



OPERATIONS & MAINTENANCE MANUAL

ESI DESIGNED AND BUILT

Kubota WG Series Natural Gas, Propane or Gasoline Engine
Mecc Alte ECP Gen End

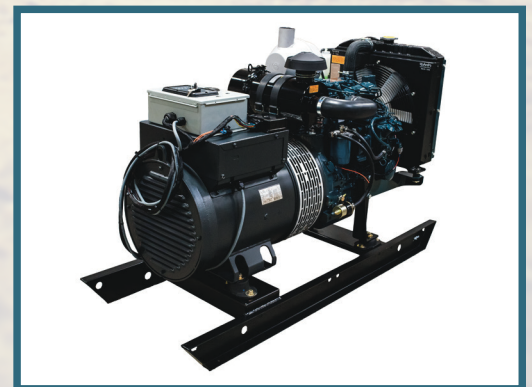
APPLICABLE MODELS

KPG-14-WG16P-MR2S-LPG

KPG-14-WG16G-MR2S-GAS

KPG-20-WG25G-MR2S-NG

KPG-45-WG38L-MR22S-LP



WWW.ESIALASKA.COM



ESlAlaska.com

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Anchorage:

7780 Old Seward Hwy
Anchorage, AK 99518
(907) 341-2250 | (877) 341-2250

Fairbanks:

1919 Van Horn Road
Fairbanks, AK 99701
(907) 458-9049 | (888) 868-9049

Seattle:

17660 W. Valley Hwy
Tukwilla, WA 98188
(425) 251-6119

Williston:

5064 Bennett Loop
Williston, ND 58801
(701) 774-5312

Equipment Source, Inc.



ESlAlaska.com

General Information & Warranty

Anchorage:

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Equipment Source, Inc.



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www.esialaska.com

For Parts & Service:

Fairbanks, Alaska

907.458.9049

FAI-Parts@ESlaska.com

Anchorage, Alaska

907.341.2250

ANC-Parts@ESlaska.com

Seattle, Washington

425.251.6119

FAI-Parts@ESlaska.com

Williston, North Dakota

701.774.5312

Williston-Sales@ESlaska.com

Anchorage:

7780 Old Seward Hwy
Anchorage, AK 99518

(907) 341-2250 | (877) 341-2250

Fairbanks:

1919 Van Horn Road
Fairbanks, AK 99701

(907) 458-9049 | (888) 868-9049

Seattle:

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OPERATORS MANUAL

ESI Generator

Kubota, JCB & Isuzu Powered
Generators by ESI

SPECIFICATIONS

See product specification sheet for product specifications



1 Introduction

**WARNING**

Read and understand this manual before operating the machine to avoid serious injury or death.

1.1 General Description

ESI built generators come in a variety of configurations and sizes. Refer to unit specifications and manual components for specific details. General operation and maintenance remains the same for all of these units.

1.2 Manual Applicability

This manual is applicable to the following Equipment Source Incorporated (ESI) machine models:

Model	Description
KPG, JCB & IPG Series	Skid mounted ESI Generators
KPG, JCB & IPG Series Enclosure Series	ESI Generators with Enclosures

This manual should be kept with the machine at all times. Immediately contact Equipment Source Incorporated (manufacturer) or an authorized dealer to obtain a copy of this manual if missing or damaged. Refer to www.equipmentsourceinc.com for current contact information.

1.3 Manual Scope

This manual contains basic operating and maintenance instructions for the above listed product. For detailed service instructions concerning specific electrical or mechanical components, refer to the operation and maintenance manual provided by the manufacture of the specific component or contact an authorized service provider. Operation and Maintenance instructions for the generator controller can be found in the separate controller manual included with the generator.

1.4 Warranty

Review the warranty before operating or working on the unit. The warranty contains important safety and operational requirements. Contact ESI for the latest warranty information.

1.5 Installation

Review the installation requirements before installing, operating or working on the unit. The installation requirements contain important information and must be adhered to in order to maintain warranty. Contact ESI for the latest installation requirements.



2 IMPORTANT SAFETY INSTRUCTIONS

WARNING

- SAVE THESE INSTRUCTIONS. This manual contains important instructions that should be followed during the operation and maintenance of the generator, battery and heater.

2.1 Training

- Never allow untrained personnel to operate or service the machine. Take time to read the manual and discuss safe practices with jobsite personnel.
- Read and understand the operating section of this manual.
- Take time to familiarize yourself with the controls and instructional placards before operating or servicing.
- Contact your dealer or service provider if additional training is necessary.

2.2 Operating

- Some components are hot while in operation. Keep clothing and combustibles away.
- Wear protective clothing, such as gloves, appropriate to the jobsite.
- Observe changes in the operating environment and respond accordingly.
- Generators vibrate in normal use. During and after the use of the generator, inspect the generator as well as extension cords and power supply cords connected to it for damage resulting from vibration. Have damaged items repaired or replaced as necessary. Do not use plugs or cords that show signs of damage such as broken or cracked insulation or damaged blades.

2.3 Service

- Only trained service technicians should attempt to service the machine.
- Properly shutdown the machine and let cool completely before attempting to service any component.
- Never defeat the safety devices
- Never modify the machine

3 Transporting

3.1 Lifting

CAUTION

- Ensure that any equipment used to lift the unit is rated for the weight of the unit.

3.2 Transporting

1. Lift the machine following the guidelines presented below.
2. If applicable: ensure all doors are closed and latched.
3. Remove any hoods in the way before lifting.
4. Lift the unit using ONLY designated lifting points or fork pockets.

3.3 Storage

Units placed in storage must be stored out of the elements and protected from rain, snow and sunlight. The warranty will be voided for units left exposed to the elements during storage. ESI built unit enclosures provide sufficient protection when properly closed.

3.3.1 Short-Term Storage (less than 90 days)

1. Shutdown the machine
2. Close all doors (if applicable)

3.3.2 Long-Term Storage (greater than 90 days)

1. Shutdown the machine
2. Verify that the main breaker and control switches are in the off position
3. Disconnect the battery
4. Drain water from fuel filters.
5. Secure/Close vents and openings (if applicable).

4 Operation

4.1 System Operation

Refer to individual component manuals for operation of those components. This unit should only be operated by trained personnel familiar with the operation of the entire system. Refer to the PRE-OPERATION CHECK portion of the Engine Manual

4.2 Recommended Fuels and Fueling Instructions

⚠ CAUTION Do not overfill tank. Tank should be filled to only 90% of the full volume to allow thermal expansion.

Use ULSD No.1 or ULSD No.2. For continuous duty operation, a refilling schedule should be established.

4.3 Engine Heat - 120V Power Input

If a cold start is required, use the 120V engine pre-heat circuit to warm the engine block and engine oil prior to starting. The engine should be pre-heated for approximately 4-hours if the ambient temperature is below -7°C (20°F). Longer preheat cycles may become necessary in extremely cold conditions.

Use a grounded flexible extension cord rated at 15A minimum to connect the machine to a 120V power supply. There is an orange, three-prong “Y” located on each of the generators.

4.4 Cold Weather Operation

ESI generators are warranted for operation down to 5 degrees Fahrenheit. Operation at colder temperatures requires an Arctic Re-Air Enclosure from ESI. Generators installed in Arctic Re-Air enclosures are warranted for operation in extreme cold. Ask the ESI sales team about Arctic Re-Air options. Operating a generator below 5 degrees Fahrenheit will void all manufacturers warranties.

4.5 Monitoring and Operation

4.5.1 Minimum Loading of Diesel Engines

Diesel generator engines require that a minimum average load be maintained. An average load of 75% of the rated output of the generator must be maintained to avoid damaging the unit (often referred to as “Wet-Stacking”). Prolonged use of the generator at loads less than 75% of rated output will void the warranty, reduce the life span of the engine and cause damage to the unit. Refer to the ESI Warranty Summary for further details. Consider using a load bank to maintain minimum loading on the engine.

4.5.2 Daily Inspection & Startup Inspection (required)

- Conduct general inspection of the unit
- Listen for abnormal sounds
- Check fluid levels
- Check all hoses for damage (including but not limited to fuel lines and coolant lines)
- Check engine temperature
- Check containment for accumulation of liquids.
- Check vents for icing or other obstructions (if applicable)
- Observe recommended maintenance schedule
- Check for error codes on control units for KPG and any other equipment associated with the unit.

4.6 Long Run Oil Tank (LRT)

- An LRT equipped ESI generator has increased service intervals up to 3000 hours
 - Oil change intervals should be determined using an oil sample analysis at regular intervals to determine maximum service interval.
 - Operating conditions may affect the service interval of the LRT.
- The service interval of the LRT may change if operating conditions change
- Prefill oil filters with oil when completing an oil change on a LRT equipped unit. This reduces the likelihood of damaging air bubbles in the oil system.
- Users can expect some oil seeping between engine base and long run oil pan on LRT installations. This is a normal condition for operating the LRT and is not warrantable.
- Great care should be taken to limit vibration of the generator. Excessive vibration will cause premature failure of LRT seals and is not warrantable. See warranty and installation instructions for further details.

4.7 EPA Tier 4 Final Rural Alaska Exemption

The EPA allows for the sale of Tier 3 generators for certain applications for use in Rural Alaska. If you have purchased a Tier 3 generator under the EPA exemption, the following requirements must be met at all times. Failure to adhere to these requirements will void all warranties and will result in legal and financial liability for the customer.

The EPA Tier 4 Final Rural Alaska Exemption allows for engines certified under EPA Tier 3 standards to be used for non-emergency applications in “Remote Areas of Alaska”.

Definition of “Remote Areas of Alaska” (according to §60.4219, “Remote Areas of Alaska” means areas of Alaska that meet paragraph (1) or (2) below):

1. Areas of Alaska that are not accessible by the Federal Aid Highway System (FAHS)
2. Areas of Alaska that meet ALL of the following criteria:
 - a. The only connection to the FAHS is through the Alaska Marine Highway System, or the stationary CI ICE (Compression Ignition Internal Combustion Engine) operation is within an isolated grid in Alaska that is not connected to the statewide electrical grid referred to as the Alaska Rail belt Grid.
 - b. At least 10 percent of the power generated by the stationary CI ICE on an annual basis is used for residential purposes.
 - c. The generating capacity of the source is less than 12 megawatts, or the stationary CI ICE is used exclusively for backup power for renewable energy

Customer is required to maintain and protect EPA or Emission Control Information labels on the engine for the life of the engine. Failure to do so will constitute failure to adhere to the requirements of the EPA Tier 4 Final Rural Alaska Exemption.

Customer agrees to indemnify ESI against, and hold ESI harmless from, any claims which may be made against ESI as a result of the EPA Tier 4 Final Rural Alaska Exemption. Customer consents to these conditions and agrees to pay in full for all legal fees, fines or other costs associated with improper application of the EPA Tier 4 Final Rural Alaska Exemption.



5 Maintenance

⚠ CAUTION

Some of the following maintenance operations should only be completed by a trained technician. Do not attempt to open electrical panels unless you are a trained technician. Maintenance schedule must be adhered to and documented in order to maintain warranty. Maintenance programs should be tailored to the specific generator, environment and operating conditions.

5.1 Maintenance Schedule

Table 1. Maintenance Schedule

Interval	Maintenance Instruction	Notes
Daily	See section 4.4.2 of this manual for additional requirements	Complete at every inspection
Every 50 hours	- Check of fuel pipes and clamp bands - Check radiator hoses and clamp bands - Drain water separator	
Varies by model	Engine Oil Change and Oil Replacement Intervals - Standard Oil Pan (Kubota Recommendation) - Initial Oil Change: 50 hours - Interval: - KPG-05: 100 hours - KPG-20-T4F, KPG-30-T4F, & - KPG-06 to KPG-24 & - Spark Ignition: 200 hours - KPG-28 & KPG-36: 250 hours - KPG-45, IPG-08, IPG-13, & - IPG-55: 500 hours - Long Run Oil Pan (LRT) Option - Interval: 3,000 hours	Engine oil must meet API Spec: CF, CF-4, CG-4, CH-4 or CI-4 See section 4.5 for additional notes on LRT oil changes.
Every 200 hours (KPG-05 to KPG-24) OR Every 250 hours (IPG-08, IPG-13, IPG-44, KPG-20-T4F, KPG-30-T4F, & KPG-28 to KPG-45)	- Clean air cleaner element - Change Engine Oil and Oil Filter (KPG-06 to KPG-36) - Check and clean fuel filter - Check battery electrolyte level - Check fan belt tightness - Check intake air line - Inspect generator (see generator section of this manual)	
Every 500 hours	- Change Engine Oil and Oil Filter Cartridge (IPG-Series, KPG-45, standard oil pan) - Replace fuel filter cartridge - Remove sediment in fuel tank - Clean water jacket (radiator interior) - Replace fan belt - Clean water separator	
Every one or two months	Charge battery as needed	
Every Year	- Replace air cleaner element - Clean Generator (blow out with air) and inspect - Change Engine Oil and Oil Filter	Air filter element may need cleaning more frequently depending on environmental conditions

Every 800 hours	▪ Check valve clearance	
Every 1500 hours	▪ Check fuel injectors	
Every 3000 hours	▪ Change Engine Oil and Oil Filter Cartridge (diesel units equipped with LRT) ▪ Check turbo charge (if unit is equipped with a turbo) ▪ Check supply pump	
Every 5000 hours	▪ Change Engine Oil and Oil Filter Cartridge (spark ignition units equipped with LRT)	
Every Two Years	▪ Change radiator coolant ▪ Replace battery ▪ Replace radiator hoses and clamp bands ▪ Replace fuel pipes and clamp bands ▪ Replace intake air line ▪ Replace fan belt (or every 500 hours, whichever occurs first)	
Every 10,000 hours / 2 years	▪ Inspect Generator sealed bearings	
At 30,000 hours	▪ Replace Generator sealed bearings	

5.2 Engine Service

Use engine operator's or service manual provided for further instruction on how to complete routine service or trouble shooting.

5.3 Battery Service

The engine starting circuit is supplied by a single 12V battery. No maintenance is required other than normal charging and occasional replacement.

To replace the battery, sequentially remove the negative ground lead, positive power lead and the bracket holding the battery in the tray. Replace the battery by securing in the tray, connecting the positive lead and then connecting the ground lead.

6 Maintenance Records

Table 2. Machine Data

Machine Serial Number	
Engine Serial Number	
Generator Serial Number	

Table 3. Maintenance Records

▪ Date ▪ Engine Hours ▪ Service Personnel ▪ Service Location	Description of work completed









Commonly Replaced ESI Generator Parts

See next page for LRT options and remote fuel filters when applicable

Engine Series	Model	Kubota Engine	Oil Filter	Air Filter	Fuel Filter	Oil Capacity
	KPG-05-Z48	Z482	15426-32430	K1211-82320	12581-43012	2.6 Liters / 0.69 Gal
	KPG-06-NG	DG972	HH150-32430	1G659-11222	N/A	3.4 Liters / 0.90 Gal
	KPG-06-LP	WG972				3.4 Liters / 0.90 Gal
05 Series	KPG-06-MQ	D1005	HH160-32093	15741-11083	15221-43170	5.1 Liter / 1.35 Gal
	KPG-06-D10	D1005				5.1 Liter / 1.35 Gal
	KPG-08-D11	D1105				5.1 Liters / 1.35 Gal
	KPG-10-D13	D1305				5.7 Liters / 1.50 Gal
	KPG-12-V15	V1505				5.7 Liters / 1.50 Gal
03 Series	KPG-14-D15	D1503	HH164-32430	70000-11081	HH166-43560	7.0 Liters / 1.85 Gal
	KPG-15-V17	D1703				7.0 Liters / 1.85 Gal
	KPG-18-V20	V2003				9.5 Liters / 2.50 Gal
	KPG-20-V22	V2203				9.5 Liters / 2.50 Gal
	KPG-23-V20T	V2003-T				9.5 Liters / 2.50 Gal
	KPG-24-V24	V2403				9.5 Liters / 2.50 Gal
V3 Series	KPG-28-V33	V3300	HH1C0-32430	3A111-19130 (inner) 59800-26110 (outer)	HH166-43560 & R60S	13.2 Liters / 3.50 Gal
	KPG-36-V36	V3600		R2401-42280 (inner) 59700-26112 (outer)		
	KPG-36-V38D	V3800-derated				
	KPG-45-V38	V3800				
T4F	KPG-20-D18-T4F	D1803-T4F				
	KPG-30-V24-T4F	V2403-T4F				
	Model	Engine	Oil Filter	Air Filter	Fuel Filter	Oil Capacity
Isuzu	IPG-08-3CH	3CH1NGZG1	5-8640-0632-0	K1211-82320	5-8640-0778-0 & R12s	3.4 Liters / 3.6 Qt
	IPG-13-3CE	3CE1UGZG1	5-8640-1515-0	K1211-82320	5-8640-1510-0 & R12s	6.7 Liters / 7.1 Qt
JCB	JPG-50-444	444 T4A-55				

Service Intervals: Air Filters: Yearly or 500 hours (more frequently may be needed) | Fuel Filters: 500 hours

Clean Water Separator: ALL: 500 hours

Oil & Oil Filter Service Intervals: ALL: Initial @ 50hrs

KPG-05: 100 hrs | 05 & 03 Series: 200 hrs | IPG-08, IPG-13, KPG-28 & KPG-36: 250 hrs

KPG-45: 500 hrs | All LRT Models: 3,000 hrs | KPG-20-T4F, KPG-30-T4F: XXX hrs

JPG-50: 500 hrs

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Long Run Oil Option (LRT)

Replaces standard oil filter and oil capacity from chart above for units with LRT installed

Model	LRT Model	LRT Size	Oil Filter (2ea.)	Oil Capacity
KPG-06 to KPG-12	05SMLRT	9 Gallon	16121-32430	32 Quarts / 8 Gal
KPG-06 to KPG-12	05LRT	19 Gallon		48 Quarts / 12 Gal
KPG-15 to KPG-24	03LRT	19 Gallon		48 Quarts / 12 Gal
KPG-28 to KPG-45	V3LRT	26 Gallon		64 Quarts / 16 Gal
KPG-20-T4F & KPG-30-T4F	03-4-LRT	19 Gallon		48 Quarts / 12 Gal
IPG-08	3CH1LRT	19 Gallon		48 Quarts / 12 Gal
IPG-13	3CE1LRT	19 Gallon		48 Quarts / 12 Gal
JPG-50	444LRT	26 Gallon		64 Quarts / 16 Gal

Remote Racor Fuel Filter

In addition to fuel filters from above chart for units with auxiliary Racor Fuel filter installed.

Model	Filter Part Number
120AS Racor Fuel Filter	R12S
660R2 Racor Fuel Filter	R60T (10 micron)

Part numbers may vary for non-standard products. Always have unit Stock # available when calling for parts. Consult the O&M Manual for additional details.

Engine Coolant Capacities

Always check fluid levels after filling. Coolant capacities are approximate

Gen Model	Engine Model	Radiator Model	Volume
KPG-06	Kubota D1005	A65	4 quarts
KPG-08	Kubota D1105	RAD2	4 quarts
KPG-10	Kubota D1305	RAD2	4.5 quarts
KPG-12	Kubota V1505	RAD4	6 quarts
KPG-14 / 15	Kubota D1503 / D1703	RAD3	8 quarts
KPG-18 / 20 / 24	Kubota 03 Series	RAD3	9 quarts
KPG-28 / 36 / 45	Kubota V3 Series	RADH	14.5 quarts
KPG-20-T4F	Kubota D1803 T4F		
KPG-30-T4F	Kubota V2403 T4F		
IPG-08	Isuzu 3CH1NGZG1		
IPG-13	Isuzu 3CE1UGZG1		
JPG-50	JCB 444 T4A-55		

ESI Generators

Output

Engine

Generator End Model

MeccAlte

Generator End

M R 8S

Marathon

Stamford

Spec Built Generators (Examples)

Phase Configuration

R = Reconnectable 12-Lead
1 = Dedicated Single Phase
4-Lead
3 = Dedicated Three Phase
S = Dedicated Three Phase
Switchable: 208/240 to 240/480

Gen End Make

K:\00_Literature\32_Price Book\00_Working Files\ESI Product Pricing and Inventory

WARRANTY**EQUIPMENT SOURCE INC.
LIMITED WARRANTY****INFORMATION**

Equipment Source Inc. (ESI) warrant to you, the original purchaser, that all parts (except those 3rd party components listed below) of your new ESI product purchased from an Authorized ESI Distributer or from ESI directly will be free from defects in materials or workmanship for 1 (one) year/2,000 hours (whichever occurs first) from invoice date. Additional component warranties are listed below.

Summary of major component warranties (see component sections of this manual for further details and additional warranties). Warranty periods are from invoice date. Not all of the following components are applicable to every product. All warranty time periods begin at invoice date:

1. Engine – 2 (two) years / 2,000 hours, whichever occurs first (please refer to the Isuzu or Kubota Engine Warranty sheet enclosed in this manual for details).
2. Generator and Controls – Free from defects in materials or workmanship for 1 (one) year / 2,000 hours.
3. Flagro Heater / Fire Box - 1 (one) year / 2,000 hours
4. ESI Manufactured Firebox– free from defects in materials or workmanship for 3 (three).
5. Pump – 1 (one) year (please refer to the pump warranty sheet enclosed in this manual), wear parts are not covered under warranty.
6. Buderus Boiler – 2 (two) years limited warranty, please refer to Buderus warranty sheet enclosed in this manual.

In order to obtain warranty repairs, you must deliver the product, at your expense, together with proof of purchase to 1919 Van Horn Road, Fairbanks, AK 99701 (907.458.9049) or 7780 Old Seward Highway, Anchorage, AK 99518 (907.341.2250). Call 907.458.9049 from outside Alaska. Offsite warranty may be performed if customer pays all travel and shipping expenses.

No person, agent or dealer is authorized to give any warranties on the behalf of ESI, nor is to assume for this company any other liability in connection with any of ESI's products unless made in writing and signed by an officer of ESI. This warranty supersedes and is in lieu of all other warranties, expressed or implied including terms and

conditions of Purchase Orders. The company must be notified within 5 (five) business days, in writing of any product failure and warranty claim.

WHAT THE WARRANTY DOES NOT COVER

This warranty **does not** cover:

1. Damage, malfunction or failures resulting from accidents, abuse, misuse, modifications, alteration, improper servicing or lack of performance of required maintenance service voids the warranty including but not limited to regularly scheduled oil changes and filter changes.
2. Damage, malfunction or failures resulting from underloading of the engine (also known as wet stacking) voids the warranty. Refer to the Operations and Maintenance manual for proper engine loading requirements.
3. Normal maintenance services or replacement of maintenance items such as light bulbs, preheater plugs, heater nozzles, filter elements, lubricants, oils, coolant, belts, tires, or other wear items.
4. This warranty does not cover cosmetic damage.
5. 3rd party parts installed on ESI products. Unauthorized modifications to the unit will void the warranty and may impair function.
6. Failure of or damage caused by ancillary systems. These include but are not limited to failures of the fuel or oil system (not provided by ESI), HVAC system, building / structure or other systems.
7. Units placed in storage must be stored out of the elements and protected from rain, snow and sunlight. The warranty will be voided for units left exposed to the elements during storage. ESI built unit enclosures provide sufficient protection when properly closed.
8. Improperly installed products. Operating the unit on or in the packing pallet or crate or improperly mounted skid generator (including installation of isolators between the skid and mounting surface) voids the warranty. Consult the product operator's manual for required installation procedures.
9. Installation of electrical components by anyone other than a licensed electrician voids the warranty.

10. Use of the unit for application other than what the product was meant for voids the warranty.
11. Warranty coverage expires whenever the client, for whatever reason, is late in payment.
12. The warranty does not cover repairs or modifications for small oil weeps on Long Run Oil Tanks (if installed). A small amounting of weeping during break in and use is expected and does not warrant repairs.

LIMITATION ON ESI's RESPONSIBILITY

Our responsibility for any and all losses and damages resulting from any cause whatsoever, including our negligence, alleged damage or defective goods, whether such defects are discoverable or latent, shall be limited to the repair or replacement of defective parts. IN NO EVENT WILL ESI BE LIABLE FOR LOSS OF USE, LOSS OF PROFITS, LOSS OF OR DAMAGE TO OTHER PROPERTY, INCONVENIENCE, COMMERCIAL LOSS, ENVIRONMENTAL CLEANUP OR OTHER SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES WHATSOEVER. ESI will in no event be liable for fuel, oil, coolant or other spills or cleanup regardless of cause or fault. Proper containment and monitoring is the sole responsibility of the end user. In no event shall ESI's liability ever exceed the purchase price of the specific unit in questions.

MONITORING REQUIREMENTS

Frequent monitoring of equipment is vital for proper operation and maintenance of the equipment. All equipment must be monitored daily by trained technicians (or more frequently if indicated in the Operation Manual). Monitoring can be achieved via electronic monitoring systems for remote installations (unless otherwise noted in the Operation Manual). The following unit conditions must be monitored on a daily basis, failure to do so will void all warranties. Additional monitoring may be required depending on site specific requirements.

- General inspection of unit to include: inspection for leaks, damage to unit, improper operation, malfunctioning equipment, error codes or other issues.
- Inspect coolant level and condition. Add coolant as needed to maintain proper coolant levels. Replace coolant if coolant condition has degraded.
- Inspect oil level and condition. Add oil as needed to maintain proper oil levels. Replace oil at recommended service intervals or if oil is found to have degraded.

- Inspect Engine temperature and engine speed.
- Inspect containment, check for leaks and presence of fluids in containment

Maintenance logs must be maintained for the unit and provided to ESI for warranty claims. ESI offers monitoring equipment for electronic monitoring.

OPERATION & SAFETY REQUIREMENTS

Failure to adhere to these requirements will void all warranties.

- Read and understand carefully all components of the Operator's Manual prior to starting or operating the unit.
- Learn how to operate and work safely. Know your equipment and its limitations. Always keep the engine in good condition.
- Do not carry out maintenance on a running or hot unit. Keep hands away from moving parts.
- Do not climb on top of the unit to perform work of any kind.
- When lifting the unit, ensure that the lifting device is rated for the unit weight. Only lift the unit with provided lifting rings or fork pockets.
- In case of emergency, shut off the engine and notify the person in responsible charge.
- Follow all applicable laws and regulations regarding operation and maintenance of the unit.
- For Trailer Mounted Units:
 - Ensure that the trailer is registered with an applicable transport authority before towing.
 - Complete a thorough walk around inspection of the unit before towing. Inspect for damage or abnormalities and repair as needed before travel.
 - Disconnect the trailer from the tow vehicle, place wheel chocks behind the wheels and level prior to running or operating the unit.
- Refer to the various component sections of the Operator's Manual for proper maintenance and service intervals.

Failure to adhere to any of the above requirements or the requirements of Installation Instructions or Operations and Maintenance Manual will void all warranties. ESI reserves the right to update or modify this warranty at time. Contact ESI for a current warranty.



**KUBOTA ENGINE AMERICA CORPORATION
LIMITED WARRANTY ON INDUSTRIAL ENGINES
AND REPLACEMENT PARTS EFFECTIVE JANUARY 1, 2009**

OUR WARRANTY TO YOU

We warrant to you, the original purchaser, that all parts (except those referred to below) of your new Kubota industrial engine and replacement parts purchased from an Authorized Kubota Industrial Engine Distributor or OEM Distributor in the United States will be free from defects in materials or workmanship during the following periods.

1. Industrial Engines for 2 years or 2,000 hours, whichever occurs first.
2. Industrial Engines Major Component Warranty (MCW), 3 years or 3000 hours, whichever occurs first, parts only.

MCW covers cylinder block, cylinder head, crankshaft, camshaft, gears, pistons, rods, flywheel, flywheel housing, oil pump, pulleys, governor, intake manifold, oil pan, ignition distributor.

MCW does not cover rings, bearings, water pump, any electrical component, valve train components, accessory parts, seals, gaskets, carburetors, exhaust manifold, hoses, all fuel system components, muffler, any filters, radiator, fan, belts, thermostat, spark plugs, fuel transfer pumps.

3. Replacement parts for 1 year.

WHAT WE WILL DO

We will, at our option, repair or replace any part covered by this warranty which becomes defective, malfunctions or otherwise fails to conform with this warranty under normal use and service during the term of the warranty at no charge for parts or labor. (Parts only for MCW)

WHAT YOU MUST DO TO OBTAIN WARRANTY SERVICE

In order to obtain warranty repairs, you must deliver the product, together with proof of purchase, to an Authorized Kubota Industrial Engine Distributor or Dealer at your expense. The names and addresses of such Authorized Kubota Industrial Engine Distributors can be found on the internet at www.kubotaengine.com, by calling 1-800-532-9808 or by contacting:

Kubota Engine America Corporation
505 Schelter Road
Lincolnshire, IL 60069

WHAT THE WARRANTY DOES NOT COVER

This warranty **does not** cover:

1. Damage, malfunctions or failures resulting from accidents, abuse, misuse, modifications, alteration, improper servicing, or lack of performance of required maintenance service.
2. Normal maintenance services or replacement of maintenance items such as light bulbs, preheater plugs, indicator and resistant coils, filter elements, lubricants, oils, spark plugs, coolant, or belts.
3. Installation of replacement parts, unless originally installed by an Authorized Kubota Industrial Engine Distributor or Dealer.
4. Non-genuine Kubota parts.
5. Any engines damaged by use of ether or any starting aid, or greater than a 50/50% solution of antifreeze and water.
6. Injection nozzle wear or any engine damage caused by injection nozzle wear or sticking.
7. Damage caused by water entering the engine due to any cause.
8. Used Products.
9. Any damage caused by overheating that is not a direct result of a defect in materials or workmanship.
10. Any Engine not application reviewed.

engine installation to optimize functionality/performance within the OEM's equipment in order to maintain durability, customer satisfaction, and reduce warranty failures and expenses. Kubota cannot anticipate all potential failures and issues that may occur with the engine or product in the field during an application review. Therefore, machine durability testing by the OEM either in a test facility and/or in the field is critical to further reduce the potential for field failures.

The amount of time spent by KEA on an application review is significantly less than the amount of time spent by the OEM's design engineers on the application. Because of this, the KEA application review is intended to identify issues that are within the scope of the application review testing performed and in some cases recommend possible solutions. The KEA application review should never take the place of proper design and testing of the finished product by the OEM.

The KEA application review does not in any way express or imply any additional warranty coverage other than what is stated in Kubota's Limited Warranty Agreement. Kubota and its subsidiary companies are not responsible for (including, but not limited to): failures resulting from any components that are not manufactured by Kubota, misrepresented or incorrect information provided from an OEM, any changes made without KEA's knowledge, any decision by the OEM not to follow KEA's recommendations, or any application related problems or deficiencies that may arise that were not found by KEA's limited application review or the OEM's durability testing.

THIS IS THE ONLY EXPRESS WARRANTY ON OUR PRODUCTS

We neither assume nor authorize anyone to assume for us any other express warranty. The Kubota Distributor/ Dealer has no authority to make any representation or promise on behalf of Kubota Engine America Corporation or to modify the terms or limitations of this warranty in any way.

LIMITATIONS ON OUR RESPONSIBILITY WITH RESPECT TO PRODUCTS PURCHASED AND USED FOR PERSONAL, FAMILY OR HOUSEHOLD USE.

Our responsibility is to repair or replace defective parts as stated above. We will not be responsible for any other expenses, losses or inconvenience which you may sustain as a result of the purchase, use, malfunction or defective condition of our products. ANY IMPLIED WARRANTIES INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE SHALL BE LIMITED IN DURATION TO THE PERIOD SET FORTH ABOVE AND IN NO EVENT WILL WE BE LIABLE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES WHATSOEVER. Some states do not allow limitations on how long an implied warranty lasts or the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights, and you may have other rights which vary from state to state.

LIMITATIONS ON OUR RESPONSIBILITY WITH RESPECT TO PRODUCTS USED FOR RENTAL OR FOR COMMERCIAL, INDUSTRIAL OR AGRICULTURAL PURPOSES.

This warranty is in lieu of all other warranties, express or implied, and of any other obligations or liability on our part. IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE EXCLUDED. Our responsibility for any and all losses and damages resulting from any cause whatsoever, including our negligence, alleged damage or defective goods, whether such defects are discoverable or latent, shall be limited to the repair or replacement of defective parts as stated above. IN NO EVENT WILL WE BE LIABLE FOR LOSS OF USE, LOSS OF PROFITS, LOSS OF OR DAMAGE TO OTHER PROPERTY, INCONVENIENCE, COMMERCIAL LOSS, OR OTHER SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES WHATSOEVER.

APPLICATION REVIEW PROCESS: The Kubota Engine America (KEA) application review process is intended to assist the OEM with



INSTALLATION REQUIREMENTS FOR ESI OPEN SKID GENERATORS KPG, IPG, FPG AND ALL OTHER SERIES GENERATORS

The installation and commissioning of a generator is never a Plug n Play event. Proper professional review is always needed for proper operation, personal safety and to maintain warranty. All applicable codes and laws must be adhered to for proper installation.

All electrical connections must be reviewed and confirmed at the time of installation by a licensed electrician. Compatibility and configurations of system components such as but not limited to: generator, fuel systems, enclosures, switchbox, controllers and service panels must be reviewed by a qualified professional at the point of installation. All wires and hoses must have protection from chaffing as needed. An adequate and safe 12v power, fuel supply and exhaust must be provided.

Proper installation of the skid mounted generator must include a solid platform for support. The skid must be secured to prevent the unit from walking and to prevent excess vibration. The generator must be removed from the shipping pallet, crate or other shipping materials for proper installation. The open skid generator is provided with isolator mounts between the engine/genset and skid. The mass of the skid is not adequate to provide vibration isolation for the supported components without proper installation. The installation of additional isolators between the skid and mounting surface will create excess vibration and voids all warranties.

The skid must be securely attached to a concrete floor, metal structure or reinforced wooden floor designed for the application and load. All installations must be reviewed by a professional shortly after commissioning to ensure compliance with these installation requirements.

ESI highly recommends that skid mounted generators be installed with adequate fluid containment and other safeties including but not limited to remote monitoring. The installer and operator of the generator must adhere to all laws and regulations governing the installation and operation of the generator. The installer and operator must follow industry best practices where they meet or exceed the requirements laid in these instructions, the Warranty Summary or the Operations and Maintenance Manual.

Improper installation or failure to adhere to these instructions will void the warranty, may promote the risk of injury and reduce the useful life of the unit. See Warranty Summary and Operations and Maintenance Manual for further details and requirements.

Contact ESI for the latest Installation Requirements, Warranty Summary or Operations and Maintenance Manual.

Anchorage:

7780 Old Seward Hwy
Anchorage, AK 99518
(907) 341-2250 | (877) 341-2250

Fairbanks:

1919 Van Horn Road
Fairbanks, AK 99701
(907) 458-9049 | (888) 868-9049

Seattle:

17660 W. Valley Hwy
Tukwilla, WA 98188
(425) 251-6119

Williston:

5064 Bennett Loop
Williston, ND 58801
(701) 774-5312



ESlAlaska.com

Alternator Manual

Anchorage:

7780 Old Seward Hwy
Anchorage, AK 99518
(907) 341-2250 | (877) 341-2250

Fairbanks:

1919 Van Horn Road
Fairbanks, AK 99701
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(425) 251-6119

Williston:

5064 Bennett Loop
Williston, ND 58801
(701) 774-5312

Equipment Source, Inc.



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Sistema Qualità Certificato



I

ALTERNATORI AUTOREGOLATI SERIE ECO-ECP

ISTRUZIONI PER L'USO E LA MANUTENZIONE

GB

SELF-REGULATING ALTERNATORS SERIES ECO-ECP

OPERATING AND MAINTENANCE INSTRUCTIONS

F

ALTERNATEURS AUTO - REGULES SERIE ECO-ECP

MANUEL D'INSTRUCTION ET DE MAINTENANCE

D

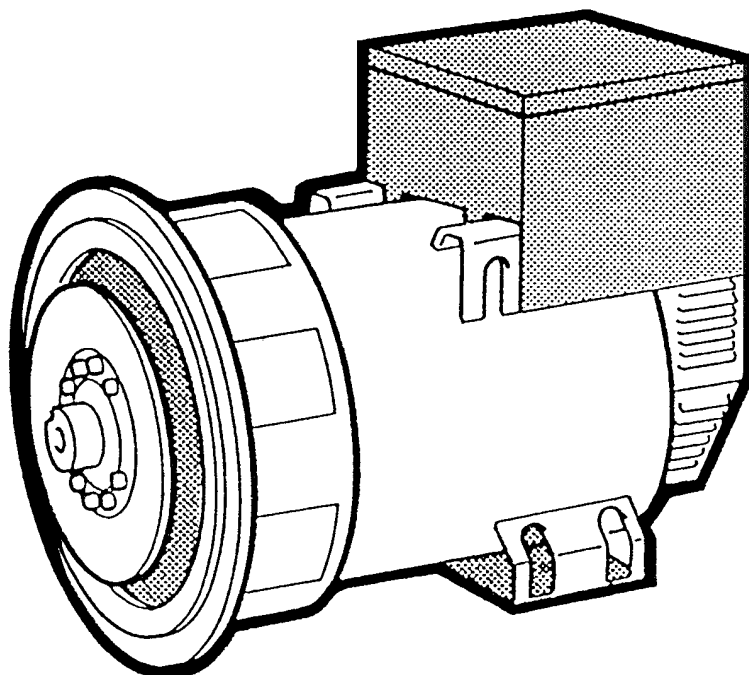
SELBSTREGELNDER GENERATOR SERIE ECO-ECP

BETRIEBS-UND WARTUNGSANLEITUNG

E

ALTERNADORES AUTOREGULADOS SERIE ECO-ECP

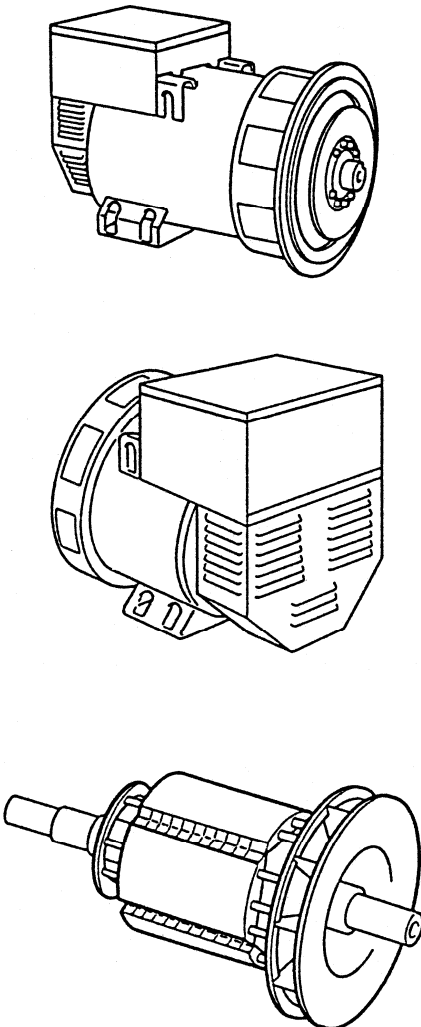
INSTRUCCIONES PARA USO Y MANTENIMIENTO



ECO ECP



US
INSULATION SYSTEM

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PREMESSA	4 ÷ 5	INTRODUCTION
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VERIFICA ALLA CONSEGNA	4 ÷ 5	INSPECTION ON DELIVERY
PRESCRIZIONI DI SICUREZZA	4 ÷ 13	SAFETY REQUIREMENTS
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DESCRIZIONE MACCHINA		MACHINE DESCRIPTION
I generatori della serie ECO-ECP sono autoregolati, brushless a 2 e 4 poli. Hanno induttore rotante provvisto di gabbia di smorzamento e indotto fisso a cave inclinate. Gli avvolgimenti sono a passo raccorciato per ridurre il contenuto armonico. I generatori sono costruiti in conformità alle direttive CEE 2006/42, 2006/95, 2004/108 e relative modifiche, alle norme CEI 2-3, EN 60034-1, IEC 34-1, VDE 0530, BS4999-5000, CAN/CSA-C22.2 N°14 - N°100. Le prove per la verifica della compatibilità elettromagnetica sono state eseguite nelle condizioni prescritte dalle norme, con il neutro collegato a terra. Esecuzioni in accordo ad altre specifiche possono essere eseguite su richiesta del cliente. La struttura meccanica, sempre molto robusta, consente un facile accesso ai collegamenti e permette di eseguire le verifiche nelle diverse parti altrettanto facilmente. La carcassa e' realizzata in acciaio, gli scudi in ghisa, l'albero in acciaio C45 con ventola calettata. Il grado di protezione e' IP21 (a richiesta e' possibile realizzare un grado di protezione superiore). Gli isolamenti sono eseguiti in classe H, le impregnazioni con resine epossidiche per le parti rotanti e trattamenti sottovuoto per le parti di piu' elevata tensione, quali gli statori (a richiesta trattamenti speciali).		ECO-ECP 2 and 4 pole alternators are brushless, self-regulating and incorporate a rotating inductor with damper cage winding and a fixed stator with skewed slots. The stator windings have a shortened pitch to reduce the harmonic content of the output waveform. The alternators are made in compliance with the 2006/42, 2006/95, 2004/108 CEE directives and their amendments, and the CEI 2-3, EN 60034-1, IEC 34-1, VDE 0530, BS4999-5000, CAN/CSA-C22.2 N°14 -N°100 regulations. Tests to verify the electromagnetic compability have been carried out in the foreseen conditions by the standards with the neutral connected to the earth. On customer's request alternators can be manufactured according to different specifications. The robust mechanical construction gives good access to the generator output connections, and allows the user to inspect the various components with ease. The casing is made of steel, the shields of cast iron, and the shaft of C45 steel and it has a keyed fan. The mechanical protection level meets standard IP21 (upon request higher levels of protection can be supplied). Insulation materials meet Class H requirements, and all rotating components are epossy resins impregnated; higher voltage parts, such as the stators, are vacuum-treated (special treatments are available on request).

PREMESSA

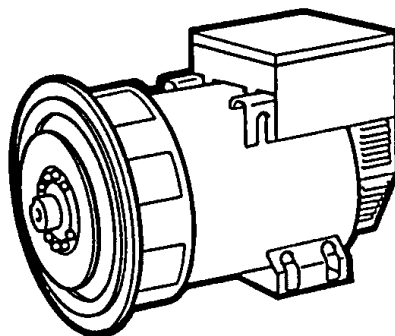
I generatori della serie ECO-ECP, rispondono alle direttive CEE 2006/42, 2006/95, 2004/108 e relative modifiche; pertanto non presentano pericolo per l'operatore, se installati, usati, mantenuti secondo le istruzioni fornite dalla Mecc Alte e a condizione che i dispositivi di sicurezza siano tenuti in perfetta efficienza.

Per questa ragione occorre attenersi scrupolosamente alle istruzioni indicate in questo manuale.

E' vietata qualsiasi riproduzione di questo manuale.

IDENTIFICAZIONE MACCHINA

Per qualsiasi comunicazione con la Mecc Alte o con i centri di assistenza autorizzati, citare sempre il tipo e il codice del generatore.



INTRODUCTION

The ECO-ECP alternators comply with the EEC 2006/42, 2006/95, 2004/108 directives and their amendments; therefore they pose no danger to the operator if they are installed, used and maintained according to the instructions given by Mecc Alte and provided the safety devices are kept in perfect working conditions.

Therefore a strict observance of these instructions is required.

Any reproduction of this manual is forbidden.

MACHINE IDENTIFICATION

Always indicate the generator type and code when contacting Mecc Alte or the authorized after-sales service centres.

Mecc Alte spa		Via Rome n.20, 36051 Tel. 0444/396111-R.A. CREAZZO VICENZA ITALIA Fax. 0444/296166		CE	
TYPE	ECO 40-15/4	N.	0000792970	PHASE	3
KVA	400	480	COSPHI	0.8	INS. CL. H
R.P.M.	1500	1800	Hz	50/60	
V	115/200/230/400		138/240/276/480		
A	2008/1155/1004/577		AMBIENT TEMPERATURE	40°C	
CONNECTION	TT/SS/T/S		IP	21	
SERV.	V.exec.	35.0	I.exc.	3.64	
KG	1024	J	5.45	COD.	ECO4015
CUSCINETTI	6318, 2RS1		DATE	1999	MECC
ROLLMENTS					IN ITALY

18V OVERLAP FOR 2 h. IN A 24 h. PERIOD
ALTERNATORE AUTOREGOLATO-SELF REGULATED ALTERNATOR-ALTERNATEUR AUTOREGULE
EN 60034-1 CET 2-3 - IEC 34-1 - VDE 0530 - BS4999-5449 - NF 61-111

VERIFICA ALLA CONSEGNA

Alla consegna del generatore controllare con la bolla di accompagnamento che non ci siano danni o parti mancanti; nel caso informare immediatamente lo spedizioniere, l'assicurazione, il rivenditore o la Mecc Alte.

mecc alte spa			
Via Roma, 20 - 36051 Creazzo (VI) - Italia			
Tel. 0444/396111 - Fax 0444/296166			
E-mail: info@meccalte.it			
Web: www.meccalte.it			
Data: 21/11/00			
Firma: [Signature]			
Stampa: [Stamp]			
Descrizione: [Text]			
Quantita': [Text]			
Destinazione: [Text]			
Note: [Text]			
Firma Cliente: [Text]			
Data Cliente: [Text]			

INSPECTION ON DELIVERY

When the alternator is delivered, check that unit conforms with the delivery note and ensure that there are no damaged or defective parts; should there be any, please inform the forwarding agent, the insurance company, the seller or Mecc Alte immediately.

PRESCRIZIONI DI SICUREZZA

Prima di qualsiasi intervento di pulizia, lubrificazione o manutenzione assicurarsi che il motore primario a cui e' collegato il generatore non sia in funzione, ma fermo e isolato dalle sue fonti di energia.

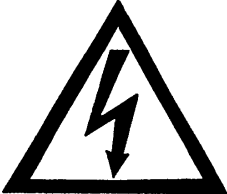
Per fermare il generatore occorre seguire scrupolosamente la procedura di arresto del sistema di trascinamento; il generatore non e' previsto di Stop/Emergenza, ma si arresta istantaneamente in relazione al sistema di arresto predisposto dall'installatore.



SAFETY REQUIREMENTS

Before any cleaning, lubrication or maintenance operation, ensure that the generator is stationary and disconnected from the power supply.

When stopping the generator, ensure the compliance with the procedures for stopping the prime mover.
The generator, in fact, has no Emergency Stop, but is controlled by the device arranged by the installer.

PRESCRIZIONI DI SICUREZZA	SAFETY REQUIREMENTS
Durante la consultazione del presente manuale d'uso e manutenzione troverete alcuni simboli; questi hanno un preciso significato qui di seguito illustrato.	In consulting this use and maintenance manual, you will find several symbols, which have a specific meaning, as illustrated below.
SIMBOLOGIA CONVENZIONALE E SUA DEFINIZIONE	CONVENTIONAL SYMBOLS AND SYMBOL DESCRIPTION
IMPORTANTE Segnala al personale interessato che l'operazione descritta presenta un rischio che può avere come conseguenza un danno alla macchina, se non effettuata nel rispetto delle normative di sicurezza.	IMPORTANT This symbol warns the personnel concerned that the described operation may cause damages to the machine if it is not carried out according to the safety standards.
ACCORTEZZA Segnala al personale interessato che l'operazione descritta presenta un rischio che può avere come conseguenza un danno alla macchina e/o lesioni al personale stesso, se non effettuata nel rispetto delle normative di sicurezza.	CAUTION This symbol warns the personnel concerned that the described operation may cause damages to the machine and/or injures to the personnel if it is not carried out according to the safety standards.
AVVERTIMENTO Segnala al personale interessato che l'operazione descritta presenta un rischio che può avere come conseguenza lesioni gravi o morte, se non effettuata nel rispetto delle normative di sicurezza.	WARNING This symbol warns the personnel concerned that the described operation may cause serious injuries or death to the personnel if it is not carried out according to the safety standards.
PERICOLO Segnala al personale interessato che l'operazione descritta presenta un rischio immediato che ha come conseguenza lesioni gravi o morte, se non effettuata nel rispetto delle normative di sicurezza.	DANGER This symbol warns the personnel concerned that the described operation may immediately cause serious injuries or death to the personnel if it is not carried out according to the safety standards.
IMPORTANTE IMPORTANT WICHTIG	
	
	
	

PRESCRIZIONI DI SICUREZZA

ADDETTO ALLA MOVIMENTAZIONE

Identifica il tipo di operatore a cui è riservato l'intervento trattato.

Questa qualifica presuppone una piena conoscenza e comprensione delle informazioni contenute nel manuale d'uso del costruttore oltre che competenze specifiche dei mezzi di sollevamento, dei metodi e delle caratteristiche d'imbragatura e della movimentazione in sicurezza.



MANUTENTORE MECCANICO

Identifica il tipo di operatore a cui è riservato l'intervento trattato.

Questa qualifica presuppone una piena conoscenza e comprensione delle informazioni contenute nel manuale d'uso del costruttore oltre che competenza specifica per effettuare gli interventi di installazione, regolazione, manutenzione, pulizia e/o riparazione.



MANUTENTORE ELETTRICO

Identifica il tipo di operatore a cui è riservato l'intervento trattato.

