Equipment Source Inc.

ES1.5
Indirect-Fired Heater

Long-term, continuous performance in extremely low temperatures.
1.5 Million BTU/Hr

HEATERS

Kubota

Carlin™
Combustion Technology, Inc.

- Big Brother to the ES700, the #1 Selling On Alaska's North Slope.
- 1,500,000 BTU/hr - Up To 9,000 CFM
- 3,000 Hour Oil Service with Extended Run Oil Sump

BUILT ARCTIC TOUGH

www.EquipmentSourceInc.com

Equipment Source Inc.

ES1.5
Indirect-Fired Heater

Performance & features
- 1,500,000 BTU with up to 9,000 CFM
- 24+ hour run time
- Kubota engine with Mecc Alte generator end
- Carlin burner
- Extended run oil sump for up to 3,000 hour oil change intervals
- Three-color beacon indicates engine, burner, fuel status
- 120V GFCI power outlet
- Emergency shutdown switch
- Dual 20” duct outlets
- 355 Gallon fuel tank

Quality construction
- 309 stainless steel fire tube & heat exchanger
- 150% secondary fluid containment
- Conforming to UL and CSA standards

Easy service by design
- Easy access engine compartment
- Standard industrial components ensure widespread parts availability

Available mounting
- Trailer mounted on dual 7,000 lb axle (standard)
- Skid mounted

Options
- **Dual Fuel**
  - Run the engine on ultra-low sulfate diesel (ULSD)
  - Run the burner on #1 heating oil for massive cost savings
- Duct storage
- Remote thermostat
- Light tower

Equipment Source Inc.

ES1.5
MILLION BTU/HR

INDIRECT FIRED PORTABLE HEATER

Equipment Source Inc.

(907) 458-9049

www.EquipmentSourceInc.com

- *Operator's manual*
- *Parts*
- *Repair*

Serial Number:

Fairbanks, AK | Anchorage, AK | Renton, WA, Williston, ND | Canada

START-UP CHECK LIST

** IF HEATER SHUTS DOWN - DETERMINE THE CAUSE BEFORE RESTARTING **

1) CHECK ENGINE OIL
2) CHECK ENGINE COOLANT
3) CHECK FOR WATER IN FUEL-WATER SEPARATORS
4) TURN OFF MAIN BREAKER
5) START ENGINE (ALLOW 5 MINUTES TO WARM UP)
6) TURN ON MAIN BREAKER
7) START FAN
8) START BURNER

SERVICE SCHEDULE

DAILY

1) CHECK AND ADD FUEL AS REQUIRED, ALWAYS USE CLEAN FUEL
2) CHECK FUEL-WATER SEPARATORS
3) INSPECT BELTS FOR WEAR
4) INSPECT CONTAINMENT SYSTEM FOR FLUID BUILD-UP
5) INSPECT COOLANT SYSTEM
6) INSPECT EXHAUST SYSTEM
7) CHECK OUTPUT AIR TEMPERATURE AND ADJUST NOZZLE OR FUEL PRESSURE

WEEKLY

1) GREASE FAN BEARINGS

500 HOUR

1) CHECK AIR FILTER, CLEAN OR REPLACE AS NEEDED
2) ADJUST BLOWER FAN BELTS

1000 HOUR

1) CHANGE FUEL FILTERS
2) CHANGE AIR FILTERS

3000 HOUR

1) CHANGE ENGINE OIL AND FILTERS
2) REPLACE BURNER NOZZLE
3) REPLACE BLOWER FAN BELTS

WARNING

READ BEFORE OPERATING

NEVER RESTART A HEATER THAT SHUTS DOWN AS A RESULT OF A SAFETY FAILURE UNTIL THE FIRE BOX COOLS COMPLETELY.

IF A HEATER FAILS TO IGNITE, PURGE THE FIRE BOX OF UNBURNT FUEL BEFORE RESTARTING.

TEST THIS HEATER'S OUTPUT AIR TEMPERATURE OFTEN. OUTPUT AIR TEMPERATURES EXCEEDING **220°F** FOR PROLONGED PERIODS MAY CAUSE SERIOUS DAMAGE TO THE FIRE TUBE AND HEAT EXCHANGER.

RUN HEATER WITH THE FAN ON AND THE BURNER

OFF FOR FIVE MINUTES TO COOL DOWN THE HEATER

BEFORE SHUTTING DOWN THE MACHINE.

Specifications

1,500,000 BTU INDIRECT FIRED HEATER

- **3000 HOUR SERVICE INTERVAL ON ENGINE**
- **335 GALLON FUEL TANK**
- **12 GALLON ENGINE OIL CAPACITY**
- **OIL PAN & COOLANT HEATERS**
- **THERMOSTAT CONTROLLED AIR TEMP IN ENGINE COMPARTMENT**
- **100% 309 STAINLESS STEEL FIRE TUBE & HEAT EXCHANGER**
- **100% ARCTIC FLEX WIRING**
- **SECONDARY FLUID CONTAINMENT**
- **NO-DRIP FUEL DOOR & 4" FUEL FILLER NECK**
- **2ea. 7000 LBS AXLEs WITH TORSION BAR SUSPENSION**
- **ENGINE RUNNING INDICATOR LIGHTS**
- **SNOW HOODS ON INTAKES**
- **9,100 POUNDS DRY WEIGHT**
- **16" - 8 HOLE WHEELS**

8' OVERALL WIDTH

CLEVELAND CONTROLS

Air Differential Switch

P/N: 2374-410

12V DISCONECT SWITCH

P/N: SW700

BUYERS OIL LEVEL GUAGE

P/N: HLLG1

RACOR
MODEL 660R2
FUEL FILTER
ASSEMBLY

12 Volt System Panel

1. Hour Meter
2. 30 Amp Spal Fan Breaker
3. DSE402 Control Panel
4. 15 Amp DSE402 Breaker

For More Detailed Parts Numbers, See Your Kubota Parts Catalogue

Over-temp Switches and Snap Discs

1. P/N: 350MT

350 degree manual reset firebox over temperature safety switch.

2. P/N: OM-120-A

Engine compartment manual over temperature safety switch.

3. P/N: CA60

Engine Cooling Fan Over Temp Safety Switch

4. P/N: L4064B2236

Output Air Overtemp Safety/ Fan Combo

Emergency Shut Down Switch

P/N: 10250T33

Other Parts and Components

ESI Wheel Chock Assembly	P/N: ESWC6810
ESI Wiggins Drain Hose Assembly	P/N: ESWG01

ENGINE COMPARTMENT COOLING FAN

P/N: 30102120

DUCTING AND DUCTING ACCESSORIES

Silicone Heater Ducting

Rated -65°F to +500°F with wire rope end rings 20" X 20'

*Other fabrics and couplers available, including canvas, insulated silicone and cuffed couplers.

DUCT TOGGLE CLAMP

P/N: 3CXW4

Trouble shooting guide

Main Causes of Burner Failure

1. NO FUEL

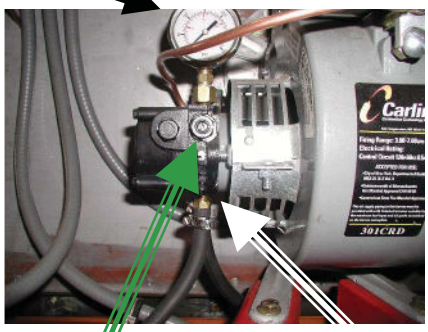
Check fuel in fuel tank. Clean fuel, with no water contamination, is essential for your heater to function properly.
Bleed air at fuel filter primer pump(1). Next, loosen bleed screw (2)on burner fuel pump 1/4 turn and cycle burner. If there is fuel in the tank but no fuel comes out of pump bleed screw, check for air leeks or blockage in fuel lines and fuel filter assembly. Next, remove fuel pump and check the fuel pump drive coupler. Be certain the fan motor turns. If all your tests are OK, replace the fuel pump.

2. NOZZLE PLUGGED

The nozzle in your heater should be changed as part of your annual service. Change the fuel nozzle if your heater runs out of fuel or if the burner will not ignite after servicing the fuel filter .

NOTE: A WORN OR BLOCKED FUEL NOZZLE MAY CAUSE PERMANENT DAMAGE TO THE FIRE BOX THAT MAY VOID YOUR WARRANTY.

FUEL PRESSURE GAUGE



FUEL BLEEDER SCREW

FUEL PRESSURE ADJUSTMENT SCREW

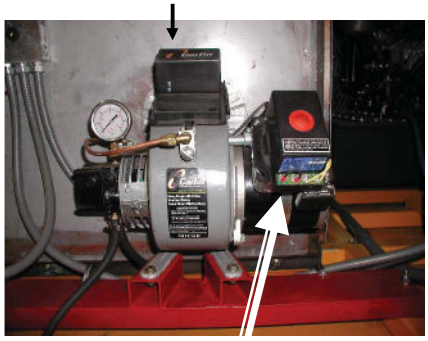
3. LOW OR NO VOLTAGE

Test voltage at main breaker. **Tests must be performed by a qualified technician as possibility of electrocution exists.** The generator is wired 240—3 phase. Your tests should show 120—135 volts. Next, test the voltage at the burner control switch and control breaker. Reset the breaker if required. Low voltage at the switch indicates a bad ground, damaged wires, or loose connections.

4. BURNER MOTOR

Check thermal reset switch on the motor. The reset will trip if the fuel pump or fuel pump drive coupler is damaged, the fan blades are damaged, or the fan motor is failing. As a test, you may remove the wire nuts from the wires coming directly out of the fan motor and plug them into a 120 volt outlet. **This test must be done by a qualified electrician.**

TRANSFORMER



COMBUSTION CONTROLLER

5. TRANSFORMER FAILURE

To check the transformer, loosen the hold down screw and tip the transformer on its side. Use a screw driver with a well insulated handle. Cycle the burner and short across the electrodes. As you open the gap, the spark should be strong and jump at least a one inch gap. **Use extreme caution when performing this test as a transformer produces 14,000 volts.**

6. CAD CELL

The Cad Cell must be free of smoke and soot to function properly. Cad Cells are cheap, so when in doubt or when doing a tune-up, install a new one. The Cad Cell serves two functions: 1) if it senses flame in the fire tube before start-up it will prevent fuel from entering the fire tube 2) after the burner cycles the Cad Cell must sense flame or it will cause the burner to shut-off the fuel supply. Note: the Cad Cell must be in total darkness for the burner to cycle

7. BURNER MOTOR TO FUEL PUMP COUPLER

Occasionally heat will cause a coupler to distort to the point it will cause the thermal reset on a fan motor to trip, shutting down the burner. The more common coupler failure is for the coupler splines to fail causing the pump to stop turning. When changing a drive coupler make sure the pump turns freely. A worn pump will cause premature failure of the coupler.

8. COMBUSTION CONTROLLER

The Combustion Controller is the burner brain. If power is going to the controller but not the motor or transformer, check your wire connections first, then change the controller. The fastest way to troubleshoot this component is to keep a spare on hand.

Note: when you install a new controller be sure to install a jumper wire across the thermostat connections.

Trouble shooting guide

9. ELECTRODES

Electrodes must be clean and properly adjusted for the burner to ignite. With fine grit sand paper, polish the ends of the electrodes, carefully bringing the end of the electrodes to a point. Inspect the insulators for cracks and check for clearance to all metal parts.

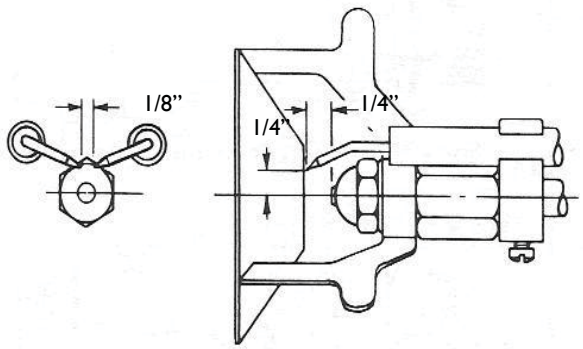
Electrode settings specified as follows:
1/8" gap, 1/4" above the nozzle centerline, and 1/4" ahead of the nozzle tip.

10. RETENTION RING AND AIR SHUTTER ADJUSTMENTS

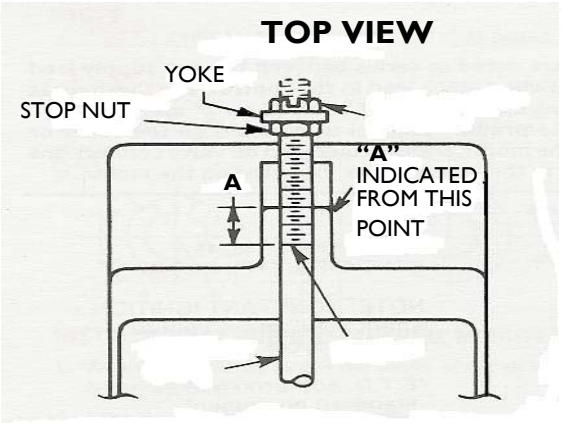
The following table shows the firing rate of each nozzle, the corresponding flame retention ring, and air shutter settings.

NOZZLE	APPROX. GPH @ 150	RETENTION RING SETTING "A"	AIR SHUTTER OPENING (%)
3.25	4.0	3/8	50
3.75	4.5	7/16	70
4.0	5.0	1/2	80
4.5	5.5	5/8	90

SIDE VIEW



TOP VIEW



THE FIREBOX IN AN ES700 HEATER IS DESIGNED TO USE A 45° NOZZLE WITH A SOLID PATTERN. IT IS CRITICAL THAT YOU SIZE THE NOZZLE TO ACHIEVE 200–210°F WORKING AIR OUT OF THE MACHINE.

11. LIGHT-OFF AND ADJUSTMENT

Before restarting the burner after changing the nozzle or performing a tune-up, preset the air shutter and retention ring position for the particular firing rate according to the table above. If the fire is too rich, open the air shutter or move the combustion head forward by increasing "A". The lower the fire rate the greater the impact a small adjustment will make. Generally, too rich a fire will result in black smoke and too lean will cause the heater to "rumble". After making adjustments, restart the heater to look for a smooth ignition and clean cut-off. If cut-off is poor, check for air leaks in the fuel suction line.

12. OVER TEMPERATURE SAFETY

The over temp snap disk is a manual reset. After the burner cools, press the reset and test for continuity. Remember this safety will often trip when the burner is shut down hot. Many times this is the result of a shut-down, not the cause. **NEVER REPLACE THIS SAFETY WITH AN AUTOMATIC RESET SAFETY OR OPERATE WITH THIS SAFETY BY-PASSED.**

13. DIFFERENTIAL PRESSURE SWITCH

The Differential Pressure Switch allows power to reach the burner when the main fan is on. To test this switch turn off the power, remove the switch cover, disconnect the two wires, and cover the wires with wire nuts. Turn on power and blower. Check for continuity across the studs. **NEVER OPERATE THIS MACHINE WITH THE AIR SWITCH SAFETY BY-PASSED.**

Easy Access

Over-sized doors make service and repairs fast. Burners can be removed without disconnecting fuel lines or wiring.

No-Spills

Fluid containment and a unique swing-down pan designed to catch the drips when fueling.

Built for the Arctic

No modifications are required to these heaters for operating under the harshest conditions.

HEATER RECONDITIONING AND REPAIR

Equipment Source Inc. was formed as a service company to recondition heaters for oil producers on Alaska's North Slope. Over the years we have grown into a manufacturing company but we have not forgotten our roots. For service or repair of your portable heaters, please call (907) 458-9049 for an estimate.

WARRANTY INFORMATION

See attached Warranty

Equipment Source Inc.

1919 Van Horn Rd.
Fairbanks, AK 99701
Ph: (907) 458-9049

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General Information
&
Warranty

BUILT ARCTIC TOUGH

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Commonly Replaced Items and Useful Information

Oil Filter

2ea HH160-32093

Air Filter

70000-11081

Fuel Filter

HH166-43560

Racor Fuel Filter

2ea R60S

Engine Fan Belt

17112-97012

Electric Fuel Pump

EP12S

Block Heater

70000-73274

2”x4” 50W Heater Pad

HP50

Oil Capacity

45.4 Liters / 12 Gallons

Equipment Source Inc.

Equipment Source, Inc.
1919 Van Horn Road
Fairbanks, AK 99701
Phone: (907) 458-9049

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Fairbanks, AK 99701
Ph: (907) 458-9049

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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 Kubota Engine Warranty sheet enclosed in this manual).
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 leu 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.

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

Equipment Source Inc.

1919 Van Horn Rd.
Fairbanks, AK 99701
Ph: (907) 458-9049

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Fairbanks, AK 99701
Ph: (907) 458-9049

Generator Controls

BUILT ARCTIC TOUGH

Equipment Source Inc.

1919 Van Horn Rd.
Fairbanks, AK 99701
Ph: (907) 458-9049

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DSEGenset

DSE402 MKII
WATERPROOF MANUAL/AUTO START CONTROL MODULE

FEATURES

The DSE402 MKII is a waterproof Manual/Automatic Start Control Module designed for genset and other applications. The module is designed to start and stop the engine via a manual waterproof key switch on the front panel. It will provide a number of engine protections, automatically shutting down the engine on detection of a fault condition. Provision is also made for an overspeed shutdown from either the MPU or AC Hz (to be specified on ordering).

First-up shutdown alarm is indicated by a steady red LED.

ENVIRONMENTAL TESTING STANDARDS

ELECTRO MAGNETIC COMPATIBILITY
BS EN 61000-6-2
EMC Generic Immunity Standard for the Industrial Environment
BS EN 61000-6-4
EMC Generic Emission Standard for the Industrial Environment

ELECTRICAL SAFETY
BS EN 60950
Safety of Information Technology Equipment, including Electrical Business Equipment

TEMPERATURE
BS EN 60068-2-1
Ab/Ae Cold Test -30°C
BS EN 60068-2-2
Bb/Be Dry Heat +70°C

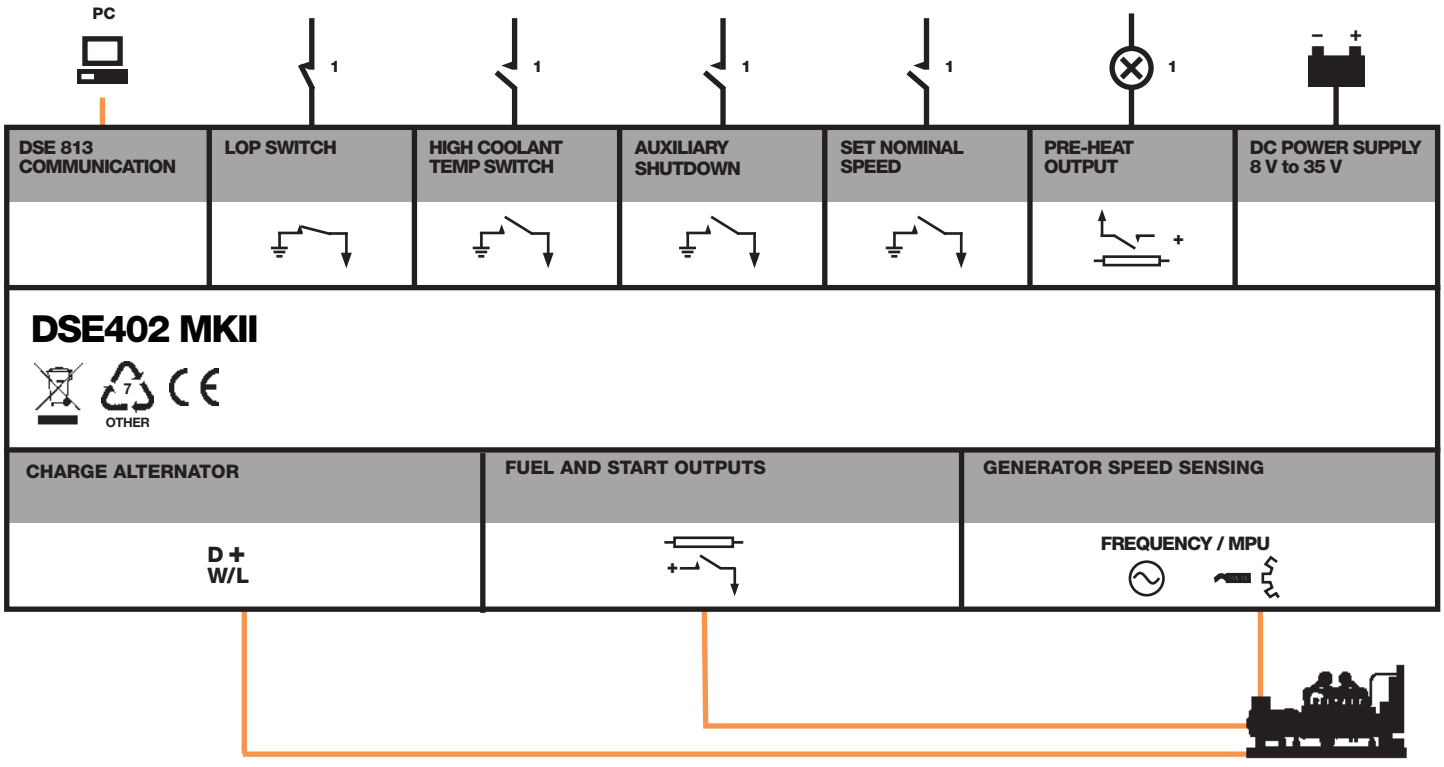
VIBRATION
BS EN 60068-2-6
Ten sweeps in each of three major axes
5Hz to 8Hz @ +/-7.5mm, 8Hz to 500Hz @ 2gn

HUMIDITY
BS EN 60068-2-30
Db Damp Heat Cyclic 20/55°C @ 95% RH
48 Hours
BS EN 60068-2-78
Cab Damp Heat Static 40°C @ 93% RH
48 Hours

SHOCK
BS EN 60068-2-27
Three shocks in each of three major axes
15gn in 11mS

DEGREES OF PROTECTION PROVIDED BY ENCLOSURES
BS EN 60529
IP66

COMPREHENSIVE FEATURE LIST TO SUIT A WIDE VARIETY OF GEN-SET APPLICATIONS



DSEGenset

DSE402 MKII
WATERPROOF MANUAL/AUTO START CONTROL MODULE

FEATURES

KEY FEATURES

- Key start
- Low oil pressure protection
- High engine temperature protection
- Auxiliary shutdown
- PC configurable via DSE813 interface and DSE Configuration Suite PC Software
- Automatic engine pre-heat
- Overspeed protection

KEY BENEFITS

- IP66 rating makes this module ideal for outdoor use
- Potted electronics prevents vibration and water damage
- Licence-free PC Software
- User friendly set up and fascia layout
- Uses DSE Configuration Suite PC Software for simple configuration

SPECIFICATION

DC SUPPLY

CONTINUOUS VOLTAGE RATING
8 V to 35 V continuous

CRANKING DROPOUTS
Able to survive 0 V for 50 mS, providing supply was at least 10 V before dropout and supply recovers to 5 V. This is achieved without the need for internal batteries.

MAXIMUM OPERATING CURRENT
120 mA at 12 V, 170 mA at 24 V

TYPICAL OPERATING CURRENT
60 mA at 12 V, 75 mA at 24 V
In stop position consumption is zero.

CHARGE/FAIL EXCITATION RANGE
0 V to 35 V

OUTPUTS

FUEL
15 A DC at supply voltage

START
15 A DC at supply voltage

PRE-HEAT
2 A DC at supply voltage

DIMENSIONS

OVERALL
157 mm x 111 mm x 60 mm
6.2” x 4.4” x 2.4”

PANEL CUT-OUT
132 mm x 84 mm

STORAGE TEMPERATURE RANGE
-40°C TO +85°C

OPERATING TEMPERATURE RANGE
-30°C TO +70°C

RELATED MATERIALS

TITLE	PART NO’S
DSE402 MKII Installation Instructions	053-087
DSE402 MKII Operator Manual	057-137
DSE402 MKII Configuration Suite Lite Software Manual	057-138
DSE813 USB Communications Adaptor Data Sheet	055-100

DEEP SEA ELECTRONICS PLC UK
Highfield House, Hunmanby Industrial Estate, Hunmanby YO14 0PH
TELEPHONE +44 (0) 1723 890099 **FACSIMILE** +44 (0) 1723 893303
EMAIL sales@deepseaplc.com **WEBSITE** www.deepseaplc.com

DEEP SEA ELECTRONICS INC USA
3230 Williams Avenue, Rockford, IL 61101-2668 USA
TELEPHONE +1 (815) 316 8706 **FACSIMILE** +1 (815) 316 8708
EMAIL sales@deepseausa.com **WEBSITE** www.deepseausa.com

Registered in England & Wales No.01319649
VAT No.316923457

055-097/4/11(2) US

DEEP SEA ELECTRONICS PLC
DSE402 MKII WATERPROOF KEYSTART CONTROLLER

Document number 057-137

Author : Paul Gibbons

Deep Sea Electronics Plc
Highfield House
Hunmanby
North Yorkshire
YO14 0PH
ENGLAND

Sales Tel: +44 (0) 1723 890099
Sales Fax: +44 (0) 1723 893303

E-mail: sales@deepseaplc.com
Website: www.deepseaplc.com

DSE Model DSE402 MKII WATERPROOF KEYSTART CONTROLLER Operators Manual

Amendments since last publication

Issue no.	Comments
1	First Release
2	Amended dimensions of Panel cut out & drawing dimensions

Clarification of notation used within this publication.

NOTE:	Highlights an essential element of a procedure to ensure correctness.
CAUTION!	Indicates a procedure or practice, which, if not strictly observed, could result in damage or destruction of equipment.
WARNING!	Indicates a procedure or practice, which could result in injury to personnel or loss of life if not followed correctly.

TABLE OF CONTENTS

Section **Page**

1 BIBLIOGRAPHY

This document refers to and is referred to by the following DSE publications which can be obtained from the DSE website www.deepseaplc.com

1.1 INSTALLATION INSTRUCTIONS

Installation instructions are supplied with the product in the box and are intended as a 'quick start' guide only.

DSE PART	DESCRIPTION
053-087	DSE402 MKII Installation Instruction

1.2 MANUALS

DSE PART	DESCRIPTION
057-138	DSE402 MKII Configuration Suite Lite Software Manual

2 INTRODUCTION

This document details the installation and operation requirements of the DSE 402 MKII controller is part of the DSEGenset ® range of products.
The manual forms part of the product and should be kept for the entire life of the product. If the product is passed or supplied to another party, ensure that this document is passed to them for reference purposes.
This is not a *controlled document.* You will not be automatically informed of updates. Any future updates of this document will be included on the DSE website at www.deepseaplc.com

The model 402 is a waterproof key start controller. The controller is used to start and stop a engine, indicating fault conditions, automatically shutting down the engine for configured conditions and indicating the engine fault by a steady (WARNING) Shutdown (FLASHING) red LED.

Operation of the module is via a 3 position 'waterproof' key-switch with STOP (O), RUN (I) and START (II) positions. Turning the switch to the 'I' position will initiate a pre-heat relay . Pre-heat operation is indicated by a LED. Once the timer has expired the pre-heat relay will de-energise and the LED will extinguish. The preheat timer output can be configured.

The FUEL relay will then energise and on crank disconnect the Safety On delay timer will commence.

Pre-heat mode can be overridden at any time by turning the switch from the 'I' position to the 'II' position while the preheat LED is illuminated.

