (P4)	Depends upon selector switch	V
Frequencymeter (P5) (only with AMF)	Between 50 and 52.5	Hz
Hourmeter (P6) (only with AMF)	Adding up	h
Fuel level gauge (P7) (only with AMF)	Above 0	fuel tank full
Engine coolant temperature gauge (P8) (only with AMF)	Below max. rating	°C
Engine oil pressure gauge (P9) (only with AMF)	Below max. rating	bar

8.3.2 Settings of switches

Switch	*Function*	*Activates at*
Engine oil pressure	Shut down	0.5 bar
Engine coolant temperature	Shut down	103°C

8.3.3 Specifications of the engine/alternator/unit

		50 Hz	*60 Hz (DF)*
Reference values 1) 4)	Rated frequency	50 Hz	60 Hz
	Rated speed	1500 rpm	1800 rpm
	Generator service duty	PRP	PRP
	Absolute air inlet pressure	100 kPa	100 kPa
	Relative air humidity	30%	30%
	Air inlet temperature	25°C	25°C
Limitations 2)	Maximum ambient temperature	50°C	50°C
	Altitude capability	4000 m	4000 m
	Relative air humidity maximum	< 100%	< 100%
	Minimum starting temperature unaided	-18°C	-18°C
	Minimum starting temperature with heater	-25°C	-25°C
Performance data 2) 3) 4) 5)	Rated active power (PRP) 3 phase	200 kW	209.8 kW
	Rated power factor (lagging) 3 phase	0.8	0.8
	Rated apparent power (PRP) 3 phase	250 kVA	262 kVA
	Rated voltage 3 phase line to line	400 V	480 V
	Rated voltage 3 phase line to line, lower voltage	230 V	240 V
	Rated current 3 phase	360.8 A	315.1 A
	Rated current 3 phase, lower voltage	627.6 A	630.3 A
	Performance class (acc. to ISO 8528-5:1993)	G2	G2
	Single step load acceptance (0-PRP)	60%	80%
	Frequency droop	isochronous	isochronous
	Fuel consumption at full load (PRP)	43.2 kg/h	46.8 kg/h
	Specific fuel consumption at full load (PRP)	0.216 kg/kWh	0.223 kg/kWh
	Fuel autonomy at full load (PRP)	10.6 h	9.7 h
	Max. oil consumption at full load (PRP)	0.04 l/h	0.05 l/h
	Max. sound power level (LWA @ 75% PRP load) measured according to REF 2000/14/EC OND	98 dB(A)	-
	Capacity of fuel tank	530 l	530 l
	Single step load capability (0-PRP)	90%	100%
Application data	Mode of operation	PRP	PRP
	Site	land use	land use
	Operation	single/parallel	single/parallel
	Start-up and control mode	manual/automatic	manual/automatic
	Start-up time	unspecified	unspecified
	Mobility/Config. acc. to ISO 8528-1:1993	transportable/D	transportable/D
	Mounting	fully resilient	fully resilient
	Climatic exposure	open air	open air
	Degree of protection (cubicle)	IP54	IP54
	Status of neutral	earthed	earthed

Alternator	Standard	IEC 34-1 ISO 8528-3	IEC 34-1 ISO 8528-3
	Make	MECC-ALTE	MECC-ALTE
	Model	ECO 38 1L/4	ECO 38 1L/4
	Rated output, class H temp. rise	250 kVA	300 kVA
	Degree of protection	IP21	IP21
	Insulation class stator	H	H
	Insulation class rotor	H	H
	Number of wires	12	12
Engine	Standard	ISO 3046 ISO 8528-2	ISO 3046 ISO 8528-2
	Type VOLVO	TAD740GE	TAD740GE
	Rated net output	220 kW	228 kW
	Rating type acc. ISO 3046-7	ICXN	ICXN
	Production tolerance	0 to +2%	0 to +2%
	Coolant	water	water
	Combustion system	direct injection	direct injection
	Aspiration	turbocharged intercooled	turbocharged intercooled
	Number of cylinders	6	6
	Swept volume	7.28 l	7.28 l
	Speed governing	electronic	electronic
	Capacity of oil sump	24 l	24 l
	Capacity of cooling system	21 l	21 l
	Electrical system	24 Vdc	24 Vdc
Power circuit	**Circuit-breaker, 3 phase**		
	Number of poles	4	4
	Thermal release It	360 A	360 A
	Magnetic release Im	3..10xIn	3..10xIn
	Circuit-breaker, 3 phase, lower voltage		
	Number of poles	3	4
	Thermal release It	625 A	625 A
	Magnetic release Im	3..10xIn	3..10xIn
	Residual current release IDn	0.025-25 A	0.025-25 A
	Outlet sockets (optional)	domestic (1x) 2p + E 16 A/230 V	
Unit	Dimensions (L x W x H)	3955 x 1430 x 2130 mm	3955 x 1430 x 2130 mm
	Weight net mass	3450 kg	3450 kg
	Weight wet mass	3860 kg	3860 kg

Notes

1) Reference conditions for engine performance to ISO 3046-1.

2) See derating diagram or consult the factory for other conditions.

3) At reference conditions unless otherwise stated.

4) Rating definition (ISO 8528-1):
LTP: Limited Time Power is the maximum electrical power which a generating set is capable of delivering (at variable load), in the event of a utility power failure (for up to 500 hours per year of which a maximum of 300 hours is continuous running). No overload is permitted on these ratings. The alternator is peak continuous rated (as defined in ISO 8528-3) at 25°C.
PRP: Prime Power is the maximum power available during a variable power sequence, which may be run for an unlimited number of hours per year, between stated maintenance intervals and under the stated ambient conditions. A 10% overload is permitted for 1 hour in 12 hours. The permissible average power output during a 24h period shall not exceed the stated load factor of 80%.

5) Specific mass fuel used: 0.86 kg/l.

Derating table (in %, 100% is declarated power at "Performance data")

Height (m)	Temperature (°C)					
	25	**30**	**35**	**40**	**45**	**50**
1000	100	100	100	100	96	93
1500	96	96	96	96	92	89
2000	92	92	91	91	87	83
2500	88	88	85	85	81	78
3000	84	84	84	84	81	78
3500	78	78	78	78	74	71
4000	72	72	72	72	70	68

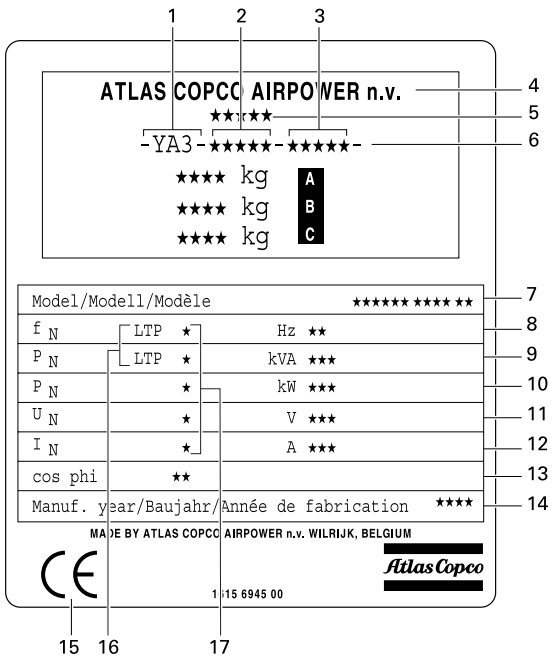
For use of generator outside these conditions, please contact Atlas Copco.

8.4 Conversion list of SI units into British units

1 bar	=	14.504 psi	1 m	=	3.281 ft
1 g	=	0.035 oz	1 mm	=	0.039 in
1 kg	=	2.205 lb	1 m^3/min	=	35.315 cfm
1 km/h	=	0.621 mile/h	1 mbar	=	0.401 in wc
1 kW	=	1.341 hp (UK and US)	1 N	=	0.225 lbf
1 l	=	0.264 US gal	1 Nm	=	0.738 lbf.ft
1 l	=	0.220 lmp gal (UK)	$t_{°F}$	=	32 + (1.8 x $t_{°C}$)
1 l	=	0.035 cu.ft	$t_{°C}$	=	($t_{°F}$ - 32)/1.8

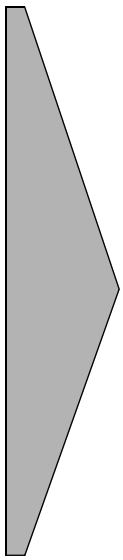
A temperature difference of 1°C = a temperature difference of 1.8°F.

8.5 Dataplate

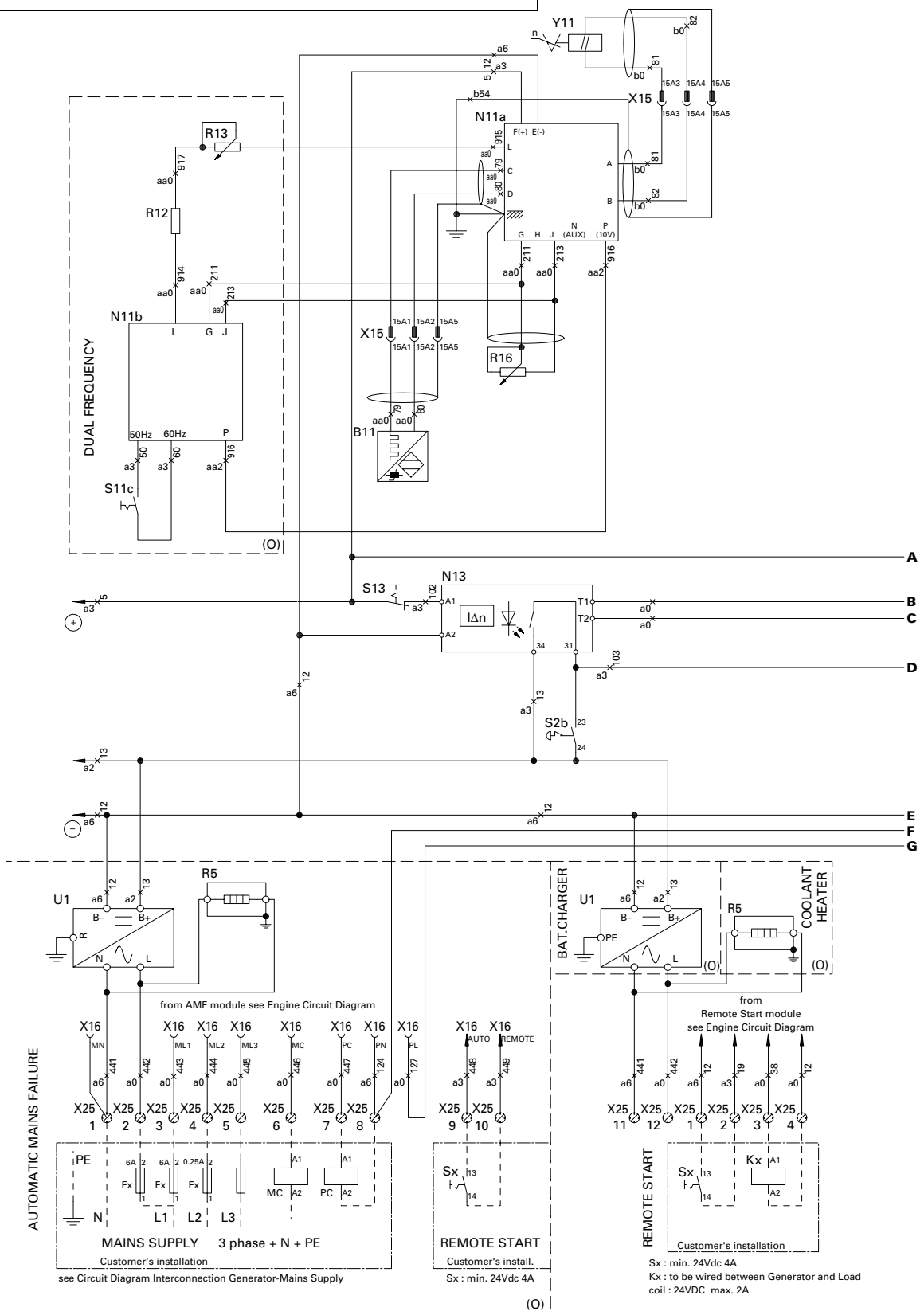


A	Maximum permitted loaded weight of the vehicle
B	Maximum permitted road weight of the front axle
C	Maximum permitted road weight of the rear axle
1	Company code
2	Product code
3	Unit serial number
4	Name of the manufacturer
5	EEC or national type approval number
6	Vehicle identification number
7	Model number
8	Frequency
9	Apparant power - PRP
10	Active power - PRP
11	Nominal rated voltage
12	Nominal rated current
13	Power factor
14	Manufacturing year
15	EEC mark in accordance witt Machine Directive 89/392E
16	Mode of operation
17	Winding connections

