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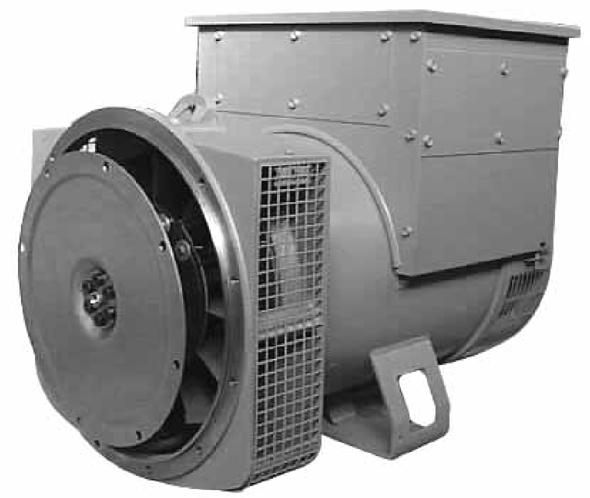
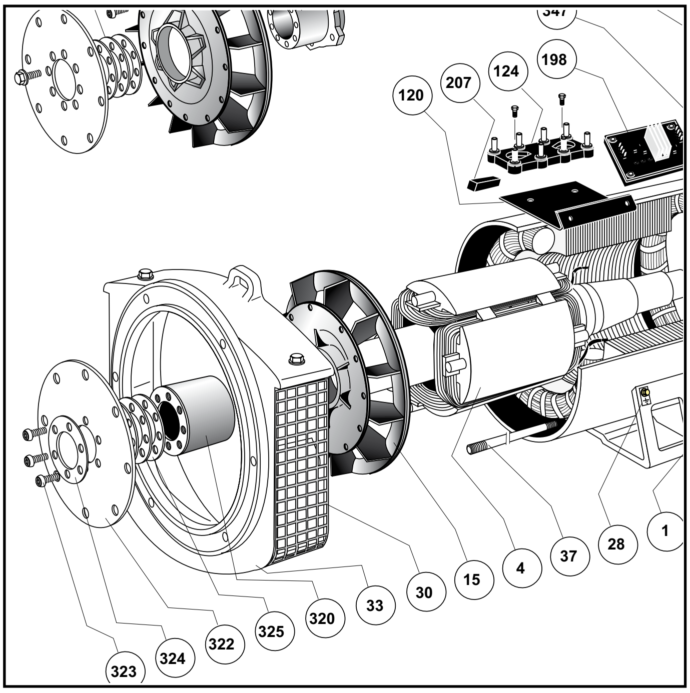


This manual is to be given to the end user



LSA 43.2/44.2 - 4 POLE

ALTERNATORS

Installation and maintenance

This manual concerns the alternator which you have just purchased.

The latest addition to a whole new generation of alternators, this range benefits from the experience of the world's leading manufacturer, using advanced technology and incorporating strict quality control.

SAFETY MEASURES

Before using your alternator for the first time, it is important to read the whole of this installation and maintenance manual.

All necessary operations and interventions on this alternator must be performed by a qualified technician.

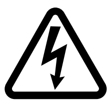
Our technical support service will be pleased to provide any additional information you may require.

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

CAUTION

Warning symbol for an operation capable of damaging or destroying the alternator or surrounding equipment.

Warning symbol for general danger to personnel.



Warning symbol for electrical danger to personnel.

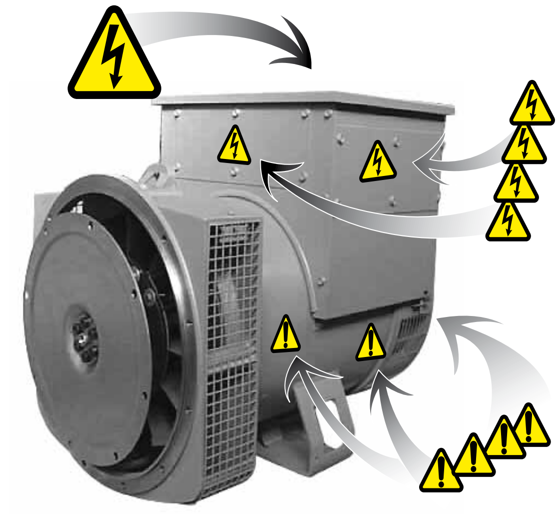
WARNING SYMBOLS

We would like to draw your attention to the following two safety measures that must be complied with:

a) During operation, do not allow anyone to stand in front of the air outlet guards, in case anything is ejected from them.

b) Do not allow children younger than 14 to go near the air outlet guards.

A set of self-adhesive stickers depicting the various warning symbols is included with this maintenance manual. They should be positioned as shown in the drawing below once the alternator has been fully installed.



WARNING

The alternators must not be put into service until the machines in which they are to be incorporated have been declared compliant with Directives EC plus any other directives that may be applicable.

Note: LEROY-SOMER reserves the right to modify the characteristics of its products at any time in order to incorporate the latest technological developments. The information contained in this document may therefore be changed without notice.

LSA 43.2 / 44.2 - 4-POLE
ALTERNATORS

LSA 43.2 / 44.2 - 4-POLE

ALTERNATORS

1 - RECEIPT

1.1 - Standards and safety measures

Our alternators comply with most international standards.

See the EC Declaration of Incorporation on the last page.

1.2 - Inspection

On receipt of your alternator, check that it has not suffered any damage in transit. If there are obvious signs of knocks, contact the transporter (you may able to claim on their insurance) and after a visual check, turn the machine by hand to detect any malfunction.

1.3 - Identification

The alternator is identified by means of a nameplate glued to the frame.
Make sure that the nameplate on the alternator conforms to your order.
The alternator name is defined according to various criteria (see below).
Example of description: **LSA 43.2 M45 J6/4**

- LSA: Name used in the PARTNER range
- M: Marine
- C: Cogeneration
- T: Telecommunications
- 43.2: Machine type
- M45: Model
- J: Excitation system (C: AREP/J: SHUNT or PMG/ E: COMPOUND)
- 6/4: Winding number/number of poles

1.3.1 - Nameplate

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

1.4 - Storage

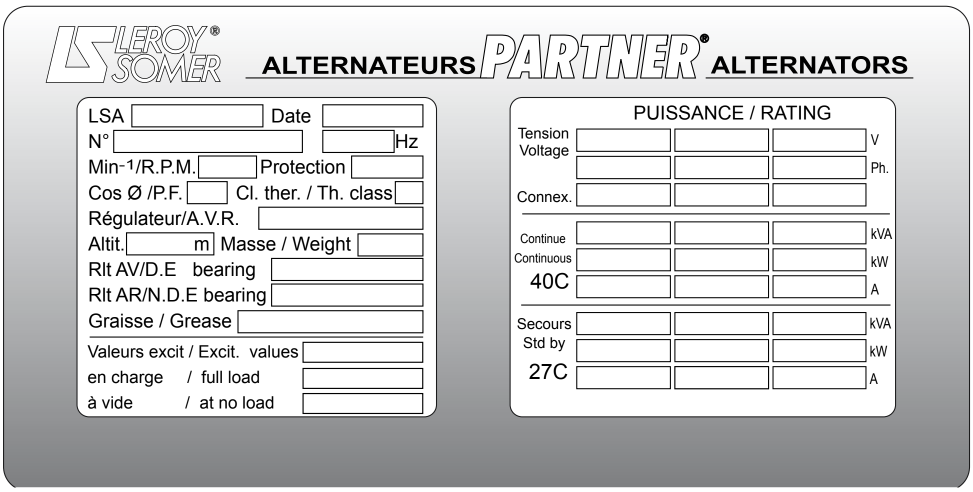
Prior to commissioning, machines should not be stored in humid conditions: at relative humidity levels greater than 90%, the machine insulation can drop very rapidly, to just above zero at around 100%. The state of the anti-rust protection on unpainted parts should be monitored.
For storage over an extended period, the alternator can be placed in a sealed enclosure (heatshrunk plastic for example) with dehydrating sachets inside, away from significant and frequent variations in temperature to avoid the risk of condensation during storage.
If the area is affected by vibration, try to reduce the effect of these vibrations by placing the generator on a damper support (rubber disc or similar) and turn the rotor a fraction of a turn once a fortnight to avoid marking the bearing rings.

1.5 - Applications

These alternators are designed mainly to produce electricity in the context of applications involving the use of generators.

1.6 - Contra-indications to use

Use of the alternator is restricted to operating conditions (environment, speed, voltage, power, etc.) compatible with the characteristics indicated on your genset.



LSA 43.2 / 44.2 - 4-POLE

ALTERNATORS

2 - TECHNICAL CHARACTERISTICS

2.1 - Electrical characteristics

PARTNER LSA 43.2/44.2 alternators are generators without sliprings or revolving field brushes, wound as «2/3 pitch», 12-wire; the insulation is class H and the field excitation system is available in either «SHUNT», «AREP» or «PMG» versions (see AVR manual).

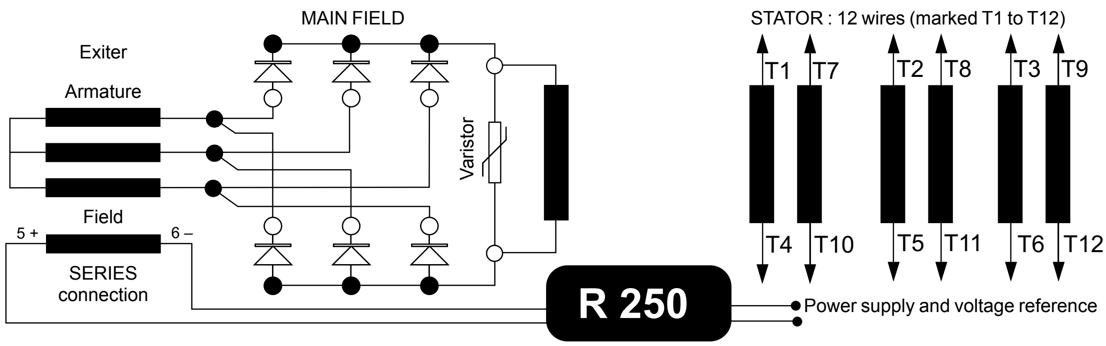
2.1.1 - Options

- Stator temperature detection probes.
- Space heaters.

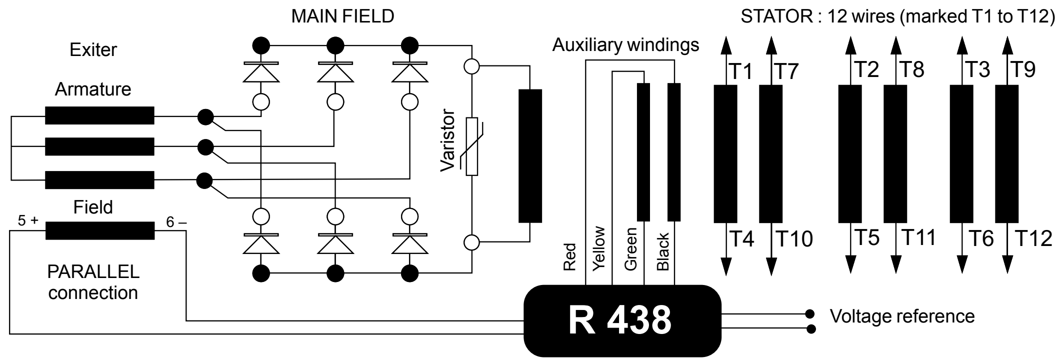
Interference suppression conforms to standard EN 55011, group 1, class B. (Europe).