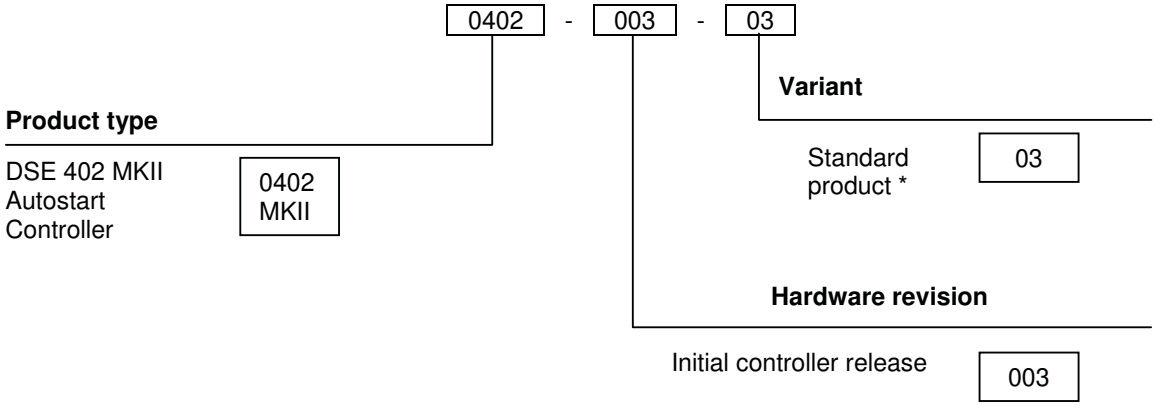
The Model 402 as described above can be configured for (AUTO), when the key position is left in RUN (I) a remote switch can be operated away from the controller to start and stop the engine.

Using a PC and the Configuration Suite Lite software along with the P813 interface allows configuration of selected operational sequences.

The Model 402 is resin encapsulated in a robust plastic case, designed for front panel mounting and supplied with a silicone seal to give IP 66 protection for the front of controller. Connections are via locking plug to Key switch and ¼ inch spade connectors.

3 SPECIFICATIONS

3.1 PART NUMBERING



* Standard product is Magnetic Pickup that can also be configured to sense frequency Hz or RPM using P813 interface and DSE Configuration Suite Lite software.

At the time of this document production, there are no variants of DSE402 MK II product.

3.2 TERMINAL SPECIFICATION

Connection type	Two part connector. • Male part fitted to controller • Female part is via ¼" Crimp Connectors (not supplied)
Minimum cable size	0.5mm² (AWG 24) (check crimp specification)
Maximum cable size	2.5mm² (AWG 10) (check crimp specification)

3.3 POWER SUPPLY REQUIREMENTS

Minimum supply voltage	8V continuous
Cranking dropouts	Able to survive 0V for 50mS providing the supply was at least 10V before the dropout and recovers to 5V afterwards. This is more than sufficient to allow the controller to operate during engine cranking where the battery supply often falls as low as 4V (on a 12V system!) This is achieved without the need for internal batteries or other external requirements.
Maximum supply voltage	35V continuous (60V protection for surges)
Reverse polarity protection	-35V continuous
Maximum operating current	170mA at 24V 120mA at 12V
Maximum standby current	In stop position consumption is zero

3.4 INPUTS

Number	(4) Auxiliary, Oil Pressure, Coolant Temp, Set Nominal Speed
Arrangement	Contact between terminal and ground
Low level threshold	2.1V minimum
High level threshold	6.6V maximum
Maximum input voltage	+50V DC with respect to plant supply negative
Minimum input voltage	-24V DC with respect to plant supply negative
Contact wetting current	2.5mA typical
Open circuit voltage	12V typical

3.4.1 FREQUENCY SENSING INPUT HZ , RPM

Measurement type	Frequency
Input Impedance	900K Ω ph-N
Phase to Neutral	15V to 333V AC (max)
Minimum frequency	3.5Hz
Maximum frequency	75.0Hz
Frequency resolution	0.1Hz
Frequency accuracy	±0.2Hz

3.4.2 MAGNETIC PICKUP

Type	Differential input
Minimum voltage	0.6V RMS
Max common mode voltage	±2V
Maximum frequency	10,000Hz
Resolution	6.25 RPM
Accuracy	±25 RPM

NOTE : DSE can supply a suitable magnetic pickup device, available in two body thread lengths :
DSE Part number 020-012 - Magnetic Pickup probe 5/8 UNF 2½" thread length
DSE Part number 020-013 - Magnetic Pickup probe 5/8 UNF 4" thread length

Magnetic Pickup devices can often be 'shared' between two or more devices. For example, one device can often supply the signal to both the DSE402 MKII speed switch and the engine governor. The possibility of this depends upon the amount of current that the magnetic pickup can supply.

3.5 CHARGE FAIL INPUT/OUTPUT

Minimum voltage	0V
Maximum voltage	35V (plant supply)
Resolution	0.2V
Accuracy	±1% of max measured voltage (±0.35V)
Excitation	Active circuit constant power output
Output Power	2.5W Nominal @12V and 24V
Current at 12V	210mA
Current at 24V	104mA

The charge fail input is actually a combined input and output.
Whenever the generator is required to run, the terminal provides excitation current to the charge alternator field winding.
When the charge alternator is correctly charging the battery, the voltage of the terminal is close to the plant battery supply voltage. In a failed charge situation, the voltage of this terminal is pulled down to a low voltage. It is this drop in voltage that triggers the *charge failure* alarm. The level at which this operates and whether this triggers a warning or shutdown alarm is configurable using the DSE Config Suite Lite Software.

3.6 OUTPUTS

3.6.1 FUEL (A), CRANK (B),

Type	Normally used for Preheat, Fuel and Start outputs.
Rating	15A resistive @ 35V

3.6.2 PRE-HEAT

Type	configurable output (Common Alarm, Energise to stop, Pre-heat)
Rating	2A resistive @ 35V

4 PC CONFIGURATION

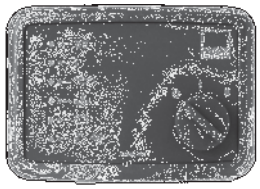
P813 Interface	USB2.0 Device for connection to PC running DSE configuration suite Lite only Max distance 6m (yards)

4.1.1 PC COMMUNICATION

Using the DSE (P813 interface lead package available from Deep Sea PLC) with all the below items, the DSE 402 MKII controller can be connected to a computer to enable simple configuration of parameters. Connection details can be seen in the DSE 402 MKII Configuration Suite Lite software manual (Part no 057-138).

To connect a DSE402 MKII controller to a PC by USB, the following items are required:

- DSE402 MKII Controller



- P813 PC Interface (USB) DSE Part number 016-125

- DSE 402 MKII DSE configuration Suite Lite software
- Available from the DSE Website www.deepseaplc.com
- The software CD will be supplied with the P813 PC Interface (USB)

NOTE:- The DC supply must be connected to the controller for configuration by PC.

NOTE:- Refer to DSE402 MKII PC Software Manual (DSE part) for further details on connecting the P813 to the controller and PC.

4.2 DIMENSIONS AND MOUNTING

4.2.1.1 DIMENSIONS

158 mm x 112 mm x 87 mm*
(6.2” x 4.4” x 3.4”*)
* excluding key switch

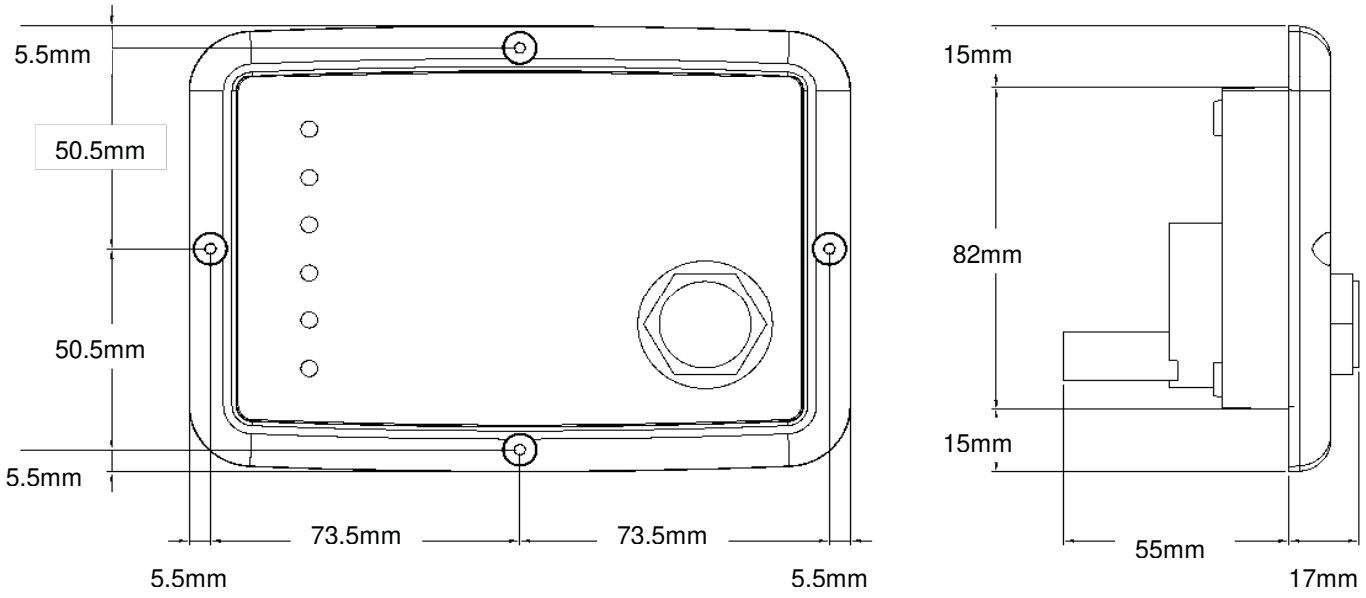
PANEL CUTOUT
132 mm x 84 mm
(5.2” x 3.3”)

Mounting
Waterproof sealing gasket for details see elsewhere in this manual.

The key-switch barrel has a drain hole which exits on the underside of the switch behind the mounting flange. Ensure suitable arrangements are made if mounting the controller within an enclosure.

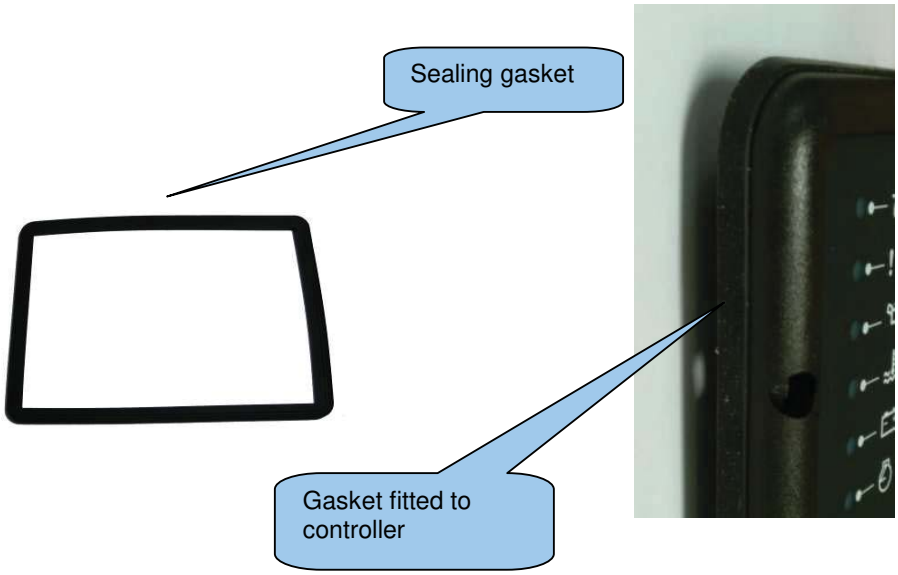
Screw Size: M4
Torque Rating: 0.60 Nm

WEIGHT
0.3 Kg (0.661 lb)



4.2.2 SILICON SEALING GASKET

The supplied silicon gasket provides improved sealing between the DSE402 MKII controller and the panel fascia.
The gasket is fitted to the controller before installation into the panel fascia.
Take care to ensure the gasket is correctly fitted to the controller to maintain the integrity of the seal.



4.3 APPLICABLE STANDARDS

BS 4884-1	This document conforms to BS4884-1 1992 Specification for presentation of essential information.
BS 4884-2	This document conforms to BS4884-2 1993 Guide to content
BS 4884-3	This document conforms to BS4884-3 1993 Guide to presentation
BS EN 60068-2-1 (Minimum temperature)	-30°C (-22°F)
BS EN 60068-2-2 (Maximum temperature)	+70°C (158°F)
BS EN 60950	Safety of information technology equipment, including electrical business equipment
BS EN 61000-6-2	EMC Generic Immunity Standard (Industrial)
BS EN 61000-6-4	EMC Generic Emission Standard (Industrial)
BS EN 60529 (Degrees of protection provided by enclosures) (see overleaf)	IP66 (front of controller when installed into the control panel with the supplied sealing gasket) IP42 (front of controller when installed into the control panel WITHOUT being sealed to the panel)
UL508 **NEMA rating** (Approximate) (see overleaf)	12 (Front of controller when installed into the control panel with the supplied sealing gasket). 2 (Front of controller when installed into the control panel WITHOUT being sealed to the panel)
IEEE C37.2 (Standard Electrical Power System Device Function Numbers and Contact Designations)	Under the scope of IEEE 37.2, *function numbers can also be used to represent functions in microprocessor devices and software programs*. As the controller is configurable by the generator OEM, the functions covered by the controller will vary. Under the controller's factory configuration, the device numbers included within the controller are : 2 – Time delay starting or closing relay 6 – Starting circuit breaker 30 – annunciator relay 54 – turning gear engaging device 62 – time delay stopping or opening relay 63 – pressure switch 74– alarm relay 81 – frequency relay 86 – lockout relay

4.3.1 ENCLOSURE CLASSIFICATIONS

IP CLASSIFICATIONS

DSE402 MKII **BS EN 60529** Degrees of protection provided by enclosures

IP66 (Front of controller when controller is installed into the control panel with the optional sealing gasket).
IP42 (front of controller when controller is installed into the control panel WITHOUT being sealed to the panel)
IP54 Rear of controller(suitable grease should be applied to terminals if exposed to a harsh environment

First Digit Protection against contact and ingress of solid objects	Second Digit Protection against ingress of water
0 No protection	0 No protection
1 Protected against ingress solid objects with a diameter of more than 50 mm. No protection against deliberate access, e.g. with a hand, but large surfaces of the body are prevented from approach.	1 Protection against dripping water falling vertically. No harmful effect must be produced (vertically falling drops).
2 Protected against penetration by solid objects with a diameter of more than 12 mm. Fingers or similar objects prevented from approach.	2 Protection against dripping water falling vertically. There must be no harmful effect when the equipment (enclosure) is tilted at an angle up to 15° from it s normal position (drops falling at an angle).
3 Protected against ingress of solid objects with a diameter of more than 2.5 mm. Tools, wires etc. with a thickness of more than 2.5 mm are prevented from approach.	3 Protection against water falling at any angle up to 60° from the vertical. There must be no harmful effect (spray water).
4 Protected against ingress of solid objects with a diameter of more than 1 mm. Tools, wires etc. with a thickness of more than 1 mm are prevented from approach.	4 Protection against water splashed against the equipment (enclosure) from any direction. There must be no harmful effect (splashing water).
5 Protected against harmful dust deposits. Ingress of dust is not totally prevented but the dust must not enter in sufficient quantity to interface with satisfactory operation of the equipment. Complete protection against contact.	5 Protection against water projected from a nozzle against the equipment (enclosure) from any direction. There must be no harmful effect (water jet).
6 Protection against ingress of dust (dust tight). Complete protection against contact.	6 Protection against heavy seas or powerful water jets. Water must not enter the equipment (enclosure) in harmful quantities (splashing over).

NEMA CLASSIFICATIONS

402 MKII NEMA Rating (Approximate)

4 (Front of controller when controller is installed into the control panel with the optional sealing gasket).
3 (front of controller when controller is installed into the control panel WITHOUT being sealed to the panel)
2 Rear of controller (suitable grease should be applied to terminals if exposed to a harsh environment)

⚠ NOTE: - There is no direct equivalence between IP / NEMA ratings. IP figures shown are approximate only.

1 **IP30**	Provides a degree of protection against contact with the enclosure equipment and against a limited amount of falling dirt.
2 **IP31**	Provides a degree of protection against limited amounts of falling water and dirt.
3 **IP64**	Provides a degree of protection against windblown dust, rain and sleet; undamaged by the formation of ice on the enclosure.
3R **IP32**	Provides a degree of protection against rain and sleet:; undamaged by the formation of ice on the enclosure.
4 (X) **IP66**	Provides a degree of protection against splashing water, windblown dust and rain, hose directed water; undamaged by the formation of ice on the enclosure. (Resist corrosion).
12/12K **IP65**	Provides a degree of protection against dust, falling dirt and dripping non corrosive liquids.
13 **IP65**	Provides a degree of protection against dust and spraying of water, oil and non corrosive coolants.

5 INSTALLATION

The DSE402 MKII controller is designed to be mounted on the panel fascia. For dimension and mounting details, see the section entitled *Specification, Dimension and mounting* elsewhere in this document.

5.1 TERMINAL DESCRIPTION

5.1.1 DC SUPPLY, FUEL AND START OUTPUTS

Icon	PIN No	DESCRIPTION	CABLE SIZE	NOTES
	1	DC Plant Supply Input (Positive) Minimum 8V to 35V	2.5mm² AWG 13	Recommended Maximum Fuse 30A anti-surge)
	2	Output relay (B) (Crank)	2.5 mm² AWG 13	Plant Supply Positive from terminal 1. 15 Amp rated.
	3	Output relay (C) (PRE-HEAT)	2.5mm² AWG 13	Plant Supply Positive from terminal 1. 2 Amp rated.
	4	Output relay (A) (FUEL)	2.5mm² AWG 13	Plant Supply Positive from terminal 1. 15 Amp rated.
	5	DC Plant Supply Input (Negative)	2.5mm² AWG 13	
	6	Auxiliary shutdown	1.0mm² AWG 18	Configurable input
	7	Oil Pressure	0.5mm² AWG 20	Connect to Oil pressure switch
	8	Coolant Temperature	0.5mm² AWG 20	Connect to Coolant Temperature switch
	9	Charge fail / excite	1.0mm² AWG 18	
	10	Signal +	0.5mm² AWG 20	Magnetic pickup Positive / Frequency Hz or RPM sensing
	11	Signal -	0.5mm² AWG 20	Magnetic pickup Negative / Frequency Hz or RPM sensing
	12	SET NOMINAL SPEED	1.0mm² AWG 18	Configurable Input

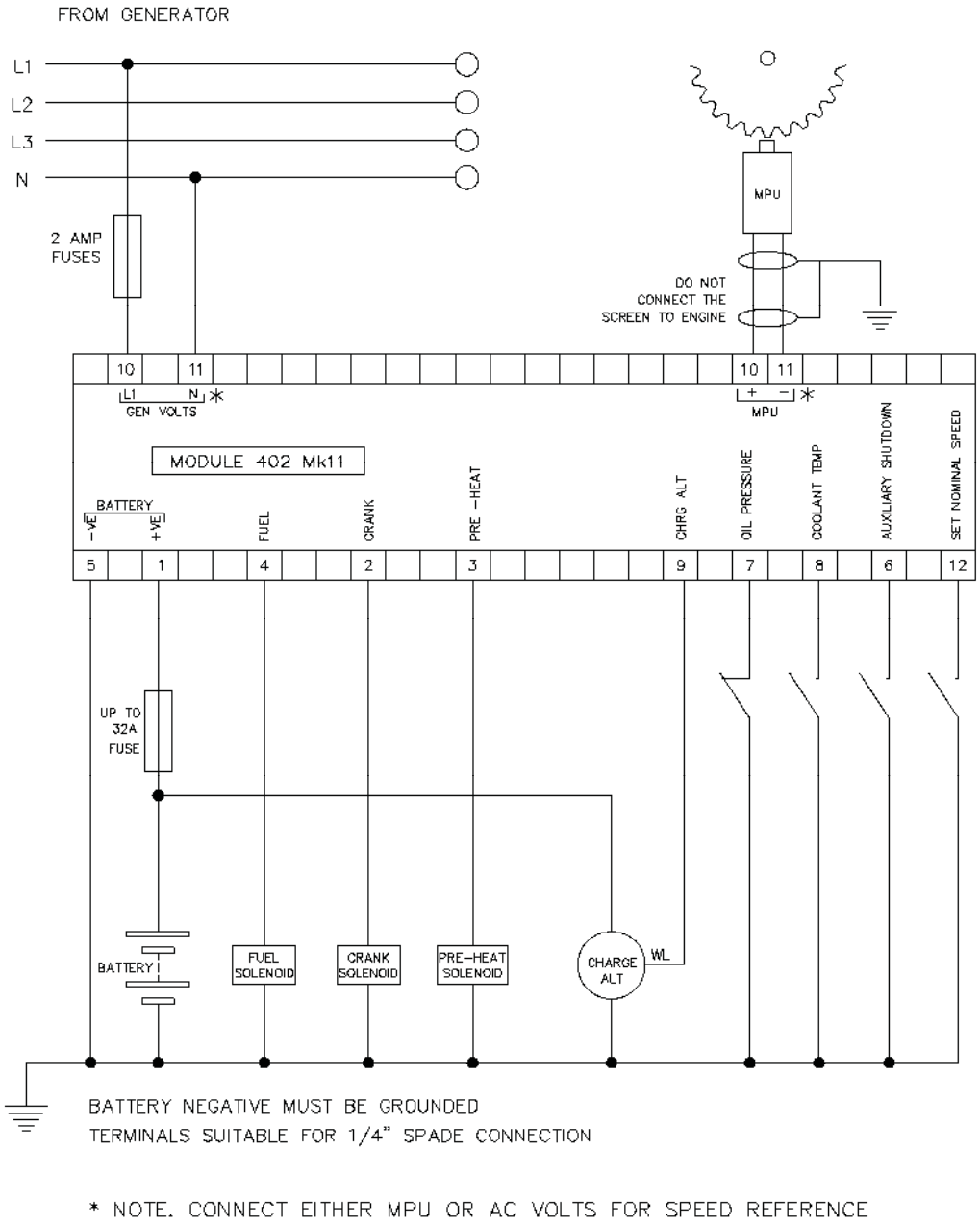
NOTE: - If you use PTFE insulating tape on the Oil pressure or Temperature switch thread when using earth return switches, ensure you do not insulate the entire thread, as this will prevent the switch body from being earthed via the engine block.

NOTE:- Screened cable must be used for connecting the Magnetic Pickup, ensuring that the screen is earthed at one end ONLY other wise the cable will act as an aerial.

5.2 TYPICAL WIRING DIAGRAMS

As every system has different requirements, these diagrams show only a TYPICAL system and do not intend to show a complete system.

Further wiring suggestions are available in the following DSE publications, available at www.deepseaplc.com to website members.



5.2.1 EARTH SYSTEMS

5.2.1.1 NEGATIVE EARTH

The typical wiring diagrams located within this document show connections for a negative earth system (the battery negative connects to Earth)

5.2.1.2 POSITIVE EARTH

When using a DSE controller with a Positive Earth System (the battery positive connects to Earth), the following points must be followed:

- Follow the typical wiring diagram as normal for all sections EXCEPT the earth points
- All points shown as Earth on the typical wiring diagram should connect to BATTERY NEGATIVE (not earth).

5.2.1.3 FLOATING EARTH

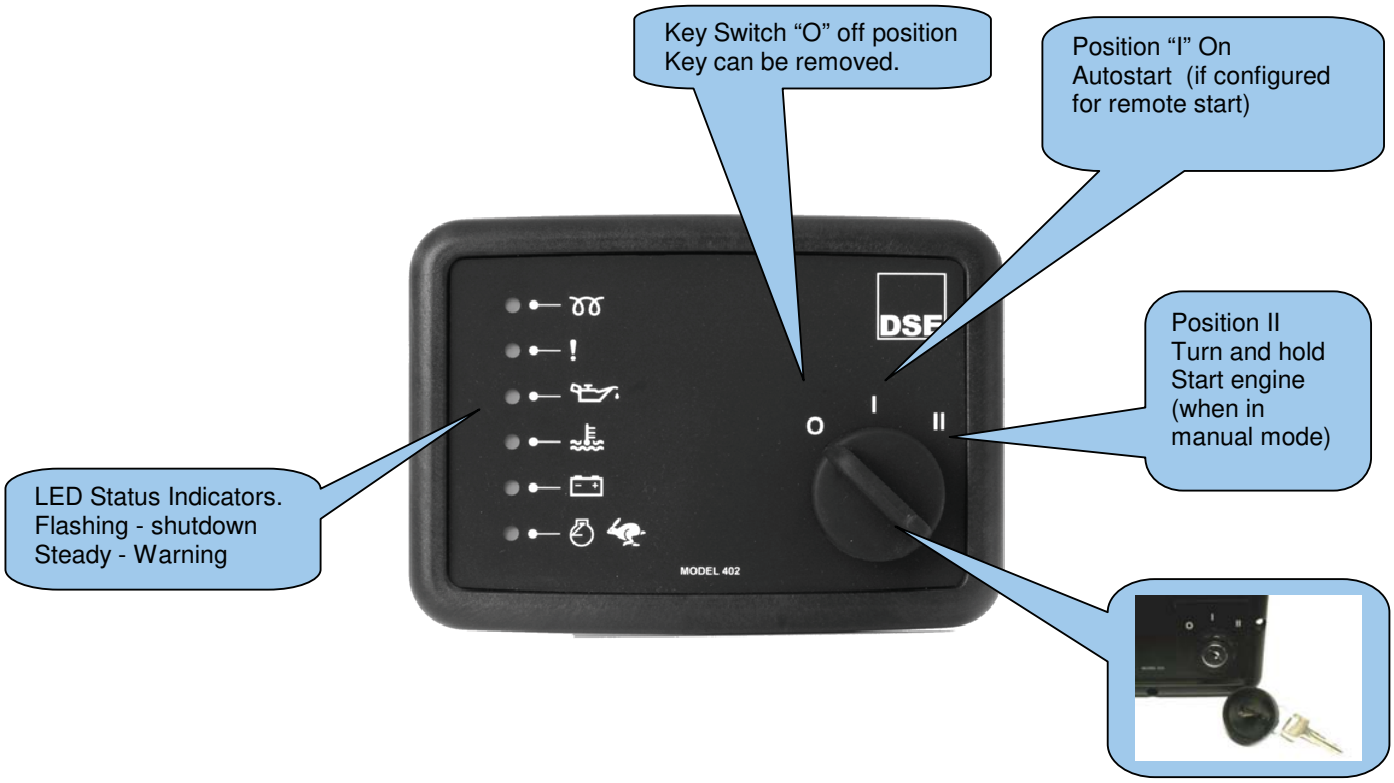
Where neither the battery positive nor battery negative terminals are connected to earth the following points must to be followed

- Follow the typical wiring diagram as normal for all sections EXCEPT the earth points
- All points shown as Earth on the typical wiring diagram should connect to BATTERY NEGATIVE (not earth).

5.3 DESCRIPTION OF CONTROLS

The following section details the function and meaning of the various controls on the controller.

5.4 DSE 402 MKII AUTOSTART CONTROL CONTROLLER



ICON	DESCRIPTION	
	Pre Heat	The Pre heat output The auxiliary charge alternator voltage is low as measured from the W/L terminal.
	Auxiliary Alarm	An external alarm condition has occurred. Example Emergency Stop
	LOW OIL PRESSURE	The controller detects that the engine oil pressure has fallen below the low oil pressure pre-alarm setting level after the *Safety On* timer has expired.
	ENGINE HIGH TEMPERATURE	The controller detects that the engine coolant temperature has exceeded the high engine temperature pre-alarm setting level after the *Safety On* timer has expired.
	BATTERY UNDER VOLTAGE / BATTERY OVER VOLTAGE	The DC supply has fallen below or risen above the low/high volts setting level.
	OVERSPEED	The engine speed has risen above the over speed pre alarm setting

5.5 QUICKSTART GUIDE

This section provides a quick start guide to the controller's operation

5.1 CONTROLS

Stop / **Reset** Turning the keyswitch to this position places the controller into its **Stop**/**Reset** mode. This will clear any alarm conditions unless the alarm condition is still present.	
Run. *Moving the Keyswitch into this position.* *Controller in manual or auto mode (auto mode if remote start configured).* *Preheat timer commences and gives pre-heat output.*	
Turn and hold In this position will send the Fuel and crank signals to start the engine, The preheat will continue if the timer has not expired this is indicated by the preheat led.	