Questa qualifica presuppone una piena conoscenza e comprensione delle informazioni contenute nel manuale d'uso del costruttore oltre che competenza specifica per gli interventi di natura elettrica di collegamento, regolazione, manutenzione e/o riparazione.

E' in grado di operare in presenza di tensione all'interno di armadi e quadri elettrici.



Nel caso di interventi straordinari e su autorizzazione scritta del servizio assistenza rivolgersi ai centri autorizzati Mecc Alte.

SAFETY REQUIREMENTS

HANDLER

This symbol identifies the type of operator in charge of the operation described.

This qualification requires a complete knowledge and understanding of the information contained in the manufacturer's instruction manual as well as specific skills about the hoisting means, slinging methods and features and safe handling procedures.

MECHANICAL SERVICE MAN

This symbol identifies the type of operator in charge of the operation described.

This qualification requires a complete knowledge and understanding of the information contained in the manufacturer's instruction manual as well as specific skills necessary to perform installation, adjustment, maintenance, cleaning and/or repair operations.

ELECTRICAL SERVICE MAN

This symbol identifies the type of operator in charge of the operation described.

This qualification requires a complete knowledge and understanding of the information contained in the manufacturer's instruction manual as well as specific skills necessary to perform electrical operations such as connections, adjustment, maintenance and/or repair.

The electrical service man must be able to work even in case electrical cabinets and panels are live.

In case of exceptional operations and upon written request of servicing operations please apply to Mecc Alte authorized centers.

PRESCRIZIONI DI SICUREZZA

Al momento dell'installazione le norme prevedono che il generatore sia collegato a terra.

Per questa ragione assicurarsi che l'impianto di messa a terra sia efficiente ed in conformità con le direttive del paese dove il generatore sarà installato.

ATTENZIONE

L'INSTALLATORE FINALE E' RESPONSABILE DELLA PREDISPOSIZIONE DI TUTTE LE PROTEZIONI (DISPOSITIVI DI SEZIONAMENTO, PROTEZIONI CONTRO I CONTATTI DIRETTI E INDIRETTI, PROTEZIONI CONTRO SOVRACORRENTI E SOVRATENSIONI, ARRESTO DI EMERGENZA ECC.) NECESSARIE PER RENDERE CONFORME IL MACCHINARIO E L'IMPIANTO UTILIZZATORE, ALLE VIGENTI NORME DI SICUREZZA INTERNAZIONALI/EUROPEE.

Per la movimentazione dei generatori di simballati usare sempre ed esclusivamente gli appositi golfari.

Utilizzare funi di portata adeguata senza sollevare il generatore troppo dal pavimento (max 30 cm.).

Alla fine del periodo di vita della macchina, rivolgersi alle agenzie di smaltimento materiali ferrosi e non disperderne parti nell'ambiente.

Gli addetti all'installazione, conduzione e manutenzione del generatore devono essere tecnici adeguatamente qualificati e che conoscano le caratteristiche dei generatori.

Le persone addette alla movimentazione devono sempre indossare guanti da lavoro e scarpe antinfortunistiche.

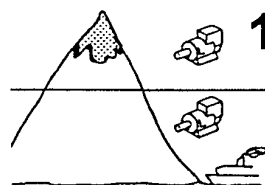
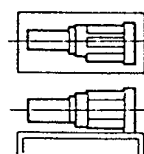
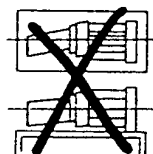
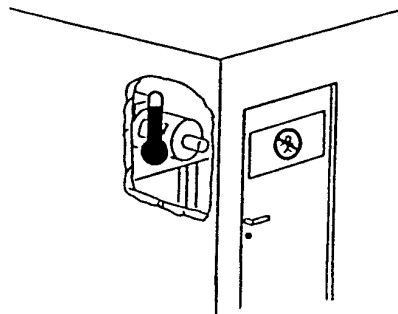
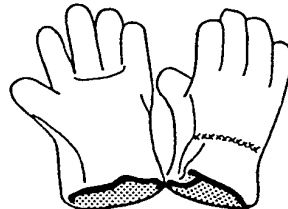
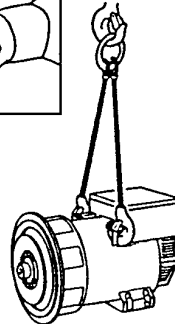
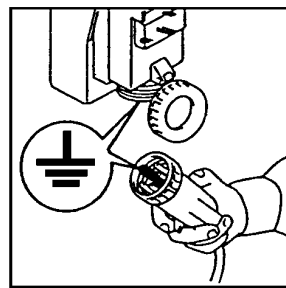
Qualora il generatore o l'intero impianto debba essere sollevato da terra, gli operatori devono usare un casco protettivo.

Il generatore va installato in un ambiente aerato. Se non c'è sufficiente aria oltre al mal funzionamento esiste pericolo di surriscaldamento (tab. 25 pag. 73). Sulla porta di ingresso del locale ci deve essere un cartello indicante il divieto di accesso alle persone non autorizzate.

Assicurarsi che il basamento del generatore e del motore primario sia calcolato per sopportare il peso e tutti gli eventuali sforzi dovuti al funzionamento.

E' responsabilità dell'installatore il corretto accoppiamento del generatore al motore, mettendo in atto tutti quegli accorgimenti necessari per garantire il corretto funzionamento del generatore ed evitare anomale sollecitazioni che possono danneggiare il generatore (come vibrazioni, disallineamenti, strane sollecitazioni etc.).

La macchina è stata progettata per garantire la potenza nominale in ambienti con temperatura massima di 40 °C e altitudine inferiore ai 1000 metri (EN60034-1), se non diversamente indicato. Per condizioni diverse vedere il catalogo commerciale (depliant).



1000m

40° C

SAFETY REQUIREMENTS

Before installing the generator, arrangements must be made to earth the machine. This is the reason why you must make sure that the grounding system is in good conditions and in compliance with the regulations of the country where the generator will be installed.

CAUTION

THE FINAL INSTALLER IS RESPONSIBLE FOR THE INSTALLATION OF ALL THE PROTECTIONS (SECTIONING DEVICES, PROTECTIONS AGAINST DIRECT AND INDIRECT CONTACTS, OVERCURRENT AND OVERVOLTAGE PROTECTIONS, EMERGENCY STOP, ETC.) NECESSARY FOR THE MACHINE TO COMPLY WITH THE EXISTING INTERNATIONAL/EUROPEAN SAFETY REGULATIONS.

For handling the unpacked generators, always use the special eyebolts only; use ropes having a suitable carrying capacity and do not lift the generator too much from the floor (max 30 cm.).

When the machine is worn out, contact the companies in charge of the disposal of ferrous material and do not throw away its parts into the environment.

The operators in charge of the installation, operation and maintenance of the generators must be skilled technicians who know the characteristics of the generators.

The people in charge of the handling must always wear work gloves and safety shoes. In case the generator or the whole plant must be lifted from the floor, the operators must wear a safety helmet.

The generator must be installed in an airy room. If there is not enough air, a malfunction or an overheating may occur (table 25 pag. 73). All entry doors into generator room should be clearly marked "Authorized persons only".

Make sure that gen-set foundations and baseframe are suitable to bear the combined weight of the alternators and prime mover.

The installer is responsible for the correct coupling of the generator to the engine and for the performance of all precautions necessary to guarantee the correct operation of the generator and avoid abnormal stress, which could damage the generator (such as vibrations, misalignment, strange noises or vibrations, etc.).

The machine was designed to guarantee the nominal power in environments with a maximum temperature of 40° C, at altitudes lower than 1000 m asl (EN60034-1), unless otherwise specified; for different operating conditions, see the commercial catalogue (brochure).

PRESCRIZIONI DI SICUREZZA

Nelle vicinanze della macchina non ci devono essere persone con indumenti svolazzanti tipo: sciarpe, fular, bracciali, etc e qualsiasi indumento deve essere chiuso con elastici alle estremità.

I generatori non devono mai e per nessuna ragione funzionare con le seguenti protezioni aperte:

-) copertura morsetti.
-) coperchi frontali.
-) protezioni delle ventole.

Nelle fasi di montaggio e smontaggio della rete, assicurarsi di tenere in posizione con le mani la stessa per evitare che l'elasticità della rete possa colpire l'operatore o chi è nelle vicinanze.

In alcuni tipi di generatore i regolatori sono corredati di 3 led visibili dall'esterno (standard per macchine grandi e opzionale per macchine piccole):

- Verde** - funzionamento regolare
- Giallo** - intervento protezione sovraccarico
- Rosso** - intervento protezione bassa velocità.

I generatori sono rumorosi (tav. 25 pag. 73); anche se il livello acustico è sicuramente inferiore a quello del motore primario, devono essere installati in ambienti isolati (stanza, sala macchine, etc.) e chi vi accede deve munirsi di cuffie antirumore.

I generatori sviluppano calore anche elevato in funzione della potenza generata. Pertanto non toccare il generatore se non con guanti antiscottatura e attendere, una volta spento, che esso raggiunga la temperatura ambiente.

Anche se la macchina è protetta in tutte le sue parti evitare di sostare nelle sue vicinanze.

Per nessuna ragione appoggiarsi o sedersi sul generatore.

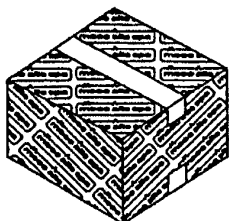
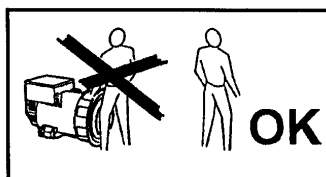
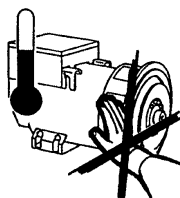
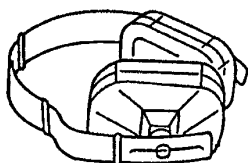
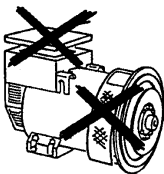
Non togliere per nessuna ragione le etichette, anzi richiederne la sostituzione in caso di necessità.

PERICOLO DI CORTO CIRCUITO

Il generatore è costruito con grado di protezione IP21; pertanto è fatto divieto di utilizzare qualsiasi tipo di idropulitrice e di spruzzare liquidi sopra le parti elettriche.

In caso di sostituzione di pezzi di ricambio richiedere esclusivamente ricambi originali.

Per la sostituzione di parti usurate comportarsi rigorosamente come descritto al capitolo manutenzione; queste manutenzioni devono essere eseguite da tecnici adeguatamente qualificati.



SAFETY REQUIREMENTS

No person must wear fluttering clothes (such as scarves, etc.) near the machine and any garment must be fastened with elastic bands at its ends.

The generators must never and for no reason run with following guards removed:

-) terminals cover
-) front covers
-) fan guards.

During assembling and disassembling operations, hold carefully both ends of the protection grid as the related material elasticity can be harmful.

In some machines the regulators are equipped with 3 leds which can be seen from the outside (as standard equipment on large machines, as optional equipment on small machines):

- Green led** - correct operation
- Yellow led** - overload protection on
- Red led** - low speed protection on.

The generators are noisy (table 25 pag. 73); even if the sound level is certainly lower than that of the prime motor, they must be installed in soundproof rooms (room, engine room, etc.) where it is necessary to wear antinoise protectors.

The generators produce heat proportional to the output.

Therefore, do not touch the generator if you do not wear antiscorch gloves and, after switching it off, do not touch it until it has cooled down.

Even if all the machine components are protected, keep away from the machine.

Do not lean or sit on the generator for whatever reason.

Do not remove the labels for whatever reason; on the contrary, if necessary, replace them.

DANGER OF SHORT CIRCUIT

the degree of protection of the generator is IP21; therefore it is made prohibition to use whichever type of hydrocleaner and to spray liquids over the parts containing electrical components.

In case of replacement of spare parts, use original spare parts only.

For the replacement of worn parts, carefully follow the maintenance instructions; these operations must be carried out by skilled technicians.

PERICOLO DANGER



GEFAHR PELIGRO

In funzione della destinazione, gli alternatori possono essere imballati per la spedizione in vari modi.

In ogni caso per movimentarli, osservare nella bolla di accompagnamento, il peso, e con mezzi adeguati, sollevarli da terra il meno possibile.

Nel caso che l'imballo debba essere movimentato con carrelli, occorre che le forche siano tenute piu' larghe possibile, in modo da evitare cadute o scivolamenti.

In caso di immagazzinamento, gli alternatori imballati e non, devono essere depositati in un locale fresco e asciutto e comunque mai esposto alle intemperie.

Una volta disimballato il generatore, (mono-supporto) non scollegare il sistema di fissaggio rotore, in quanto quest'ultimo potrebbe scivolare.

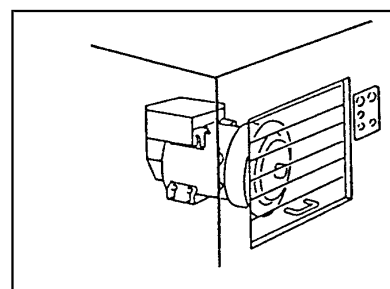
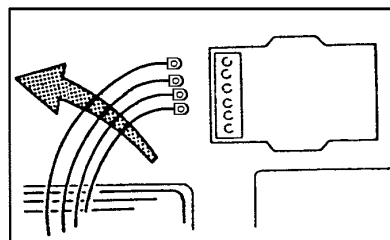
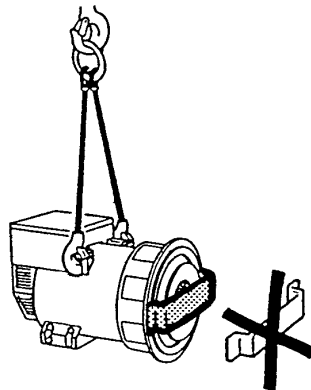
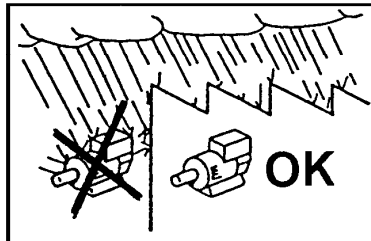
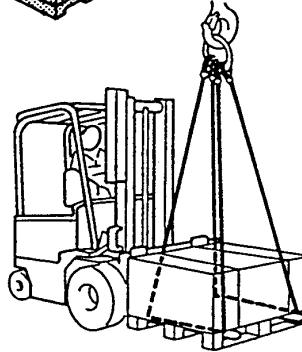
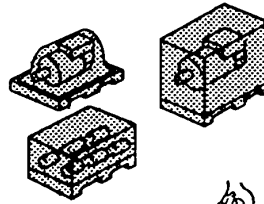
Per la movimentazione al fine dell'installazione, sollevare i generatori, sempre, attraverso i propri golfari (tav. 25 pag. 73).

IMPORTANTE:

DOPO LUNGHI PERIODI DI IMMAGAZZINAMENTO O IN PRESENZA DI SEGNI EVIDENTI DI UMIDITA' / CONDENSA, VERIFICARE LO STATO D'ISOLAMENTO.

LA PROVA DI ISOLAMENTO DEVE ESSERE ESEGUITA DA UN TECNICO ADEGUATAMENTE QUALIFICATO.

PRIMA DI ESEGUIRE TALE PROVA E' NECESSARIO SCONNETTERE IL REGOLATORE DI TENSIONE; SE LE PROVE DARANNO UN RISULTATO TROPPO BASSO (INFERIORE A 1 MΩ)(EN60204-1) SI DOVRA' ASCIUGARE L'ALTERNATORE IN UN FORNO A 50 - 60°C.



Alternators will be packed for shipment in a manner suitable to their mode of transport and final destination.

Prior to handling goods, please ensure that lifting equipment is of sufficient capacity. Under lifting conditions machinery should be elevated to a minimal distance from the ground.

When lifting or moving goods by forklift apparatus, care should be taken to ensure that forks are correctly positioned to prevent slipping or falling of pallet or crate.

Both packed and unpacked alternators shall be stored in a cool and dry room, and shall never be exposed to the inclemency of the weather.

With regard to single bearing alternators (form MD35) please ensure that the rotor securing device is in place. Failure to do so may lead to slippage or assembly.

When installing the alternators, always lift them by using their eyebolts (table 25 pag 73).

IMPORTANT :

AFTER PROLONGER STORAGE OR IF THE MACHINES SHOW SIGNS OF CONDENSATION, ALL WINDINGS SHOULD BE SUBJECTED TO INSULATION TESTS PRIOR TO OPERATING.

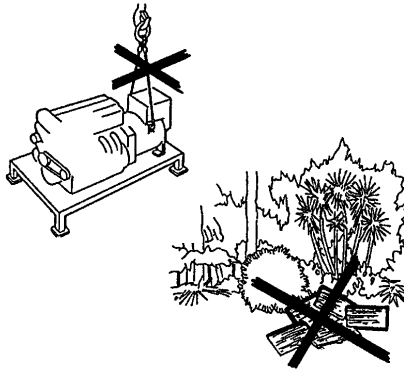
THE INSULATION TEST SHALL BE MADE BY SKILLED PERSONNEL.

BEFORE CARRYING OUT THE TEST, THE VOLTAGE REGULATOR MUST BE DISCONNECTED; IF THE TEST RESULTS ARE TOO LOW (LOWER THAN 1 MΩ)(EN60204-1) THE ALTERNATOR MUST BE DRIED IN AN OVEN AT 50-60°C.

TRASPORTO E IMMAGAZZINAMENTO

Ricordarsi che, una volta che il generatore sarà accoppiato al motore primario, o montato su un basamento, o installato in un telaio in modo da formare un corpo unico, non dovrà più essere sollevato dai propri golfari ma si dovranno seguire le indicazioni dell'installatore.

Non disperdere l'imballo nell'ambiente, ma rivolgersi alle agenzie di smaltimento.



TRANSPORT AND STORAGE

Once the generator is coupled with an engine, mounted on a baseframe, or installed on a complete generating set, it cannot be lifted by its lifting bolts. The relevant instructions for lifting complete generating set should be followed.

Any packing materials should be disposed of via correct waste disposal methods. Do not discard waste materials into the environment.

ACCOPIAMENTO MECCANICO

Con il fine di proteggere, durante il trasporto e l'immagazzinamento, la flangia di accoppiamento o la estremità d'albero (a seconda della forma costruttiva del generatore) a tali parti meccaniche viene applicata una vernice antiruggine facilmente rimovibile. Tale sostanza DEVE ESSERE assolutamente RIMOSSA prima dell'assemblaggio finale.

L'accoppiamento del generatore al motore primo è a cura dell'utilizzatore finale ed è eseguito secondo la sua sola discrezione (per le coppie di serraggio vedere tabella 24 pag. 72).

Un allineamento impreciso può causare vibrazioni e danneggiamenti dei cuscinetti. È consigliabile inoltre verificare la compatibilità delle caratteristiche torsionali del motore / generatore (a cura del cliente).

I dati sul generatore necessari per tale verifica sono disponibili nella relativa documentazione tecnica.

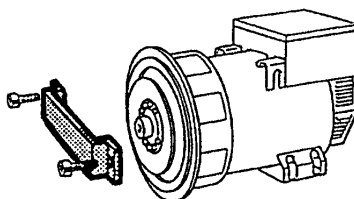
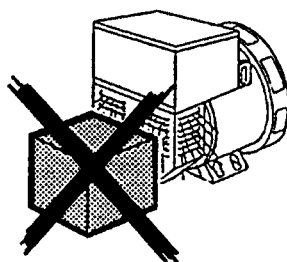
Le attenzioni richieste sono:

NELLA MESSA IN SERVIZIO AVER CURA CHE LE APERTURE DI ASPIRAZIONE E SCARICO DELL'ARIA DI RAFFREDDAMENTO SIANO SEMPRE LIBERE.

IL LATO DI ASPIRAZIONE NON DEVE ESSERE VICINO A SORGENTI DI CALORE. IN OGNI CASO, SE NON SPECIFICAMENTE CONCORDATO, LA TEMPERATURA DELL'ARIA DI RAFFREDDAMENTO DEVE ESSERE QUELLA AMBIENTE E COMUNQUE NON SUPERIORE A 40°C.

NELLE FASI DI MONTAGGIO E SMONTAGGIO DELLA RETE, ASSICURARSI DI TENERE IN POSIZIONE CON LE MANI LA STESSA PER EVITARE CHE L'ELASTICITÀ DELLA RETE POSSA COLPIRE L'OPERATORE O CHI È NELLE VICINANZE.

IN CASO DI GENERATORI MONO-SUPPORTO IN FASE DI ACCOPPIAMENTO CON IL MOTORE PRIMO, FARE ATTENZIONE CHE IL ROTORE NON SI SFILI; TOGLIERE IL SISTEMA DI FISSAGGIO ROTORE, SE PRESENTE.



MECHANICAL COUPLING

For transit and storage purposes the generator flange spigot and the generator end shaft (for the generators in B3-B14 construction form) have been coated with a rust preventer that can be removed easily.

This **MUST BE** removed before assembling to the engine.

The mechanical coupling is under the sole responsibility of the final user, and has to be done at his discretion (for tightening torque see tab. 24 pag. 72).

A bad alignment may cause vibrations and bearing damages. It is advisable to verify the compatibility of the engine / generator torsional characteristics (by the customer).

The necessary data for this verification are available on the concerning documentation.

Warnings:

BEFORE STARTING THE ALTERNATOR, CHECK THAT THE AIR INLETS AND OUTLETS ARE FREE OF ANY OBSTRUCTIONS.

THE AIR INLETS SHOULD NOT BE NEAR ANY HEATING SOURCES.

IN ANY CASE, IF NOT SPECIFICALLY REQUESTED, THE COOLING AIR TEMPERATURE MUST BE EQUAL TO THE ENVIRONMENT TEMPERATURE AND NEVER HIGHER THAN 40°C.

DURING ASSEMBLING AND DISASSEMBLING OPERATIONS, HOLD CAREFULLY BOTH ENDS OF THE PROTECTION GRID AS THE RELATED MATERIAL ELASTICITY CAN BE HARMFUL.

BEFORE MECHANICAL COUPLING OF SINGLE BEARING ALTERNATORS REMOVE THE ROTOR SECURING DEVICE, IF FITTED, PLACED THERE TO PREVENT ROTOR FROM SLIPPING.

ACCOPPIAMENTO MECCANICO

ISTRUZIONI PER MONTAGGIO IN FORMA COSTRUTTIVA MD35.

Un allineamento impreciso può causare vibrazioni e danneggiamenti dei cuscinetti. E' consigliabile inoltre verificare la compatibilità delle caratteristiche torsionali del motore / generatore (a cura del cliente).

I dati sul generatore necessari per tale verifica sono disponibili nella relativa documentazione tecnica.

Per l'accoppiamento del generatore con forma costruttiva MD35, procedere come segue:

a) verificare il corretto posizionamento dei dischi (quota "L") in funzione del tipo di accoppiamento considerato (tavola 24 pag. 72); se necessario ripristinare la quota "L" spostando leggermente e assialmente il rotore. In posizione corretta il cuscinetto posteriore deve avere un gioco assiale da 0,5 a 2 mm.

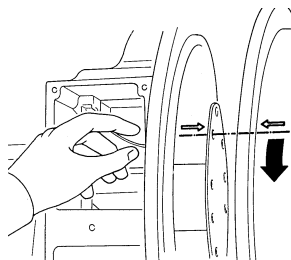
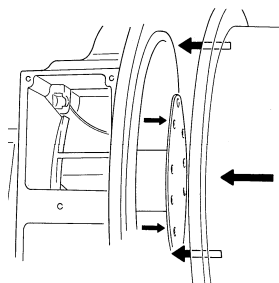
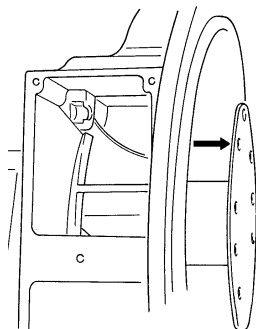
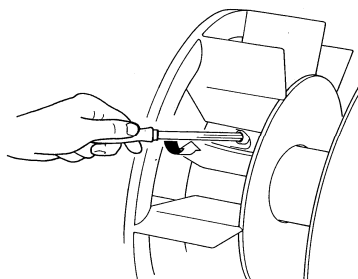
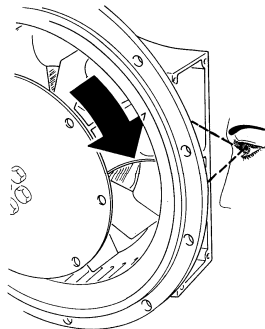
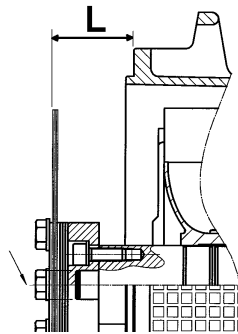
b) (Per serie 28) attraverso una delle due aperture laterali e ruotando manualmente il rotore, individuare sul mozzo della ventola, la relativa vite di bloccaggio

c) (Per serie 28) rendere la ventola libera di ruotare allentando la vite M8 di bloccaggio, utilizzando una chiave esagonale possibilmente con testa snodata

d) (Per serie 28) posizionare uno dei fori dei dischi in prossimità della parte alta di una delle aperture laterali e posizionare lo scarico realizzato su una delle pale della ventola, nella stessa posizione

e) avvicinare l'alternatore al motore di accoppiamento

f) allineare uno dei fori di fissaggio dei dischi del volano con il foro dei dischi precedentemente posizionato (punto "d")



MECHANICAL COUPLING

INSTRUCTIONS FOR THE ASSEMBLING OF GENERATORS WITH MD35 FORM.

A bad alignment may cause vibrations and bearing damages. It is advisable to verify the compatibility of the engine / generator torsional characteristics (by the customer).

The necessary data for this verification are available on the concerning documentation.

For the coupling of a generator with MD35 form, proceed as follows:

a) according to the type of the coupling, verify the correct placement of the discs (dimension "L") (table 24 pag. 72); if necessary restore the "L" dimension moving gently and axially the rotor. In the right position the clearance of rear bearing should be from 0.5 to 2 mm.

b) (For series 28) through one of the two lateral openings, and by manually rotating the rotor, detect the relevant clamp screw on the fan hub

c) (For series 28) let the fan be free to rotate by slackening the M8 screw by means of an hexagonal wrench, possibly having an articulated head

d) (For series 28) position one of the disk holes near the upper part of one of the side openings and place the slit that is on one of the fan blades, in the same position

e) move the generator close to the coupling engine

f) align one of the flywheel disk fastening holes with the holes of the previously positioned disks (point "d")

ACCOPPIAMENTO MECCANICO

g) inserire ed avvitare parzialmente la relativa vite che blocca i dischi al volano. Tenendo ferma la ventola (ECP28), ruotare il volano affinché altri due fori si ripresentino nella stessa posizione ed avvitare parzialmente la relativa vite. Ripetere detta operazione per tutti gli altri fori

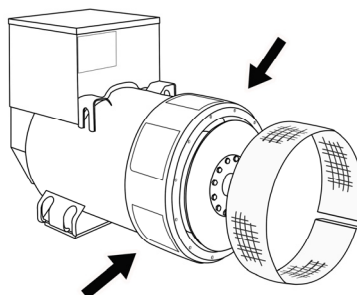
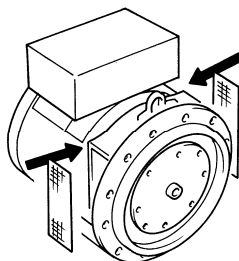
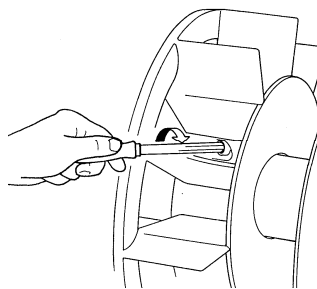
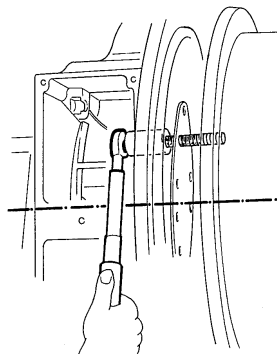
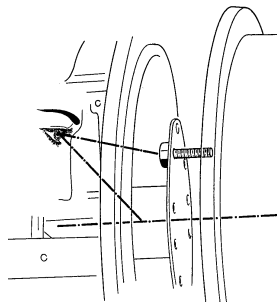
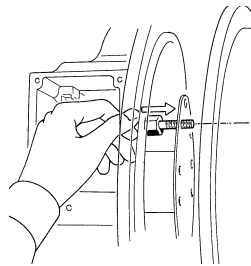
h) dopo aver verificato il corretto centraggio dei dischi nel volano motore, bloccare definitivamente dette viti

i) (Per serie 28) terminata l'operazione di bloccaggio dischi, ribloccare la ventola serrando la relativa vite con una coppia di serraggio pari a $16 \text{ Nm} \pm 10\%$; la posizione radiale della ventola non è vincolante per il corretto funzionamento del sistema

l) montare le retine di protezione, fornite a corredo del generatore.

L'osservanza delle prescrizioni dei punti "i" ed "l" è di fondamentale importanza onde evitare seri danni del generatore e situazioni pericolose per cose e persone.

Solamente dopo che il generatore è stato ben fissato meccanicamente procedere all'accoppiamento elettrico.



MECHANICAL COUPLING

g) Insert and partially tighten the screws that lock the disks to the flywheel. Keeping the fan still (ECP28), turn the flywheel until another two holes are in the same position and partially tighten the screw. Repeat this operation for all the other holes

h) after inspecting the correct centring of the disks on the engine flywheel, the screws must be completely tightened

i) (For series 28) once the clamping of the disks is over, stop the fan once again by tightening the screw with a torque wrench setting adjusted at $16 \text{ Nm} \pm 10\%$; the radial position of the fan is not binding for the correct operation of the system

l) fix the protection grids supplied with the generator.

Compliance with items "i" and "l" is of the utmost consequence in order to avoid serious damages to the generator or hazardous situations for people or objects.

Only after a correct mechanical coupling, proceed with the electrical connections.

PERICOLO DANGER



GEFAHR PELIGRO

L'accoppiamento elettrico e' a cura dell'utilizzatore finale ed e' eseguito secondo la sua sola discrezione.

Per l'ingresso nella scatola morsetti si raccomanda di utilizzare passacavi e serracavi in accordo con le specifiche del paese di esportazione.

COLLEGAMENTO AVVOLGIMENTI

Sono previsti entrambi i collegamenti, stella con neutro (Y) e triangolo (Δ) in tutti gli alternatori (tav. 2 pag. 60).

Per passare da un collegamento Y a Δ (es. da 400V a 230V) e' sufficiente spostare i ponti sulla morsettiera principale (vedere schema tav. 2 pag. 60).

Nessun intervento e' richiesto sul regolatore di tensione.

I generatori sono costruiti di serie con 12 cavi di uscita per consentire di ottenere tensioni diverse (es. 230 / 400 / 460 / 800V).

I generatori, vanno sempre collegati a terra con un conduttore di adeguata sezione utilizzando uno dei due (interno/esterno) appositi morsetti.

Per il collegamento elettrico utilizzare cavi adeguati in funzione della potenza del generatore ed effettuare le connessioni ai morsetti come indicato nelle tavole 12 o 17.

Dopo aver eseguito il collegamento (per le coppie di serraggio vedere tabella 24 pag. 72) rimontare il coperchio scatola morsetti.

IMPORTANTE: variazioni di frequenza.

La macchina fornita per funzionare a 50Hz puo' funzionare anche a 60Hz (o viceversa); e' sufficiente tarare il potenziometro al nuovo valore nominale di tensione.

Passando da 50Hz a 60Hz, la potenza puo' aumentare del 20% (corrente invariata), se la tensione aumenta del 20%; se la tensione rimane invariata la potenza, puo' aumentare del 5% per effetto della migliore ventilazione.

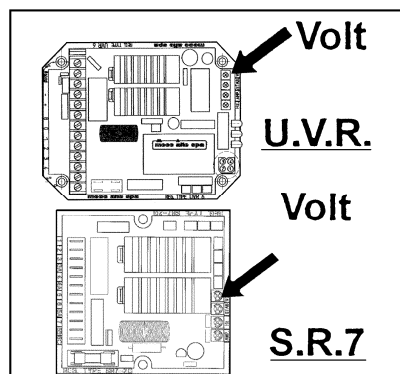
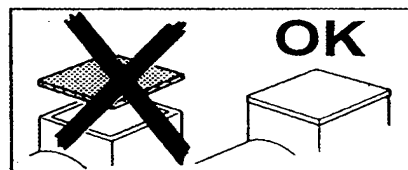
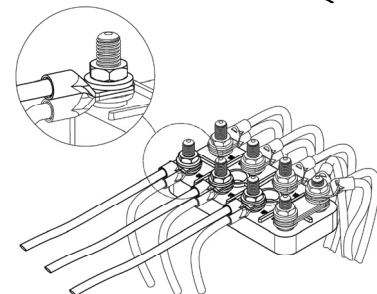
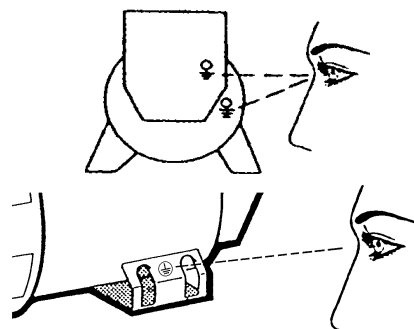
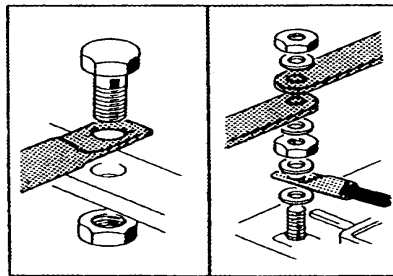
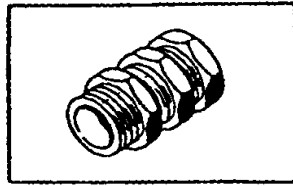
Per generatori costruiti appositamente per una frequenza di 60Hz nel passaggio a 50Hz, la tensione e la potenza devono necessariamente diminuire del 20% rispetto a quella riferita a 60Hz.

REGOLATORI (tav. 3 pag 60)

I regolatori tipo U.V.R.6/1-F e S.R.7/2-G possono essere indifferentemente usati nella serie ECO-ECP senza modificare le prestazioni.

L'U.V.R.6/1-F e' montato di serie nelle tipologie 38 - 40 - 43 - 46, mentre l'S.R.7/2-G nelle serie 28-31-32-34.

I due regolatori sono perfettamente uguali nelle prestazioni, ma si differenziano nelle segnalazioni e nel riferimento.



All electrical output connections are the responsibility of, and are at the discretion of, the end user.

When making terminal box connections, all cable and terminal lugs should meet the relevant standards of the country of final destination.

WINDINGS CONNECTION

All alternators feature both star with neutral (Y) and delta (Δ) connections (table. 2 pag. 60).

To reconnect from a star to delta connection (for ex. from 400V to 230V), modify the linking arrangements on the output terminal board (see diagram on table 2 page 60).

It is not necessary to adjust the voltage regulator.

Standard alternators are equipped with 12 cables to offer different voltages (ex. 230 / 400 / 460 / 800V).

The alternator must always be earthed by sufficiently rated cable, using one of the inside or outside terminals. For the electrical connections use wires suitable for the power of the generator and connect them to the terminal board as indicated on table 12 or 17.

After completing output connections (for tightening torque see tab. 24 pag. 72), ensure that the terminal box cover is securely in place.

IMPORTANT: frequency variations.

A standard production machine wound for 50 Hz can also function at 60 Hz (and vice versa) by resetting the A.V.R. voltage potentiometer to the new nominal voltage value. When changing from 50 to 60 Hz the alternator power, and nominal voltage will increase by 20%, but the current does not change from 50 Hz value. Should voltage stay at 50 Hz nominal value, then the output power may be increased by 5% due to improved ventilation.

For machines wound for 60 Hz, changing to 50 Hz, the voltage and power values have to decrease by 20% of 60 Hz value.

REGULATORS (table. 3 pag 60)

Either U.V.R.6/1-F and S.R.7/2-G regulators can be used on the ECO-ECP series without affecting performances.

The U.V.R.6/1-F is a standard feature on the 38-40-43-46 models whereas the S.R.7/2-G is standard on the 28-31-32-34 series.

The two regulators ensure the same level of performance but have different signal systems and references.

ACCOPIAMENTO ELETTRICO

IMPORTANTE :

il controllo di tensione va eseguito a vuoto con l'alternatore funzionante a frequenza nominale.

Agendo sul potenziometro tensione dei regolatori elettronici si può ottenere la regolazione della tensione entro il $\pm 5\%$ del valore nominale.

E' possibile ottenere la regolazione della tensione a distanza in un range di $\pm 5\%$ inserendo negli appositi morsetti un potenziometro da 100K (per le macchine a 6 morsetti) o un potenziometro da 100K con in serie una resistenza da 100K (per le macchine a 12 morsetti).

Istruzioni per il collegamento del potenziometro esterno :

ATTENZIONE: quando si collega il potenziometro esterno è necessario seguire la procedura sottoriportata per ottenere un corretto funzionamento dell'alternatore.

- 1) Ruotare il trimmer VOLT nel regolatore elettronico completamente in senso antiorario
- 2) Posizionare il potenziometro esterno a metà corsa e connetterlo agli appositi morsetti del regolatore elettronico
- 3) Tramite il trimmer VOLT del regolatore elettronico tarare la tensione al valore nominale.

PROTEZIONI

U.V.R.6/1-F - S.R.7/2-G

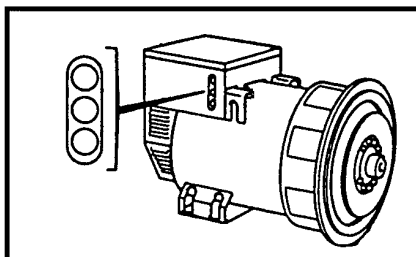
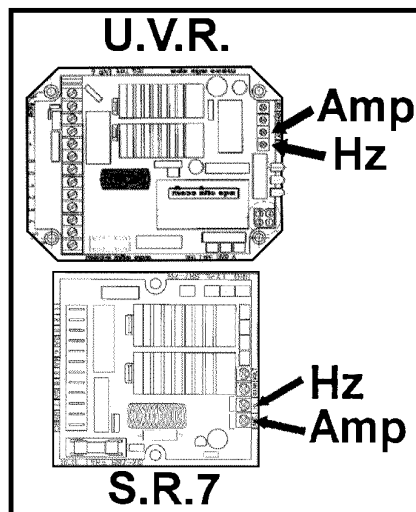
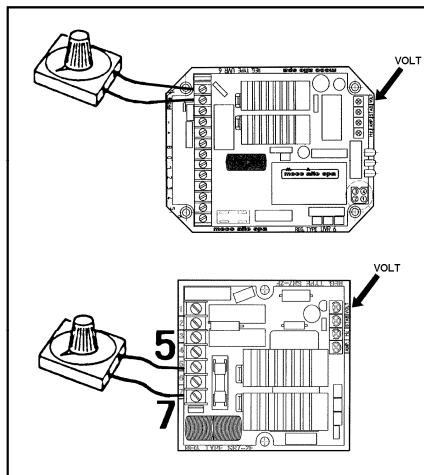
Entrambi i regolatori sono provvisti di una protezione di bassa velocità la cui soglia di intervento e' regolabile tramite il potenziometro "Hz". L'intervento di tale protezione e' istantaneo riducendo la tensione di macchina quando la frequenza scende sotto il 10% di quella nominale. I regolatori prevedono anche una seconda protezione (protezione di sovraccarico), che sente la tensione parzializzata che va al campo di statore dell'eccitatrice e se essa supera per più di 20 sec il valore stabilito, abbassa la tensione di macchina limitando la corrente di eccitazione entro valori di sicurezza.

Il ritardo appositamente inserito consente lo spunto del motore che normalmente si avvia in 5 - 10 sec. Anche la soglia di intervento di questa protezione e' regolabile tramite il potenziometro "AMP".

U.V.R.6/1-F

Il regolatore U.V.R.6/1-F aggiunge alle prestazioni prima descritte, le seguenti caratteristiche:

- 1 - possibilità di avere il riferimento trifase oltre che monofase.
- 2 - segnalazioni a led di autodiagnostica che indicano le condizioni di funzionamento della macchina: un led verde, che normalmente acceso indica il funzionamento normale del generatore; un led rosso che indica l'intervento della protezione di bassa velocità, un led giallo che indica l'intervento della protezione di sovraccarico.



ELECTRICAL CONNECTIONS

IMPORTANT :

the generator output voltage must be checked under no-load conditions, with the correct setting of frequency.

The voltage may be adjusted by $\pm 5\%$ of the nominal, by acting upon the voltage potentiometer on the electronic regulators.

It is possible to get a remote voltage regulation of $\pm 5\%$ inserting in the proper terminals a 100K potentiometer (for the 6 lead units) or a 100K potentiometer with a 100K resistance in series (for the 12 lead units).

Instructions to follow for the external potentiometer connection:

CAUTION: in order to get a correct working of the alternator, it is necessary to follow the following procedure, connecting the external potentiometer.

- 1) Turn the VOLT trimmer of the electronic regulator completely anticlockwise.
- 2) Set the external potentiometer at half turn and connect it to the proper terminals of the electronic regulator.
- 3) Adjust the voltage at the nominal value by the VOLT trimmer of the electronic regulator.

PROTECTIONS

U.V.R.6/1-F - S.R.7/2-G

Both regulators are provided with an underspeed protection with an intervention threshold which can be adjusted by the potentiometer marked "Hz". This protection intervenes instantaneously by reducing the alternator voltage to a safe value when frequency falls below 10% of the nominal value. These regulators also have inherent overload protection which senses the exciter field voltage value. Should this field voltage value exceed the nominal value for a period of more than 20 seconds, then again the alternator voltage is automatically reduced to a safe operating level. This overload function has a built-in delay to allow for the overload when starting motors (normally 5-10 seconds). The operating threshold of this protection device is adjustable by the potentiometer marked "AMP".

U.V.R.6/1-F

Aside from the above mentioned characteristics, the U.V.R.6/1-F regulator also offers the following:

- 1 - possibility to have single-phase as well as three-phase sensing
- 2 - led indicators for self-diagnosis which indicate the unit's operational conditions: a green led which when lit confirms the alternator's normal functioning; a red led indicates the underspeed protection is on; a yellow led indicates the overload protection is on.

ACCOPPIAMENTO ELETTRICO

IMPORTANTE

Nel funzionamento normale del generatore deve essere acceso solamente il led verde. Tutte queste segnalazioni possono essere remote a distanza e manipolate per usi diversi tramite l'utilizzo del dispositivo chiamato SPD96/A, disponibile a richiesta.

CAUSE CHE PROVOCANO L'INTERVENTO DELLE PROTEZIONI.

Intervento istantaneo protezione bassa velocità:

1 - velocità ridotta del 10% rispetto ai dati di targa.

Intervento ritardato protezione sovraccarico :

- 2 - sovraccarico del 20% rispetto ai dati di targa.
- 3 - fattore di potenza ($\cos \varphi$) inferiore ai dati di targa.
- 4 - temperatura ambiente oltre i 50°C.

Intervento di entrambe le protezioni:

5 - combinazione del fattore 1 con i fattori 2, 3, 4.

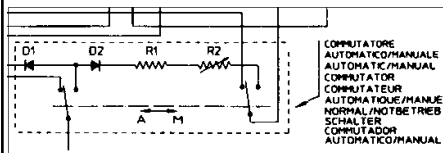
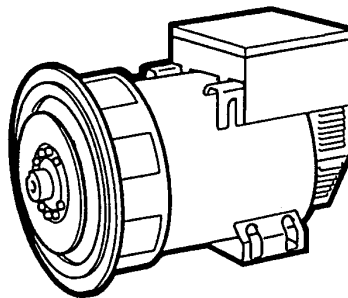
Nel caso di intervento delle protezioni, la tensione erogata dall'alternatore scenderà fino ad un valore che dipenderà dall'entità dell'anomalia.

La tensione tornerà automaticamente al suo valore nominale qualora venga a cessare l'inconveniente.

Per maggiori dettagli sui regolatori consultare il manuale specifico.

OPTIONALS :

Tutti gli alternatori della serie ECO-ECP possono anche funzionare con regolazione manuale, senza l'ausilio di sorgenti esterne ma con il solo utilizzo di un reostato (tav. 10-11 pag. 65).



ELECTRICAL CONNECTIONS

IMPORTANT

In normal functioning, only the green led has to be lit.

All these indicators can be remotely controlled and adjusted, for any type of use, by utilizing the SPD96/A accessory which is available on request.

INTERVENTION OF PROTECTION DEVICES CAUSES.

Underspeed protection instantaneous intervention :

1 - speed reduced by 10% of nominal RPM

Delayed intervention of overload protection :

- 2 - overload by 20% of nominal rating.
- 3 - power factor ($\cos \varphi$) lower than the nominal one.
- 4 - ambient temperature above 50°C.

Intervention of both protections :

5 - combination of factor 1 with factors 2, 3, 4.

In case of intervention the output voltage will drop down to a value which will depend on the fault.

The voltage will return automatically to its nominal value as soon as the fault is removed.

For further details on regulators, please see the specific manual.

OPTIONALS :

All ECO-ECP series alternators can function with manual regulation, without assistance from any external source, by using a rheostat (tab. 10-11 pag. 65).

ACCOPPIAMENTO ELETTRICO

FUNZIONAMENTO IN PARALLELO

Nel caso si voglia far funzionare dei generatori in parallelo e' necessario montare un dispositivo che assicura un identico statismo sulla caratteristica esterna.

Questo significa che se le macchine lavorassero separatamente si avrebbe una uguale caduta di tensione (circa 4%) passando da vuoto a pieno carico.

Questo dispositivo e' montato di serie sulle grandezze 40 - 43 - 46, per cui, quando due o piu' di queste macchine devono lavorare in parallelo e' sufficiente togliere il ponticello che cortocircuita il secondario del dispositivo di parallelo.

Per le grandezze inferiori il dispositivo viene montato a richiesta o puo' essere montato (ad eccezione del tipo ECP28/4) dal cliente stesso secondo le tav.14-16-18-20. Dopo aver montato il dispositivo e' necessario verificare l'esatto collegamento; si dovra' controllare cioe' che le macchine lavorando singolarmente presentino una caduta di tensione di circa il 4% passando, a velocita' nominale e $\cos \varphi$ 0.8, da vuoto a pieno carico.

MONTAGGIO DI UN DISPOSITIVO DI PARALLELO

Riferendosi alle tavole 14-16-19 montare il trasformatore di parallelo come illustrato.

Collegare le spire di potenza in serie alla fase.

Il numero delle spire da eseguire sul trasformatore saranno indicate sulle istruzioni allegate al trasformatore stesso.

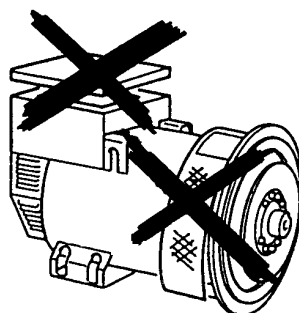
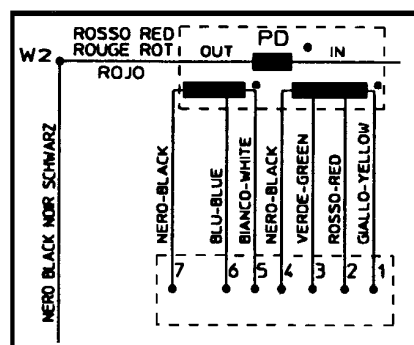
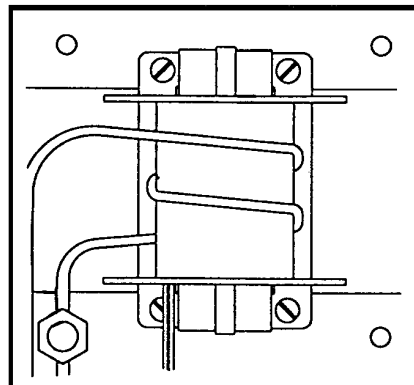
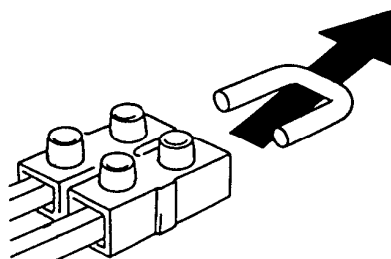
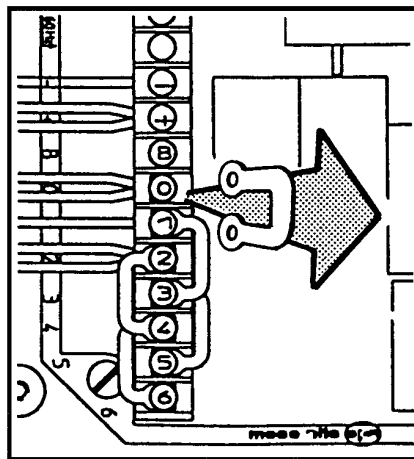
Il secondario del trasformatore di parallelo va connesso in serie al riferimento del regolatore elettronico come mostrato nelle tavole 4 e 5 pag. 61.

Per abilitare il dispositivo di parallelo rimuovere il ponticello che cortocircuita il secondario del dispositivo stesso come mostrano gli schemi sopra indicati.