2.1.2 - SHUNT system with R 250 AVR

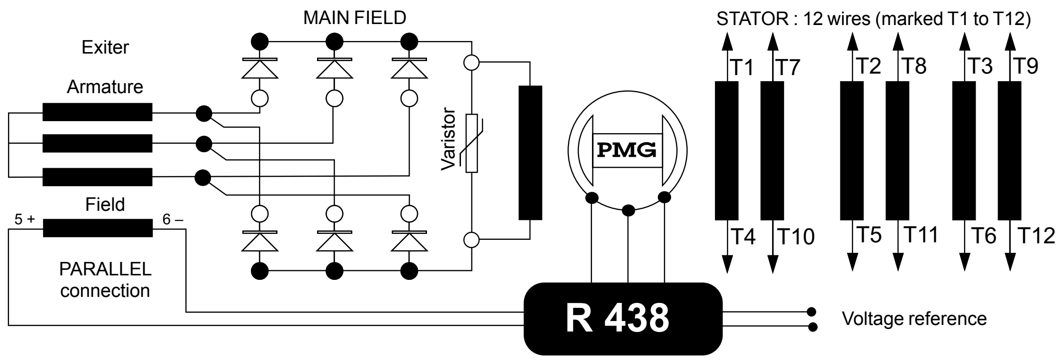
Other version R 251 AVR for dedicated single-phase or R 448 for additional function.



2.1.3 - AREP system with R 438 AVR



2.1.4 - PMG system with R 438 AVR



2.2 - Mechanical characteristics

- Steel frame
- Cast iron end shields
- Protected ball bearings, greased for life
- Mounting arrangements:

IM 1201 (MD 35) foot and flange mounted, single-bearing with SAE coupling disc.
IM 1001 (B 34) double-bearing with SAE flange and standard cylindrical shaft extension.
- Drip-proof machine, self-cooled
- Degree of protection: IP 23

2.2.1 - Options

- Air inlet filter
- Regreasable bearings (only for LSA 44.2 and SHUNT or AREP version)
- IP 44 protection

3 - INSTALLATION

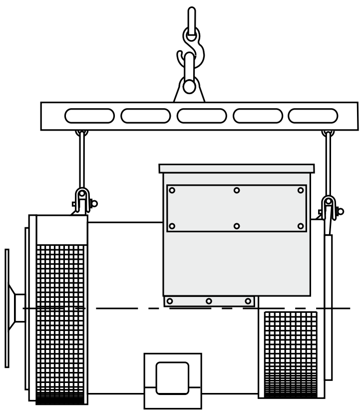
Personnel undertaking the various operations discussed in this section must wear the appropriate personal protective equipment for mechanical and electrical hazards.

3.1 - Assembly

All mechanical handling operations must be undertaken using approved equipment and the machine must be horizontal. Check how much the alternator weight (see 4.9) before choosing the lifting tool. During this operation, do not allow anyone to stand under the load.

3.1.1 - Handling

The generously-sized lifting rings are for handling the alternator alone. They must not be used to lift the genset. The choice of lifting hooks or handles should be determined by the shape of these rings. Choose a lifting system that has regard for the integrity and environment of the alternator.



3.1.2 - Coupling

3.1.2.1 - Single-bearing alternator

Before coupling the alternator and the heat engine, check they are compatible by:
- undertaking a torsional analysis of the transmission on both units
- checking the dimensions of the flywheel and its housing, the flange, coupling discs and offset.

CAUTION

When coupling the alternator to the prime mover, the holes of the coupling discs should be aligned with the flywheel holes by cranking the engine.
Do not use the alternator fan to turn the rotor.
Make sure the alternator is securely bedded in position during coupling.

Tighten the coupling disc screws to the recommended torque and check that there is lateral play on the crankshaft.

3.1.2.2 - Two-bearing alternator

- Semi-flexible coupling

Careful alignment of the alternator and the heat engine is recommended, checking that the differences in concentricity and parallelism of the two parts of the coupling do not exceed 0.1 mm.

CAUTION

This alternator has been balanced with a half-key.

3.1.3 - Location

Ensure that the ambient temperature in the room where the alternator is placed cannot exceed 40 °C for standard power ratings (for temperatures > 40 °C, apply a derating coefficient). Fresh air, free from damp and dust, must be able to circulate freely around the air intake grilles on the opposite side from the coupling.

3.2 - Inspection prior to first use

3.2.1 - Electrical checks

Under no circumstances should an alternator, new or otherwise, be operated if the insulation is less than 1 megohm for the stator and 100,000 ohms for the other windings.

There are three possible methods for restoring the above minimum values.
a) Dry out the machine for 24 hours in a drying oven at a temperature of approximately 110 °C (without the AVR).
b) Blow hot air into the air inlet, having made sure that the machine is rotating with the exciter field disconnected.
c) Run in short-circuit mode (disconnect the AVR):
- Short-circuit the three output terminals (power) using connections capable of supporting the rated current (try not to exceed 6 A/ mm^2)
- Insert a clamp ammeter to monitor the current passing through the short-circuit connections
- Connect a 48 Volt battery in series with a rheostat of approximately 10 ohms (50 W) to the exciter field terminals, respecting the polarity
- Open all the alternator openings fully
- Run the alternator at its rated speed, and adjust the exciter field current using the rheostat to obtain the rated output current in the short-circuit connections

Note: Prolonged standstill: In order to avoid these problems, we recommend the use of space heaters, as well as turning over the machine from time to time. Space heaters are only really effective if they are working continuously while the machine is stopped.

CAUTION

Ensure that the alternator has the degree of protection matching the defined environmental conditions.

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3.2.2 - Mechanical checks

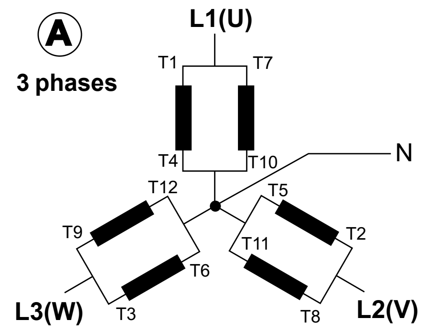
Before starting the machine for the first time, check that:
- the fixing bolts on the feet are tight,
- the cooling air is drawn in freely,
- the protective grilles and housing are correctly in place,
- the standard direction of rotation is clockwise as seen from the shaft end (phase rotation in order 1-2-3). For anti-clockwise rotation, swap 2 and 3.
- the winding connection corresponds to the site operating voltage (see section 3.3).

3.3 - Terminal connection diagrams

To modify the connection, change the position of the terminal cables. The winding code is specified on the nameplate.

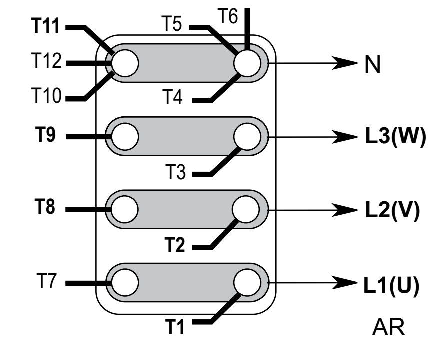
Any intervention on the alternator terminals during reconnection or checks should be performed with the machine stopped.

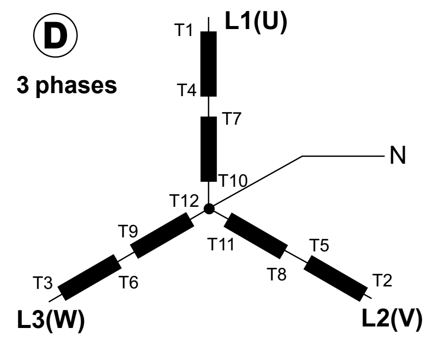
Connections codes | L.L voltage | Factory connection



Winding	50 Hz	60 Hz
6	190 - 208	190 - 240
7	220 - 230	-
8	-	190 - 208

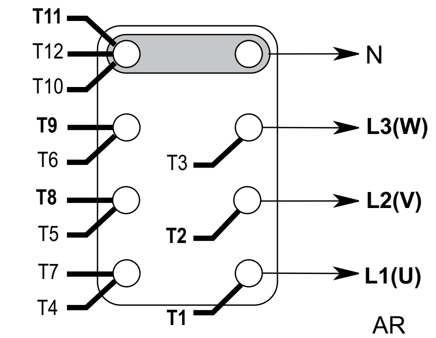
R 250 voltage sensing:
0 => (T8) / 110 V => (T11)
R 438 voltage sensing:
0 => (T3) / 220 V => (T2)

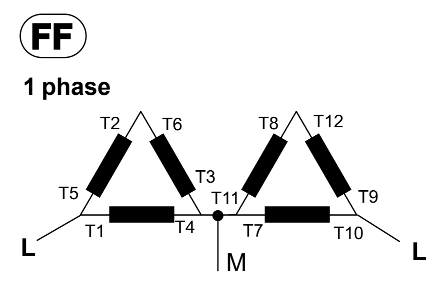




Winding	50 Hz	60 Hz
6	380 - 415	380 - 480
7	440 - 460	-
8	-	380 - 416

R 250 voltage sensing:
0 => (T8) / 110 V => (T11)
R 438 voltage sensing:
0 => (T3) / 380 V => (T2)

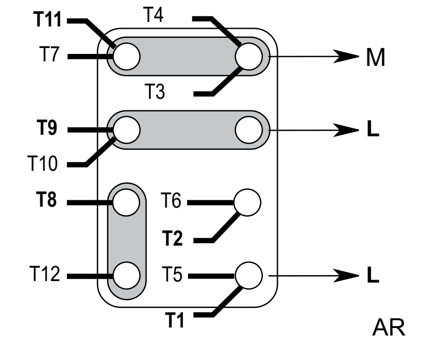


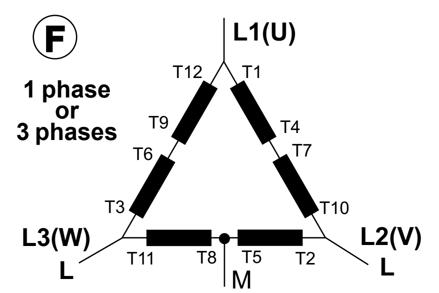


LM voltage = 1/2 LL voltage

Winding	50 Hz	60 Hz
6	220 - 240	220 - 240
7	250 - 260	-
8	200	220 - 240

R 250 voltage sensing:
0 => (T1) / 110 V => (T4)
R 438 voltage sensing:
0 => (T10) / 220 V => (T1)

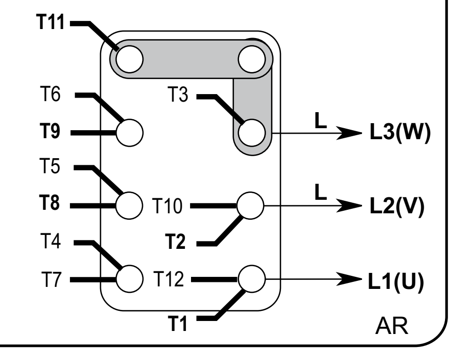




LM voltage = 1/2 LL voltage

Winding	50 Hz	60 Hz
6	220 - 240	220 - 240
7	250 - 260	-
8	200	220 - 240

R 250 voltage sensing:
0 => (T8) / 110 V => (T11)
R 438 voltage sensing:
0 => (T3) / 220 V => (T2)



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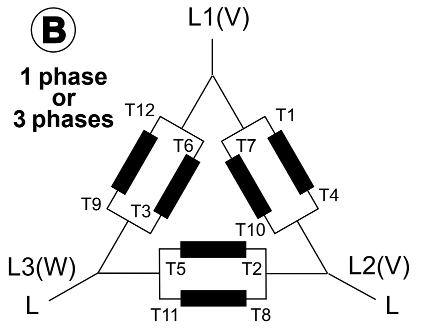
ALTERNATORS

Connection codes	L.L. voltage	Factory connection

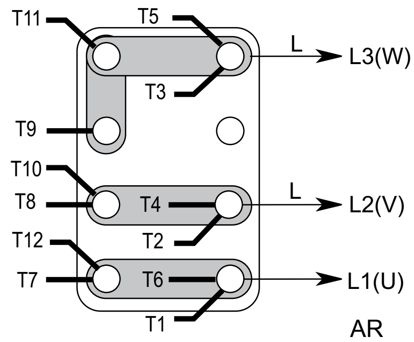
B

1 phase or 3 phases



Winding	50 Hz	60 Hz
6	110 - 120	120
7	120 - 130	-
8	-	110 - 120

R 250 voltage sensing:
0 => (T8) / 110 V => (T11)
R 438 voltage sensing:
0 => (T3) / 110 V => (T2)