6 SETTINGS AND ADJUSTMENTS

The setting of nominal speed and adjustment of trip points can be set using the following method.

6.1.1.1 SETTING OF NOMINAL SPEED

- With the DSE402 MKII connected, run the engine at nominal speed. Connect the 'Set Nominal Speed' input to battery negative to set the nominal speed.

6.1.1.2 ADJUSTMENT OF TRIP POINTS

- Turn the pre-set potentiometers to set the trip point. The factory setting for the Trip is 90% to 140% . The range is adjusted from 0% to 400% of nominal engine speed via the DSE Configuration Suite Lite PC Software.
- Turn the pre-set potentionmeters clockwise to increase the trip point, turn it anti-clockwise to decrease the trip point.
- The *'Engine Overspeed LED'* will illuminate when the trip has been achieved.

6.2 SHUTDOWNS / WARNINGS

Shutdowns are latching alarms and stop the Generator. Clear the alarm and remove the fault then switch the Keyswitch to "O" to reset the controller.
A flashing LED indicates a shutdown condition
A steady LED indicates a warning.

NOTE:- The alarm condition must be rectified before a reset will take place. If the alarm condition remains, it will not be possible to reset the unit (The exception to this is the Low Oil Pressure alarm and similar 'active from safety on' alarms, as the oil pressure will be low with the engine at rest).

Display	Reason
LOW OIL PRESSURE	The engine oil pressure has fallen below the low oil pressure trip setting level after the *Safety On* timer has expired.
ENGINE HIGH TEMPERATURE	The engine coolant temperature has exceeded the high engine temperature trip setting level after the *Safety On* timer has expired.
OVERSPEED	The engine speed has exceeded the pre-set trip
UNDERSPEED	The engine speed has fallen below the pre-set trip after the ***Safety On*** timer has expired.

7 COMMISSIONING

7.1.1 PRE-COMMISSIONING

Before the system is started, it is recommended that the following checks are made:-

10.1. The unit is adequately cooled and all the wiring to the controller is of a standard and rating compatible with the system. Check all mechanical parts are fitted correctly and that all electrical connections (including earths) are sound.

10.2. The unit **DC** supply is fused and connected to the battery and that it is of the correct polarity.

10.3. Make all checks on the engine and alternator as detailed by their respective manufacturer documentation.
10.4. Check all other parts in the system according to the manufacturer documentation.
10.5. Thoroughly review the configuration of the DSE controller and check that all parameters meet the requirements of your system.

10.6. +To check the start cycle operation, take appropriate measures to prevent the engine from starting (disable the operation of the fuel solenoid). After a visual inspection to ensure it is safe to proceed, connect the battery supply. Put the Keyswitch into the "**I**" position and then "**II**", the unit start sequence will commence.

10.7. The starter will engage and operate for the pre-set crank period. After the starter motor has attempted to start the engine the explanation mark will illuminate.

10.8. Restore the engine to operational status (reconnect the fuel solenoid). Turn the Ketswitch to the off position and then to the **"I " then "II"**. This time the engine will start and the starter motor will disengage automatically. If not then check the engine is fully operational (fuel available, etc.) and the fuel solenoid is operating. The engine will now run up to operating speed. If not, and an alarm is present, check the alarm condition for validity, and check input wiring. The engine will continue to run for an indefinite period.

10.9. Fully commission the engine/alternator and any other parts in the system as detailed in the respective manufacturer documentation. This could includes load bank testing, load acceptance, breaker control and more.

10.10. If despite repeated checking of the connections between the **DSE402 MKII** controller and the customer's system, satisfactory operation cannot be achieved, then the customer is requested to contact the factory for further advice on:-

INTERNATIONAL TEL: +44 (0) 1723 890099
INTERNATIONAL FAX: +44 (0) 1723 893303
E-mail: Support@Deepseaplc.com
Website : www.deepseaplc.com

FAULT FINDING

SYMPTOM	POSSIBLE REMEDY
Unit is inoperative Read/Write configuration does not operate	Check the battery and wiring to the unit. Check the DC supply. Check the DC fuse.
Unit shuts down	Check DC supply voltage is not above 35 Volts or below 9 Volts Check the operating temperature is not above 70°C. Check the DC fuse.
Intermittent Magnetic Pick-up sensor fault	Ensure that Magnetic pick-up screen only connects to earth at one end, if connected at both ends, this enables the screen to act as an aerial and will pick up random voltages. Check pickup is correct distance from the flywheel teeth.
Low oil Pressure fault operates after engine has fired	Check engine oil pressure. Check oil pressure switch and wiring. Check configured polarity (if applicable) is correct (i.e. Normally Open or Normally Closed)
High engine temperature fault operates after engine has fired.	Check engine temperature. Check switch and wiring. Check configured polarity (if applicable) is correct (i.e. Normally Open or Normally Closed) .
common fault operates	Check relevant switch and wiring of fault indicated by LED. Check configuration of input.
Fail to Start is activated after pre-set number of attempts to start	Check wiring of fuel solenoid. Check fuel. Check battery supply. Check battery supply is present on the Fuel output of the controller. Check the speed-sensing signal is present on the controller's inputs. Refer to engine manual.
Continuous starting of generator when in **AUTO**	Check that there is no signal present on the "Remote Start" input. Check configured polarity is correct.
Generator fails to start on receipt of Remote Start signal.	Check Start Delay timer has timed out. Check signal is on "Remote Start" input. Confirm correct configuration of input Check that the oil pressure switch is indicating low oil pressure to the controller. Depending upon configuration, then set will not start if oil pressure is not low.
Pre-heat inoperative	Check wiring to engine heater plugs. Check battery supply. Check battery supply is present on the Pre-heat output of controller. Check pre-heat configuration is correct.
Starter motor inoperative	Check wiring to starter solenoid. Check battery supply. Check battery supply is present on the Starter output of controller. Ensure that the Emergency Stop input is at Positive. Ensure oil pressure switch or sensor is indicating the "low oil pressure" state to the controller.
Controller appears to 'revert' to an earlier configuration	When editing a configuration using the PC software it is vital that the configuration is first 'read' from the controller before editing it. This edited configuration must then be "written" back to the controller for the changes to take effect.

NOTE:- The above fault finding is provided as a guide check-list only. As the controller is configurable for a range of different features, always refer to the source of your controller configuration if in doubt.

8 MAINTENANCE, SPARES, REPAIR AND SERVICING

The DSE402 MKII controller is *Fit and Forget*. As such, there are no user serviceable parts within the controller. In the case of malfunction, you should contact your original equipment manufacturer (OEM).

8.1 PURCHASING ADDITIONAL SEALING GASKET FROM DSE

Item	Description	Part No.
	DSE402 MKII silicon sealing gasket	020-016

9 WARRANTY

DSE provides limited warranty to the equipment purchaser at the point of sale. For full details of any applicable warranty, you are referred to your original equipment supplier (OEM).

10 DISPOSAL

10.1 WEEE (WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT)

Directive 2002/96/EC
If you use electrical and electronic equipment you must store, collect, treat, recycle and dispose of WEEE separately from your other waste.

10.2 ROHS (RESTRICTION OF HAZARDOUS SUBSTANCES)

Directive 2002/95/EC: 2006
To remove specified hazardous substances (Lead, Mercury, Hexavalent Chromium, Cadmium, PBB & PBDE´s)

Exemption Note: Category 9. (Monitoring & Control Instruments) as defined in Annex 1B of the WEEE directive will be exempt from the RoHS legislation. This was confirmed in the August 2005 UK´s Department of Trade and Industry RoHS REGULATIONS Guide (Para 11).

Despite this exemption, DSE has been carefully removing all non RoHS compliant components from our supply chain and products.
When this is completed, a Lead Free & RoHS compatible manufacturing process will be phased into DSE production.

This process is almost complete and is being phased through different product groups.

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Hourmeters

ETM-97030B
Revised 11-01
Catalog Section 20
(00-02-0259)

CE*

TM Series

- 2 in. (51 mm) Diameter Dial
- Tamperproof and Environmentally Sealed
- Mechanical Counter–No Battery Needed to Maintain Elapsed Time
- Reversed Polarity Protected
- Quartz-Crystal Time Base for Accurate Long-Term Timekeeping
- Powered by 12 to 24 VDC

Description

The TM Series hourmeters record the operating time of vehicles or powered equipment. They are electromechanical and have a quartz base time counter that insures accuracy (better than ±0.02% over the entire range). They can record up to 99,999.9 hours (9,999.9 for TM612/624) and include an automatic recycle to zero hours feature. The TM Series models have a shock-proof and tamperproof, totally sealed case made of an engineered plastic. These small, light weight time meters are rugged and durable. They are the answer to applications requiring a low DC power, reliable hourmeter.

The TM612/624 model includes a 3-hole mounting shock ring for extreme-shock protection.

Basic Models

6-Digits Hourmeters

Model	*Bezel Type*
TM4592	Bright Stainless Steel Bezel
TM4593	Black Stainless Steel Bezel
TM4594	SAE Bright Stainless Steel Bezel
TM4595	SAE Stainless Steel Black Bezel

5-Digits Hourmeter with Shock Ring Mounting

TM612/624	3-Hole Mount, Black Bezel

Applications

These hourmeters can be used on any engine where operating time needs to be recorded. All it requires is a DC power source (refer to Specifications, at right).

Outstanding Features

- Solid-State Electronic Drive Circuit
- Quartz-Crystal for Accurate Timing
- Quiet Operation–Permanently Lubricated
- High-Impact, Tamperproof Plastic Case
- Sealed Against Moisture and Dirt
- Indicates Operating Time in Hours and Tenths
- No Battery Back Up Required
- Made in the U.S.A.

Specifications

Power Input: 12 to 24 VDC
Power Consumption: Less than 0.03 W @ 12 VDC; 0.4 W @ 24 VDC.
Accuracy: ± 0.02% over entire range.
Temperature Range: -40°F to 185°F (-40°C to +85°C).
Dial (Face Plate): White numerals (over black background).
Time Scale: TM4592-95 models: 6-digits 99,999.9 hours; TM612/624 models: 5-digits 9,999.9 hours. Automatic recycle to zero.
Vibration Resistance: Withstands 10 to 75 Hz @ 1 to 8 G's.
Case Material: Plastic.
Bezel: Stainless Steel.
Terminations: 1/4 in. (6 mm) male blade terminals.
TM4592/4595 Shipping Weight: 5 ozs. (140 g).
Shipping Dimensions: 3-1/8 x 3 x 3 in. (79 x 76 x 76 mm) approximately.
TM612/624 Shipping Weight: 8 ozs. (230 g).
TM612/624 Shipping Shipping Dimensions: 5 x 5 x 3-1/4 in. (127 x 127 x 83 mm) approx.

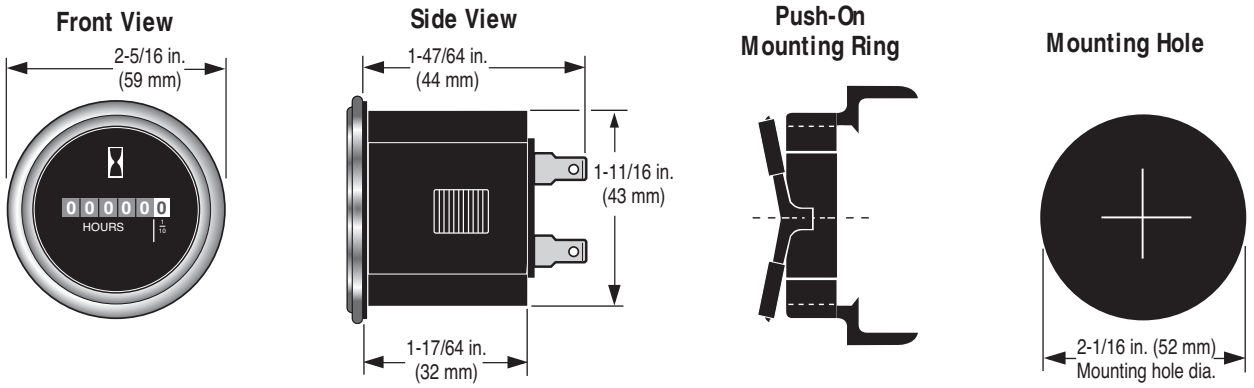
Warranty

A limited warranty on materials and workmanship is given with this FW Murphy product. A copy of the warranty may be viewed or printed by going to www.fwmurphy.com/support/warranty.htm

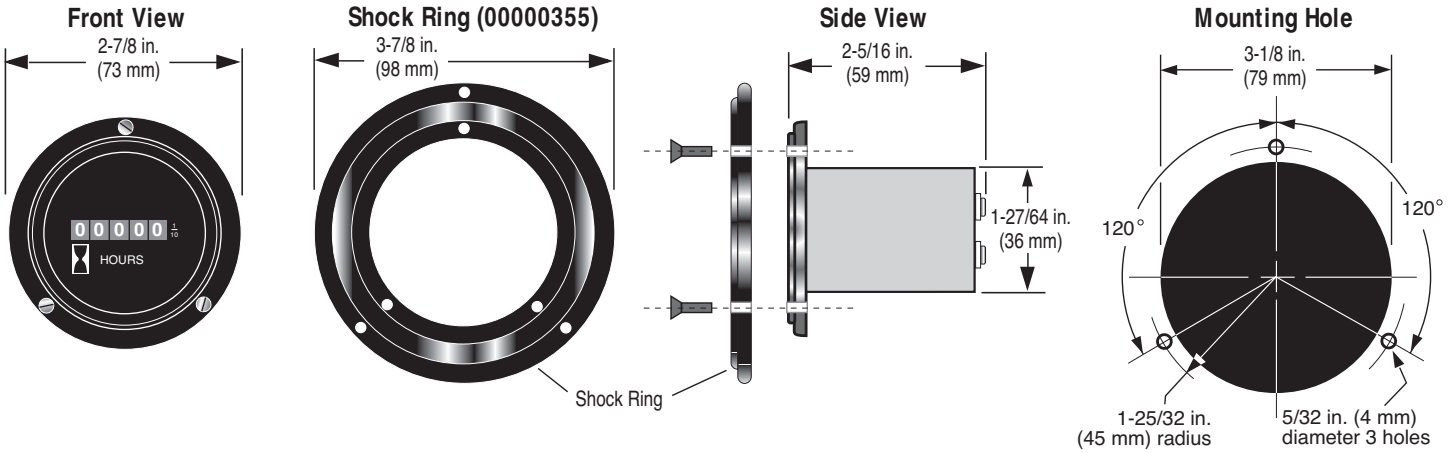
* Products covered by this bulletin comply with EMC Council directive 89/336/EEC regarding electromagnetic compatibility except as noted. The CE mark does not apply to the TM612 and TM624 models.

MURPHY®

TM4592–TM4595 Models

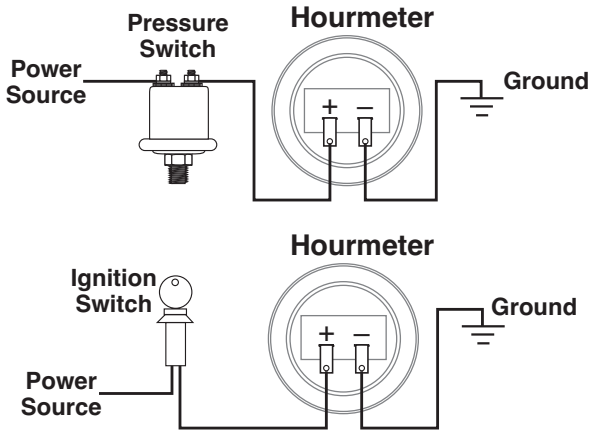


TM612/624 Model with Shock Ring



Typical Wiring Diagrams

WARNING: Turn the power source OFF before wiring.



How to Order

Example: **TM4592**

Model Designation

Model	*Description*
TM4592	6-digits w/Bright Stainless Steel Bezel
TM4593	6-digits w/Black Stainless Steel Bezel
TM4594	6-digits w/SAE Bright Stainless Steel Bezel
TM4595	6-digits w/SAE Stainless Steel Black Bezel
TM612/624	5-digits w/Shock Ring Mount Black Bezel
00000355	Shock Ring only for TM612/624

MURPHY
www.fwmurphy.com
918.317.4100 Email: sales@fwmurphy.com

Equipment Source Inc.

1919 Van Horn Rd.
Fairbanks, AK 99701
Ph: (907) 458-9049

Generator

BUILT ARCTIC TOUGH

Equipment Source Inc.

1919 Van Horn Rd.
Fairbanks, AK 99701
Ph: (907) 458-9049

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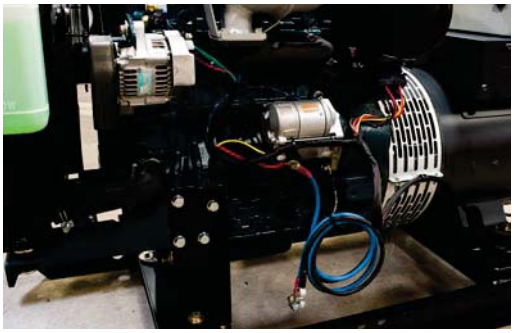
Equipment Source Inc.

KPG 15kW
Diesel Generator

Standard Features

- Kubota 3-cylinder diesel engine
- Electronic speed governing provides isochronous speed regulation, no load to full load
- EPA tier 4 compliant
- Liquid cooled with industrial grade radiator and belt driven blower fan
- Manual safety shutdown override, fuse protection
- Safety shutdowns, energized-to-run, for low oil pressure/high coolant temperature
- Four anti-vibration mounts between gen set and base
- Electric fuel transfer and priming pump (12 VDC)
- Battery cables for 12 VDC starting system
- Key start panel with hour meter

Powered by a Kubota diesel engine, this generator set produces 15 kilowatts of prime power output. The engine is directly coupled to a Mecc Alte generator, and the entire set is mounted on a rugged steel skid. All components are suitable for prime or intermittent usage. The KPG 15kW is constructed to UL approved standards, and is thoroughly load tested prior to shipment.



Note: Pictures shown are for illustration purposes only. Product will vary depending on actual configuration.

BUILT ARCTIC TOUGH

www.EquipmentSourceInc.com

Specifications

Engine	
Manufacturer	Kubota
Model	D1703-M-BG
Cylinders	Three
Bore x Stroke	3.43” x 3.64”
Displacement	1647 cc (100.5 cu.in.)
Comp. ratio	22:1
Engine weight	362 lbs dry
Fuel system	
Fuel type	#2 diesel or #1 ULSD
Injection Pump	Bosch PFR
Nozzle type	Throttle type
Transfer pump	Electric, 12 VDC
Fuel lift	1 meter (3.3 ft)
Suction fitting	5/16” push on
Return fitting	3/16” push on *Optional 1/4” suction and return fittings on skid*
Specific fuel consumption	1.30 gph @ full load 0.68 gph @ half load
Lube oil system	
Grade	API classification CF or other approved. See owner manual.
Capacity	1.5 gal
Filter	Full flow, spin on
Air intake system	
Filter	Replaceable element
Combustion air	50.6 cfm
Total system restriction	20” H2O
DC electrical system	
Starter	12V, 1.4kW
Alternator	12V, 40 Amp
Glow plugs location	Combustion chambers
Battery required	12V 650 CCA equiv, min
Run solenoid	12V Energize-to-run
Ancillary equipment	
Mounting	Steel base w/ mounting holes
Isolators	Four composite mounts

Generator technical information	
Manufacturer	Mecc Alte
Model	ECO 32 (standard)
Construction	Four pole, brushless, open drip-proof (IP23), single bearing
Excitation	Dedicated auxiliary winding
Cooling airflow	286 cfm
Leads	4 or 12, application dependent
60 Hz voltages (Continuous)	240 1-phase: 54.7 A 208 3-phase: 45.6 A 480 3-phase: 19.8 A
Power factor	Single phase rating @ 1.0PF Three phase rating @ 0.8 PF
Voltage reg.	DSR solid state +/- 1% NL-> FL
Temperature rise	105C rise prime
Tel. interference	THF <2%
Winding pitch	Two thirds
Control system	Self-excited
Cooling system	
Radiator	Finned tube type
Material	Copper core, soldered tanks
Pressure	12.9 psi max
Fan type	Blower, nylon
Water pump	Gear case mounted
Type	Centrifugal, belt drive
Thermostat	Wax pellet type
Recommended coolant	50/50
Cooling air required	1502 cfm
Exhaust system	
Muffler type	Industrial grade
Mounting	Vertical
Restriction	1.5 in Hg max
Dimensions	
Please contact salesperson for weight and dimensions	

Anchorage, AK
7780 Old Seward Hwy.
907-341-2250

Fairbanks, AK
1919 Van Horn Rd.
907-458-9049

Renton, WA
1010 SW 41st St.
425-251-6119

Williston, ND
5064 Bennet Loop
701-774-5312

OPERATORS MANUAL

KPG Generator

SPECIFICATIONS

See product specification sheet for product specifications

Equipment Source, Inc.
1919 Van Horn Rd. Fairbanks, AK 99701
Ph (907) 458-9049 equipmentsourceinc.com

1 Introduction

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

1.1 General Description

ESI built KPG 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 Series	Skid mounted ESI Generators
KPG 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 Monitoring and Operation

4.4.1 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.

4.4.2 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.

4.5 Long Run Oil Tank (LRT)

- A 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.

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) o Initial Oil Change: 50 hours o Interval: ▪ KPG-06 to KPG-24: 200 hours ▪ KPG-28 & KPG-36: 250 hours ▪ KPG-45: 500 hours ▪ Long Run Oil Pan (LRT) Option o 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-06 to KPG-24) **OR** Every 250 hours (KPG-28 & 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 (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 (units equipped with LRT) ▪ Check turbo charge (if unit is equipped with a turbo) ▪ Check supply pump	
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**

Equipment Source Inc.

1919 Van Horn Rd.
Fairbanks, AK 99701
Ph: (907) 458-9049

Alternator Manual

BUILT ARCTIC TOUGH

Equipment Source Inc.

1919 Van Horn Rd.
Fairbanks, AK 99701
Ph: (907) 458-9049

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I
ALTERNATORI AUTOREGOLATI SERIE ECO-ECP
ISTRUZIONI PER L'USO E LA MANUTENZIONE

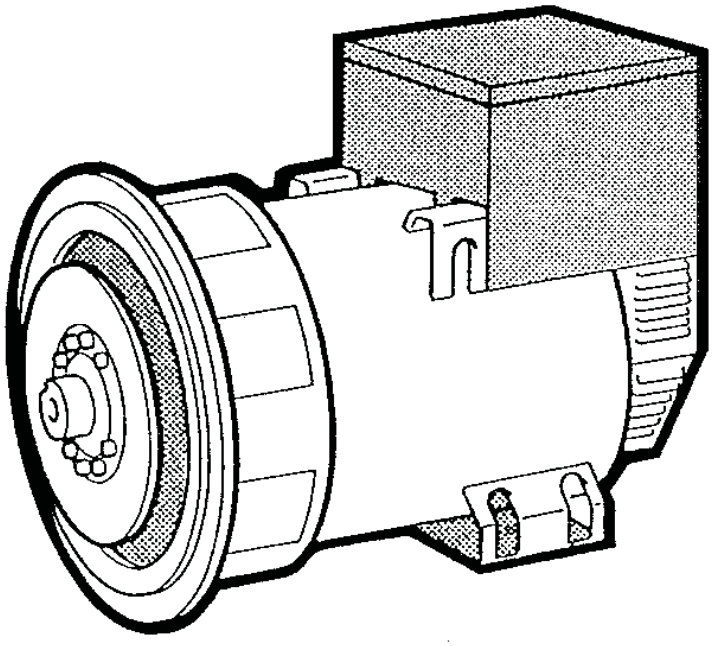
GB
SELF- REGULATING ALTERNATORS SERIES ECO-ECP
OPERATING AND MAINTENANCE INSTRUCTIONS

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

CE



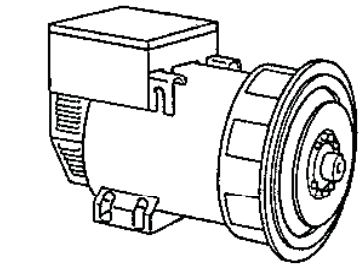
ECO
ECP

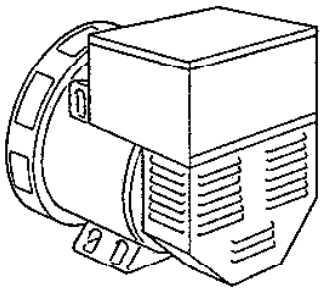
CSA

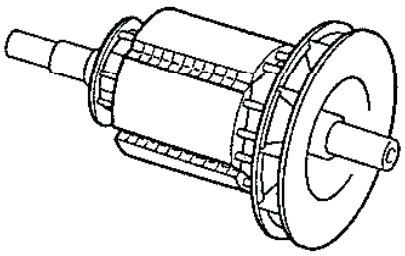
cULus INSULATION SYSTEM

DESCRIZIONE MACCHINA

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 compatibilita' 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).







MACHINE DESCRIPTION

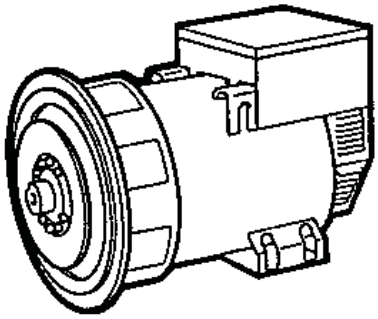
ECO-ECP 2 and 4 pole alternators are brushless, self-regulating and incorporate a rotating inductor with damper cage winding and a fixed stator with skewed slots.
The stator windings have a shortened pitch to reduce the harmonic content of the output waveform.
The alternators are made in compliance with 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, manutenuti 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.



INTRODUCTION

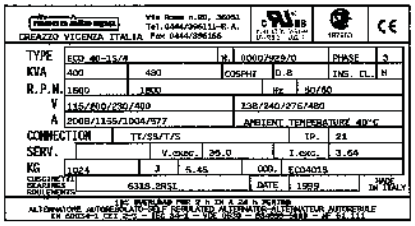
The ECO-ECP alternators comply with the EEC 2006/42, 2006/95, 2004/108 directives and their amendments; therefore they pose no danger to the operator if they are installed, used and maintained according to the instructions given by Mecc Alte and provided the safety devices are kept in perfect working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

Therefore a strict observance of these instructions is required.

Any reproduction of this manual is forbidden.

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.

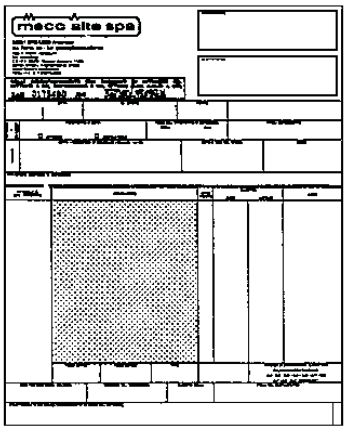


MACHINE IDENTIFICATION

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

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 spedizionere, l'assicurazione, il rivenditore o la Mecc Alte.



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

Durante la consultazione del presente manuale d'uso e manutenzione troverete alcuni simboli; questi hanno un preciso significato qui di seguito illustrato.

SIMBOLOGIA CONVENZIONALE E SUA DEFINIZIONE

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.

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.

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.

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.

IMPORTANTE
IMPORTANT
WICHTIG

SAFETY REQUIREMENTS

In consulting this use and maintenance manual, you will find several symbols, which have a specific meaning, as illustrated below.

CONVENTIONAL SYMBOLS AND SYMBOL DESCRIPTION

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.

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.

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.

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.

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 conformita' con le direttive del paese dove il generatore sara' 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 disimballati 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.