Circuit diagrams

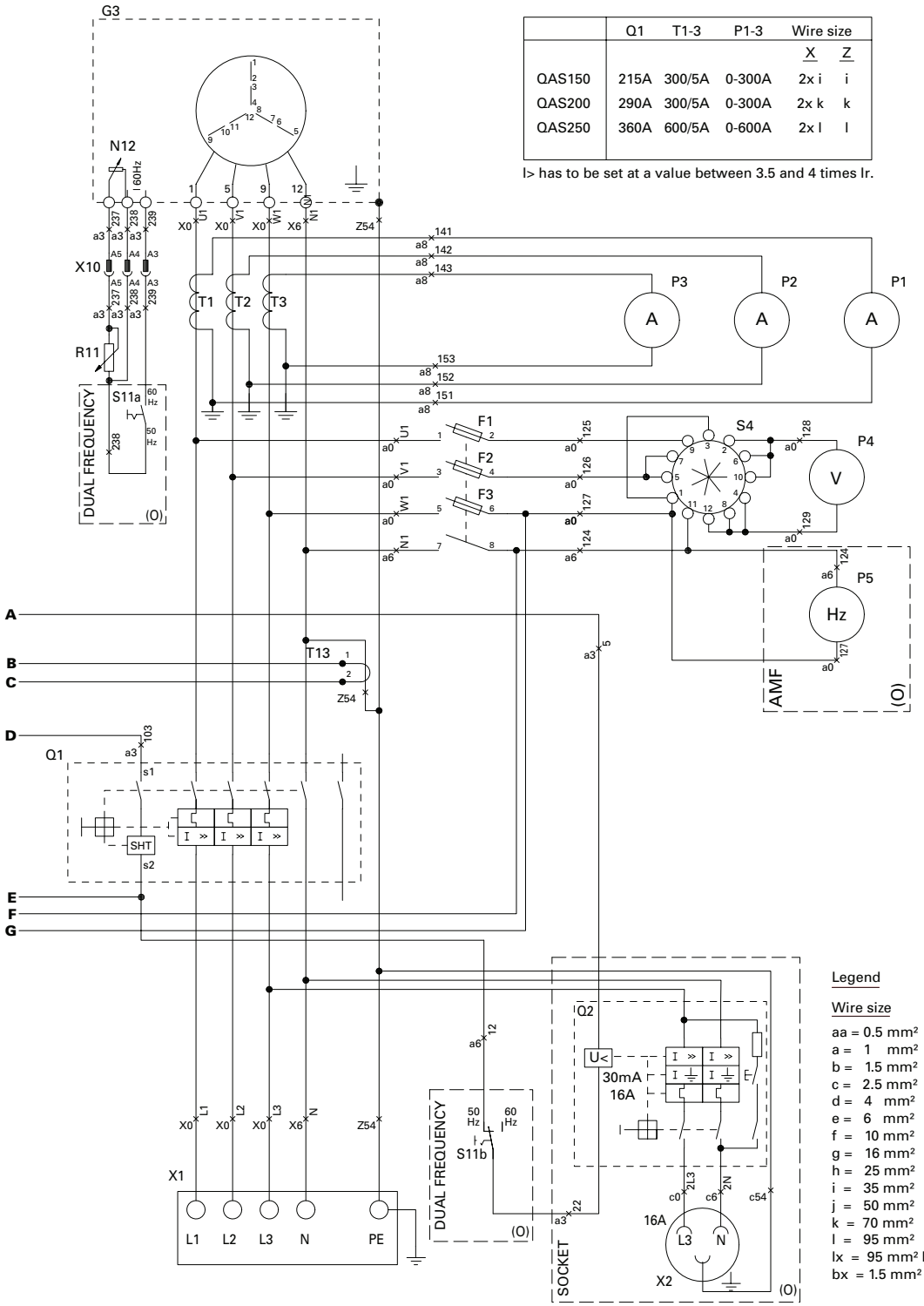


9822 0889 51/07
Applicable for QAS 150-200-250 Volvo - Power Circuit



B11	Magnetic speed pick up	N11b	Dual frequency controller	P4	Voltmeter 0-500V
F1-3	Fuse 4 A	N12	Automatic voltage regulator	P5	Frequencymeter 45-65 Hz
G3	Alternator	N13	Earth fault current relay	Q1	Main circuit breaker
N11a	Engine speed controller	P1-3	Amperemeter	Q2	Circuit breaker

CIRCUIT DIAGRAM



	Q1	T1-3	P1-3	Wire size	
				X	Z
QAS150	215A	300/5A	0-300A	2x i	i
QAS200	290A	300/5A	0-300A	2x k	k
QAS250	360A	600/5A	0-600A	2x l	l

I> has to be set at a value between 3.5 and 4 times Ir.

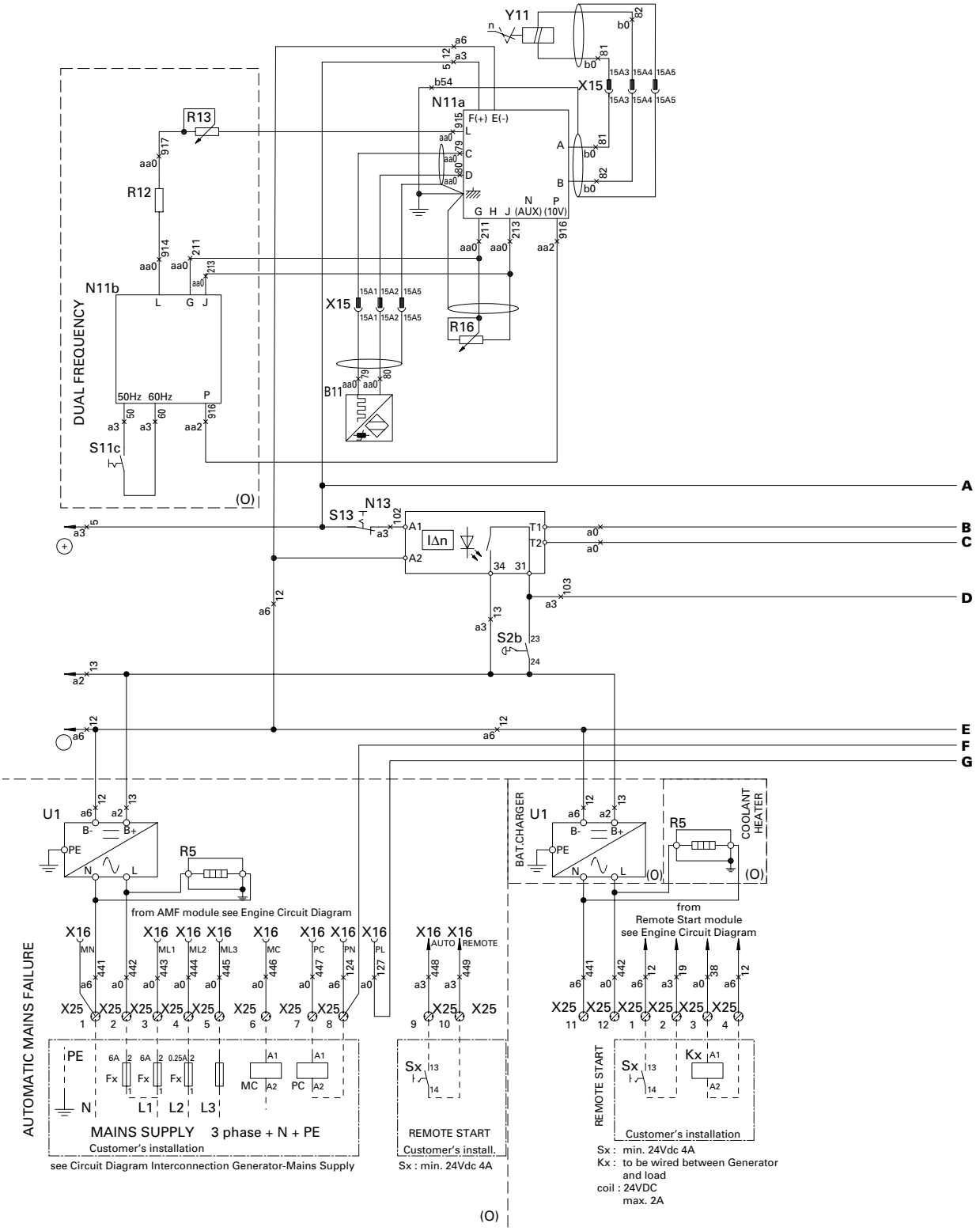
Legend

Wire size	Colour code
aa = 0.5 mm²	0 = black
a = 1 mm²	1 = brown
b = 1.5 mm²	2 = red
c = 2.5 mm²	3 = orange
d = 4 mm²	4 = yellow
e = 6 mm²	5 = green
f = 10 mm²	6 = blue
g = 16 mm²	7 = purple
h = 25 mm²	8 = grey
i = 35 mm²	9 = white
j = 50 mm²	54 = green/yellow
k = 70 mm²	
l = 95 mm²	

lx = 95 mm² EPR-CSP to BS6195 4C
bx = 1.5 mm² NSGAFOeU

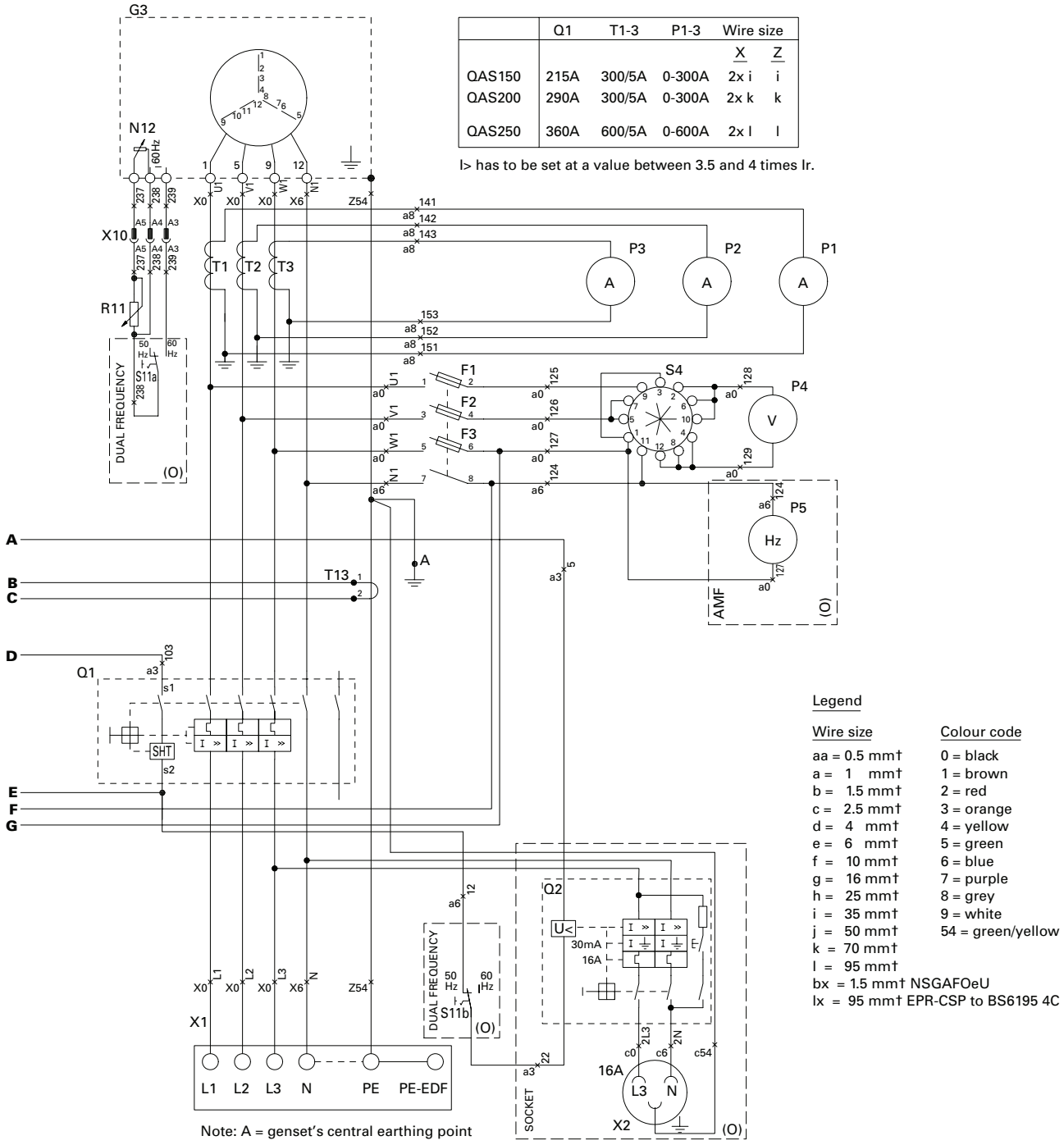
R5	Coolant heater	S11 a, b, c	Selector switch 50 Hz / 60 Hz	X10, X15	15-pole connector
R11	Voltage adjustment potentiometer	S13	Earth relay lock-out switch	X25	Terminal strip
R12	Resistor for dual frequency (fixed)	T1-3	Current transformer	Y11	Actuator
R13	Resistor for dual frequency (variable)	T13	Toroid transformer for earth relay	Sx	Remote Start/Stop
R16	Engine speed adjustment potmeter	U1	Static battery conditioner	Kx	Contactor generator ready (by voltage free contact, 15 sec. delayed)
S2b	Emergency stop (S2a: see Engine Circ)	X1	Terminal board		
S4	Voltmeter change-over switch	X2	Outlet socket		

9822 0889 53/06
Applicable for QAS 150-200-250 Volvo - Electricité de France



B11	Magnetic speed pick up	N12	Automatic voltage regulator	P5	Frequencymeter 45-65Hz
F1-3	Fuse 4 A	N13	Earth fault-current relay	Q1	Main circuit breaker
G3	Alternator	P1-3	Amperemeter	Q2	Circuit breaker
N11	Engine speed controller	P4	Voltmeter 0-500V	R5	Coolant heater

CIRCUIT DIAGRAM



	Q1	T1-3	P1-3	Wire size X	Wire size Z
QAS150	215A	300/5A	0-300A	2x i	i
QAS200	290A	300/5A	0-300A	2x k	k
QAS250	360A	600/5A	0-600A	2x l	l