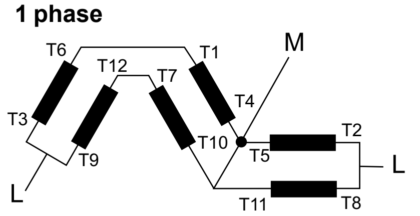


FOR LSA 44.2, THE COUPLING **B** IS NOT POSSIBLE

G

Connection not recommended

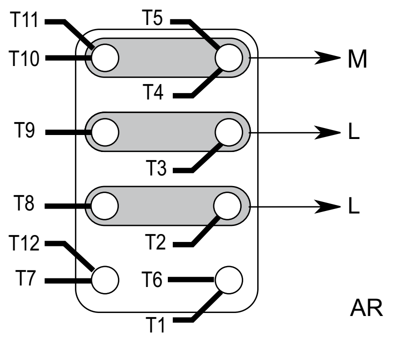
1 phase



LM voltage = 1/2 LL voltage

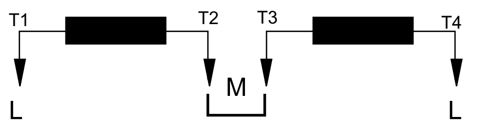
Winding	50 Hz	60 Hz
6	220 - 240	220 - 240
7	250 - 260	-
8	200	220 - 240

R 250 voltage sensing:
0 => (T8) / 110 V => (T11)
R 438 voltage sensing:
0 => (T3) / 220 V => (T2)



SINGLE-PHASE 4-WIRE - type M or M1 DEDICATED WINDING

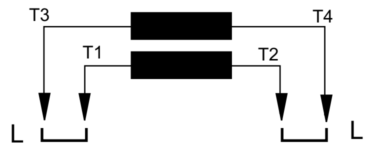
SERIAL CONNECTION



Voltage 50/60Hz		Link	Output		
L - L	L - M		L	L	M
220 230 240	110 115 120	T2 - T3	T1	T4	T2 - T3

R 251 voltage sensing: 0 => (T1) / 110 V => (T2)

PARALLEL CONNECTION (Not possible with LSA 44.2)

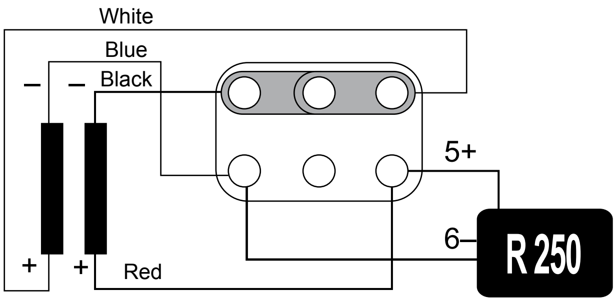


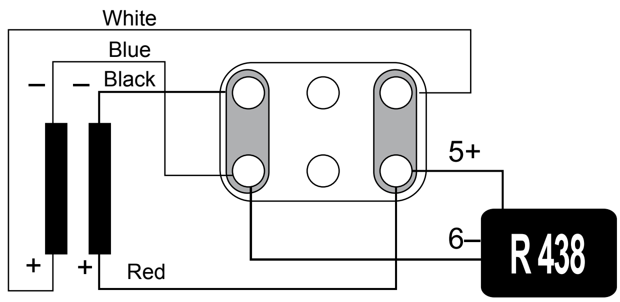
Voltage 50/60Hz		Link	Output		
L - L	L - M		L	L	M
110 115 120	- - -	T1 - T3 T2 - T4	T1-T3	T2 - T4	-

R 251 voltage sensing: 0 => (T1) / 110 V => (T2)

3.3.1 - Connexion de l'excitatrice

Series connection (shunt excitation)	Parallel connection (AREP or PMG excitation)





Single-phase dedicated SHUNT version: R 251 AVR, no connection for 2000 (2-wire output without terminal block)

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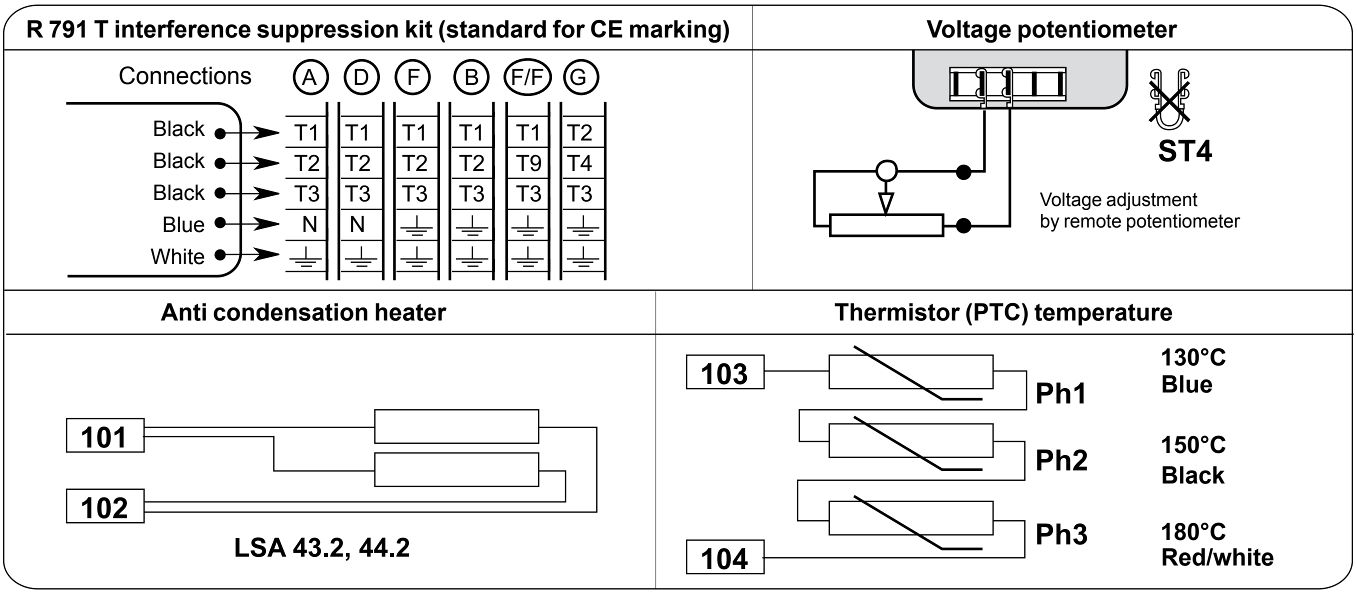
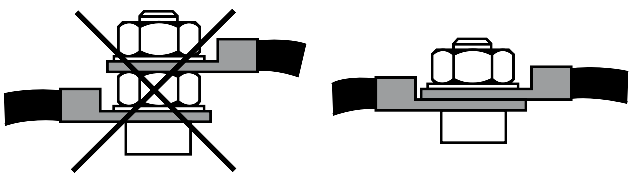
3.3.2 - Schéma de connexion des options



3.3.3 - Connection checks

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

Check that:
- The residual circuit-breaker complies with legislation on protection of personnel in force in the country of use, and has been correctly installed on the alternator power output as close as possible to the alternator. (In this case, disconnect the blue wire of the R 791 interference suppression module linking the neutral);
- Any protective devices in place have not tripped;
- If there is an external AVR, the connections between the alternator and the cubicle are made in accordance with the connection diagram;
- There is no short-circuit between phase or phase-neutral between the alternator output terminals and the generator set control cabinet (part of the circuit not protected by circuit-breakers or cubicle relays);
- The alternator has been connected with the busbar separating the terminals as shown in the terminal connection diagram.



- The equipotential earth links have been implemented correctly (cross-section and continuity of the earths).

3.4 - Commissioning

The alternator can only be started up and used if the installation is in accordance with the regulations and instructions defined in this manual.

The alternator is tested and set in the factory. When first used with no load, make sure that the drive speed is correct and stable (see the genset nameplate). On application of the load, the alternator should achieve its rated speed and voltage; however, in the event of abnormal operation, the alternator setting can be altered (follow the adjustment procedure: see section 3.5). If the operation is still incorrect, the cause of the malfunction must be located (see section 4.4 & 4.5).

3.5 - Setting up

The various adjustments during tests must be made by a qualified engineer. The screwdriver for making adjustments must be suitable for use with electrical equipment. It is essential that the drive speed specified on the genset nameplate is reached before commencing adjustment. The AVR is used to make any adjustments to the alternator. Access to the AVR adjustments is via the panel provided for this purpose.
After operational testing, replace all access panels or covers.

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ALTERNATORS

4 - SERVICING / MAINTENANCE

4.1 - Safety measures

Servicing or troubleshooting must be carried out strictly in accordance with instructions so as to avoid the risk of accidents and to maintain the alternator in its original state.

All such operations performed on the alternator should be undertaken by personnel trained in the commissioning, servicing and maintenance of electrical and mechanical components, who must wear the appropriate personal protective equipment for mechanical and electrical hazards.
Before carrying out any work on the alternator, ensure that it cannot be started by a manual or automatic system by isolating the power in any cabinet or enclosure and make sure you have understood the operating principles of the system.

4.2 - Regular maintenance

4.2.1 - Checks after start-up

After approximately 20 hours of operation, check that all fixing screws on the alternator are still tight, plus the general state of the alternator and the various electrical connections in the installation.

4.2.2 - Cooling circuit

It is advisable to check that circulation of air is not reduced by partial blocking of the air intake and outlet grilles: mud, fibre, grease, etc. and to check whether the ventilation guards are corroded or scratched.

4.2.3 - Bearings

The bearings are permanently greased: approximate life of the grease = 20,000 hours or 3 years.
As an option, they are regreasable for the LSA 44.2. It is advisable to lubricate the alternator during operation. Time intervals and quantity of grease are given in the table below.

NDE/DE bearing	6315 C3	6309 C3
Quantity of grease	30 g	15 g
Regreasing interval	6000 hrs	10,000 hrs

Lubrication intervals are given for grease type
LITHIUM - standard - NLGI 3.
In the factory, the grease used for lubrication is:
ESSO UNIREX N3.
Before using another grease, check for compatibility with the original one. Monitor the temperature rise in the bearings, which must not exceed 50°C above the ambient temperature. Should this value be exceeded, the alternator must be stopped and checks carried out.

4.2.4 - Electrical servicing

Cleaning product for the windings.

CAUTION

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

Certain strictly defined pure volatile degreasing agents can be used, such as:
- Normal petrol (without additives); inflammable
- Toluene (slightly toxic); inflammable
- Benzene (or benzine, toxic); inflammable
- Ciclohexare (non toxic); inflammable

The insulating components and the impregnation system are not at risk of damage from solvents (see the list of authorized products).
Avoid letting the cleaning product run into the slots. Apply the product with a brush, sponging frequently to avoid accumulation in the housing. Dry the winding with a dry cloth. Let any traces evaporate before reassembling the alternator.

These operations must be performed at a cleaning station, equipped with a vacuum system that collects and flushes out the products used.

4.2.5 - Mechanical servicing

CAUTION

Cleaning the machine using a water spray or a high-pressure washer is strictly prohibited.
Any problems arising from such treatment are not covered by our warranty.
The machine should be cleaned with a degreasing agent, applied using a brush. Check that the degreasing agent will not affect the paint.
Compressed air should used to remove any dust.
If filters have been added to the machine after manufacture and do not have thermal protection, the service personnel should clean the air filters periodically and systematically, as often as necessary (every day in very dusty atmospheres).
Cleaning can be performed using water for dry dust or in a bath containing soap or detergent in the case of greasy dust. Petrol or chloroethylene can also be used.
After cleaning the alternator, it is essential to check the winding insulation (see sections 3.2 and 4.8).