NOTA

Alla richiesta del dispositivo di parallelo e' indispensabile conoscere i dati nominali dell'alternatore su cui andra' applicato.

Dopo aver eseguito tutti i collegamenti elettrici e **solo dopo aver chiuso tutte le protezioni** e' possibile effettuare la prova di primo avviamento del sistema.



ELECTRICAL CONNECTIONS

PARALLEL OPERATION

Should the alternators be required to operate in parallel, it is necessary to add a paralleling device to ensure equal droop of generator output voltages.

This ensures that if the machines are operated separately, the voltage droop (4% approx.) is equal when switching from no-load to full load.

The parallel device is fitted as standard on 40-43-46 models, therefore when two or more of these units must function in parallel, it is sufficient to remove the bridge which shortcircuits the secondary winding of the parallel device.

On smaller models this device is mounted on request or it can be added (except for ECP28/4) by the client himself following the instructions of tables 14-16-18-20.

After the device has been mounted, check whether the connection has been properly made; make sure that there is a voltage drop of approximately 4% in the machines when they function individually switching at rated speed and $\cos \varphi$ 0.8 from no-load to full load operation.

HOW TO MOUNT THE PARALLEL DEVICE

Referring to tables 14-16-19 mount parallel device as indicated.

Connect the power turns in series with phase. The numbers of turns to be wound on the transformer will be indicated in the instruction accompanying the transformer itself. The secondary winding of the parallel transformer must be connected in series to the sensing of the electronic regulator as shown on tables 4 - 5 page 61.

In order to activate the parallel device remove the bridge which shortcircuits the secondary winding of the device itself as shown in the above mentioned tables.

NOTE

When requesting a parallel device, it is necessary to indicate the nominal data of the alternator on which the device will be applied.

After all the electric connections have been made and **only after all the protections have been put in place**, can the system be started.

AVVIAMENTO E ARRESTO

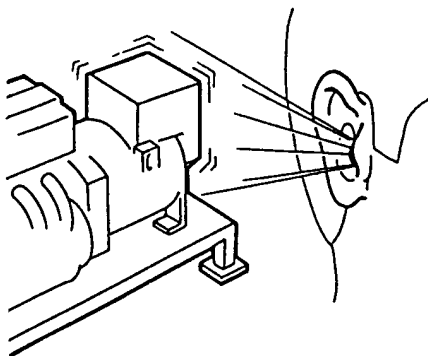
La strumentazione per l'avviamento, la conduzione e l'arresto del sistema e' a carico dell'installatore.

LE OPERAZIONI DI AVVIAMENTO, CONDUZIONE E ARRESTO DEVONO ESSERE ESEGUITE DA PERSONALE ADEGUATAMENTE QUALIFICATO E CHE ABBA LETTO E COMPRESO LE PRESCRIZIONI DI SICUREZZA ALL'INIZIO DEL MANUALE.

IMPORTANTE :

Durante il primo avviamento, che deve essere eseguito a velocita' ridotta, l'installatore dovra' verificare che non si presentino rumori anomali.

In caso di rumori anomali provvedere a fermare immediatamente il sistema e intervenire per migliorare l'accoppiamento meccanico.



STARTING AND STOPPING OPERATIONS

All the instrumentation for starting, running and stopping the system shall be provided by the installer.

THE STARTING, RUNNING AND STOPPING OPERATIONS MUST BE CARRIED OUT BY SKILLED PERSONNEL WHO HAVE READ AND UNDERSTOOD THE SAFETY INSTRUCTIONS AT THE BEGINNING OF THIS MANUAL.

IMPORTANT :

When the system is set to work for the first time, which has to be done at a reduced speed, the operator shall check that no anomalous noises can be detected.

If an anomalous noise is detected, stop the system immediately and improve the mechanical coupling.

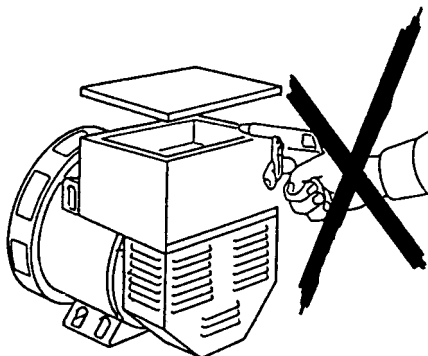
PULIZIA E LUBRIFICAZIONE

Prima di avvicinarsi al generatore assicurarsi che sia a stato energetico zero e a temperatura ambiente; a questo punto e' possibile pulirlo esternamente con aria compressa.

NON UTILIZZARE MAI LIQUIDI O ACQUA.

NON PULIRE CON ARIA COMPRESSA LE PARTI ELETTRICHE INTERNE, POICHE' POSSONO VERIFICARSI CORTOCIRCUITI O ALTRE ANOMALIE.

Per la lubrificazione dei cuscinetti consultare la tabella 23 pag. 71.



CLEANING AND LUBRICATION

Prior to approaching or touching the alternator, ensure that it is not live and it is at room temperature; at this stage it is possible to clean it on the outside using compressed air.

NEVER USE LIQUIDS OR WATER.

DO NOT CLEAN THE INSIDE ELECTRIC COMPONENTS WITH COMPRESSED AIR, BECAUSE THIS MAY CAUSE SHORT-CIRCUITS OR OTHER ANOMALIES.

For the lubrication of bearings, see table 23 on page 71.

MANUTENZIONE

MAINTENANCE

**PERICOLO
DANGER**



**GEFAHR
PELIGRO**

I generatori della serie ECO-ECP sono costruiti per lavorare a lungo senza manutenzione.

PRIMA DI ESEGUIRE QUESTA OPERAZIONE LEGGERE MOLTO ATTENTAMENTE LE PRESCRIZIONI DI SICUREZZA ALL'INIZIO DI QUESTO MANUALE.

The alternators series ECO-ECP are designed to give a long maintenance free working life.

BEFORE PERFORMING THIS OPERATION, READ THE SAFETY REQUIREMENTS AT THE BEGINNING OF THIS MANUAL CAREFULLY.

MANUTENZIONE

Gli interventi di manutenzione sul generatore Mecc Alte si possono dividere in ordinari e straordinari; in ogni caso qualsiasi intervento deve essere autorizzato dal responsabile della sicurezza, a macchina ferma e isolata elettricamente dall'impianto o dalla rete. La manutenzione e la ricerca guasti deve essere eseguita da personale elettricamente/meccanicamente qualificato in quanto ogni operazione a seguito descritta presenta pericoli per il personale.

Si raccomanda inoltre che siano prese tutte le precauzioni per impedire che la macchina venga riavviata inavvertitamente durante le fasi di manutenzione e ricerca guasti.

Gli interventi di manutenzione ordinaria possono essere riassunti in :

- verifiche condizioni avvolgimenti dopo lunghi periodi di immagazzinamento o di sosta
- verifiche, ad intervalli regolari, del corretto funzionamento (assenza di rumori o vibrazioni anomale)
- verifiche meccaniche su tutti i bulloni di fissaggio ed in particolare delle connessioni elettriche
- pulizia esterna del generatore

a) Verifiche condizioni avvolgimenti dopo lunghi periodi di immagazzinamento o di sosta.

La condizione degli avvolgimenti può essere verificata mediante la misura della resistenza di isolamento verso terra. Tale misura si esegue con uno strumento "Megger" o similari a 500V di tensione continua; è importante che prima di eseguire la prova, il regolatore di tensione (fig. a), il ponte diodi rotante (fig. b), i filtri anti disturbi radio (fig. c) e tutti gli eventuali dispositivi connessi elettricamente agli avvolgimenti da verificare, vengano scollegati.

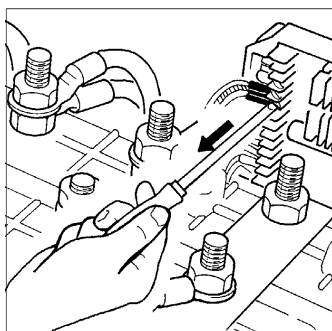
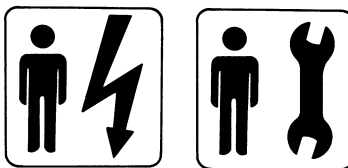


fig. a

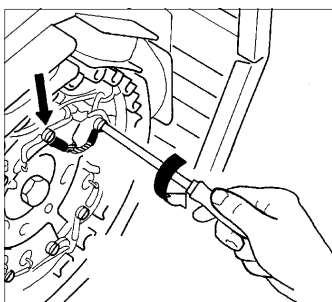


fig. b

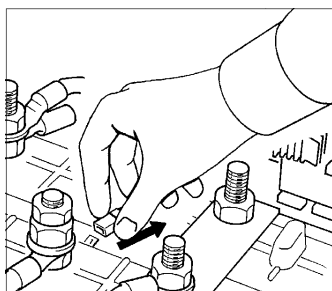


fig. c

MAINTENANCE

Maintenance operations on Mecc Alte generators can be divided into routine and extraordinary maintenance operations; in both cases, all operations must be authorised by the safety representative and they must be carried out when the machine is turned off and insulated from the electric installation or from the power mains.

High-qualified mechanical or electrical technicians must carry out maintenance operations and any fault search since all operations described hereunder could put personnel in serious danger.

It is also highly recommended to take all the necessary precautions so as to prevent an inadvertent starting of the machine during maintenance and fault search operations.

Routine maintenance operations can be summed up as follows:

- Assessment of windings conditions after long periods of storage or inactivity
- Assessment, on a regular basis, of correct functioning (absence of anomalous noises or vibrations)
- Mechanical inspections on all fastening bolts and, in particular, on electric connections
- external cleaning of generator

a) Assessment of windings conditions after long periods of storage or inactivity.

Measuring the insulating earth resistance can assess the condition of the windings. This measurement can be carried out with a "Megger" device, or similar, with a 500V direct-current voltage. It is very important to disconnect the voltage regulator (fig. a), the rotating diode bridge (fig. b) and the radio-interference filter (fig. c), as well as any other device connected to the windings to be checked, before carrying out the measurement.

MANUTENZIONE

Il valore misurato di resistenza verso terra di tutti gli avvolgimenti deve essere superiore a $1\text{M}\Omega$.

Nell'ipotesi in cui il valore misurato sia inferiore a quanto sopra riportato, gli avvolgimenti devono essere opportunamente asciugati. Tale operazione può essere eseguita indirizzando un getto di aria calda a circa $50-60^\circ\text{C}$, negli ingressi o nelle uscite dell'aria del generatore.

In alternativa a quanto sopra, gli avvolgimenti di statore possono essere collegati elettricamente e fatti attraversare da una corrente mediante un alimentatore in continua; il valore di corrente da fare circolare negli avvolgimenti dipenderà dalle dimensioni dell'alternatore e comunque dovrà essere stabilito in accordo ai valori nominali riportati nella targhetta.

b) Verifiche del corretto funzionamento (assenza di rumori o vibrazioni anomale).

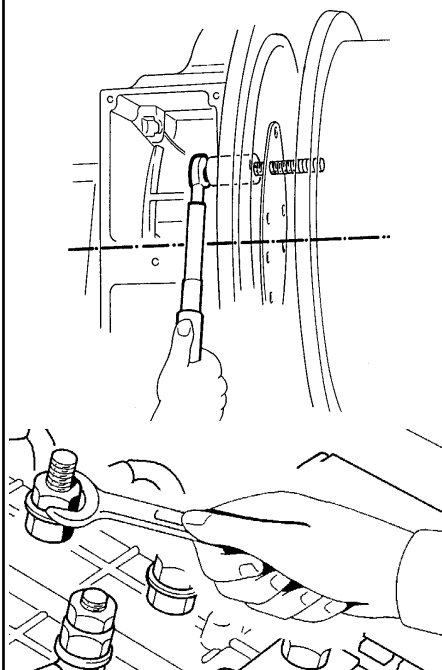
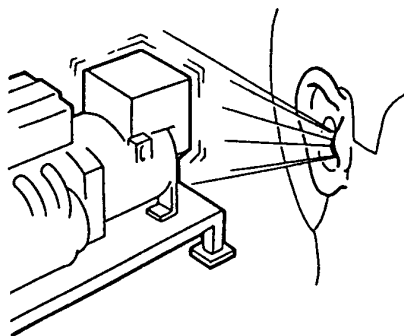
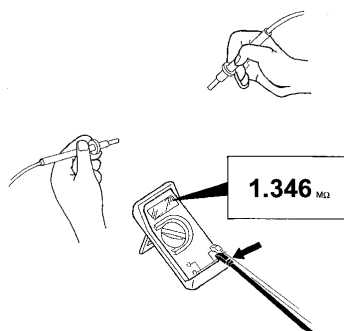
Ad intervalli regolari raccomandiamo di verificare che il generatore funzioni regolarmente senza rumori o vibrazioni anomale; tali presenze potrebbero denotare il danneggiamento dei cuscinetti.

Ricordiamo che l'alternatore a sé stante non presenta vibrazioni particolari in quanto le parti rotanti sono perfettamente bilanciate. Premesso che la bilanciatura del rotore non sia stata alterata e che i cuscinetti dell'alternatore non siano danneggiati, le cause delle vibrazioni presenti sul gruppo elettrogeno saranno da ricercare negli allineamenti degli accoppiamenti, nelle sollecitazioni del motore termico o nei supporti antivibranti.

Si raccomanda inoltre di verificare i dati funzionali che devono risultare in linea con quanto riportato nella targhetta del generatore.

c) Verifiche meccaniche su tutti i bulloni di fissaggio ed in particolare delle connessioni elettriche.

Ad intervalli regolari raccomandiamo di verificare che tutti i bulloni di fissaggio siano adeguatamente stretti; una particolare attenzione deve essere rivolta alle connessioni elettriche, operazione che deve essere eseguita con la assoluta certezza di assenza di tensione. Nel manuale del generatore sono indicate le corrette coppie di serraggio delle varie dimensioni di bullone.



MAINTENANCE

The figure resulting from the measurement of the windings' earth resistance must be over $1\text{M}\Omega$.

Should the figure be smaller than the above-mentioned one, the windings must be adequately dried up. This can be done by directing a jet of hot air of about $50-60^\circ\text{C}$ into the generator's air inlets or outlets; alternatively, the stator's windings can be electrically connected and a voltage can be passed through them by means of a direct-current power supply. The amount of current in the windings depends on the generator size, even though it must be fixed according to the nominal values stated on the plate.

b) Assessment of current functioning (absence of anomalous noises or vibrations).

We recommend users to check regularly the correct functioning of the generator, and to verify that there are no anomalous noises or vibrations; their presence might indicate damage of bearings.

May we remind you that the alternator itself has no particular vibration since the rotating parts are perfectly balanced. Provided that the rotor balancing has not been altered and that the rotor's bearings have not been damaged, vibrations in the generator set may occur due to alignments of couplings, due to stress upon the combustion engine, or to vibration mounts.

We also recommend checking of performance data which must comply with the data on the generator's plate.

c) Mechanical checks of fastening bolts and, in particular, of electric connections.

We recommend a regular check of all fastening bolts, which must be perfectly tightened up. Special attention should be paid to all electric connections; this inspection must be carried out in the complete absence of voltage. To choose the correct tightening wrenches suitable for the different sizes of the bolts, see generator manual.

MANUTENZIONE

d) Pulizia esterna ed interna del generatore.

Per la pulizia esterna del generatore è possibile utilizzare dell'aria compressa; vietiamo assolutamente l'uso di qualsiasi tipo di idropulitrice e di liquidi detergenti; il grado di protezione standard del generatore è IP21 e pertanto utilizzando liquidi potrebbero verificarsi delle anomalie o anche cortocircuiti.

Gli interventi di manutenzione straordinaria possono essere riassunti in:

- manutenzione dei cuscinetti ed eventuale sostituzione
- pulizia dei filtri aria (se presenti)
- pulizia degli avvolgimenti
- sostituzione del ponte a diodi
- sostituzione dell'eccitatrice
- sostituzione del regolatore di tensione
- controllo della tensione residua

a) Manutenzione dei cuscinetti ed eventuale sostituzione.

Tutti i cuscinetti sono ingrassati in fase di montaggio; il grasso impiegato normalmente è del tipo SKF28 o equivalenti.

Tutti i generatori ad eccezione dei tipi ECO40, ECO43N ed ECO46, montano cuscinetti di tipo stagno; per tali tipi di cuscinetti non sono necessarie manutenzioni per tutto il periodo di funzionamento (stimabile in circa 30.000 ore).

Per i generatori tipo 40, 43 e 46, ad intervalli regolari (vedere tabella cuscinetti) occorre procedere all'ingrassaggio dei cuscinetti mediante un apposito ingrassatore a pressione.

Controlli periodici durante il periodo di funzionamento, devono essere eseguiti per verificare eventuali surriscaldamenti o rumori; eccessive vibrazioni possono essere causate da una usura anomala del cuscinetto.

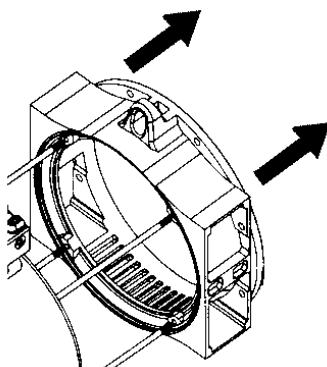
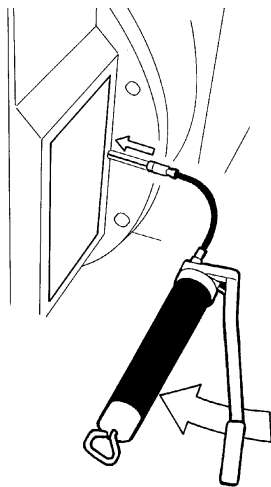
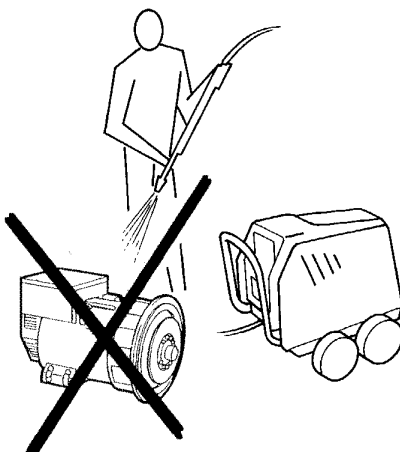
In tal caso, il cuscinetto deve essere smontato per essere esaminato ed eventualmente sostituito.

Qui di seguito viene descritta la procedura per sostituire il cuscinetto.

Generatore tipo 28-31-32-34.

Per smontare l'alternatore della serie 28-31-32-34, attenersi alle seguenti istruzioni:

-) togliere il coperchio anteriore



MAINTENANCE

d) Internal and external cleaning of the generator.

For the external cleaning of the generator, you can use compressed air. The use of hydro-cleaners and detergent fluids is strictly forbidden. The standard protection degree of the generator is IP21; therefore, use of fluids could cause anomalies or even short-circuits.

Extraordinary maintenance operations can be summed up as follows:

- Maintenance and replacement (if necessary) of bearings
- Cleaning of air filters (if available)
- Cleaning of windings
- Replacement of diode bridge
- Replacement of exciter
- Replacement of voltage regulator
- Check of residual voltage

a) Maintenance and replacement (if necessary) of bearings.

During the assembling phase, all bearings are greased with SKF28 grease, or similar.

All generators, except the ECO40, the ECO43N and ECO46 versions, are equipped with sealed bearings; for this kind of bearing, no maintenance is required for the total operating time (estimated: 30.000 hours).

Bearings of alternator versions 40, 43 and 46 must be greased on a regular basis by means of a pressure grease cup (see bearings chart).

During the operating time, checks to detect presence of either overheating, or noises, must be carried out on a regular basis. If the bearing is worn off, it can cause excessive vibrations. In such a case, the bearing must be removed, examined, and if necessary, replaced.

A description of the procedure for a bearing replacement.

Generator versions: 28-31-32-34.

To disassemble alternator versions 28-31-32-34, follow these instructions:

-) Remove front cover

MANUTENZIONE

-) sfilare il rotore utilizzando un mezzo di sollevamento con funi morbide ma di portata adeguata; verificare che i mezzi di sollevamento predisposti siano comunque adeguati per i pesi dei componenti da movimentare

-) per estrarre il cuscinetto deve essere utilizzato un apposito estrattore

-) per il montaggio del nuovo cuscinetto, riscaldare lo stesso con un apposito dispositivo magnetico

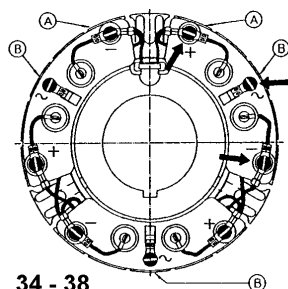
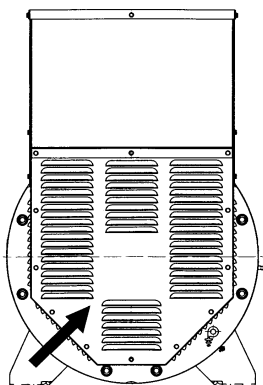
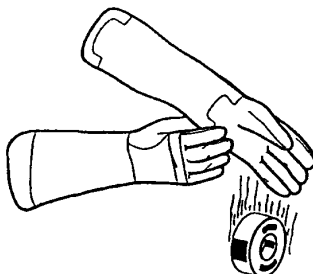
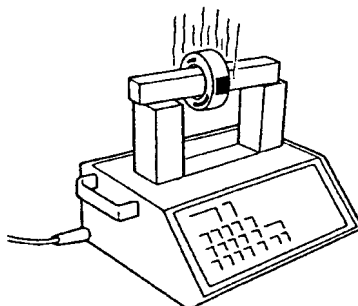
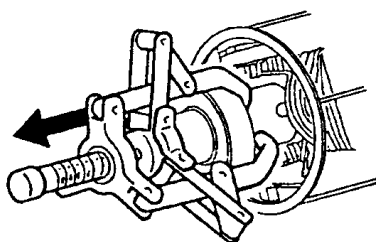
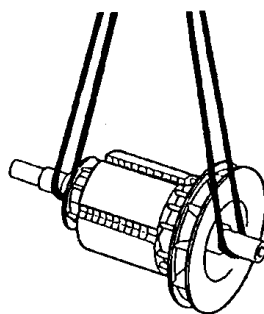
-) indossando gli appositi guanti anti-scottatura, montare il cuscinetto nella sua sede

Generatore tipo 38-40-43-46.

Per smontare l'alternatore della serie 38-40-43-46, è necessario rimuovere l'eccitatrice, pertanto attenersi alle seguenti istruzioni :

-) togliere la chiusura posteriore

-) sconnettere i cinque fili del ponte diodi rotante "A" e "B".



34 - 38

MAINTENANCE

-) Use a lifting device equipped with soft ropes of an adequate lifting capacity to extract rotor. Make sure that the lifting devices are suitable for the weight of the parts to be shifted;

-) To pull the bearing out, use a puller

-) To insert new bearing, heat it with a suitable magnetic device

-) Put on safety gloves and insert bearing into its place

Generator versions: 38-40-43-46.

To disassemble alternator versions 38-40-43-46, remove exciter as follows:

-) Remove rear seal

-) Disconnect the five wires of the rotating diode bridge "A" and "B".

MANUTENZIONE

-) nel caso di alternatori della serie 38, togliere le viti di bloccaggio dei settori porta diodi del ponte rotante, mentre nel caso di alternatori della serie 40-43-46 togliere il bullone di bloccaggio e tirando leggermente togliere il ponte diodi

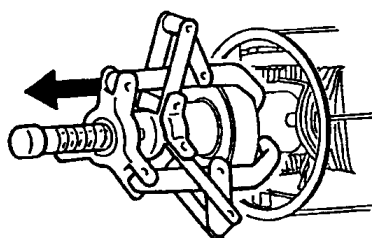
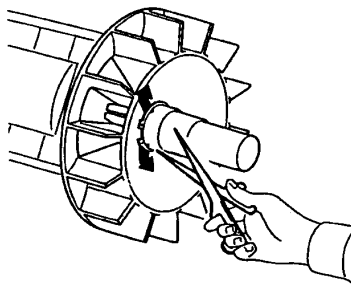
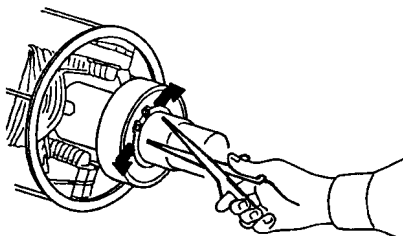
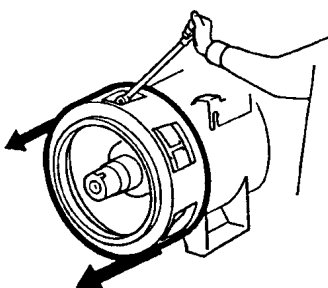
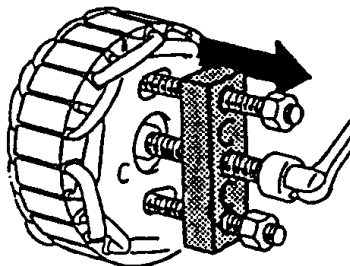
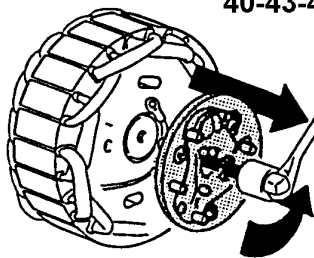
-) inserire un adeguato estrattore per sfilare il rotore eccitatrice

-) dal lato accoppiamento sfilare il rotore principale; nel caso in cui il diametro del coperchio anteriore fosse minore del diametro esterno della ventola, togliere il coperchio stesso per sfilare il rotore

-) togliere gli anelli seeger servendosi di una pinza adeguata

-) per estrarre il cuscinetto deve essere utilizzato un apposito estrattore

40-43-46



MAINTENANCE

-) When dealing with versions 38, remove clamp screws from the diodes area of the rotating bridge, whilst when dealing with versions 40, 43 and 46, remove clamp bolt and, by pulling it gently, remove Diode Bridge

-) Insert an adequate puller to pull out exciter rotor

-) Pull out rotor from the drive-end side; should the front lead diameter be smaller than the impeller's external diameter, remove lid to pull out rotor

-) Use a pair of suitable pliers to remove seeger rings

-) Use a suitable puller to remove bearing

MANUTENZIONE

-) per il montaggio del nuovo cuscinetto, riscaldare lo stesso con un apposito dispositivo magnetico

-) indossando gli appositi guanti anti-scottatura, montare il cuscinetto nella sua sede

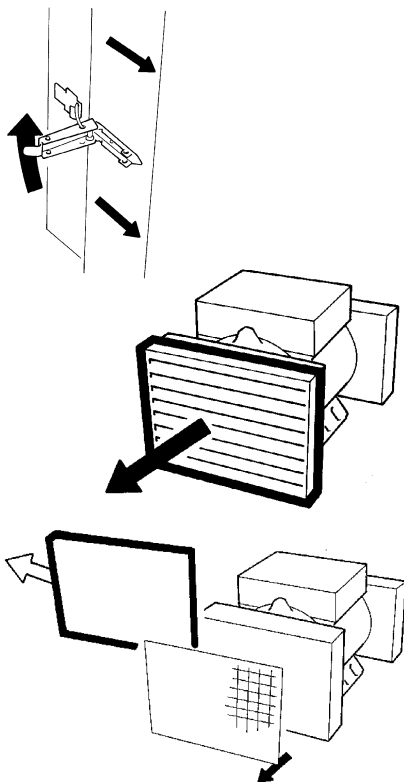
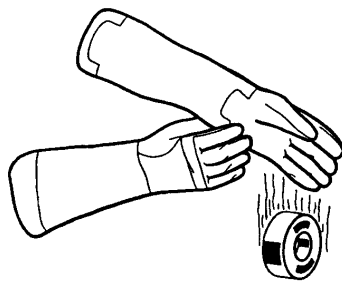
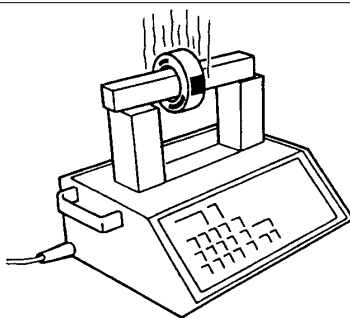
b) Pulizia dei filtri aria (se presenti)

I filtri aria sono degli accessori che vengono montati su richiesta dei clienti; tali dispositivi devono essere periodicamente puliti in quanto al loro interno è situata una retina a maglie che deve essere mantenuta pulita per garantire l'efficienza del filtro. La periodicità di intervento sui filtri aria dipenderà dalla severità delle condizioni del luogo di installazione; in ogni caso una regolare ispezione di questi componenti permetterà di stabilire se sarà il caso di intervenire. E' importante ricordare che la pulizia di questi elementi deve essere eseguita con il generatore non in servizio, in quanto la rimozione consente l'accesso a parti che potrebbero trovarsi in tensione.

c) Pulizia degli avvolgimenti

La durata degli avvolgimenti e quindi del generatore stesso, può essere migliorata da una corretta manutenzione e pulizia; un programma di ispezione e manutenzione dovrebbe essere stabilito tenendo presente che la frequenza di tali verifiche dipenderà dalle condizioni effettive dell'ambiente di utilizzo.

Se il generatore lavora in ambienti asciutti e puliti, un'ispezione all'anno può essere sufficiente; al contrario, se le condizioni sono più severe, è opportuno aumentare la frequenza delle ispezioni.



MAINTENANCE

-) To insert new bearing, heat it with a suitable magnetic device

-) Put on safety gloves and insert bearing into its place

b) Cleaning of air filters (if available)

Air filters are optional parts that are supplied upon request; these devices must be cleaned on a regular basis; inside these filters there is a mesh net that has to be kept clean in order to ensure a good performance of the filter. The time interval between each cleaning operation depends on the conditions of the installation site. A frequent inspection of these parts will establish if any cleaning is required. Make sure you turn off the generator set when performing cleaning operations of such parts as their removal entails contact with live parts.

c) Cleaning of windings

Both windings and generator will last longer with a correct maintenance and cleaning; an inspection and a maintenance schedule should be established by keeping in mind that the frequency of these inspections depends on the conditions of the site where the generator is being used.

If the generator is used in a dry and clean environment, an inspection a year is enough; in case of severe conditions, inspections must be carried out more frequently.

MANUTENZIONE

In ogni caso, indipendentemente dal programma stabilito, raccomandiamo di procedere a tale manutenzione nelle seguenti ipotesi :

-) presenza di ruggine
-) segni evidenti di corrosione
-) deterioramento dell'isolamento
-) presenza di polvere sulla superficie degli avvolgimenti

Gli avvolgimenti possono essere puliti utilizzando degli appositi solventi come ad esempio "l'acqua ragia" o il "solvesso"; tali sostanze, avendo un alto grado di evaporazione, permettono una pulizia adeguata senza intaccare il grado di isolamento degli avvolgimenti.

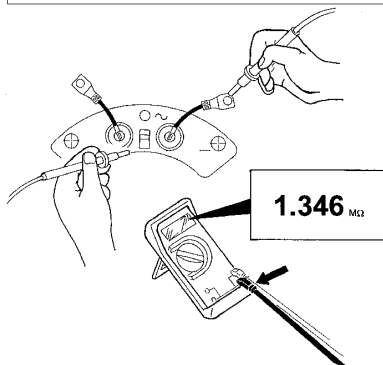
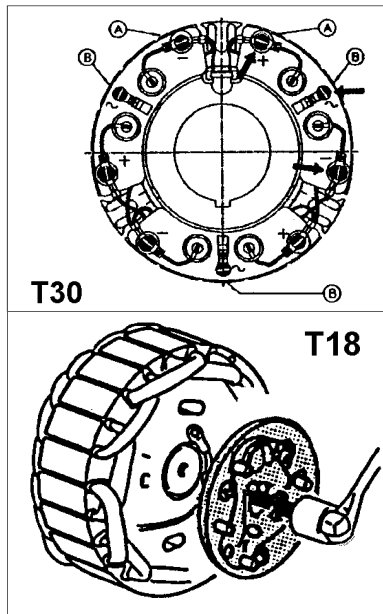
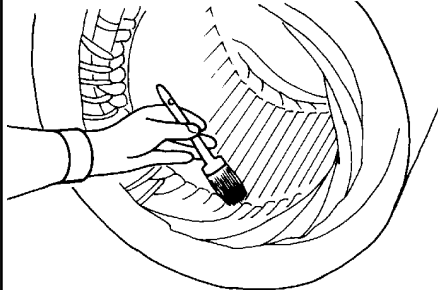
A pulizia ultimata, raccomandiamo di controllare che non vi siano segni di sovrariscaldamenti ed eventuali tracce di carbonizzazioni.

Inoltre si consiglia di asciugare gli avvolgimenti a circa 60-80°C e se si notano degradamenti della vernice degli avvolgimenti, procedere ad una ulteriore verniciatura degli stessi.

d) Sostituzione del ponte a diodi

A seconda del tipo di alternatore, il ponte a diodi può essere composto o da tre settori separati su ognuno dei quali sono fissati due diodi (T30) oppure da un blocco unico circolare (T18) con sei diodi. La prima configurazione (T30) viene installata nei generatori tipo 34-38 mentre la seconda (T18) viene installata nei generatori tipo 40-43-46.

Ciascun singolo diodo può essere verificato molto facilmente con un multimetro; è sufficiente scollegare il cavetto del diodo in esame e controllarne la resistenza nei due sensi. Un diodo che funziona correttamente indicherà una resistenza molto alta in un senso e molto bassa nel senso opposto. Un diodo guasto avrà o una resistenza molto bassa o una resistenza infinita in entrambi i sensi. Una volta sostituito il settore o l'intero ponte vi raccomandiamo di serrare le relative viti con le corrette coppie di fissaggio e di rispettare le polarità secondo gli schemi e le tabelle forniti da Mecc Alte.



MAINTENANCE

However, we recommend that a check should be done, regardless of the schedules, in the following cases:

-) in case of rust
-) in case of corrosion
-) when the insulation is damaged
-) when there is dust on the surface of the windings

To clean windings, use solvents like oil of turpentine or "Solvesso" solvent. Cleaning with such substances, which contain a high evaporation level, will not damage the isolation level of the windings. When cleaning is over, please look out for any overheating or carbonisation signs.

We also recommend drying up of windings at 60-80°C and if you notice that the varnish of windings is not in good shape, then have them varnished again.

d) Replacement of diode bridge

The diode bridge varies according to the model of the generator. It can have three separate sectors with two diodes fixed on each sector (T30), or one circular body (T18) with 6 diodes. The first type (T30) is used in the alternator models 34-38, whereas the second one (T18) is used in the 40,43 and 46 versions.

Diodes can be easily inspected with a multimeter: simply disconnect the wire of the particular diode and check its resistance on both directions. A perfectly functioning diode will show a very high resistance in one direction and a very low resistance in the opposite direction. A faulty diode will show either a very low resistance, or an infinite resistance in both directions. Once the whole sector, or the whole bridge, is replaced, remember to tighten the screws with a suitable tightening wrench and to strictly comply with the polarities and the diagrams indicated by Mecc Alte.

MANUTENZIONE

Generatore tipo 28-31-32.

Procedura di verifica per diodi rotore eccitatrice.

Strumentazione necessaria :

- batteria 12V
- lampada 12V-21W (o in alternativa resistenza 6.8Ω-30W)
- voltmetro (Ex. Multimetro su scala VOLT d.c.)

Importante: Prima di eseguire le operazioni seguenti sconnettere i due cavi di collegamento del rotore principale al ponte diodi (+ e -).

TEST DEI DIODI SUL "NEGATIVO"

- Connettere gli strumenti come indicato in figura A (tabella 26 pag. 74)
- Fissare il cavo connesso alla lampada al morsetto negativo del ponte come indicato in figura A (tabella 26 pag. 74)
- Connettere il terminale "Probe" ai punti A1, A2 ed A3 in sequenza per verificare rispettivamente i diodi 1, 2 e 3. Verificare la lettura sul voltmetro in relazione a quanto indicato in tabella (tabella 26 pag. 74).

TEST DEI DIODI SUL "POSITIVO"

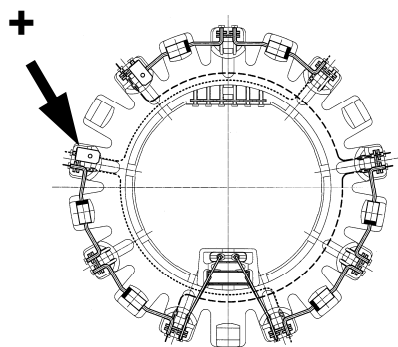
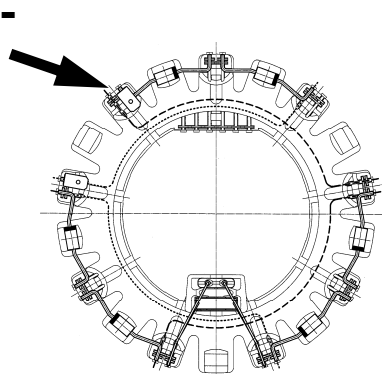
- Connettere gli strumenti come indicato in figura B (tabella 26 pag. 74)
- Fissare il cavo connesso al negativo della batteria al morsetto positivo del ponte come indicato in figura B (tabella 26 pag. 74)
- Connettere il terminale "Probe" ai punti A4, A5 e A6 in sequenza per verificare rispettivamente i diodi 4, 5 e 6; verificare la lettura sul voltmetro in relazione a quanto indicato in tabella (tabella 26 pag. 74).

ISTRUZIONI PER LA SOSTITUZIONE DEL DIODO.

Qualora i valori riscontrati indichino un diodo danneggiato, occorrerà procedere alla sostituzione del componente.

A tale scopo si raccomanda di non estrarre i reofori dalle rispettive sedi ma di tagliarli in prossimità del corpo del componente; inserire il nuovo componente rispettando le polarità e saldare a stagno accuratamente i reofori con gli spezzoni rimasti nelle sedi.

**IMPORTANTE
IMPORTANT
WICHTIG**



MAINTENANCE

Generator versions: 28-31-32.

Procedure to check the diodes of the exciter rotor.

Necessary equipment :

- 12V battery
- 12V-21W lamp (or alternatively 6.8Ω-30W Resistance)
- Voltmeter (for instance, multimeter on scale VOLT d.c.)

Warning: before performing the following actions, it is necessary to disconnect the 2 cables connecting the main rotor to the diode bridge (+and-)

TEST OF THE DIODES ON THE "NEGATIVE"

- Connect the equipment, as it is pointed out in the picture A (table 26 page 74)
- Fix the cable connected to the lamp to the negative terminal of the bridge, as it is pointed out in the picture A (table 26 page 74)
- Connect the terminal "Probe" to the point A1 (it is checked the diode 1), then to the point A2 (it is checked the diode 2) and finally to the point A3 (it is checked the diode 3); check the readings on the voltmeter in relation with what is reported on the table (table 26 page 74).

TEST OF THE DIODES ON THE "POSITIVE"

- Connect the equipment, as it is pointed out in the picture B (table 26 page 74)
- Fix the cable connected to the negative terminal of the battery to the positive terminal of the bridge, as it is pointed out in the picture B (table 26 page 74)
- Connect the terminal "Probe" to the point A4 (it is checked the diode 4), then to the point A5 (it is checked the diode 5) and finally to the point A6 (it is checked the diode 6); check the readings on the voltmeter in relation with what is reported on the table (table 26 page 74).

INSTRUCTIONS TO REPLACE THE DIODE

When the values measured point out a diode damaged, it is necessary to replace the component.

For this purpose it is recommended to not pull the rheophores out from their locations, but to cut them near to the body of the component; then fit in the new component respecting the polarity and soft-solder accurately the rheophores with the pieces remained in their locations.

MANUTENZIONE

e) Sostituzione dell'eccitatrice Generatore tipo 28-31-32-34.

Per smontare l'eccitatrice dell'alternatore della serie 28-31-32-34, attenersi alle seguenti istruzioni :

-) togliere il coperchio anteriore

-) sfilare il rotore utilizzando un mezzo di sollevamento con funi morbide ma di portata adeguata; verificare che i mezzi di sollevamento predisposti siano comunque adeguati per i pesi dei componenti da movimentare

-) per estrarre il cuscinetto deve essere utilizzato un apposito estrattore

-) per smontare il rotore eccitatrice, inserire un adeguato estrattore facilmente costruibile o reperibile presso la nostra sede.

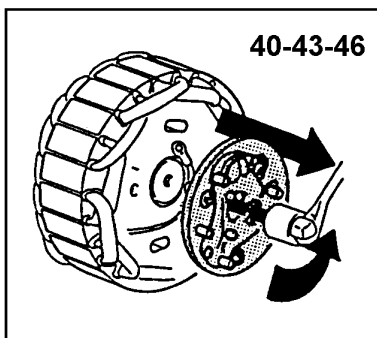
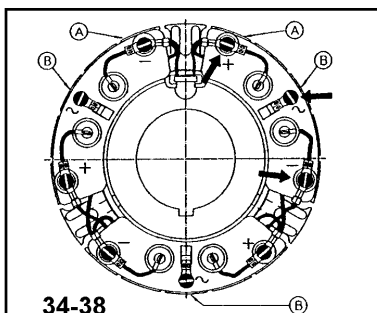
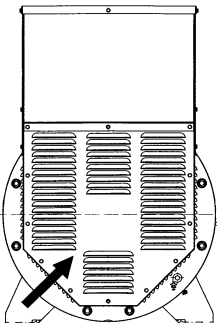
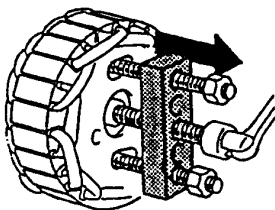
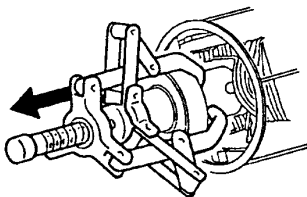
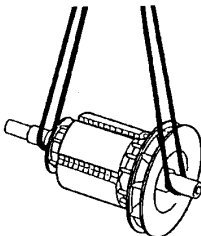
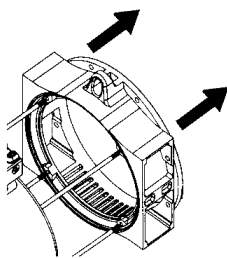
Generatore tipo 38-40-43-46.

Per smontare l'eccitatrice dell'alternatore della serie 38-40-43-46, non è necessario smontare l'intero alternatore, pertanto attenersi alle seguenti istruzioni:

-) togliere la chiusura posteriore

-) sconnettere i cinque fili del ponte diodi rotante

-) nel caso di alternatori della serie 38, togliere le viti di bloccaggio dei settori mentre nel caso di alternatori della serie 40-43-46 togliere il bullone di bloccaggio e tirando leggermente togliere il ponte diodi



MAINTENANCE

e) Replacement of exciter Generator versions: 28-31-32-34

Follow these instructions to remove exciter of the 28-31-32-34 versions:

-) remove front lead

-) Use a lifting device equipped with soft ropes of an adequate lifting capacity to extract rotor. Make sure that the lifting devices are suitable for the weight of the parts to be shifted

-) Use a puller to pull out bearing

-) To remove the exciter rotor, use a suitable puller, which can be easily constructed or forwarded by the manufacturer upon request.

Generator versions: 38-40-43-46.

To remove exciter of the 38-40-43-46 versions, there is no need to disassemble the entire generator, however, you must follow the instructions below:

-) Remove rear seal

-) Disconnect the five wires of the rotating diode bridge

-) When dealing with the 38 versions, remove clamp screws from sectors; whilst when dealing with the 40-43-46 versions, remove clamp bolt and, by pulling it gently, pull out diode bridge

MANUTENZIONE

-) per smontare il rotore eccitatrice, inserire un adeguato estrattore facilmente costruibile o reperibile presso la nostra sede

f) Sostituzione del regolatore di tensione

I generatori sono provvisti di regolatore automatico di tensione; a seconda del tipo di alternatore, i regolatori elettronici possono essere di due tipi : SR7/2-G, UVR6/1-F.

L'SR7/2-G è montato di serie nelle tipologie 28-31-32-34, l'UVR6/1-F è montato nelle tipologie 38-40-43-46.

Nel caso in cui si riscontrassero dei comportamenti anomali vi preghiamo di consultare il manuale specifico o di contattare il nostro servizio di assistenza tecnica.

Una volta stabilito che il regolatore deve essere sostituito, procedere come segue :

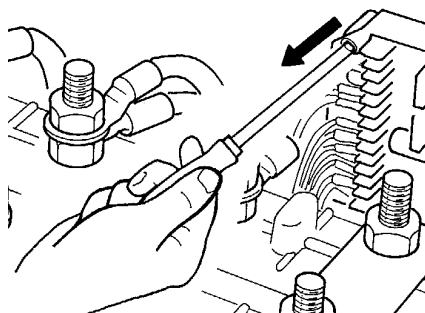
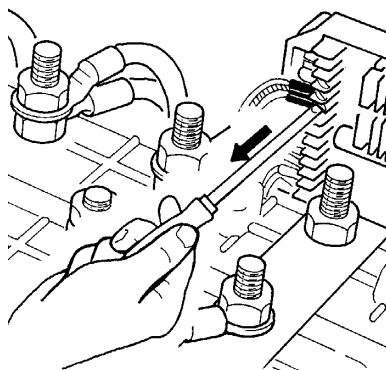
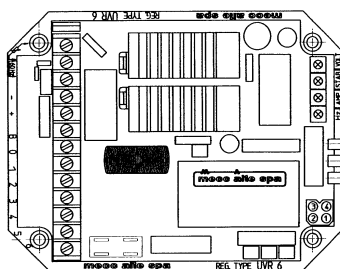
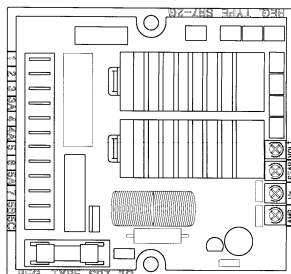
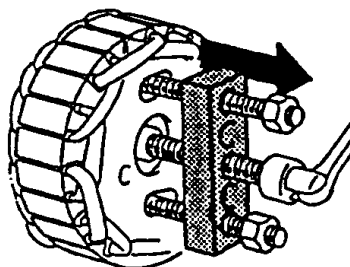
-) scollegare tutti i cavetti di collegamento in morsettieria

-) svitare le 2/4 viti di bloccaggio del regolatore

-) collocare il nuovo regolatore nella posizione prevista

-) fissare il nuovo regolatore con le viti precedentemente raccolte

-) ricollegare tutti i cavi alla morsettieria del regolatore, servendosi in caso di bisogno, degli schemi forniti da Mecc Alte.



MAINTENANCE

-) To insert exciter rotor, use a suitable puller, which can be easily constructed or forwarded by the manufacturer upon request.

f) Replacement of voltage regulator

All generators are equipped with an automatic voltage regulator; depending on the alternator model, electronic regulators can be of two different types: SR7/2-G, UVR6/1-F.

The SR7/2-G is an integral part of the 28-31-32-34 generators; the UVR6/1-F is supplied with the 38-40-43 and 46 versions. Should some anomalous functioning be detected, please consult our technical manual or contact our technical assistance service.

Once it has been ascertained that the regulator needs to be replaced, proceed as follows:

-) Disconnect all terminal board wires

-) Unscrew the 2/4 clamp screws of the regulator

-) Set new regulator in the usual position

-) Tighten the new regulator with the previously unscrewed screws

-) Connect again all wires to the terminal board of the regulator. Follow diagrams supplied by Mecc Alte, if necessary.

MANUTENZIONE

g) Controllo della tensione residua

La seguente procedura è applicabile ai generatori muniti di regolatore elettronico e deve essere applicata nell'eventualità che il generatore non si autoecciti (in tale condizione, pur ruotando alla velocità nominale, non è presente tensione nella morsettiera principale del generatore):

-) con il generatore fermo, rimuovere il coperchio di chiusura della scatola morsetti

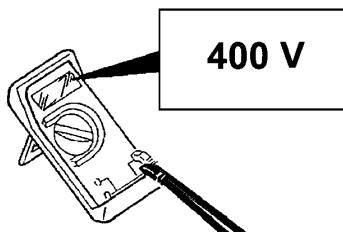
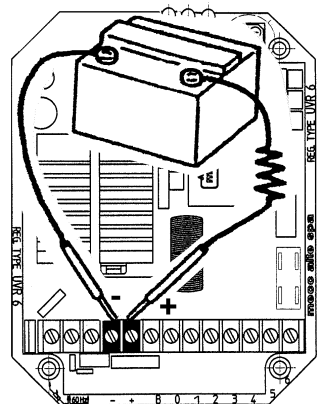
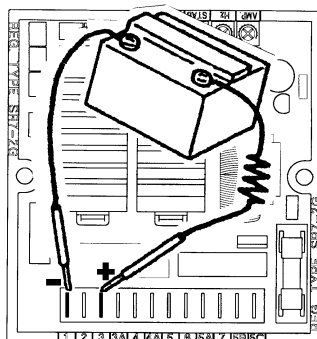
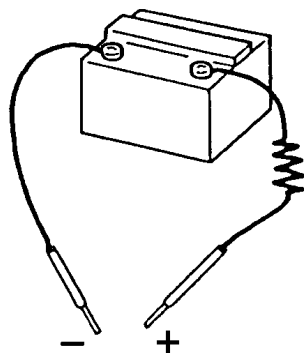
-) predisporre due terminali collegati ad una batteria da 12 Vdc con in serie una resistenza da 30 Ω

-) individuare con l'ausilio degli schemi elettrici forniti da Mecc Alte, i morsetti "+" e "-" del regolatore elettronico

-) avviare il generatore

-) applicare per un istante i due terminali ai morsetti precedentemente individuati facendo molta attenzione nel rispettare le polarità (morsetto "+" del regolatore con morsetto "+" della batteria, morsetto "-" del regolatore con morsetto "-" della batteria)

-) verificare con un voltmetro o con la relativa strumentazione da quadro, che il generatore generi la tensione nominale prevista nella targhetta.