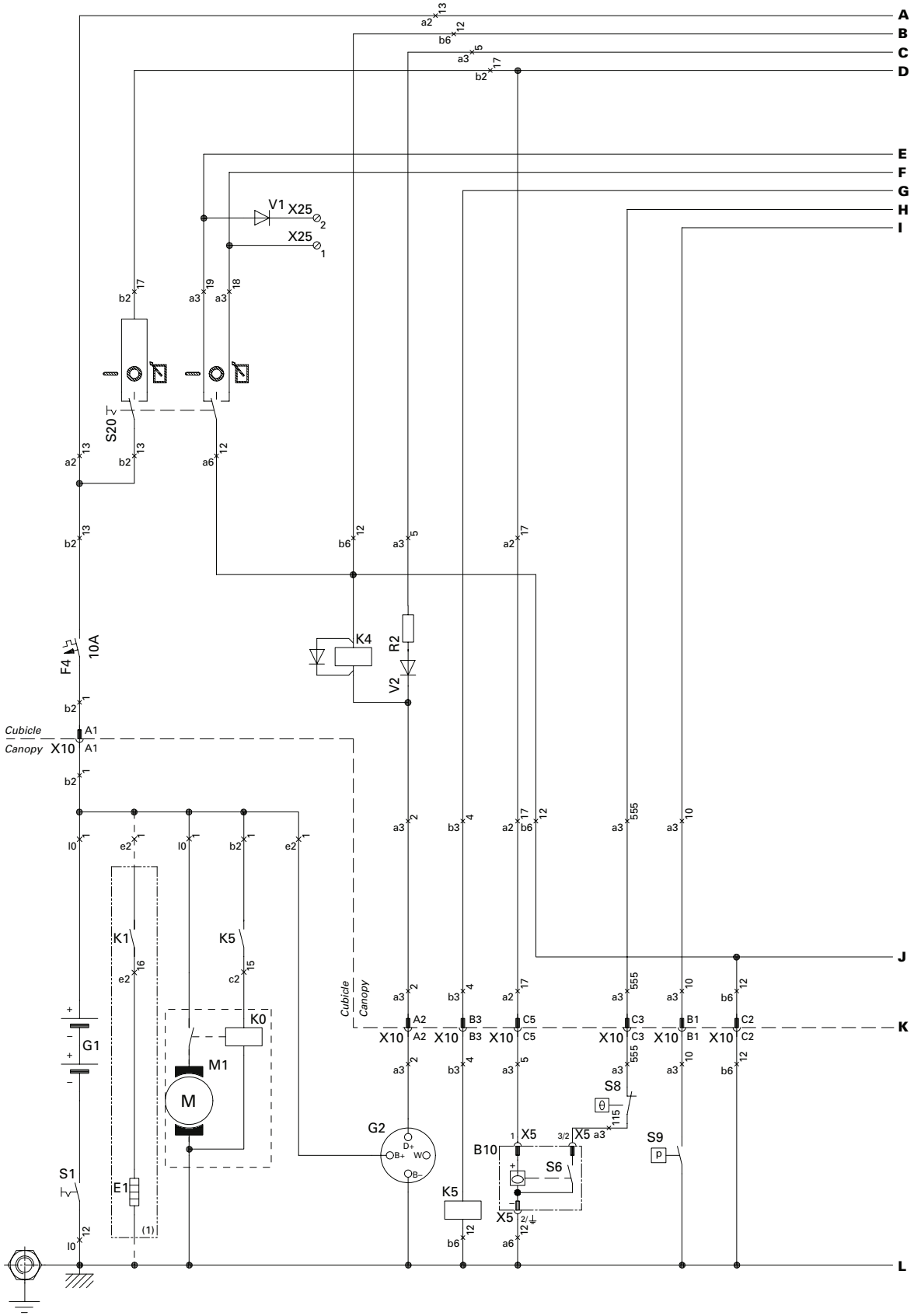
I> has to be set at a value between 3.5 and 4 times Ir.

Legend

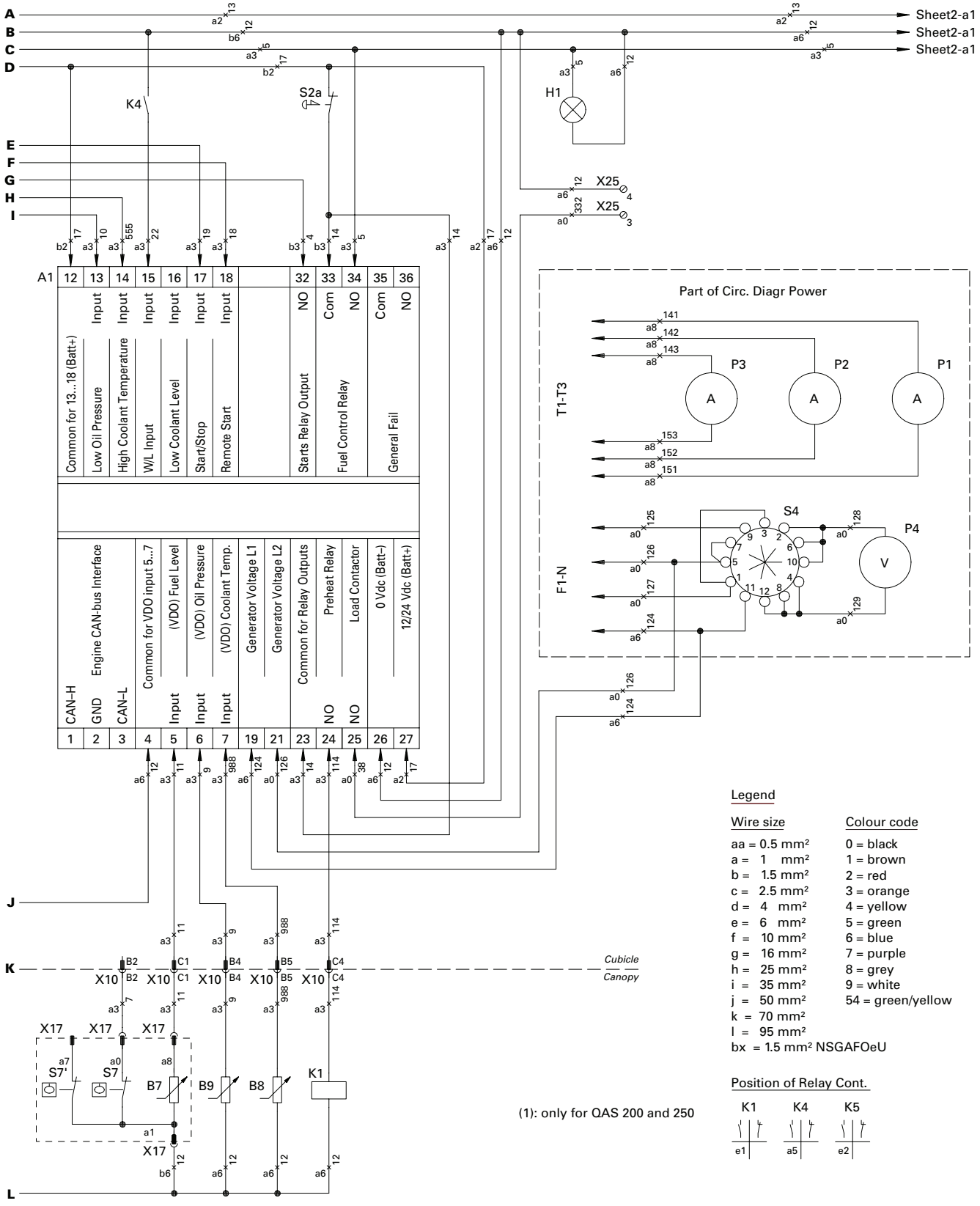
Wire size	Colour code
aa = 0.5 mm†	0 = black
a = 1 mm†	1 = brown
b = 1.5 mm†	2 = red
c = 2.5 mm†	3 = orange
d = 4 mm†	4 = yellow
e = 6 mm†	5 = green
f = 10 mm†	6 = blue
g = 16 mm†	7 = purple
h = 25 mm†	8 = grey
i = 35 mm†	9 = white
j = 50 mm†	54 = green/yellow
k = 70 mm†	
l = 95 mm†	
bx = 1.5 mm† NSGAFOeU	
lx = 95 mm† EPR-CSP to BS6195 4C	

R11	Voltage adjustment potentiometer	S13	Earth fault relay lock-out switch	X25	Terminal strip
R12	Resistor for dual frequency (fixed)	T1-3	Current transformer	Y11	Actuator
R13	Resistor for dual frequency (variable)	T13	Toroid transformer for earth relay	Sx	Remote Start/Stop
R16	Engine speed adjustment potmeter	U1	Static battery conditioner	Kx	Contactor generator ready (by voltage free contact, 15 sec. delayed)
S2b	Emergency stop (S2a: see Engine Circ)	X1	Terminal board		
S4	Voltmeter change-over switch	X2	Outlet socket		
S11 a, b, c	Selector switch 50/60 Hz	X10, X15	15-pole connector		

9822 0889 57/02 A
Applicable for QAS 150-200-250 Volvo - Qc1001™, Engine Circuit



CIRCUIT DIAGRAM



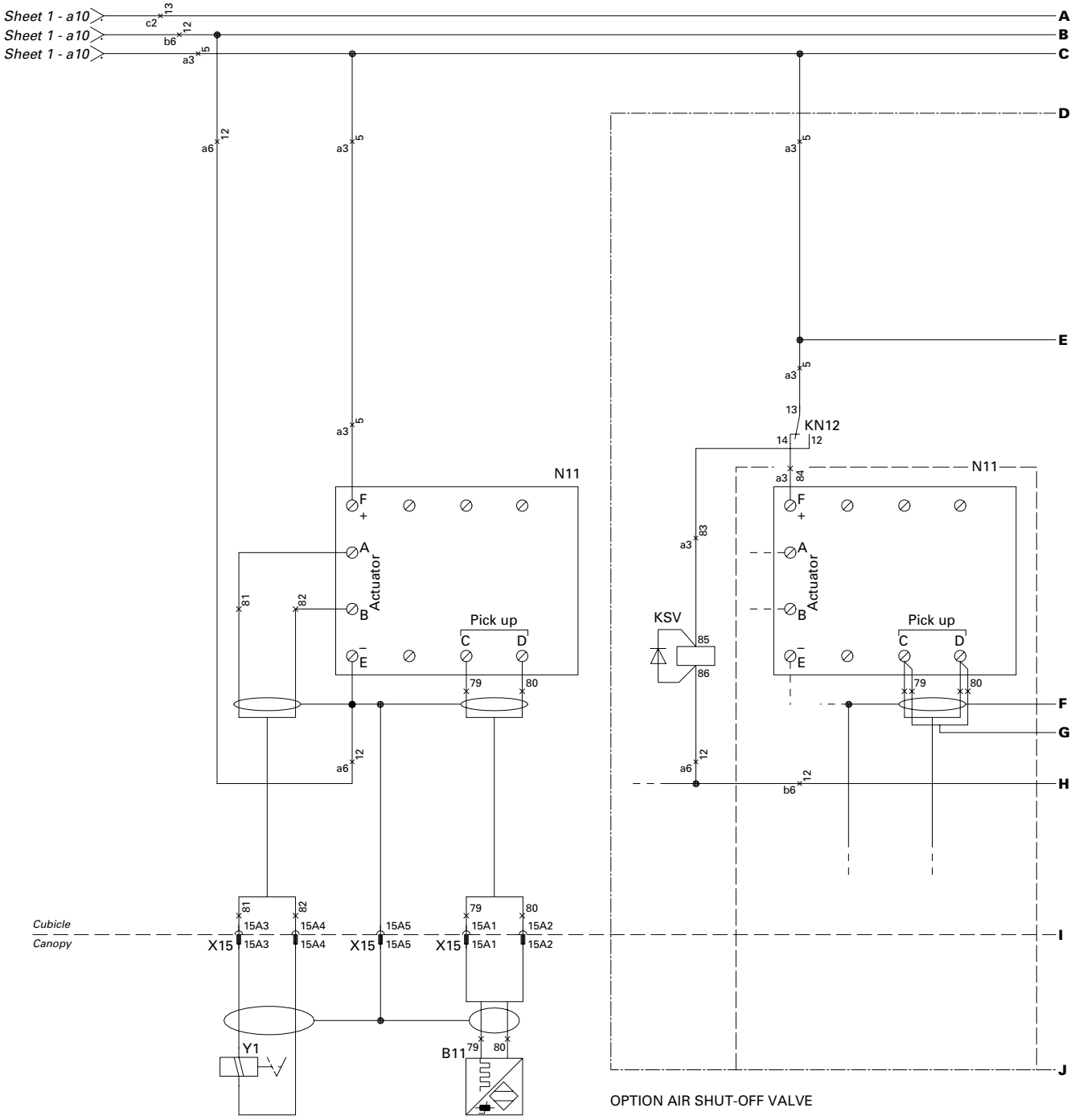
(1): only for QAS 200 and 250

Legend

Wire size	Colour code
aa = 0.5 mm²	0 = black
a = 1 mm²	1 = brown
b = 1.5 mm²	2 = red
c = 2.5 mm²	3 = orange
d = 4 mm²	4 = yellow
e = 6 mm²	5 = green
f = 10 mm²	6 = blue
g = 16 mm²	7 = purple
h = 25 mm²	8 = grey
i = 35 mm²	9 = white
j = 50 mm²	54 = green/yellow
k = 70 mm²	
l = 95 mm²	
bx = 1.5 mm² NSGAFOeU	

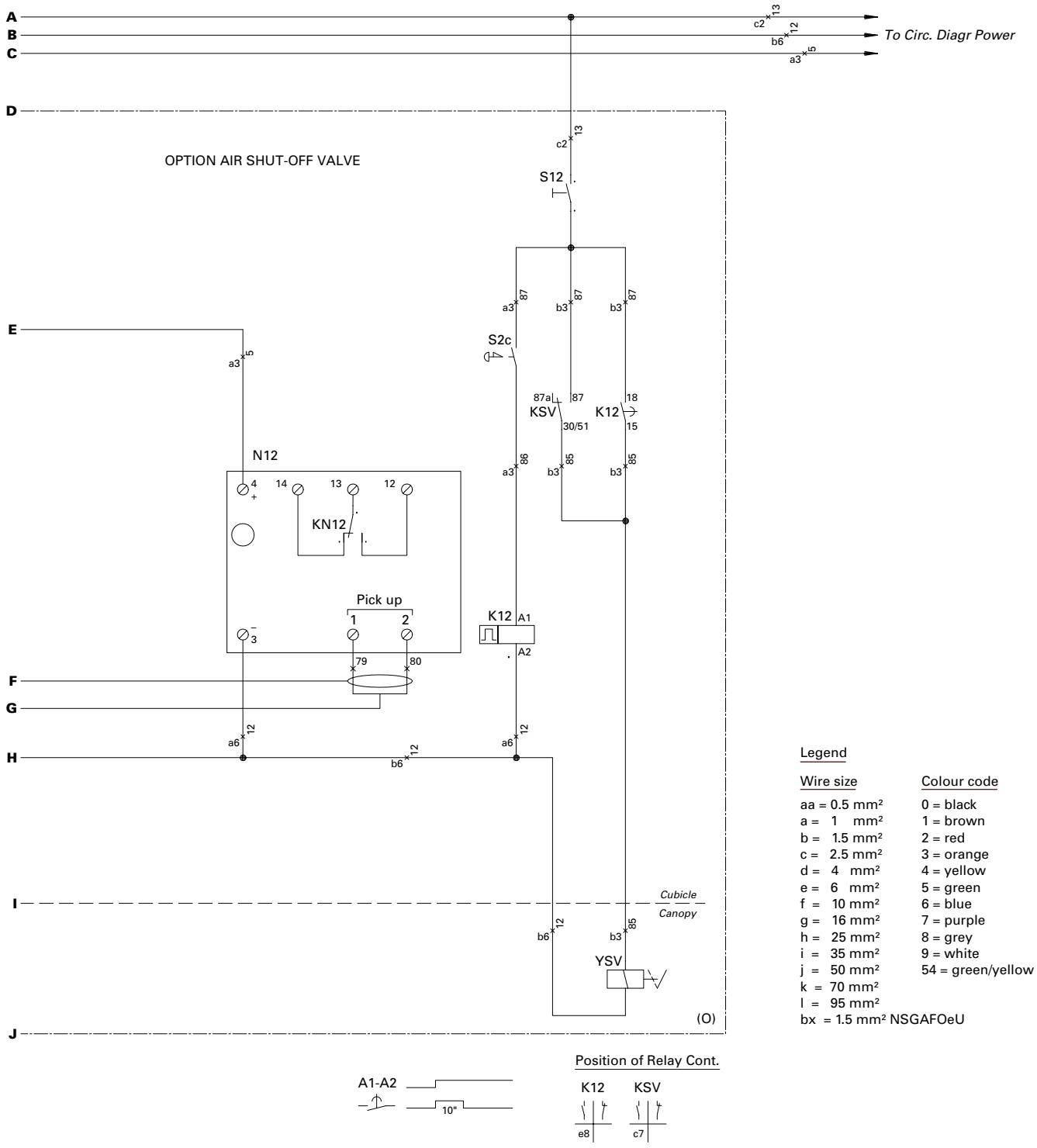
Position of Relay Cont.