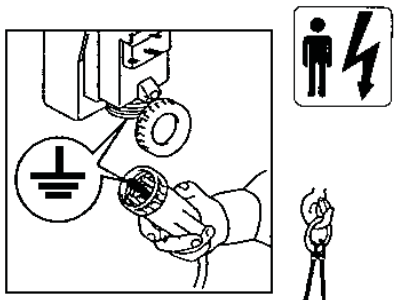
Gli addetti all'installazione, conduzione e manutenzione del generatore devono essere tecnici adeguatamente qualificati e che conoscano le caratteristiche dei generatori.

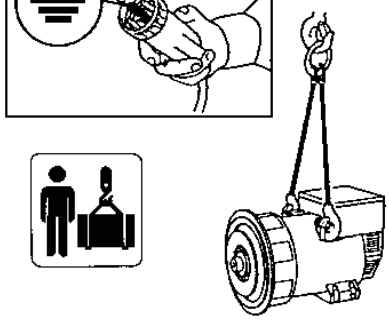
Le persone addette alla movimentazione devono sempre indossare guanti da lavoro e scarpe antinfortunistiche.
Qualora il generatore o l'intero impianto debba essere sollevato da terra, gli operatori devono usare un casco protettivo.

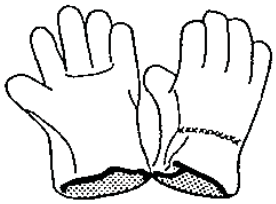
Il generatore va installato in un ambiente aerato. Se non c'è sufficiente aria oltre al mal funzionamento esiste pericolo di surriscaldamento (tab. 25 pag. 73). Sulla porta di ingresso del locale ci deve essere un cartello indicante il divieto di accesso alle persone non autorizzate.
Assicurarsi che il basamento del generatore e del motore primario sia calcolato per sopportarne il peso e tutti gli eventuali sforzi dovuti al funzionamento.

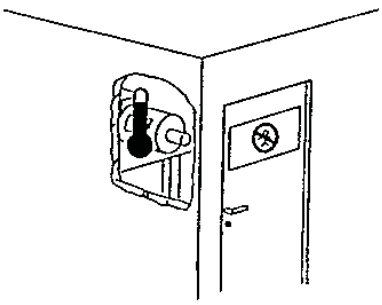
E' responsabilità dell'installatore il corretto accoppiamento del generatore al motore, mettendo in atto tutti quegli accorgimenti necessari per garantire il corretto funzionamento del generatore ed evitare anomale sollecitazioni che possono danneggiare il generatore (come vibrazioni, disallineamenti,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

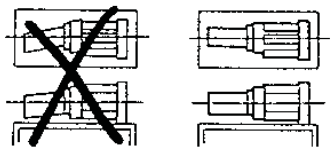
La macchina è stata progettata per garantire la potenza nominale in ambienti con temperatura massima di 40 °C e altitudine inferiore ai 1000 metri (EN60034-1), se non diversamente indicato. Per condizioni diverse vedere il catalogo commerciale (depliant).

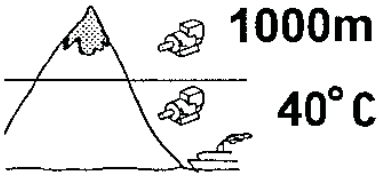












SAFETY REQUIREMENTS

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 RESPONSI-BLE 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 cut, 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.

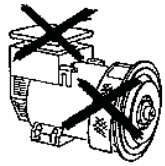
The installer is responsible for the correct coupling of the generator to the engine and for the performance of all precautions necessary to guarantee the correct operation of the generator and avoid abnormal stress, which could damage the generator (such as vibrations, misalignment, strange noises or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

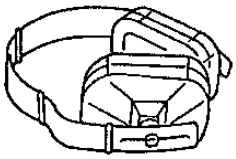
I generatori non devono mai e per nessuna ragione funzionare con le seguenti protezioni aperte:
-) copertura morsetti.
-) coperchi frontali.
-) protezioni delle ventole.



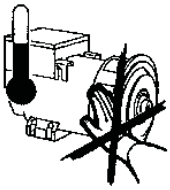
Nelle fasi di montaggio e smontaggio della rete, assicurarsi di tenere in posizione con le mani la stessa per evitare che l'elasticità della rete possa colpire l'operatore o chi è nelle vicinanze.

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 velocita'.

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.

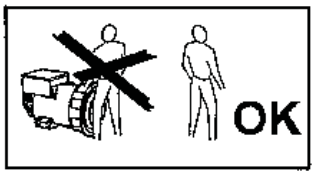


I generatori sviluppano calore anche elevato in funzione della potenza generata.
Pertanto non toccare il generatore se non con guanti antiscottatura e attendere, una volta spento, che esso raggiunga la temperatura ambiente.



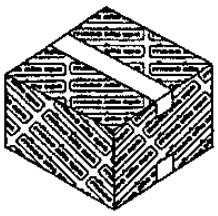
Anche se la macchina e' protetta in tutte le sue parti evitare di sostare nelle sue vicinanze.

Per nessuna ragione appoggiarsi o sedersi sul generatore.



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

PERICOLO DI CORTO CIRCUITO
Il generatore e' costruito con grado di protezione IP21; pertanto e' 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 whith 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 containings electrical components.

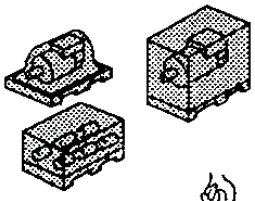
In case of replacement of spare parts, use original spare parts only.

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

PERICOLO DANGER

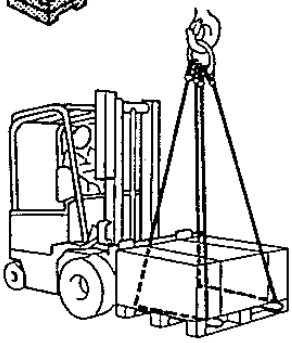
GEFAHR PELIGRO

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



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

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

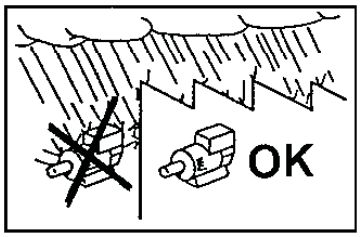


Prior to handling goods, please ensure that lifting equipment is of sufficient capacity. Under lifting conditions machinery should be elevated to a minimal distance from the ground.

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.

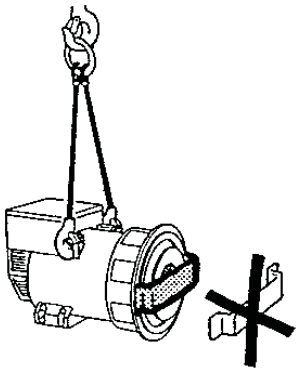
When lifting or moving goods by forklift apparatus, care should be taken to ensure that forks are correctly positioned to prevent slipping or falling of pallet or crate.

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



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.

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



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.

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

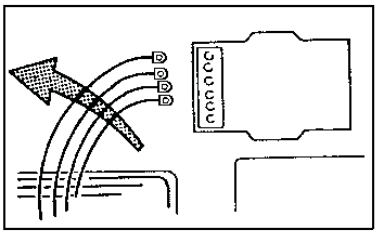
When installing the alternators, always lift them by using their eyebolts (table 25 pag 73).

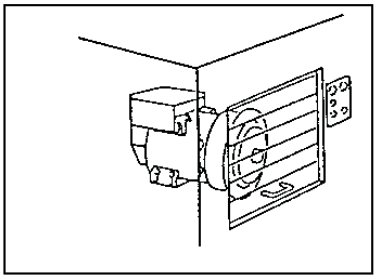
IMPORTANTE:

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 - 60C°.





IMPORTANT :

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

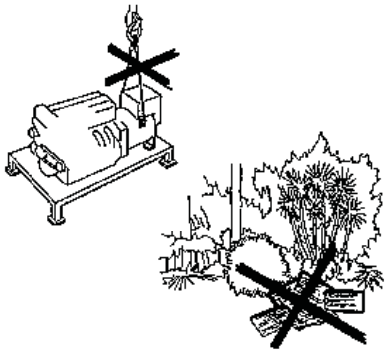
THE INSULATION TEST SHALL BE MADE BY SKILLED PERSONNEL.

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 sara' accoppiato al motore primario, o montato su un basamento, o installato in un telaio in modo da formare un corpo unico, non dovra piu' 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.

ACCOPPIAMENTO MECCANICO

Con il fine di proteggere, durante il trasporto e l'immagazzinamento, la flangia di accoppiamento o la estremita' d'albero (a seconda della foma 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 e' a cura dell'utilizzatore finale ed e' 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. 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.

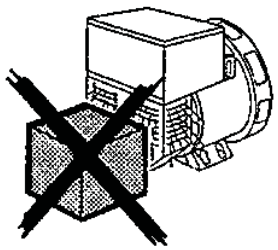
Le attenzioni richieste sono:

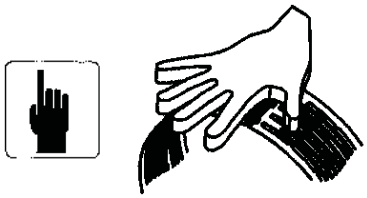
NELLA MESSA IN SERVIZIO AVER CURA CHE LE APERTURE DI ASPIRAZIONE E SCARICO DELL'ARIA DI RAFFREDDAMENTO SIANO SEMPRE LIBERE.

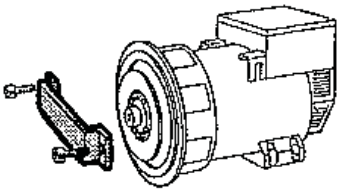
IL LATO DI ASPIRAZIONE NON DEVE ESSERE VICINO A SORGENTI DI CALORE. IN OGNI CASO, SE NON SPECIFICATAMENTE CONCORDATO, LA TEMPERATURA DELL'ARIA DI RAFFREDDAMENTO DEVE ESSERE QUELLA AMBIENTE E COMUNQUE NON SUPERIORE A 40°C.

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 ACCOP-PIAMENTO CON IL MOTORE PRIMO, FARE ATTENZIONE CHE IL ROTORE NON SI SFILI; TOGLIERE IL SISTE-MA 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 assemblying 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.

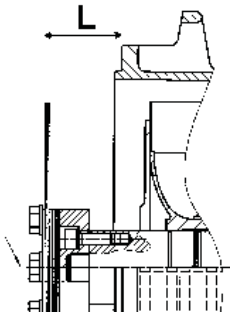
DURING ASSEMBLING AND DISASSEMBLING OPERATIONS, HOLD CAREFULLY BOTH ENDS OF THE PROTECTION GRID AS THE RELATED MATERIAL ELASTICITY CAN BE HARMFUL.

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

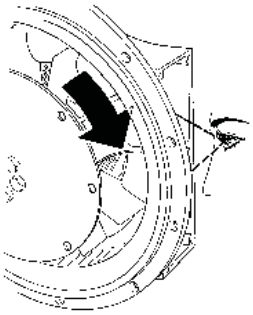
ACCOPPIAMENTO MECCANICO

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.

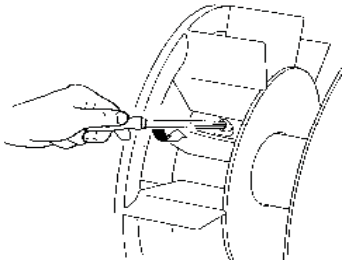


Per l'accoppiamento del generatore con forma costruttiva MD35, procedere come segue:

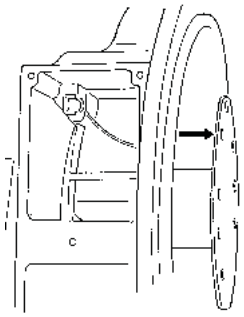


a) verificare il corretto posizionamento dei dischi (quota "L") in funzione del tipo di accoppiamento considerato (tavola 24 pag. 72); se necessario ripristinare la quota "L" spostando leggermente e assialmente il rotore. In posizione corretta il cuscinetto posteriore deve avere un gioco assiale da 0,5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

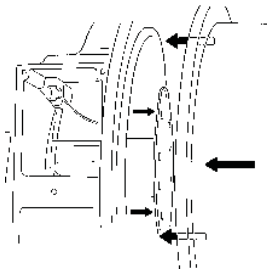
b) (Per serie 28) attraverso una delle due aperture laterali e ruotando manualmente il rotore, individuare sul mozzo della ventola, la relativa vite di bloccaggio



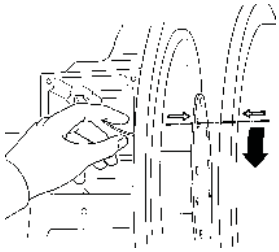
c) (Per serie 28) rendere la ventola libera di ruotare allentando la vite M8 di bloccaggio, utilizzando una chiave esagonale possibilmente con testa snodata



d) (Per serie 28) posizionare uno dei fori dei dischi in prossimita' 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

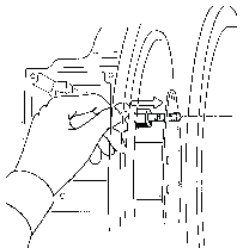
d) (For series 28) position one of the disk holes near the upper part of one of the side openings and place the slit that is on one of the fan blades, in the same position

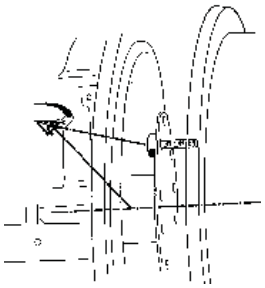
e) move the generator close to the coupling engine

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

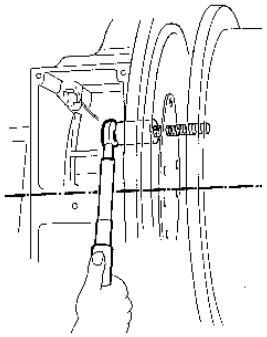
ACCOPPIAMENTO MECCANICO

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

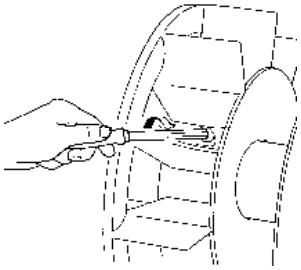




h) dopo aver verificato il corretto centraggio dei dischi nel volano motore, bloccare definitivamente dette viti

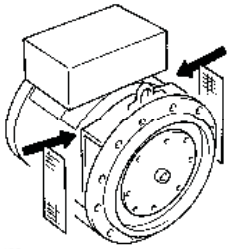


i) (Per serie 28) terminata l'operazione di bloccaggio dischi, ribloccare la ventola serrando la relativa vite con una coppia di serraggio pari a 16 Nm ± 10%; la posizione radiale della ventola non è vincolante per il corretto funzionamento del sistema

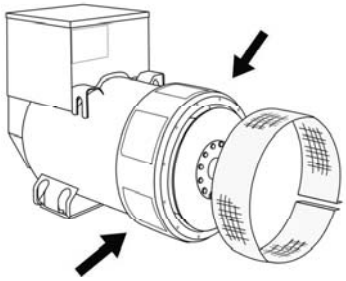


l) montare le retine di protezione, fornite a corredo del generatore.

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 e' 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 Nm ± 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.

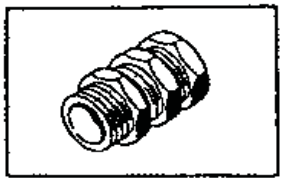
ACCOPPIAMENTO ELETTRICO

ELECTRICAL CONNECTIONS

PERICOLO
DANGER

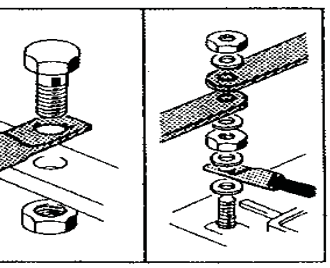
GEFAHR
PELIGRO

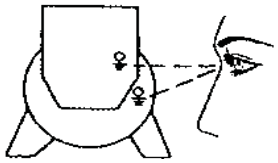
L'accoppiamento elettrico e' a cura dell'utilizzatore finale ed e' eseguito secondo la sua sola discrezione.
Per l'ingresso nella scatola morsetti si raccomanda di utilizzare passacavi e serracavi in accordo con le specifiche del paese di esportazione.

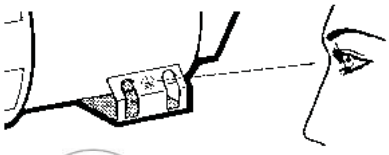


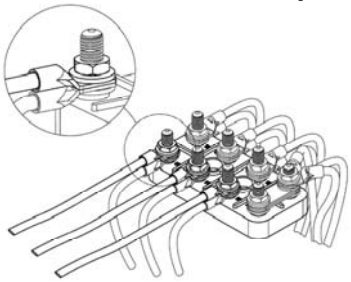
All electrical output connections are the responsibility of, and are at the discretion of, the end user.
When making terminal box connections, all cable and terminal lugs should meet the relevant standards of the country of final destination.

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.



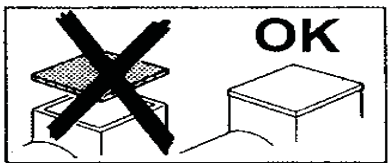






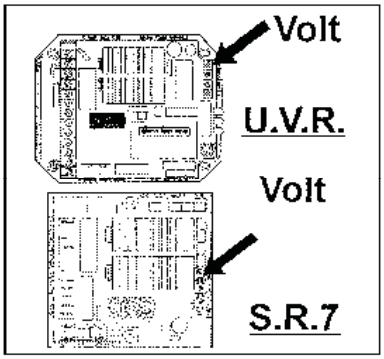
WINDINGS CONNECTION
All alternators feature both star with neutral (Y) and delta (Δ) connections (table. 2 pag.60) .
To reconnect from a star to delta connection (for ex. from 400V to 230V), modify the linking arrangements on the output terminal board (see diagram on table 2 page 60).
It is not necessary 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.

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.



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.

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.



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.

ACCOPPIAMENTO 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 puo' ottenere la regolazione della tensione entro il ± 5% del valore nominale.

E' possibile ottenere la regolazione della tensione a distanza in un range di ± 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).

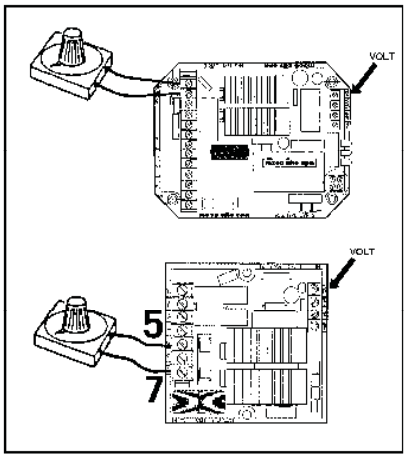
Istruzioni per il collegamento del potenziometro esterno :

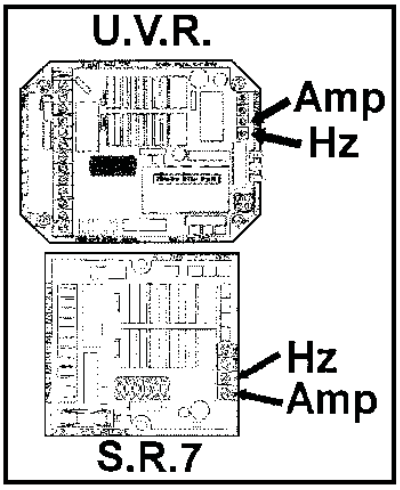
ATTENZIONE: quando si collega il potenziometro esterno è necessario seguire la procedura sottoriportata per ottenere un corretto funzionamento dell'alternatore.

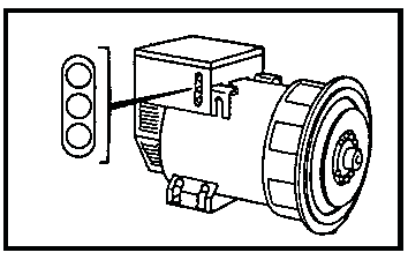
1) Ruotare il trimmer VOLT nel regolatore elettronico completamente in senso antiorario
2) Posizionare il potenziometro esterno a meta' corsa e connetterlo agli appositi morsetti del regolatore elettronico
3) Tramite il trimmer VOLT del regolatore elettronico tarare la tensione al valore nominale.

PROTEZIONI
U.V.R.6/1-F - S.R.7/2-G
Entrambi i regolatori sono provvisti di una protezione di bassa velocita' 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 piu' 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 - possibilita' 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 velocita', 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 ± 5% of the nominal, by acting upon the voltage potenziometer on the electronic regulators.

It is possible to get a remote voltage regulation of ± 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.

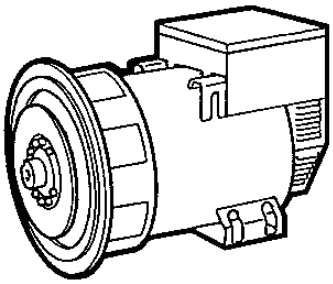
ACCOPPIAMENTO ELETTRICO

IMPORTANTE
Nel funzionamento normale del generatore deve essere acceso solamente il led verde.
Tutte queste segnalazioni possono essere remotate 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 velocita':
1 - velocita' 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 φ) 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.

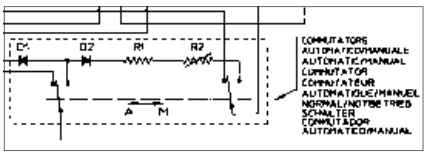


Nel caso di intervento delle protezioni, la tensione erogata dall'alternatore scendera' fino ad un valore che dipendera' dall'entita' dell'anomalia.
La tensione tornera' automaticamente al suo valore nominale qualora venga a cessare l'inconveniente.

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 φ) 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).

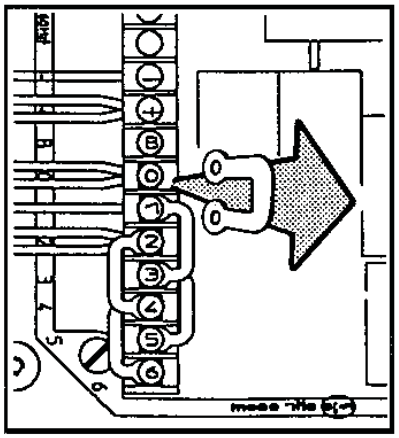
ACCOPPIAMENTO ELETTRICO

FUNZIONAMENTO IN PARALLELO

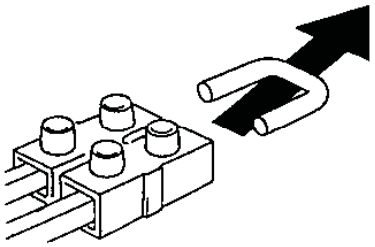
Nel caso si voglia far funzionare dei generatori in parallelo e' necessario montare un dispositivo che assicura un identico statismo sulla caretteristica esterna.

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 φ 0.8, da vuoto a pieno carico.



MONTAGGIO DI UN DISPOSITIVO DI PARALLELO

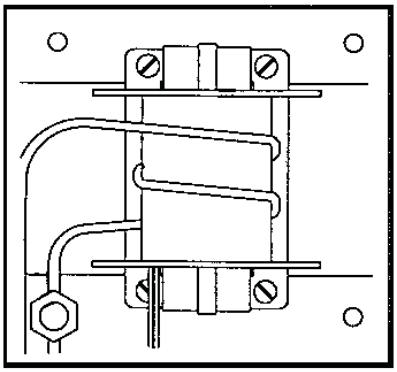
Riferendosi alle tavole 14-16-19 montare il trasformatore di parallelo come illustrato.

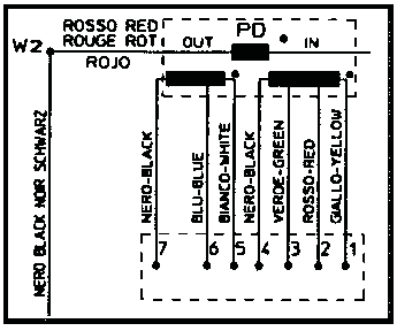
Collegare le spire di potenza in serie alla fase.

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.

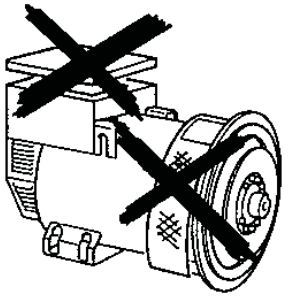
Per abilitare il dispositivo di parallelo rimuovere il ponticello che cortocircuita il secondario del dispositivo stesso come mostrano gli schemi sopra indicati.





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 φ 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.

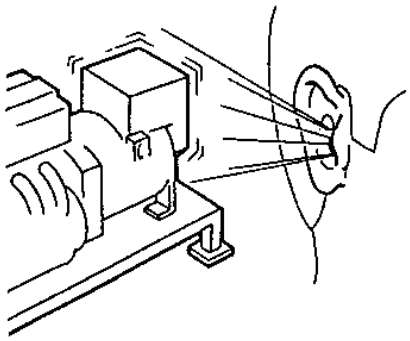
After all the electric connections have been made and **only after all the protections have been put in place,** can the system be started.

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 ABBIA 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.

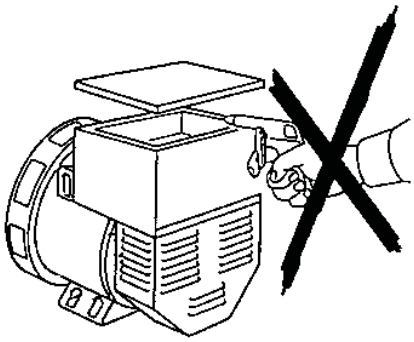
PULIZIA E LUBRIFICAZIONE

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.

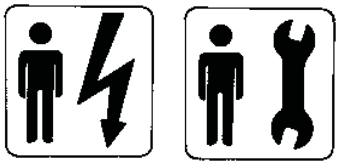
PRIMA DI ESEGUIRE QUESTA OPERAZIONE LEGGERE MOLTO ATTENTAMENTE LE PRESCRIZIONI DI SICUREZZA ALL'INIZIO DI QUESTO MANUALE.

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 :

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

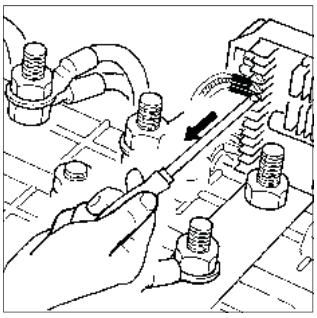


fig. a

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.

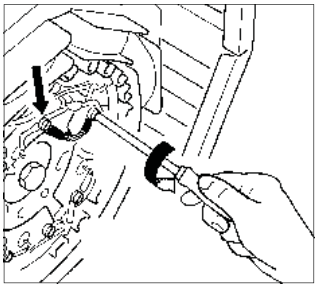


fig. b

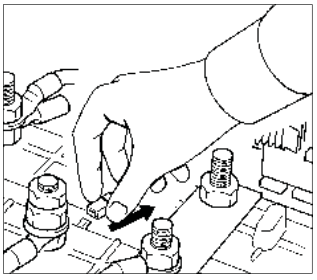


fig. c

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.

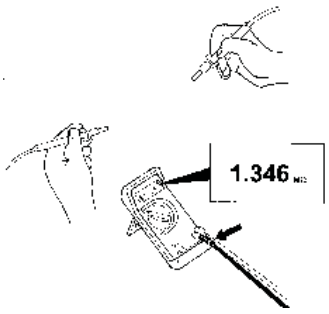
Routine maintenance operations can be summed up as follows:

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

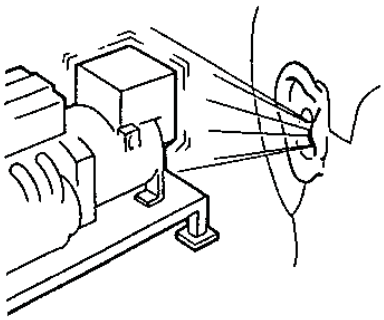
a) Assessment of windings conditions after long periods of storage or inactivity.
Measuring the insulating earth resistance can assess the condition of the windings. This measurement can be carried out with a "Megger" device, or similar, with a 500V direct-current voltage. It is very important to disconnect 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

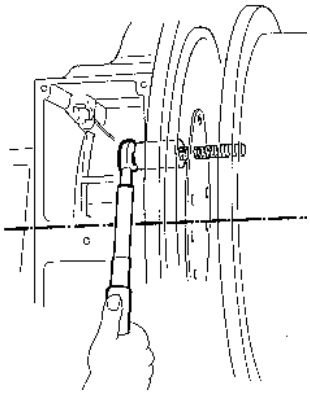
Il valore misurato di resistenza verso terra di tutti gli avvolgimenti deve essere superiore a 1MΩ.
Nell'ipotesi in cui il valore misurato sia inferiore a quanto sopra riportato, gli avvolgimenti devono essere opportunamente asciugati. Tale operazione può essere eseguita indirizzando un getto di aria calda a circa 50-60°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.