4.3 - Fault detection

If, when commissioned, the alternator does not work normally, the source of the malfunction must be identified.
To do this, check that:
- the protective devices are fitted correctly
- the connections comply with the diagrams in the manuals supplied with the machine
- the speed of the unit is correct (see section 1.3)
Repeat the operations defined in section 3

4.4 - Mechanical defects

Fault		Action
Bearing	Excessive overheating of one or both bearings (temperature > 80 °C on the bearing retainers with or without abnormal noise)	- If the bearing has turned blue or if the grease has turned black, change the bearing. - Bearing not properly seated. - End shields misaligned (flanges not properly fitted).
Temperature abnormal	Excessive overheating of alternator frame (more than 40 °C above the ambient temperature)	- Air flow (intake-outlet) partially clogged or hot air is being recycled from the alternator or engine - Alternator operating at too high a voltage (> 105% of Un on load) - Alternator overloaded
Vibration	Excessive vibration	- Misalignment (coupling) - Defective mounting or play in coupling - Rotor balancing fault
	Excessive vibration and humming noise coming from the machine	- Alternator operating in single-phase mode (single-phase load or faulty contactor or installation fault) - Stator short-circuit
Abnormal noise	Alternator damaged by a significant impact, followed by humming and vibration	- System short-circuit - Mis-paralleling Possible consequences - Broken or damaged coupling - Broken or bent shaft end - Shifting and short-circuit of main field - Fan fractured or coming loose on shaft - Irreparable damage to rotating diodes or AVR

4.5 - Electrical faults

Fault	Action	Effect	Check/Cause
No voltage at no load on start-up	Connect between E- and E+ a new battery of 4 to 12 volts, respecting the AVR polarities, for 2 to 3 seconds	The alternator builds up and its voltage is still correct when the battery is removed.	- Lack of residual magnetism
		The alternator builds up but its voltage does not reach the rated value when the battery is removed.	- Check the connection of the voltage reference to the AVR - Faulty diodes - Armature short-circuit
		The alternator builds up but its voltage disappears when the battery is removed	- Faulty AVR - Field windings disconnected - Main field winding open circuit. Check the resistance
Voltage too low	Check the drive speed	Correct speed	Check the AVR connections (AVR may be faulty) - Field windings short-circuited - Rotating diodes burnt out - Main field winding short-circuited - Check the resistance
		Speed too low	Increase the drive speed (Do not touch the AVR voltage pot. (P2) before running at the correct speed.)
Voltage too high	Adjust AVR voltage potentiometer	Adjustment ineffective	Faulty AVR
Voltage oscillations	Adjust AVR stability potentiometer	If no effect: try normal/rapid recovery modes (ST2)	- Check the speed: possibility of cyclic irregularity - Loose connections - Faulty AVR - Speed too low when on load (or LAM set too high)
Voltage correct at no load and too low when on load (*)	Run at no load and check the voltage between E+ and E- on the AVR	Voltage between E+ and E- SHUNT < 20 V - AREP/PMG < 10 V	- Check the speed (or LAM set too high)
		Voltage between E+ and E- SHUNT > 30 V - AREP/PMG > 15 V	- Faulty rotating diodes - Short-circuit in the main field. Check the resistance - Faulty exciter armature
(*) Caution: For single-phase operation, check that the sensing wires coming from the AVR are correctly connected to the operating terminals			
Voltage disappears during operation (**)	Check the AVR, the surge suppressor, the rotating diodes, and replace any defective components	The voltage does not return to the rated value	- Exciter winding open circuit - Faulty exciter armature - Faulty AVR - Main field open circuit or short-circuited
(**) Caution: Internal protection may be activated (overload, open circuit, short-circuit)			

LSA 43.2 / 44.2 - 4-POLE

ALTERNATORS

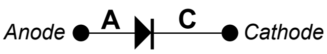
4.5.1 - Checking the winding

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

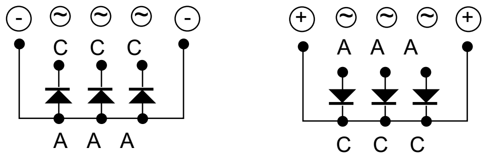
CAUTION

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

4.5.2 - Checking the diode bridge



LSA 43.2 / 44.2 diode bridge



A diode in good working condition allows the current to flow in only one direction, from anode to cathode.

4.5.3 - Checking the windings and rotating diodes using separate excitation

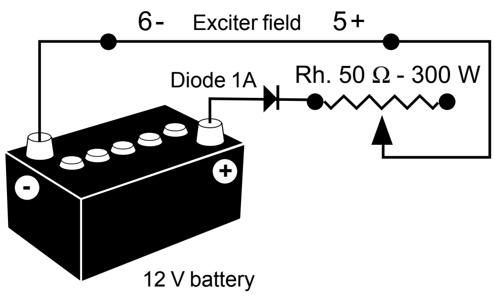
During this procedure, make sure that the alternator is disconnected from any external load and inspect the terminal box to check that the connections are fully tightened.

1) Stop the unit, disconnect and isolate the AVR wires.

2) There are two ways of creating an assembly with separate excitation.

Assembly A: Connect a 12 V battery in series with a rheostat of approximately 50 ohms - 300 W and a diode on both exciter field wires (5+) and (6-).

Assembly A



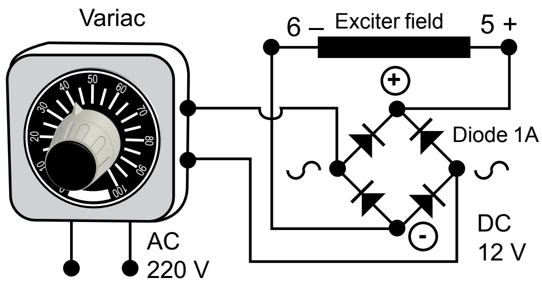
Assembly B: Connect a «Variac» variable power supply and a diode bridge on both exciter field wires (5+) and (6-).

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

3) Run the unit at its rated speed.

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

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



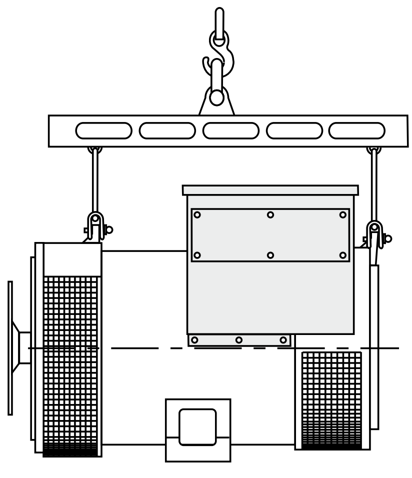
Assembly B

4.6 - Dismantling, reassembly

(see sections 5.4.1/5.4.2 & 5.4.3)

During the warranty period, this operation should only be carried out in an LEROY-SOMER approved workshop or in our factory, otherwise the warranty may be invalidated.

Whilst being handled, the alternator should remain horizontal (translational movement of rotor not locked). Check how much the alternator weighs (see section 4.9) before choosing the lifting method.
The choice of lifting hooks or handles should be determined by the shape of the lifting rings.



4.6.1 - Tools required

To fully dismantle the machine, we recommend using the tools listed below:
- 1 ratchet spanner + extension
- 1 torque wrench
- 1 set of flat spanners: 7 mm, 8 mm, 10 mm, 12 mm
- 1 socket set: 8 mm, 10 mm, 13 mm, 16 mm, 18 mm, 21 mm, 22 mm, 24 mm
- 1 size 5 Allen key (eg. Facom: ET5)
- 1 size 6 Allen key (eg. Facom: ET6)
- 1 size 10 Allen key (eg. Facom: ET10)
- 1 size 14 Allen key (eg. Facom: ET14)
- 1 T20 and T30 TORX bit
- 1 puller (eg. Facom: U35)
- 1 puller (eg. Facom: U32/350).

4.6.2 - Screw tightening torque

IDENTIFICATION	screw Ø	Torque N.m
Field terminal block screw	M4	4 N.m
Field screw	M6	10 N.m
Diode bridge/RP	M6	5 N.m
Diode nut	M5	4 N.m
43.2 tie rod	M12	57 N.m
44.2 tie rod	M14	90 N.m
Earth screw	M8	26 N.m
43.2 disc/shaft screw	M12	110 N.m
44.2 disc/shaft screw	M16	250 N.m
44.2 turbine screw	M6	5 N.m
Grille screws	M6	5 N.m
Cover screws	M6	5 N.m
Terminal block nut	M10	20 N.m

4.6.3 - Access to connections and the regulation system

The terminals are accessed directly by removing the terminal box lid [48].
To access the AVR adjustment potentiometers, the side plate [367] should be removed.

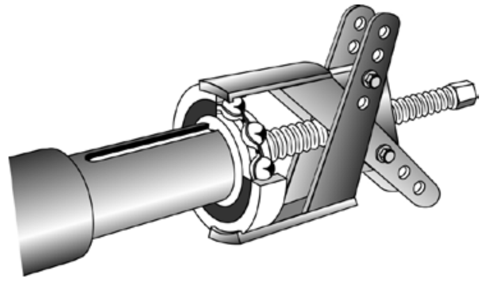
4.6.4 - Accessing, checking and replacing diodes

4.6.4.1 - Dismantling
- Remove the air intake grille [51]
- Remove the surge suppressor [347]
- Disconnect the 6 diodes using an ohmmeter or a battery lamp (see section 4.5.2)

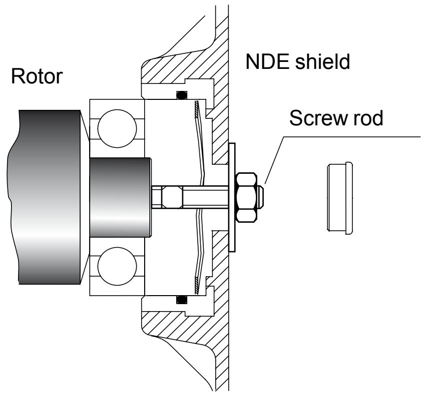
4.6.4.2 - Reassembly
- Replace the bridges, respecting the polarity (see section 4.5.1)
- Replace the surge suppressor [347]
- Refit the air intake grille [51]
- Replace the terminal box lid [48]

4.6.5 - Replacing the NDE bearing on single-bearing machines

4.6.5.1 - Dismantling
- Remove the terminal box lid [48]
- Remove the air intake grille [51]
- Unscrew the fixing clamps on the power output cables, remove the connector from the exciter and the R 791 module.
- Remove the 4 nuts on the tie rods
- Remove the NDE shield [36] using a puller: eg. U.32 - 350 (FACOM)
- Remove the ball bearing [70] using a screw puller



4.6.5.2 - Reassembly
- Heat the inner slipring of a new bearing by induction or in a drying oven at 80 °C (do not use an oil-bath) and fit it to the machine.
- Place the preloading wavy washer [79] in the shield and fit a new O ring seal [349].
Refit the NDE shield and pass the bundle of wires between the top bars of the shield.
- Refit the fixing clamps on the cables, the R 791 module and the exciter connector.
- Refit the air intake grille [51].
- Replace the terminal box lid [48].



4.6.6 - Replacing the bearings on two-bearing machines

4.6.6.1 - Dismantling
- Uncouple the alternator from the prime mover.
- Remove the 8 assembly screws.
- Remove the DE shield [30].
- Remove the NDE shield (see section 4.6.5.1)
- Remove both ball bearings [60] and [70] using a puller with a central screw.

4.6.6.2 - Reassembly
- Heat the new bearings by induction or in a drying oven at 80°C (do not use an oil-bath) and fit them to the machine.
- Check that both the preloading wavy washer [79] and the new O ring seal [349] have been fitted on the NDE shield [36].
Refit the NDE shield and pass the bundle of wires between the top bars of the shield.
- Refit the DE shield [30] and tighten the 4 fixing screws.
- Check that the machine assembly is correctly mounted and that all screws are tightened.