9822 0889 57/02 B
Applicable for QAS 150-200-250 Volvo - Qc1001™, Engine Circuit



A1	Control module	F4	Fuse	K5	Starter relay
B7	Fuel level sensor	G1	Battery 24V	M1	Starter motor
B8	Coolant temperature sensor	G2	Charging alternator	N11	Speed controller
B9	Oil pressure sensor	H1	Panel light	R2	Excitation resistor 470 Ohm
B10	Coolant level switch	K0	Starter solenoid	S1	Battery switch
B11	Speed pick up	K1	Preheat relay		
E1	Preheat resistor	K4	W/L invertor relay		

CIRCUIT DIAGRAM



Legend

Wire size	Colour code
aa = 0.5 mm²	0 = black
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c = 2.5 mm²	3 = orange
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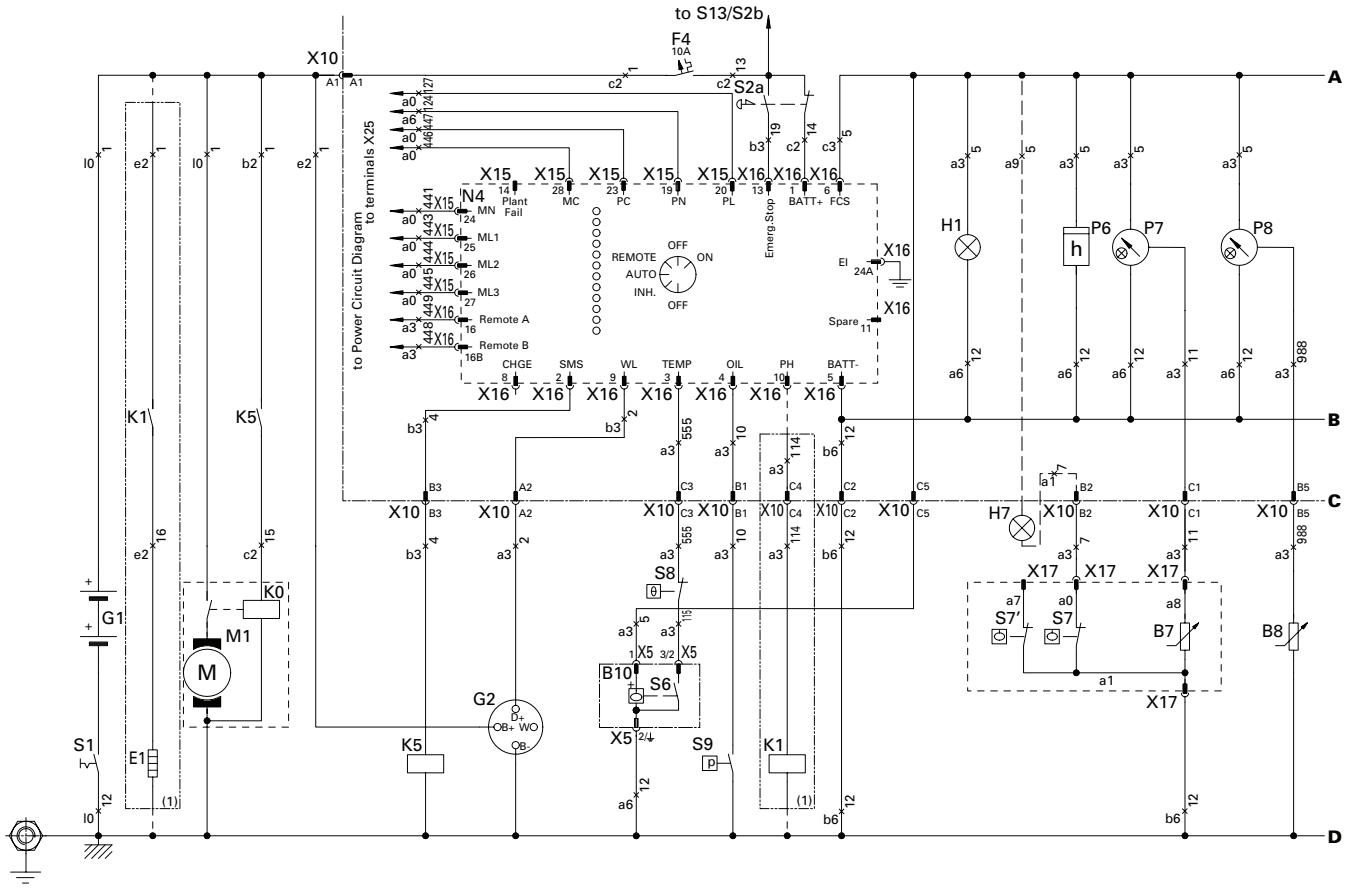
g = 16 mm²	7 = purple
h = 25 mm²	8 = grey
i = 35 mm²	9 = white
j = 50 mm²	54 = green/yellow
k = 70 mm²	
l = 95 mm²	
bx = 1.5 mm² NSGAFOeU	

S2a	Emergency stop button	V1, V2	Diode		**Air shut-off valve option**
S2c	(S2b: see Power Circuit)	X10, X15	15-pole connector	K12	Timer relay shut-off valve
S6	Low coolant level switch	X17	Fuel level unit connector	KSV	Aux. relay shut-off valve
S7	Low fuel level switch	X25	Customer's terminal strip	N12	Speed switch
S7'	Low fuel level switch, warning	Y1	Actuator		Set at 3548 Hz for QAS 150
S8	Coolant high temperature switch				Set at 3850 Hz for QAS 200, 250
S9	Engine oil low pressure switch			S12	On-off switch shut-off valve
S20	ON/OFF/remote switch			YSV	Air shut-off valve

9822 0889 59/04
Applicable for QAS 150-200-250 Volvo - Automatic Mains Failure, Engine Circuit

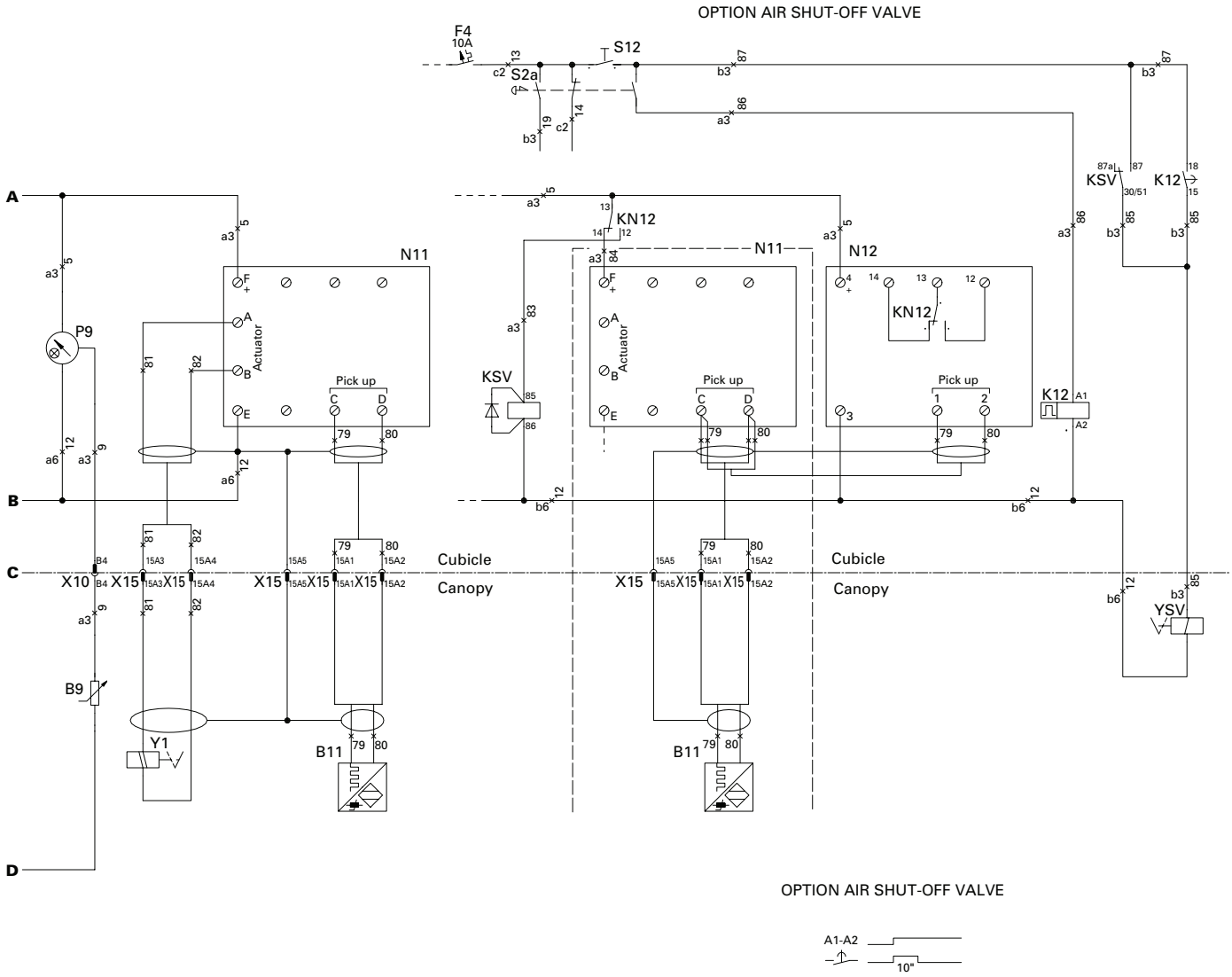


Legend

Wire size	Colour code
aa = 0.5 mm†	0 = black
a = 1 mm†	1 = brown
b = 1.5 mm†	2 = red
c = 2.5 mm†	3 = orange
d = 4 mm†	4 = yellow
e = 6 mm†	5 = green
f = 10 mm†	6 = blue
g = 16 mm†	7 = purple
h = 25 mm†	8 = grey
i = 35 mm†	9 = white
j = 50 mm†	54 = green/yellow
k = 70 mm†	
l = 95 mm†	
bx = 1.5 mm† NSGAFOeU	

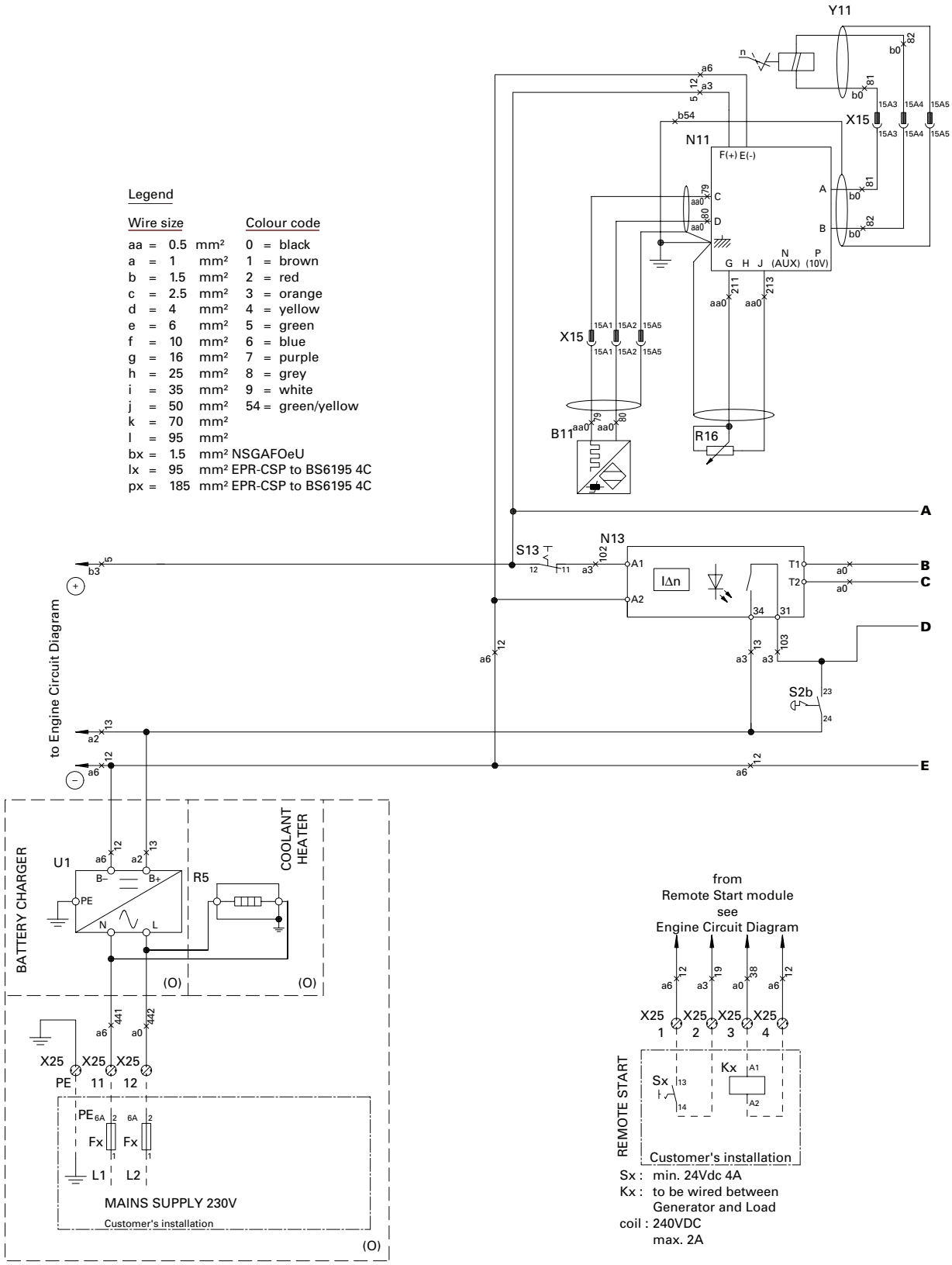
B7	Fuel level sensor	E1	Preheat resistor	H7	Indic. lamp low fuel level (optional)
B8	Coolant temperature sensor	F4	Fuse	K0	Starter solenoid
B9	Oil pressure sensor	G1	Battery 24V	K1	Preheat relay
B10	Coolant level switch	G2	Charging alternator	K5	Starter relay
B11	Speed pick up	H1	Panel light	M1	Starter motor