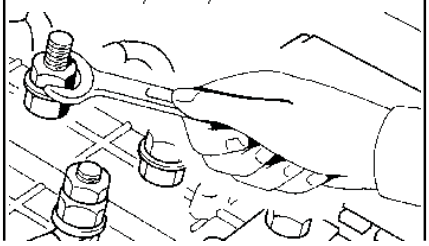


b) Verifiche del corretto funzionamento (assenza di rumori o vibrazioni anomale).
Ad intervalli regolari raccomandiamo di verificare che il generatore funzioni regolarmente senza rumori o vibrazioni anomale; tali presenze potrebbero denotare il danneggiamento dei cuscinetti.
Ricordiamo che l'alternatore 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

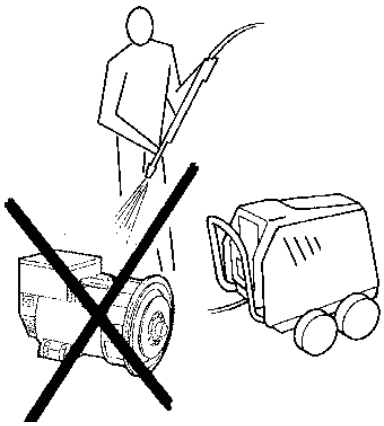
The figure resulting from the measurement of the windings' earth resistance must be over 1MΩ.
Should the figure be smaller than the above-mentioned one, the windings must be adequately dried up. This can be done by directing a jet of hot air of about 50-60°C into the generator's air inlets or outlets; 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.

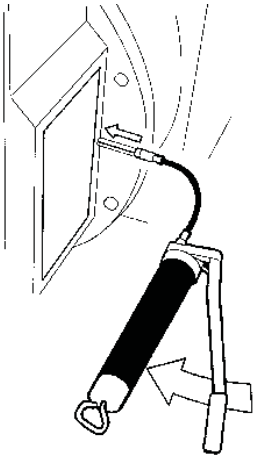
MANUTENZIONE

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.

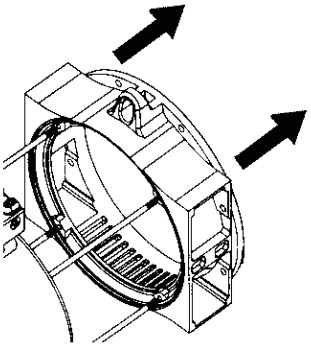


Gli interventi di manutenzione straordinaria possono essere riassunti in:
a) manutenzione dei cuscinetti ed eventuale sostituzione
b) pulizia dei filtri aria (se presenti)
c) pulizia degli avvolgimenti
d) sostituzione del ponte a diodi
e) sostituzione dell'eccitatrice
f) sostituzione del regolatore di tensione
g) 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.

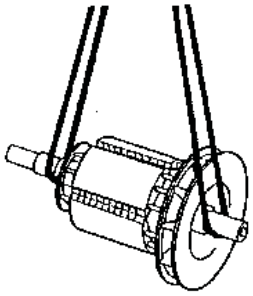
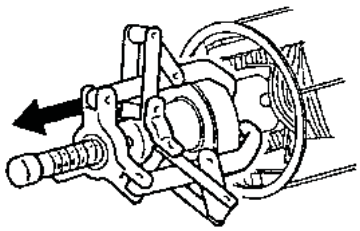
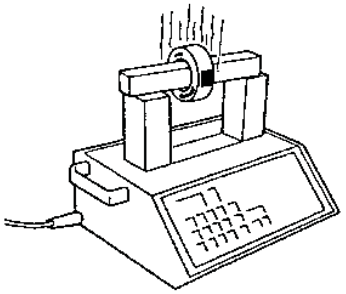
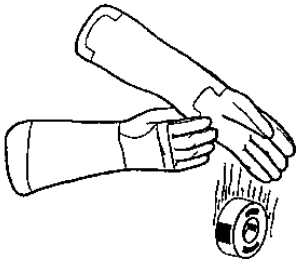
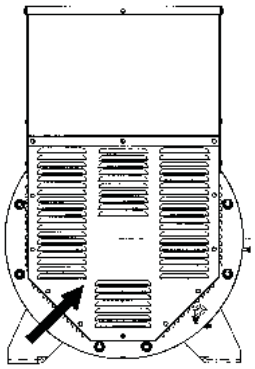
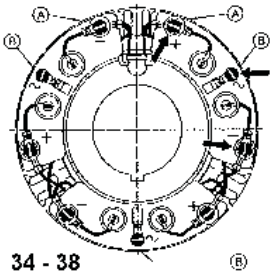
Extraordinary maintenance operations can be summed up as follows:
a) Maintenance and replacement (if necessary) of bearings
b) Cleaning of air filters (if available)
c) Cleaning of windings
d) Replacement of diode bridge
e) Replacement of exciter
f) Replacement of voltage regulator
g) Check of residual voltage

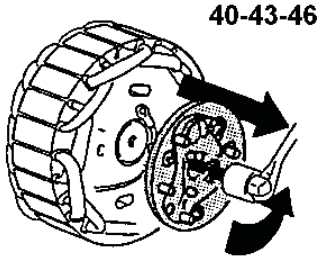
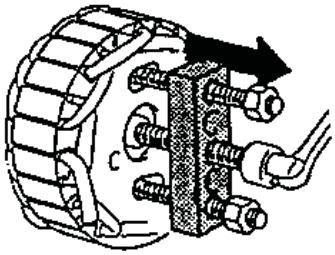
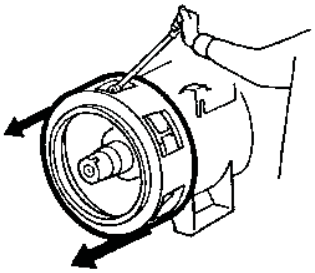
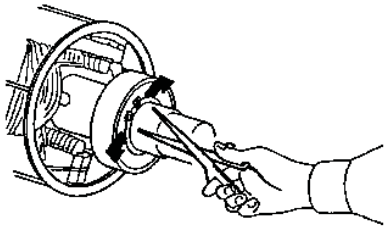
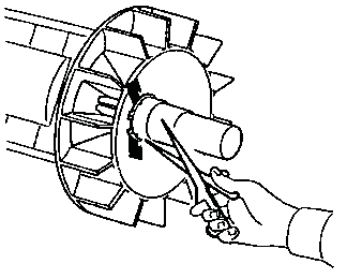
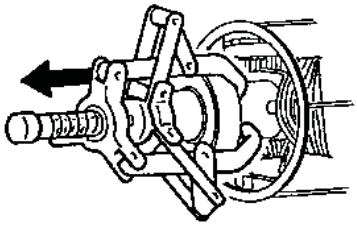
a) Maintenance and replacement (if necessary) of bearings.
During the assembling phase, all bearings are greased with SKF28 grease, or similar.

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:

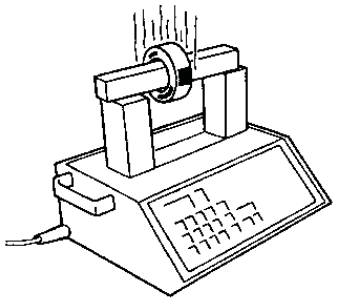
-) Remove front cover

MANUTENZIONE		MAINTENANCE
-) 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		-) 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;
-) per estrarre il cuscinetto deve essere utilizzato un apposito estrattore		-) To pull the bearing out, use a puller
-) per il montaggio del nuovo cuscinetto, riscaldare lo stesso con un apposito dispositivo magnetico		-) To insert new bearing, heat it with a suitable magnetic device
-) indossando gli appositi guanti anti-scottatura, montare il cuscinetto nella sua sede		-) Put on safety gloves and insert bearing into its place
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 :		**Generator versions: 38-40-43-46.** To disassemble alternator versions 38-40-43-46, remove exciter as follows:
-) togliere la chiusura posteriore		-) Remove rear seal
-) sconnettere i cinque fili del ponte diodi rotante "A" e "B".		-) Disconnect the five wires of the rotating diode bridge "A" and "B".

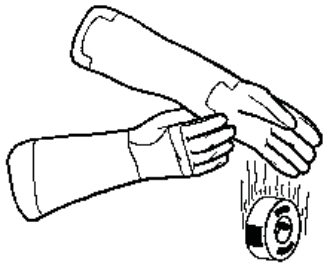
MANUTENZIONE		MAINTENANCE
-) nel caso di alternatori della serie 38, togliere le viti di bloccaggio dei settori porta diodi del ponte rotante, mentre nel caso di alternatori della serie 40-43-46 togliere il bullone di bloccaggio e tirando leggermente togliere il ponte diodi	40-43-46 	-) When dealing 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
-) inserire un adeguato estrattore per sfilare il rotore eccitatrice		-) Insert an adequate puller to pull out exciter rotor
-) 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		-) 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
-) togliere gli anelli seeger servendosi di una pinza adeguata	 	-) Use a pair of suitable pliers to remove seeger rings
-) per estrarre il cuscinetto deve essere utilizzato un apposito estrattore		-) Use a suitable puller to remove bearing

MANUTENZIONE

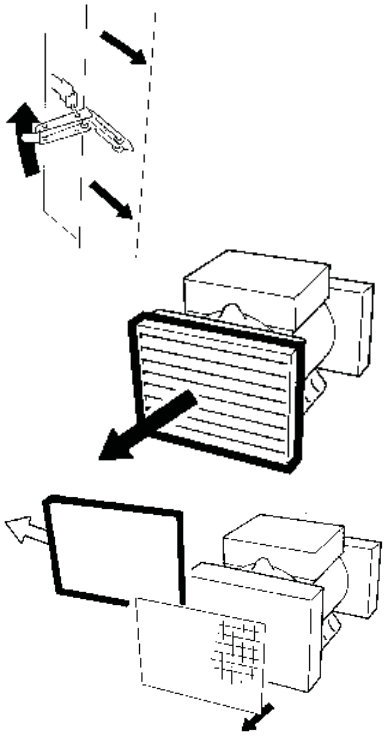
-) per il montaggio del nuovo cuscinetto, riscaldare lo stesso con un apposito dispositivo magnetico



-) 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.

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

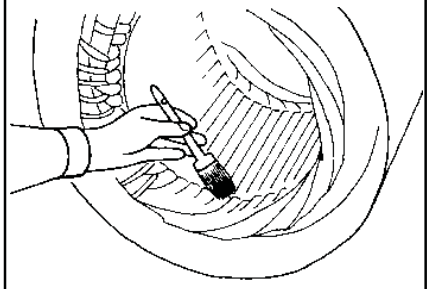
-) Put on safety gloves and insert bearing into its place

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.

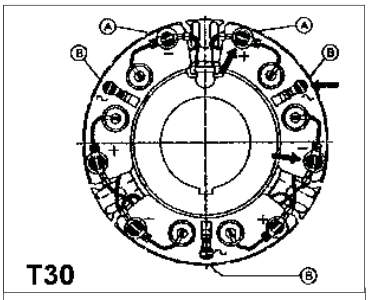
c) Cleaning of windings
Both windings and generator will last longer with a correct maintenance and cleaning; an inspection and a maintenance schedule should be established by keeping in mind that the frequency of these inspections depends on the conditions of the site where the generator is being used.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

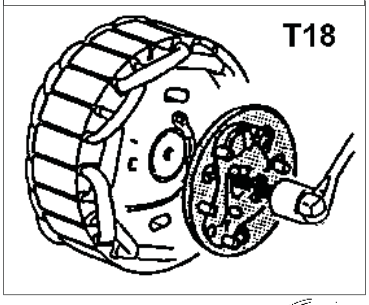
MANUTENZIONE

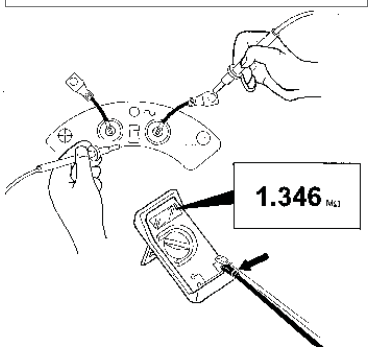
In ogni caso, indipendentemente dal programma stabilito, raccomandiamo di procedere a tale manutenzione nelle seguenti ipotesi :
-) presenza di ruggine
-) segni evidenti di corrosione
-) deterioramento dell'isolamento
-) presenza di polvere sulla superficie degli avvolgimenti
Gli avvolgimenti possono 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"

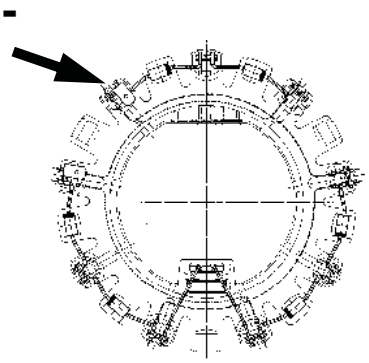
- Connettere gli strumenti come indicato in figura A (tabella 26 pag. 74)
- Fissare il cavo connesso alla lampada al morsetto negativo del ponte come indicato in figura A (tabella 26 pag. 74)
- Connettere il terminale "Probe" ai punti A1, A2 ed A3 in sequenza per verificare rispettivamente i diodi 1,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

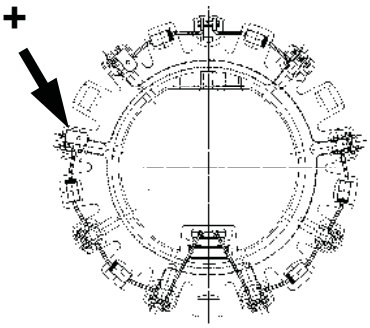
TEST DEI DIODI SUL "POSITIVO"

- 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, occorrera' 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 necessaty 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).

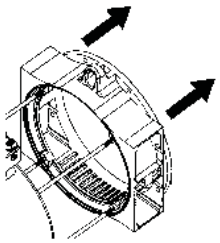
TEST OF THE DIODES ON THE "POSITIVE"

- 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.

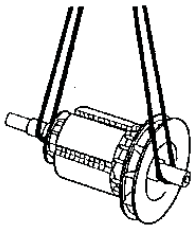
e) Sostituzione dell'eccitatrice
Generatore tipo 28-31-32-34.

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

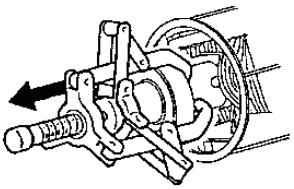


-) togliere il coperchio anteriore

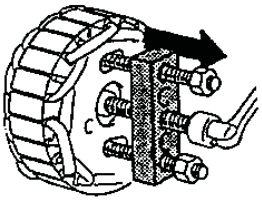
-) sfilare il rotore utilizzando un mezzo di sollevamento con funi morbide ma di portata adeguata; verificare che i mezzi di sollevamento predisposti siano comunque adeguati per i pesi dei componenti da movimentare



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

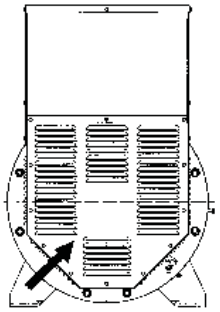


-) per smontare il rotore eccitatrice, inserire un adeguato estrattore facilmente costruibile o reperibile presso la nostra sede.

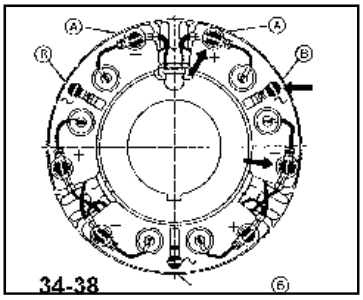


Generatore tipo 38-40-43-46.

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

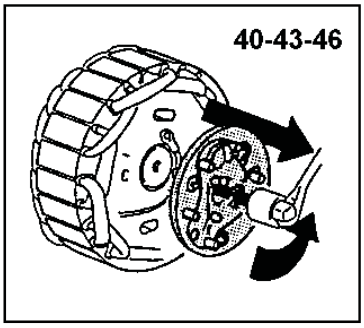


-) togliere la chiusura posteriore



-) 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



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.

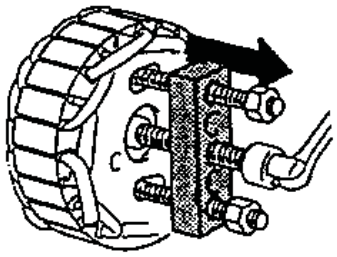
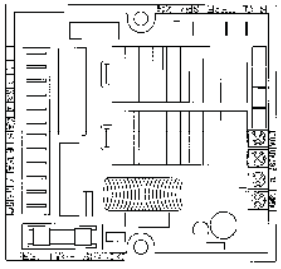
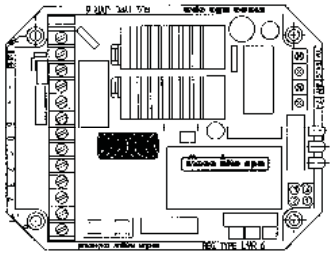
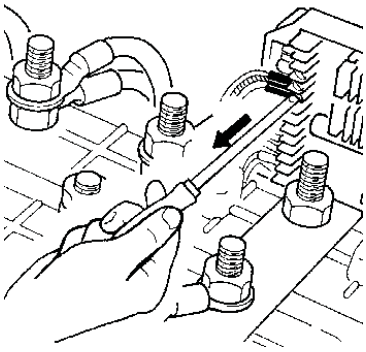
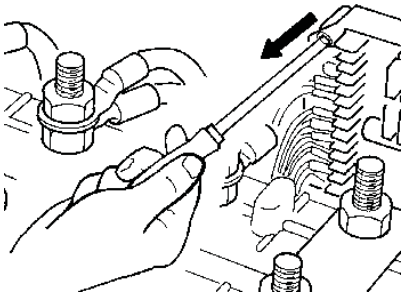
Generator versions: 38-40-43-46.

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 real 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		MAINTENANCE
-) per smontare il rotore eccitatrice, inserire un adeguato estrattore facilmente costruibile o reperibile presso la nostra sede		-) To insert exciter rotor, use a suitable puller, which can be easily constructed or forwarded by the manufacturer upon request.
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.	 	**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.
Una volta stabilito che il regolatore deve essere sostituito, procedere come segue :		Once it has been ascertained that the regulator needs to be replaced, proceed as follows:
-) scollegare tutti i cavetti di collegamento in morsettiera		-) Disconnect all terminal board wires
-) svitare le 2/4 viti di bloccaggio del regolatore		-) Unscrew the 2/4 clamp screws of the regulator
-) collocare il nuovo regolatore nella posizione prevista		-) Set new regulator in the usual position
-) fissare il nuovo regolatore con le viti precedentemente raccolte		-) Tighten the new regulator with the previously unscrewed screws
-) ricollegare tutti i cavi alla morsettiera del regolatore, servendosi in caso di bisogno, degli schemi forniti da Mecc Alte.		-) Connect again all wires to the terminal board of the regulator. Follow diagrams supplied by Mecc Alte, if necessary.

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):

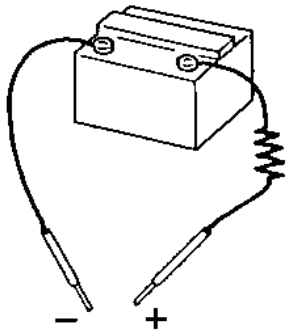
g) Check of residual voltage

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):

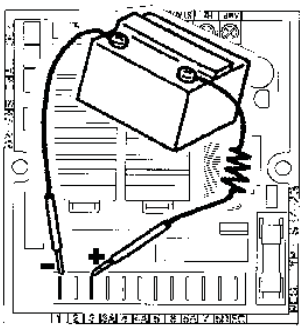
-) con il generatore fermo, rimuovere il coperchio di chiusura della scatola morsetti

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

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

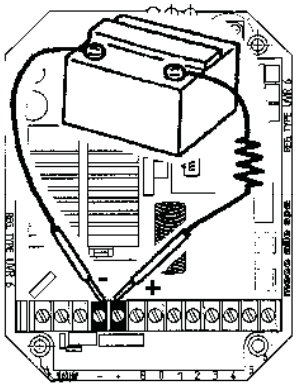


-) Connect two connecting wires to a 12 Vdc battery with a 30Ω in-series resistance



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

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



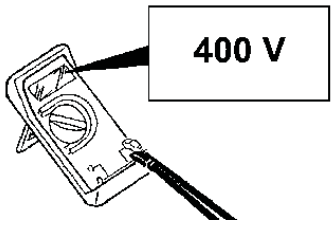
-) avviare il generatore

-) Start generator

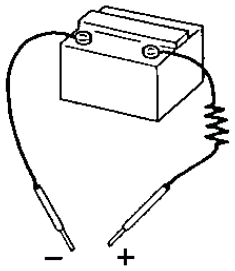
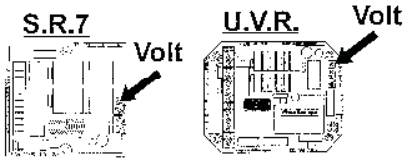
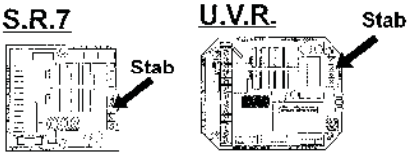
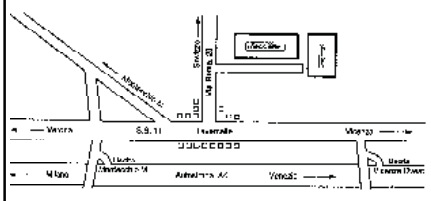
-) applicare per un istante i due terminali ai morsetti precedentemente individuati facendo molta attenzione nel rispettare le polarità (morsetto "+" del regolatore con morsetto "+" della batteria, morsetto "- del regolatore con morsetto "-" della batteria)

-) 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)

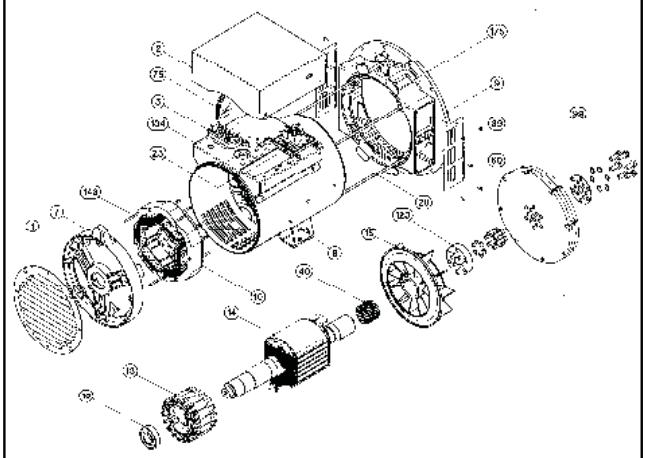
-) verificare con un voltmetro o con la relativa strumentazione da quadro, che il generatore generi la tensione nominale prevista nella targhetta.



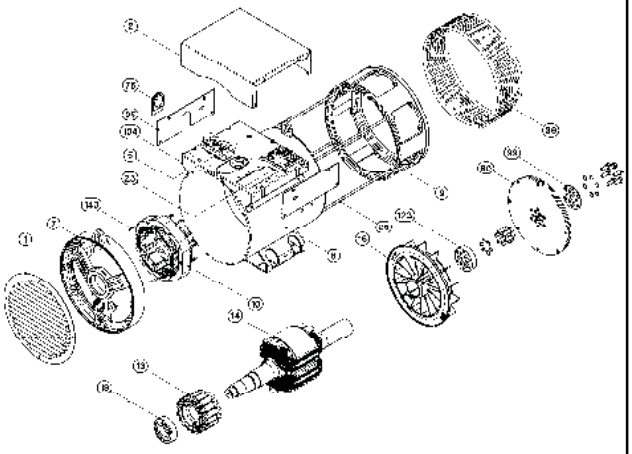
-) Use a voltmeter or the right instrument panel, to check whether the generator is producing the nominal voltage indicated on the plate.

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 φ 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.