4.4.6.7 - Accessing the main field and stator

4.6.7.1 - Dismantling

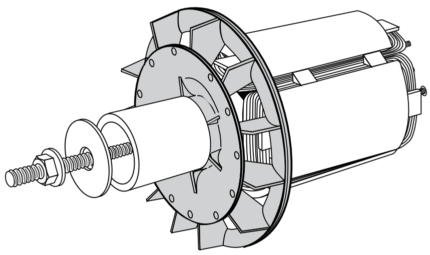
Follow the procedure for dismantling the bearings (see sections 4.6.5.1 and 4.6.6.1)
- Remove the coupling disc (single-bearing alternator) or the DE shield (two-bearing alternator) and insert a tube of the corresponding diameter on the shaft end.
- Rest the rotor on one of its poles, then slide it out. Use the tube as a lever arm to assist dismantling.
- After extraction of the rotor, be careful not to damage the fan. If the fan is dismantled, it is essential that it is replaced for the 43.2.

NOTE: If intervention is required on the main field (rewinding, replacement of components), the rotor assembly must be rebalanced.

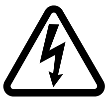
4.6.7.2 - Reassembling the main field

- Follow the dismantling procedure in reverse order.

Take care not to knock the windings when refitting the rotor in the stator.
- If the fan is being replaced on the 43.2, assemble the parts as shown in the following diagram. Fit a tube and a threaded screw. On the 44.2 the fan is fixed by screws on the hub.



Follow the procedure for reassembling the bearings (see sections 4.6.5.2 and 4.6.6.2).



After operational testing, replace all access panels or covers.

4.7 - Installation and maintenance of the PMG

For the LSA 43.2 and LSA 44.2, the PMG reference is PMG 1. See the PMG maintenance manual, ref: 4211.

CAUTION

Mounting is impossible with the «regreasable bearings» option with the LSA 44.2.

4.8 - Electrical characteristics

Table of average values:
Alternator - 2 and 4 poles - 50 Hz/60 Hz - Winding n° 6 and M or M1 connected in dedicated single-phase. (400 V for the excitation values).
The voltage and current values are given for no-load operation and operation at rated load with separate field excitation. All values are given at ± 10% (for exact values, consult the test report) and are subject to change without prior warning. For 60 Hz machines, the resistance values are the same and the excitation current «i exc» is approximately 5 to 10% weaker.

4.8.1 - 3-phase LSA 43.2 4 P, SHUNT excitation

Resistances at 20 °C (Ω)

LSA 43.2	Stator L/N	Rotor	Field	Armature
S1	0.155	1.35	18.4	0.23
S15	0.155	1.35	18.4	0.23
S25	0.155	1.35	18.4	0.23
S35	0.128	1.41	18.4	0.23
M45	0.105	1.57	18.4	0.23
L65	0.083	1.76	18.4	0.23
L8	0.063	1.96	18.4	0.23

Field excitation current i exc (A) - 400 V - 50 Hz
«i exc»: excitation current of the exciter field

LSA 43.2	no load	on load
S1	0.5	1.3
S15	0.5	1.5
S25	0.5	1.6
S35	0.5	1.8
M45	0.4	1.6
L65	0.4	1.6
L8	0.4	1.6

4.8.2 - 3-phase LSA 43.2 4 P, AREP excitation

Resistances at 20 °C (Ω)

LSA 43.2	Stator L/N	Rotor	Wind. X1,X2	Widing. Z1,Z2	Field	Armat.
S1	0.155	1.35	0.32	0.52	4.6	0.23
S15	0.155	1.35	0.32	0.52	4.6	0.23
S25	0.155	1.35	0.32	0.52	4.6	0.23
S35	0.128	1.41	0.29	0.5	4.6	0.23
M45	0.105	1.57	0.26	0.51	4.6	0.23
L65	0.083	1.76	0.26	0.44	4.6	0.23
L8	0.063	1.96	0.21	0.4	4.6	0.23

Field excitation current i exc (A) -400 V -50 Hz
«i exc»: excitation current of the exciter field

LSA 43.2	no load	on load
S1	1	2.6
S15	1	3
S25	1	3.2
S35	1	3.6
M45	0.8	3.2
L65	0.8	3.2
L8	0.8	3.2

4.8.3 - Dedicated single-phase LSA 43.2: 4-pole, SHUNT excitation (60 Hz only)

Resistances at 20 °C (Ω)

LSA 43.2	Stator L/N	Rotor	Field	Armature
S1	0.058	1.35	13.9	0.23
S25	0.058	1.35	13.9	0.23
S35	0.046	1.41	13.9	0.23
M45	0.037	1.57	13.9	0.23
L65	0.027	1.76	13.9	0.23
L8	0.019	1.96	13.9	0.23

Field excitation current i exc (A) -240 V -60 Hz

«i exc»: excitation current of the exciter field

LSA 43.2	no load	on load
S1	0.59	1.44
S25	0.59	1.68
S35	0.66	1.65
M45	0.61	1.48
L65	0.62	1.48
L8	0.74	1.46

4.8.4 - 3-phase LSA 44.2: 4-pole, SHUNT excitation

Resistances at 20 °C (Ω)

LSA 44.2	Stator L/N	Rotor	Field	Armature
VS3	0.046	2.51	18.4	0.5
VS45	0.046	2.51	18.4	0.5
S7	0.036	2.91	18.4	0.5
S75	0.036	2.91	18.4	0.5
M95	0.024	3.32	18.4	0.5
L12	0.019	3.66	18.4	0.5

Field excitation current i exc (A) - 400 V - 50 Hz

«i exc»: excitation current of the exciter field

LSA 44.2	no load	on load
VS3	0.5	1.8
VS45	0.5	2.1
S7	0.5	1.9
S75	0.5	2.1
M95	0.6	2
L12	0.5	1.9

4.8.5 - 3-phase LSA 44.2: 4-pole, AREP excitation

Resistances at 20 °C (Ω)

LSA 44.2	Stator L/N	Rotor	Wind. X1,X2	Wind. Z1,Z2	Field	Armat.
VS3	0.046	2.51	0.3	0.5	4.9	0.5
VS45	0.046	2.51	0.3	0.5	4.9	0.5
S7	0.036	2.91	0.21	0.32	4.9	0.5
S75	0.036	2.91	0.21	0.32	4.9	0.5
M95	0.024	3.32	0.17	0.28	4.9	0.5
L12	0.019	3.66	0.16	0.21	4.9	0.5

Field excitation current i exc (A) -400 V -50 Hz

«i exc»: excitation current of the exciter field

LSA 44.2	no load	on load
VS3	1	3.6
VS45	1	4.2
S7	1	3.8
S75	1	4.2
M95	1.2	4
L12	1	3.8

4.8.6 - Dedicated single-phase LSA 44.2: 4-pole, SHUNT excitation (60 Hz only)

Resistances at 20 °C (Ω)

LSA 44.2	Stator L/N	Rotor	Field	Armature
VS3	0.0194	2.51	18.4	0.5
VS45	0.0194	2.51	18.4	0.5
S7	0.0140	2.91	18.4	0.5
M95	0.0088	3.32	18.4	0.5

Field excitation current i exc (A) -240 V -60 Hz

«i exc»: excitation current of the exciter field

LSA 44.2	no load	on load
VS3	0.44	1.18
VS45	0.44	1.25
S7	0.43	1.2
M95	0.55	1.28

4.9 - Table of weights

LSA 43.2	Total weight (kg)	Rotor (kg)
S1	220	76
S15	220	76
S25	220	76
S35	240	80
M45	270	90
L65	290	102
L8	330	120

LSA 44.2	Total weight (kg)	Rotor (kg)
VS3	405	140
VS45	405	140
S7	460	165
S75	460	165
M95	515	185
L12	570	210

LSA 43.2 / 44.2 - 4-POLE

ALTERNATORS

5 - SPARE PARTS

5.1 - First maintenance parts

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

Ref.	Designation	Qty	LSA 43.2/44.2 - SHUNT	Code
198	AVR	1	R 250	AEM 110 RE 019
			R 251	AEM 110 RE 021
343	Diode bridge assembly	1	LSA 432 9 100	ALT 432 KD 001
347	Surge suppressor	1	LSA 432 1 13	AEM 000 RE 126
	AVR fuse	1	250 V - 8 A/slow-blow	

Ref.	Designation	Qty	LSA 43.2/44.2 - AREP 4 P	Code
198	AVR	1	R 438	AEM 110 RE 017
343	Diode bridge assembly	1	LSA 432 9 100	ALT 432 KD 001
347	Surge suppressor	1	LSA 432 1 13	AEM 000 RE 126
	AVR fuse	2	250 V - 8 A/fast-blow	

5.2 - Bearing designations

Ref.	Designation	Qty	LSA 43.2	Code	LSA 44.2	Code
60	Bearing on shaft extension end	1	6312 2RS/C3	RLT060ET007	6315 2RS/C3	RLT075ET004
70	Bearing on exciter end	1	6307 2RS/C3	RLT035ET030	6309 2RS/C3	RLT045ET030

5.3 - Technical support service

Our technical support service will be pleased to provide any additional information you may require.
When ordering spare parts, you should indicate the complete machine type, its serial number and the information given on the genset nameplate.

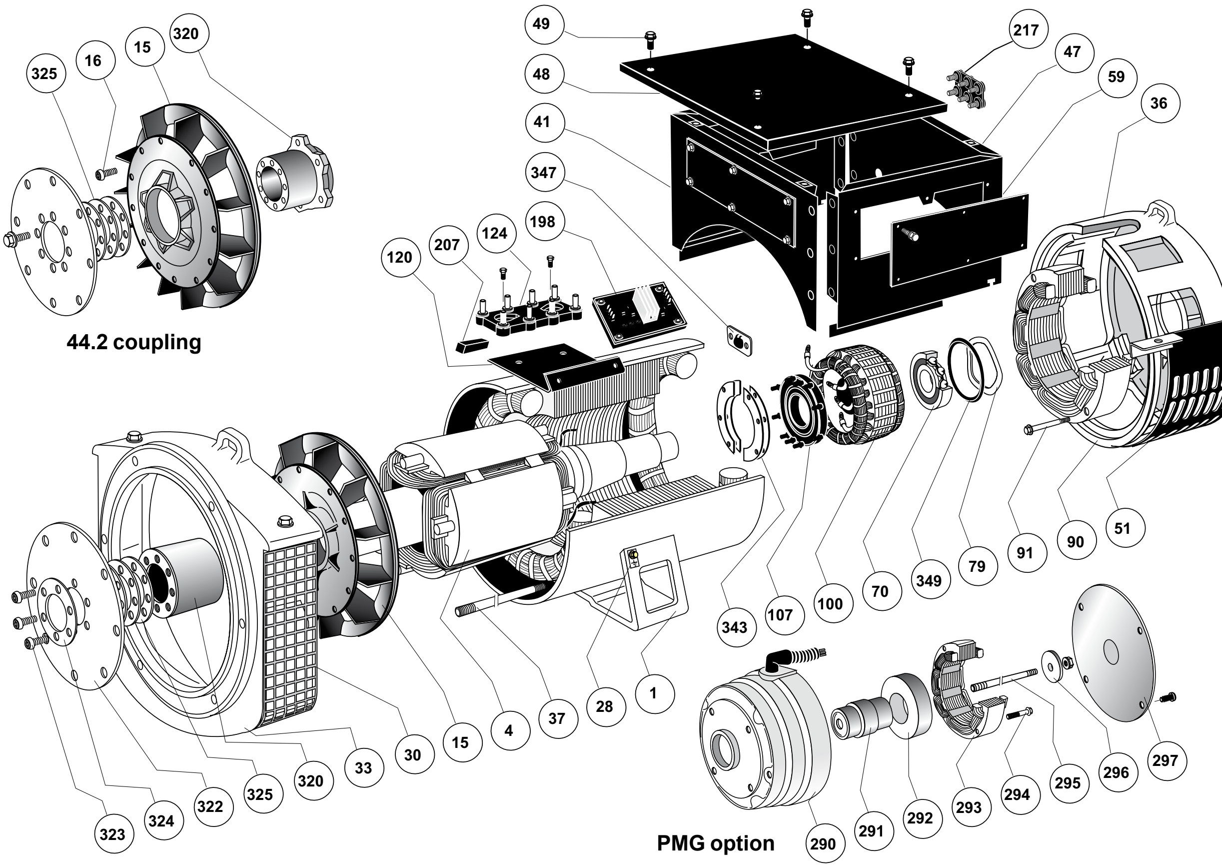
Address your enquiry to your usual contact.