MAINTENANCE

g) Check of residual voltage

For generators equipped with an electronic regulator, you must perform the following procedure. This must be applied to ensure that the generator is not over-excited (in such a condition, though it still rotates at nominal velocity, no voltage is present in the generator's main terminal board):

-) When the generator is switched off, remove lid from the terminals case

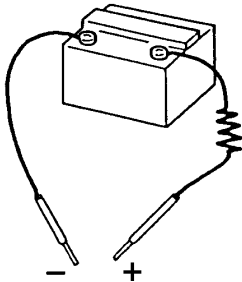
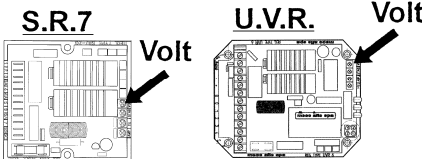
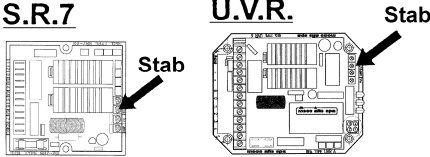
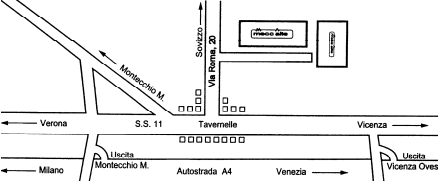
-) Connect two connecting wires to a 12 Vdc battery with a 30 Ω in-series resistance

-) Follow the electrical diagrams supplied by Mecc Alte, to locate positive and negative terminals of electronic regulator

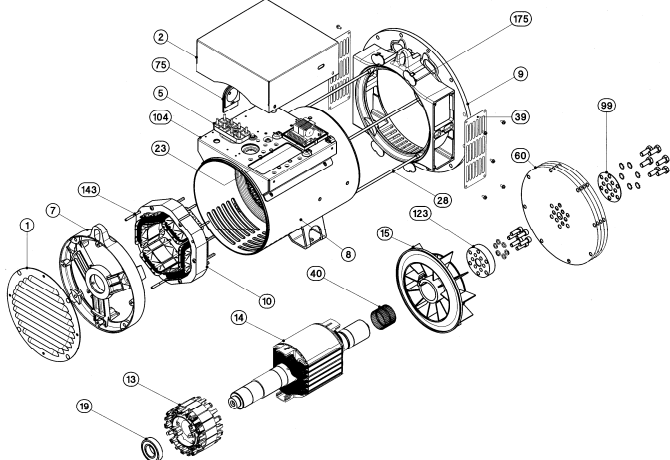
-) Start generator

-) Connect, only for a moment, the two connecting wires to the previously located terminals. Make sure to match polarities (positive terminal of regulator with positive terminal of battery, negative terminal of regulator with negative terminal of battery)

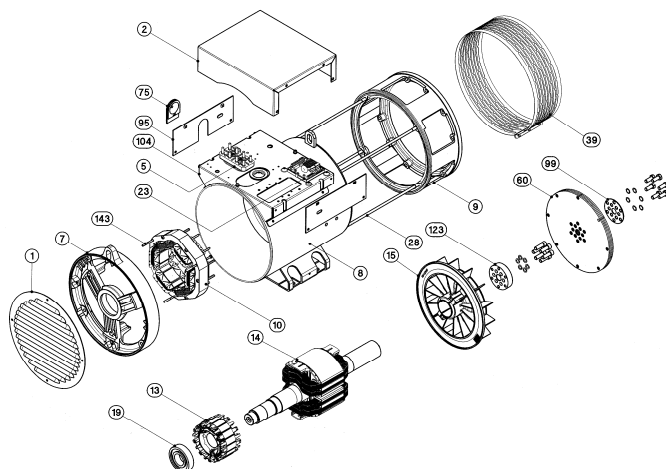
-) Use a voltmeter or the right instrument panel, to check whether the generator is producing the nominal voltage indicated on the plate.

ANOMALIE E RIMEDI		DEFECTS AND REMEDIES
IL GENERATORE NON SI ECCITA - Controllare il fusibile. - Aumentare la velocità del 15%. - Applicare per un istante al “+” e al “-” del regolare elettronico, una tensione di 12 V di una batteria con in serie una resistenza di 30 Ω rispettando le polarità.		ALTERNATOR DOES NOT EXCITE - Substitute fuse. - Increase speed by 15%. - For an instant apply on “+” and “-” of the electronic regulator a 12 V battery voltage with a 30 Ω resistor in series, respecting the polarities.
DOPO ECCITATO SI DISECCITA - Controllare i cavi di collegamento servendosi dei disegni allegati.		AFTER BEING EXCITED ALTERNATOR DOES NOT EXCITE - Check connection cables as per attached drawings.
A VUOTO TENSIONE BASSA - Ritarare la tensione. - Controllare il numero di giri. - Controllare gli avvolgimenti.		LOW VOLTAGE AT NO LOAD - Reset voltage potentiometer. - Check speed. - Check windings.
A VUOTO TENSIONE TROPPO ALTA - Ritarare la tensione. - Sostituire il regolatore.		HIGH VOLTAGE AT NO LOAD - Reset voltage potentiometer. - Substitute regulator.
A CARICO TENSIONE INFERIORE ALLA NOMINALE - Ritarare la tensione. - Corrente troppo alta, $\cos \varphi$ inferiore a 0.8, velocità inferiore del 4% della nominale. - Sostituire il regolatore. - Controllare i diodi scollegando i cavi.		AT LOAD CONDITIONS, VOLTAGE LOWER THAN RATED VALUE - Reset voltage potentiometer. - Current too high, power factor lower than 0.8, speed lower than 4% of rated speed. - Substitute regulator. - Check diodes, disconnect cables.
A CARICO TENSIONE SUPERIORE ALLA NOMINALE - Ritarare la tensione. - Sostituire il regolatore.		AT LOAD CONDITIONS, VOLTAGE HIGHER THAN RATED VOLTAGE - Reset voltage potentiometer. - Substitute regulator.
TENSIONE INSTABILE - Controllare uniformità di rotazione. - Regolare la stabilità del regolatore agendo sul potenziometro “STAB”.		UNSTABLE VOLTAGE - Check uniformity of rotation. - Regulate stability of regulator by acting on “STAB.” potentiometer.
Per qualsiasi altra anomalia rivolgersi al rivenditore, ai centri di assistenza autorizzati o direttamente alla Mecc Alte.		For any other defect, please contact the seller, the after-sales service or Mecc Alte directly.

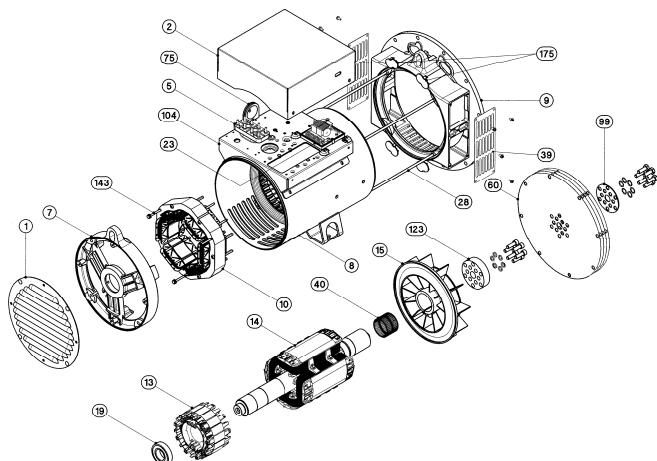
ECP 28/2



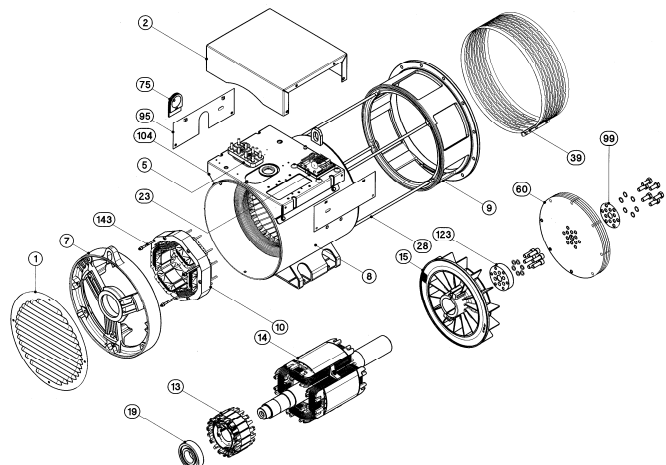
ECO 31N/2



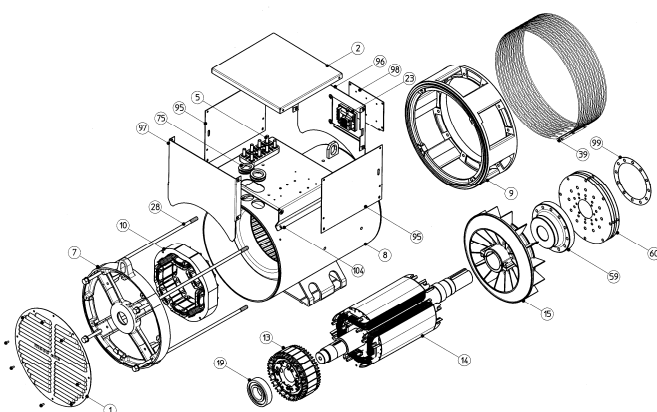
ECP 28/4



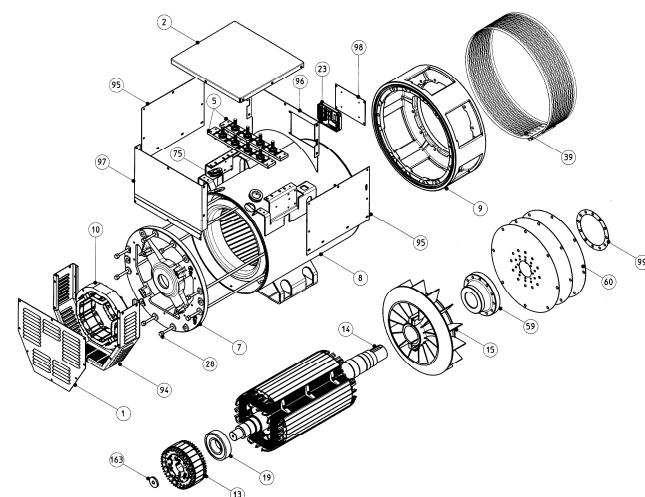
ECO 32/4



ECP 34



ECO 38N

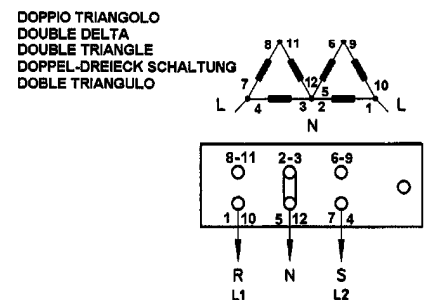
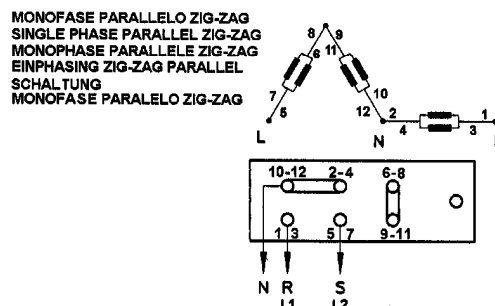
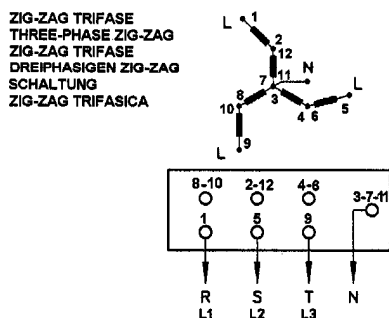
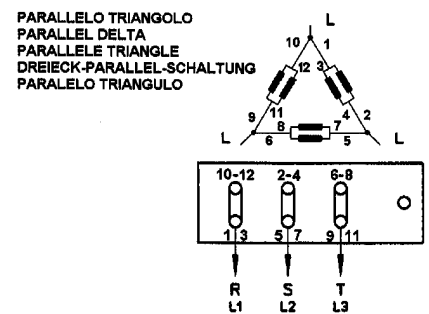
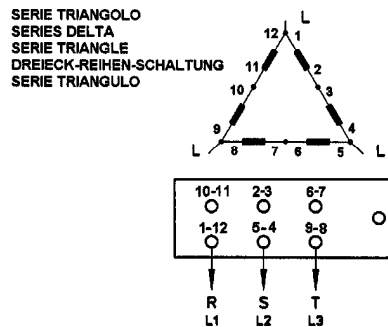
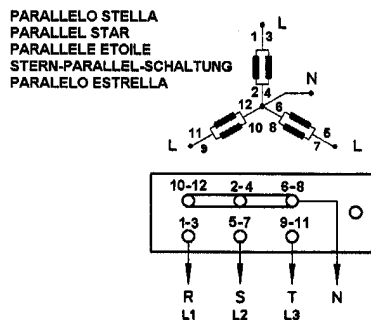
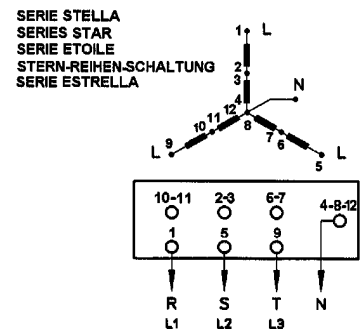
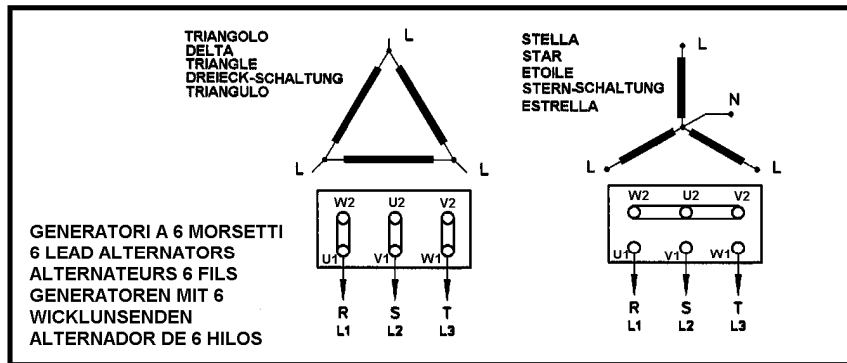


GENERATORI 4 POLI - 4 POLE GENERATORS - ALTERNATEURS 4 POLES**GENERATOREN 4 POLIG - GENERADORES 4 POLOS**

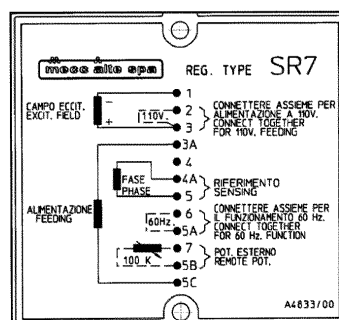
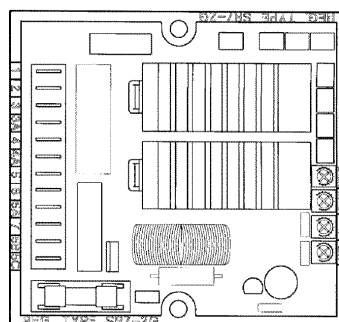
TIPO TYPE TYP	V / Hz	GENERATORE GENERATOR PARTIE PUISSANCE GENERADORES			ECCITATRICE EXCITER EXCITATRICE ERREGER	
		STATORE STATOR 1-2	ROTORE ROTOR	AVVOLGIMENTO AUSILIARIO AUXILIARY WINDING HILFS WICKLUNG BOBINADO AUXILIAR	STATORE STATOR	ROTORE FASE-FASE ROTOR PHASE-PHASE
		Ω	Ω	Ω	Ω	Ω
ECP 28 1VS	115/200/230/400-50	0,951	0,911	3,753	10,60	0,417
ECP 28 2VS	115/200/230/400-50	0,582	1,032	3,225	10,60	0,417
ECP 28 0S	115/200/230/400-50	0,430	1,13	2,957	10,60	0,417
ECP 28 S	115/200/230/400-50	0,283	1,260	4,060	10,60	0,417
ECP 28 1L	115/200/230/400-50	0,198	1,396	2,250	10,60	0,417
ECP 28 2L	115/200/230/400-50	0,128	1,670	2,150	10,60	0,417
ECP 28 VL	115/200/230/400-50	0,106	1,860	2,170	10,60	0,417
ECO 32 2S	115/200/230/400-50	0,097	2,010	1,098	10,60	0,417
ECO 32 3S	115/200/230/400-50	0,078	2,163	0,929	10,60	0,417
ECO 32 1L	115/200/230/400-50	0,061	2,473	0,993	11,35	0,442
ECO 32 2L	115/200/230/400-50	0,041	2,861	0,909	11,35	0,442
ECO 32 3L	115/200/230/400-50	0,035	3,171	0,790	11,35	0,442
ECP 34 1.5VS	115/200/230/400-50	0,045	2,248	1,04	15,28	0,410
ECP 34 1S	115/200/230/400-50	0,030	2,477	1,43	15,28	0,410
ECP 34 2S	115/200/230/400-50	0,020	2,951	1,35	15,28	0,410
ECP 34 1L	115/200/230/400-50	0,018	3,165	1,18	15,28	0,410
ECP 34 2L	115/200/230/400-50	0,015	3,577	1,05	15,28	0,410
ECP 34 3L	115/200/230/400-50	0,015	4,35	0,855	15,28	0,410
ECO 38 1SN	115/200/230/400-50	0,0130	3,905	0,854	15,28	0,685
ECO 38 2SN	115/200/230/400-50	0,0105	4,133	0,845	15,28	0,685
ECO 38 3SN	115/200/230/400-50	0,0085	4,449	0,778	15,28	0,685
ECO 38 1LN	115/200/230/400-50	0,0065	4,887	0,796	15,28	0,685
ECO 38 2LN	115/200/230/400-50	0,0055	5,604	0,751	15,28	0,685
ECO 38 3LN	115/200/230/400-50	0,0042	6,780	0,700	15,28	0,685
ECO 40 1S	115/200/230/400-50	0,0048	4,488	0,558	8,85	0,317
ECO 40 2S	115/200/230/400-50	0,0074	4,881	0,521	8,85	0,317
ECO 40 3S	230/400/460/800-50	0,0106	5,176	0,540	8,85	0,317
ECO 40 1L	115/200/230/400-50	0,0055	6,025	0,476	8,85	0,317
ECO 40 1.5L	230/400/460/800-50	0,0087	1,376	0,550	8,85	0,050
ECO 40 2L	115/200/230/400-50	0,0042	1,500	0,481	8,85	0,050
ECO 40 VL	230/400/460/800-50	0,0104	1,592	0,300	8,85	0,050
ECO 43 1SN	230/400/460/800-50	0,0109	2,100	0,440	10,63	0,130
ECO 43 2SN	230/400/460/800-50	0,0086	2,300	0,413	10,63	0,130
ECO 43 1LN	230/400/460/800-50	0,0078	2,500	0,713	10,63	0,130
ECO 43 2LN	230/400/460/800-50	0,0058	2,800	0,677	10,63	0,130
ECO 43 VL	230/400/460/800-50	0,0046	2,886	0,40	10,63	0,130
ECO 46 1S	230/400/460/800-50	0,0057	3,050	0,414	12,90	0,120
ECO 46 1.5S	230/400/460/800-50	0,0034	3,319	0,35	12,90	0,120
ECO 46 2S	230/400/460/800-50	0,0039	3,500	0,330	12,90	0,120
ECO 46 1L	230/400/460/800-50	0,0032	3,977	0,360	12,90	0,120
ECO 46 1.5L	230/400/460/800-50	0,0027	4,27	0,40	12,90	0,120
ECO 46 2L	230/400/460/800-50	0,0024	4,500	0,390	12,90	0,120

GENERATORI 2 POLI - 2 POLE GENERATORS - ALTERNATEURS 2 POLES**GENERATOREN 2 POLIG - GENERADORES 2 POLOS**

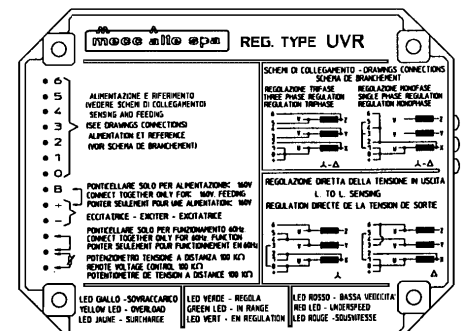
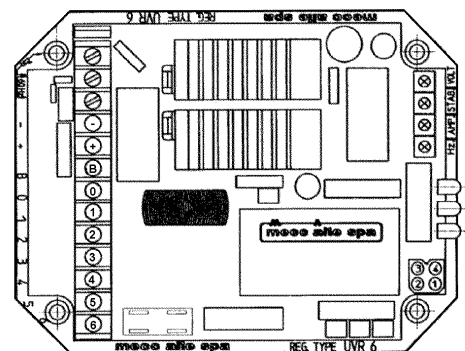
ECP 28 1L	115/200/230/400-50	0,1480	4,877	2,706	10,60	0,417
ECP 28 2L	115/200/230/400-50	0,0863	5,523	1,173	10,60	0,417
ECP 28 3L	115/200/230/400-50	0,0860	5,848	1,087	10,60	0,417
ECP 28 VL	115/200/230/400-50	0,056	6,500	0,690	10,60	0,417
ECO 31 2SN	115/200/230/400-50	0,110	3,650	1,553	10,60	0,417
ECO 31 3SN	115/200/230/400-50	0,046	4,071	1,403	10,60	0,417
ECO 31 1LN	115/200/230/400-50	0,043	4,301	1,358	11,35	0,475
ECO 31 2LN	115/200/230/400-50	0,034	4,680	1,141	11,35	0,475

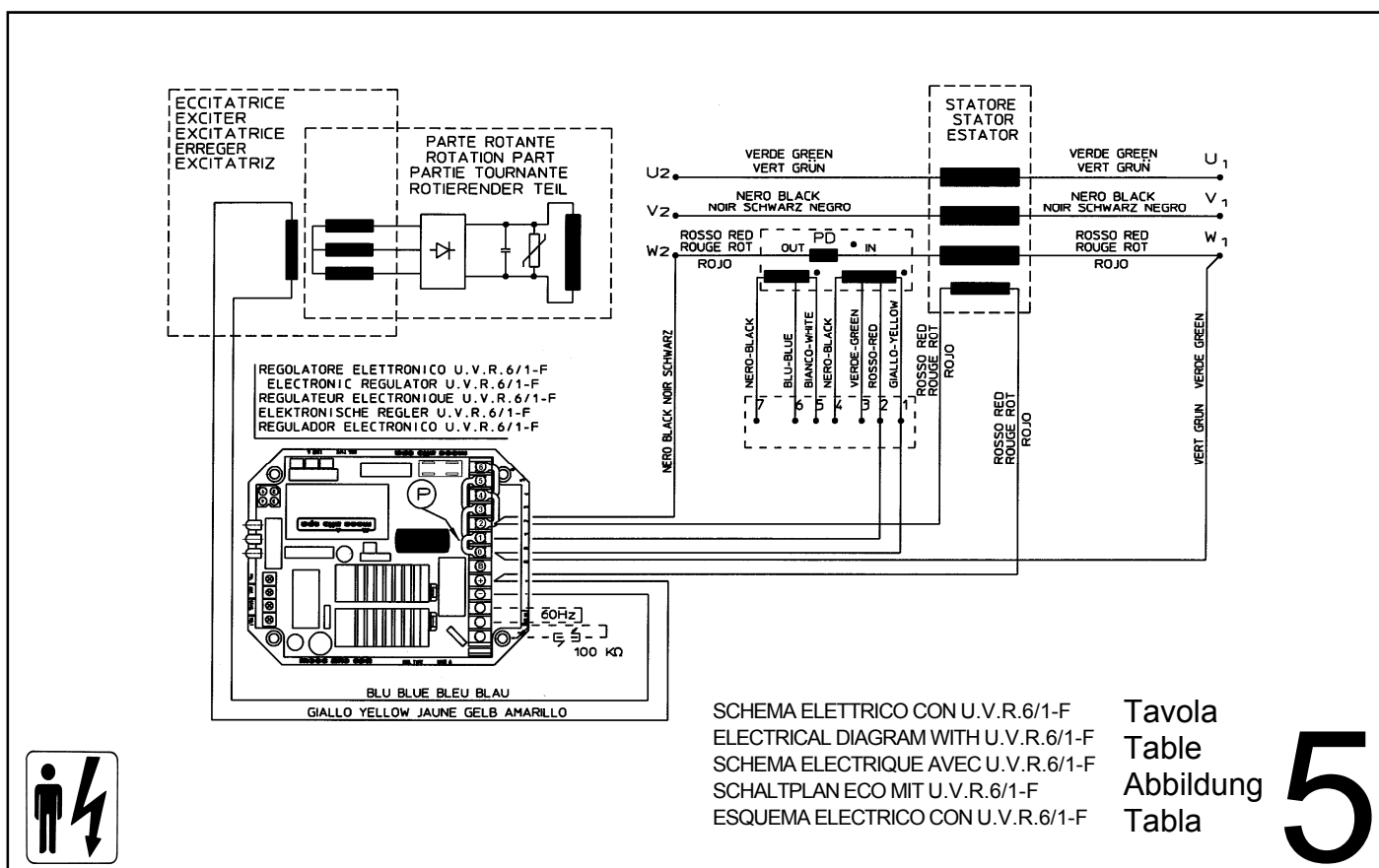
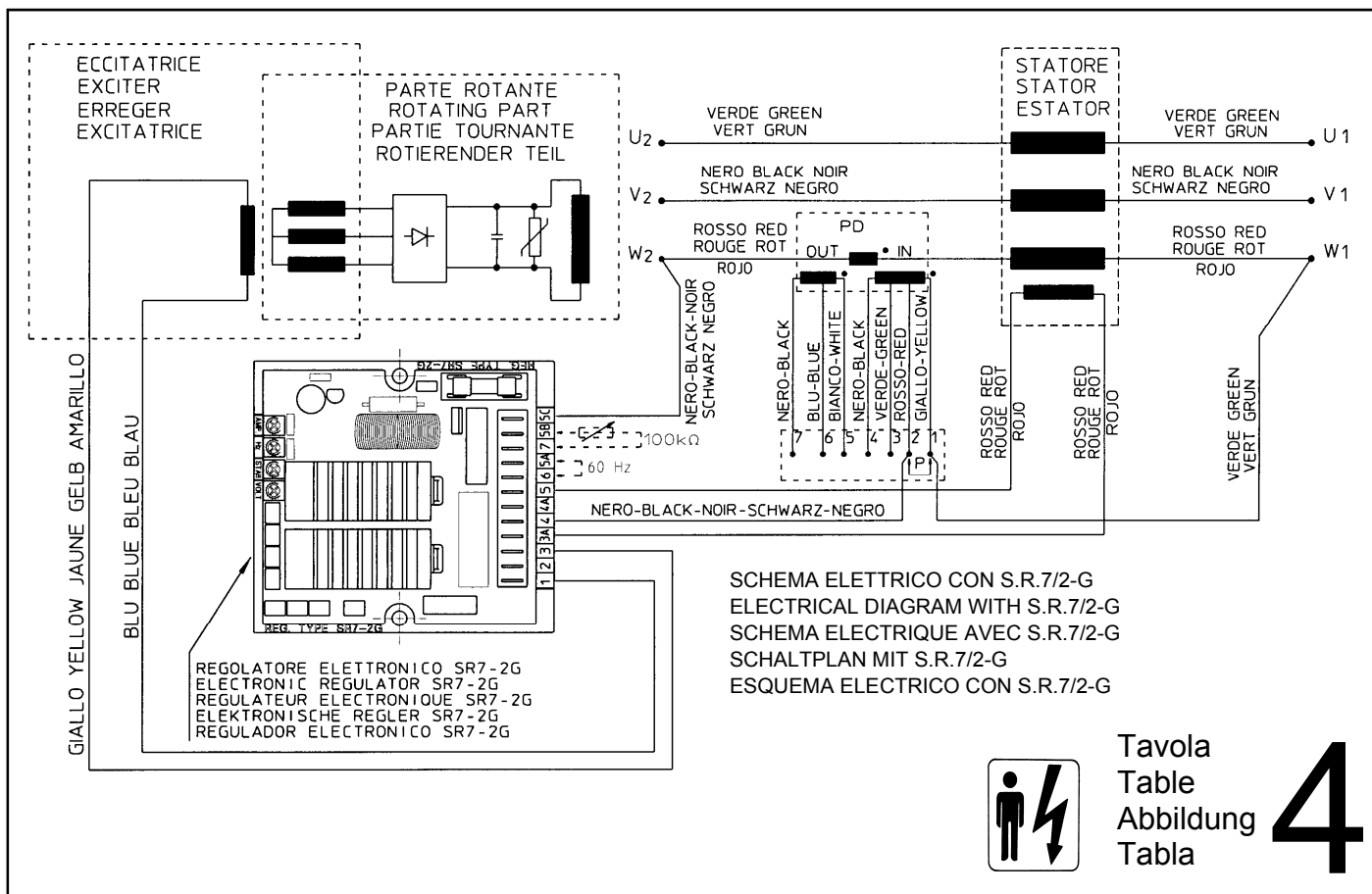


S.R.7/2-G

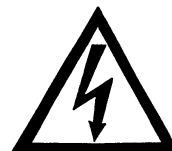


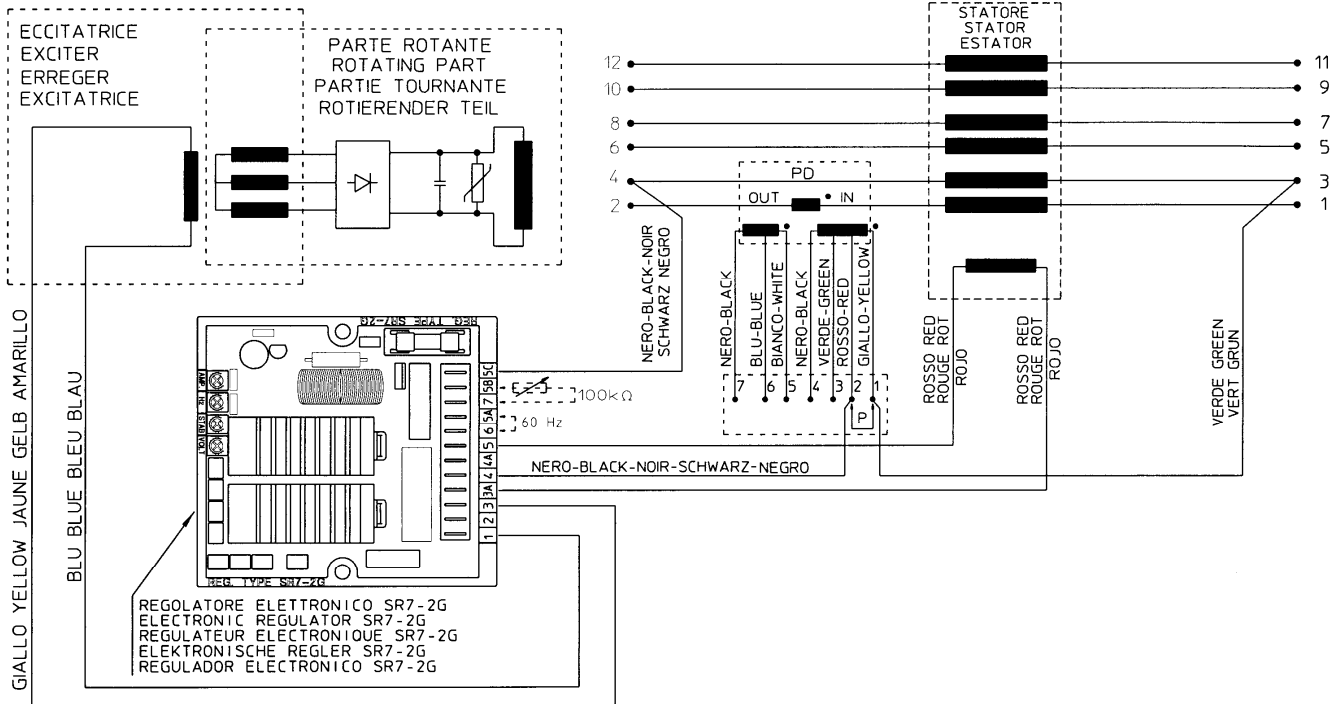
U.V.R.6/1-F





Note : Il dispositivo di parallelo PD è opzionale fino a 350 kVA.
Il ponticello P abilita o disabilita il dispositivo di parallelo se presente.
The parallel device PD is optional up to 350 kVA.
The link P activates or de-activates the parallel device, if it is present.
Le dispositif de parallele PD est en option jusqu'à 350 kVA.
Le pont P met ou supprime le circuit du dispositif de parallele.
Die Parallelvorrichtung PD ist bis zu 350 kVA optional.
Die Brücke P deaktiviert die Parallelvorrichtung, sofern vorhanden.
El dispositivo de paralelo PD es opcional hasta 350 kVA.
El puentecillo P, si esta presente, activa o desactiva el dispositivo de paralelo.

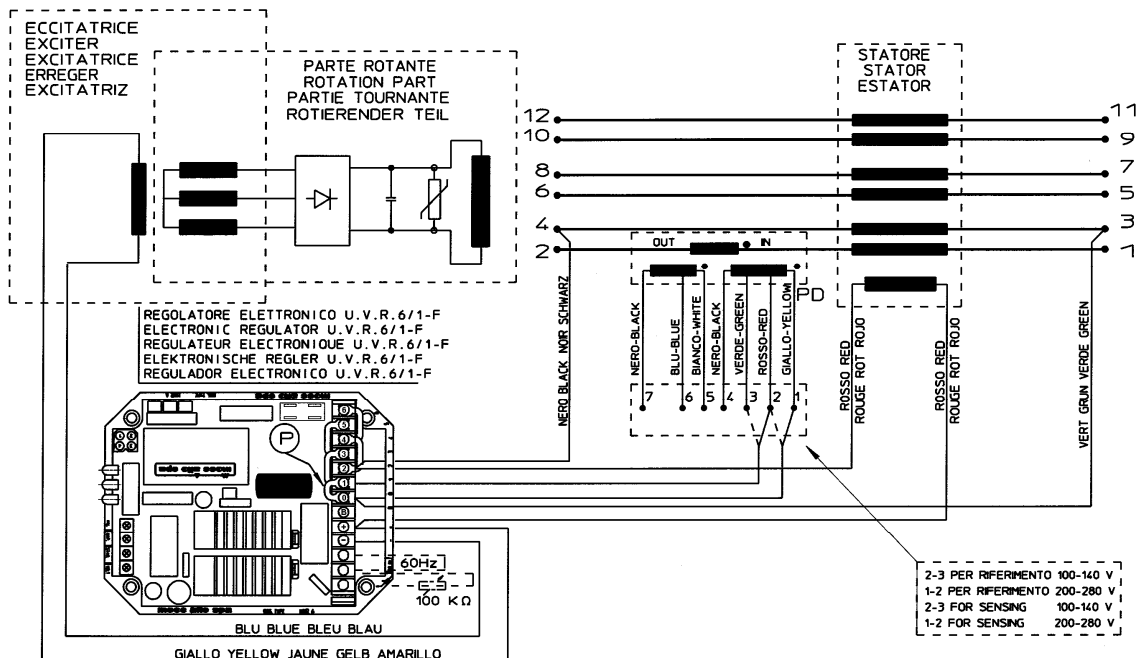




SCHEMA ELETTRICO 12 MORSETTI CON S.R.7/2-G
12 WIRES ELECTRICAL DIAGRAM WITH S.R.7/2-G
SCHEMA ELECTRIQUE 12 BORNES AVEC S.R.7/2-G
SCHALTPLAN MIT 12 KLEMMEN UND S.R.7/2-G
ESQUEMA ELECTRICO 12 HILOS CON S.R.7/2-G

Tavola
Table
Abbildung
Tabla

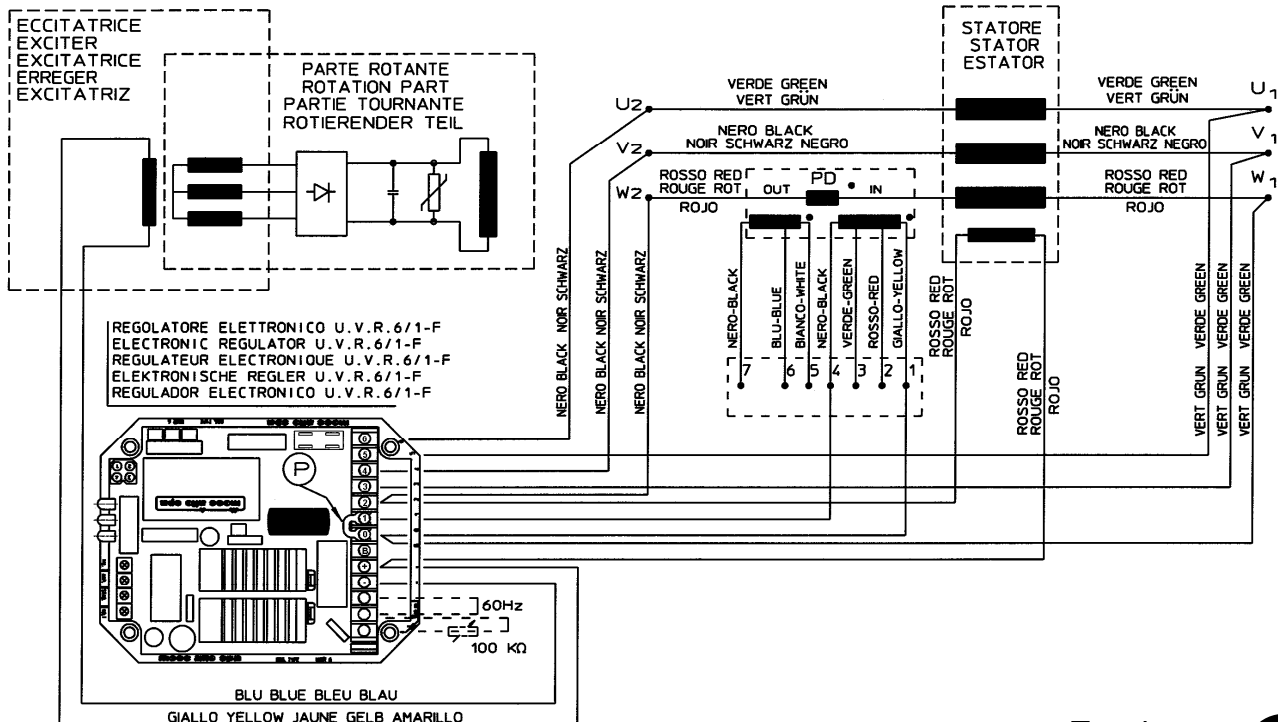
4A



SCHEMA ELETTRICO 12 MORSETTI CON U.V.R.6/1-F
12 WIRES ELECTRICAL DIAGRAM WITH U.V.R.6/1-F
SCHEMA ELECTRIQUE 12 BORNES AVEC U.V.R.6/1-F
SCHALTPLAN MIT 12 KLEMMEN UND U.V.R.6/1-F
ESQUEMA ELECTRICO 12 HILOS CON U.V.R.6/1-F

Tavola
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Abbildung
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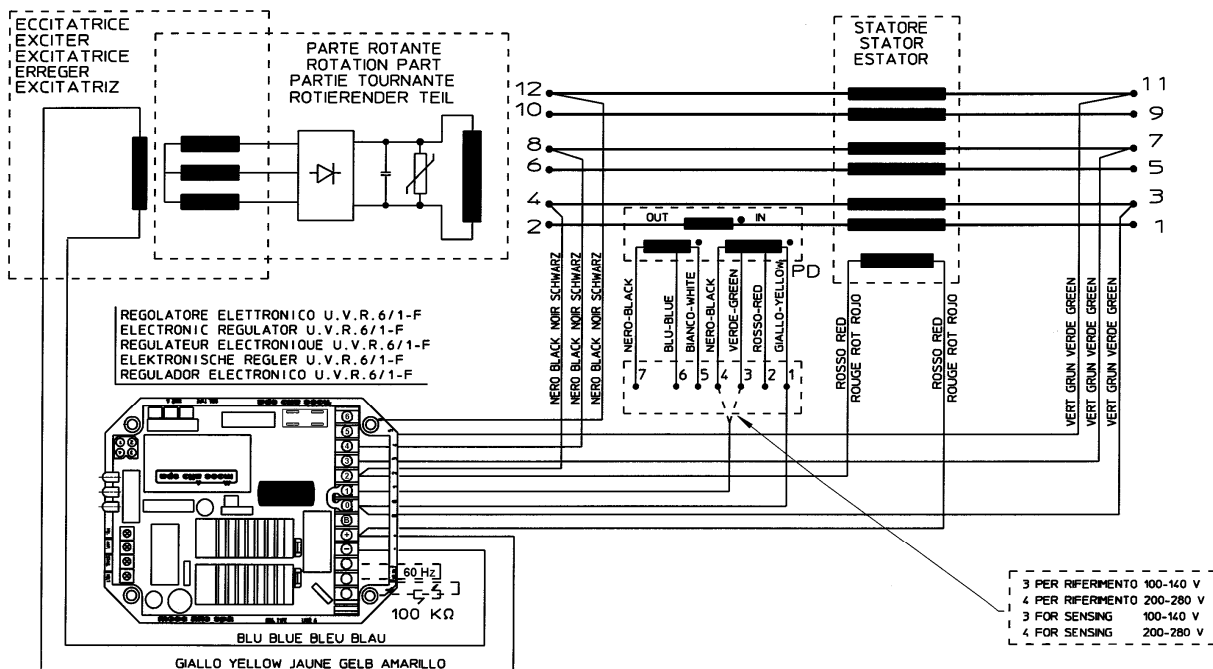
5A



SCHEMA ELETTRICO RIFERIMENTO TRIFASE
ELECTRICAL DIAGRAM WITH THREEPHASE SENSING
SCHEMA ELECTRIQUE REFERENCE TRIPHASE
SCHALTPLAN MIT DREIPHASIGEN ISTWERT
ESQUEMA ELECTRICO CON REFERENCIA TRIFASICA

Tavola
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Abbildung
Tabla

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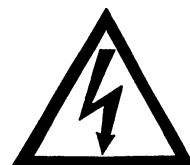


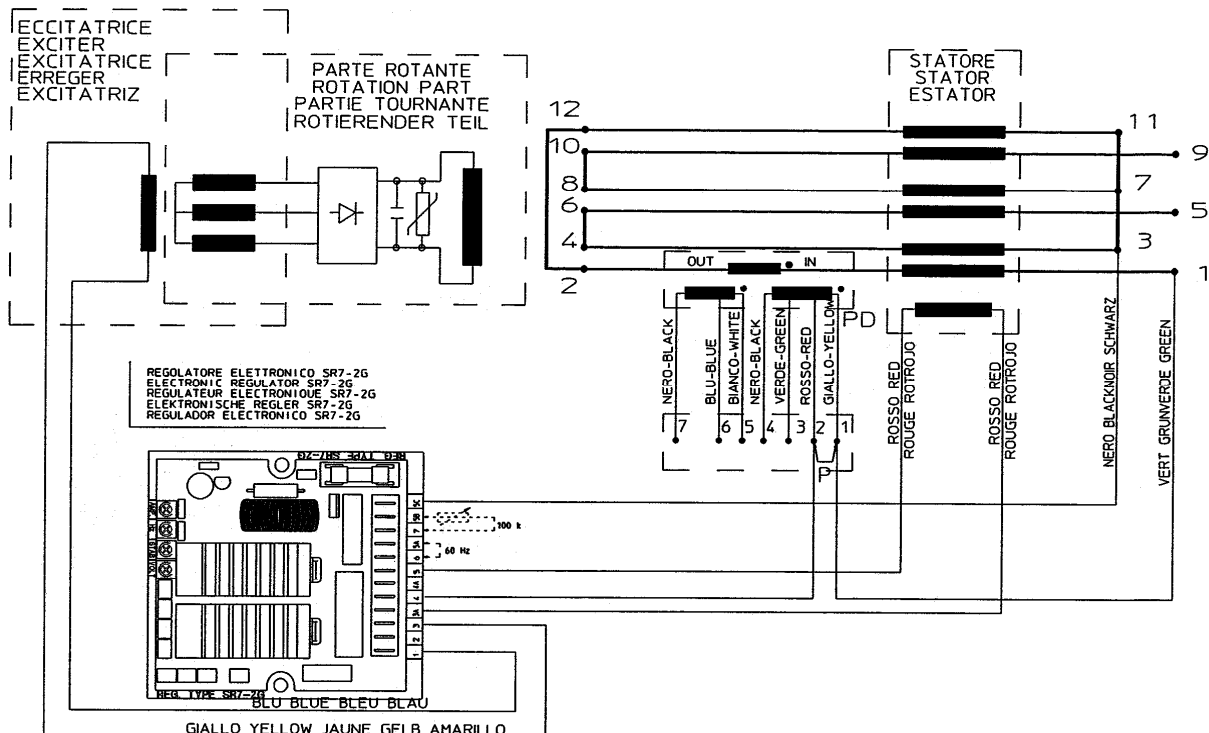
SCHEMA ELETTRICO 12 MORSETTI RIFERIMENTO TRIFASE
12 WIRES ELECTRICAL DIAGRAM WITH THREEPHASE SENSING
SCHEMA ELECTRIQUE 12 BORNES REFERENCE TRIPHASE
SCHALTPLAN MIT 12 KLEMMEN UND DREIPHASIGEN ISTWERT
ESQUEMA ELECTRICO 12 HILOS CON REFERENCIA TRIFASICA

Tavola
Table
Abbildung
Tabla

7

Note : Il dispositivo di parallelo PD è opzionale fino a 350 kVA.
Il ponticello P abilita o disabilita il dispositivo di parallelo se presente.
The parallel device PD is optional up to 350 kVA.
The link P activates or de-activates the parallel device, if it is present.
Le dispositif de parallele PD est en option jusqu'à 350 kVA.
Le pont P met ou supprime le circuit du dispositif de parallele.
Die Parallelvorrichtung PD ist bis zu 350 kVA optional.
Die Brücke P deaktiviert die Parallelvorrichtung, sofern vorhanden.
El dispositivo de paralelo PD es opcional hasta 350 kVA.
El puentecillo P, si esta presente, activa o desactiva el dispositivo de paralelo.