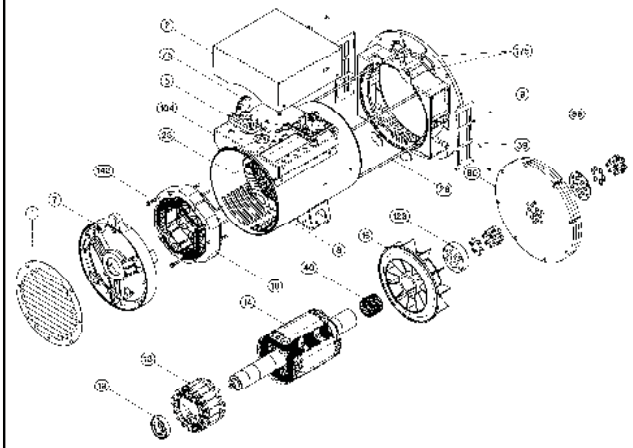
ECP 28/2



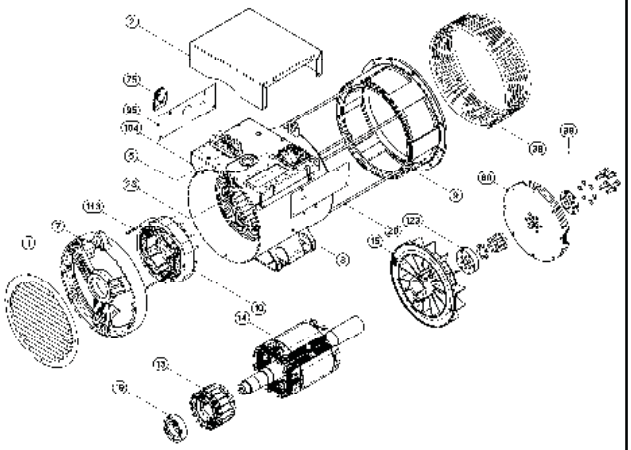
ECO 31N/2



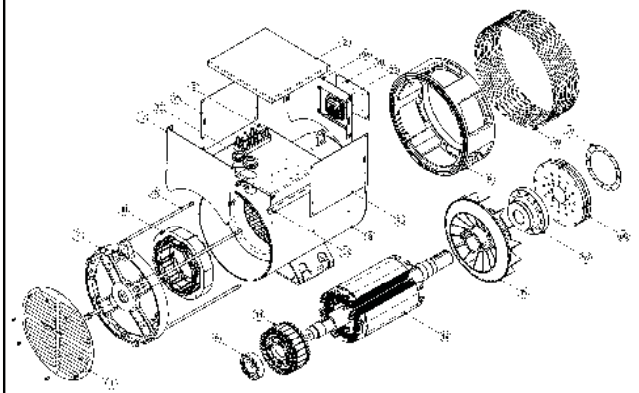
ECP 28/4



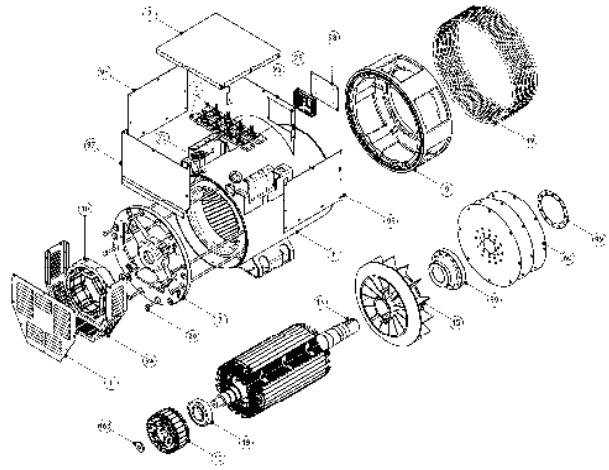
ECO 32/4



ECP 34



ECO 38N



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RESISTENZA DEGLI AVVOLGIMENTI A 20 °C AMBIENTE
WINDING RESISTENCES AT 20 °C AMBIENT
RESISTANCE DES ENROULEMENTS A TEMPERATURE AMBIANTE 20 °C
WICKLUNGWIDERSTAND BEI 20 °C UMGEBUNGTEMPERATUR
RESISTENCIA DE LOS BOBINADOS A 20 °C AMBIENTE

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

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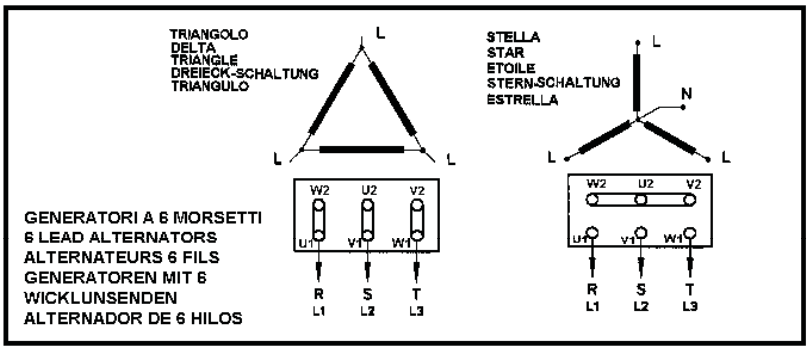
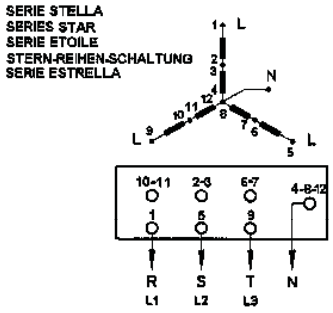
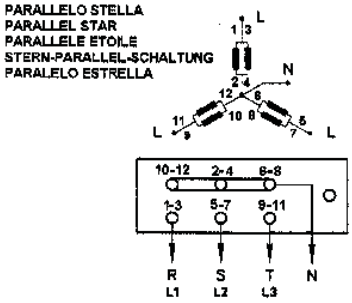
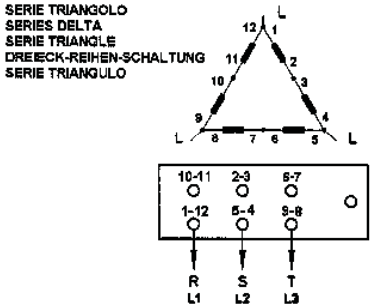
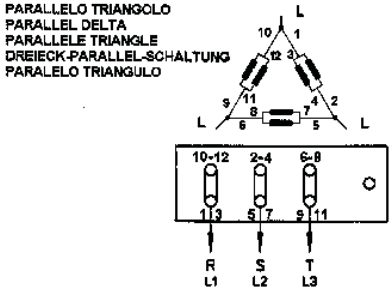
COLLEGAMENTI GENERATORI
CONNECTIONS ALTERNATORS
CONNECTIONS ALTERNATEURS
ANSCHLUSSE DER GENERATOREN
CONEXION ALTERNADOR

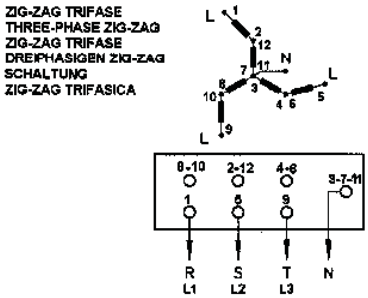


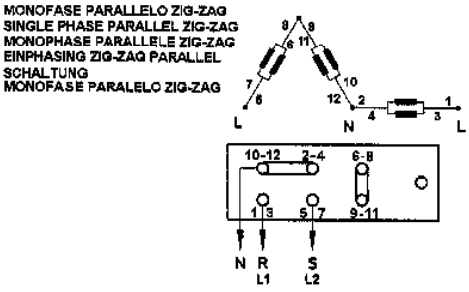


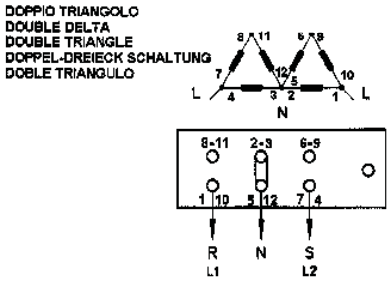












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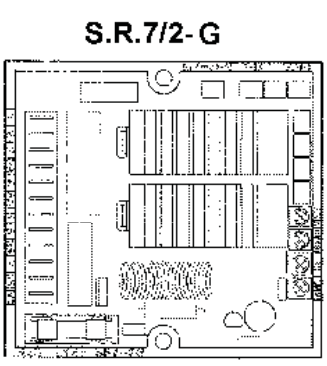

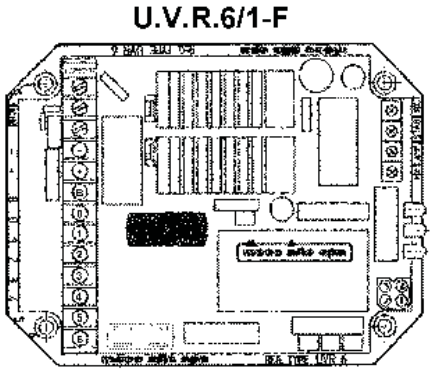

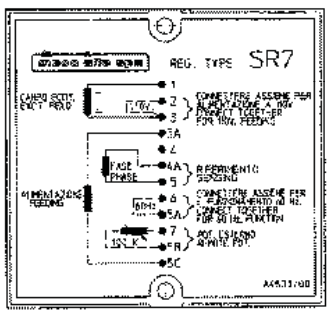

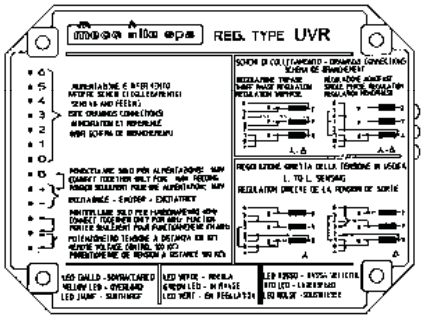

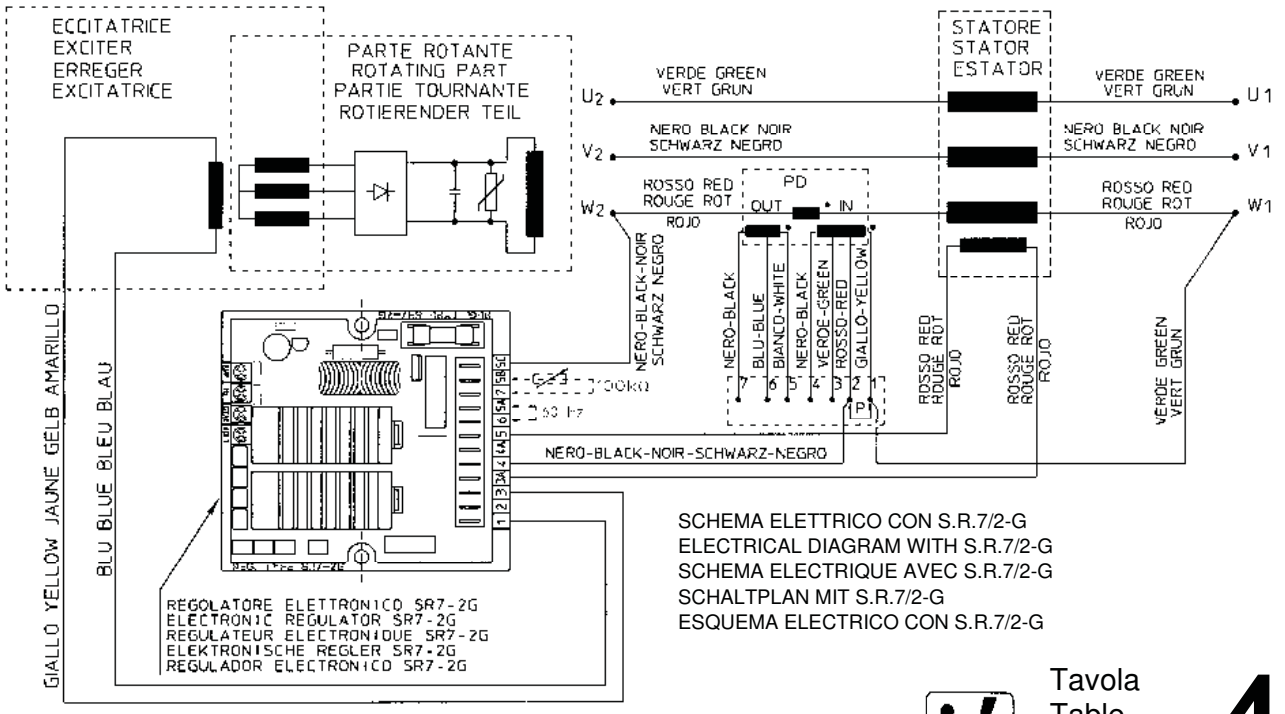

SCHEMA ELETTRICO CON S.R.7/2-G
ELECTRICAL DIAGRAM WITH S.R.7/2-G
SCHEMA ELECTRIQUE AVEC S.R.7/2-G
SCHALTPLAN MIT S.R.7/2-G
ESQUEMA ELECTRICO CON S.R.7/2-G

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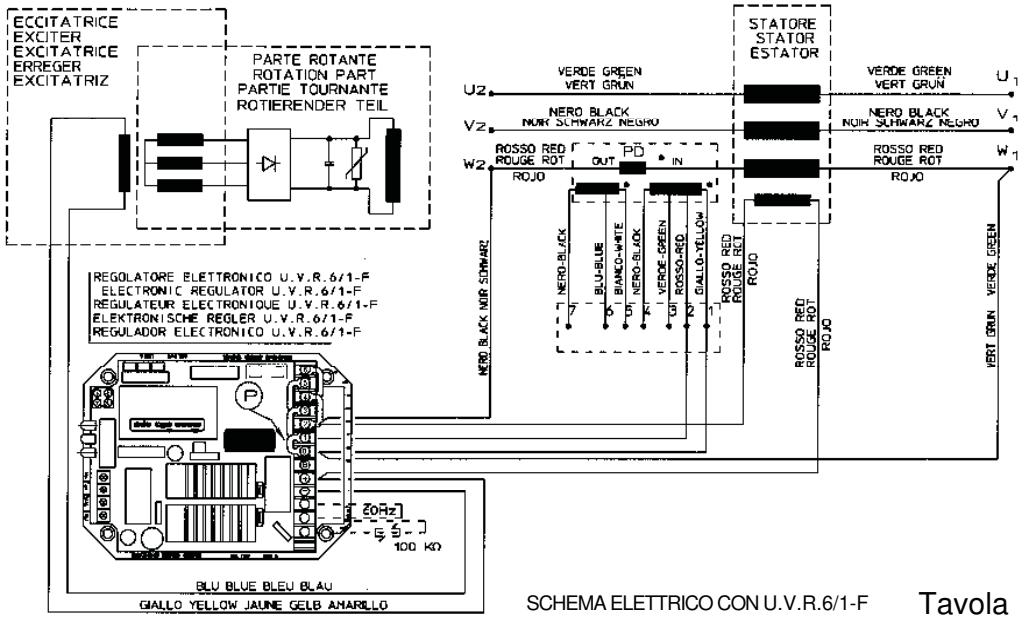

SCHEMA ELETTRICO CON U.V.R.6/1-F
ELECTRICAL DIAGRAM WITH U.V.R.6/1-F
SCHEMA ELECTRIQUE AVEC U.V.R.6/1-F
SCHALTPLAN ECO MIT U.V.R.6/1-F
ESQUEMA ELECTRICO CON U.V.R.6/1-F

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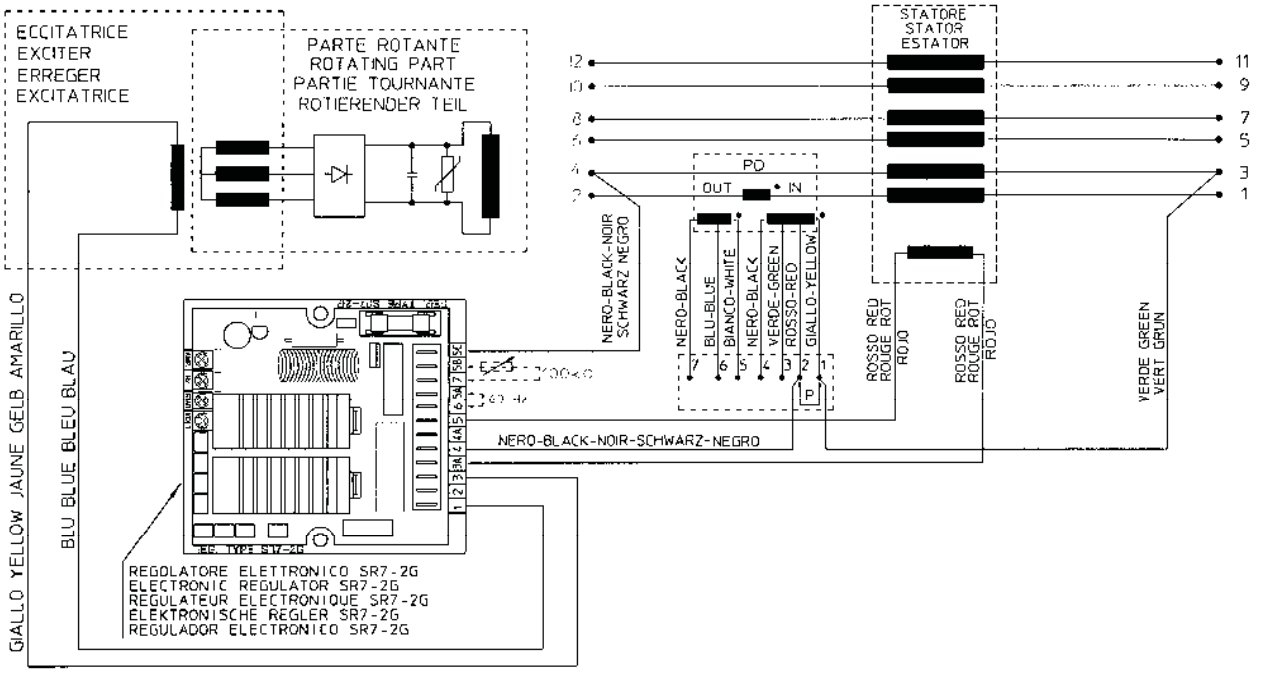
Note : Il dispositivo di parallelo PD è opzionale fino a 350 kVA.
Il ponticello P abilita o disabilita il dispositivo di parallelo se presente.

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 Brucke 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

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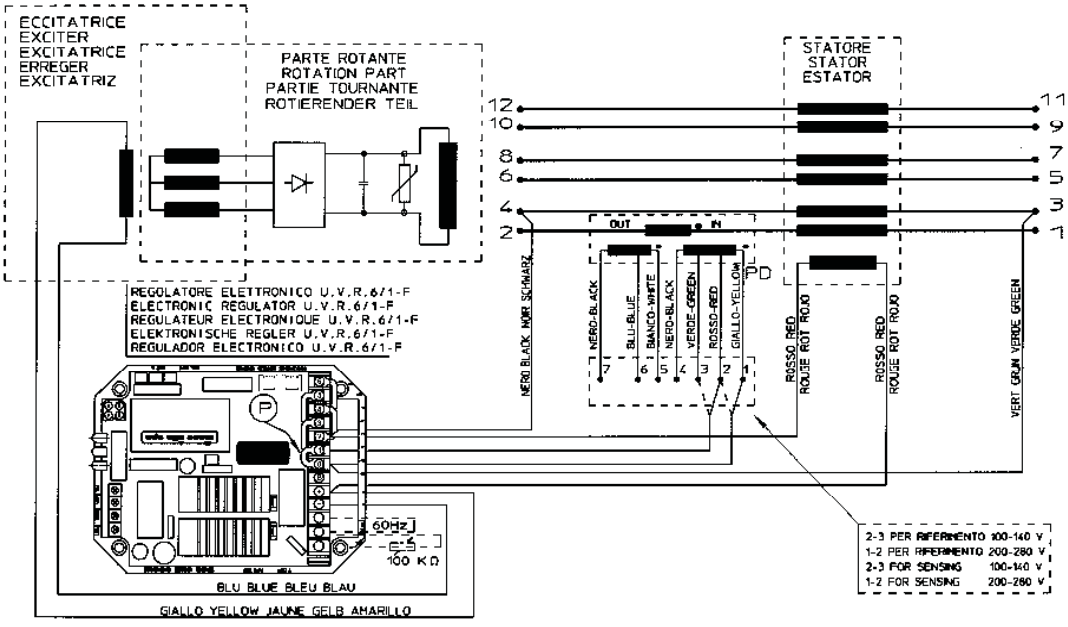

SCHEMA ELETTRICO 12 MORSETTI CON U.V.R.6/1-F
12 WIRES ELECTRICAL DIAGRAM WITH U.V.R.6/1-F
SCHEMA ELECTRIQUE 12 BORNES AVEC U.V.R.6/1-F
SCHALTPLAN MIT 12 KLEMMEN UND U.V.R.6/1-F
ESQUEMA ELECTRICO 12 HILOS CON U.V.R.6/1-F

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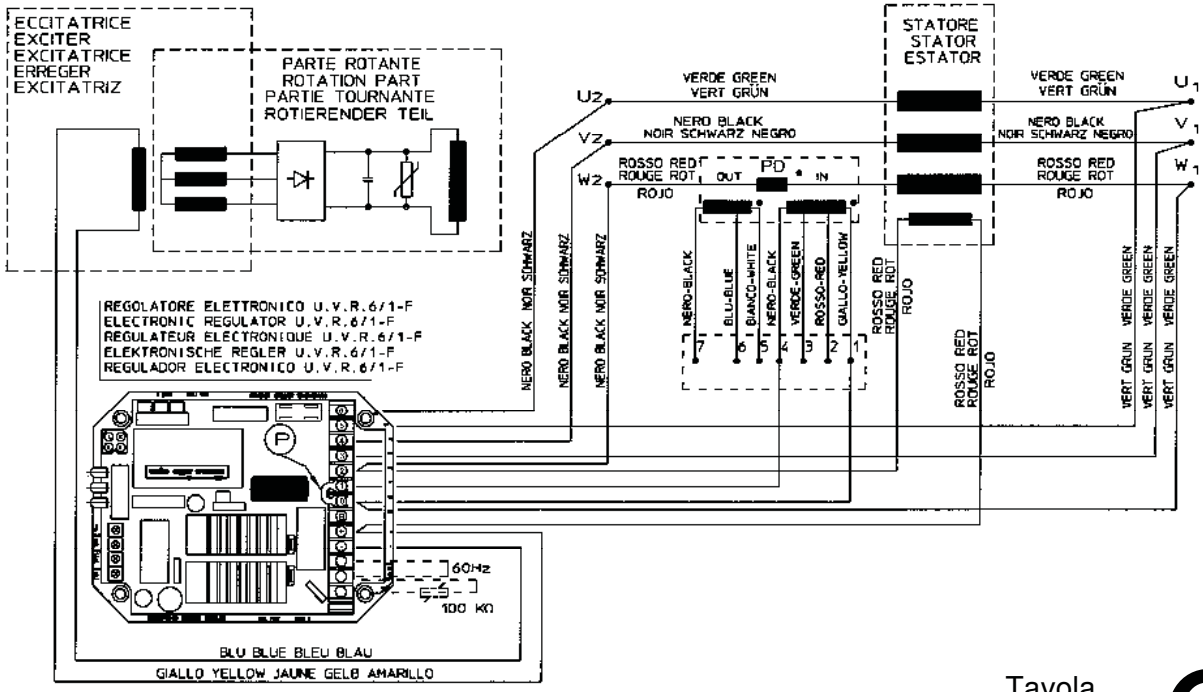
5A



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

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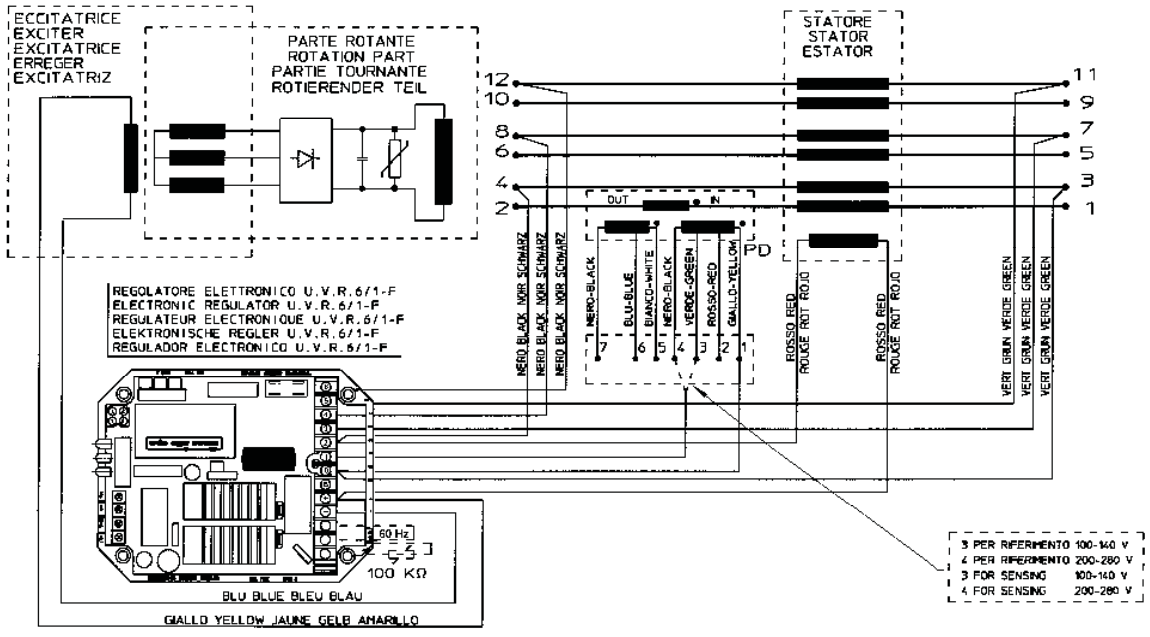

SCHEMA ELETTRICO 12 MORSETTI RIFERIMENTO TRIFASE
12 WIRES ELECTRICAL DIAGRAM WITH THREEPHASE SENSING
SCHEMA ELECTRIQUE 12 BORNES REFERENCE TRIPHASE
SCHALTPLAN MIT 12 KLEMMEN UND DREIPHASIGEN ISTWERT
ESQUEMA ELECTRICO 12 HILOS CON REFERENCIA TRIFASICA

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7

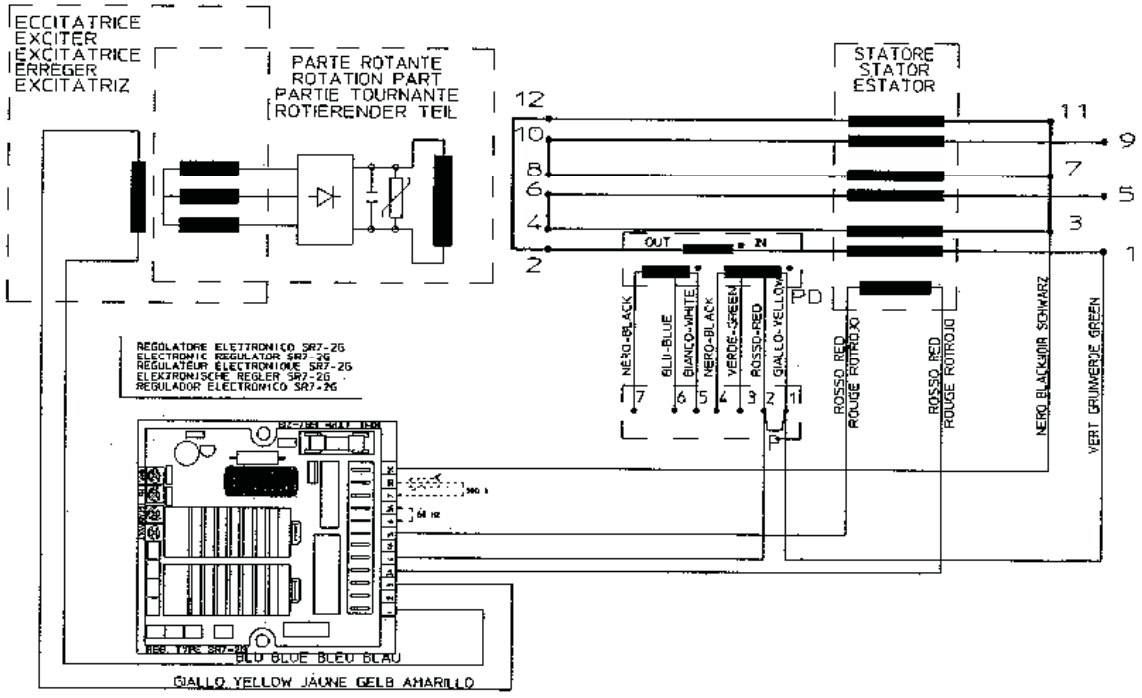
Note : Il dispositivo di parallelo PD è opzionale fino a 350 kVA.
Il ponticello P abilita o disabilita il dispositivo di parallelo se presente.