CIRCUIT DIAGRAM



N4	Control module	S1	Battery switch	S8	Coolant high temperature switch
N11	Speed controller	S2a	Emergency stop button (S2b: see Power Circuit)	S9	Engine oil low pressure switch
P6	Hourmeter			X10, X15	15-pole connector
P7	Fuel level gauge	S6	Low coolant level switch	X16	Module connector
P8	Coolant temperature gauge	S7	Low fuel level switch	X17	Fuel level unit connector
P9	Oil pressure gauge	S7’	Low fuel level switch, warning	Y1	(1) Fuel stop solenoid / (2) Actuator

9822 0889 60/05
Applicable for QAS 150-200-250 Volvo - Power Circuit, Low Voltage

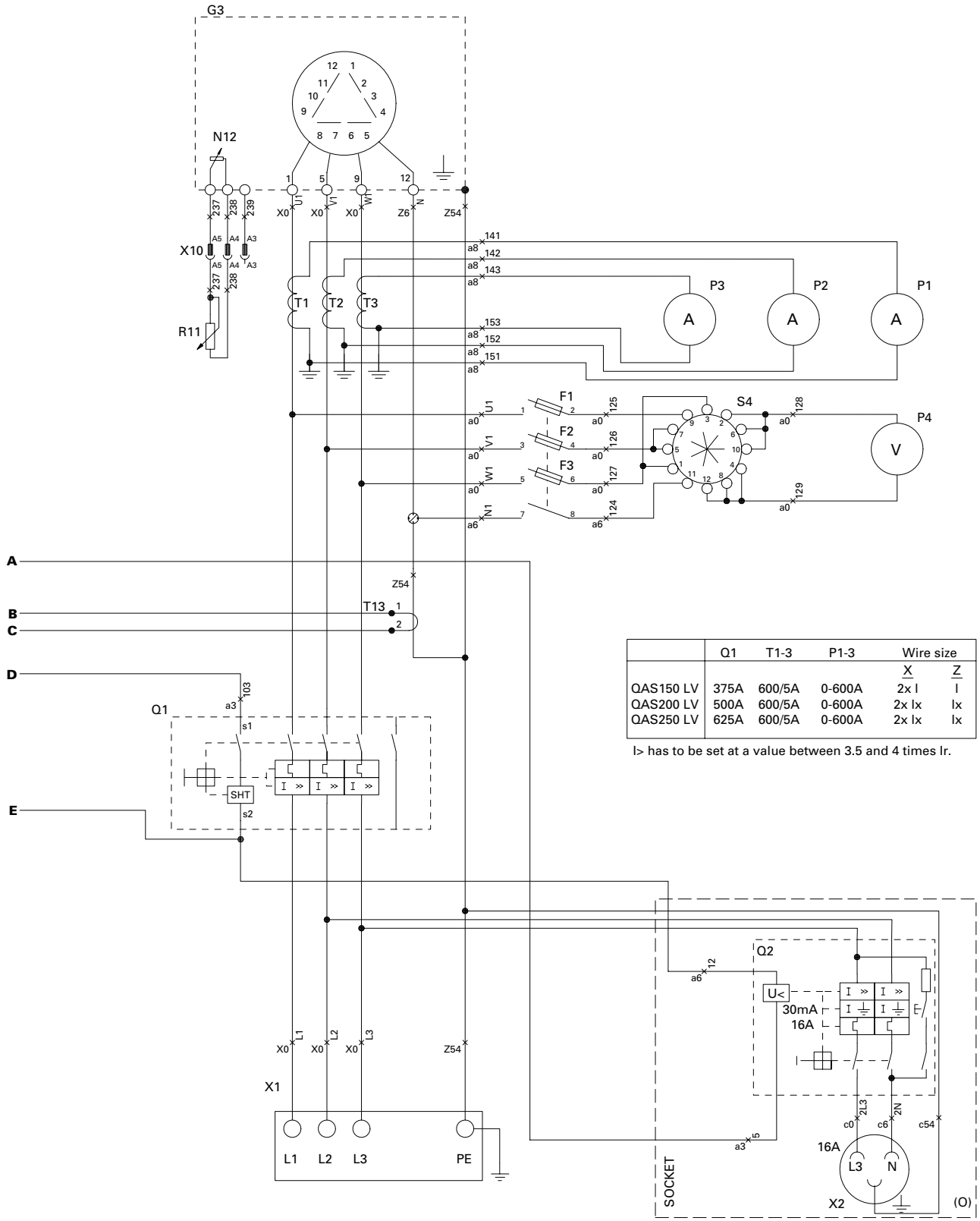


Legend

Wire size			Colour code		
aa	= 0.5	mm²	0	=	black
a	= 1	mm²	1	=	brown
b	= 1.5	mm²	2	=	red
c	= 2.5	mm²	3	=	orange
d	= 4	mm²	4	=	yellow
e	= 6	mm²	5	=	green
f	= 10	mm²	6	=	blue
g	= 16	mm²	7	=	purple
h	= 25	mm²	8	=	grey
i	= 35	mm²	9	=	white
j	= 50	mm²	54	=	green/yellow
k	= 70	mm²			
l	= 95	mm²			
bx	= 1.5	mm²	NSGAFOeU		
lx	= 95	mm²	EPR-CSP to BS6195 4C		
px	= 185	mm²	EPR-CSP to BS6195 4C		

F1-3	Fuse 4 A	N13	Earth fault-current relay	Q1	Circuit breaker
G3	Alternator	P1-3	Amperemeter	Q2	Circuit breaker
N12	Automatic voltage regulator	P4	Voltmeter 0-500V		

CIRCUIT DIAGRAM

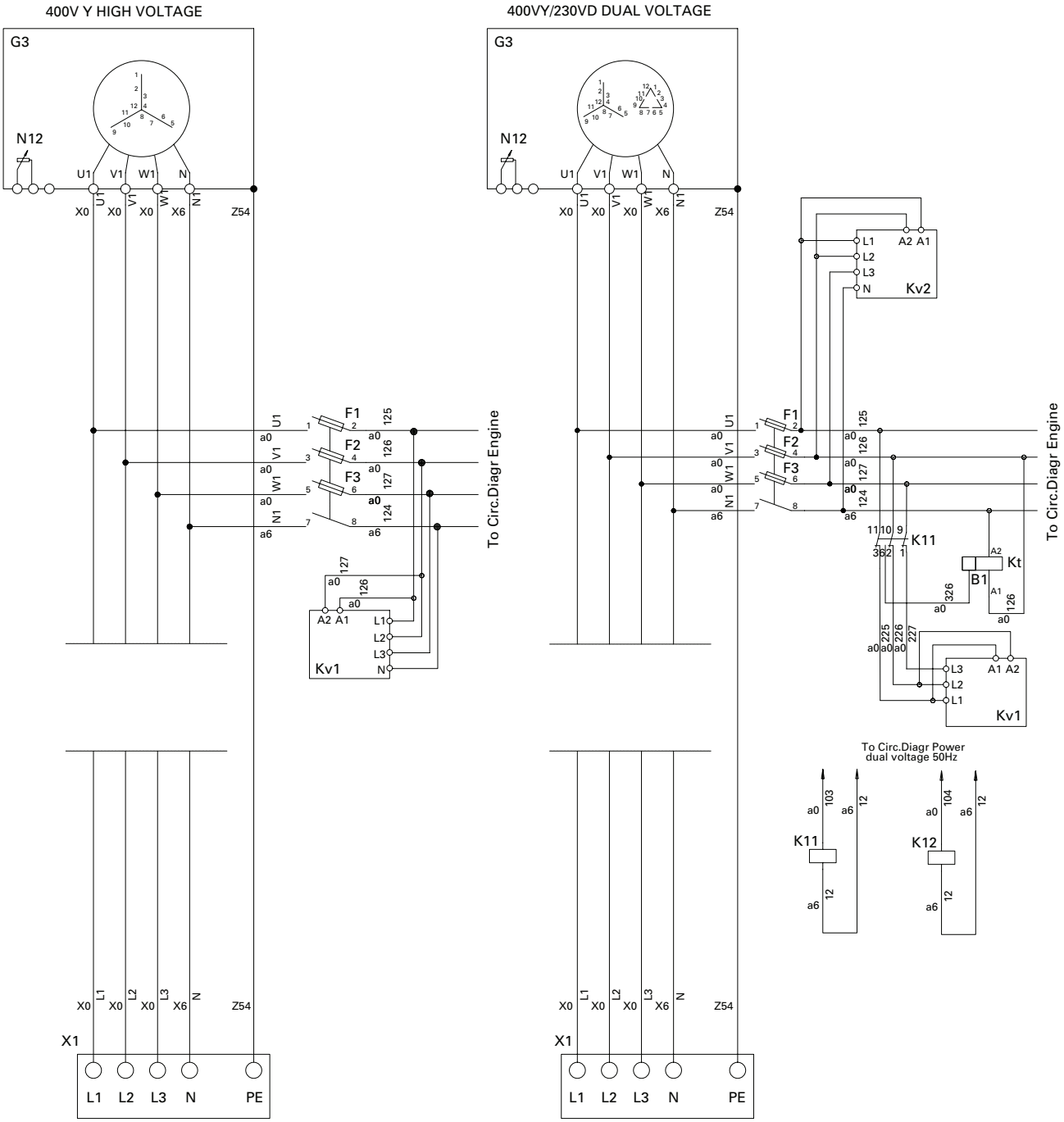


	Q1	T1-3	P1-3	Wire size	
				X	Z
QAS150 LV	375A	600/5A	0-600A	2x I	I
QAS200 LV	500A	600/5A	0-600A	2x Ix	Ix
QAS250 LV	625A	600/5A	0-600A	2x Ix	Ix

I> has to be set at a value between 3.5 and 4 times Ir.

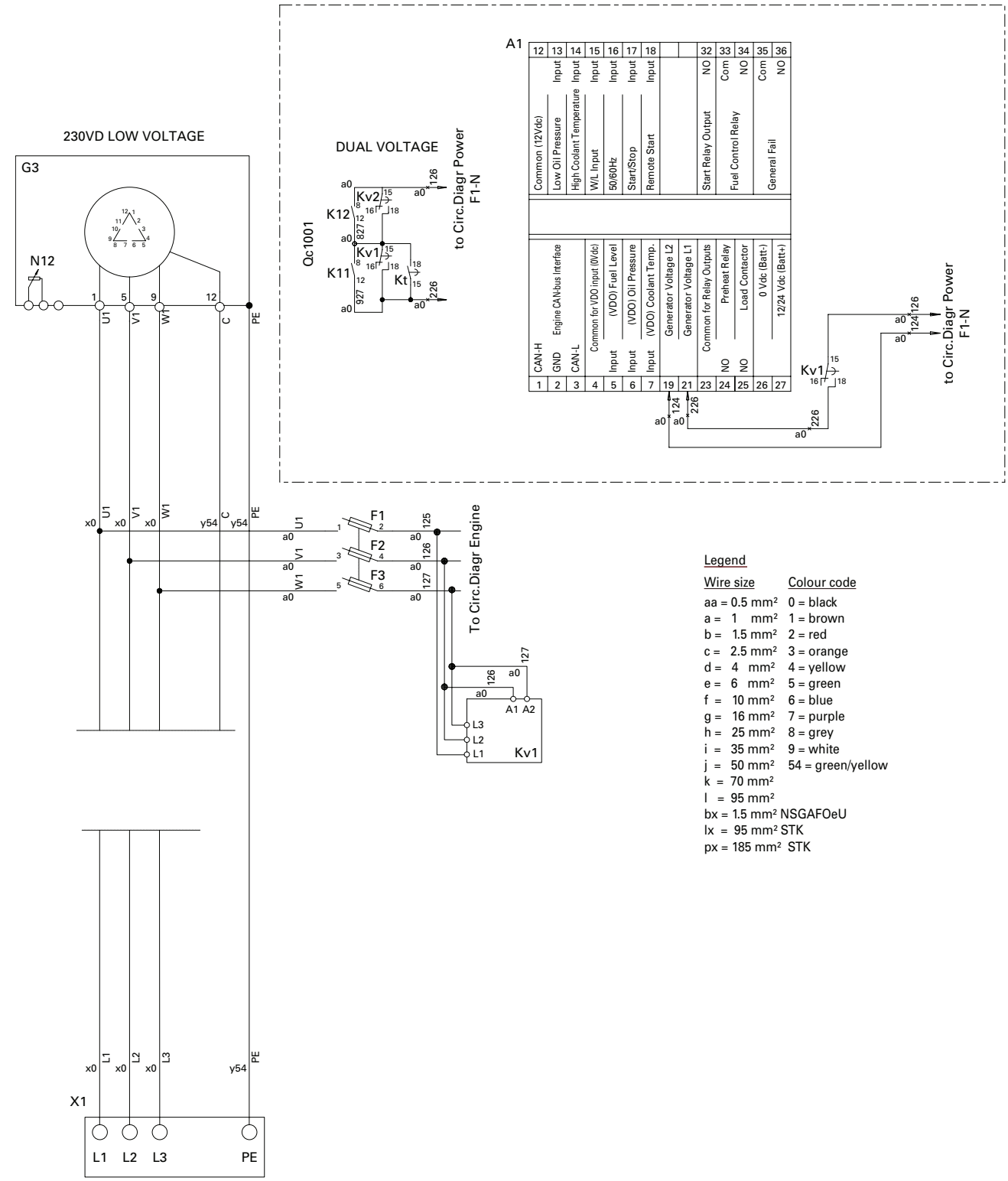
R5	Coolant heater	T13	Toroid transformer for earth relay	X25	Terminal strip
S2b	Emergency stop (S2a: see Engine Circ)	U1	Static battery charger	Sx	Remote Start/Stop
S4	Voltmeter change-over switch	X1	Terminal board	Kx	Contactor generator ready (by voltage free contact, 15 sec. delayed)
S13	Earth relay lock-out switch	X2	Outlet socket		
T1-3	Current transformer	X15	10-pole connector		