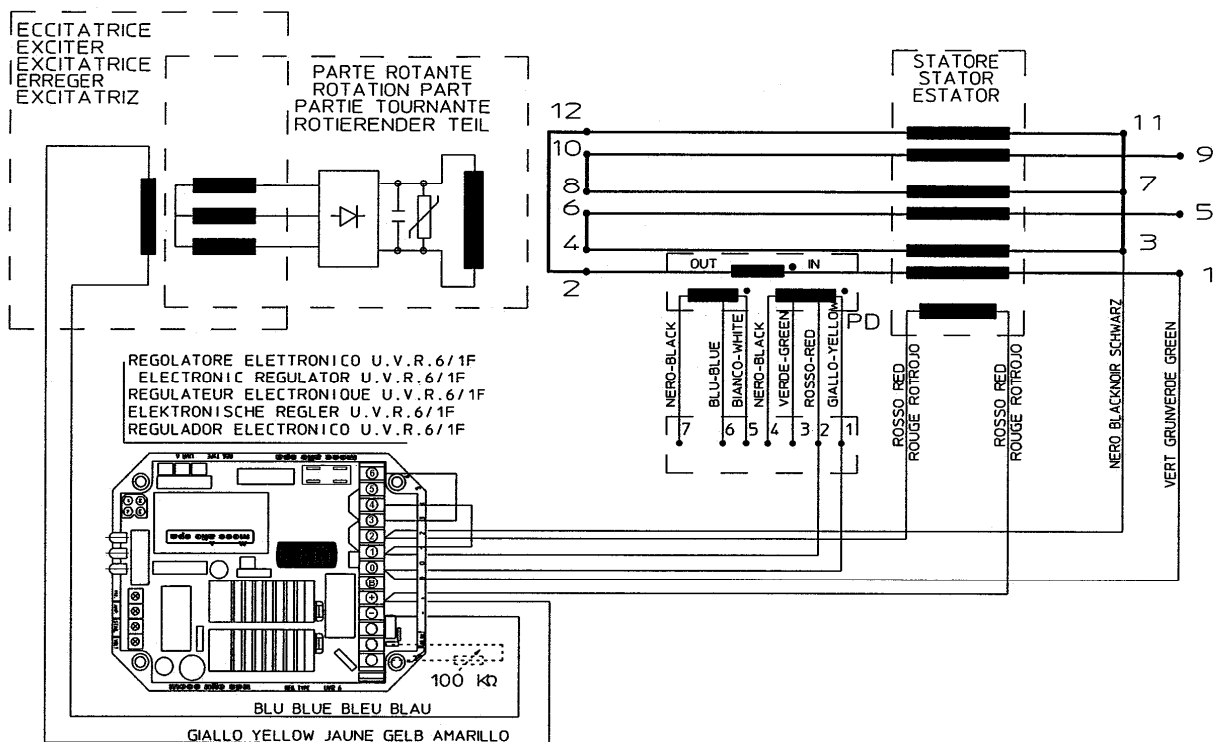




SCHEMA ELETTRICO 12 MORSETTI CON S.R.7/2-G (ZIG-ZAG)
 12 WIRES ELECTRICAL DIAGRAM WITH S.R.7/2-G (ZIG-ZAG)
 SCHEMA ELECTRIQUE 12 BORNES AVEC S.R.7/2-G (ZIG-ZAG)
 SCHALTPLAN MIT 12 KLEMMEN UND S.R.7/2-G (ZIG-ZAG)
 ESQUEMA ELECTRICO 12 HILOS CON S.R.7/2-G (ZIG-ZAG)

Tavola
 Table
 Abbildung
 Tabla

8



SCHEMA ELETTRICO 12 MORSETTI CON U.V.R.6/1-F (ZIG-ZAG)
 12 WIRES ELECTRICAL DIAGRAM WITH U.V.R.6/1-F (ZIG-ZAG)
 SCHEMA ELECTRIQUE 12 BORNES AVEC U.V.R.6/1-F (ZIG-ZAG)
 SCHALTPLAN MIT 12 KLEMMEN UND U.V.R.6/1-F (ZIG-ZAG)
 ESQUEMA ELECTRICO 12 HILOS CON U.V.R.6/1-F (ZIG-ZAG)

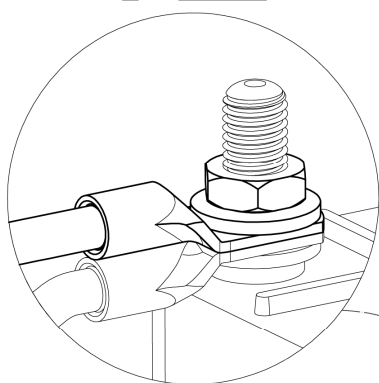
Tavola
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9

Tavola
Table
Abbildung
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COLLEGAMENTO CAVI UTILIZZATORE 28-31-32-34
USER CABLES CONNECTION 28-31-32-34
CONNEXION DES CÂBLES PAR L'UTILISATEUR 28-31-32-34
VERBRAUCHERKABELANSCHLUSS 28-31-32-34
CONEXIÓN CABLES USUARIO 28-31-32-34



CAVI UTILIZZATORE
USER CABLES
UTILISATEUR CABLE
KABEL BENUTZER
CABLE DE USUARIO

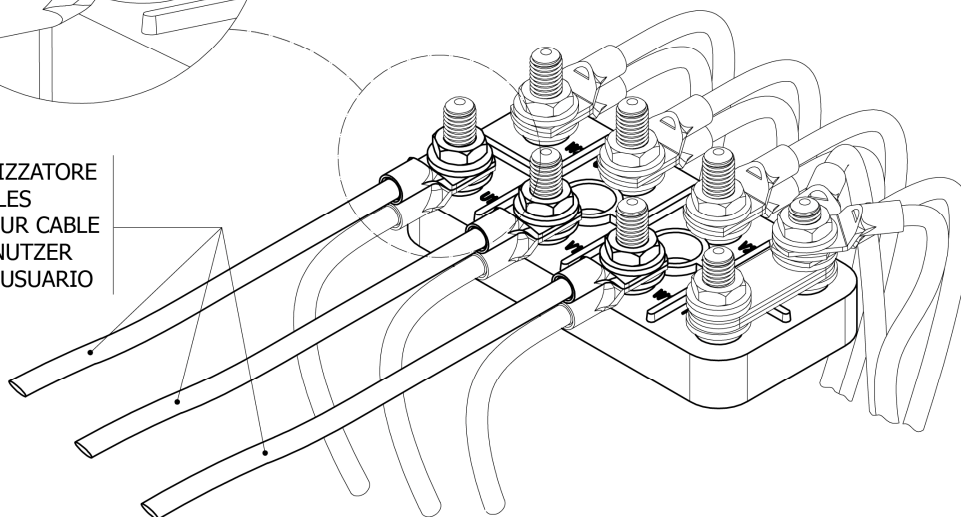
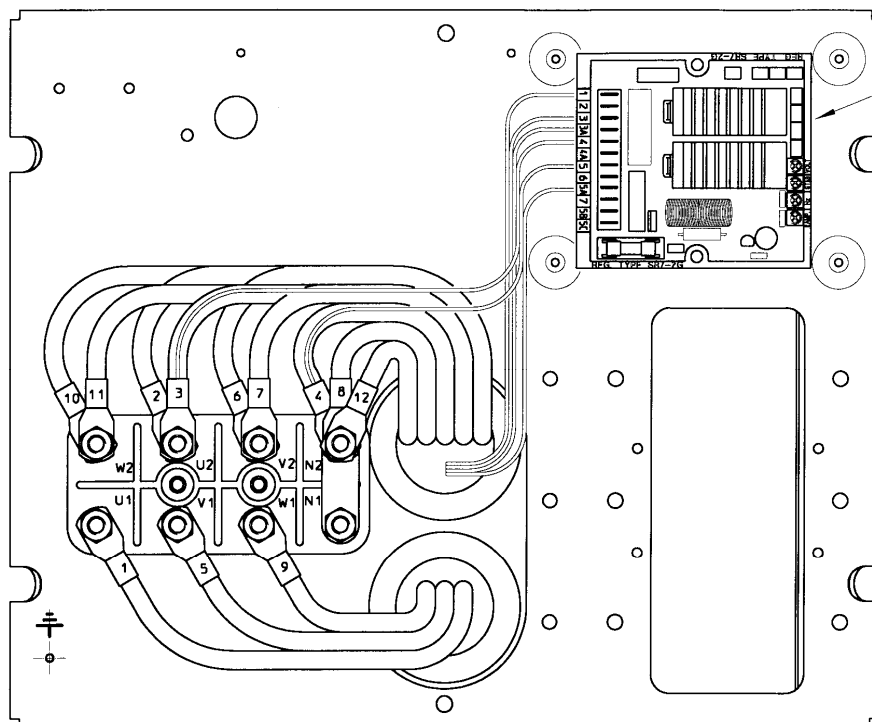


Tavola
Table
Abbildung
Tabla

13

SCATOLA REGOLAZIONE 28-31-32
TERMINAL BOX 28-31-32
BOITIER DE REGULATION 28-31-32
REGLERKASTEN 28-31-32
CAJA DE REGULACION 28-31-32



REGOLATORE ELETTRONICO SR7-2G
ELECTRONIC REGULATOR SR7-2G
REGULATEUR ELECTRONIQUE SR7-2G
ELEKTRONISCHE REGLER SR7-2G
REGULADOR ELECTRONICO SR7-2G

Collegamento serie stella / Series star connection / Connection serie étoile / Stern-Reihen-Schaltung / Connexion en serie estrella

Tavola
Table
Abbildung
Tabla

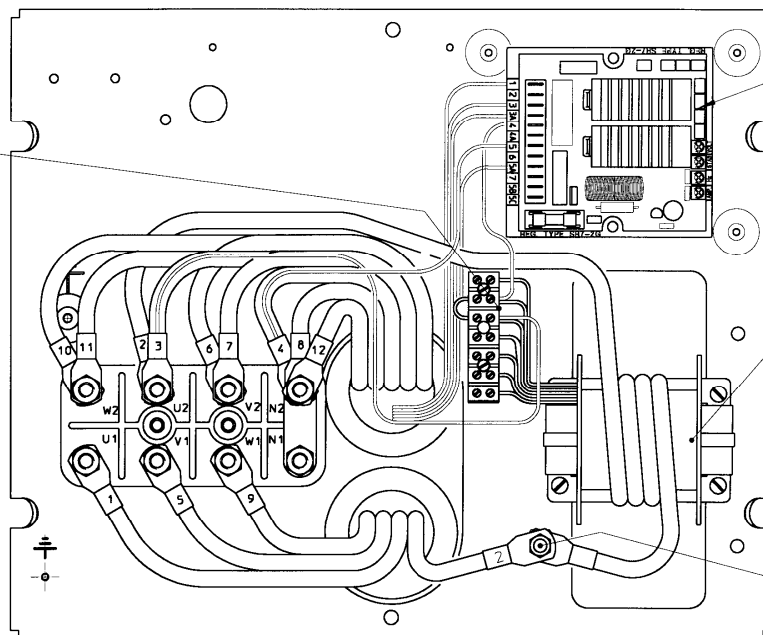
14

SCATOLA REGOLAZIONE 28-31-32 CON DISPOSITIVO DI PARALLELO
TERMINAL BOX 28-31-32 WITH PARALLEL DEVICE
BOITIER DE REGULATION 28-31-32 AVEC DISPOSITIF DE PARALLELE
REGLERKASTEN 28-31-32 MIT EINRICHTUNG FUR PARALLEL BETRIEB
CAJA DE REGULACION 28-31-32 CON DISPOSITIVO DE PARALELO



RIMUOVERE IL PONTICELLO
PER ABILITARE IL

DISPOSITIVO DI PARALLELO
REMOVE THE LINK BRIDGE TO
OPERATE THE PARALLEL DEVICE
ENLEVER LE PETIT PONT POUR
LE FONCTIONNEMENT DU
DISPOSITIF DE PARALLELE
BRUKE BEI PARALLEL BETRIEB
ENTFERNT
DESMONTAR EL PUENTICILLO
PARA HABILITAR EL DISPOSITIVO
DE PARALELO



REGOLATORE ELETTRONICO SR7-2G
ELECTRONIC REGULATOR SR7-2G
REGULATEUR ELECTRONIQUE SR7-2G
ELEKTRONISCHE REGLER SR7-2G
REGULADOR ELECTRONICO SR7-2G

DISPOSITIVO DI PARALLELO
PARALLEL DEVICE
DISPOSITIF DE PARALLELE
STATIKWANDLER
DISPOSITIVO DE PARALELO

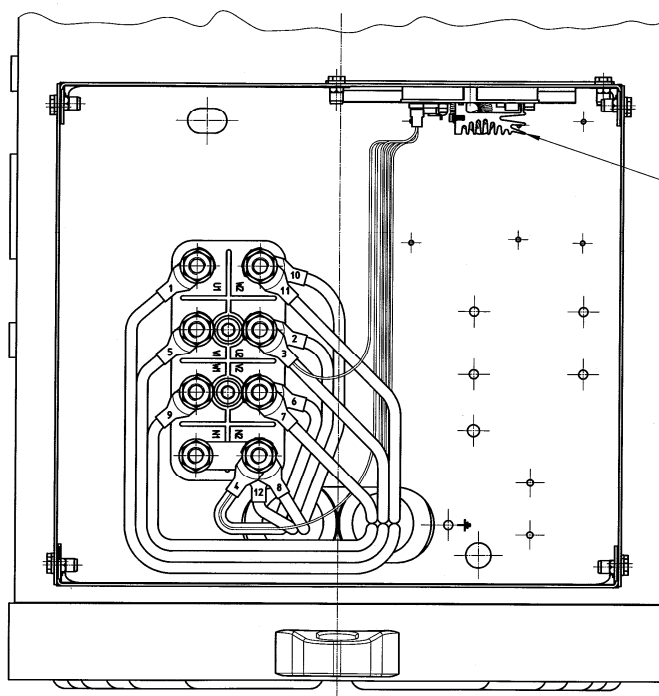
ISOLATORE
INSULATOR
ISOLATEUR
ISOLATOR
AISLADOR

Collegamento serie stella / Series star connection / Connection serie etoile / Stern-Reihen-Schaltung / Connexion en serie estrella

Tavola
Table
Abbildung
Tabla

15

SCATOLA REGOLAZIONE 34
TERMINAL BOX 34
BOITIER DE REGULATION 34
REGLERKASTEN 34
CAJA DE REGULACION 34



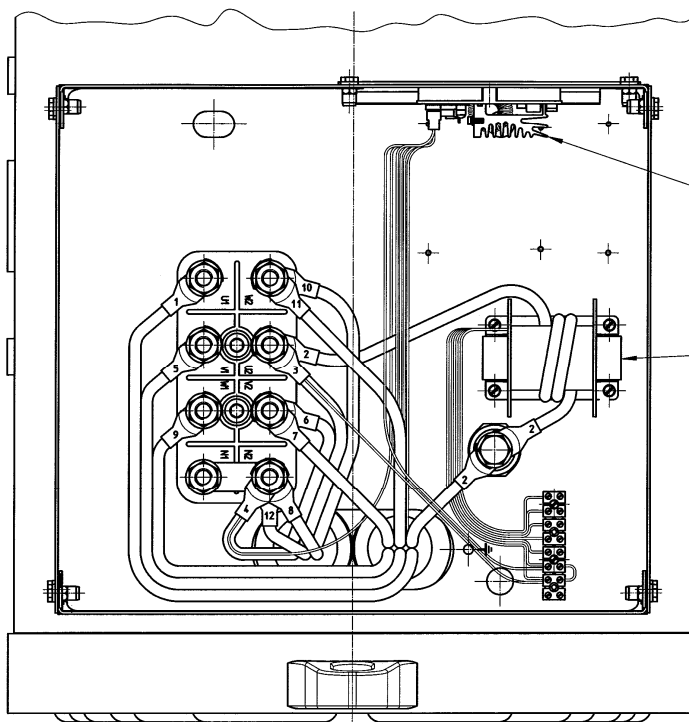
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ELECTRONIC REGULATOR SR7-2G
REGULATEUR ELECTRONIQUE SR7-2G
ELEKTRONISCHE REGLER SR7-2G
REGULADOR ELECTRONICO SR7-2G

Collegamento serie stella / Series star connection / Connection serie etoile / Stern-Reihen-Schaltung / Connexion en serie estrella

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Table
Abbildung
Tabla

16

SCATOLA REGOLAZIONE 34 CON DISPOSITIVO DI PARALLELO
TERMINAL BOX 34 WITH PARALLEL DEVICE
BOITIER DE REGULATION 34 AVEC DISPOSITIF DE PARALLELE
REGLERKASTEN 34 MIT EINRICHTUNG FUR PARALLEL BETRIEB
CAJA DE REGULACION 34 CON DISPOSITIVO DE PARALELO



REGOLATORE ELETTRONICO SR7-2G
ELECTRONIC REGULATOR SR7-2G
REGULATEUR ELECTRONIQUE SR7-2G
ELEKTRONISCHE REGLER SR7-2G
REGULADOR ELECTRONICO SR7-2G

DISPOSITIVO DI PARALLELO
PARALLEL DEVICE
DISPOSITIF DE PARALLELE
STATIKWANDLER
DISPOSITIVO DE PARALELO

Collegamento serie stella / Series star connection / Connection serie etoile / Stern-Reihen-Schaltung / Connexion en serie estrella

Tavola
Table
Abbildung
Tabla

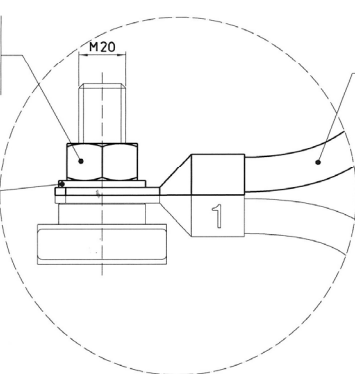
17

COLLEGAMENTO CAVI UTILIZZATORE 38-40
USER CABLES CONNECTION 38-40
CONNEXION DES CÂBLES PAR L'UTILISATEUR 38-40
VERBRAUCHERKABELANSCHLUSS 38-40
CONEXIÓN CABLES USUARIO 38-40



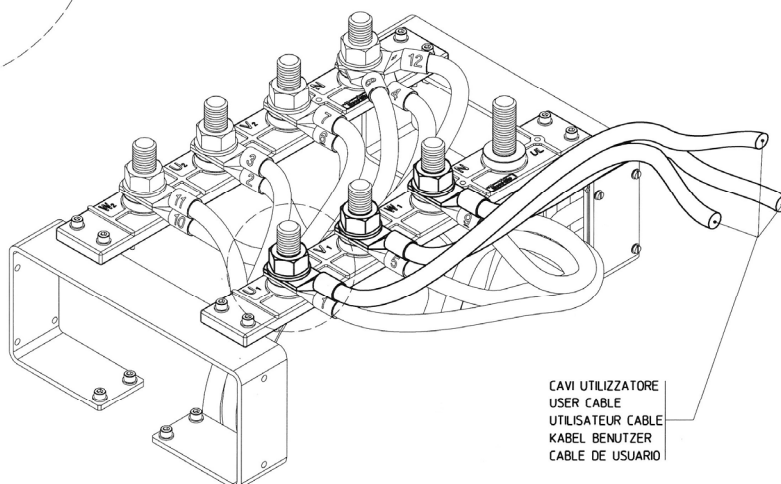
DADO ESAGONALE
HEXAGON NUT
ECROU HEXAGONAL
NUSSE HEXAGONAL
TUERCA HEXAGONAL

RONDELLA PIANA
PLAIN WASHER
RONDELLE
UNTERLEGSCHIBE
ARANDELA SENCILLA



CAVO UTILIZZATORE
USER CABLE
UTILISATEUR CABLE
KABEL BENUTZER
CABLE DE USUARIO

COLLEGAMENTO SERIE STELLA
SERIES STAR CONNECTION
CONNECTION SERIE ETOILE
STERN-REIHEN-SCHALTUNG
CONNEXION EN SERIE ESTRELLA

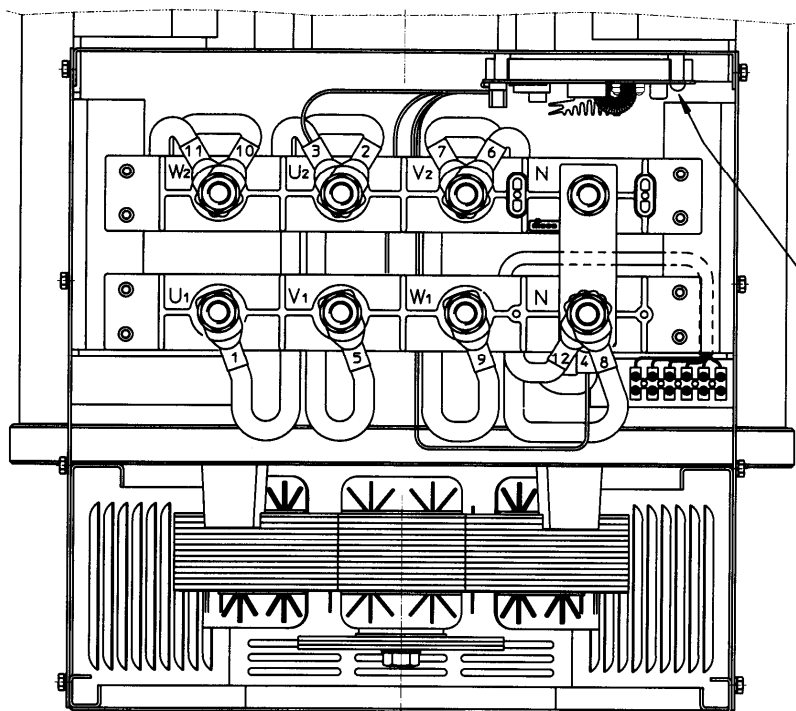


CAVI UTILIZZATORE
USER CABLE
UTILISATEUR CABLE
KABEL BENUTZER
CABLE DE USUARIO

Tavola
Table
Abbildung
Tabla

18

SCATOLA REGOLAZIONE 38
TERMINAL BOX 38
BOITIER DE REGULATION 38
REGLERKASTEN 38
CAJA DE REGULACION 38



REGOLATORE ELETTRONICO U.V.R.6/1-F
ELECTRONIC REGULATOR U.V.R.6/1-F
REGULATEUR ELECTRONIQUE U.V.R.6/1-F
ELEKTRONISCHER REGLER U.V.R.6/1-F
REGULADOR ELECTRONICO U.V.R.6/1-F

Collegamento serie stella / Series star connection / Connection serie etoile / Stern-Reihen-Schaltung / Connexion en serie estrella

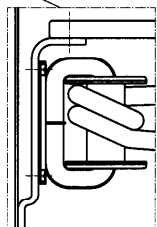
Tavola
Table
Abbildung
Tabla

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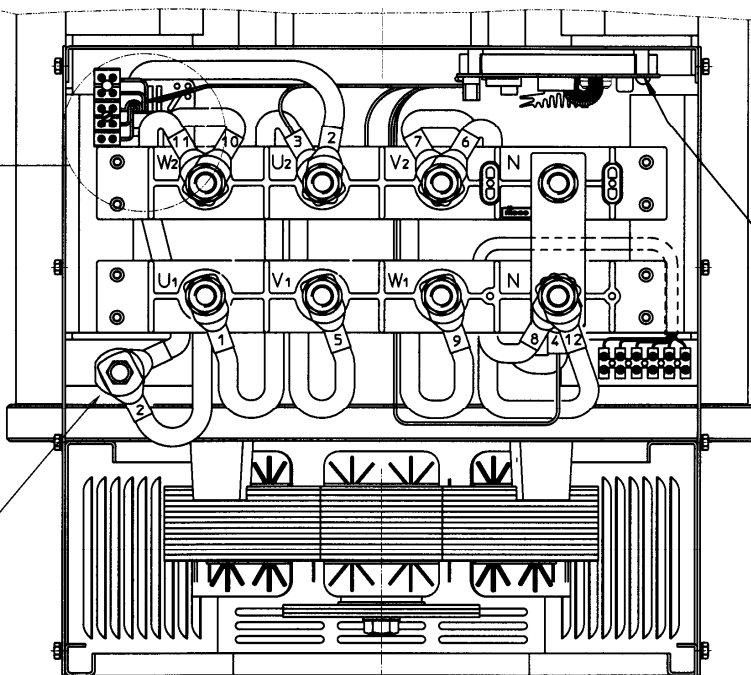
SCATOLA REGOLAZIONE 38 CON DISPOSITIVO DI PARALLELO
TERMINAL BOX 38 WITH PARALLEL DEVICE
BOITIER DE REGULATION 38 AVEC DISPOSITIF DE PARALLELE
REGLERKASTEN 38 MIT EINRICHTUNG FUR PARALLEL BETRIEB
CAJA DE REGULACION 38 CON DISPOSITIVO DE PARALELO



DISPOSITIVO DI
PARALLELO
PARALLEL DEVICE
DISPOSITIF DE
PARALLELE
STATIKWANDLER
DISPOSITIVO DE
PARALELO

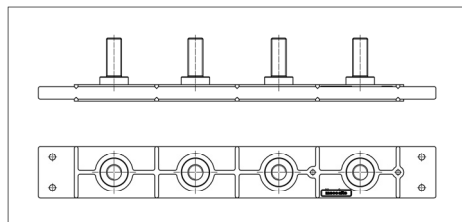
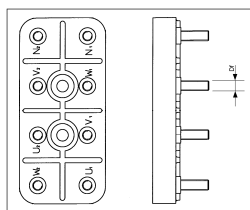


ISOLATORE
INSULATOR
ISOLATEUR
ISOLATOR
AISLADOR



REGOLATORE ELETTRONICO U.V.R.6/1-F
ELECTRONIC REGULATOR U.V.R.6/1-F
REGULATEUR ELECTRONIQUE U.V.R.6/1-F
ELEKTRONISCHER REGLER U.V.R.6/1-F
REGULADOR ELECTRONICO U.V.R.6/1-F

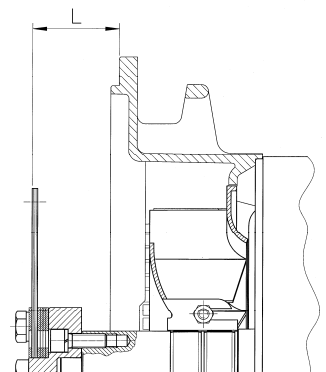
Collegamento serie stella / Series star connection / Connection serie etoile / Stern-Reihen-Schaltung / Connexion en serie estrella



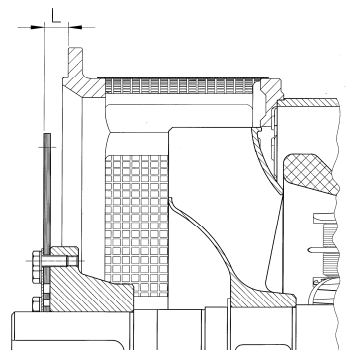
DIAMETRO DI FILETTATURA Df THREAD DIAMETER Df DIAMETRE DE FILETAGE Df GEWINDE DURCHMESSER Df DIAMETRO DE FILETEADO Df	TIPO TYPE TYP	COPPIA DI SERRAGGIO (Nm) TIGHTENING TORQUE (Nm) COUPLE DE SERRAGE (Nm) ANZUGSMOMENT (Nm) PAR DE TORQUE (Nm)
M6	ECP 28	8 ± 7%
M8	ECO 32	18 ± 7%
M10 (Steel)	ECO43-ECO46	30 ± 7%
M12	ECP34	42 ± 7%
M14	ECO32-34 special	54 ± 7%
M16	ECO38	80 ± 7%
M20	ECO40	100 ± 7%

TABELLA COPPIE DI SERRAGGIO PER DISCHI
COUPLING DISCS TIGHTENING TORQUE TABLE
TABLEAU DE COUPLE DE SERRAGE POUR DISQUES
KUPPLUNG AUZUGSMOMENT TABELLE
TABLA PAR DE TORQUE POR DISCOS

TIPO / TYPE / TYP 28 - 31 - 32

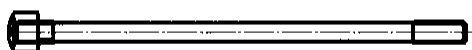


TIPO / TYPE / TYP 34 - 38 - 40 - 43 - 46



TIPO TYPE TYP	SAE	L	DIMENSIONE VITI SCREWS DIMENSIONS DIMENSIOIS VIS SCHRAUBENBMESSUNGEN DIMENSIONES TORNILLOS		COPPIA DI SERRAGGIO (Nm) TIGHTENING TORQUE (Nm) COUPLE DE SERRAGE (Nm) ANZUGSMOMENT (Nm) PAR DE TORQUE (Nm)	
			TE	TCCEI	CL. 8.8	CL. 12.9
ECP28	6 ½	30,2	M10x30-8.8	/	48	/
	7 ½	30,2	M10x30-8.8	/	48	/
	8	62	M12x30-8.8	M10x30-8.8	80-48	/
	10	53,8	M12x30-8.8	M10x30-8.8	80-48	/
	11 ½	39,6	M10x40-8.8	/	48	/
ECO31-32	6 ½	30,2	/	M12x40-12.9	/	140
	7 ½	30,2	/	M12x40-12.9	/	140
	8	62	M12x30-8.8	M12x40-12.9	80	140
	10	53,8	M12x30-8.8	M12x40-12.9	80	140
	11 ½	39,6	/	M12x40-12.9	/	140
ECP34	10	53,8	M10x30-8.8	M10x40-8.8	48	/
	11 ½	39,6	M10x45-8.8	/	48	/
	14	25,4	M10x30-8.8	/	48	/
ECO38-N	11 ½	39,6	M12x45-8.8	/	80	/
	14	25,4	M12x30-8.8	/	80	/
ECO40	14	25,4	M16x45-8.8	/	200	/
	18	15,7	M16x40-8.8	/	200	/
ECO43-N	14	25,4	M16x55-8.8	/	200	/
	18	15,7	M16x40-8.8	/	200	/
	21	0	M16x40-8.8	/	200	/
ECO46	18	15,7	M16x40-8.8	/	200	/
	21	0	M16x40-8.8	/	200	/

TABELLA COPPIE DI SERRAGGIO PER TIRANTI
STAY BOLT TIGHTENING TORQUE TABLE
TABLEAU DE COUPLE DE SERRAGE POUR TIGE
TABELLE FUR DAS ANZUGSMOMENT VON ZUGSTANGEN
TABLA PAR DE TORQUE POR TIRANTE



DIAMETRO DI FILETTATURA Df THREAD DIAMETER Df DIAMETRE DE FILETAGE Df GEWINDE DURCHMESSER Df DIAMETRO DE FILETEADO Df	TIPO TYPE TYP	COPPIA DI SERRAGGIO (Nm) TIGHTENING TORQUE (Nm) COUPLE DE SERRAGE (Nm) ANZUGSMOMENT (Nm) PAR DE TORQUE (Nm)
M8	ECP 28	17 ± 7%
M10	ECO 32	48 ± 7%
M14	ECP34	120 ± 7%
M12	ECO38	80 ± 7%
M16	ECO40	180 ± 7%
M14	ECO43-46	120 ± 7%

**GENERATORI A 4 POLI - 4 POLE GENERATORS
ALTERNATEURS 4 POLES
GENERATOREN 4 POLIG - GENERADORES 4 POLOS**

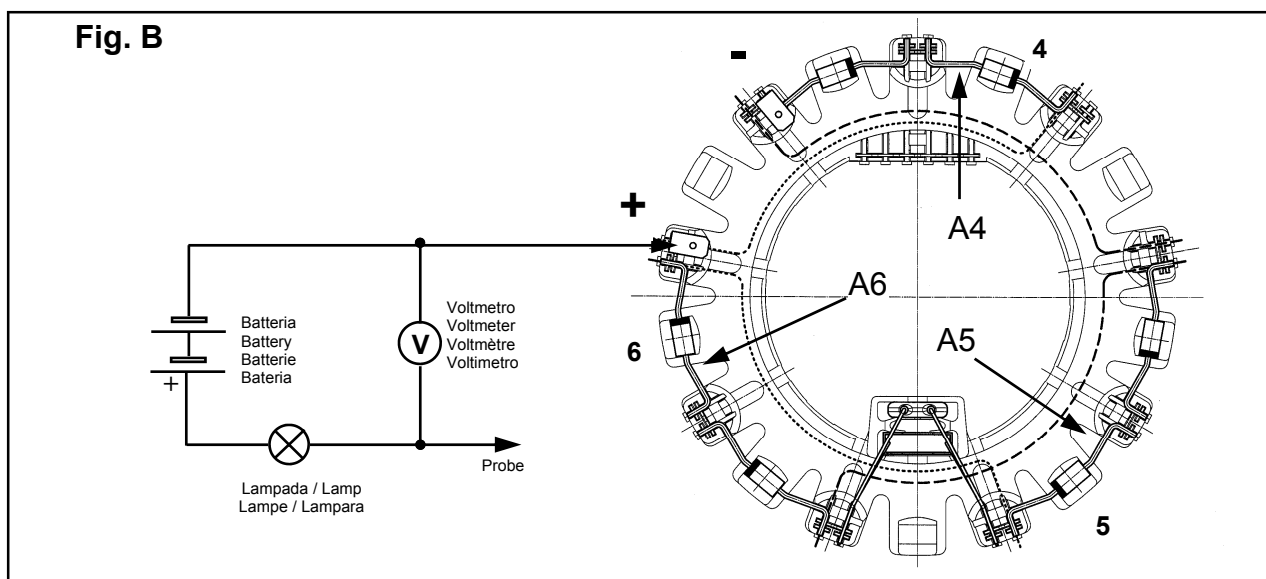
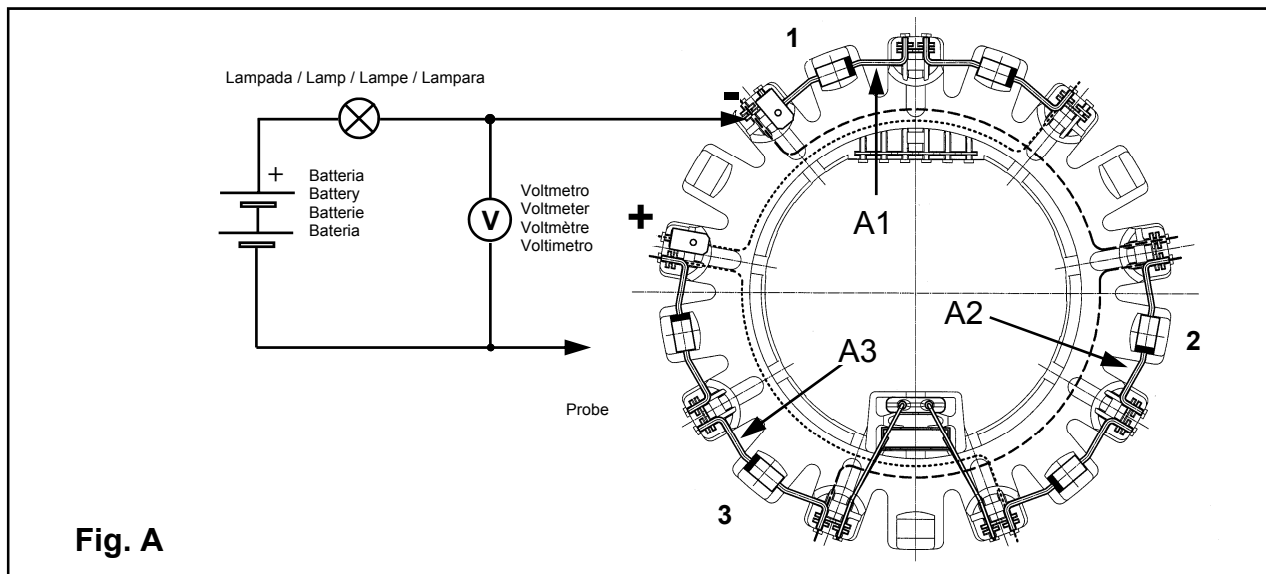
TIPO TYPE TYP	Volume d'aria Air flow Volume d'air Luftmenge Volumen de aire		Rumore Noise Bruit Gerausch Ruido dB(A)				Peso Weight Poids Gewicht Peso
	m³/min		50 Hz		60 Hz		
	50 Hz	60 Hz	1m	7m	1m	7m	
ECP 28 1VS	5,3	5,8	68	57	71	61	82
ECP 28 2VS							89
ECP 28 0S							99
ECP 28 S							107
ECP 28 1L							122
ECP 28 2L							139
ECP 28VL							165
ECO 32 2S	11,8	14,5	75	60	79	64	199
ECO 32 3S							214
ECO 32 1L							248
ECO 32 2L							282
ECO 32 3L							298
ECP 34 1.5VS	19,3	23	79	65	83	69	310
ECP 34 1S							341
ECP 34 2S							419
ECP 34 1L							445
ECP 34 2L							491
ECP 34 3L							495
ECO 38 1SN	32	39	82	69	86	73	510
ECO 38 2SN							560
ECO 38 3SN							590
ECO 38 1LN							680
ECO 38 2LN							765
ECO 38 3LN							905
ECO 40 1S	54	64,8	94	82	98	88	1040
ECO 40 2S							1118
ECO 40 3S							1171
ECO 40 1L							1324
ECO 40 1.5L							1380
ECO 40 2L							1586
ECO 40 VL							1693
ECO 43 1SN	90	108	95	84	99	89	1870
ECO 43 2SN							2090
ECO 43 1LN							2395
ECO 43 2LN							2660
ECO 43 VL							2950
ECO 46 1S	135	162	97	86	100	91	2770
ECO 46 1.5S							3380
ECO 46 2S							3440
ECO 46 1L							3720
ECO 46 1.5L							4260
ECO 46 2L							4250

**GENERATORI A 2 POLI - 2 POLE GENERATORS
ALTERNATEURS 2 POLES
GENERATOREN 2 POLIG - GENERADORES 2 POLOS**

TIPO TYPE TYP	Volume d'aria Air flow Volume d'air Luftmenge Volumen de aire		Rumore Noise Bruit Gerausch Ruido dB(A)				Peso Weight Poids Gewicht Peso
	m³/min		50 Hz		60 Hz		
	50 Hz	60 Hz	1m	7m	1m	7m	
	Kg						
ECP 28 1L	9,7	11	86	74	90,5	78	129
ECP 28 2L							136
ECP 28 3L							141
ECP 28 VL							156
ECO 31 2SN	22,4	27	88	77	93	80	178
ECO 31 3SN							204
ECO 31 1LN							217
ECO 31 2LN							236



ALTERNATORE TIPO / ALTERNATOR TYPE / ALTERNATEUR TYPE / GENERATORTYP / ALTERNADOR TIPO : 28-31-32

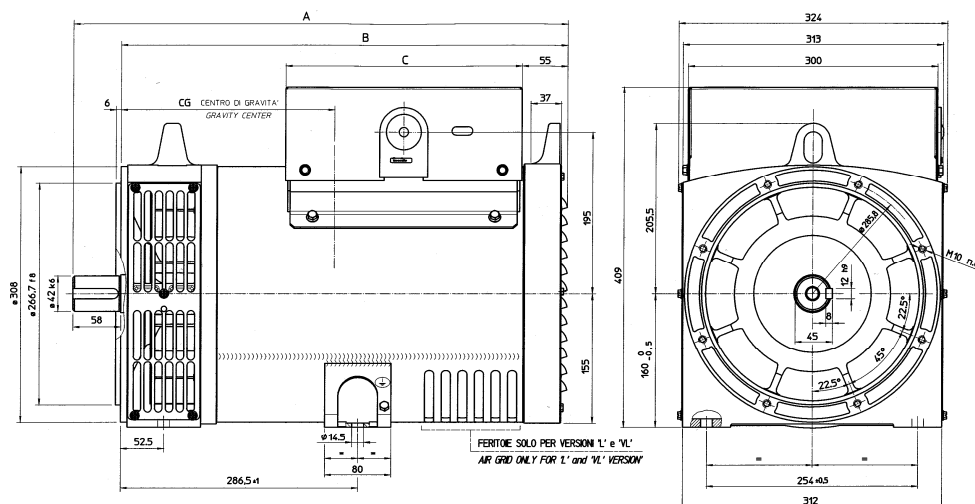


2 and 4 pole ALTERNATORE TIPO ALTERNATOR TYPE ALTERNATEUR TYPE GENERATORTYP ALTERNADOR TIPO	TENSIONE MISURATA / VOLTAGE MEASURED TENSION MESUREE / GEMESSENE SPANNUNG TENSION MEDIDA (fig. A-B)			
	Diodo buono Good diode Diode bonne Diode gut Diodo bueno	Diodo in corto Diode in short diode en court-circuit Diode in Kurzschlss Diodo en corto	Diodo aperto Diode open diode ouverte Diode offen Diodo abierto	
ECP28, ECO31-2SN, ECO31-3SN, ECO32-2S, ECO32-3S	da 0,8V from de von de a to à bis a 1,2V	inferiore a lower than Inférieure à Kleiner als Inferior a	0,6V	superiore a more than supérieure à grösser als Superior a
ECO31-1LN, ECO31-2LN, ECO32-1L, ECO32-2L, ECO32-3L	da 0,8V from de von de a to à bis a 1,2V	inferiore a lower than Inférieure à Kleiner als Inferior a	0,6V	superiore a more than supérieure à grösser als Superior a

ECP 28

FORMA FORM FORME B3/B14

dimensions in mm



TIPO / TYPE	A	B	C
28 1VS/4-2VS/4	476	418	225
28 0S/4-S/4	516	458	285
28 1L/4-2L/4 28 1L/2-2L/2 28 3L/2	596	538	285
28 VL	626	568	285

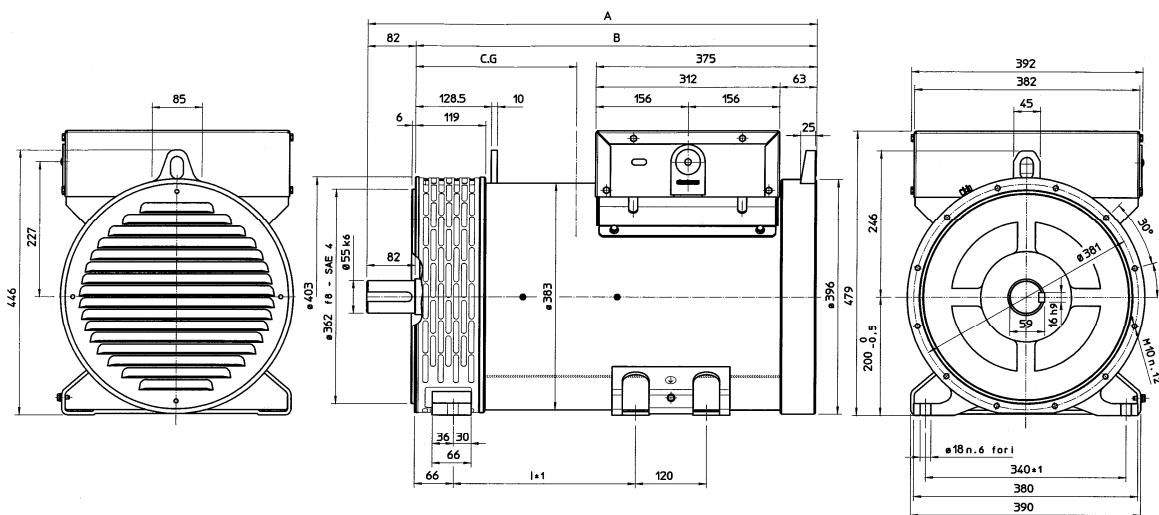
TIPO / TYPE	CG*	TIPO / TYPE	CG*
28-1VS/4	230	28-1L/2	267
28-2VS/4	230	28-2L/2	271
28-0S/4	235	28-3L/2	275
28-S/4	237	28-VL/2	291

* Center of Gravity

ECO 31N

FORMA FORM FORME B3/B14

dimensions in mm



TIPO / TYPE	CG*
31-2S/2	272
31-3S/2	285
31-1L/2	311
31-2L/2	336

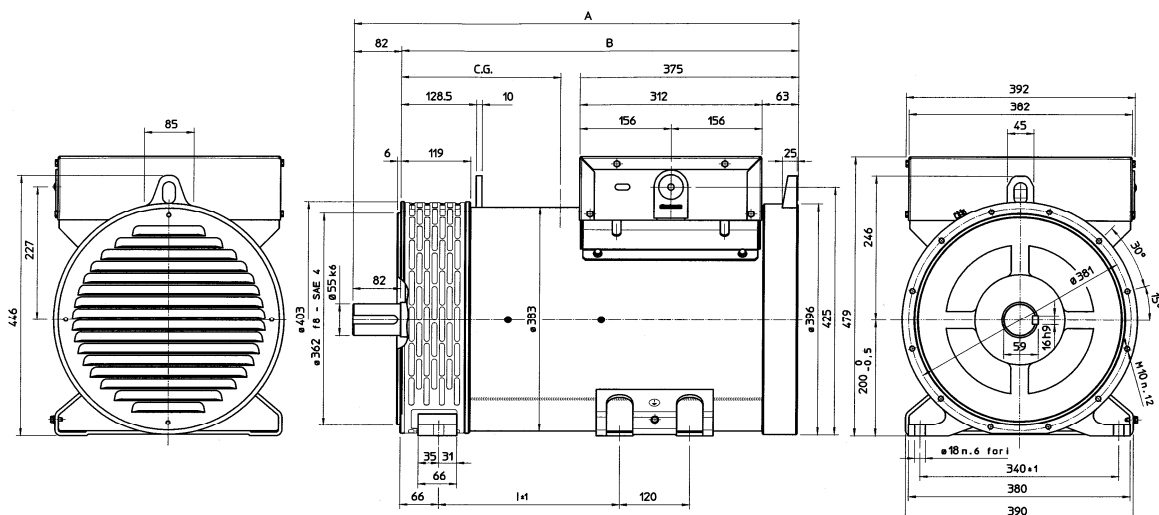
* Center of Gravity

TIPO / TYPE	A	B	I
ECO 31 S	658	576	205
ECO31 L	763	681	310

ECO 32

FORMA FORM FORME B3/B14

dimensions in mm



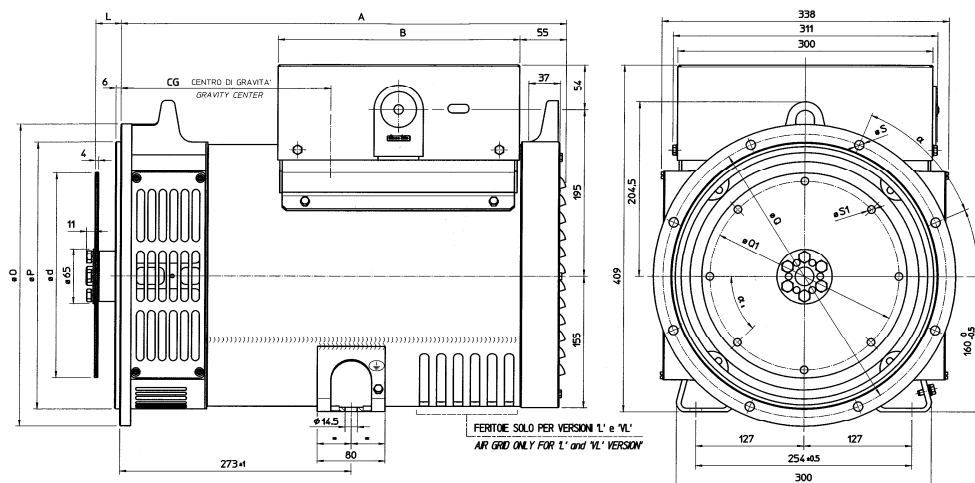
TIPO / TYPE	CG*
32-2S/4	269
32-3S/4	274
32-1L/4	316
32-2L/4	330
32-3L/4	351

* Center of Gravity

TIPO / TYPE	A	B	I
ECO 32 S	638	556	185
ECO32 L	763	681	310

ECP 28

FORMA FORM FORME MD35



dimensions in mm

SAE N°	Giunti a dischi Disc coupling Disque de monopalier Scheibenkupplung					
	L	d	Q1	N° fori	S1	αl
6 ½	30,2	215,9	200	6	9	60°
7 ½	30,2	241,3	222,25	8	9	45°
8	62	263,52	244,47	6	11	60°
10	53,8	314,32	295,27	8	11	45°
11 ½	39,6	352,42	333,37	8	11	45°

Flangia / Flange						
SAE N°	O	P	Q	N° fori	S	α
5	356	314,3	333,4	8	11	45°
4	403	362	381	12	11	30°
3	451	409,6	428,6	12	11	30°
2	490	447,7	466,7	12	11	30°

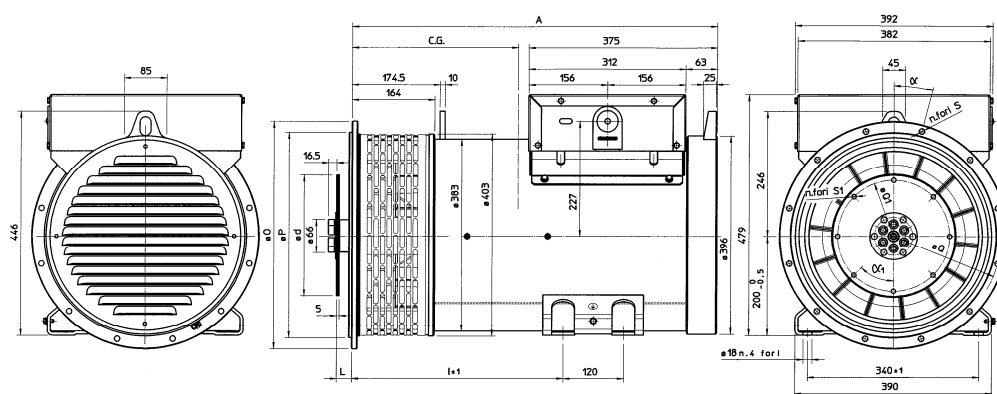
TIPO TYPE	CG*	TIPO TYPE	CG*
28-1L/2	242	28-1VS	200
28-2L/2	248	28-2VS	200
28-3L/2	254	28-0S	214
28-VL/2	273	28-S/4	217

TIPO TYPE	A	B	TIPO TYPE	CG*
28 1VS-2VS	405	225	28-1L/4	247
28 0S-S	445	285	28-2L/4	254
28 1L/2-2L/2-3L/2	525	285	28-VL/4	274
28 1L/4-2L/4				
28 VL	555	285		

* Center of Gravity

ECO 31N

FORMA FORM FORME MD35



dimensions in mm

SAE N°	Giunti a dischi Disc coupling Disque de monopalier Scheibenkupplung					
	L	d	Q1	N° fori	S1	αl
6 ½	30,2	215,9	200	6	9	60°
7 ½	30,2	241,3	222,25	8	9	45°
8	62	263,52	244,47	6	11	60°
10	53,8	314,32	295,27	8	11	45°
11 ½	39,6	352,42	333,37	8	11	45°

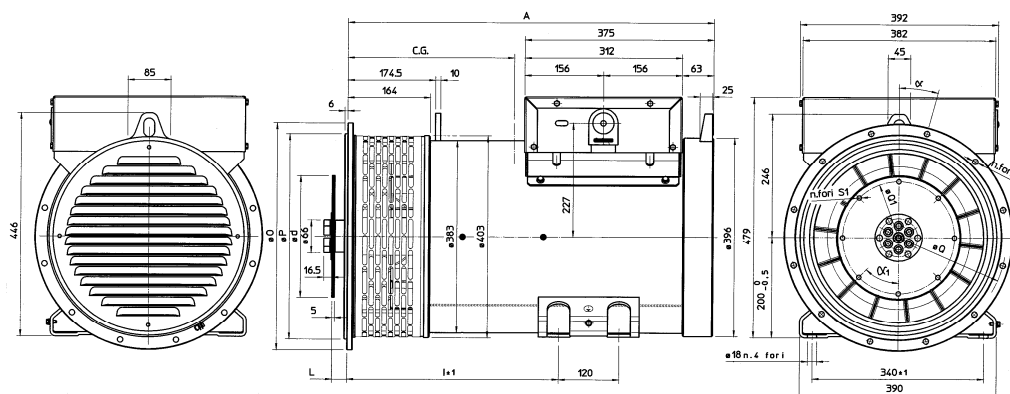
Flangia / Flange Bride / Flansch						
SAE N°	O	P	Q	N° fori	S	α
5	356	314,3	333,4	8	11	45°
4	403	362	381	12	11	30°
3	451	409,6	428,6	12	11	30°
2	490	447,7	466,7	12	11	30°
1	552	511,2	530,2	12	11	30°

TIPO TYPE	A	B	TIPO TYPE	CG*
ECO 31 S	621	315	31-2SN/2	296
ECO 31 L	726	420	31-3SN/2	310
			31-1LN/2	335
			31-2LN/2	360

* Center of Gravity

ECO 32

FORMA FORM FORME MD35



dimensions in mm

SAE N°	Giunti a dischi Disc coupling Disque de monopalier Scheibenkupplung						
	L	d	Q1	N° fori	S1	αl	F
6 ½	30,2	215,9	200	6	9	60°	7
7 ½	30,2	241,3	222,25	8	9	45°	7
8	62	263,52	244,47	6	11	60°	2
10	53,8	314,32	295,27	8	11	45°	10
11 ½	39,6	352,42	333,37	8	11	45°	24

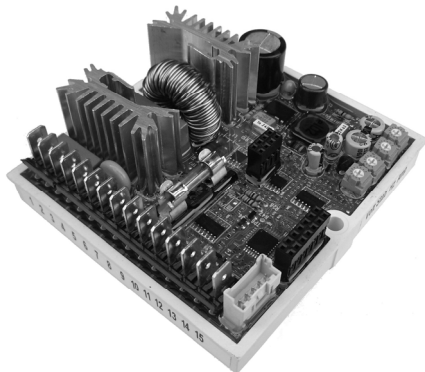
Flangia / Flange Bride / Flansch						
SAE N°	O	P	Q	N° fori	S	α
5	356	314,3	333,4	8	11	45°
4	403	362	381	12	11	30°
3	451	409,6	428,6	12	11	30°
2	490	447,7	466,7	12	11	30°
1	552	511,2	530,2	12	11	30°

TIPO TYPE	A	I	TIPO TYPE	CG*
ECO 32 S	601	295	32-2S/4	312
ECO 32 L	726	420	32-3S/4	316
			32-1L/4	366
			32-2L/4	377
			32-3L/4	388

* Center of Gravity

REGOLATORE DIGITALE DSR

DSR DIGITAL REGULATOR



Ulteriori informazioni sul regolatore DSR sono scaricabili nell'area download del sito web al seguente indirizzo :

www.meccalte.com

Further information about DSR regulator are available in the web site download area at following address :

www.meccalte.com

INSTALLAZIONE

Al ricevimento del regolatore digitale controllare visivamente che non ci siano danni dovuti al trasporto e alla movimentazione dell'apparato. Nel caso informare immediatamente lo spedizioniere, l'assicurazione, il rivenditore o Mecc Alte. Se il regolatore non viene installato immediatamente, immagazzinatelo nel suo imballo originale in un luogo privo di polveri e di umidità.