CAUTION

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

5.4 - Exploded views, parts list

5.4.1 - Single-bearing LSA 43.2/44.2

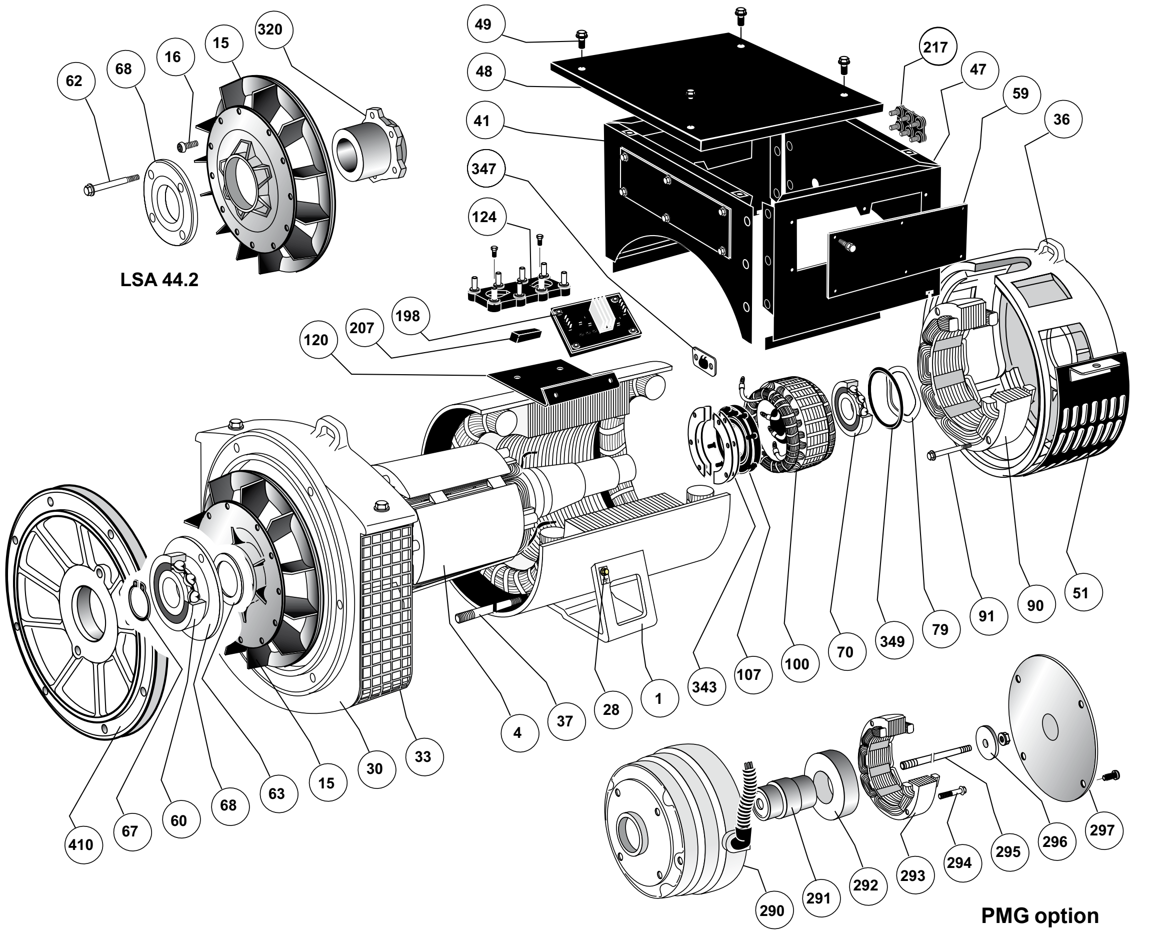


N°	Nbr	Description	N°	Nbr	Description
1	1	Stator assembly	120	1	Terminal block support (AREP)
4	1	Rotor assembly	124	1	Terminal block
15	1	Fan	198	1	Voltage regulator (AVR)
16	6	Fixing screws (44.2 only)	207	1	AVR damper seal
28	1	Earth terminal	217	1	Terminal block
30	1	DE shield	290	1	PMG housing
33	1	Air outlet grille	291	1	Adaptation shaft
36	1	Shield on exciter end	292	1	Magnetic rotor
37	4	Tie rod	293	1	Stator
41	1	Cover front panel	294	2	Fixing screws
47	1	Cover rear panel	295	1	Tie rod
48	1	Cover top panel	296	1	Cable gland washer + nut
49	34	Fixing screws	297	1	End plate
51	1	Air intake grille	320	1	Hub (43.2 L7 & 44.2 only)
59	3	Inspection door	322	1	Coupling disc
70	1	NDE bearing	323	-	Fixing screws
79	1	Preloading wavy washer	324	1	Clamping washer (43.2 S1 to L6)
90	1	Exciter field	325	-	Spacer shim (43.2 L7 & 44.2 only)
91	4	Exciter field fixing screw	343	1	Diode bridge assembly
100	1	Exciter armature	347	1	Surge suppressor
107	1	Diode crescent support	349	1	«O» ring

LSA 43.2 / 44.2 - 4-POLE

ALTERNATORS

5.4.2 - Two-bearing LSA 43.2/44.2



N°	Nbr	Description	N°	Nbr	Description
1	1	Stator assembly	90	1	Exciter field
4	1	Rotor assembly	91	4	Exciter field fixing screw
15	1	Fan	100	1	Exciter armature
16	6	Fixing screws (44.2 only)	107	1	Diode crescent support
28	1	Earth terminal	120	1	Terminal block support (AREP)
30	1	DE shield	124	1	Terminal block
33	1	Air outlet grille	198	1	Voltage regulator (AVR)
36	1	Shield on exciter end	207	1	AVR damper seal
37	4	Tie rod	217	1	Terminal block
41	1	Cover front panel	290	1	PMG housing
47	1	Cover rear panel	291	1	Adaptation shaft
48	1	Cover top panel	292	1	Magnetic rotor
49	34	Fixing screws	293	1	Stator
51	1	Air intake grille	294	2	Fixing screws
59	3	Inspection door	295	1	Tie rod
60	1	DE bearing	296	1	Cable gland washer + nut
62	2/4	Bearing retainer fixing screw	297	1	End plate
63	1	Cable gland washer (43.2 only)	320	1	Hub (44.2 only)
67	1	Circlips	343	1	Diode bridge assembly
68	1	Inner bearing retainer	347	1	Surge suppressor
70	1	NDE bearing	349	1	«O» ring
79	1	Preloading wavy washer	410	1	End shield

Electric Power Generation

DECLARATION of COMPLIANCE
related to CE marking

This Declaration applies to the generators designed to be incorporated into machines complying with the Machine Directive Nr 2006/42/CE dated 17 May 2006.

MOTEURS LEROY-SOMER
Boulevard Marcellin Leroy
16015 ANGOULEME (France)

Declares hereby that the electric generators of the ranges " PARTNER", Industrial and Professional, as well as their derivatives, manufactured by Leroy Somer or on Leroy Somer's behalf, comply with the following International Standards and Directives :

- EN et CEI 60034 -1 et 60034 -5
- ISO 8528 – 3 " Reciprocating internal combustion engine driven alternating current generating sets. Part 3. Alternating current generators for generating sets "
- The Low Voltage Directive Nr 2006/95/CE dated 12 December 2006.

Furthermore, these generators, designed in compliance with the Machine Directive Nr 2006/42, are therefore able to be incorporated into Electrical Gen-Sets complying with the following International Standards and Directives :

- The Machine Directive Nr 2006/42/CE dated 17 May 2006
- The EMC Directive Nr 2004/108/CE dated 15 December 2004, as intrinsic levels of emissions and immunity are concerned

WARNING :

The here above mentioned generators should not be commissioned until the corresponding Gen-Sets have been declared in compliance with the Directives Nr 2006/42/CE et 2004/108/CE, as well as with the other relevant Directives.

Technical Managers

P Betge – O Cadel

4152 en – 12.2009 / c

MOTEURS LEROY-SOMER 16015 ANGOULÊME CEDEX - FRANCE

RCS ANGOULÊME N° B 671 820 223
S.A. au capital de 62 779 000 €

http://www.leroy-somer.com

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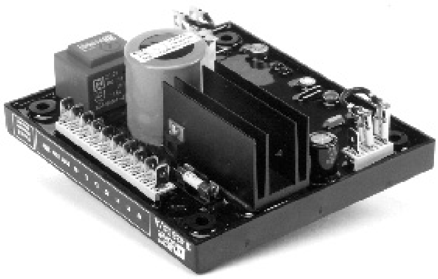
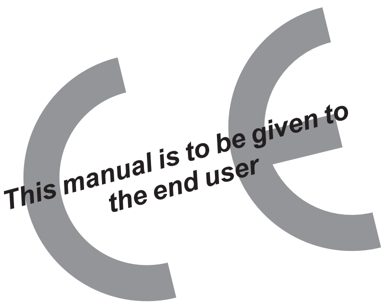
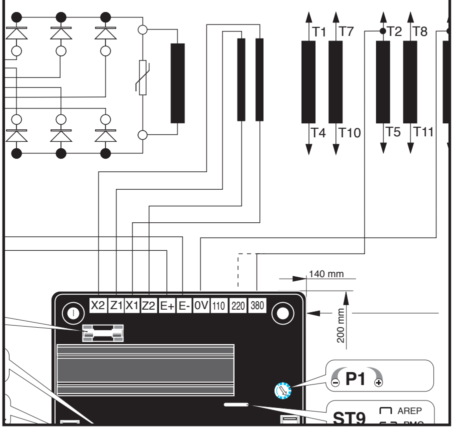






R438

A.V.R.

Installation and maintenance

R438
A.V.R.

This manual concerns the alternator A.V.R. which you have just purchased.

We wish to draw your attention to the contents of this maintenance manual. By following certain important points during installation, use and servicing of your A.V.R., you can look forward to many years of trouble-free operation.

SAFETY MEASURES

Before using your machine for the first time, it is important to read the whole of this installation and maintenance manual.

All necessary operations and interventions on this machine must be performed by a qualified technician.

Our technical support service will be pleased to provide any additional infor-mation you may require.

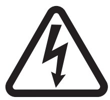
The various operations described in this manual are accompanied by recommen-dations or symbols to alert the user to potential risks of accidents. It is vital that you understand and take notice of the following warning symbols.

This A.V.R. can be incorporated in a machine marked C.E.

WARNING

Warning symbol for an operation capable of damaging or destroying the machine or surround-ing equipment.

Warning symbol for general danger to personnel.

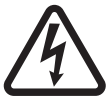


Warning symbol for electrical danger to personnel.

Note: LEROY-SOMER reserves the right to modify the characteristics of its products at any time in order to incorporate the latest technological developments. The information contained in this document may therefore be changed without notice.

R438
A.V.R.

CONTENTS



All such operations performed on the A.V.R. should be undertaken by personnel trained in the commissioning, servicing and maintenance of electrical and mechanical components.