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 Brucke 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)

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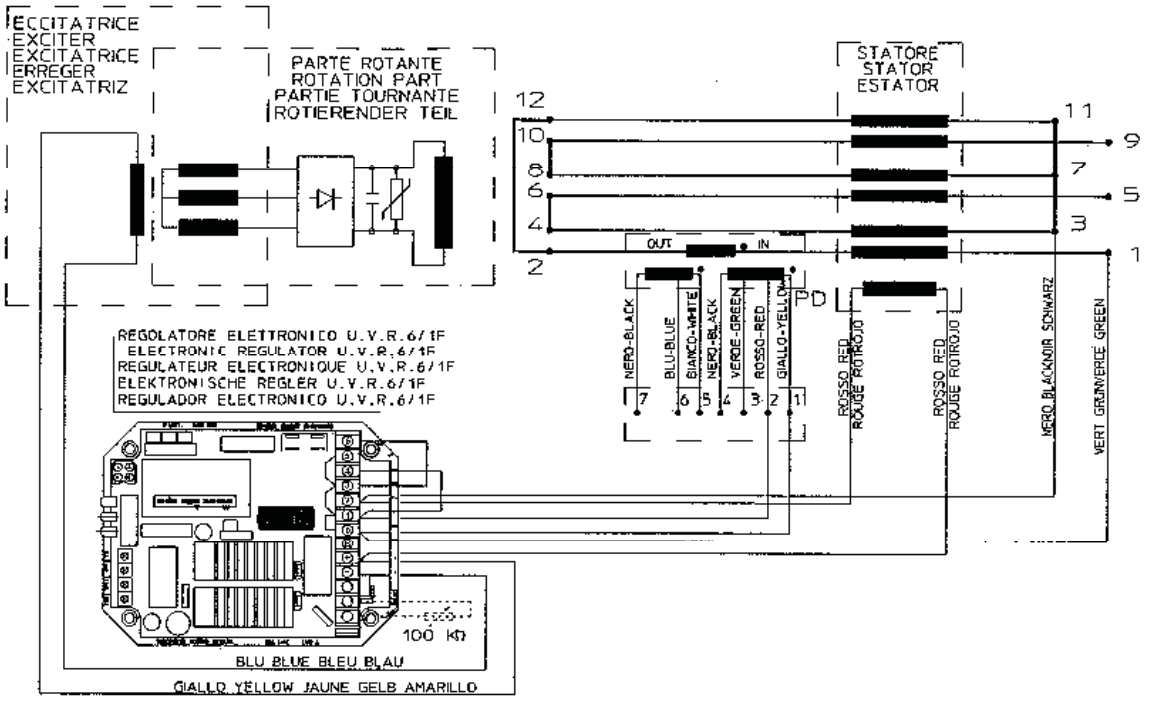

SCHEMA ELETTRICO 12 MORSETTI CON U.V.R.6/1-F (ZIG-ZAG)
12 WIRES ELECTRICAL DIAGRAM WITH U.V.R.6/1-F (ZIG-ZAG)
SCHEMA ELECTRIQUE 12 BORNES AVEC U.V.R.6/1-F (ZIG-ZAG)
SCHALTPLAN MIT 12 KLEMMEN UND U.V.R.6/1-F (ZIG-ZAG)
ESQUEMA ELECTRICO 12 HILOS CON U.V.R.6/1-F (ZIG-ZAG)

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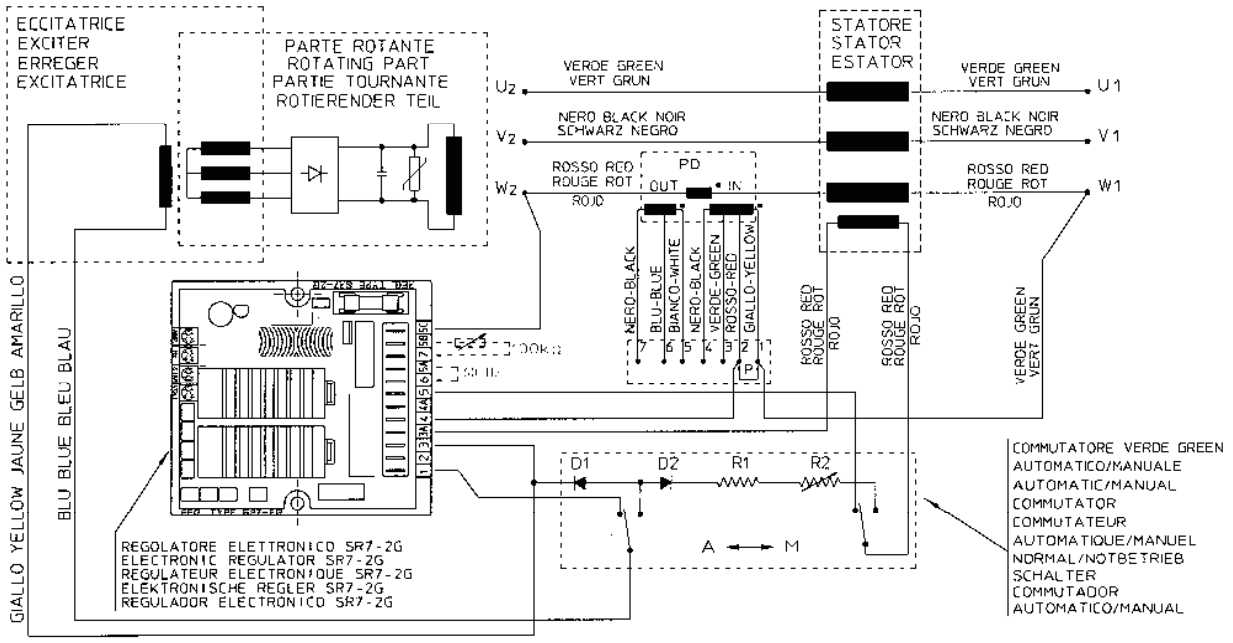

COMANDO MANUALE/AUTOMATICO CON REGOLATORE S.R.7/2-G
AUTOMATIC/MANUAL COMMAND WITH S.R.7/2-G REGULATOR
COMMANDE MANUELLE/AUTOMATIQUE AVEC REGULATEUR S.R.7/2-G
UMSCHALTER MANUELL/AUTOMATISCH MIT S.R.7/2-G REGLER
COMANDO MANUAL/AUTOMATICO CON REGULADOR S.R.7/2-G

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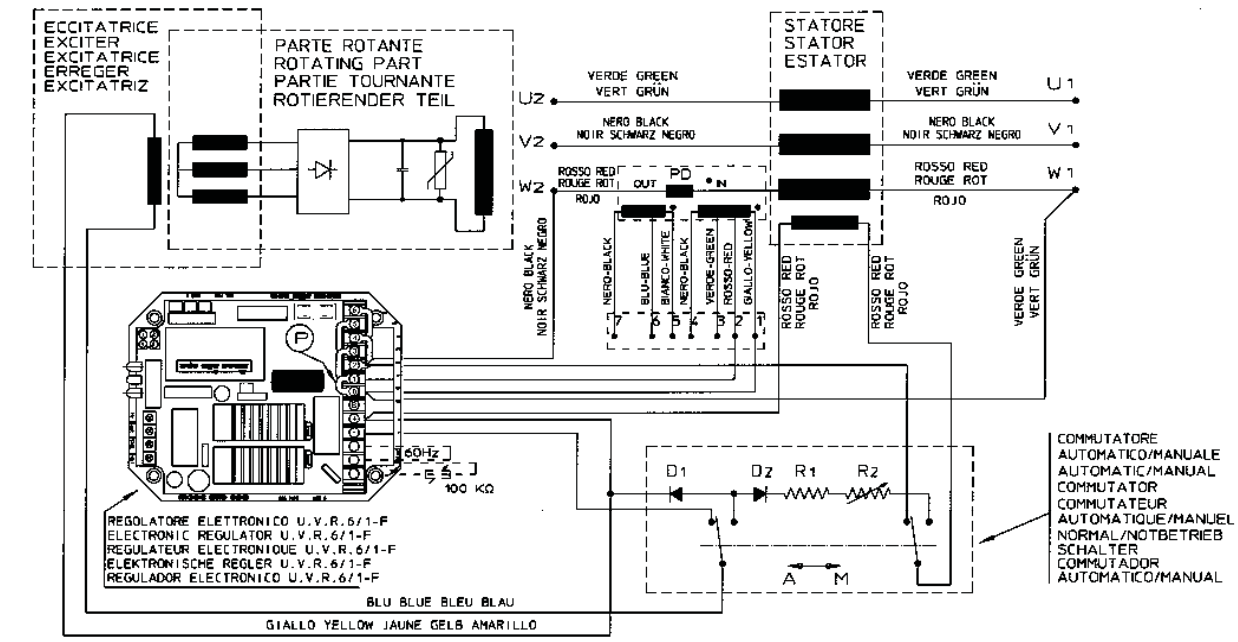

COMANDO MANUALE/AUTOMATICO CON REGOLATORE U.V.R.6/1-F
AUTOMATIC/MANUAL COMMAND WITH U.V.R.6/1-F REGULATOR
COMMANDE MANUELLE/AUTOMATIQUE AVEC REGULATEUR U.V.R.6/1-F
UMSCHALTER MANUELL/AUTOMATISCH MIT U.V.R.6/1-F REGLER
COMANDO MANUAL/AUTOMATICO CON REGULADOR U.V.R.6/1-F

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11

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 Brucke 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.

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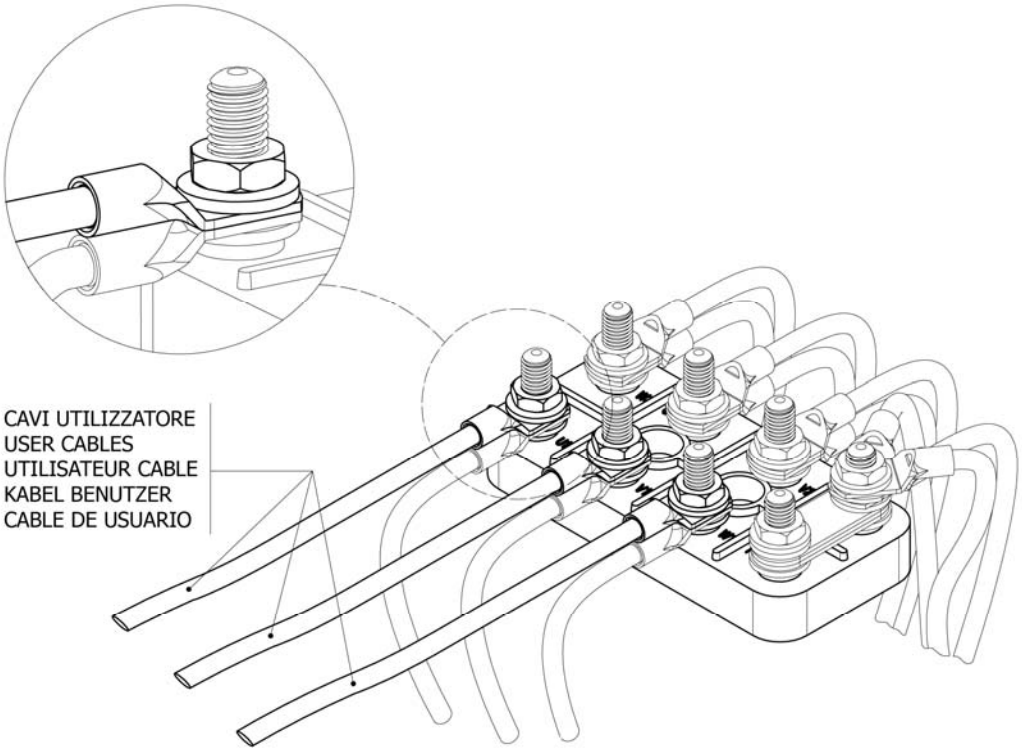
COLLEGAMENTO CAVI UTTILIZZATORE 28-31-32-34
USER CABLES CONNECTION 28-31-32-34
CONNEXION DES CÂBLES PAR L'UTILISATEUR 28-31-32-34
VERBRAUCHERKABELANSCHLUSS 28-31-32-34
CONEXIÓN CABLES USUARIO 28-31-32-34



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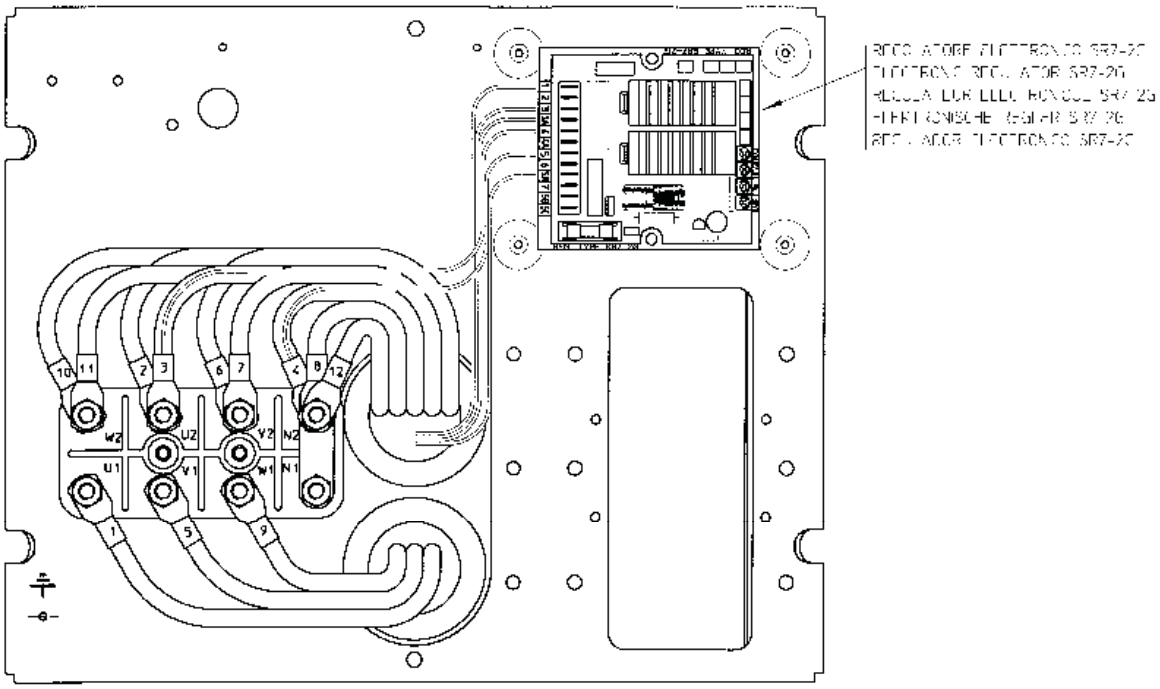
SCATOLA REGOLAZIONE 28-31-32
TERMINAL BOX 28-31-32
BOITIER DE REGULATION 28-31-32
REGLERKASTEN 28-31-32
CAJA DE REGULACION 28-31-32



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

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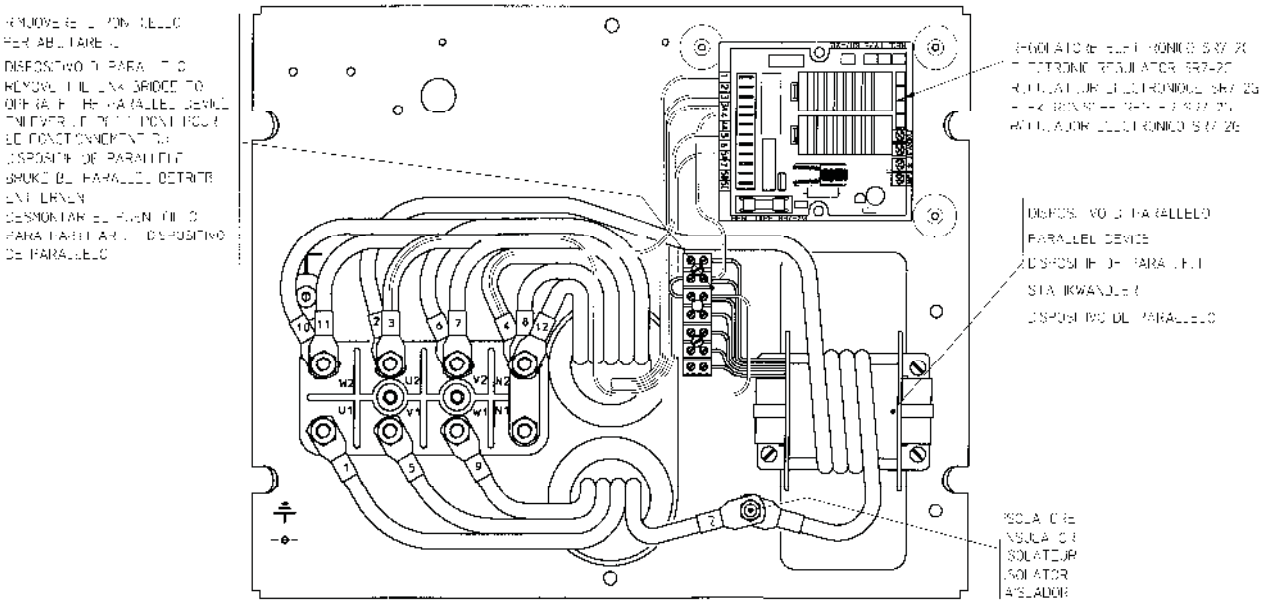
SCATOLA REGOLAZIONE 28-31-32 CON DISPOSITIVO DI PARALLELO
TERMINAL BOX 28-31-32 WITH PARALLEL DEVICE
BOITIER DE REGULATION 28-31-32 AVEC DISPOSITIF DE PARALLELE
REGLERKASTEN 28-31-32 MIT EINRICHTUNG FUR PARALLELBETRIEB
CAJA DE REGULACION 28-31-32 CON DISPOSITIVO DE PARALELO



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

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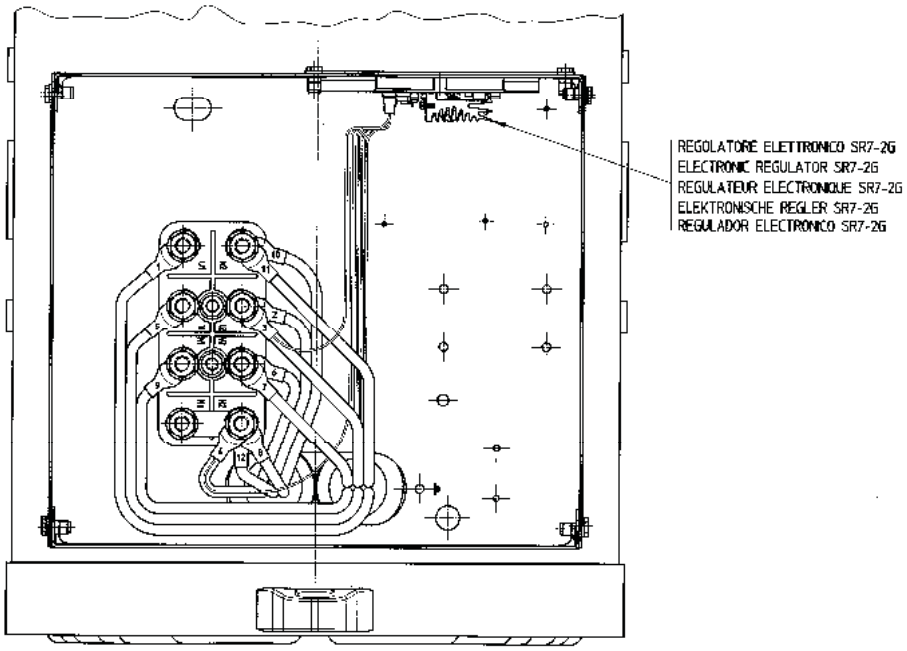
SCATOLA REGOLAZIONE 34
TERMINAL BOX 34
BOITIER DE REGULATION 34
REGLERKASTEN 34
CAJA DE REGULACION 34



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

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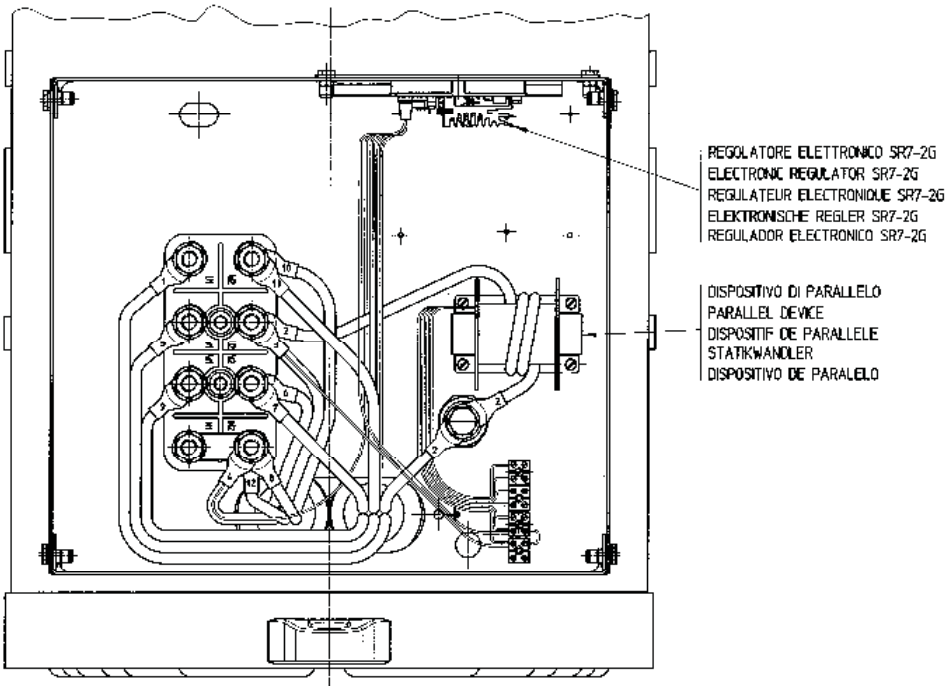
SCATOLA REGOLAZIONE 34 CON DISPOSITIVO DI PARALLELO
TERMINAL BOX 34 WITH PARALLEL DEVICE
BOITIER DE REGULATION 34 AVEC DISPOSITIF DE PARALLELE
REGLERKASTEN 34 MIT EINRICHTUNG FUR PARALLELBETRIEB
CAJA DE REGULACION 34 CON DISPOSITIVO DE PARALELO



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

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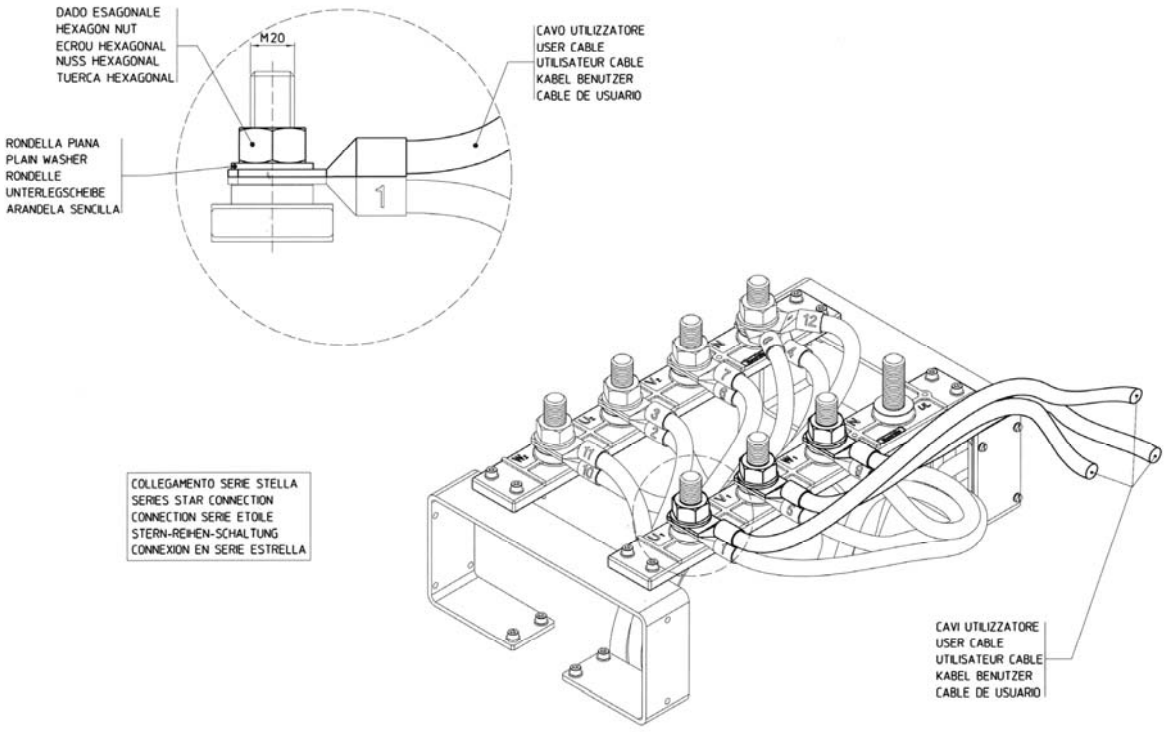
COLLEGAMENTO CAVI UTTILIZZATORE 38-40
USER CABLES CONNECTION 38-40
CONNEXION DES CÂBLES PAR L'UTILISATEUR 38-40
VERBRAUCHERKABELANSCHLUSS 38-40
CONEXIÓN CABLES USUARIO 38-40



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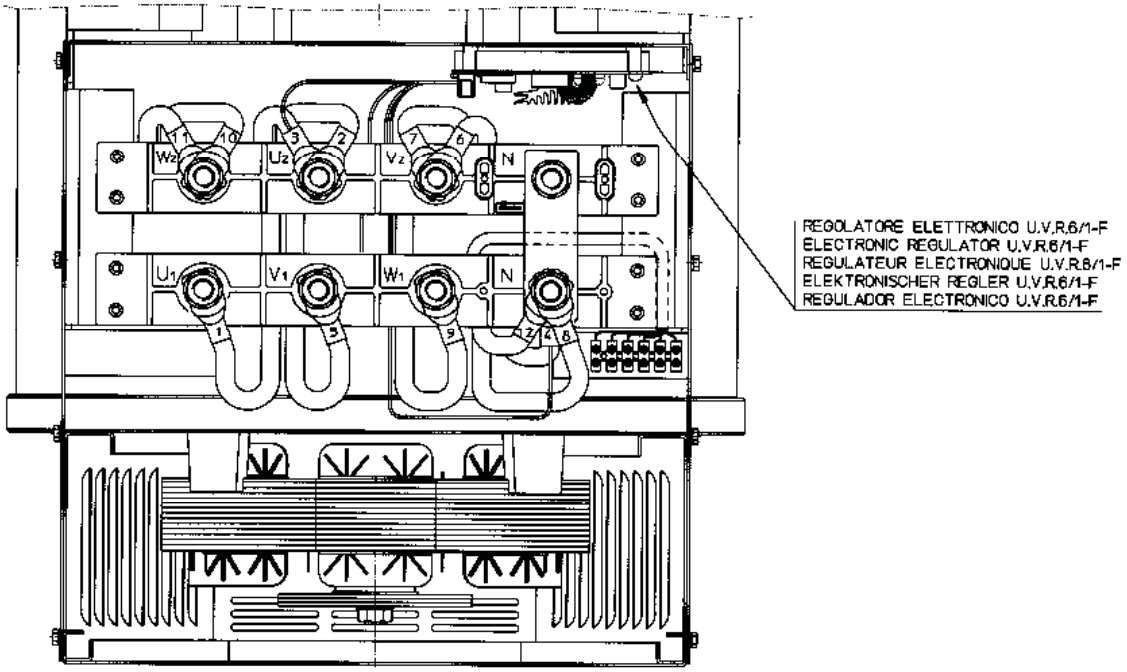
SCATOLA REGOLAZIONE 38
TERMINAL BOX 38
BOITIER DE REGULATION 38
REGLERKASTEN 38
CAJA DE REGULACION 38



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

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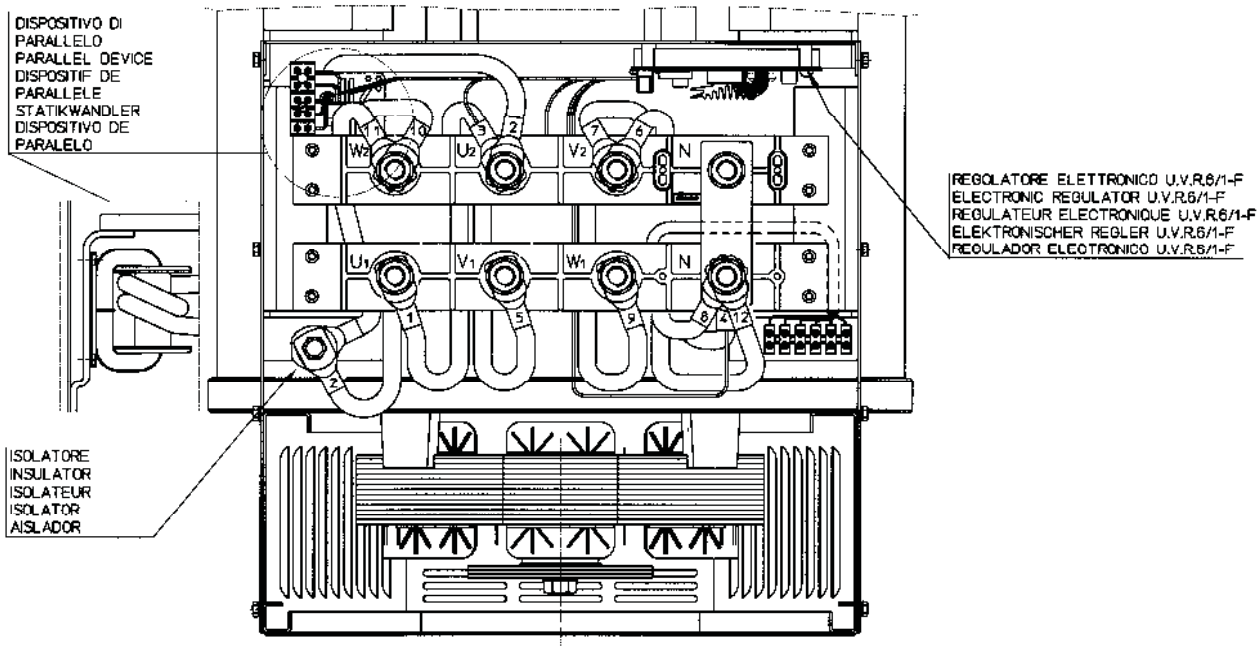
SCATOLA REGOLAZIONE 38 CON DISPOSITIVO DI PARALLELO
TERMINAL BOX 38 WITH PARALLEL DEVICE
BOITIER DE REGULATION 38 AVEC DISPOSITIF DE PARALLELE
REGLERKASTEN 38 MIT EINRICHTUNG FUR PARALLELBETRIEB
CAJA DE REGULACION 38 CON DISPOSITIVO DE PARALELO