9822 0889 63/01
Applicable for QAS 150-200-250 Volvo - Over and Under Voltage Relay



F1-F3	Fuse 4 A	Q2	Circuit breaker	T13	Toroid transformer for earth relay
G3	Alternator	R5	Coolant heater	U1	Static battery conditioner
Kx	Contactor generator ready (by voltage free contact, 15 sec. delayed)	S2b	Emergency stop (S2a see Engine circuit)	X1	Terminal board
				X2	Outlet socket
N12	Automatic voltage regulator	S13	Earth relay lock-out switch	X10	15-pole connector
N13	Earth fault current relay	Sx	Remote Start/Stop	X25	Terminal strip
Q1	Main circuit breaker	T1-T3	Current transformer	(O)	Optional equipment

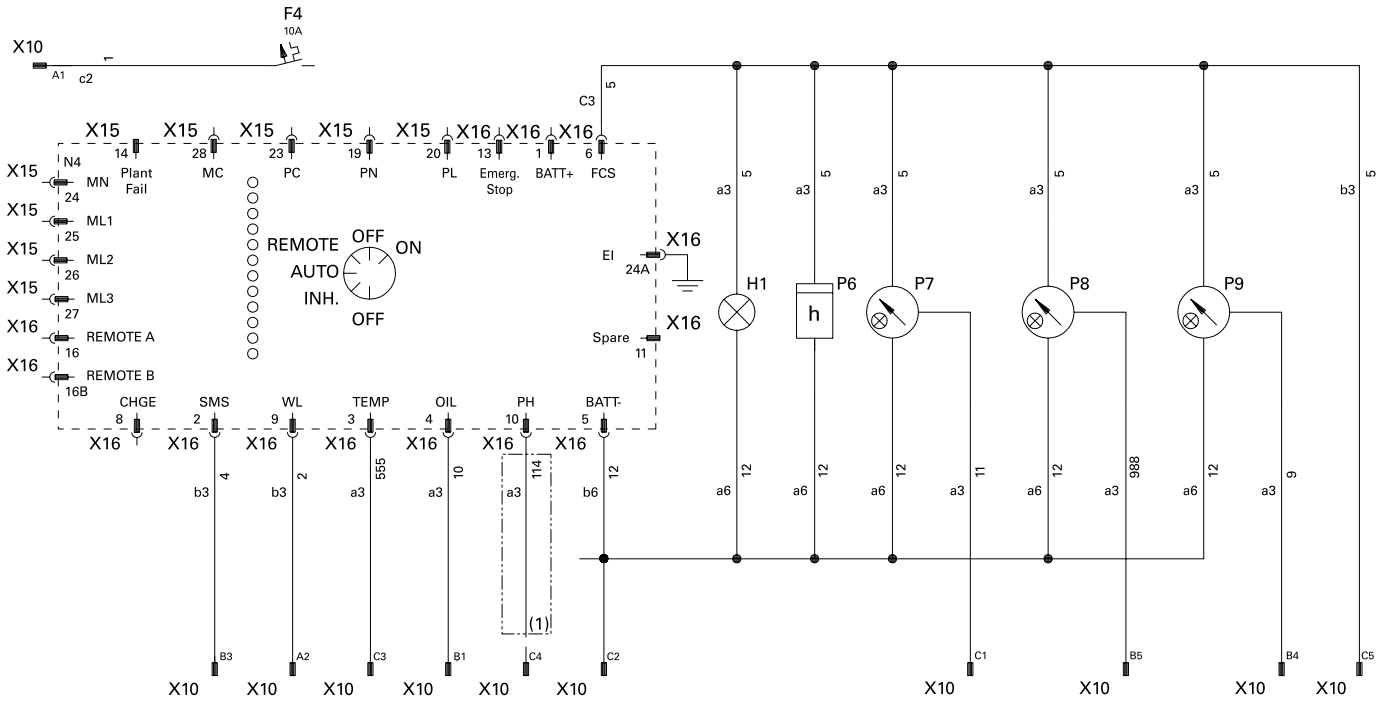
CIRCUIT DIAGRAM



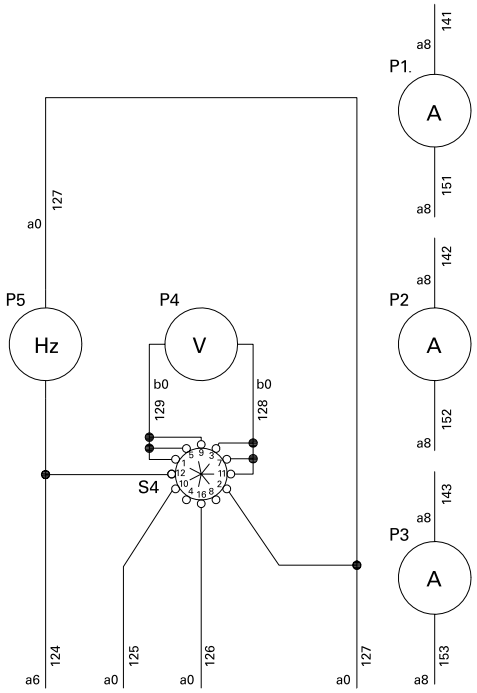
Legend

Wire size	Colour code
aa = 0.5 mm²	0 = black
a = 1 mm²	1 = brown
b = 1.5 mm²	2 = red
c = 2.5 mm²	3 = orange
d = 4 mm²	4 = yellow
e = 6 mm²	5 = green
f = 10 mm²	6 = blue
g = 16 mm²	7 = purple
h = 25 mm²	8 = grey
i = 35 mm²	9 = white
j = 50 mm²	54 = green/yellow
k = 70 mm²	
l = 95 mm²	
bx = 1.5 mm² NSGAFOeU	
lx = 95 mm² STK	
px = 185 mm² STK	

9822 0889 69/00
Applicable for QAS 150-200-250 Volvo - Automatic Mains Failure



CIRCUIT DIAGRAM



Legend

Wire size	Colour code
aa = 0.5 mm²	0 = black
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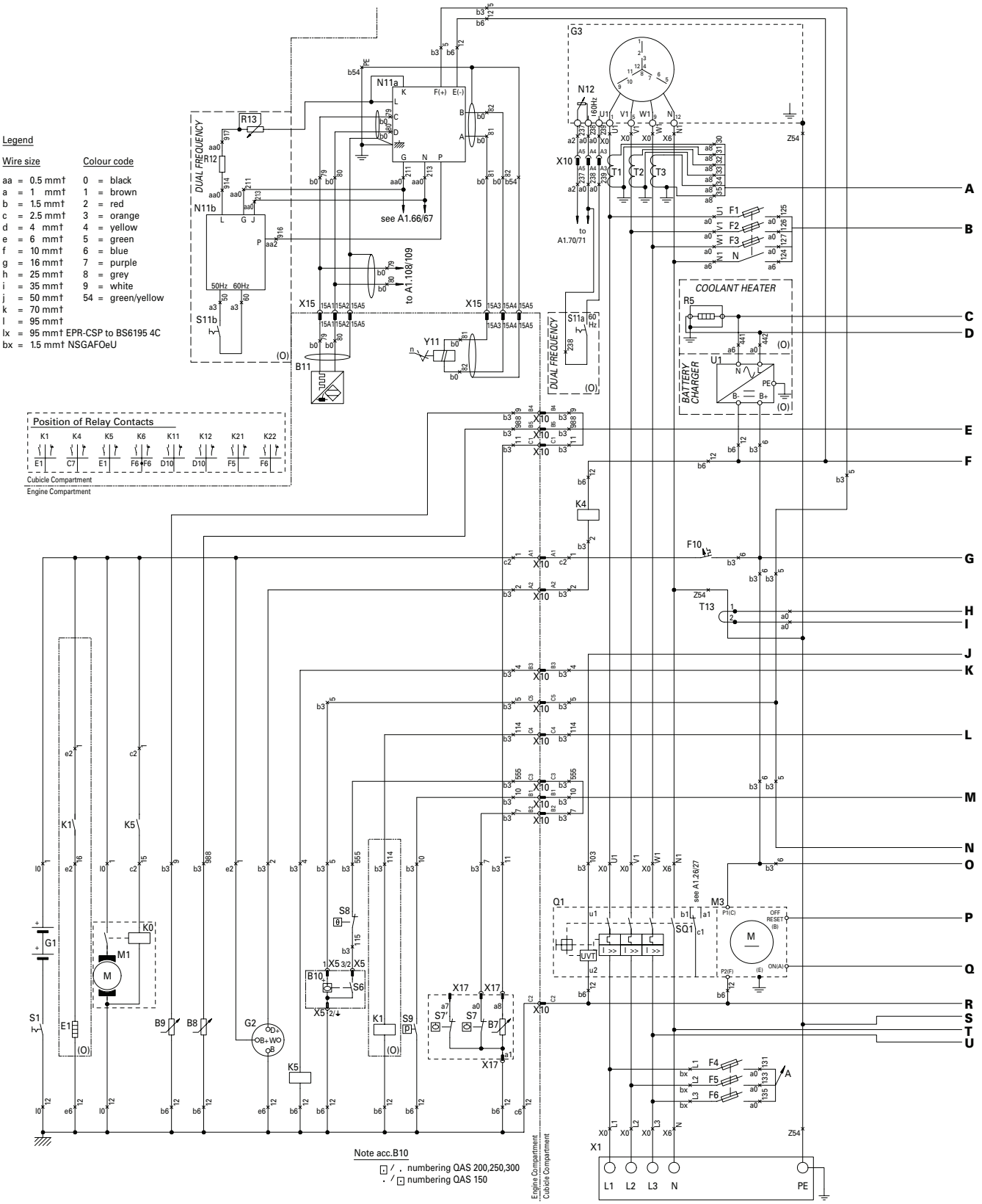
h = 25 mm²	8 = grey
i = 35 mm²	9 = white
j = 50 mm²	54 = green/yellow
k = 70 mm²	
l = 95 mm²	
bx = 1.5 mm² NSGAFOeU	
lx = 95 mm² STK	
px = 185 mm² STK	

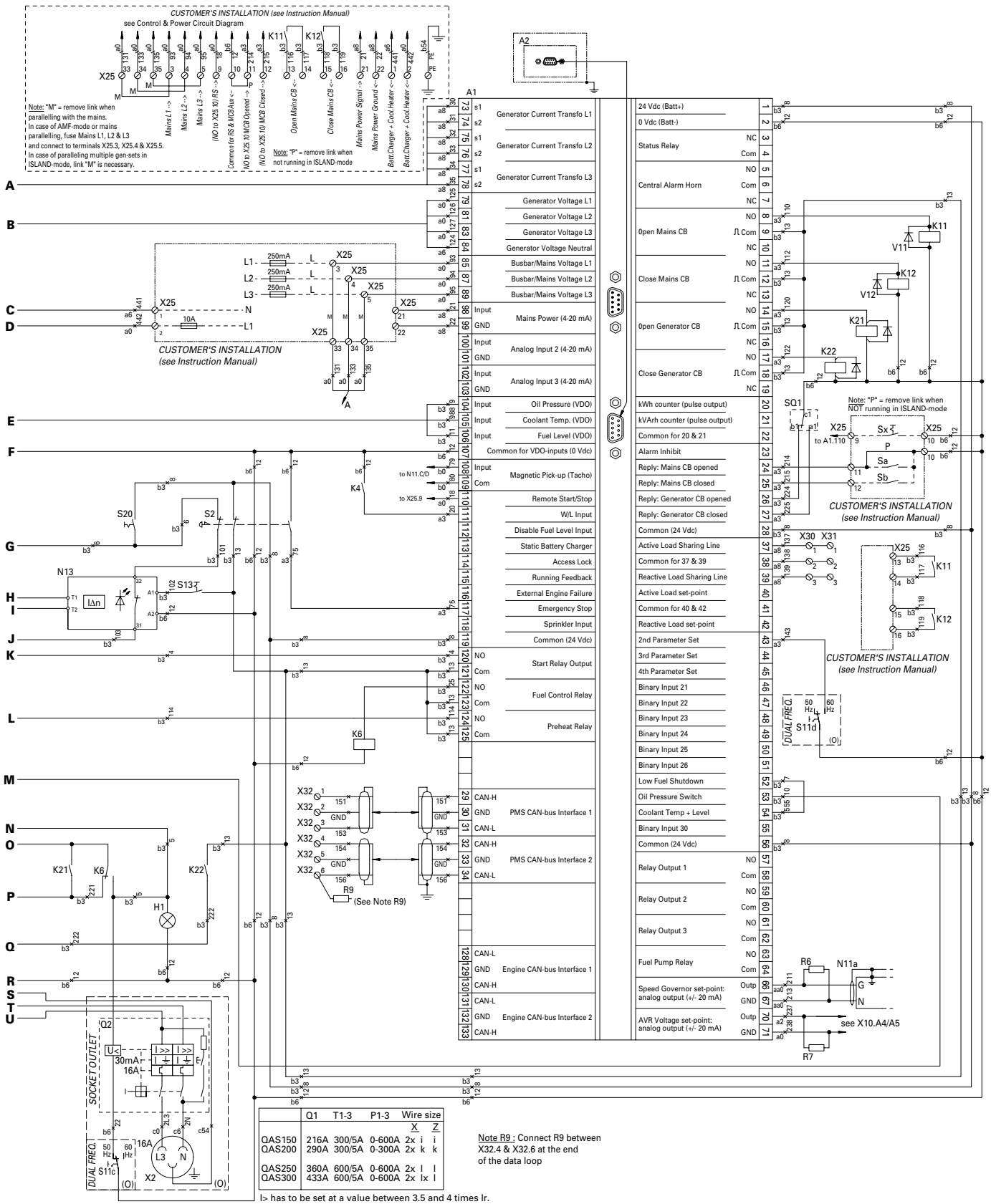
(1): not for QAS150

F4	Fuse (10A)	P5	Frequencymeter	X10	15-pole connector
H1	Panel light	P6	Hourmeter	X15	15-pole connector
N4	Control module	P7	Fuel level gauge	X16	Module connector
P1-3	Amperemeter	P8	Coolant temperature gauge	S4	Voltage selector switch
P4	Voltmeter	P9	Oil pressure gauge		