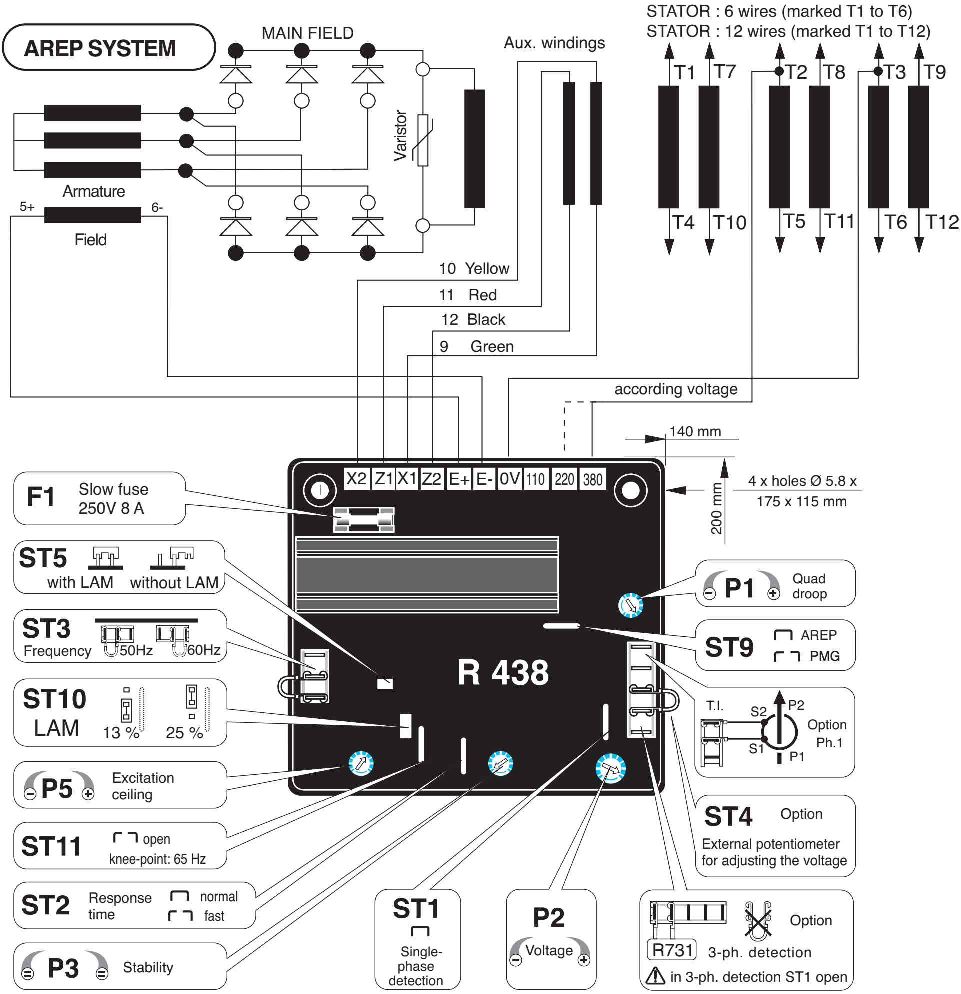
The R438 is an IP00 product. It must be installed inside a unit so that this unit's cover can provide IP20 minimum total protection (it must only be installed on LS alternators in the appropriate location so that when viewed externally, it has a higher degree of protection than IP20).

R438
A.V.R.

1 - SUPPLY

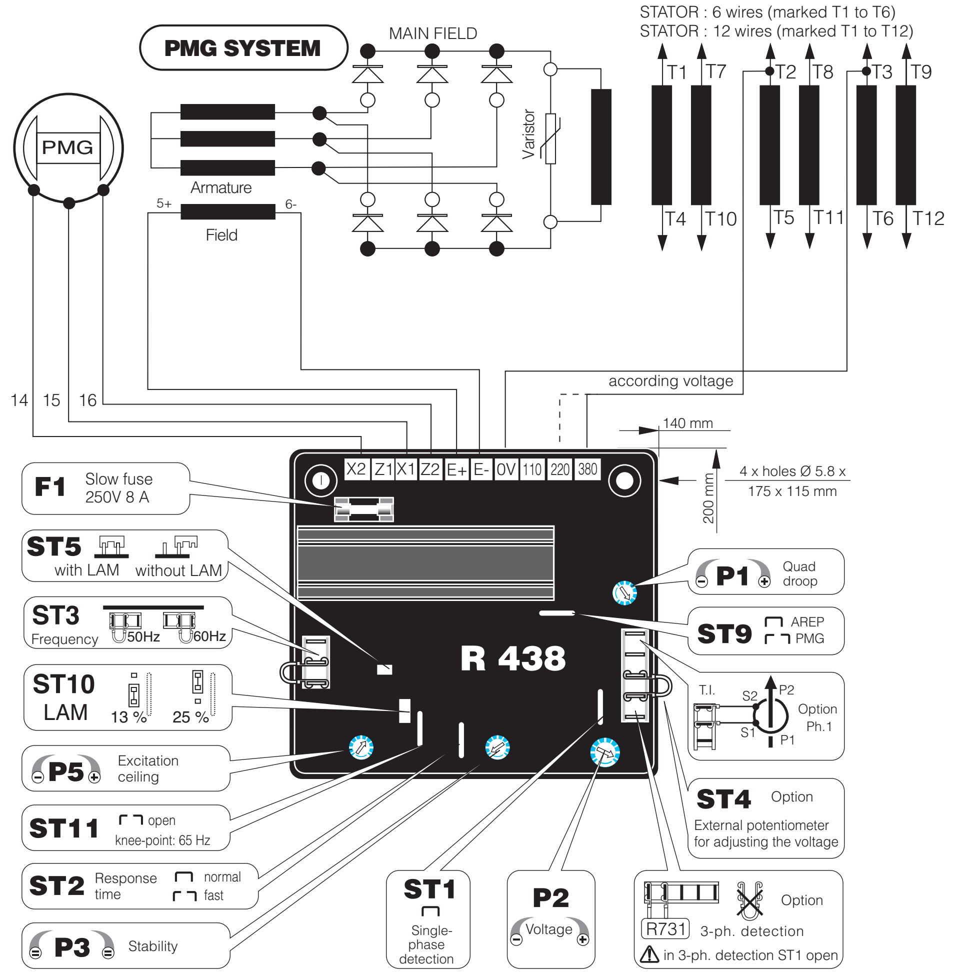
1.1 - AREP excitation system

For both AREP & PMG excitation systems, the alternator voltage regulator is the R438.
With **AREP** excitation, the R438 electronic AVR is powered by two auxiliary windings which are independent of the voltage match circuit.
The first winding has a voltage in proportion to that of the alternator (characteristic Shunt), the second has a voltage in proportion to the stator current (compound characteristic: Booster effect).
The power supply voltage is rectified and filtered before being used by the AVR monitoring transistor. This principle ensures that regulation is not affected by distortions generated by the load.



1.2 - PMG excitation system

This excitation system consists of a «**PMG**» (permanent magnet generator). This is fitted at the rear of the machine and connected to the R438 AVR.
The PMG supplies the AVR with constant voltage which is independent of the main alternator winding. As a result the machine has a short-circuit current capacity and good immunity to distortions generated by the load.
The AVR monitors and corrects the alternator output voltage by adjusting the excitation current.
- 50/60 Hz selection via the **ST3** jumper.



1.3 - SHUNT or separate excitation system

A.V.R. can be operated with SHUNT supply (with a transformer / secondary 50V or a 48V battery).

2 - R438 A.V.R.

2.1 - Characteristics

- Storage : -55°C ; +85°C
- Operation : -40°C ; +70°C
- Standard power supply: AREP or PMG.
- Rated overload current: 8 A - 10 s
- Electronic protection (overload, short-circuit on opening of voltage sensing circuit): excitation overload current for 10 seconds then return to approximately 1A. The alternator must be stopped (or the power switched off) in order to reset the protection.
- Fuse : F1 on X1, X2. 8A ; slow - 250V
- Voltage sensing : 5 VA isolated via transformer ;
  - 0-110 V terminals = 95 to 140 V,
  - 0-220 V terminals = 170 to 260 V,
  - 0-380 V terminals = 340 to 520 V.
- Voltage regulation ± 1%.
- Normal or rapid response time via **ST2** jumper (see below).
- Voltage adjustment via potentiometer **P2**. other voltages via adapter transformer
- Current sensing (parallel operation): C.T. 2.5 VA cl1, secondary 1 A (optional).
- Quadrature droop adjustment via potentiometer **P1**.
- Max. excitation current adjustment via **P5** (see below).

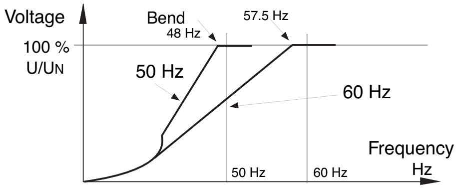
2.1.1 - Configuration jumpers function

Pot.	Delivrery config. Open	Delivrery config. Closed	Position	Function
ST1	3-ph.	Mono		Open for module installation tri detection
ST2	Fast	Normal		Response time
ST3			50 ou 60 Hz	Frequency selection
ST4	External potentio-meter	Without		Potentiometer
ST5	Without	With		LAM
ST9	Others (PMG...)	AREP		Supply
ST10			13% or 25%	LAM voltage drop amplitude
ST11	65 Hz	48 or 58 Hz		U/f function bend position

2.1.2 - Setting potentiometers function

Delivrery position	Pot.	Function
0	P1	Quadrature droop ; // operation with C.T.
400V	P2	Voltage
Centre	P3	Stability
Maxi	P5	Excitation current ceiling

2.2 - Frequency compared with voltage (without LAM)

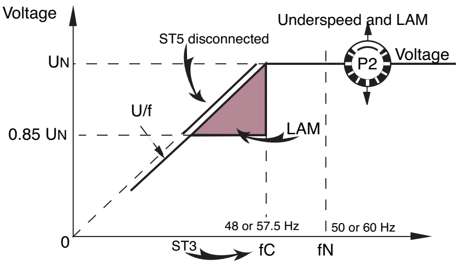


2.3 - LAM (Load Acceptance Module) characteristics

2.3.1 - Voltage drop

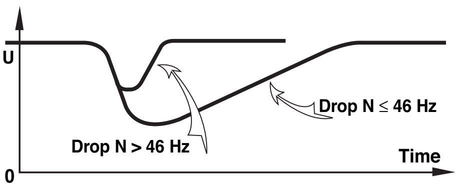
The LAM system is integrated in the R 438 AVR as standard.
Role of the «LAM» (Load Adjustment Module) :
On application of a load, the rotation speed of the generator set decreases. When it passes below the preset frequency threshold, the LAM causes the voltage to drop by approximately 13% or 25% and consequently the amount of active load applied is reduced by approximately 25% to 50%, until the speed reaches its rated value again.
Hence the LAM can be used either to reduce the speed variation (frequency) and its duration for a given applied load, or to increase the applied load possible for one speed variation (turbo-charged engine).
To avoid voltage oscillations, the trip threshold for the LAM function should be set approximately 2 Hz below the lowest frequency in steady state.

- LAM : action eliminated by cutting the ST5 jumper.



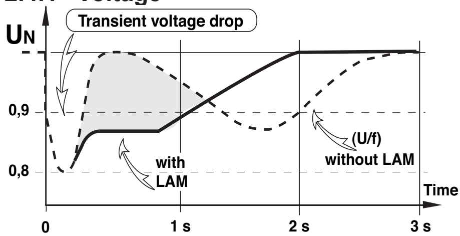
2.3.2 - Gradual voltage return function

During load impacts, the function helps the genset to return to its rated speed faster thanks to a gradual increase in voltage according to the principle:
- If the speed drops between 46 and 50 Hz, the rated voltage follows a fast gradient as it is restored.
- If the speed drops below 46 Hz, since the engine needs more help, the voltage follows a slow gradient as it returns to the reference value.

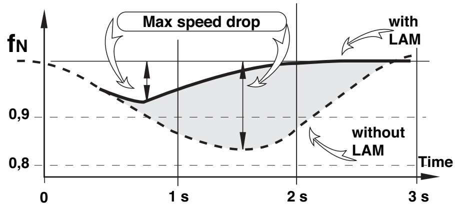


2.4 - Typical effects of the LAM with a diesel engine with or without a LAM (U/F only)

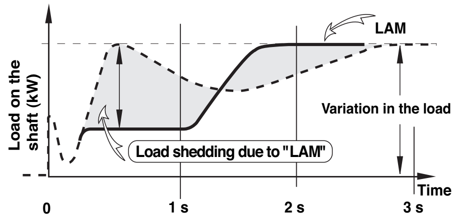
2.4.1 - Voltage



2.4.2 - Frequency



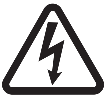
2.4.3 - Power



2.5 - R438 A.V.R. options

- **Current transformer** for parallel operation of ....../1A. 5 VA CL 1.