Il regolatore viene normalmente installato nella scatola morsetti del generatore. Viene fissato con due viti M4x20 o M4x25 e deve essere montato dove la temperatura ambiente non ecceda le condizioni ambientali previste.

COLLEGAMENTI

I collegamenti al regolatore digitale dipendono dall'applicazione e dal sistema di eccitazione. **Un errore nei collegamenti può avere conseguenze serie per l'unità.** Controllate attentamente e assicuratevi che tutti i collegamenti siano esatti ed in accordo agli schemi allegati, prima di applicare potenza.

TERMINALI

I collegamenti devono essere eseguiti utilizzando cavi di sezione minima pari a :

- 1,5 mm² per i cavi di potenza sui morsetti 1, 2, 3 e 9 (Exc-, Aux/exc+, Aux)
- 1 mm² per i cavi di segnale

INGRESSI E USCITE : SPECIFICHE TECNICHE

INSTALLATION

Upon receipt of the digital regulator, perform a visual inspection to ensure that no damage has been sustained during transportation and movement of the equipment. In the event of damage, advise the shipper, the insurance company, the seller or Mecc Alte immediately. If the regulator is not installed immediately, store it in its original packaging in a dust and humidity-free environment.

The regulator is normally installed in the generator terminal box. It is fixed with two M4x20 or M4x25 screws and must be installed in a location where the temperature does not exceed the environmental conditions foreseen.

CONNECTIONS

The digital regulator connections depend on the application and excitation system. **An error in connection may have serious consequences for the unit.** Carefully check to make sure that all connections are precise and in accordance with the attached drawings, before turning on the power.

TERMINALS

The connections must be made using cables having a minimum diameter:

- 1.5 mm² for power cables on terminals 1, 2, 3 and 9 (Exc-, Aux/exc+, Aux)
- 1 mm² for signal cables

INPUTS AND OUTPUTS: TECHNICAL SPECIFICATIONS

TABELLA 1 : CONNETTORE CN1

Morsetto Terminal	Denominazione Name	Funzione Function	Specifiche Specifications
1	Exc-	Eccitazione / Excitation	Reg. continuo/Continuous Rating : 4Adc max Reg. transitorio/Transitory Rating : 12Adc di picco/peak
2	Aux/Exc+		
3	Aux/Exc+		
9	Aux/Neutral	Alimentazione / Power	Frequenza/Frequency : da/from 12Hz a/to 72Hz Range: 40Vac - 270Vac
4	F phase	Sensing	Range: 140Vac - 280Vac Assorbimento/Burden : <1VA
5	F Phase		
6	H phase		
7	H phase	Sensing	Range: 70Vac - 140Vac Assorbimento/Burden : <1VA
8	Aux/Neutral		
10	Vext/Pext	Ingresso per controllo remoto della tensione	Tipo/Type: Non isolato/Not isolated Range: 0 - 2,5 Vdc o Potenziometro/Potentiometer 10K Regolazione/Adjustment: da/from -10% a/to +10% Assorbimento/Burden: 0 - 2 mA (sink) Lunghezza massima/Max length: 30m ⁽²⁾
11	Common	Input for remote voltage control	
12	50/60Hz	Ingresso per jumper 50/60Hz	Tipo/Type: non isolato/not isolated Lunghezza massima/Max length: 3m
13	Common	Jumper Input 50/60Hz	
14	A.P.O.	Uscita protezioni attive	Tipo/Type: Open collector non isolato/not isolated Corrente/Current : 100mA Tensione/Voltage: 30V Lunghezza massima/Max length: 30m ⁽²⁾
15	Common	Active protections output	

Nota 1) Sono connessi assieme sulla scheda i morsetti: 2 con 3, 4 con 5, 6 con 7, 8 con 9, 11 con 13 e 15.

Nota 2) con filtro EMI esterno (3m senza filtro EMI)

A bordo di alternatori nuovi di fabbrica il DSR è già tarato, in caso di regolatori sciolti (ad es. ricambi) o qualora siano richieste variazioni di cablaggio o di taratura, per garantirne il corretto funzionamento esso dovrà essere accuratamente impostato.

Le impostazioni basilari possono essere effettuate direttamente sul regolatore tramite i 4 trimmers (VOLT - STAB - Hz - AMP), il jumper 50/60 e l'ingresso Vext. Impostazioni o misure più dettagliate possono essere effettuate esclusivamente via software utilizzando ad esempio l'interfaccia di comunicazione MeccAlte DI1 e il programma DSR_Terminal o DSR_Reader.

Ingresso Vext

L'ingresso Vext (connettore CN1 morsetti 10 e 11) permette il controllo remoto analogico della tensione di uscita tramite un potenziometro da 10Kohm con range di variazione programmabile via software (di default l'impostazione è $\pm 5\%$) rispetto al valore impostato; qualora si volesse impiegare una tensione continua, essa avrà effetto se compresa nel range da 0V a +2,5V. L'ingresso tollera tensioni da -5V a +5V ma per valori che eccedono i limiti 0V / +2,5V (o in caso di sconnessione) esso non viene considerato e la regolazione della tensione ritorna sul valore impostato tramite trimmer.

NOTA : La sorgente di tensione continua deve essere in grado di assorbire almeno 2 mA.

Segnale 50/60

Un jumper posto sull'ingresso 50/60 (connettore CN1 morsetti 12 e 13) comporta la commutazione della soglia di protezione di bassa velocità da $50 \cdot (100\% - \alpha\text{Hz}\%)$ a $60 \cdot (100\% - \alpha\text{Hz}\%)$ dove $\alpha\text{Hz}\%$ rappresenta la posizione relativa del trimmer Hz.

Contatto APO

Acronimo di **Active Protection Output** : (connettore CN1 morsetti 14 e 15) transistor open collector non isolato 30V-100mA, normalmente aperto, si chiude (con un ritardo programmabile via software da 1 a 15 secondi) quando, tra tutti gli allarmi, ne risultano attivi uno o più selezionabili via software separatamente.

Il **trimmer VOLT** permette una regolazione da circa 70V a circa 140V qualora per il sensing si utilizzino i morsetti 4 e 5, oppure da circa 140V a circa 280V qualora si utilizzino i morsetti 6 e 7.

Il **trimmer STAB** regola la risposta dinamica (statismo) dell'alternatore in condizioni transitorie.

Il **trimmer AMP** regola la soglia di intervento della protezione di sovraccorrente di eccitazione.

Per tarare la protezione di sovraccarico seguire la seguente procedura:

- 1) ruotare il trimmer Hz tutto in senso antiorario
- 2) applicare all'alternatore il carico nominale
- 3) diminuire la velocità del 10%
- 4) ruotare il trimmer AMP completamente in senso antiorario
- 5) dopo alcuni secondi, si dovrà notare una diminuzione nel valore della tensione del generatore, e l'attivazione dell'allarme 5 (visibile tramite un cambio del lampeggio del LED)
- 6) In queste condizioni, ruotare lentamente il trimmer "AMP" in senso orario fino a portare il valore della tensione di uscita al 97% del valore nominale: l'allarme 5 è ancora attivo.
- 7) Riportandosi alla velocità nominale, dopo alcuni secondi l'allarme 5 scompare e la tensione del generatore sale al valore nominale.
- 8) ritarare il trimmer Hz come indicato al seguente paragrafo.

Il **trimmer Hz** permette la taratura della soglia d'intervento della protezione di bassa velocità fino al -20% rispetto al valore di velocità nominale impostato dal jumper 50/60 (a 50 Hz la soglia può essere tarata da 40Hz a 50Hz, a 60 Hz la soglia può essere tarata da 48Hz a 60Hz).

L'intervento della protezione fa diminuire la tensione del generatore e la taratura si effettua come segue :

- 1) ruotare il trimmer Hz tutto in senso antiorario
- 2) se la macchina deve funzionare a 60 Hz, assicurarsi che sia inserito il ponticello tra i morsetti 12 e 13 del connettore CN1
- 3) portare il generatore ad una velocità pari al 90% di quella nominale
- 4) agire lentamente sul trimmer "Hz" ruotandolo in senso orario affinché la tensione del generatore inizi a diminuire e simultaneamente accertarsi che il LED inizi a lampeggiare velocemente
- 5) aumentando la velocità, la tensione del generatore si dovrà normalizzare e l'allarme dovrà scomparire
- 6) riportare la velocità al valore nominale.

Durante funzionamento normale un LED montato sulla scheda lampeggia con periodo pari a 2sec e duty cycle del 50%; in caso di intervento o segnalazione di allarme si hanno diverse modalità di lampeggio come indicato in figura 1.

NOTA: Pur continuando a regolare la tensione, il DSR si pone in modalità di spegnimento qualora la frequenza scenda sotto i 20Hz. Per il ripristino è necessario fermare completamente l'alternatore.

DSR regulator, on board of new generators, is already calibrated; in case of loose regulators (ie spare parts) or in case of wiring modifications or adjusting, to guarantee its correct working, it must be accurately set .

Basic settings can be done directly on the regulator by its four trimmers (VOLT - STAB - Hz - AMP), the jumper 50/60 and the Vext input. More detailed settings or measures can be done exclusively by software using for example the MeccAlte communication interface DI1 and the program DSR_Terminal or DSR_Reader.

Vext Input

The Vext input (connector CN1 – terminals 10 and 11) permits an analogical remote control of output voltage through a 10Kohm potentiometer with a programmable by software variation range (by default the setting is $\pm 5\%$) with respect to the value set; if you want to use continuous voltage, it will be effective if it is in the range between 0V and +2,5V. The input tolerates voltages from -5V to +5V, but for values exceeding the limits of 0V / +2,5V (or in the event of disconnection) it is automatically disabled and the voltage adjustment goes back to the value set through the trimmer (if enabled).

NOTE : The DC voltage generator must be able to sink at least 2mA.

50/60 Signal

A jumper is located on the 50/60 input (connector CN1, terminals 12 and 13); it provokes the commutation of the underspeed protection threshold from $50 \cdot (100\% - \alpha\text{Hz}\%)$ to $60 \cdot (100\% - \alpha\text{Hz}\%)$, where $\alpha\text{Hz}\%$ represents the position relative to the Hz trimmer.

APO Contact

The acronym **APO** stands for Active Protection Output: (connector CN1 – terminals 14 and 15) 30V-100mA non-insulated open collector transistor, normally opened, is closed (with a delay that can be programmed by software from 1 to 15 seconds) when, among all the alarms, one or more of the active ones can be selected separately by software.

The **VOLT** trimmer allows adjustment from about 70V to about 140V when using for sensing terminals 4 and 5, or from about 140V to about 280V when using terminals 6 and 7.

The **STAB** trimmer adjusts the dynamic response (statism) of the alternator under transient conditions.

The **AMP** trimmer adjusts the excitation overcurrent protection intervention threshold.

Use the following procedure in order to calibrate the overload protection:

- 1) Rotate the Hz trimmer entirely in the counter clockwise direction
- 2) Apply the nominal load to the alternator.
- 3) Decrease the speed by 10%
- 4) Rotate the AMP trimmer completely in the counter clockwise direction.
- 5) After a few seconds, there should be a decrease in the voltage value of the generator and alarm 5 should come on (visible due to a change in the flashing indicator light) .
- 6) Under these conditions, rotate the AMP trimmer slowly in the clockwise direction, until the output voltage value is 97% of the nominal value: alarm 5 is still activated.
- 7) Return to the nominal speed; alarm 5 should disappear in a few seconds and the generator voltage should increase to the nominal value.
- 8) Re-adjust the trimmer as indicated in the following paragraph.

The **Hz trimmer** allows to calibrate the threshold of the intervention of the under frequency protection up to -20% with respect to the nominal speed value set by jumper 50/60 (at 50 Hz the threshold can be calibrated from 40 Hz to 50 Hz, at 60 Hz the threshold can be calibrated from 48 Hz to 60 Hz).

The intervention of this protection reduce the output generator voltage and, to calibrate it, use the following procedure :

- 1) Rotate the Hz trimmer entirely in the counter clockwise direction.
- 2) If the machine has to operate at 60 Hz, ensure that the bridge is inserted between terminals 12 and 13 of the CN1 connector.
- 3) Bring the generator to 90% of the nominal speed.
- 4) Slowly turn the "Hz" trimmer, rotating it clockwise until the generator voltage begins to drop and ascertain that the indicator light simultaneously begins flashing rapidly.
- 5) By increasing speed, the generator voltage will normalise and the alarm will disappear.
- 6) Set the speed to the nominal value

During normal operation and a duty cycle of 50% an indicator light mounted on the board flashes every 2 seconds; it flashes differently in the event of intervention or alarm, as indicated in figure 1.

NOTE: Notwithstanding DSR maintains the voltage regulation, it goes in shutdown mode if the frequency decreases under 20Hz. The reset needs the Gen-Set switching off.

N.	Descrizione evento <i>Description of event</i>	Azione <i>Action</i>
1	Checksum EEprom	Ripristino dati default, Blocco Reset default, Blockage
2	Sovratensione / <i>Overvoltage</i>	APO
3	Sottotensione / <i>Under voltage</i>	APO
4	Corto circuito / <i>Short circuit</i>	APO, Massima corrente, Blocco APO, Maximum current, Blockage
5	Sovracorrente di eccitazione <i>Excitation Overcurrent</i>	APO, Riduzione corrente di eccitazione APO, Reduction of excitation current
6	Bassa velocità / <i>Underspeed</i>	APO, Rampa/Ramp V/F
7	Sovravelocità / <i>Overspeed</i>	APO

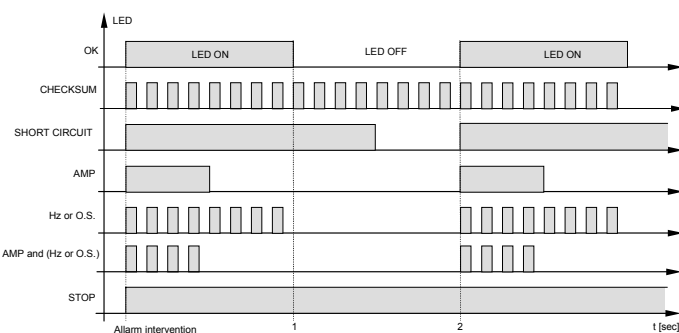
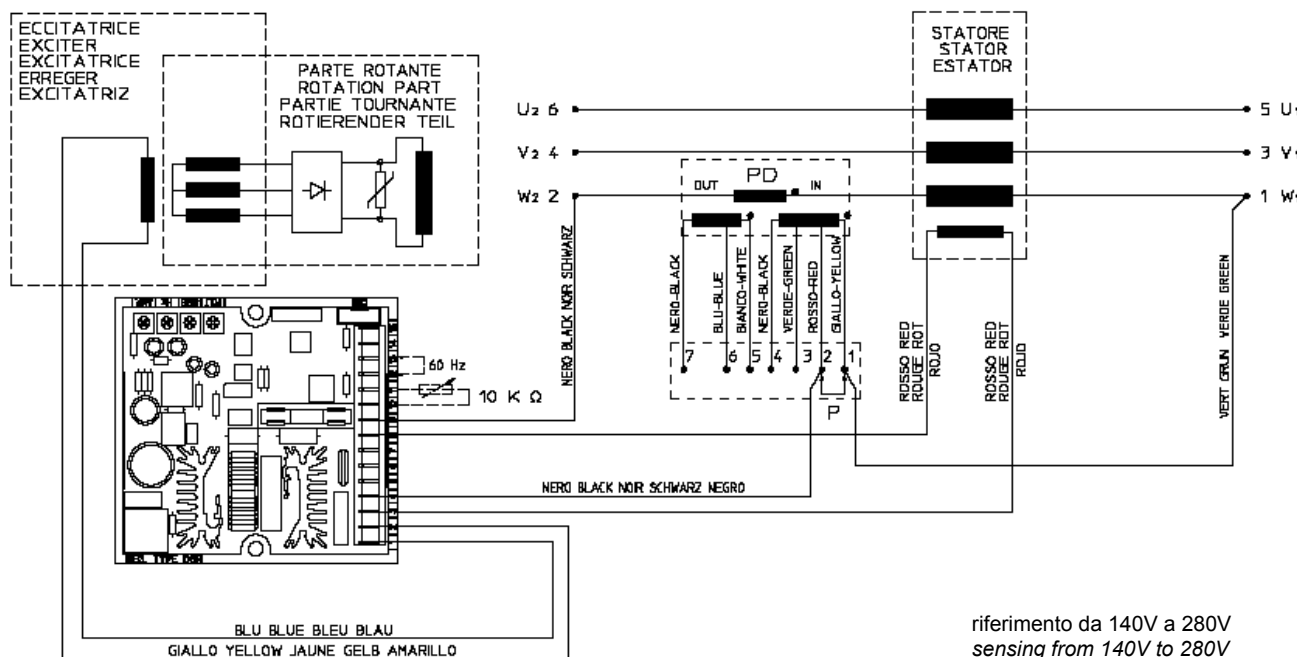


Fig. 1

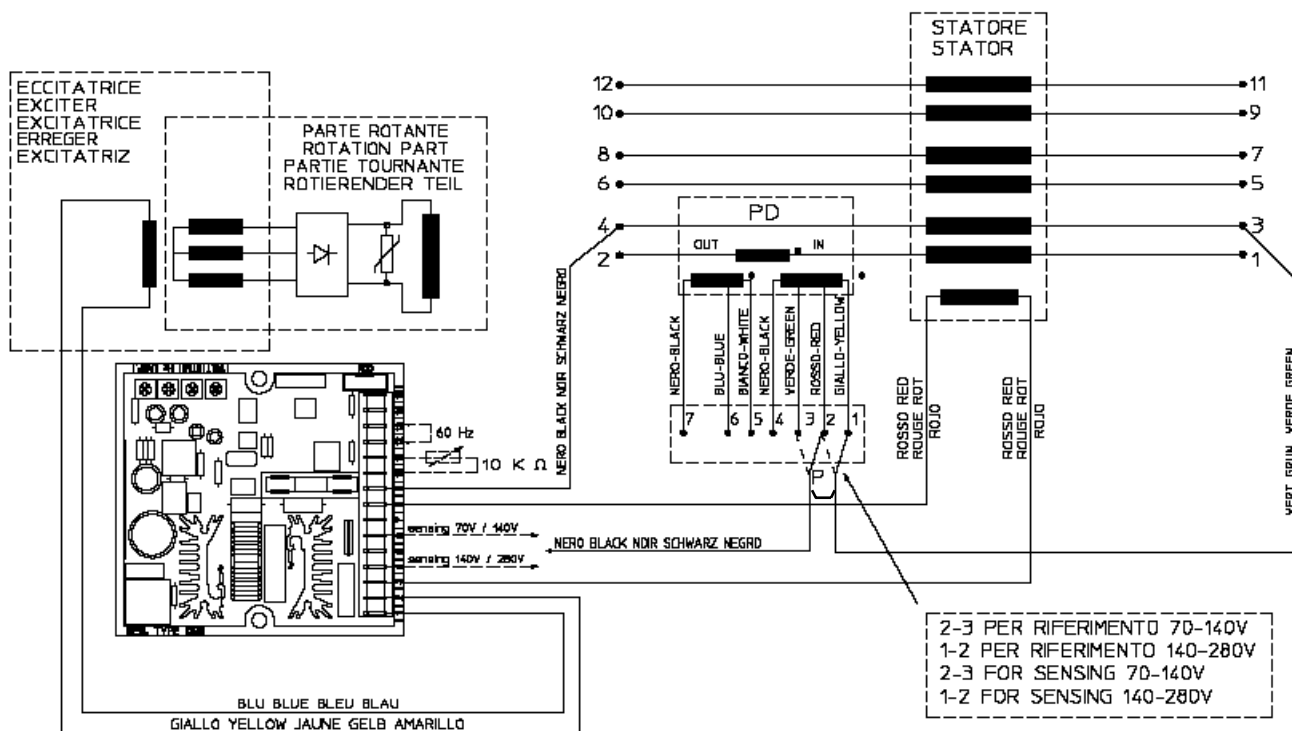
Alternatori a 6 morsetti / 6 terminal alternators

SCC0061/02



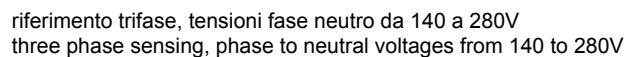
Alternatori a 12 morsetti/12 terminal alternators

SCC0100/00

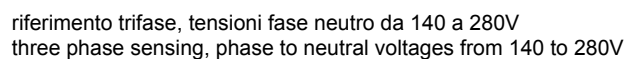


morsetto/terminal 4 : sensing 140V / 280V
morsetto/terminal 6 : sensing 70V / 140V

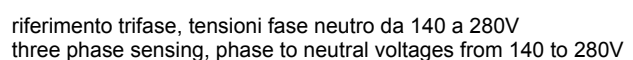
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SCC0106/00



SCC0105/00



GARANZIA	WARRANTY	GARANTIE	GARANTIE	GARANTIA
A La Mecc Alte garantisce la buona costruzione e qualita' dei propri alternatori per 24 mesi dalla data di spedizione dai propri stabilimenti o filiali. B Durante il suddetto periodo la Mecc Alte si impegna a riparare o sostituire (a proprie spese) nella propria sede, quelle parti che si fossero avariate, senza pero' essere tenuta a risarcimenti di danni diretti o indiretti. C La decisione sul riconoscimento o meno della garanzia e' riservata esclusivamente alla Mecc Alte previo esame delle parti avariate che dovranno per-venire in porto franco, alla sua sede di Vicenza. D Tutte le eventuali spese di viaggio, trasferta, trasporto, mano d'opera per lo smontaggio e rimontaggio dell'alternatore dall'apparecchiatura azionante sono sempre a carico dell'utente. E La garanzia decade se durante il periodo predetto, i prodotti fossero: 1 immagazzinati in luogo non adatto; 2 riparati o modificati da personale non autorizzato dalla Mecc Alte; 3 usati o sottoposti a manutenzione non in base alle norme stabilite dalla Mecc Alte; 4 sovraccaricati o impiegati in prestazioni diverse da quelle per le quali sono stati forniti. La garanzia cessa comunque qualora il cliente fosse inadempiente nei pagamenti per qualunque ragione.	A Mecc Alte warrants the good manufacture and quality of all its products for 24 months, starting from the time of shipment from our factories or our branches. B During said period Mecc Alte obliges to repair replace at its cost, at its works, all those parts which failed without any other liability of any type, direct or indirect. C The decision for warranty approval is Mecc Alte's exclusive right and subject to a previous examination of the failed parts which are to be forwarded fob Mecc Alte Italy for analysis. D All the eventual expenses concerning travel, board, transport, and labour for assembly/disassembly of alternator from the drive unit are always at the user's charge. E The warranty shall be void if during the above described period the following anomalies should occur: 1 inadequate storage; 2 repair or modification by unauthorized personnel; 3 use or maintenance conditions which do not conform with norms established by Mecc Alte; 4 overload or application other than what the product was meant for. Warranty coverage also expires whenever the client, for whatever reason, is late in payment.	A La société Mecc Alte garantit la bonne construction et qualité de ses produits pour une durée de 24 mois à compter de la date d'expédition de ses usines de fabrication ou filiales. B Durant la période indiquée, Mecc Alte s'engage à réparer ou à remplacer (à prix équivalent) dans la société, la partie qui serait endommagée sans toutefois être tenue de prendre en considération les frais directs ou indirects. C La décision sur la prise en charge ou non de la garantie est réservée exclusivement à Mecc Alte sur examen préalable des pièces endommagées qui devront parvenir en port Franco à l'usine de Vicenza. D Tout les éventuels frais de voyage, transfert, transport, main d'oeuvre pour le démontage de l'alternateur sont toujours à la charge de l'utilisateur. E La garantie ne s'applique pas si durant la période indiquée il y a: 1 emmagasinement dans un local non adapté; 2 réparations ou modifications personnelles non autorisées par Mecc Alte; 3 usage et manutentions non conformes aux normes établies par Mecc Alte; 4 surcharges et emplois des fonctions différentes de celles pour lequel ils sont fournis. Il est bien évident que la garantie ne s'applique que sur le matériel payé en totalité.	A Die Firma Mecc Alte gibt 24 Monate Garantie ab dem Zeitpunkt der Auslieferung vom Stammhaus oder einer ihrer Filialen auf die einwandfreie Konstruktion und Qualität ihrer Generatoren. B Während der genannten Periode repariert oder ersetzt Mecc Alte zu seinen Kosten alle fehlerhaften Teile, ohne Rücksicht ob direkt oder indirekt. C Mecc Alte behält sich das Recht vor, die fehlerhaften Teile frei Mecc Alte Vicenza zurückzufordern, zu Schadensuntersuchung D Alle eventuellen Kosten wie Transport, Fahrtkosten, Arbeitslohn für De-und Montage gehen zu Lasten des Kunden. E Die Garantie in O.A. Zeit wird für nachstehende Faktoren ausgeschlossen: 1 nicht korrekte Lagerung; 2 Reparatur oder Modifizierung durch nicht von Mecc Alte autorisiertem Personal; 3 Gebrauch oder Einsatz bei Konditionen die nicht der Norm von Mecc Alte entsprechen; 4 Überlast Gebrauch oder Montage anders als wofür das Produkt bestimmt ist. Die Garantie erlischt auch, wenn aus welchen Gründen auch immer, der Kunde in Zahlung überfällig ist.	A Mecc alte garantiza la buena construccion y calidad de los propios productos por 24 meses desde la fecha de salida de sus fabricas o de sus filiales. B Durante dicho periodo la Mecc Alte se obliga a reparar o sustituir a su cargo, en su establecimiento todas aquellas piezas que hubieran sido averiadas, sin hacerse cargo de otro tipo de danos, directos o indirectos. C La decision acerca del reconocimiento de garantia esta reservada exclusivamente a la Mecc Alte, previo examen de las partes averiadas que deberan permanecer en puerto franco o en su propia sede de Vicenza. D Todos los eventuales gastos de transporte, viaje, transferencia o mano de obra, para el desmontaje y nuevo montaje, del alternador o elemento accionante seran siempre a cargo del usuario. E La garantia caduca si durante el periodo descrito se produjeran las siguientes anomalias: 1 almacenaje en lugar inadecuado; 2 reparacion o modificacion por personal no autorizado por Mecc Alte; 3 utilizacion o condiciones de manutencion que contravengan las normas establecidas por Mecc Alte; 4 sobrecarga o empleo en prestaciones distintas de aquellas para las que ha estado suministrado. La garantia cesa igualmente en el momento que el cliente sea moroso de pago, cualquiera que sea la razon.



ESlAlaska.com

Engine Manual

Anchorage:

7780 Old Seward Hwy
Anchorage, AK 99518
(907) 341-2250 | (877) 341-2250

Fairbanks:

1919 Van Horn Road
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(907) 458-9049 | (888) 868-9049

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Tukwilla, WA 98188
(425) 251-6119

Williston:

5064 Bennett Loop
Williston, ND 58801
(701) 774-5312

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KUBOTA

U.S.A. : **KUBOTA ENGINE AMERICA CORPORATION**
505 Schelter Road, Lincolnshire, Illinois 60069 U.S.A.
Telephone : (847)955-2500

Canada : **KUBOTA CANADA LTD.**
5900 14th Avenue, Markham, Ontario, L3S 4K4, Canada
Telephone : (905)294-7477

France : **KUBOTA EUROPE S.A.S**
19-25, Rue Jules Verne, Z.I. BP88, 95101 Argenteuil Cedex, France
Telephone : (33)1-3426-3434

Italy : **KUBOTA EUROPE S.A.S Italy Branch**
Via Grandi, 29 20068 Peschiera Borrome (MI) Italy
Telephone : (39)02-51650377

Germany : **KUBOTA (DEUTSCHLAND) GmbH**
Senefelder Str. 3-5 63110 Rodgau /Nieder-Roden, Germany
Telephone : (49)6106-873-0

U.K. : **KUBOTA (U.K.) LTD.**
Dormer Road, Thame, Oxfordshire, OX9 3UN, U.K.
Telephone : (44)1844-214500

Australia : **KUBOTA AUSTRALIA PTY LTD.**
25-29 Permas Way, Truganina, VIC 3029, Australia
Telephone : (61)-3-9394-4400

Malaysia : **KUBOTA MALAYSIA SDN. BHD.**
Lot 766, Jalan Subang 4, off Persiaran Subang Sungai Penaga Industrial Park,
47500 Subang Jaya
Telephone : (60)-3-7890-3533

Philippines : **KUBOTA PHILIPPINES, INC.**
232 Quirino Highway, Baesa, Quezon City 1106, Philippines
Telephone : (63)2-422-3500

Indonesia : **P.T. KUBOTA INDONESIA**
Taman Industri Bukit Semarang Baru(BSB) Blok D.1 Kav.8, Kel. Jatibarang-
Kec.Mijen, Semarang, Indonesia
Telephone : (62)-24-7472649

Japan : **KUBOTA Corporation**
Engine Export Dept.
2-47, Shikitsuhigashi 1-chome, Naniwa-ku, Osaka, Japan 556-8601
Telephone : (81)6-6648-2155 Fax : (81)6-6648-3521

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OPERATOR'S MANUAL KUBOTA LIQUID COOLED GASOLINE/LPG ENGINE

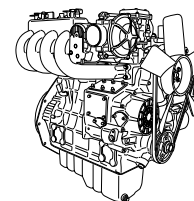
MANUEL DE L'OPERATEUR MOTEUR À ESSENCE/LPG REFROIDI PAR LIQUIDE DE KUBOTA

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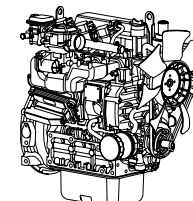
MANUALE DELL'OPERATORE MOTORE KUBOTA A BENZINA/LPG CON RAFFREDDAMENTO A LIQUIDO

MANUAL DE INSTRUCCIONES MOTOR KUBOTA DE GASOLINA/LPG REFRIGERADO POR LÍQUIDO

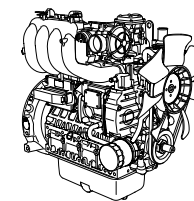
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WG1605-GL-E3	WG1903-GL-E3	WG2503-GL-E3	WG3800-GL-E3
WG1605-N-E3	WG1903-N-E3	WG2503-N-E3	WG3800-N-E3
WG1605-LN-E3	WG1903-LN-E3	WG2503-LN-E3	WG3800-LN-E3
			WG3800-L-E5



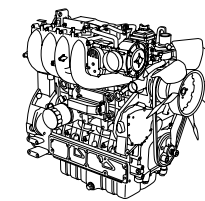
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1BGA AIA P0220



1BGA AIA P0440

READ AND SAVE THIS BOOK
MANUEL A LIRE ET A CONSERVER
DIESE ANLEITUNG BITTE SORGFÄLTIG DURCHLESEN
UND GRIFFBEREIT AUFBEWAHREN
LEGGETE E CONSERVATE QUESTO MANUALE
LEAN Y CONSERVEN ESTE MANUAL

California Proposition 65

**WARNING**

Engine exhaust, some of its constituents, certain vehicle components and fluids, contain or emit chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

WG1605-G-E3/WG1605-L-E3/WG1605-GL-E3/WG1605-N-E3/WG1605-LN-E3
WG1903-G-E3/WG1903-L-E3/WG1903-GL-E3/WG1903-N-E3/WG1903-LN-E3
WG2503-G-E3/WG2503-L-E3/WG2503-GL-E3/WG2503-N-E3/WG2503-LN-E3
WG3800-G-E3/WG3800-L-E3/WG3800-GL-E3/WG3800-N-E3/WG3800-LN-E3
WG3800-L-E5
AY. J. 19-37. 12. K

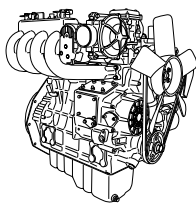
OPERATOR'S MANUAL

KUBOTA

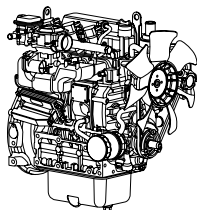
LIQUID COOLED GASOLINE/LPG ENGINE

MODELS

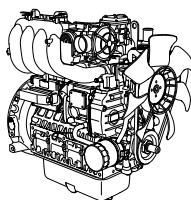
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WG1605-L-E3	WG1903-L-E3	WG2503-L-E3	WG3800-L-E3
WG1605-GL-E3	WG1903-GL-E3	WG2503-GL-E3	WG3800-GL-E3
WG1605-N-E3	WG1903-N-E3	WG2503-N-E3	WG3800-N-E3
WG1605-LN-E3	WG1903-LN-E3	WG2503-LN-E3	WG3800-LN-E3
			WG3800-L-E5



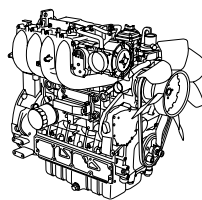
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READ AND SAVE THIS BOOK

Kubota

FOREWORD

You are now the proud owner of a KUBOTA Engine. This engine is a product of KUBOTA quality engineering and manufacturing. It is made of fine materials and under a rigid quality control system. It will give you long, satisfactory service. To obtain the best use of your engine, please read this manual carefully. It will help you become familiar with the operation of the engine and contains many helpful hints about engine maintenance. It is KUBOTA's policy to utilize as quickly as possible every advance in our research. The immediate use of new techniques in the manufacture of products may cause some small parts of this manual to be outdated. KUBOTA distributors and dealers will have the most up-to-date information. Please do not hesitate to consult with them.



SAFETY FIRST

This symbol, the industry's "Safety Alert Symbol", is used throughout this manual and on labels on the machine itself to warn of the possibility of personal injury. Read these instructions carefully. It is essential that you read the instructions and safety regulations before you attempt to assemble or use this unit.



DANGER : Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



WARNING : Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION : Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

IMPORTANT : Indicates that equipment or property damage could result if instructions are not followed.

NOTE : Gives helpful information.

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SAFE OPERATION

Careful operation is your best assurance against an accident. Read and understand this section carefully before operating the engine. All operators, no matter how much experience they may have, should read this and other related manuals before operating the engine or any equipment attached to it. It is the owner's obligation to provide all operators with this information and instruct them on safe operation.

Be sure to observe the following for safe operation.

1. OBSERVE SAFETY INSTRUCTIONS

- Read and understand carefully this "OPERATOR'S MANUAL" and "LABELS ON THE ENGINE" before attempting to start and operate the engine.
- Learn how to operate and work safely. Know your equipment and its limitations. Always keep the engine in good condition.
- Before allowing other people to use your engine, explain how to operate and have them read this manual before operation.
- DO NOT modify the engine. UNAUTHORIZED MODIFICATIONS to the engine may impair the function and/or safety and affect engine life. If the engine does not perform properly, consult your local Kubota Engine Distributor first.



1AAACAAAP008B

2. WEAR SAFE CLOTHING AND PERSONAL PROTECTIVE EQUIPMENT (PPE)

- DO NOT wear loose, torn or bulky clothing around the machine that may catch on working controls and projections or into fans, pulleys and other moving parts causing personal injury.
- Use additional safety items-PPE, e.g. hard hat, safety protection, safety goggles, gloves, etc., as appropriate or required.
- DO NOT operate the machine or any equipment attached to it while under the influence of alcohol, medication, or other drugs, or while fatigued.
- DO NOT wear radio or music headphones while operating the engine.



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3. CHECK BEFORE STARTING & OPERATING THE ENGINE

- Be sure to inspect the engine before operation. Do not operate the engine if there is something wrong with it. Repair it immediately.
- Ensure all guards and shields are in place before operating the engine. Replace any that are damaged or missing.
- Check to see that you and others are a safe distance from the engine before starting.
- Always keep the engine at least 3 feet (1 meter) away from buildings and other facilities.
- DO NOT allow children or livestock to approach the machine while the engine is running.
- DO NOT start the engine by shorting across starter terminals. 1BAABADAP0010



4. KEEP THE ENGINE AND SURROUNDINGS CLEAN

- Be sure to stop the engine before cleaning.
- Keep the engine clean and free of accumulated dirt, grease and trash to avoid a fire. Store flammable fluids in proper containers and cabinets away from sparks and heat.
- Check for and repair leaks immediately.
- DO NOT stop the engine without idling; Allow the engine to cool down, first. Keep the engine idling for about 5 minutes before stopping unless there is a safety problem that requires immediate shut down. 1AEAAAAAP0120



5. SAFE HANDLING OF FUEL AND LUBRICANTS -KEEP AWAY FROM FIRE

- Always stop the engine before refueling and/or lubricating.
- DO NOT smoke or allow flames or sparks in your work area. Fuel is extremely flammable and explosive under certain conditions.
- Refuel at a well ventilated and open place. When fuel and/or lubricants are spilled, refuel after letting the engine cool down.
- Do not use unapproved containers e.g. buckets, bottles, jars. Use approved fuel storage containers and dispensers. 1BGAAAIAP013A



- If running the engine on LPG, use the standard LPG fuel recommended by KUBOTA. The use of other fuel may cause a hazardous or dangerous condition.
- LPG fuel in the gaseous state is heavier than air and will settle in low areas, this may be hazardous.
Please follow all operator's manual instructions when changing the fuel tank and servicing the fuel system.

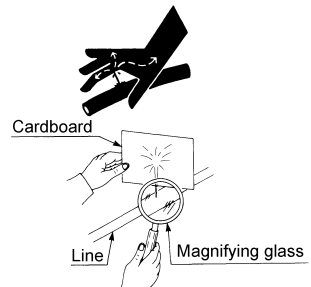
6. EXHAUST GASES & FIRE PREVENTION

- Engine exhaust fumes can be very harmful if allowed to accumulate. Be sure to run the engine in a well ventilated location and where there are no people or livestock near the engine.
- The exhaust gas from the muffler is very hot. To prevent a fire, do not expose dry grass, mowed grass, oil or any other combustible materials to exhaust gas. Keep the engine and muffler clean at all times.
- To avoid a fire, be alert for leaks of flammable substances from hoses and lines. Be sure to check for leaks from hoses or pipes, such as fuel and hydraulic fluid by following the maintenance check list.
- To avoid a fire, do not short across power cables and wires. Check to see that all power cables and wirings are in good condition. Keep all electrical connections clean. Bare wire or frayed insulation can cause a dangerous electrical shock and personal injury.



7. ESCAPING FLUID

- Relieve all pressure in the air, the oil and the cooling systems before disconnecting any lines, fittings or related items.
- Be cautious of possible pressure relief when disconnecting any device from a pressurized system that utilizes pressure. DO NOT check for pressure leaks with your hand. High pressure oil or fuel can cause personal injury.
- Escaping fluid under pressure has sufficient force to penetrate skin causing serious personal injury.
- Fluid escaping from pinholes may be invisible. Use a piece of cardboard or wood to search for suspected leaks: do not use hands and body. Use safety goggles or other eye protection when checking for leaks.
- If injured by escaping fluid, see a medical doctor immediately. This fluid can produce gangrene or severe allergic reaction.



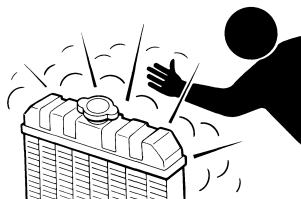
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8. CAUTIONS AGAINST BURNS & BATTERY EXPLOSION

- To avoid burns, be cautious of hot components, e.g. muffler, muffler cover, radiator, hoses, engine body, coolants, engine oil, etc. during operation and after the engine has been shut off.
- DO NOT remove the radiator cap while the engine is running or immediately after stopping. Otherwise hot water will spout out from the radiator. Wait until the radiator is completely cool to the touch before removing the cap. Wear safety goggles.
- Be sure to close the coolant drain valve, secure the pressure cap, and fasten the pipe band before operating. If these parts are taken off, or loosened, it will result in serious personal injury.
- The battery presents an explosive hazard. When the battery is being charged, hydrogen and oxygen gases are extremely explosive.
- DO NOT use or charge the battery if its fluid level is below the LOWER mark.
Otherwise, the component parts may deteriorate earlier than expected, which may shorten the service life or cause an explosion. Immediately, add distilled water until the fluid level is between the UPPER and LOWER marks.
- Keep sparks and open flames away from the battery, especially during charging. DO NOT strike a match near the battery.
- DO NOT check the battery charge by placing a metal object across the terminals. Use a voltmeter or hydrometer.
- DO NOT charge a frozen battery. There is a risk of explosion. When frozen, warm the battery up to at least 16°C (61°F).



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9. KEEP HANDS AND BODY AWAY FROM ROTATING PARTS

- Be sure to stop the engine before checking or adjusting the belt tension and cooling fan.
- Keep your hands and body away from rotating parts, such as the cooling fan, V-belt, fan drive pulley or flywheel. Contact with rotating parts can cause severe personal injury.
- DO NOT run the engine without safety guards. Install safety guards securely before operation.



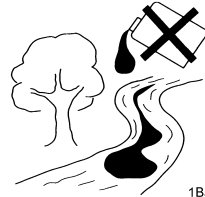
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10. ANTI-FREEZE & DISPOSAL OF FLUIDS

- Anti-freeze is poisonous. If it is swallowed, seek immediate medical help. Do NOT make a person throw up unless told to do so by poison control or a health care professional. Use standard first aid and CPR for signs of shock or cardiac arrest. Call your local Poison Control Center or your local emergency number for further assistance.
- Wear rubber gloves to avoid personal injury, when you treat anti-freeze. In case of contact with skin, wash it off immediately.
- DO NOT mix different types of Anti-freeze. The mixture can produce a chemical reaction causing harmful substances. Use approved or genuine KUBOTA Anti-freeze.
- Be mindful of the environment and the ecology. Before draining any fluids, determine the correct way to dispose of them. Observe the relevant environmental protection regulations when disposing of oil, fuel, coolant, brake fluid, filters and batteries.
- When draining fluids from the engine, place a suitable container underneath the engine body.
- DO NOT pour waste onto the ground, down a drain, or into any water source. Dispose of waste fluids according to environmental regulations.



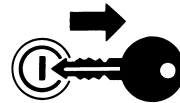
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11. CONDUCTING SAFETY CHECKS & MAINTENANCE

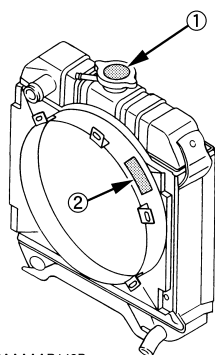
- When inspecting the engine or servicing, place the engine on a large flat surface. DO NOT work on anything that is supported ONLY by lift jacks or a hoist. Always use blocks or the correct stands to support the engine before servicing.
- Disconnect the battery from the engine before conducting service. Put a "DO NOT OPERATE!" tag on the key switch to avoid accidental starting.
- To avoid sparks from an accidental short circuit always disconnect the battery's ground cable (-) first and reconnect it last.
- Be sure to stop the engine and remove the key when conducting daily and periodic maintenance, service and cleaning.
- Check or conduct maintenance after the engine, coolant, muffler, or muffler cover have cooled off completely.
- Always use the appropriate tools and fixtures. Verify that they are in good condition before performing any service work. Make sure you understand how to use them before service.
- Use ONLY correct engine barring techniques for manually rotating the engine. DO NOT attempt to rotate the engine by pulling or prying on the cooling fan and V-belt. This practice can cause serious personal injury or premature damage to the cooling fan and belt.



1BJABAAAP0200

- Replace fuel pipes and lubricant pipes with their hose clamps every 2 years or earlier whether they are damaged or not. They are made of rubber and age gradually.
- When servicing is performed together by two or more persons, take care to perform all work safely.
- Keep a first aid kit and fire extinguisher handy at all times.

12. WARNING AND CAUTION LABELS



1ABAAAAAP148B

- ① Part No. 19077-8724-1 or 16667-8724-1
(55mm in diameter) (37mm in deameter)



1ABACAAAP036K

- ② Part No. TA040-4957-1
Do not get your hands close to engine fan and fan belt.



1AGAMAAAP2620

13. CARE OF WARNING AND CAUTION LABELS

1. Keep warning and caution labels clean and free from obstructing material.
2. Clean warning and caution labels with soap and water, dry with a soft cloth.
3. Replace damaged or missing warning and caution labels with new labels from your local KUBOTA dealer.
4. If a component with warning and caution label(s) affixed is replaced with a new part, make sure the new label(s) is (are) attached in the same location(s) as the replaced component.
5. Mount new warning and caution labels by applying to a clean dry surface and pressing any bubbles to the outside edge.

ENGINE MODEL

This is the instruction manual for Kubota LSI (Large Spark Ignited) engines.
The engines are classified as follows.

Engine	Fuel	Emission
WG1605	-G	-
WG1605	-G	-E3
WG1605	-L	-
WG1605	-L	-E3
WG1605	-GL	-
WG1605	-GL	-E3
WG1605	-N	-
WG1605	-N	-E3
WG1605	-LN	-
WG1605	-LN	-E3
WG1903	-G	-
WG1903	-G	-E3
WG1903	-L	-
WG1903	-L	-E3

Engine	Fuel	Emission
WG1903	-GL	-
WG1903	-GL	-E3
WG1903	-N	-
WG1903	-N	-E3
WG1903	-LN	-
WG1903	-LN	-E3
WG2503	-G	-
WG2503	-G	-E3
WG2503	-L	-
WG2503	-L	-E3
WG2503	-GL	-
WG2503	-GL	-E3
WG2503	-N	-
WG2503	-N	-E3

Engine	Fuel	Emission
WG2503	-LN	-
WG2503	-LN	-E3
WG3800	-G	-
WG3800	-G	-E3
WG3800	-L	-
WG3800	-L	-E3
WG3800	-L	-E5
WG3800	-GL	-
WG3800	-GL	-E3
WG3800	-N	-
WG3800	-N	-E3
WG3800	-LN	-
WG3800	-LN	-E3

Engine Model: WG1605, WG1903, WG2503, WG3800

Fuel Type

G: This engine can be operated on unleaded gasoline.