9822 0889 74/07 A
Applicable for QAS 150-200-250 Volvo - Qc4001™



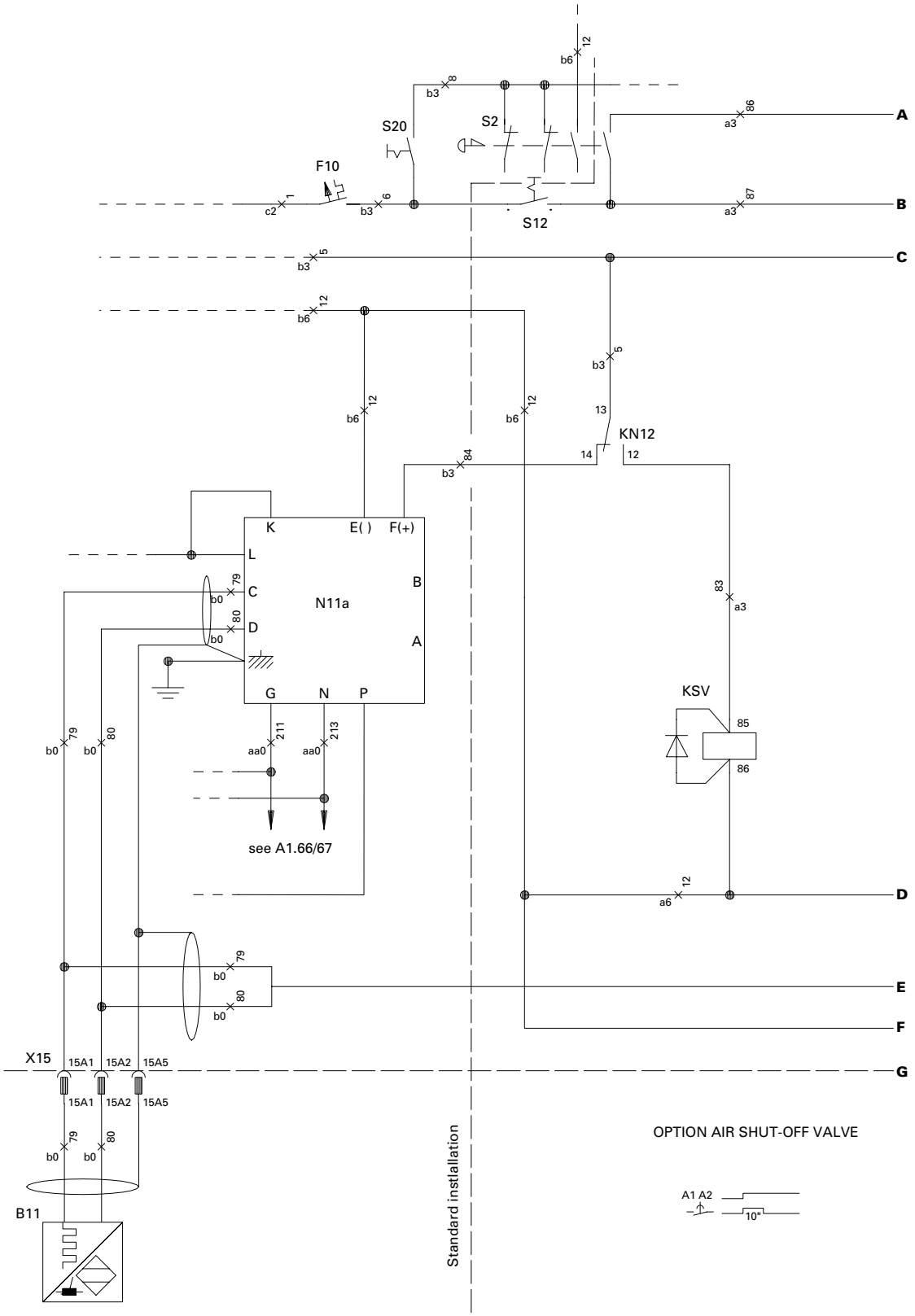
CIRCUIT DIAGRAM



	Q1	T1-3	P1-3	Wire size X	Z
QAS150	216A	300/5A	0-600A	2x i	i
QAS200	290A	300/5A	0-300A	2x k	k
QAS250	360A	600/5A	0-600A	2x l	l
QAS300	433A	600/5A	0-600A	2x lx	l

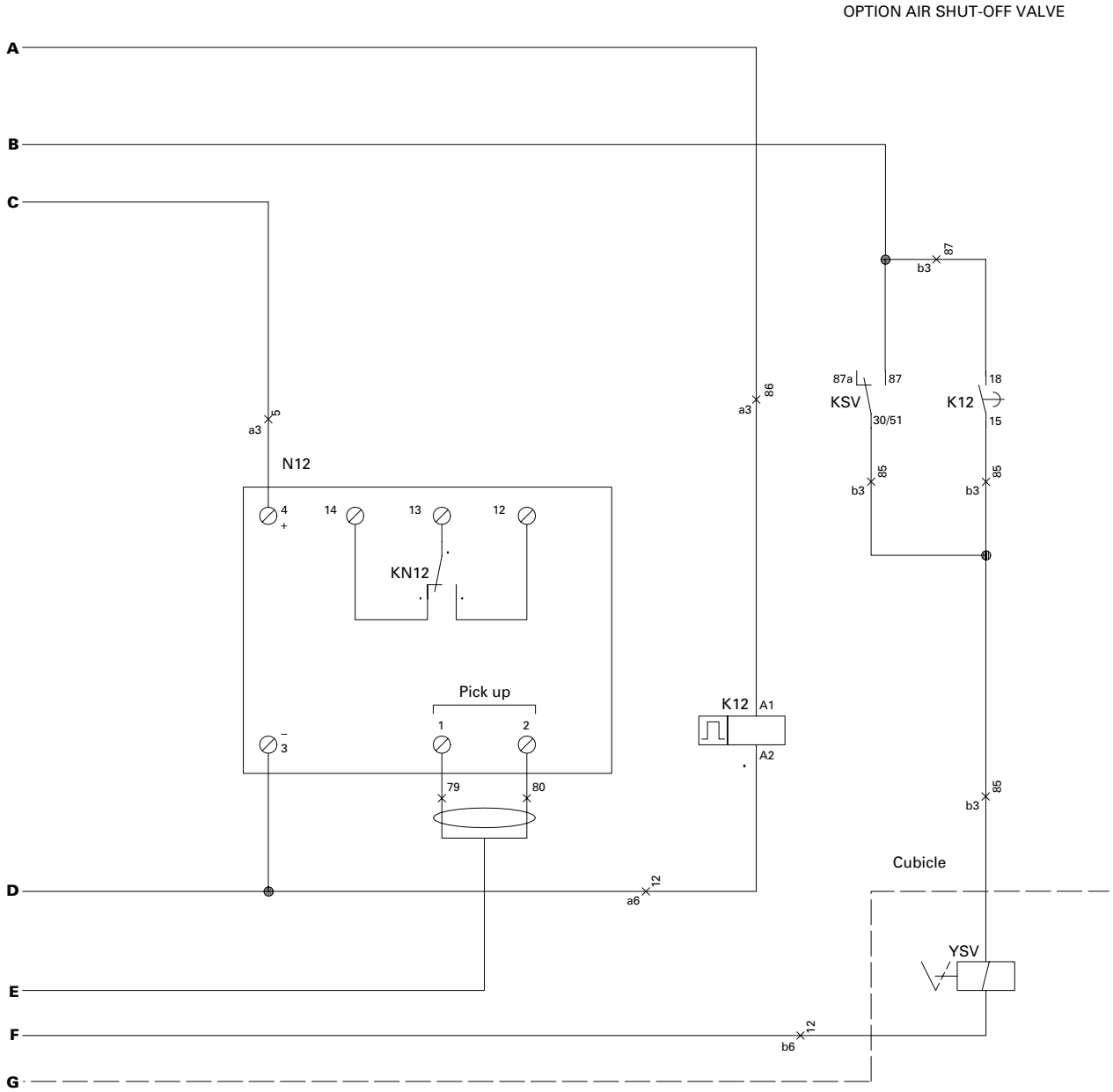
I> has to be set at a value between 3.5 and 4 times Ir.

9822 0889 74/07 B
Applicable for QAS 150-200-250 Volvo - Qc4001™



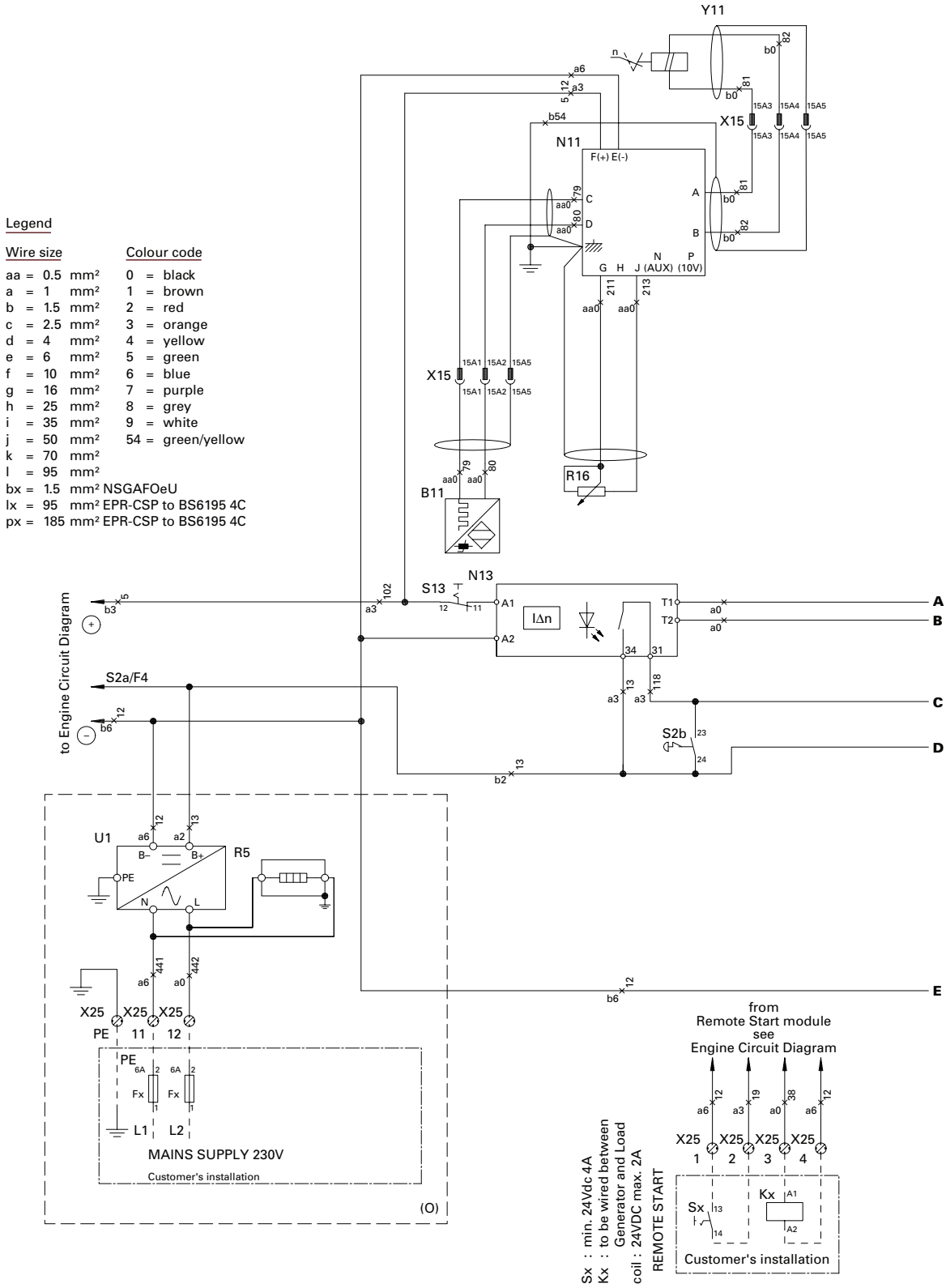
A1	Generator control unit	B9	Oil pressure sensor	F1-6	Fuses 250mA
A2	LCD display	B10	Coolant level switch	F10	Fuse 10A
B7	Fuel level sensor	B11	Magnetic speed pick up	G1	Battery 24Vdc
B8	Coolant temperature sensor	E1	Preheat resistors	G2	Charging alternator