- **Remote voltage adjustment potentiometer**: 470 Ω, 0.5 W min: adjustment range ± 5% (range limited by internal voltage potentiometer **P2**). Remove ST4 to connect the po-ten-tiometer. (A 1 kΩ potentiometer can also be used to extend the adjustment range).



For wiring up the external potentiometer; the “earth” wires must be isolated as well as the potentiometer terminals (wires at the same voltage as the power).

- **R 731 external module**: sensing of 3-phase voltage 200 to 500 V, compatible with parallel operation. Disconnect ST1 to connect the module; set the voltage via the module potentiometer.

- R 734 module: detection of 3-phase current and voltage for parallel operation on unbalanced installations (imbalance > 15%).

- **R 726 module**: 3 functions (mounted externally).
P.F. regulation (2F) and voltage sensing circuit before paralleling (3 F).

- Control through DC voltage used monitoring apply to the terminals for connection of a potentiometer DC voltage :
• internal impedance 1,5 kΩ
• ± 0,5V enable a voltage setting of 10%.

3 - INSTALLATION - COMMISSIONING

3.1 - Electrical checks on the AVR

- Check that all connections have been made properly as shown in the attached wiring diagram.
- Check that the ST3 frequency selection jumper is on the correct frequency setting.
- Check whether the ST4 jumper or the remote adjustment potentiometer have been connected.
- Optional operating modes.
  • ST1 jumper : open to connect the R 731or R 734 3-phase sensing module.
  • ST2 jumper : open if rapid response time used
  • ST5 jumper : open to suppress the LAM function.

3.2 - Settings

The machine is tested and set at the factory. When first used with no load, make sure that the drive speed is correct and stable (see the nameplate). After operational testing, replace all access panels or covers.
The only possible adjustments to the machine should be made on the AVR.

3.2.1 - R438 settings (AREP or PMG system)

WARNING

Before any intervention on the A.V.R., make sure that the ST9 jumper is closed with AREP excitation and disconnected with PMG or SHUNT or separate excitation.

a) Initial potentiometer settings (see table below)
- Remote voltage adjustment potentiometer : centre (ST4 jumper removed).

Action	Factory setting	Pot.
Voltage minimum fully anti-clockwise	400V - 50 Hz (Input 0 - 380 V)	P2
Stability	Not set (centre position)	P3
Voltage quadrature droop (// operation with C.T.) - 0 quadrature loop fully anti-clockwise.	Not set (fully anti-clockwise)	P1
Excitation ceiling Limit of excitation and short-circuit current, minimum fully anti-clockwise.	10 A maximum	P5

Stability adjustments in standalone operation

b) Install a D.C. analogue voltmeter (needle dial) cal. 50V on terminals E+, E- and an A.C. voltmeter cal 300 - 500 or 1000V on the alternator output terminals.

c) Make sure that the **ST3** jumper is positioned on the desired frequency (50 or 60 Hz).

d) Voltage potentiometer **P2** at minimum, fully anti-clockwise.

e) Stability potentiometer **P3** to around 1/3 of the anti-clockwise limit.

f) Start the engine and set its speed to a frequency of 48 Hz for 50 Hz, or 58 for 60 Hz.

g) Set the output voltage to the desired value using **P2**.
- Rated voltage UN for solo operation (eg. 400 V)
- Or UN + 2 to 4% for parallel operation with C.T. (eg. 410 V)
If the voltage oscillates, use P3 to make adjustments (try both directions) observing the voltage between E+ and E- (approx. 10V D.C.).

The best response times are obtained at the limit of the instability. If no stable position can be obtained, try disconnecting or replacing the ST2 jumper (normal/fast).

h) Check LAM operation : **ST5** closed.

i) Vary the frequency (speed) around 48 or 58 Hz according to the operating frequency, and check the change in voltage from that observed previously (~ 15%).

j) Readjust the speed of the unit to its rated no-load value.
Adjustments in parallel operation

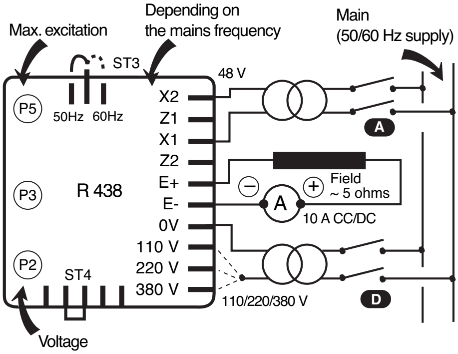
Before any intervention on the alternator, make sure that the speed droop is identical for all engines.

k) Preset for parallel operation (with C.T. connected to S1, S2)
- Potentiometer P1 (quadrature droop) in centre position.
Apply the rated load (cos φ = 0.8 inductive).
The voltage should drop by 2 to 3%. If it increases, check that V and W and also S1 and S2 have not been reversed.

l) The no-load voltages should be identical for all the alternators intended to run in parallel.
- Couple the machines in parallel.
- By adjusting the **speed**, try to obtain **0 KW** power exchange.
- By altering the voltage setting P2 on one of the machines, try to cancel (or minimise) **the current** circulating between the machines.
- From now on, do not touch the voltage settings.

m) Apply the available load (the setting is only correct if a **reactive** load is available)
- By altering the **speed**, match the **kW** (or divide the rated power of the units proportionally)
- By altering the quadrature droop potentiometer **P1**, match or divide the **currents**.

3.2.2 - Max. excitation setting (excitation ceiling)



Static adjustment of the current limit, potentiometer P5 (factory setting: 7.5 A, fuse rating: 8 A - 10 seconds).

The maximum factory setting corresponds to that of the excitation current required to obtain a 3-phase short-circuit current of approximately 3 IN at 50 Hz for industrial power, unless otherwise specified(*).

A static method can be used to reduce this value or adapt the Isc to the actual operating power (derated machine), which is safer for the alternator and the installation. Disconnect power supply wires X1,X2 and Z1,Z2 and the voltage reference (0-110V-220V-380V) on the alternator.

Connect the mains power supply using a transformer (200-240V) as indicated (X1,X2 : 48V). Install a 10A D.C. ammeter in series with the exciter field. Turn P5 fully anti-clockwise and activate the power supply. If there is no output current from the AVR, turn potentiometer P2 (voltage) clockwise until the ammeter indicates a stable current. Switch the power supply off, then on again, turn P5 clockwise until the required max. current is obtained (no more than 8 A).

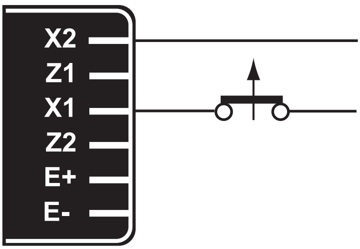
Checking the internal protection :
Open switch (D) : the excitation current should increase to its preset ceiling, remain at that level for ≥ 10 seconds and then drop to < 1A.
To reset, switch off the power supply by opening switch (A).
Note: After setting the excitation ceiling as described, adjust the voltage again (see section 2.1.1)
(*) In some countries it is a legal requirement to have a short-circuit current of 3 I_N, so as to offer selective protection.

3.2.3 - Special type of use

WARNING

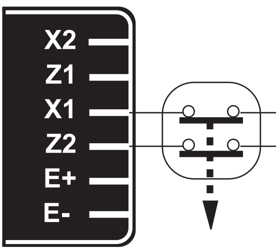
Excitation circuit E+, E- must not be left open when the machine is running : AVR damage will occur.

3.2.3.1 - R438 field weakening (SHUNT)



The exciter is switched off by disconnecting the AVR power supply (1 wire - X1 or X2).
Contact rating 16 A - 250V A.C.

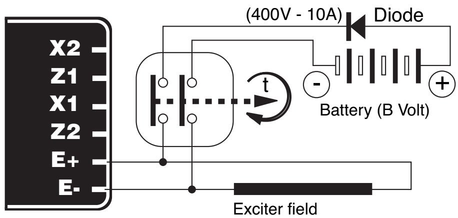
3.2.3.2 - R438 field weakening (AREP/PMG)

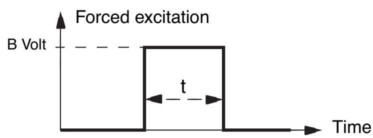


The exciter is switched off by disconnecting the AVR power supply (1 wire on each auxiliary winding) - contact rating 16 A - 250V A.C.
Connection is identical for resetting the AVR internal protection.

In case of using the de-excitation, provide a forced excitation.

3.2.3.3 - R438 field forcing

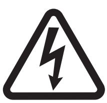




Applications	B volts	Time t
Guaranteed voltage build-up	12 (1A)	1 - 2 s
Parallel operation, de-energized	12 (1A)	1 - 2 s
Parallel operation, at standstill	12 (1A)	5 - 10 s
Frequency starting	12 (1A)	5 - 10 s
Sustained voltage on overload	12 (1A)	5 - 10 s

3.3 - Electrical faults

Fault	Action	Effect	Check/Cause
No voltage at no load on start-up	Connect a new battery of 4 to 12 volts to terminals E- and E+, respecting the polarity, for 2 to 3 seconds	The alternator builds up and its voltage is still correct when the battery is removed.	- Lack of residual magnetism
		The alternator builds up but its voltage does not reach the rated value when the battery is removed.	- Check the connection of the voltage reference to the AVR - Faulty diodes - Armature short-circuit
		The alternator builds up but its voltage disappears when the battery is removed	- Faulty AVR - Field windings disconnected - Main field winding open circuit - check the resistance
Voltage too low	Check the drive speed	Correct speed	Check the AVR connections (AVR may be faulty) - Field windings short-circuited - Rotating diodes burnt out - Main field winding short-circuited - Check the resistance
		Speed too low	Increase the drive speed (Do not touch the AVR voltage pot. (P2) before running at the correct speed.)
Voltage too high	Adjust AVR voltage potentiometer	Adjustment ineffective	Faulty AVR
Voltage oscillations	Adjust AVR stability potentiometer	If no effect : try normal / fast recovery modes (ST2)	- Check the speed : possibility of cyclic irregularity - Loose connections - Faulty AVR - Speed too low when on load (or U/F bend set too high)
Voltage correct at no load and too low when on load (*)	Run at no load and check the voltage between E+ and E- on the AVR	Voltage between E+ and E- SHUNT < 20 V AREP / PMG < 10V	- Check the speed (or U/F bend set too high)
		Voltage between E+ and E- SHUNT > 30V AREP / PMG > 15V	- Faulty rotating diodes - Short-circuit in the main field. Check the resistance - Faulty exciter armature.
(*) Caution : For single-phase operation, check that the sensing wires coming from the AVR are correctly connected to the operating terminals			
Voltage disappears during operation (**)	Check the AVR, the surge suppressor, the rotating diodes, and replace any defective components	The voltage does not return to the rated value.	- Exciter winding open circuit - Faulty exciter armature - Faulty AVR - Main field open circuit or short-circuited
(**) Caution : Internal protection may be activated (overload, open circuit, short-circuit)			



Warning : after operational testing, replace all access panels or covers.

4 - SPARE PARTS

4.1 - Designation

Description	Type	Code
A.V.R.	R 438	AEM 110 RE 017

4.2 - Technical support service

Our technical support service will be happy to provide any information you require.

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

Part numbers should be identified from the exploded views and their description in the parts list.

Our extensive network of «service stations» can dispatch the necessary parts without delay.
To ensure correct operation and the safety of our machines, we recommend the use of original manufacture spare parts.
In the event of failure to comply with this advice, the manufacturer cannot be held responsible for any damage.

NOTES

NOTES

MOTEURS LEROY-SOMER 16015 ANGOULÊME CEDEX - FRANCE

338 567 258 RCS ANGOULÊME
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