L: This engine can be operated on commercial propane gas.

GL: This engine can be operated on unleaded gasoline and commercial propane gas.

N: This engine can be operated on commercial natural gas.

LN: This engine can be operated on commercial propane gas and commercial natural gas.

Emission Regulation Model

-: Exhaust emission regulations non-certified model

E3: WG1605, WG1903, WG2503

This engine is certified of U.S. EPA Tier 2 and CARB Tier 3 exhaust emission regulations.

And/or this engine is certified of EU Stage V exhaust emission regulations.

WG3800

This engine is certified of U.S. EPA Tier 2 and CARB Tier 3 exhaust emission regulations.

And/or this engine is certified of EU Stage V (P<56kW) exhaust emission regulations.

E5:WG3800

This engine is certified of U.S. EPA Tier 2 and CARB Tier 3 exhaust emission regulations.

And/or this engine is certified of EU Stage V (P≥56kW) exhaust emission regulations.

For the WG1605, WG1903, WG2503 and WG3800 engines, refer to their respective instructions. For the gasoline-powered engines, refer to the corresponding "G" or "Gasoline" pages. For the LPG-powered engines, refer to the corresponding "L" or "LPG" pages. For the natural-gas-powered engines, refer to the corresponding "N" or "Natural Gas" pages. For the Model E3 and Model E5 engines, refer to the corresponding "E3" and "E5" pages, respectively. All the other descriptions than above are common for all the models.

SERVICING OF THE ENGINE

Your dealer is interested in your new engine and has the desire to help you get the most value from it. After reading this manual thoroughly, you will find that you can do some of the regular maintenance yourself.

However, when in need of parts or major service, be sure to see your KUBOTA dealer.

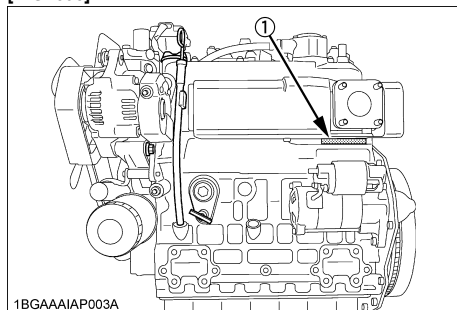
For service, contact the KUBOTA Dealership from which you purchased your engine or your local KUBOTA dealer.

When in need of parts, be prepared to give your dealer the engine serial number.

Locate the serial number now and record them in the space provided.

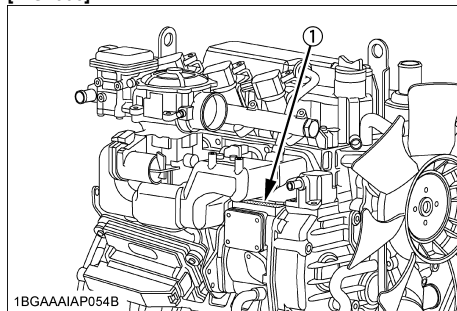
	Type	Serial No.
Engine		
Date of Purchase		
Name of Dealer		
(To be filled in by purchaser)		

[WG1605]



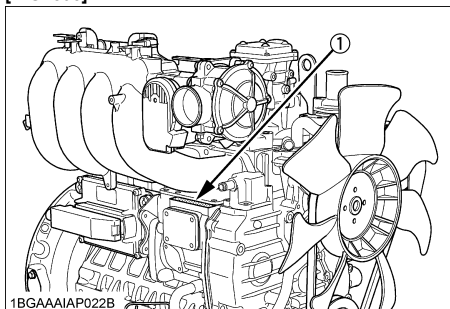
(1) Engine serial number

[WG1903]



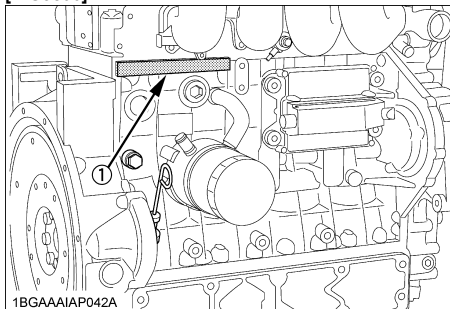
(1) Engine serial number

[WG2503]



(1) Engine serial number

[WG3800]



(1) Engine serial number

IMPORTANT INFORMATION OF EMISSION REGULATION

To conform to U.S. EPA Tier 2, CARB Tier 3 and/or EU stage V emission regulations, the following standards must be followed before using the E3 and E5 engine.

1. EXHAUST SYSTEM (COMMON)

EACH ENGINE MUST USE THE BELOW CATALYTIC PARTS.

ENGINE MODEL	GENUINE PART	PART No.
WG1605	CATALYTIC CONVERTER	EG523-1212△
	CATALYTIC MUFFLER	EG526-1211△ or EG541-1211△
WG1903	CATALYTIC CONVERTER	EG523-1212△
WG2503	CATALYTIC CONVERTER	EG543-1212△
	CATALYTIC MUFFLER	EG541-1211△
WG3800	CATALYTIC CONVERTER	EG504-1212△

Any modifications to the fuel system or any adjustments made on this engine will cause this engine to be in non-compliance with emission regulations.

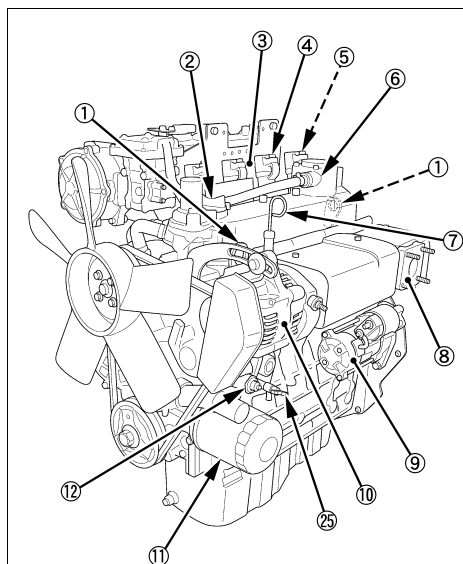
2. LPG REGULATOR WITH VAPORIZER (L, GL, LN engines,)

When operating L, GL, LN engines, only a KUBOTA genuine regulator assy (D-STAGE) and lock off valve with LPG filter can be used.

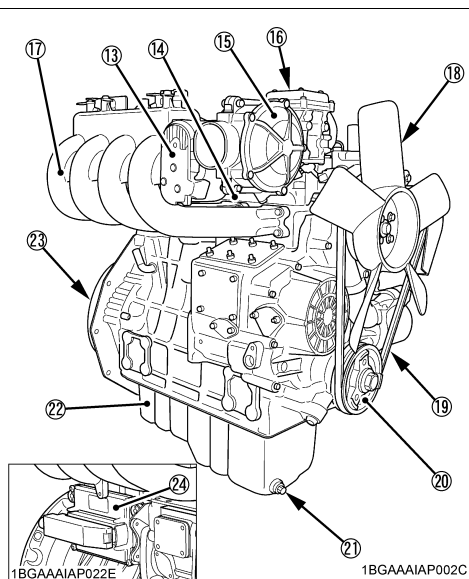
Only this regulator assy (D-STAGE) and lock off valve with LPG filter can be installed by an authorized KUBOTA DISTRIBUTOR or the manufacturer of the equipment in which this engine is used.

NAMES OF PARTS

[WG1605]



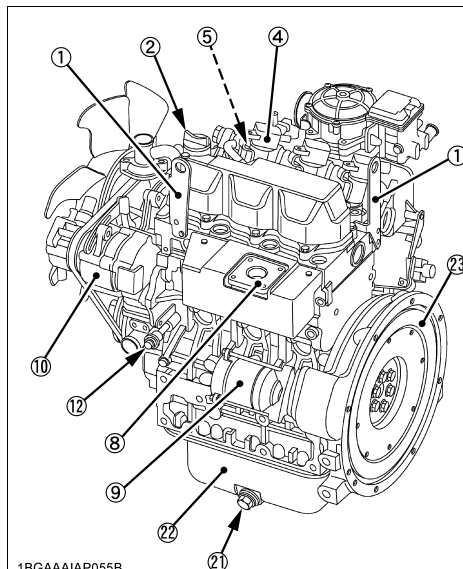
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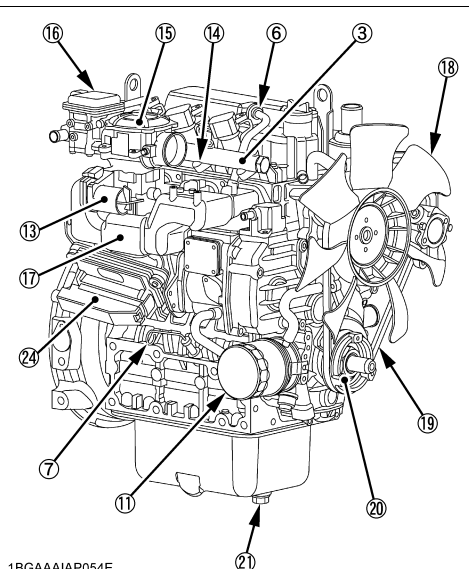
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[WG1903]

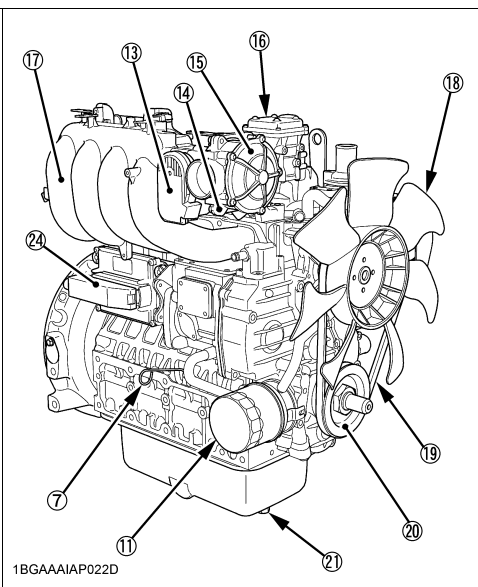
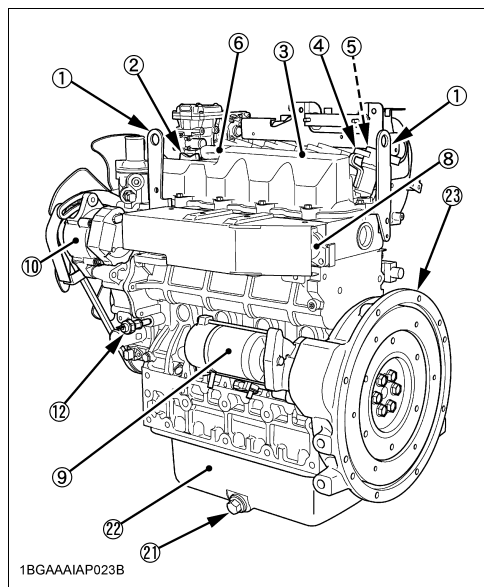


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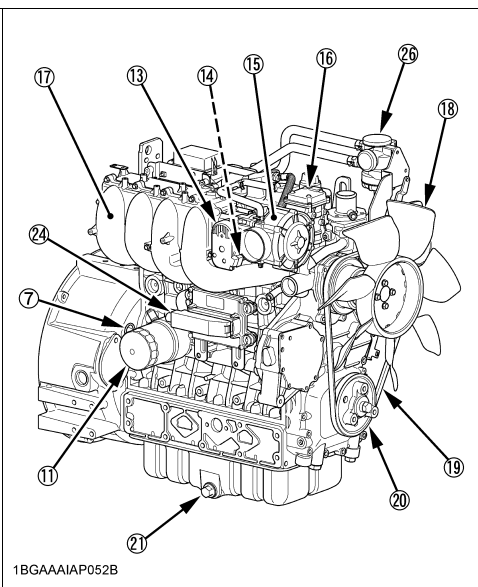
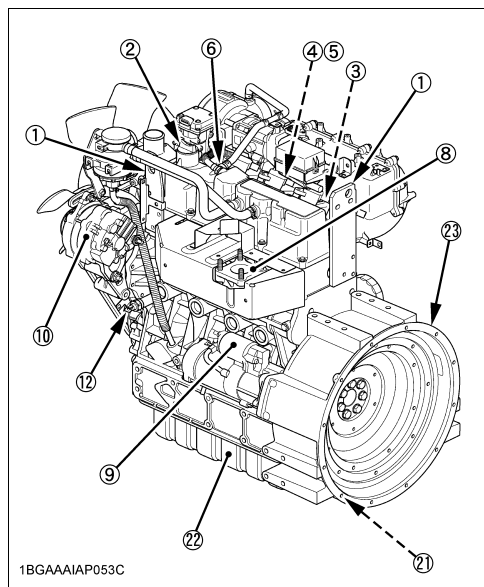


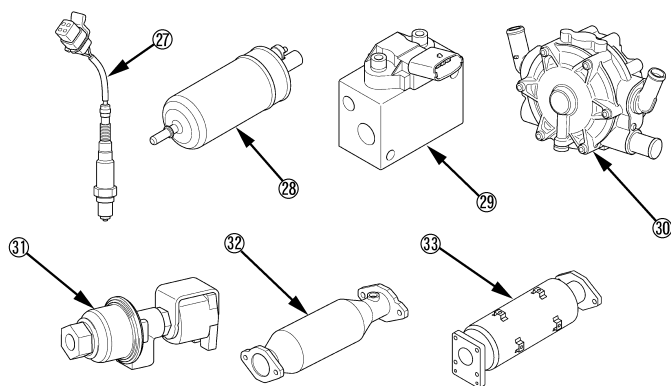
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[WG2503]



[WG3800]





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Ref. No.	Part Name	Remarks	Ref. No.	Part Name	Remarks
1	Engine hook		18	Cooling fan	
2	Oil filler plug		19	Fan belt	
3	Delivery pipe (gasoline)	Only G and GL type engines	20	Fan drive pulley	
4	Ignition coil		21	Oil drain plug	
5	Spark plug		22	Oil pan	
6	PCV valve		23	Flywheel	
7	Oil level gauge		24	ECU (Engine control unit)	
8	Exhaust manifold		25	Coolant drain shutoff-valve	Only WG1605
9	Starter		26	Oil separator	Only WG3800-L/N/LN *1
10	Alternator		27	Sensor (O2)	
11	Oil filter cartridge		28	Fuel pump	Only G and GL type engines
12	Oil pressure switch		29	Manifold (FPM)	Only G and GL type engines
13	Electronic control throttle		30	Regulator assy (D-STAGE)	Only L, GL and LN type engines *2
14	Injector	Only G and GL type engines	31	Lock off valve	
15	Gas mixer	Other than G type engine	32	Catalytic converter	or catalytic muffler
16	Pressure regulator	Other than G type engine	33	Catalytic muffler	or catalytic converter
17	Intake manifold				

NOTE :

- Gas mixer of WG1903, WG2503 and WG3800 has two models.
N and LN type's gas mixer are different from L and GL type.
- The part marked *1 is optional. It is required for continuous operation over 15 hours (day and night) ex. Generator Pump.
- *2 In case of N type, if the supply pressure of natural gas is more than 5 kPa, regulator assy (D-STAGE) is necessary.

PRE-OPERATION CHECK

BREAK-IN

- During the engine break-in period, observe the following by all means:
1. Change engine oil and oil filter cartridge after the first 50 hours of operation. (See "ENGINE OIL" in "PERIODIC SERVICE" section.)
 2. When ambient temperature is low, operate the machine after the engine has been completely warmed up.

DAILY CHECK

To prevent trouble from occurring, it is important to know the conditions of the engine well. Check it before starting.



WARNING

To avoid personal injury or death:

- Be sure to install shields and safeguards attached to the engine when operating.
- Stop the engine at a flat and wide space when checking.
- Keep dust or fuel away from the battery, wiring, muffler and engine to prevent a fire. Check and clear them before operating everyday. Pay attention to the heat of the exhaust pipe or exhaust gas so that it can not ignite trash.

Item		Ref. page
1. Parts which had trouble in previous operation		-
2. By walking around the machine	(1) Oil or water leaks	15 to 20
	(2) Engine oil level and contamination	15, 16
	(3) Amount of fuel	14
	(4) Amount of coolant	18 to 20
	(5) Dust in air cleaner dust cup	21
	(6) Damaged parts and loosened bolts and nuts	-
3. By inserting the key into the starter switch	(1) Proper functions of meters and pilot lamps; no stains on these parts	-
4. By starting the engine	(1) Unusual engine noise	10
	(2) Engine start-up condition	8
	(3) Slow-down and acceleration behavior	10

OPERATING THE ENGINE

STARTING THE ENGINE (NORMAL)



WARNING

To avoid personal injury or death:

- Do not allow children to approach the machine while the engine is running.
- Be sure to install the machine on which the engine is installed, on a flat place.
- Do not run the engine on gradients.
- Do not run the engine in an enclosed area. Exhaust gas can cause air pollution and exhaust gas poisoning.
- Keep your hands away from rotating parts (such as fan, pulley, belt, flywheel etc.) during operation.
- Do not operate the machine while under the influence of alcohol or drugs.
- Do not wear loose, torn or bulky clothing around the machine. It may catch on moving parts or controls, leading to the risk of accident. Use additional safety items, e.g. hard hat, safety boots or shoes, eye and hearing protection, gloves, etc., as appropriate or required.
- Do not wear radio or music headphones while operating engine.
- Check to see if it is safe around the engine before starting.
- Reinstall safeguards and shields securely and clear all maintenance tools when starting the engine after maintenance.

IMPORTANT :

- When starting the engine after a long storage (of more than 3 months), activate the starter for about 10 seconds to allow oil to reach every engine part.

Gasoline

- 1*. Turn the fuel selector switch* to the "GASOLINE" position.

NOTE:

*The step 1 above is for GL type only.

*The fuel selector switch is not provided by KUBOTA.

Proceed to step 3.

Natural Gas

1. Open the withdrawal valve of the NG supply.
- 2*. Turn the fuel selector switch* to the "NG" position.

NOTE:

*The step 2 above is for LN type only.

*The fuel selector switch is not provided by KUBOTA.

Proceed to step 3.

LPG

1. Open the liquid withdrawal valve of the LPG fuel tank.
- 2*. Turn the fuel selector switch* to the "LPG" position.

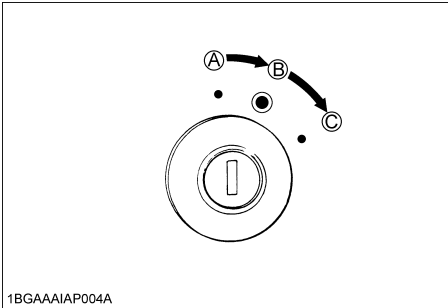
NOTE:

*The step 2 above is for GL and LN type.

*The fuel selector switch is not provided by KUBOTA.

Proceed to step 3.

3. Insert the key into the starter switch and turn it to the "ON" (●) position.



(A) "OFF"
(B) "ON"
(C) "START"

4. Check to see that MIL (Malfunction Indicator Light) is ON.
5. Turn the key to the "START" position and the starter will begin turning. Release the key immediately, when the engine starts.
6. Check to see that MIL (Malfunction Indicator Light) is OFF. If not, immediately stop the engine and check the cause.
7. Warm up the engine at medium speed running for 3 to 5 minutes.

IMPORTANT :

- Be sure to warm up the engine not only in winter but also in other warmer seasons.
- In case of converting the fuel (gasoline ↔ LPG) while running the engine, the engine should be operated with the engine speed high and no-loaded. If you convert the fuel with the engine speed low, the engine will stop.

STOPPING THE ENGINE

Gasoline

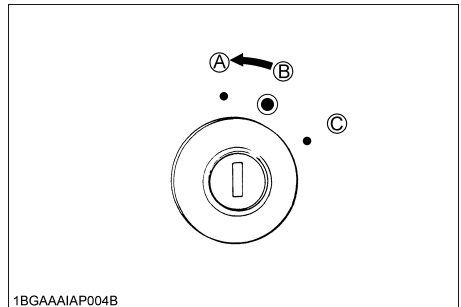
1. Cool down the engine for 2 to 3 minutes.
2. Turn the starter switch to the "OFF" (●) position.
3. Remove the key at the "OFF" position.

Natural Gas

1. Cool down the engine for 2 to 3 minutes.
2. Turn the starter switch to the "OFF" (●) position.
3. Close the withdrawal valve of the NG supply.
4. Remove the key at the "OFF" position.

LPG

1. Cool down the engine for 2 to 3 minutes.
2. Turn the starter switch to the "OFF" (●) position.
3. Close the liquid withdrawal valve of the LPG fuel tank.
4. Remove the key at the "OFF" position.



(A) "OFF"
(B) "ON"
(C) "START"

CHECKS DURING OPERATION

While running, make the following checks to see that all parts are working correctly.

■ Radiator cooling water (Coolant)



WARNING

To avoid personal injury or death:

- **Do not remove radiator cap until coolant temperature is well below its boiling point. Then loosen cap slightly to the stop position, to relieve any pressure, before removing cap completely.**

If the coolant temperature warning lamp lights up or if steam or coolant does not stop squirting from the radiator overflow pipe, turn off the load and **keep the engine idling (COOLING-DOWN) for at least 5 minutes** to let it cool down gradually. Then stop the engine and take the following inspection and servicing.

1. Check to see if the coolant runs short or if there is any coolant leak;
2. Check to see if there is any obstacle around the cooling air inlet or outlet;
3. Check to see if there is any dirt or dust between radiator fins and tube;
4. Check to see if the fan belt is too loose; and
5. Check to see if radiator water pipe is clogged.

■ Oil pressure lamp

The lamp lights up to warn the operator that the engine oil pressure has dropped below the prescribed level. If this should happen during operation or should not go off even after the engine is accelerated more than 1000rpm, immediately stop the engine and check the following:

1. Engine oil level (See "ENGINE OIL" in "PERIODIC SERVICE" section.)

■ Immediately stop the engine if;

- The engine suddenly slows down or accelerates.
- Unusual noises are suddenly heard.

■ If MIL (Malfunction Indicator Light) lights up:

Consult your KUBOTA dealer.

EMISSION CONTROL SYSTEM

- Operate, use and maintain the engine, including the emission control system in accordance with the instructions provided to the end users, so that the engine's emissions performance is kept within the requirements applicable to the engine's category.
- Do not deliberately tamper, or misuse, the engine emission control system, especially with regard to deactivating or not maintaining an exhaust gas recirculation (EGR) system or a reagent dosing system.
- When a warning indicator lights up, the engine is experiencing trouble, which may also cause problems in the emission control system. Take prompt action and rectify any incorrect operation, use, or maintenance of the emission control system in accordance with the rectification measures. (See "TROUBLESHOOTING" or, where applicable, "OPERATOR WARNING AND INDUCEMENT".

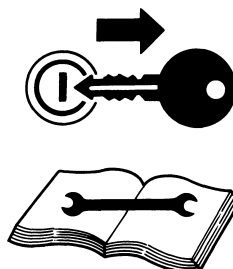
MAINTENANCE



WARNING

To avoid personal injury or death:

- Be sure to conduct daily checks, periodic maintenance, refueling or cleaning on a level surface with the engine shut off and remove the key.
- Before allowing other people to use your engine, explain how to operate, and have them read this manual before operation.
- Always use proper tools, that are in good condition. Make sure you understand how to use them, before performing any service work.
- When installing, be sure to tighten all bolts lest they should be loose. Tighten the bolts by the specified torque.
- Do not put any tools on the battery, or battery terminals may short out. Severe burns or fire could result. Detach the battery from the engine before maintenance.
- Do not touch muffler or exhaust pipes while they are hot; Severe burns could result.



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1ABAAAAAP1280

SERVICE INTERVALS

Non-warranty maintenance, repair, or replacement of the emission control devices and systems should be performed by a qualified repair establishment or individual which has the experience and equipment to perform such work.

See the Emission Warranty Statement.

In order to keep your engine in good working conditions, be sure to follow the maintenance / checking schedule given in the table below. (The schedule applies to an engine in use under normal conditions.)

Interval	Item		Ref. page	
Daily	Checking each part		-	
	Checking engine oil level		15	
	Checking fuel pipe and clamps connector		-	
	Checking fan belt		24	
	Checking fan belt with auto tensioner		-	
	Checking radiator coolant		18	
	Cleaning air cleaner element (if necessary)		21	
	Checking Fuel tank LPG line (if necessary)		14	
	Checking Fuel tank (NG) (if necessary)		15	
Every 50 hours	Checking fuel pipe and clamps		14	
Every 100 hours	Cleaning air cleaner element		21	
	Cleaning fuel filter		-	
	Adjusting fan belt tension (if necessary)		24	
	Replacing fuel filter (if necessary)		-	
	Cleaning spark plug (if necessary)		17	
	Adjusting spark plug (if necessary)		17	
Every 200 hours	WG1605, WG1903, WG2503	Changing engine oil	16	⊙
		Replacing oil filter cartridge	17	⊙
	Checking fuel tank LPG line		14	
	Checking fuel tank (NG)		15	
	Checking radiator hoses and clamp bands		19	
Every 400 hours	WG3800	Changing engine oil	16	⊙
		Replacing oil filter cartridge	17	⊙
Every 500 hours	Changing fan belt		24	
Every 1000 hours	Checking PCV valve		-	
	Checking hot water line of LPG vaporizer regulator		14	
	Checking hot water line of NG regulator		15	
	Checking LPG lock off valve		-	
	Adjusting valve clearance		-	*1
Every 1500 hours	Replacing oil separator element		25	
Every 2000 hours	Replacing spark plug		-	*2
Every 3000 hours	Replacing fan belt with auto tensioner		-	

Interval	Item	Ref. page	
Every year	Replacing air cleaner element	21	*3
	Checking intake pipe and clamp bands	-	
	Replacing fuel filter	-	
	Cleaning fuel tank (Gasoline line)	-	
	Checking fuel tank (NG)	15	
	Replacing fuel pipe and clamps (Gasoline line)	14	
	Cleaning radiator and water jacket	20	
Every 2 years	Replacing intake pipe and clamp bands	-	
	Replacing fuel pipe and clamps (LPG, NG line)	-	
	Replacing breather tube	-	
	Replacing hot water line of LPG vaporizer regulator	-	
	Replacing hot water line of NG regulator	-	
	Checking inner parts of LPG vaporizer regulator	-	*4
	Checking inner parts of NG regulator	-	*4
	Replacing radiator coolant	19	
	Replacing radiator hoses and clamp bands	19	
	Replacing rubber piping related oil separator	25	

IMPORTANT :

- The jobs indicated by ☉ must be done after the first 50 hours of operation.
- *1 If you do not have the proper tools and/or are not mechanically proficient, contact your local KUBOTA dealer.
No adjustment is needed on the models equipped with HLA (Hydraulic Lash Adjuster).
- *2 This is not necessary to keep the emission related warranty valid.
- *3 Change more often when operating under dusty conditions.
- *4 If you do not have the proper tools and/or are not mechanically proficient, contact your local KUBOTA dealer.
- To ensure the best quality and reliability, use new KUBOTA Genuine parts or their equivalents for repair and replacement, whenever you have maintenance done.

PERIODIC SERVICE

FUEL

Fuel is flammable and can be dangerous. You should handle fuel with care.

■ Gasoline

[Type:G, GL]

1. Use unleaded gasoline and E10 only.

IMPORTANT :

- DO NOT use gasoline blended with methyl alcohol.

■ Fuel level check and refueling

1. Check to see that the fuel level is above the lower limit of the fuel level gauge.
2. If the fuel is too low, add fuel to the upper limit. Do not overfill.

■ Checking the fuel pipes



WARNING

To avoid personal injury or death:

- Stop the engine before checking or replacing the fuel pipes. Broken fuel pipes can cause fires.

Check the fuel pipes every 50 hours of operation. When if;

1. If the clamp band is loose, apply oil to the screw of the band, and tighten the band securely.
2. If the fuel pipes, made of rubber, become worn out, replace them and clamp bands every year.
3. If the fuel pipes and clamp bands are found worn or damaged before one year passes, replace or repair them at once.

IMPORTANT :

- When the fuel pipes are not installed, plug them at both ends with clean cloth or paper to prevent dirt from entering. Dirt in the pipes can cause fuel injector malfunction.

NOTE :

- For the locations of fuel pipes, see "Fuel system diagrams" in "FUEL SYSTEM AND DIAGRAMS" section.

■ LPG

[Type:L, GL, LN]

1. Use Commercial LPG only.
2. Fuel tank is liquid withdrawal type.

IMPORTANT :

- Be sure that the fill up valve and the liquid withdrawal valve are closed.
- Be sure that LPG hose is connected with the liquid withdrawal valve.
- Be sure that LPG tank is placed firmly not to move by machine vibration.
(See "FUEL SYSTEM AND DIAGRAMS" section.)

■ LPG leakage check



WARNING

To avoid personal injury or death:

- Never test for gas leaks with a flame.

Turn on the gas at low idling rpm and use a soap solution or equivalent to check all connections for leaks between the fuel tank and D-EPR.

Bubbles will indicate a loose connection.

■ LPG fuel tank check

Check that LPG fuel tank is installed firmly.

Be sure that the fill up valve and liquid withdrawal valve of the LPG fuel tank can be opened and closed easily.

■ LPG regulator check

Check that the hot water lines are not leaking.

■ NG

[Type:N, LN]

1. Use Commercial Natural Gas (include CNG).
2. Consult Kubota for further info of fuel used.

NORTH AMERICA ONLY - For wellhead gas usage, please look at "Application Manual" or "Workshop Manual".

IMPORTANT :

- Be sure that fill up valve and the withdrawal valve.
- Be sure that CNG hose is connected with the withdrawal valve.
- Be sure that CNG tank is placed firmly not to move by machine vibration. (See "fuel system and diagrams" section)
- Filters that remove 99% of solids such as abrasive silicates-dirt, rust-scale, metallic shavings or welding debris from piping and fittings must be used to remove particulates larger than 1 micron from fuel before it enters the engine fuel system.

- Coalescing filters must be used whenever liquids i.e. water, hydrocarbons or sulfur-Hydrogen Sulfide (H₂S) are present in fuel. Removal of these liquids is essential to prevent poor engine performance and detonation. Excessive levels of Total Sulfur and H₂S will result in damage to internal parts and components of the engine by creating sulfuric acid when mixing with moisture inside the engine. Drain valves for trapped liquids on coalescing filters are to be automatic and have recovery vessel to prevent trapped liquids from being spilled on the ground or ingested back into the engine. Filters must be maintained according the filter manufacturer's recommendation in order to achieve rated filtration levels.
- DO NOT USE fuels that have total sulfur content greater than 11.4 mg/m³ (0.5/100 grain/ft³) or Hydrogen Sulfide (H₂S) content greater than 6 ppmv.
- If it is not known when the engine will be run next or will not be run for an extended period of time, it is required to clear residual gas from the engine. Residual gas may damage the engine components through corrosion especially if there is any presence of sulfur (e.g. sulfur may be present in wellhead gas). Also, if the engine has been emergency stopped or unexpectedly stopped while running, clearing the engine of residual gas for safety is mandatory. Shut off fuel supply, disconnect or disable the lock off valve and unplug all ignition coils and crank over engine for 8 seconds and rest, two times in a well ventilated area, in order to clear the residual gas. Failure to do so could result in unexpectedly igniting residual gas in the intake or exhaust systems, which can be dangerous.

■ NG leakage check



WARNING

To avoid personal injury or death:

- Never test for gas leaks with a flame.

Turn on the gas at low idling rpm and use a soap solution or equivalent to check all connections for leaks between NG supply source and D-EPR.

Bubbles will indicate a loose connection.

■ NG fuel tank check

Check that CNG fuel tank is installed firmly.

Be sure that the valve of the NG fuel supply can be opened and closed easily.

■ NG regulator check

Check the hot water lines are not leaking (when used).

■ NG line check

Be sure that a suitable NG fuel system dependent on NG fuel supply is installed.

The related parts and the method of installation should be approved for NG used and confirming to local regulations and all other standards.

ENGINE OIL



WARNING

To avoid personal injury or death:

- Be sure to stop the engine before checking and changing the engine oil and the oil filter cartridge.
- Contact with engine oil can damage your skin. Put on gloves when using engine oil. If you come in contact with engine oil, wash it off immediately.

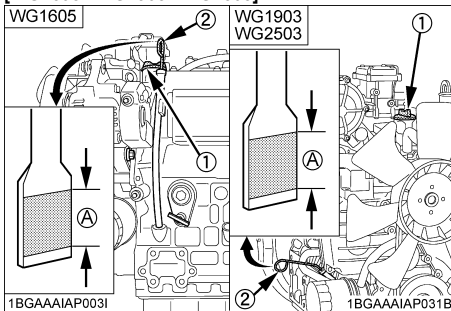
NOTE :

- Be sure to inspect the engine, locating it on a level place. If placed on gradients accurately, oil quantity may not be measured.

■ Checking oil level and adding engine oil

1. Check the engine oil level before starting or more than 5 minutes after stopping the engine.
2. Remove the oil level gauge, wipe it clean and reinstall it.
3. Take the oil level gauge out again, and check the oil level.

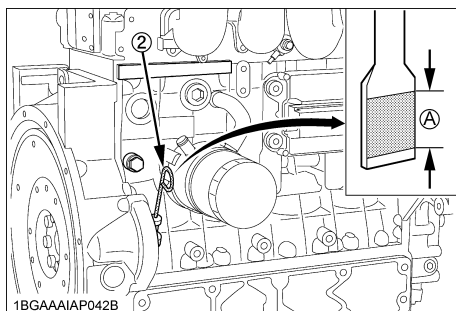
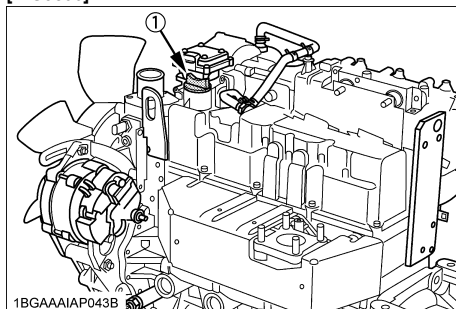
[WG1605 / WG1903 / WG2503]



- (1) Oil filler plug
(2) Oil level gauge

[Lower end of oil level gauge]
(A) Engine oil level within this range is proper.

[WG3800]



- (1) Oil filler plug [Lower end of oil level gauge]
 (2) Oil level gauge (A) Engine oil level within this range is proper.

- If the oil level is too low, remove the oil filler plug, and add new oil to the prescribed level.
- After adding oil, wait more than 5 minutes and check the oil level again. It takes some time for the oil to drain down to the oil pan.

Models	Engine oil quantity
WG1605	6.0 L (1.59 U.S.gals.)
WG1903	7.0 L (1.85 U.S.gals.)
WG2503	9.5 L (2.51 U.S.gals.)
WG3800	12.2 L (3.22 U.S.gals.)

IMPORTANT :

- Engine oil should have properties of API classification SL or higher.
- Change the type of engine oil according to the ambient temperature.

Above 25°C (77°F)	SAE30 or SAE10W-30 SAE15W-40
0°C to 25°C (32°F to 77°F)	SAE20 or SAE10W-30
0°C to -20°C (32°F to -4°F)	SAE10W or SAE10W-30
Below -20°C (-4°F)	SAE5W-30

- When using oil of different brands from the previous one, be sure to drain all the previous oil before adding the new engine oil.

■ Changing engine oil

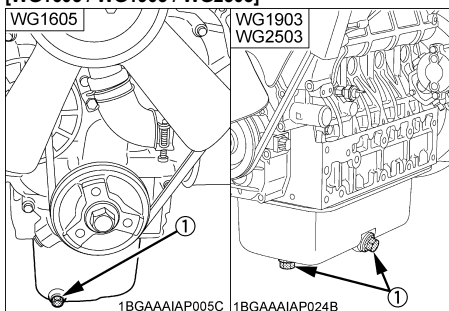
**WARNING**

To avoid personal injury or death:

- Be sure to stop the engine before draining engine oil.
- When draining engine oil, place some container underneath the engine and dispose it according to local regulations.
- Do not drain oil after running the engine. Allow engine to cool down sufficiently.

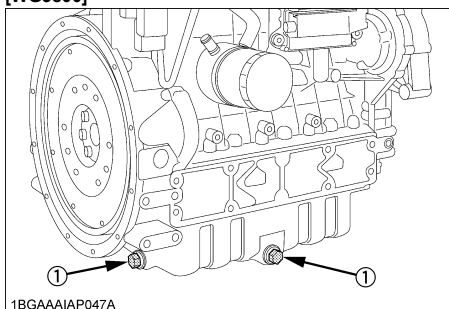
- Change oil after the initial 50 hours of operation and every 200 hours thereafter [WG1605, WG1903, WG2503] or every 400 hours thereafter [WG3800].
- Remove the drain plug at the bottom of the engine, and drain all the old oil. Drain oil will drain easier when the oil is warm.

[WG1605 / WG1903 / WG2503]



- (1) Oil drain plug

[WG3800]



- (1) Oil drain plug

3. Replace the drain plug gasket.
4. Add new engine oil up to the upper limit of the oil level gauge.

■ Replacing the oil filter cartridge



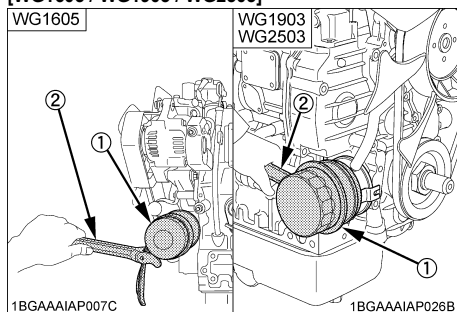
WARNING

To avoid personal injury or death:

- Be sure to stop the engine before changing the oil filter cartridge.
- Allow engine to cool down sufficiently, oil can be hot and cause burns.

1. Replace the oil filter cartridge after the initial 50 hours of operation and every 200 hours thereafter [WG1605, WG1903, WG2503] or every 400 hours thereafter [WG3800].
2. Remove the old oil filter cartridge with a filter wrench.
3. Apply a film of oil to the gasket for the new cartridge.
4. Screw in the cartridge by hand. When the gasket contacts the seal surface, tighten the cartridge enough by hand. Because, if you tighten the cartridge with a wrench, it will be tightened too much.

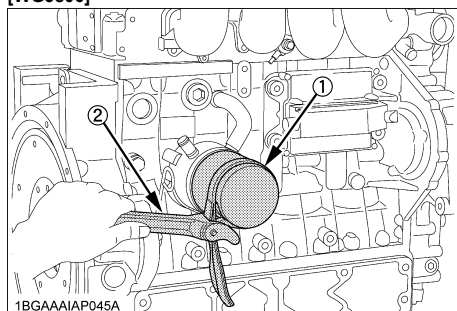
[WG1605 / WG1903 / WG2503]



(1) Oil filter cartridge

(2) Remove with a filter wrench
(Tighten with your hand)

[WG3800]



(1) Oil filter cartridge

(2) Remove with a filter wrench
(Tighten with your hand)

5. After the new cartridge has been replaced, the engine oil level normally decreases a little. Thus, run the engine for a while and check for oil leaks through the seal before checking the engine oil level. Add oil if necessary.

NOTE :

- Wipe off any oil sticking to the machine completely.

SPARK PLUG

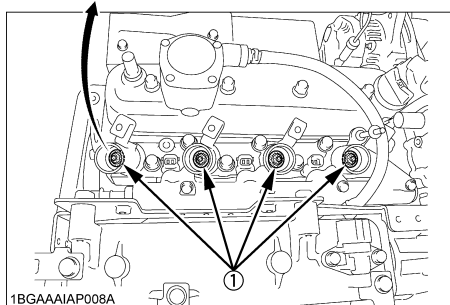
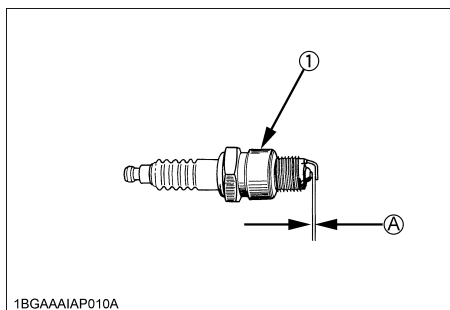
■ Cleaning and adjustment clearance

If the spark plug electrode or its insulator is soiled or is covered with deposited carbon, it may cause engine trouble. The soil, carbon deposits etc. can be brushed off using a wire brush.

After cleaning, be sure to adjust for proper clearance.

◆ Tightening Torque

25 to 30 N·m (2.5 to 3.0 kgf·m, 18.0 to 21.6 ft·lbs)



(1) Spark plug

(A) Clearance : 0.7 to 0.8 mm
(0.028 to 0.032 in.)

RADIATOR

Coolant will last for one day's work if filled all the way up before operation start. Make it a rule to check the coolant level before every operation.



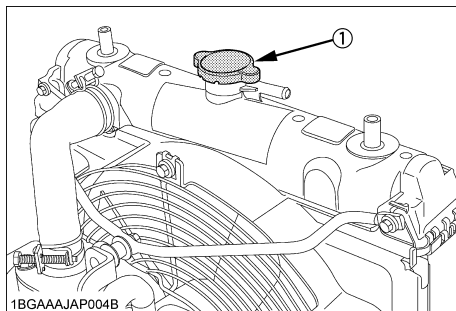
WARNING

To avoid personal injury or death:

- Do not stop the engine suddenly, stop it after about 5 minutes of unloaded idling.
- Work only after letting the engine and radiator cool off completely (more than 30 minutes after it has been stopped).
- Do not remove the radiator cap while coolant is hot. When cool to the touch, rotate cap to the first stop to allow excess pressure to escape. Then remove cap completely. If overheats should occur, steam may gush out from the radiator or recovery tank; Severe burns could result.

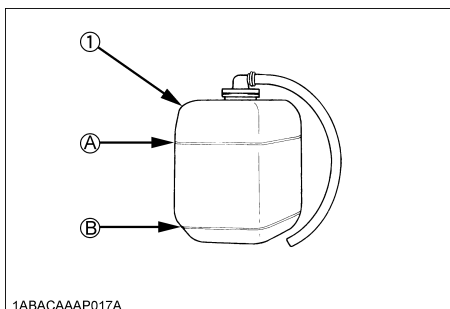
■ Checking coolant level, adding coolant

1. Remove the radiator cap, after the engine has completely cooled, and check to see that coolant reaches the supply port.



(1) Radiator pressure cap

2. If the radiator is provided with a recovery tank, check the coolant level of the recovery tank. When it is between the "FULL" and "LOW" marks, the coolant will last for one day's work.



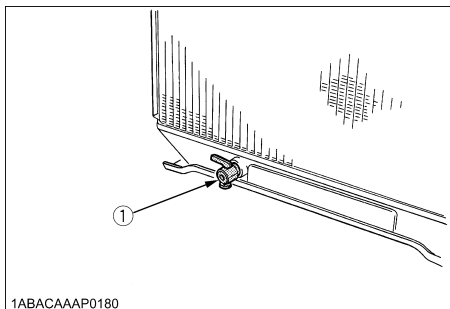
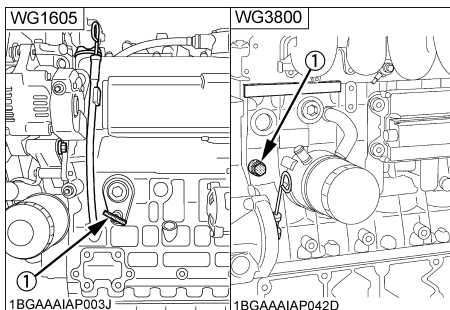
(1) Recovery tank

(A) "FULL"
(B) "LOW"

3. When the coolant level drops due to evaporation, add water only up to the full level.

[WG1605 / WG3800]

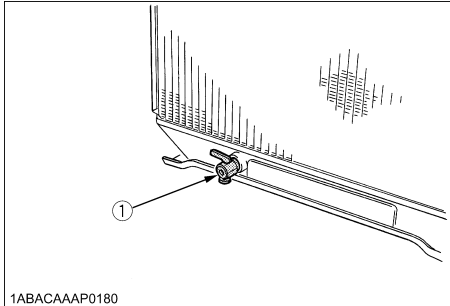
4. Check to see that two drain shutoff-valves; one is at the crankcase side and the other is at the lower part of the radiator as figures below.



(1) Coolant drain shutoff-valve

[WG1903 / WG2503]

4. Check to see the drain shutoff-valve; which is at the lower part of the radiator as figures below.



(1) Coolant drain shutoff-valve

IMPORTANT :

- If the radiator cap has to be removed, follow the caution and securely retighten the cap.
- If coolant should be leak, consult your local KUBOTA dealer.
- Make sure that muddy or sea water does not enter the radiator.
- Use clean, fresh water and 50% anti-freeze to fill the recovery tank.
- Do not refill recovery tank with coolant over the "FULL" level mark.
- Be sure to close the radiator cap securely. If the cap is loose or improperly closed, coolant may leak out and decrease quickly.

Changing coolant

1. To drain coolant, always open both drain shutoff-valves and simultaneously open the radiator cap as well. With the radiator cap kept closed, a complete drain of water is impossible.
2. Remove the overflow pipe of the radiator pressure cap to drain the recovery tank.
3. Prescribed coolant volume (U.S.gallons)

Models	Quantity
WG1605	4.0 L (1.06 U.S.gals.)
WG1903	5.8 L (1.53 U.S.gals.)
WG2503	8.4 L (2.22 U.S.gals.)
WG3800	9.0 L (2.38 U.S.gals.)

NOTE :

- Coolant quantities shown are for standard radiators.

4. An improperly tightened radiator cap or a gap between the cap and the seat quickens loss of coolant.

5. Coolant (Radiator cleaner and anti-freeze)

Season	Coolant
All seasons	Pure water and anti-freeze (See "Anti-freeze" in "RADIATOR" section.)

Remedies for quick decrease of coolant

1. Check any dust and dirt between the radiator fins and tube. If any, remove them from the fins and the tube.
2. Check the tightness of the fan belt. If loose, tighten it securely.
3. Check the internal blockage in the radiator hose. If scale forms in the hose, clean with the scale inhibitor or its equivalent.

Checking radiator hoses and clamp bands**WARNING**

To avoid personal injury or death:

- Be sure to check radiator hoses and clamp bands periodically. If radiator hose is damaged or coolant leaks, overheats or severe burns could occur.

Check to see if radiator hoses are properly fixed every 200 hours of operation or 6 months, whichever comes first.

1. If hose clamps are loose or water leaks, tighten hose clamp securely.
2. Replace hoses and tighten hose clamps securely, if radiator hoses are swollen, hardened or cracked.

Replace hoses and hose clamps every 2 years or earlier, if checked and found that hoses are swollen, hardened or cracked.

Precaution at overheating

The event that the coolant temperature is nearly or more than the boiling point is called "**OVERHEATING**".

While running, make the following checks to see that all parts are working correctly. **If anything is unusual, inspect it, referring to the relevant description in "MAINTENANCE" and "PERIODIC SERVICE" section.**

◆ Coolant

If the coolant temperature warning lamp lights up or if steam or coolant does not stop squirting from the radiator overflow pipe, turn off the load and **keep the engine idling (COOLING-DOWN) for at least 5 minutes** to let it cool down gradually. Then stop the engine and take the following inspection and servicing.

1. Check to see if the coolant runs short or if there is any coolant leak;
2. Check to see if there is any obstacle around the cooling air inlet or outlet;
3. Check to see if there is any dirt or dust between radiator fins and tube;
4. Check to see if the fan belt is too loose; and
5. Check to see if radiator water pipe is clogged.

■ Cleaning radiator core (outside)

If dust is between the fin and tube, wash it away with running water.

IMPORTANT :

- Do not clean radiator with firm tools such as spatulas or screwdrivers. They may damage specified fin or tube. It can cause coolant leaks or decrease cooling performance.

■ Anti-freeze



WARNING

To avoid personal injury or death:

- When using anti-freeze, put on some protection such as rubber gloves. (Anti-freeze is poisonous.)
- If it is swallowed, seek immediate medical help. Do NOT make a person throw up unless told to do so by poison control or a health care professional. Use standard first aid and CPR for signs of shock or cardiac arrest. Call your local Poison Control Center or your local emergency number for further assistance.
- When anti-freeze comes in contact with the skin or clothing, wash it off immediately.
- Do not mix different types of anti-freeze. The mixture can produce chemical reaction causing harmful substances.
- Anti-freeze is extremely flammable and explosive under certain conditions. Keep fire and children away from anti-freeze.

- When draining fluids from the engine, place some container underneath the engine body.
- Do not pour waste onto the grounds, down a drain, or into any water source.
- Also, observe the relevant environmental protection regulations when disposing of anti-freeze.

Always use a 50/50 mix of long-life coolant and clean soft water in KUBOTA engines.

Contact KUBOTA concerning coolant for extreme conditions.

1. Long-life coolant (hereafter LLC) comes in several types. Use ethylene glycol (EG) type for this engine.
2. Before employing LLC-mixed cooling water, flush the radiator with fresh water. Repeat this procedure 2 or 3 times to clean up the radiator and engine block from inside.
3. Mixing the LLC
Premix 50% LLC with 50% clean soft water. When mixing, stir it up well, and then fill into the radiator.
4. The procedure for the mixing of water and anti-freeze differs according to the make of the anti-freeze. Refer to SAE J1034 standard, more specifically also to SAE J814c.