CIRCUIT DIAGRAM



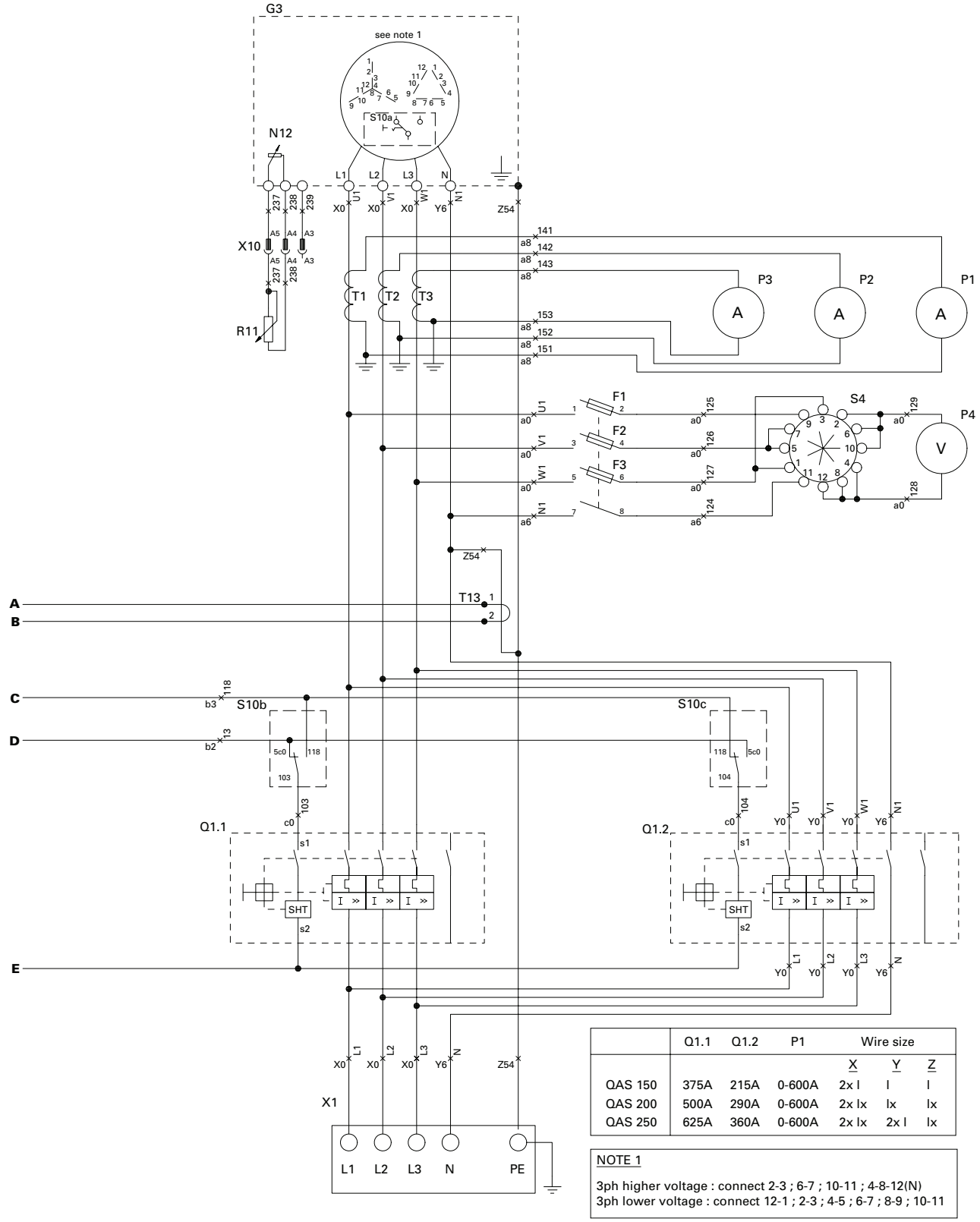
G3	Alternator	Q2	Circuit breaker 16A (with U<)	Sb	Aux. contact mains CB closed (mounted in MCB)
H1	Panel light	R5	Engine coolant heater	SQ1	Aux. contact generator CB (mounted inside Q1)
K1	Engine preheat relay	R6, R7	Resistor 220 Ohm	Sx	Remote start/stop-switch
K4	W/L-invertor relay	R9	Resistor 120 Ohm	T1-3	Current transformers
K5	Starter relay	R12	Resistor dual frequency	T13	Torus earth leakage relay
K6	Fuel Solenoid Relay	R13	Potmeter dual frequency	U1	Battery charger
K11	Aux. relay open mains CB	S1	Battery isolator	Y11	Actuator
K12	Aux. relay close mains CB	S2	Emergency stop	X1	Terminal board
K21	Aux. relay open generator CB	S6	Low coolant level switch	X2	Socket outlet
K22	Aux. relay close generator CB	S7	Fuel level switch	X10-15	Connector engine wire harness
M1 + K0	Starter motor	S8	High coolant temperature switch	X25	Customer's terminal strip
M3	Motor drive for Q1	S9	Low oil pressure switch	X30-31	Connector load sharing
N11a	Engine speed controller	S11a-d	50/60Hz-switch	X32	PMS interface terminals
N11b	Dual frequency controller	S20	ON/OFF-switch	(O)	Optional equipment
N12	Automatic voltage regulator	Sa	Aux. contact mains CB opened (mounted in MCB)		
N13	Earth leakage relay				
Q1	Generator circuit breaker (3P+N)				

9822 0889 76/05
Applicable for QAS 150-200-250 Volvo - Qc1001™, Power Circuit, Dual Voltage



B11	Speed sensor	N13	Earth fault-current relay	R5	Coolant heater
F1-4	Fuse 4 A	P1-3	Amperemeter	R11	Supply voltage adjust
G3	Alternator	P4	Voltmeter 0-500V	S2b	Emergency stop (S2a: see Engine Circ)
N11	Speed controller	Q1.1	Circuit breaker (lower voltage)	S4	Voltmeter change-over switch
N12	Automatic voltage regulator	Q1.2	Circuit breaker (higher voltage)		

CIRCUIT DIAGRAM



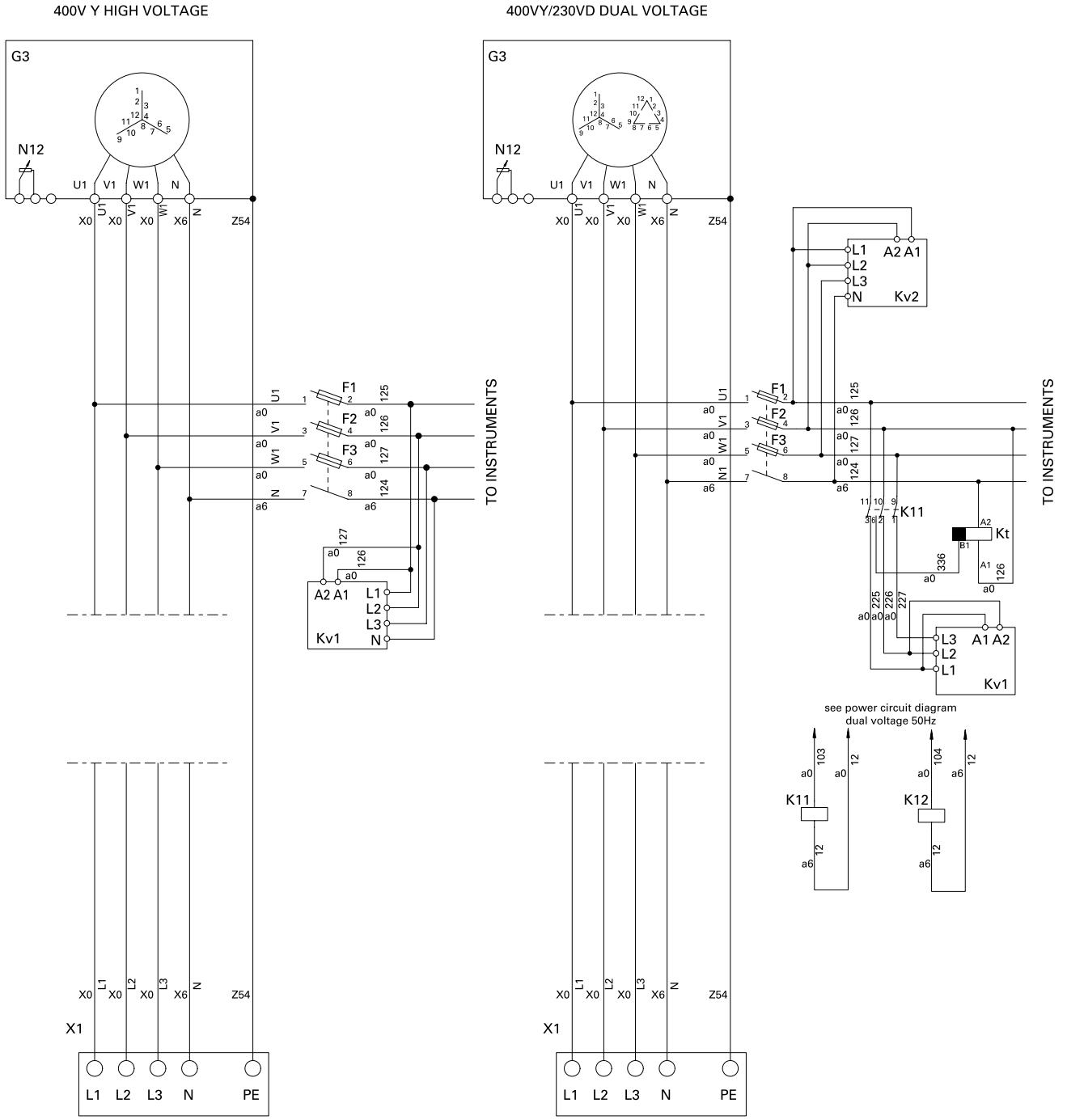
	Q1.1	Q1.2	P1	Wire size		
				X	Y	Z
QAS 150	375A	215A	0-600A	2x I	I	I
QAS 200	500A	290A	0-600A	2x Ix	Ix	Ix
QAS 250	625A	360A	0-600A	2x Ix	2x I	Ix

NOTE 1

3ph higher voltage : connect 2-3 ; 6-7 ; 10-11 ; 4-8-12(N)
3ph lower voltage : connect 12-1 ; 2-3 ; 4-5 ; 6-7 ; 8-9 ; 10-11

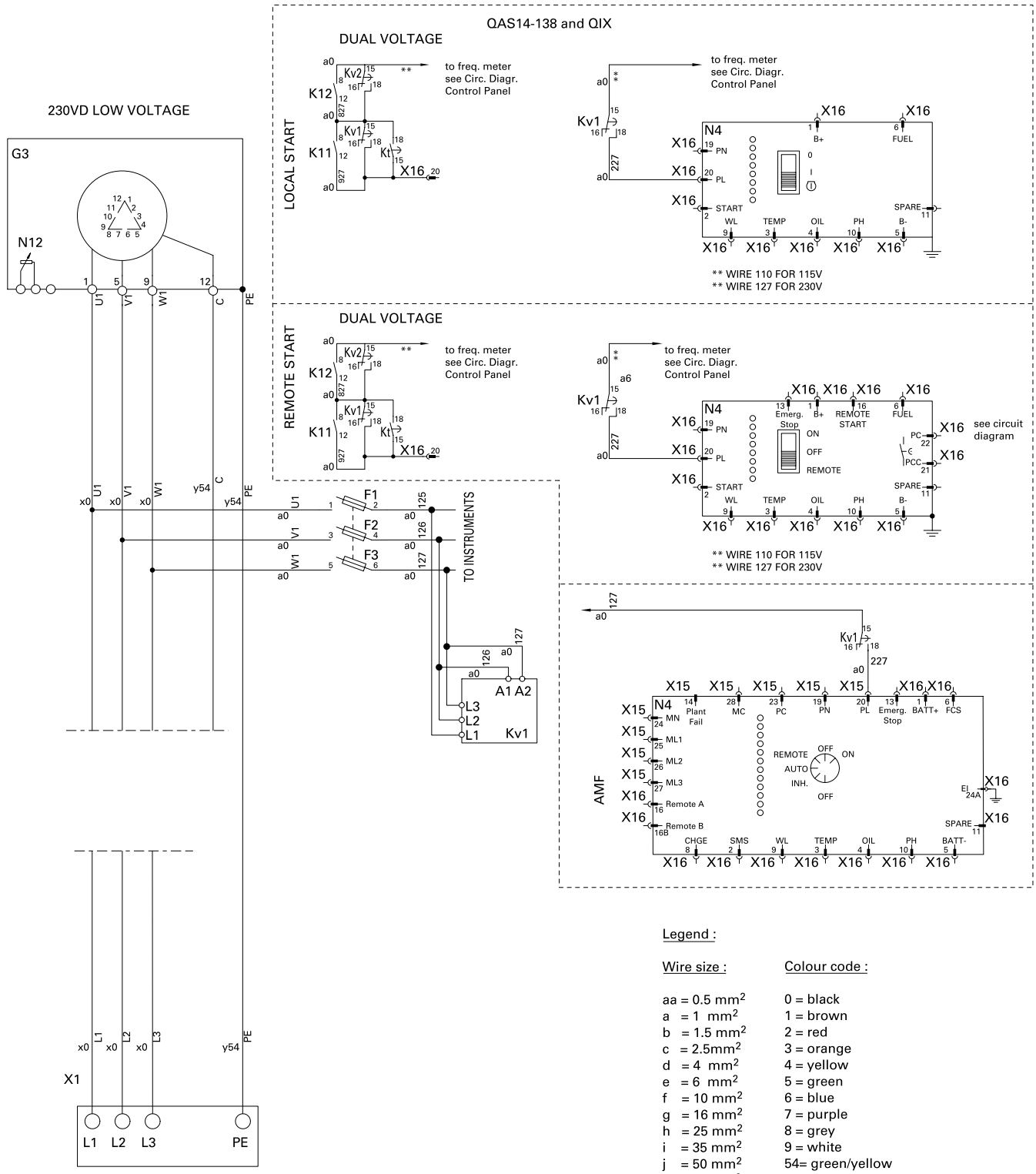
S10 a, b, c	Supply voltage switch	U1	Static battery conditioner	Sx	Remote Start/Stop
S13	Earth fault relay lock-out switch	X1	Terminal board	Kx	Contactor generator ready (by voltage free contact, 15 sec. delayed)
T1-3	Current transformer	X25	Terminal strip		
T13	Earth fault-current detector	Y11	Actuator		

9822 0888 89/01
Applicable for QAS 150-200-250 Volvo - Over and Under Voltage Relay



K11	Auxiliary relay u/o voltage low voltage	Kv1	Under/overvoltage relay (low voltage) Umax = +8%, Umin = -8%, t1 = 5s To be sealed after adjustment!	Kt	Timer (Delay = 10s)
K12	Auxiliary relay u/o voltage high voltage	Kv2	Under/overvoltage relay (high voltage) Umax = +8%, Umin = -8%, t1 = 5s To be sealed after adjustment!		

CIRCUIT DIAGRAM



Legend :

Wire size :	Colour code :
aa = 0.5 mm²	0 = black
a = 1 mm²	1 = brown
b = 1.5 mm²	2 = red
c = 2.5mm²	3 = orange
d = 4 mm²	4 = yellow
e = 6 mm²	5 = green
f = 10 mm²	6 = blue
g = 16 mm²	7 = purple
h = 25 mm²	8 = grey
i = 35 mm²	9 = white
j = 50 mm²	54= green/yellow
k = 70 mm²	
l = 95 mm²	
bx = 1.5 mm² NSGAFOeU	
lx = 95 mm² STK	
px = 185 mm² STK	

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