Vol % Anti-freeze	Freezing Point		Boiling Point *	
	°C	°F	°C	°F
50	-37	-34	108	226

*At $1.013 \times 10^5 \text{ Pa}$ (760 mmHg) pressure (atmospheric). A higher boiling point is obtained by using a radiator pressure cap which permits the development of pressure within the cooling system.

5. Adding the LLC
 - (1) Add only water if the coolant level reduces in the cooling system by evaporation.
 - (2) If there is a coolant leak, add the LLC of the same manufacturer and type in the same coolant percentage.
- *Never add any long-life coolant of different manufacturer. (Different brands may have different additive components, and the engine may fail to perform as specified.)
6. When the LLC is mixed, do not employ any radiator cleaning agent. The LLC contains anti-corrosive agent. If mixed with the cleaning agent, sludge may build up, adversely affecting the engine parts.
 7. Kubota's genuine long-life coolant has a service life of 2 years. Be sure to change the coolant every 2 years.

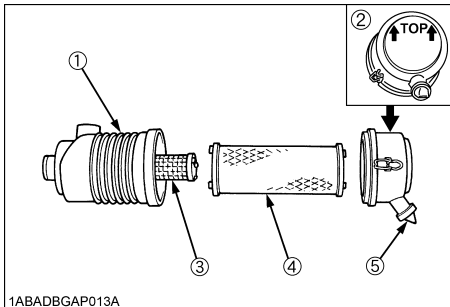
NOTE :

- The above data represents industry standards that necessitate minimum glycol content in the concentrated anti-freeze.

AIR CLEANER

Since the air cleaner employed on this engine is a dry type, never apply oil to it.

1. Open the evacuator valve once a week under ordinary conditions - or daily when used in a dusty place. This will get rid of large particles of dust and dirt.
2. Wipe the inside air cleaner clean with cloth if it is dirty or wet.
3. Avoid touching the element except when cleaning.
4. When dry dust adheres to the element, blow compressed air from the inside turning the element. Pressure of compressed air must be under 205 kPa (2.1 kgf/cm², 30 psi).
5. Replace the primary element every year or every 6 cleanings.
If the primary element is stained heavily, replace it soon. At this time, replace the secondary element too.
6. The secondary element should be removed only if it is to be replaced.
7. To protect the engine, do not remove the secondary element in servicing the primary element.



- 1ABADBGAP013A
- (1) Air cleaner body
(2) Cover
(3) Secondary element
(4) Primary element
(5) Evacuator valve

IMPORTANT :

- Make sure the hooking clip for cover for the element is tight enough. If it is loose, dust and dirt may be sucked in, wearing down the cylinder liner and piston ring earlier and thereby resulting in poor power output.
- Do not overservice the air cleaner element. Overservicing may cause dirt to enter the engine causing premature wear. Use the dust indicator as a guide on when to service.

■Cleaning primary air cleaner element

1. To clean the element, use clean dry compressed air on the inside of the element.
Air pressure at the nozzle must not exceed 205 kPa (2.1kgf/cm², 30psi).
Maintain reasonable distance between the nozzle and the filter.

■Evacuator valve

Open the evacuator valve once a week under ordinary conditions - or daily when used in a dusty place - to get rid of large particles of dust and dirt.

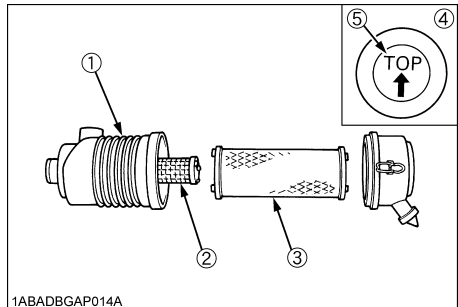
■For the air cleaner with a dust cup (optional)

Remove and clean out the dust cup before it becomes half full with dust; usually once a week, or even every day if the working surroundings are dusty.

Install the air cleaner dust cup with "TOP" indicated on the rear of the cup in the up position. (However, it may be installed in either direction when the cover is placed at the lower part.)

IMPORTANT :

- If the dust cup is mounted incorrectly, dust or dirt does not collect in the cup, and direct attachments of the dust to the element will cause its lifetime to shorten to a great extent.

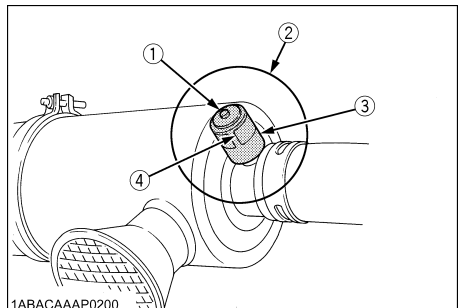


- 1ABADBGAP014A
- (1) Air cleaner body
(2) Secondary element
(3) Primary element
(4) Dust cup
(5) "TOP" mark

■Dust indicator (optional)

If the red signal on the dust indicator attached to the air cleaner has reached the service level.

Clean the element immediately, and reset the signal with the "RESET" button.



- 1ABACAAAP0200
- (1) "RESET" button
(2) Dust indicator
(3) Service level
(4) Signal

FUEL SYSTEM AND DIAGRAMS

■LPG fuel system

Never use LPG fuel on the G type engines. Otherwise severe damage will occur.

- All fuel connections added to this engine must be installed by qualified personnel and utilizing recognized procedures and standards.
- These non-KUBOTA installed parts, such as hoses, fittings, and piping should be approved for LPG use and conform to UL, CSA, NFPA, MSHA and all other applicable standards.
- For the location of the lock off valve with LPG filter and regulator assy (D-STAGE), see "Fuel system diagrams" section.

■Tightening torques and leak check for LPG regulator with vaporizer

1. Each fitting must be sealed with approved joint sealant compound, and be tightened to the specified torque using a wrench and leak check must be performed as shown in the below table.

FITTING	Q'ty	SIZE	Tightening torque			Leak check pressure		
			N-m	kgf-m	ft-lbs	kPa	Kgf/cm ²	psi
LPG OUT (VAPOR)	1	φ19 mm (3/4")Hose Fitting	---	---	---	1745±15	17.8±0.15	253±2.1
LPG IN (LIQUID)*	1	1/4-18 NPTF	19.6 to 39.2	2.0 to 4.0	14.5 to 28.9			
WATER IN/OUT	2	φ16 mm (5/8")Hose Fitting	---	---	---	210±10	2.1±0.1	29.9±1.4

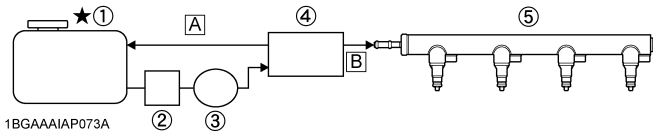
*NOT KUBOTA supplied

■NG fuel system

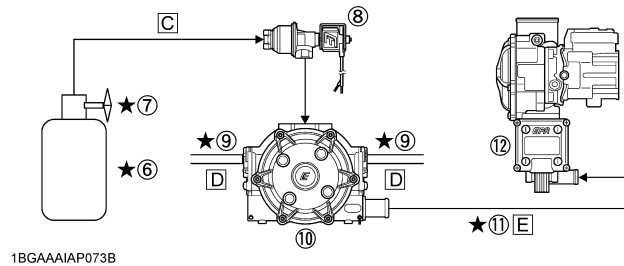
- All fuel connections added to this engine must be installed by qualified personnel and utilizing recognized procedures and standards.
- These non-KUBOTA installed parts, such as fittings, and piping should be approved for NG use and conform to UL, CSA NFPA, MSHA and all other applicable standards.
- For the location of the NG fuel components, see "Fuel system diagrams" section.

Fuel system diagrams

[Type : G, GL]



[Type : L, GL, LN]



- ★ (1) Gasoline tank
- (2) Fuel filter
- (3) Fuel pump assy
- (4) Manifold (FPM)
- (5) Delivery pipe assy
- ★ (6) LPG tank
- ★ (7) LPG manual valve
- ★ (8) Lock off valve with LPG filter
 - (a) Solenoid
 - (b) Outlet
 - (c) Filter bowl
- ★ (9) Coolant hose
- (10) Regulator assy (D-STAGE)
- ★ (11) Vapor hose
- (12) Regulator assy (D-EPR)

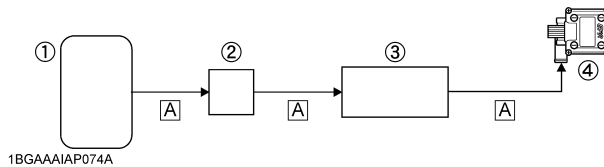
NOTE :

- The ★-marked component parts are Not Provided by KUBOTA.

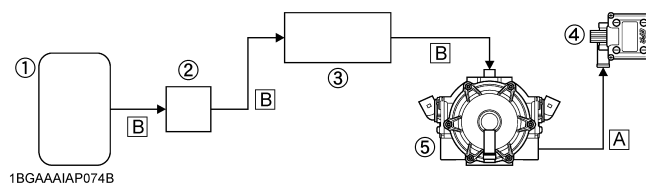
- (A) Bleed / Return circuit
- (B) Gasoline line
- (C) Liquid propane line
- (D) Hot coolant inlet or outlet line
- (E) Gaseous propane line

[Type : N, LN]

1. If the supply pressure of natural gas is 5kPa or less.

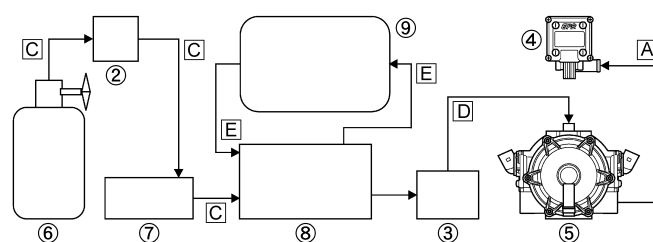


2. If the supply pressure of natural gas is more than 5kPa.



- (1) NG fuel supply
- (2) Filter
- (3) Lock-off valve for NG fuel
- (4) D-EPR
- (5) Vaporizer (DSR)
- (6) CNG tank
- (7) High pressure Lock-off valve
- (8) High pressure regulator
- (9) Crank case
- (A) NG line
 - (Low pressure, $\leq 5\text{kPa}$)
- (B) NG line
 - (Low pressure, 5kPa to 1MPa)
- (C) CNG iline
 - (High pressure, < 24MPa)
- (D) NG line
 - (Low pressure, About 1MPa)
- (E) hot water line

3. Compressed natural gas.



ELECTRIC WIRING



WARNING

To avoid personal injury or death:

◆ Shorting of electric cable or wiring may cause a fire.

● Check to see if electric cables and wiring are swollen, hardened or cracked.

● Keep dust and water away from all power connections.

Loose wiring terminal parts, make bad connections. Be sure to repair them before starting the engine.

Damaged wiring reduces the capacity of electrical parts. Change or repair damaged wiring immediately.

FAN BELT

■ Adjusting fan belt tension



WARNING

To avoid personal injury or death:

● Be sure to stop the engine and remove the key before checking the belt tension.

● Be sure to reinstall the detached safety shield after maintenance or checking.

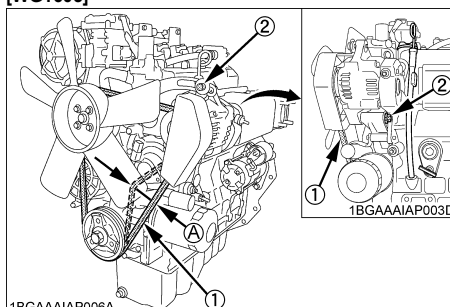
1. Stop the engine and remove the key.
2. Apply moderate thumb pressure to belt between the pulleys.
3. If tension is incorrect, loosen the alternator mounting bolts and, using a lever placed between the alternator and the engine block, pull the alternator out until the deflection of the belt falls within acceptable limits.
4. Replace fan belt if it is damaged.

IMPORTANT :

- If belt is loosen or damaged and the fan is damaged, it could result in overheats or insufficient charging. Correct or replace belt.

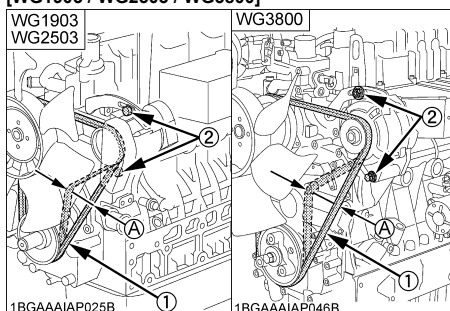
Proper fan belt tension	A deflection (A) when the belt is pressed in the middle of the span.
Models	(A)
WG1605	7 to 9 mm (0.28 to 0.35 in.) (under load of 10 kgf (22.1 lbs))
WG1903	
WG2503	
WG3800	10 to 12 mm (0.39 to 0.47 in.) (under load of 6 to 7 kgf (13.2 to 15.4 lbs))

[WG1605]



- (1) Fan belt
(2) Bolt and nut

[WG1903 / WG2503 / WG3800]



- (1) Fan belt
(2) Bolt and nut

OIL SEPARATOR

■ Changing of oil separator element

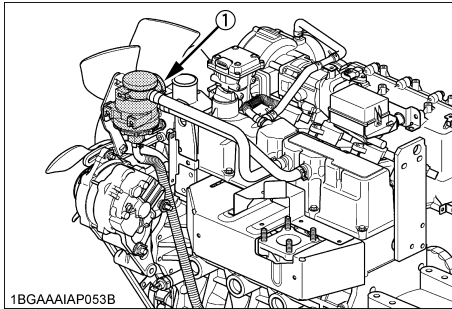


WARNING

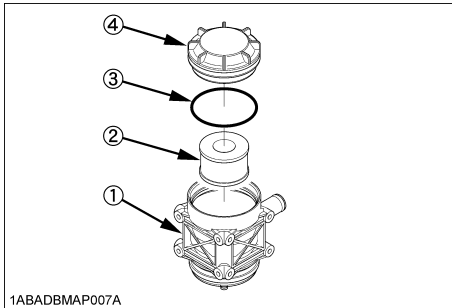
To avoid personal injury or death:

- Be sure to stop the engine before changing the oil separator element.

1. Remove the cover and take out the oil separator element and gasket. Then wipe oil and grease off the zone in question.
2. Fit a new oil separator element and gasket into position.



(1) Oil separator



- (1) Body
- (2) Oil separator element
- (3) Gasket
- (4) Cover

RUBBER PIPING RELATED OIL SEPARATOR

■ Replacement of rubber piping related oil separator

Consult your local KUBOTA Dealer for this service.

CARRIAGE AND STORAGE

CARRIAGE



WARNING

To avoid personal injury or death:

- Fix the engine securely not to fall during operation.
- Do not stand near or under the engine while carrying it.
- The engine is heavy. In handling it, be very alert not to get your hands and body caught in.

1. Use carrier such as a crane when moving the engine to avoid bodily injury. Support the engine securely to avoid injury or damage.
2. When lifting the engine, put the hook securely to metal fittings attached to the engine. Use strong hook and fittings enough to hang the engine.

STORAGE



WARNING

To avoid personal injury or death:

- Do not clean the machine with engine running.
- To avoid the danger of exhaust fume poisoning, do not operate the engine in a closed building without proper ventilation.
- When storing the engine just after running, let the engine cool off.

Before storing the engine for more than a few months, remove any dirt on the machine, and:

1. Drain the coolant in the radiator. Open the shutoff-valve at the bottom of the radiator, and remove the pressure cap to drain water completely. Leave the shutoff-valve open. Hang a note written "No water" on the pressure cap. Since water may freeze when the temperature drops below 0°C (32°F), it is very important that no water is left in the machine.

NOTE :

- When using anti-freeze, it is not necessary to take step (1) above.
2. Remove dirty engine oil, fill with new oil and run the engine for about 5 minutes to let the oil penetrate to all the parts.
 3. Check all the bolts and nuts, and tighten if necessary.
 4. Remove the battery from the engine, adjust the electrolyte level, and recharge it. Store the battery in a dry and dark place.
 5. When the engine is not used for a long period of time, run it for about 5 minutes under no load every 2 to 3 months to keep it free from rust. If the engine is stored without any running, moisture in the air may condense into dew over the sliding parts of the engine, resulting in rust there.
 6. If you forget to run the engine for longer than 5 to 6 months, apply enough engine oil to the valve guide and valve stem seal and make sure the valve works smoothly before starting the engine.
 7. Store the engine in a flat place and remove the key from engine.
 8. Do not store the engine in a place where has flammable materials such as dry grass or straw.
 9. When covering the engine for storage, let engine and muffler cool off completely.
 10. Operate the engine after checking and repairing damaged wirings or pipes, and clearing flammable materials carried by mouse.

TROUBLESHOOTING

The engine malfunctions can result from a large number of causes. The following describes symptoms that are encountered relatively more often than others, their major causes and remedies.

■ When it is difficult to start the engine

Cause	Countermeasures
Fuel doesn't flow.	* Check the fuel tank, fuel filter, fuel hoses and fuel pump. * As fuel will be filtered by the filter, if there should be water or other foreign matters on the filter, clean the filter.
Valve clearance is not as specified.	* Adjust valve clearance when the engine is cold.
Engine oil becomes thick in cold weather and engine cranks slow.	* Change grade of oil according to the weather (temperature).
Low compression	* Bad valve or excessive wear of rings, pistons and liners cause insufficient compression. Replace with new parts.
Battery is discharged and the engine will not crank.	* Charge battery. * In winter, always remove battery from machine, charge fully and keep indoors. Install in machine at time of use.
Clogged air cleaner	* Clean or replace.
Spark plug electrodes are wet with gasoline	* Dry electrode and restart.
Defective starter	* Repair or replace.
Defective main switch	* Repair or replace.
Defective vaporizer	* Replace.
Defective lock off valve	* Replace.
Disconnection	* Check the wire harness.

■ When output is insufficient

Cause	Countermeasures
Compression is insufficient.	* Bad valve or excessive wear of rings, pistons and liners cause insufficient compression. Replace with new parts.
Fuel is insufficient.	* Check fuel system.
Overheating of moving parts	* Check lubricating oil system. * Check to see if lubricating oil filter is working properly. * Filter element deposited with impurities would cause poor lubrication. Change element. * Check to see if the clearance of bearing is within factory specs.
Valve clearance is not as specified.	* Adjust valve clearance when the engine is cold.
Air cleaner is dirty.	* Clean or replace.
Defective spark plug	* Clean or replace.
Defective ignition coil	* Replace.
Disconnection	* Check the wire harness.

■ When engine speed is insufficient

Cause	Countermeasures
Improper or defective spark plug	* Clean or replace.
Defective ignition coil	* Replace.
Defective throttle body	* Replace.
Breather tube has separated.	* Attach correctly.
Improper input signal to ECU	* Check the wire harness.
Disconnection	* Check the wire harness.

■ When engine suddenly stops

Cause	Countermeasures
Lack of fuel	* Check the fuel tank and refill the fuel, if necessary. * Also check the fuel system for air or leaks.
Moving parts are overheated due to shortage of lubrication oil or improper lubrication.	* Check amount of engine oil with oil level gauge. * Check lubricating oil system. * Replace oil filter cartridge.
Clogged air cleaner	* Clean or replace.
Disconnection	* Check the wire harness.

■ When excessive black exhaust gas is observed

Cause	Countermeasures
Fuel system is bad.	* Check the fuel system.
Fuel is extremely poor quality.	* Replace fuel.

■ When white exhaust gas is observed

Cause	Countermeasures
Excessive engine oil	* Reduce to specified level.
Piston ring and liner worn or stuck	* Replace.
Defective valve stem seal	* Replace.

■ When lubricant oil consumption is excessive

Cause	Countermeasures
Oil leaking from oil seal, gasket, etc.	* Replace.
Defective valve stem seal	* Replace.
Piston ring and liner worn or stuck	* Replace.

■ When engine overheats

Cause	Countermeasures
Engine oil insufficient	* Check oil level. Replenish oil as required.
Fan belt broken or elongated	* Change belt or adjust belt tension.
Coolant insufficient	* Replenish coolant.
Excessive concentration of antifreeze	* Add water only or change to coolant with the specified mixing ratio.
Radiator net or radiator fin clogged with dust	* Clean net or fin carefully.
Inside of radiator or coolant flow route corroded	* Clean or replace radiator and parts.
Defective fan or radiator or radiator cap	* Replace defective parts.
Defective thermostat	* Check thermostat and replace if necessary.
Defective temperature sensor	* Check temperature with thermometer and replace if necessary.
Overload running	* Reduce load.
Head gasket defective or water leakage	* Replace parts.

NOTE :

- If the cause of trouble can not be found, consult your KUBOTA dealer.
- If MIL (Malfunction Indicator Light) lights up, consult your KUBOTA dealer.

SPECIFICATIONS

Model			WG1605-E3		
			Type: G, L, GL		Type: N, LN
			Gasoline	LPG	Natural Gas
Type			Vertical, Water-cooled 4 cycle		
No. of cylinders - bore x stroke		mm (in.)	4-φ79 x 78.4 (3.11 x 3.09)		
Total displacement		L (cu-in.)	1.537 (93.79)		
Brake horse power	SAE Gross intermittent	kW(HP) / min ⁻¹ (rpm)	42.5 (57.0) / 3600 37.0 (49.6) / 3000	41.0 (55.0) / 3600 36.0 (48.3) / 3000	38.4 (51.5) / 3600 33.8 (45.3) / 3000
	SAE net intermittent	kW(HP) / min ⁻¹ (rpm)	33.5 (44.9) / 3000	32.5 (43.6) / 3000	30.6 (41.0) / 3000
	SAE net continuous	kW(HP) / min ⁻¹ (rpm)	25.0 (33.5) / 3000		
Max. torque	SAE Gross intermittent	N-m(lbf-ft) / min ⁻¹ (rpm)	120 (88.5) / 2400	117 (86.3) / 2400	110 (81.0) / 2600
Governor type			Electronic Governor		
Ignition system			Full transistor battery ignition type		
Lubricating oil capacity		L (US gals.)	6.0 (1.59)		
Starter			12 V x 1.0 kW		
Total dimensions (L x W x H)		mm (in.)	592 (23.3) x 479 (18.9) x 652 (25.7)		
Weight (Dry)*1		kg (lbs)	Type: G=119 (262.3) / Type: L, N=120 (264.6) / Type: GL, LN=121 (267.0)		
Common tune up specification					
Minimum bare idling speed		min ⁻¹ (rpm)	800		
Maximum bare speed		min ⁻¹ (rpm)	3000		
Ignition timing		deg. BTDC / rpm	26 / 3000, 10 / 800	20 / 3000, 10 / 800	23 / 3000,15 / 800
Spark plug type / Spark plug gap		mm (in.)	NGK IFR6F8DN / 0.7 to 0.8 (0.028 to 0.031)		
Intake / Exhaust valve clearance Check when engine is cold.		mm (in.)	0.145 to 0.185 (0.0057 to 0.0073)		
EU engine family name			JKBXB01.5CFA / JKBXB01.5PDA		JKBXB01.5CFA / JKBXB01.5PCA*4
CO ₂ Emission data	Non-road steady-state test cycle	g/kWh	1090.0 / 1087.6	1043.9 / 1038.6 (Fuel A*3) 1006.8 / 1008.3 (Fuel B*3)	920.9 / 927.2 (G _R *3) 743.4 / 746.5 (G ₂₅ *3)
	LSI-NRTC*2	g/kWh	1075.0 / 1082.4	1025.5 / 1030.6 (Fuel A*3) 993.8 / 999.4 (Fuel B*3)	905.0 / 915.9 (G _R *3) 724.0 / 739.3 (G ₂₅ *3)

NOTE :

- Specifications are subject to change without notice.
- LPG regulator with vaporizer operates on a liquid withdrawal type system.
- This CO₂ measurement results from testing over a fixed test cycle under laboratory conditions a(n) (parent) engine representative of the engine type (engine family) and shall not imply or express any guarantee of the performance of a particular engine.

*1 The engine weight depends on the flywheel, flywheel housing and other component parts.

*2 Large spark-ignition engines non-road transient test cycle

*3 Defined in Annex IX to Delegated Regulation (EU) 2017/654.

*4 EU engine family name of LN type is only JKBXB01.5CFA.

Model			WG1903-E3	
			Type: G, L, GL	
			Gasoline	LPG
Type			Vertical, Water-cooled 4 cycle	
No. of cylinders - bore x stroke		mm (in.)	3-φ88 x 102.4 (3.46 x 4.03)	
Total displacement		L (cu-in.)	1.868 (114.0)	
Brake horse power	SAE Gross intermittent	kW(HP) / min ⁻¹ (rpm)	35.0 (46.9) / 2700 32.4 (43.4) / 2400	35.0 (46.9) / 2700 32.9 (44.1) / 2400
	SAE net intermittent	kW(HP) / min ⁻¹ (rpm)	31.6 (42.4) / 2700 30.0 (40.2) / 2400	31.6 (42.4) / 2700 30.2 (40.5) / 2400
	SAE net continuous	kW(HP) / min ⁻¹ (rpm)	27.0 (36.2) / 2700 25.0 (33.5) / 2400	
	Max. torque	SAE Gross intermittent	N-m(lbf-ft) / min ⁻¹ (rpm)	133 (98.1) / 1800
Governor type			Electronic Governor	
Ignition system			Full transistor battery ignition type	
Lubricating oil capacity		L (US gals.)	7.0 (1.85)	
Starter			12 V x 2.0 kW	
Total dimensions (L x W x H)		mm (in.)	575 (22.6) x 534 (21.0) x 700 (27.6)	
Weight (Dry)*1		kg (lbs)	167 (368.2)	
Common tune up specification				
Minimum bare idling speed		min ⁻¹ (rpm)	900	700
Maximum bare speed		min ⁻¹ (rpm)	2400, 2700	
Ignition timing		deg. BTDC / rpm	30 / 2700, 29 / 2400, 8 / 900	27 / 2700, 26 / 2400, 6 / 700
Spark plug type / Spark plug gap		mm (in.)	NGK IFR6F8DN / 0.7 to 0.8 (0.028 to 0.031)	
Intake / Exhaust valve clearance Check when engine is cold.		mm (in.)	0.18 to 0.22 (0.0071 to 0.0087)	
EU engine family name			JKBXB01.9GDA	
CO ₂ Emission data	Non-road steady-state test cycle	g/kWh	1091.6	934.4 (Fuel A*3) 917.3 (Fuel B*3)
	LSI-NRTC*2	g/kWh	1088.6	922.0 (Fuel A*3) 899.8 (Fuel B*3)

NOTE :

- Specifications are subject to change without notice.
- LPG regulator with vaporizer operates on a liquid withdrawal type system.
- For the long-range-maintenance models (equipped with Hydraulic Lash Adjuster)
 - Maximum bare speed: 2400 rpm
 - There is no need to check the valve clearance.
- This CO₂ measurement results from testing over a fixed test cycle under laboratory conditions a(n) (parent) engine representative of the engine type (engine family) and shall not imply or express any guarantee of the performance of a particular engine.

*1 The engine weight depends on the flywheel, flywheel housing and other component parts.

*2 Large spark-ignition engines non-road transient test cycle

*3 Defined in Annex IX to Delegated Regulation (EU) 2017/654.

Model			WG1903-E3	
			Type: N, LN	
			LPG	Natural Gas
Type			Vertical, Water-cooled 4 cycle	
No. of cylinders - bore x stroke		mm (in.)	3-φ88 x 102.4 (3.46 x 4.03)	
Total displacement		L (cu-in.)	1.868 (114.0)	
Brake horse power	SAE Gross intermittent	kW(HP) / min ⁻¹ (rpm)	35.0 (46.9) / 2700 32.9 (44.1) / 2400	32.5 (43.6) / 2700 30.4 (40.8) / 2400
	SAE net intermittent	kW(HP) / min ⁻¹ (rpm)	31.6 (42.4) / 2700 30.2 (40.5) / 2400	29.6 (39.7) / 2700 28.1 (37.7) / 2400
	SAE net continuous	kW(HP) / min ⁻¹ (rpm)	27.0 (36.2) / 2700 25.0 (33.5) / 2400	25.0 (33.5) / 2700 23.0 (30.8) / 2400
	Max. torque	SAE Gross intermittent	N-m(lbf-ft) / min ⁻¹ (rpm)	140 (103.3) / 1400
Governor type			Electronic Governor	
Ignition system			Full transistor battery ignition type	
Lubricating oil capacity		L (US gals.)	7.0 (1.85)	
Starter			12 V x 2.0 kW	
Total dimensions (L x W x H)		mm (in.)	575 (22.6) x 534 (21.0) x 700 (27.6)	
Weight (Dry)*1		kg (lbs)	167 (368.2)	
Common tune up specification				
Minimum bare idling speed		min ⁻¹ (rpm)	700	
Maximum bare speed		min ⁻¹ (rpm)	2400, 2700	
Ignition timing		deg. BTDC / rpm	27 / 2700, 26 / 2400, 6 / 700	39 / 2700, 36 / 2400, 6 / 700
Spark plug type / Spark plug gap		mm (in.)	NGK IFR6F8DN / 0.7 to 0.8 (0.028 to 0.031)	
Intake / Exhaust valve clearance Check when engine is cold.		mm (in.)	0.18 to 0.22 (0.0071 to 0.0087)	
EU engine family name			JKBXB01.9GEA	
CO ₂ Emission data	Non-road steady-state test cycle	g/kWh	941.3 (Fuel A*3) 923.7 (Fuel B*3)	872.7 (G _R *3) 683.7 (G ₂₅ *3)
	LSI-NRTC*2	g/kWh	938.5 (Fuel A*3) 912.7 (Fuel B*3)	851.9 (G _R *3) 665.7 (G ₂₅ *3)

NOTE :

- Specifications are subject to change without notice.
- LPG regulator with vaporizer operates on a liquid withdrawal type system.
- For the long-range-maintenance models (equipped with Hydraulic Lash Adjuster)
 - Maximum bare speed: 2400 rpm
 - There is no need to check the valve clearance.
- This CO₂ measurement results from testing over a fixed test cycle under laboratory conditions a(n) (parent) engine representative of the engine type (engine family) and shall not imply or express any guarantee of the performance of a particular engine.

*1 The engine weight depends on the flywheel, flywheel housing and other component parts.

*2 Large spark-ignition engines non-road transient test cycle

*3 Defined in Annex IX to Delegated Regulation (EU) 2017/654.

Model			WG2503-E3	
			Type: G, L, GL	
			Gasoline	LPG
Type			Vertical, Water-cooled 4 cycle	
No. of cylinders - bore x stroke		mm (in.)	4-φ88 x 102.4 (3.46 x 4.03)	
Total displacement		L (cu-in.)	2.491 (152.0)	
Brake horse power	SAE Gross intermittent	kW(HP) / min ⁻¹ (rpm)	45.5 (61.0) / 2700 41.8 (56.1) / 2400	46.0 (61.7) / 2700 42.7 (57.3) / 2400
	SAE net intermittent	kW(HP) / min ⁻¹ (rpm)	41.0 (55.0) / 2700 38.5 (51.6) / 2400	41.5 (55.7) / 2700 39.4 (52.8) / 2400
	SAE net continuous	kW(HP) / min ⁻¹ (rpm)	35.0 (46.9) / 2700 32.5 (43.6) / 2400	
	Max. torque	SAE Gross intermittent	N-m(lbf-ft) / min ⁻¹ (rpm)	171 (126.2) / 1800
Governor type			Electronic Governor	
Ignition system			Full transistor battery ignition type	
Lubricating oil capacity		L (US gals.)	9.5 (2.51)	
Starter			12 V x 2.0 kW	
Total dimensions (L x W x H)		mm (in.)	670 (26.4) x 509 (20.0) x 761 (30.0)	
Weight (Dry)*1		kg (lbs)	Type: G, L=195 (429.9) / Type: GL=197 (434.3)	
Common tune up specification				
Minimum bare idling speed		min ⁻¹ (rpm)	700	
Maximum bare speed		min ⁻¹ (rpm)	2400, 2700	
Ignition timing		deg. BTDC / rpm	33 / 2700, 31.5 / 2400, 12.5 / 700	30 / 2700, 28.5 / 2400, 13 / 700
Spark plug type / Spark plug gap		mm (in.)	NGK IFR6F8DN / 0.7 to 0.8 (0.028 to 0.031)	
Intake / Exhaust valve clearance Check when engine is cold.		mm (in.)	0.18 to 0.22 (0.0071 to 0.0087)	
EU engine family name			JKBXB02.5GDA / JKBXB02.5HDA	
CO ₂ Emission data	Non-road steady-state test cycle	g/kWh	1098.1 / 1120.9	963.3 / 975.4 (Fuel A*3) 938.7 / 952.9 (Fuel B*3)
	LSI-NRTC*2	g/kWh	1072.0 / 1086.4	941.5 / 957.0 (Fuel A*3) 919.5 / 932.2 (Fuel B*3)

NOTE :

- Specifications are subject to change without notice.
- LPG regulator with vaporizer operates on a liquid withdrawal type system.
- For the long-range-maintenance models (equipped with Hydraulic Lash Adjuster)
 - Maximum bare speed: 2400 rpm
 - There is no need to check the valve clearance.
- This CO₂ measurement results from testing over a fixed test cycle under laboratory conditions a(n) (parent) engine representative of the engine type (engine family) and shall not imply or express any guarantee of the performance of a particular engine.

*1 The engine weight depends on the flywheel, flywheel housing and other component parts.

*2 Large spark-ignition engines non-road transient test cycle

*3 Defined in Annex IX to Delegated Regulation (EU) 2017/654.

Model			WG2503-E3	
			Type: N, LN	
			LPG	Natural Gas
Type			Vertical, Water-cooled 4 cycle	
No. of cylinders - bore x stroke		mm (in.)	4-φ88 x 102.4 (3.46 x 4.03)	
Total displacement		L (cu-in.)	2.491 (152.0)	
Brake horse power	SAE Gross intermittent	kW(HP) / min ⁻¹ (rpm)	46.0 (61.7) / 2700 42.7 (57.3) / 2400	42.4 (56.9) / 2700 39.2 (52.6) / 2400
	SAE net intermittent	kW(HP) / min ⁻¹ (rpm)	41.5 (55.7) / 2700 39.4 (52.8) / 2400	38.0 (51.0) / 2700 36.1 (48.4) / 2400
	SAE net continuous	kW(HP) / min ⁻¹ (rpm)	35.0 (46.9) / 2700 32.5 (43.6) / 2400	32.3 (43.3) / 2700 30.7 (41.2) / 2400
	Max. torque	SAE Gross intermittent	N-m(lbf-ft) / min ⁻¹ (rpm)	178 (131.3) / 1400
Governor type			Electronic Governor	
Ignition system			Full transistor battery ignition type	
Lubricating oil capacity		L (US gals.)	9.5 (2.51)	
Starter			12 V x 2.0 kW	
Total dimensions (L x W x H)		mm (in.)	670 (26.4) x 509 (20.0) x 761 (30.0)	
Weight (Dry)*1		kg (lbs)	Type: N=195 (429.9) / Type: LN=197 (434.3)	
Common tune up specification				
Minimum bare idling speed		min ⁻¹ (rpm)	700	
Maximum bare speed		min ⁻¹ (rpm)	2400, 2700	
Ignition timing		deg. BTDC / rpm	30 / 2700, 28.5 / 2400, 13 / 700	31 / 2700, 29 / 2400, 15 / 700
Spark plug type / Spark plug gap		mm (in.)	NGK IFR6F8DN / 0.7 to 0.8 (0.028 to 0.031)	
Intake / Exhaust valve clearance Check when engine is cold.		mm (in.)	0.18 to 0.22 (0.0071 to 0.0087)	
EU engine family name			JKBXB02.5GEA / JKBXB02.5HCA*4	
CO ₂ Emission data	Non-road steady-state test cycle	g/kWh	958.3 (Fuel A*3) 934.3 (Fuel B*3)	889.2 / 889.0 (G _R *3) 720.9 / 706.1 (G ₂₅ *3)
	LSI-NRTC*2	g/kWh	939.4 (Fuel A*3) 916.7 (Fuel B*3)	866.8 / 875.6 (G _R *3) 719.7 / 699.0 (G ₂₅ *3)

NOTE :

- Specifications are subject to change without notice.
- LPG regulator with vaporizer operates on a liquid withdrawal type system.
- For the long-range-maintenance models (equipped with Hydraulic Lash Adjuster)
 - Maximum bare speed: 2400 rpm
 - There is no need to check the valve clearance.
- This CO₂ measurement results from testing over a fixed test cycle under laboratory conditions a(n) (parent) engine representative of the engine type (engine family) and shall not imply or express any guarantee of the performance of a particular engine.

*1 The engine weight depends on the flywheel, flywheel housing and other component parts.

*2 Large spark-ignition engines non-road transient test cycle

*3 Defined in Annex IX to Delegated Regulation (EU) 2017/654.

*4 EU engine family name of LN type is only JKBXB02.5GEA.

[CARB / EPA]

Model			WG3800-E3	
			Type: G, GL	
			Gasoline	LPG
Type			Vertical, Water-cooled 4 cycle	
No. of cylinders - bore x stroke		mm (in.)	4-φ100 x 120 (3.93 x 4.72)	
Total displacement		L (cu-in.)	3.769 (229.9)	
Brake horse power	SAE Gross intermittent	kW(HP) / min ⁻¹ (rpm)	65.0 (87.1) / 2600	68.0 (91.2) / 2600
	SAE net intermittent	kW(HP) / min ⁻¹ (rpm)	57.8 (77.5) / 2600	60.4 (81.0) / 2600
	SAE net continuous	kW(HP) / min ⁻¹ (rpm)	49.5 (66.4) / 2600	
Max. torque	SAE Gross intermittent	N-m(lbf-ft) / min ⁻¹ (rpm)	256 (188.9) / 1400	280 (206.5) / 1200
Governor type			Electronic Governor	
Ignition system			Full transistor battery ignition type	
Lubricating oil capacity		L (US gals.)	12.2 (3.22)	
Starter			12V x 2.5 kW	
Total dimensions (L x W x H)		mm (in.)	745 (29.3) x 584 (23.0) x 799 (31.5)	
Weight (Dry)*1		kg (lbs)	Type: G=268 (590.8) / Type: GL=288 (634.9)	
Common tune up specification				
Minimum bare idling speed		min ⁻¹ (rpm)	700	
Maximum bare speed		min ⁻¹ (rpm)	2600	
Ignition timing		deg. BTDC / rpm	30 / 2600, 15 / 700	35 / 2600, 15 / 700
Spark plug type / Spark plug gap		mm (in.)	NGK IFR6F8DN / 0.7 to 0.8 (0.028 to 0.031)	
Intake / Exhaust valve clearance Check when engine is cold.		mm (in.)	0.18 to 0.22 (0.0071 to 0.0087)	

NOTE :

- Specifications are subject to change without notice.
- LPG regulator with vaporizer operates on a liquid withdrawal type system.

*1 The engine weight depends on the flywheel, flywheel housing and other component parts.

[CARB / EPA]

Model			WG3800-E3	
			Type: L, N, LN	
			LPG	Natural Gas
Type			Vertical, Water-cooled 4 cycle	
No. of cylinders - bore x stroke		mm (in.)	4-φ100 x 120 (3.93 x 4.72)	
Total displacement		L (cu-in.)	3.769 (229.9)	
Brake horse power	SAE Gross intermittent	kW(HP) / min ⁻¹ (rpm)	70.0 (93.8) / 2600	65.0 (87.2) / 2600
	SAE net intermittent	kW(HP) / min ⁻¹ (rpm)	62.2 (83.4) / 2600	57.8 (77.5) / 2600
	SAE net continuous	kW(HP) / min ⁻¹ (rpm)	53.0 (71.1) / 2600	48.0 (64.3) / 2600
Max. torque	SAE Gross intermittent	N-m(lbf-ft) / min ⁻¹ (rpm)	290 (213.9) / 1200	269 (198.4) / 1200
Governor type			Electronic Governor	
Ignition system			Full transistor battery ignition type	
Lubricating oil capacity		L (US gals.)	12.2 (3.22)	
Starter			12V x 2.5 kW	
Total dimensions (L x W x H)		mm (in.)	745 (29.3) x 584 (23.0) x 799 (31.5)	
Weight (Dry)*1		kg (lbs)	Type: L, N=268 (590.8) / Type: LN=288 (634.9)	
Common tune up specification				
Minimum bare idling speed		min ⁻¹ (rpm)	700	
Maximum bare speed		min ⁻¹ (rpm)	2600	
Ignition timing		deg. BTDC / rpm	30 / 2600, 15 / 700	38 / 2600, 15 / 700
Spark plug type / Spark plug gap		mm (in.)	NGK IFR6F8DN / 0.7 to 0.8 (0.028 to 0.031)	
Intake / Exhaust valve clearance Check when engine is cold.		mm (in.)	0.18 to 0.22 (0.0071 to 0.0087)	

NOTE :

- Specifications are subject to change without notice.
- LPG regulator with vaporizer operates on a liquid withdrawal type system.

*1 The engine weight depends on the flywheel, flywheel housing and other component parts.

[CARB / EPA]
[EU (P<56kW)]

Model			WG3800-E3	
			Type: G, GL	
			Gasoline	LPG
Type			Vertical, Water-cooled 4 cycle	
No. of cylinders - bore x stroke		mm (in.)	4-φ100 x 120 (3.93 x 4.72)	
Total displacement		L (cu-in.)	3.769 (229.9)	
Brake horse power	SAE net intermittent	kW(HP) / min ⁻¹ (rpm)	54.6 (73.2) / 2600	
	SAE net continuous	kW(HP) / min ⁻¹ (rpm)	49.5 (66.4) / 2600	
Max. torque	SAE net intermittent	N-m(lbf-ft) / min ⁻¹ (rpm)	247 (182.2) / 1400	271 (199.9) / 1200
Governor type			Electronic Governor	
Ignition system			Full transistor battery ignition type	
Lubricating oil capacity		L (US gals.)	12.2 (3.22)	
Starter			12V x 2.5 kW	
Total dimensions (L x W x H)		mm (in.)	745 (29.3) x 584 (23.0) x 799 (31.5)	
Weight (Dry)*1		kg (lbs)	Type: G=268 (590.8) / Type: GL=288 (634.9)	
Common tune up specification				
Minimum bare idling speed		min ⁻¹ (rpm)	700	
Maximum bare speed		min ⁻¹ (rpm)	2600	
Ignition timing		deg. BTDC / rpm	30 / 2600, 15 / 700	35 / 2600, 15 / 700
Spark plug type / Spark plug gap		mm (in.)	NGK IFR6F8DN / 0.7 to 0.8 (0.028 to 0.031)	
Intake / Exhaust valve clearance Check when engine is cold.		mm (in.)	0.18 to 0.22 (0.0071 to 0.0087)	
EU engine family name			JKBXB03.8CDA	
CO ₂ Emission data	Non-road steady-state test cycle	g/kWh	1179.2	958.5 (Fuel A*3) 934.3 (Fuel B*3)
	LSI-NRTC*2	g/kWh	1140.4	946.1 (Fuel A*3) 925.1 (Fuel B*3)

NOTE :

- Specifications are subject to change without notice.
- LPG regulator with vaporizer operates on a liquid withdrawal type system.
- This CO₂ measurement results from testing over a fixed test cycle under laboratory conditions a(n) (parent) engine representative of the engine type (engine family) and shall not imply or express any guarantee of the performance of a particular engine.

*1 The engine weight depends on the flywheel, flywheel housing and other component parts.

*2 Large spark-ignition engines non-road transient test cycle

*3 Defined in Annex IX to Delegated Regulation (EU) 2017/654.

[CARB / EPA]
[EU (P<56kW)]

Model			WG3800-E3		
			Type: L, N, LN		
			LPG (Type: L)	LPG (Type: LN)	Natural Gas
Type			Vertical, Water-cooled 4 cycle		
No. of cylinders - bore x stroke		mm (in.)	4-φ100 x 120 (3.93 x 4.72)		
Total displacement		L (cu-in.)	3.769 (229.9)		
Brake horse power	SAE net intermittent	kW(HP) / min ⁻¹ (rpm)	54.6 (73.2) / 2600		54.6 (73.2) / 2600
	SAE net continuous	kW(HP) / min ⁻¹ (rpm)	53.0 (71.1) / 2600		48.0 (64.3) / 2600
Max. torque	SAE net intermittent	N-m(lbf-ft) / min ⁻¹ (rpm)	281 (207.3) / 1200		261 (192.5) / 1200
Governor type			Electronic Governor		
Ignition system			Full transistor battery ignition type		
Lubricating oil capacity		L (US gals.)	12.2 (3.22)		
Starter			12 V x 2.5 kW		
Total dimensions (L x W x H)		mm (in.)	745 (29.3) x 584 (23.0) x 799 (31.5)		
Weight (Dry)*1		kg (lbs)	Type: L, N=268 (590.8) / Type: LN=288 (634.9)		
Common tune up specification					
Minimum bare idling speed		min ⁻¹ (rpm)	700		
Maximum bare speed		min ⁻¹ (rpm)	2600		
Ignition timing		deg. BTDC / rpm	30 / 2600, 15 / 700		38 / 2600, 15 / 700
Spark plug type / Spark plug gap		mm (in.)	NGK IFR6F8DN / 0.7 to 0.8 (0.028 to 0.031)		
Intake / Exhaust valve clearance Check when engine is cold.		mm (in.)	0.18 to 0.22 (0.0071 to 0.0087)		
EU engine family name			JKBXB03.8CBA	JKBXB03.8CEA	
CO ₂ Emission data	Non-road steady-state test cycle	g/kWh	901.1 (Fuel A*3) 880.7 (Fuel B*3)	905.0 (Fuel A*3) 881.9 (Fuel B*3)	823.2 (G _R *3) 639.7 (G ₂₅ *3)
	LSI-NRTC*2	g/kWh	902.2 (Fuel A*3) 880.9 (Fuel B*3)	906.5 (Fuel A*3) 882.3 (Fuel B*3)	815.4 (G _R *3) 630.7 (G ₂₅ *3)

NOTE :

- Specifications are subject to change without notice.
- LPG regulator with vaporizer operates on a liquid withdrawal type system.
- This CO₂ measurement results from testing over a fixed test cycle under laboratory conditions a(n) (parent) engine representative of the engine type (engine family) and shall not imply or express any guarantee of the performance of a particular engine.

*1 The engine weight depends on the flywheel, flywheel housing and other component parts.

*2 Large spark-ignition engines non-road transient test cycle

*3 Defined in Annex IX to Delegated Regulation (EU) 2017/654.

[CARB / EPA]
[EU (P ≥ 56kW)]

Model			WG3800-L-E5
			LPG
Type			Vertical, Water-cooled 4 cycle
No. of cylinders - bore x stroke	mm (in.)		4-φ100 x 120 (3.93 x 4.72)
Total displacement	L (cu-in.)		3.769 (229.9)
Brake horse power	SAE Gross intermittent	kW(HP) / min ⁻¹ (rpm)	69.0 (92.5) / 2500
	SAE net intermittent	kW(HP) / min ⁻¹ (rpm)	61.8 (82.9) / 2500
	SAE net continuous	kW(HP) / min ⁻¹ (rpm)	52.5 (70.4) / 2500
Max. torque	SAE Gross intermittent	N-m(lbf-ft) / min ⁻¹ (rpm)	290 (213.9) / 1200
Governor type			Electronic Governor
Ignition system			Full transistor battery ignition type
Lubricating oil capacity	L (US gals.)		12.2 (3.22)
Starter			12V x 2.5 kW
Total dimensions (L x W x H)	mm (in.)		745 (29.3) x 584 (23.0) x 799 (31.5)
Weight (Dry)*1	kg (lbs)		268 (590.8)
Common tune up specification			
Minimum bare idling speed	min ⁻¹ (rpm)		700
Maximum bare speed	min ⁻¹ (rpm)		2500
Ignition timing	deg. BTDC / rpm		41 / 2500, 15 / 700
Spark plug type / Spark plug gap	mm (in.)		NGK IFR6F8DN / 0.7 to 0.8 (0.028 to 0.031)
Intake / Exhaust valve clearance Check when engine is cold.	mm (in.)		0.18 to 0.22 (0.0071 to 0.0087)
EU engine family name			KKBXB03.8DBA
CO ₂ Emission data	Non-road steady-state test cycle	g/kWh	782.3 (Fuel A*2) 766.2 (Fuel B*2)
	Non-road transient test cycle	g/kWh	850.5 (Fuel A*2) 830.7 (Fuel B*2)

NOTE :

- Specifications are subject to change without notice.
- LPG regulator with vaporizer operates on a liquid withdrawal type system.
- This CO₂ measurement results from testing over a fixed test cycle under laboratory conditions a(n) (parent) engine representative of the engine type (engine family) and shall not imply or express any guarantee of the performance of a particular engine.

*1 The engine weight depends on the flywheel, flywheel housing and other component parts.

*2 Defined in Annex IX to Delegated Regulation (EU) 2017/654.



This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

7780 Old Seward Hwy
Anchorage, AK 99518
(907) 341-2250 | (877) 341-2250

1919 Van Horn Road
Fairbanks, AK 99701
(907) 458-9049 | (888) 868-9049

17660 W. Valley Hwy
Tukwilla, WA 98188
(425) 251-6119

5064 Bennett Loop
Williston, ND 58801
(701) 774-5312