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

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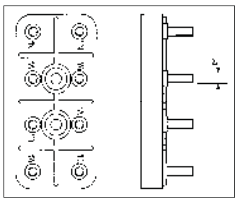
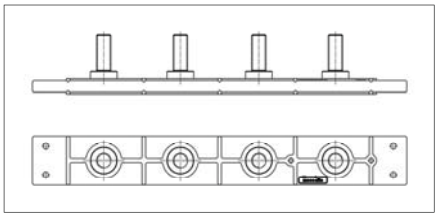
TABELLA COPPIE DI SERRAGGIO PER MORSETTIERE
TERMINAL BOARD TIGHTENING TORQUE TABLE
TABLEAU DE COUPLE DE SERRAGE POUR PLANCHETTE A BORNES
KLEMMENBRETT AUZUGSMOMENT TABELLE
TABLA PAR DE TORQUE POR PLACA DE BORNES

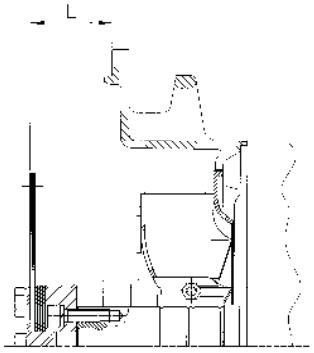




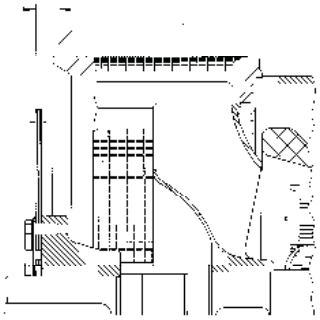
DIAMETRO DI FILETTATURA Df THREAD DIAMETER Df DIAMETRE DE FILETAGE Df GEWINDE DURCHMESSER Df DIAMETRO DE FILETEADO Df	TIPO TYPE TYP	COPPIA DI SERRAGGIO (Nm) TIGHTENING TORQUE (Nm) COUPLE DE SERRAGE (Nm) ANZUGSMOMENT (Nm) PAR DE TORQUE (Nm)
M6	ECP 28	8 ± 7%
M8	ECO 32	18 ± 7%
M10 (Steel)	ECO43-ECO46	30 ± 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

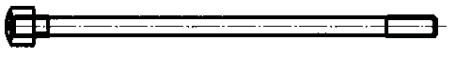


TIPO / TYPE / TYP 34 - 38 - 40 - 43 - 46



TIPO TYPE TYP	SAE	L	DIMENSIONE VITI SCREWS DIMENSIONS DIMENSIOS 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%

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VOLUMI D'ARIA, RUMOROSITA' E PESI
AIR FLOW, NOISE AND WEIGHT
VOLUME D'AIR, BRUIT ET POIDS
LUFTMENGE, GERÄUSCH UND GEWICHT
VOLUMEN DE AIRE, RUIDO E PESO

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 m³/min		Rumore Noise Bruit Gerausch Ruido dB(A)				Peso Weight Poids Gewicht Peso
			50 Hz		60 Hz		
	50 Hz	60 Hz	1m	7m	1m	7m	Kg
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 m³/min		Rumore Noise Bruit Gerausch Ruido dB(A)				Peso Weight Poids Gewicht Peso
			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

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PROCEDURA VERIFICA PER DIODI ROTORE ECCITATRICE
PROCEDURE TO CHECK THE DIODES OF THE EXCITER ROTOR
PROCEDURE POUR CONTROLER LES DIODES DU STATOR D'EXCITATRICE
VORGEHENSWEISE ZUR PRÜFUNG DER DIODEN IM ERREGERROTOR
PROCEDIMIENTO DE CONTROL PARA DIODOS ROTOR EXCITATRIZ

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

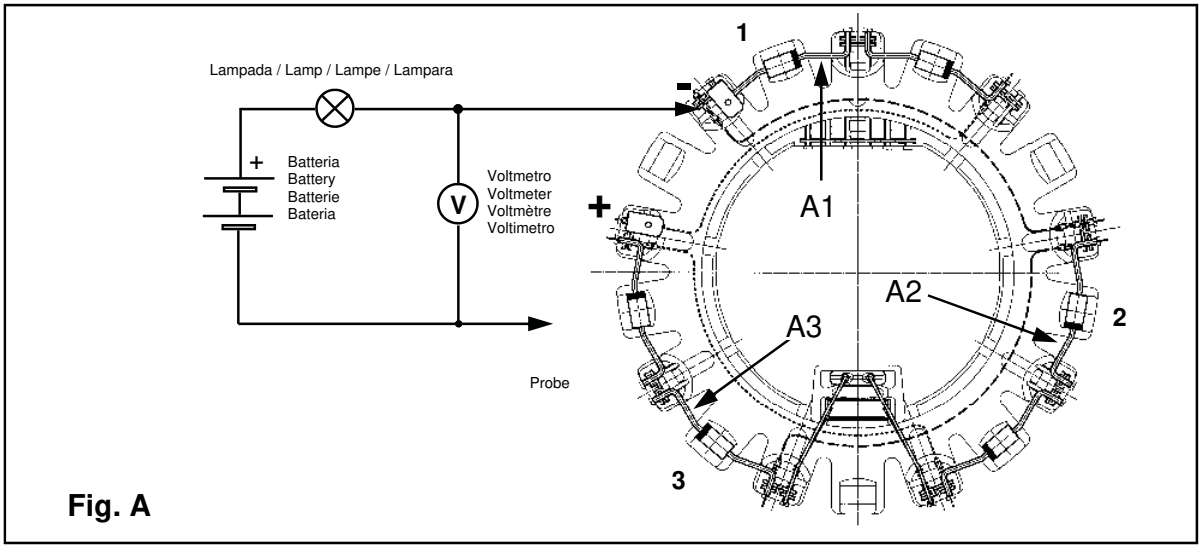
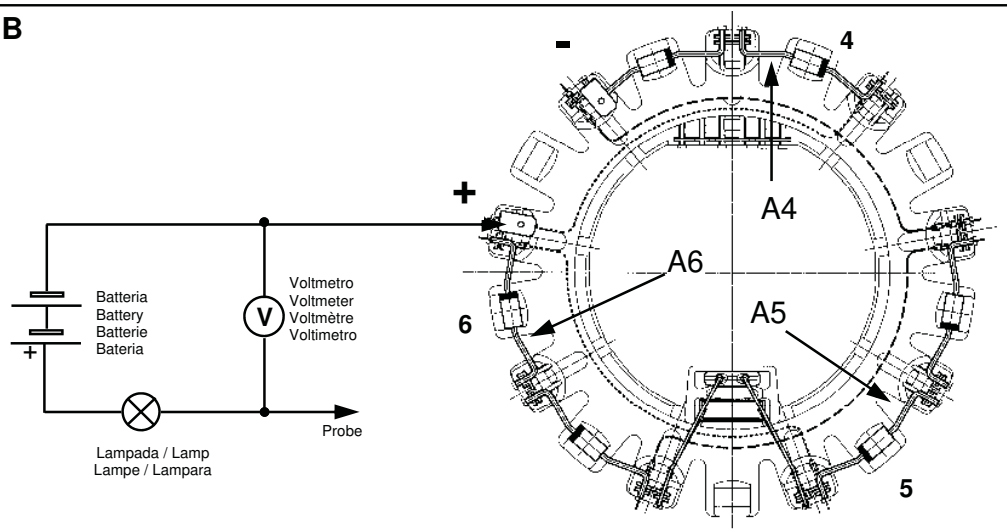


Fig. A

Fig. B

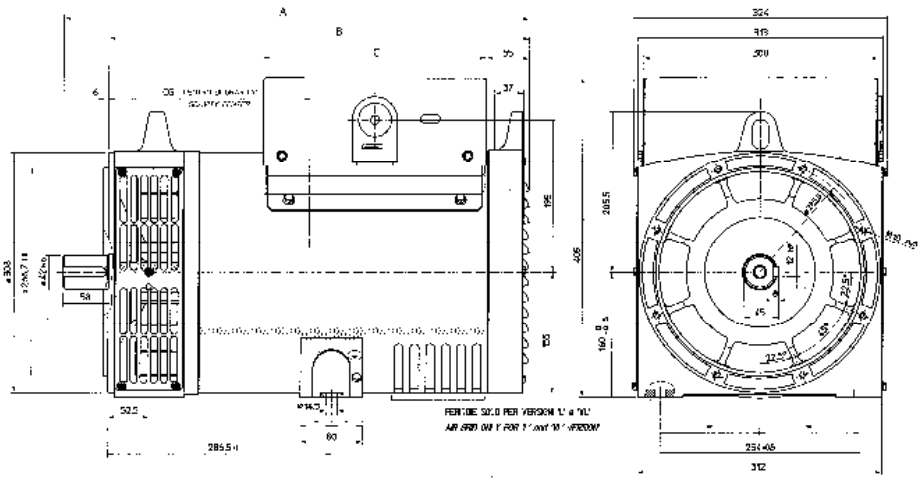


2 and 4 pole ALTERNATORE TIPO ALTERNATOR TYPE ALTERNATEUR TYPE GENERATORTYP ALTERNADOR TIPO	TENSIONE MISURATA / VOLTAGE MEASURED TENSION MESUREE / GEMESSENE SPANNUNG *TENSION MEDIDA* (fig. A-B) Diodo buono Good diode Diode bonne Diode gut Diodo bueno	Diodo in corto *Diode in short* diode en court-circuit 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 / from / de / von / de 0,8V 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* 1,3V
ECO31-1LN, ECO31-2LN, ECO32-1L, ECO32-2L, ECO32-3L	da / from / de / von / de 0,8V 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* 1,4V

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*
28-1VS/4	230
28-2VS/4	230
28-0S/4	235
28-S/4	237
28-1L/4	268
28-2L/4	275
28-VL/4	286

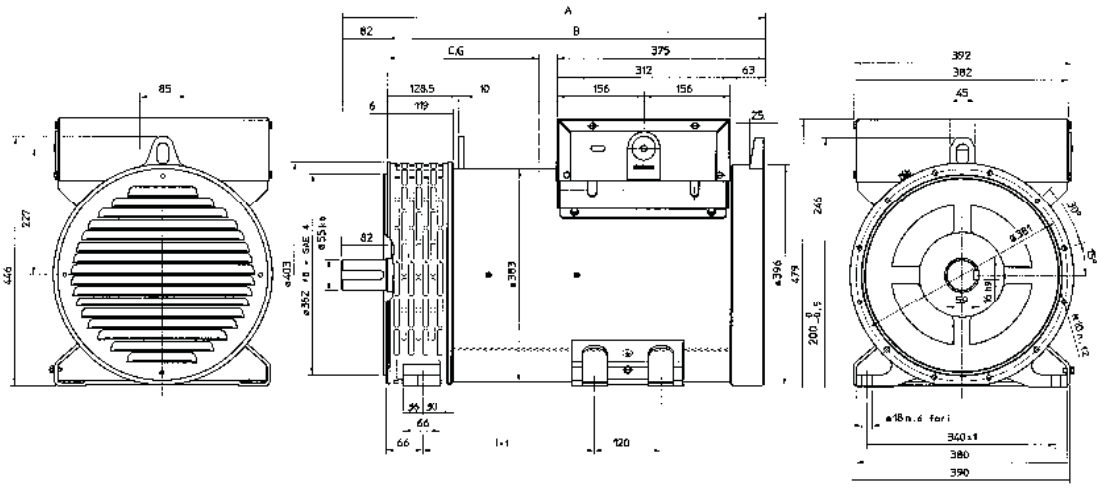
TIPO / TYPE	CG*
28-1L/2	267
28-2L/2	271
28-3L/2	275
28-VL/2	291

* 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

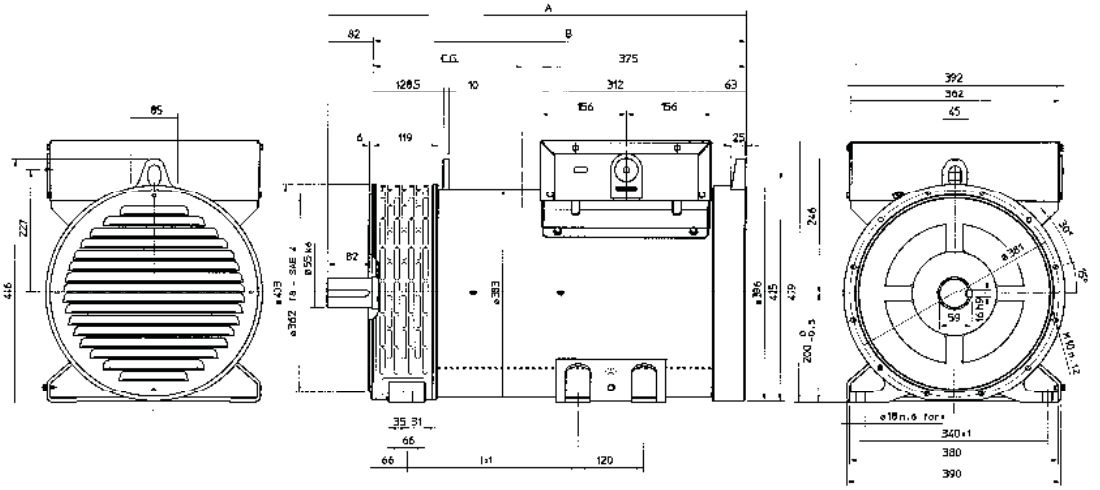
* Center of Gravity

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



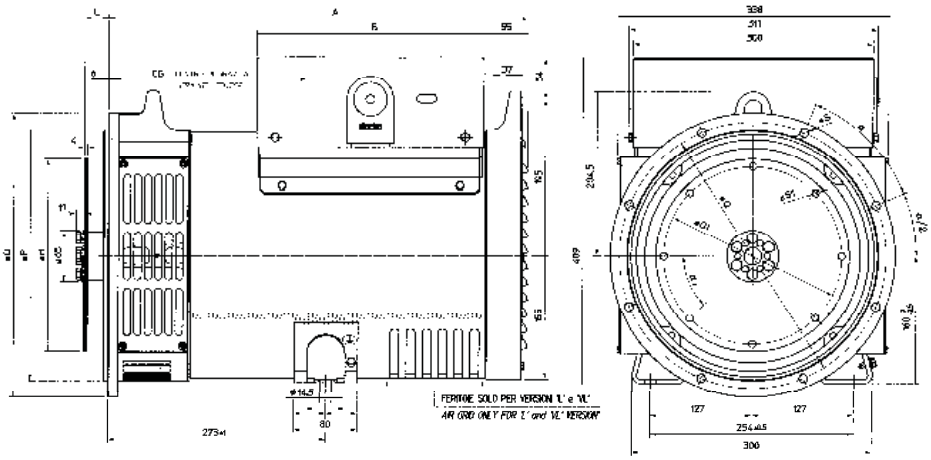
TIPO / TYPE	CG*
32-2S/4	269
32-3S/4	274
32-1L/4	316
32-2L/4	330
32-3L/4	351

* 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	α1
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°

SAE N°	Flangia / Flange					
	O	P	Q	N°	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*
28-1L/2	242
28-2L/2	248
28-3L/2	254
28-VL/2	273

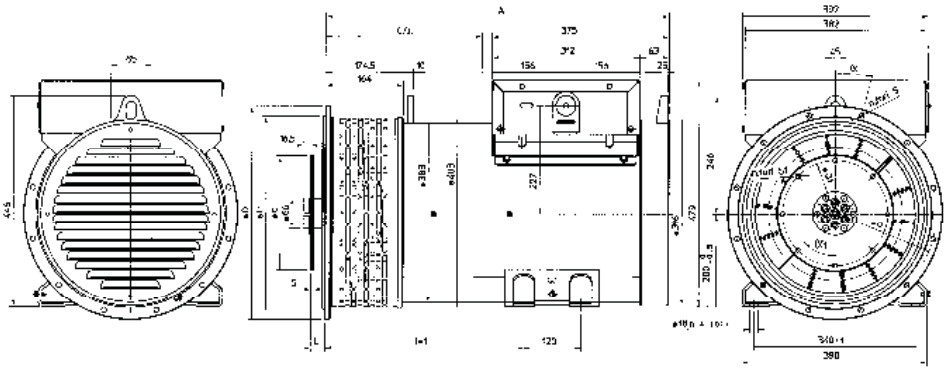
TIPO TYPE	CG*
28-1VS	200
28-2VS	200
28-0S	214
28-S/4	217
28-1L/4	247
28-2L/4	254
28-VL/4	274

TIPO TYPE	A	B
28 1VS-2VS	405	225
28 0S-S	445	285
28 1L/2-2L/2-3L/2 28 1L/4-2L/4	525	285
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	α1
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°

SAE N°	Flangia / Flange Bride / Flansch					
	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°

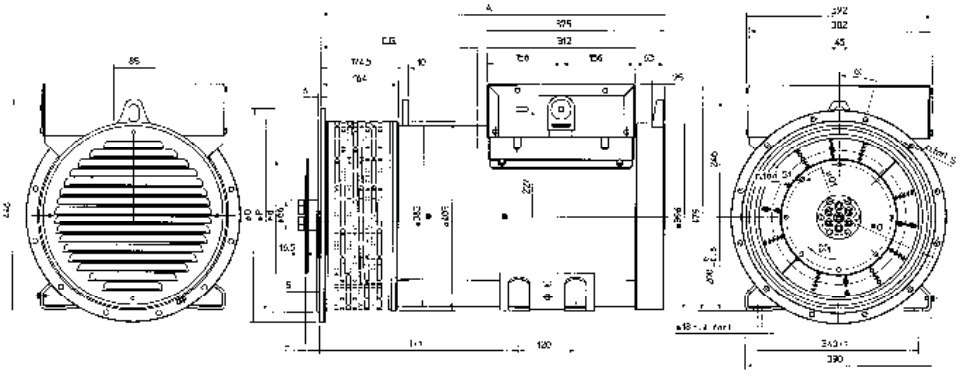
TIPO TYPE	A	B
ECO 31 S	621	315
ECO 31 L	726	420

TIPO TYPE	CG*
31-2SN/2	296
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	α1	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

SAE N°	Flangia / Flange Bride / Flansch					
	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
ECO 32 S	601	295
ECO 32 L	726	420

TIPO TYPE	CG*
32-2S/4	312
32-3S/4	316
32-1L/4	366
32-2L/4	377
32-3L/4	388

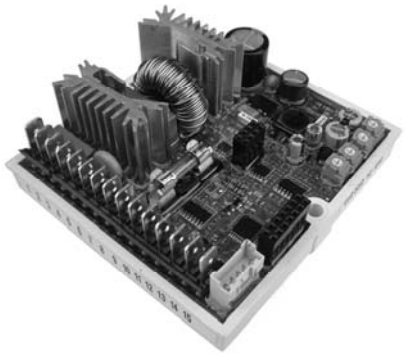
* Center of Gravity

APPENDICE DSR

DSR APPENDIX

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 spedizionere, 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 puo' 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 [1] ***Terminal***	**Denominazione** ***Name***	**Funzione** ***Function***	**Specifiche** ***Specifications***
1	Exc-	Eccitazione / Excitation	Reg. continuo/Continuous Rating : 4Adc max
2	Aux/Exc+		Reg. transitorio/Transitory Rating : 12Adc di picco/peak
3	Aux/Exc+	Alimentazione / Power	Frequenza/Frequency : da/from 12Hz a/to 72Hz
9	Aux/Neutral		Range: 40Vac - 270Vac
4	F_phase	Sensing	Range: 140Vac - 280Vac
5	F_Phase		Assorbimento/Burden : <1VA
6	H_phase	Sensing	Range: 70Vac - 140Vac
7	H_phase		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%
11	Common	Input for remote voltage control	Assorbimento/Burden: 0 - 2 mA (sink) Lunghezza massima/Max length: 30m[2]
12	50/60Hz	Ingresso per jumper 50/60Hz	Tipo/Type: non isolato/not isolated
13	Common	Jumper Input 50/60Hz	Lunghezza massima/Max length: 3m
14	A.P.O.	Uscita protezioni attive	Tipo/Type: Open collector non isolato/not isolated Corrente/Current : 100mA
15	Common	Active protections output	Tensione/Voltage: 30V Lunghezza massima/Max length: 30m[2]

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 ± 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·(100%-αHz%) a 60·(100%-αHz%) dove αHz% rappresenta la posizione relativa del trimmer Hz.

Contatto APO
Acronimo di **A**ctive **P**rotection **O**utput : (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 dovra' 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 affinchè 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 analogical remote control of output voltage through a 10Kohm potentiometer with a programmable by software variation range (by default the setting is ±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 al 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·(100%-αHz%) to 60·(100%-αHz%), where αHz% 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 *Description of event*	Azione *Action*
1	Checksum EEprom	Ripristino dati default, Blocco Reset default, Blockage
2	Sovratensione / *Overvoltage*	APO
3	Sottotensione / *Under voltage*	APO
4	Corto circuito /*Short circuit*	APO, Massima corrente, Blocco APO, Maximum current, Blockage
5	Sovracorrente di eccitazione *Excitation Overcurrent*	APO, Riduzione corrente di eccitazione APO, Reduction of excitation current
6	Bassa velocità / *Underspeed*	APO, Rampa/Ramp V/F
7	Sovravelocità / *Overspeed*	APO

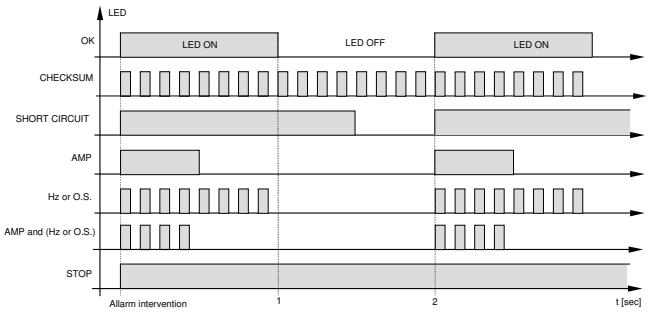
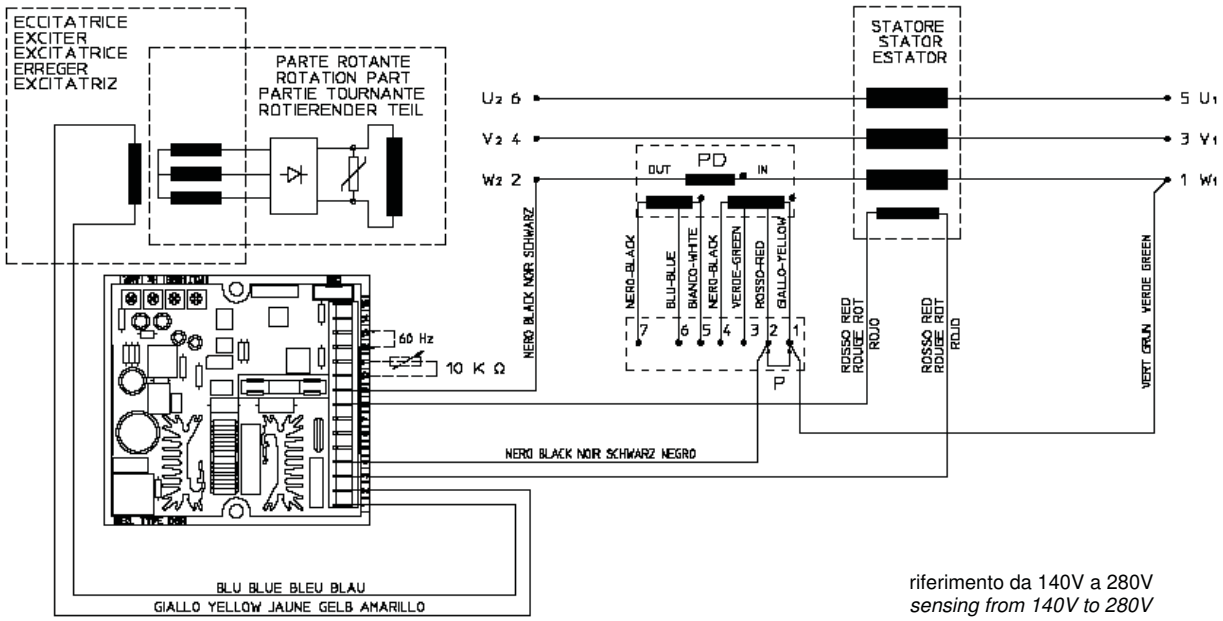


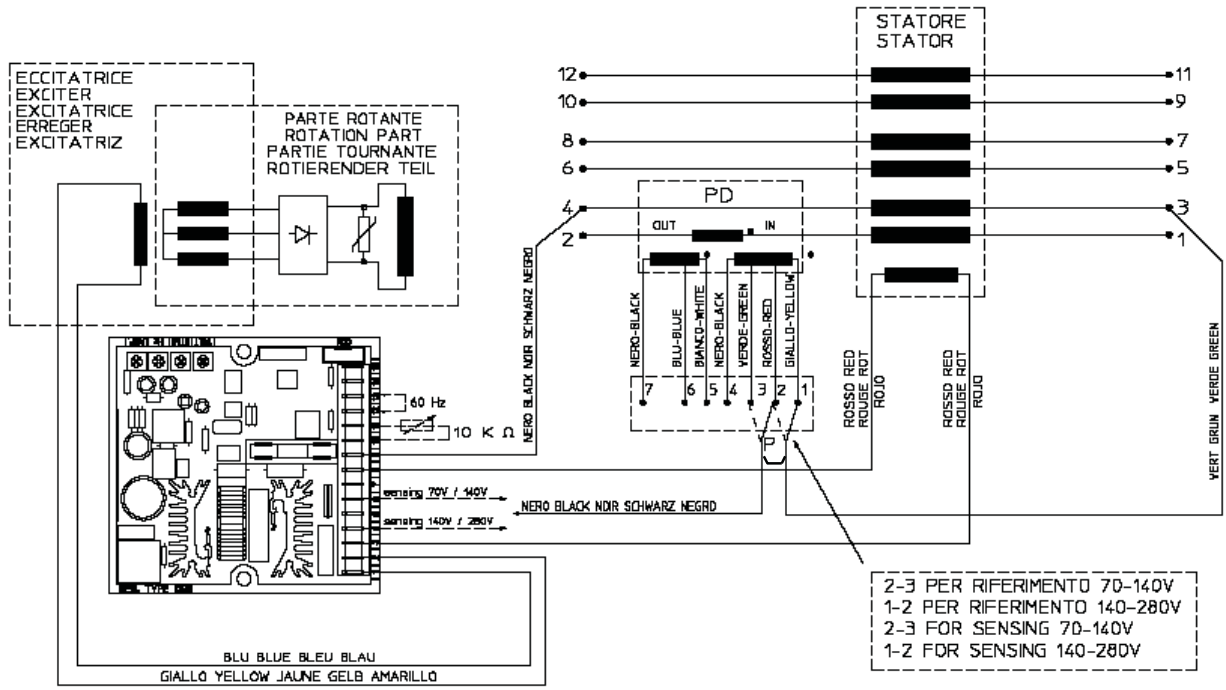
Fig. 1

Alternatori a 6 morsetti / ***6 terminal alternators*** **SCC0061/02**



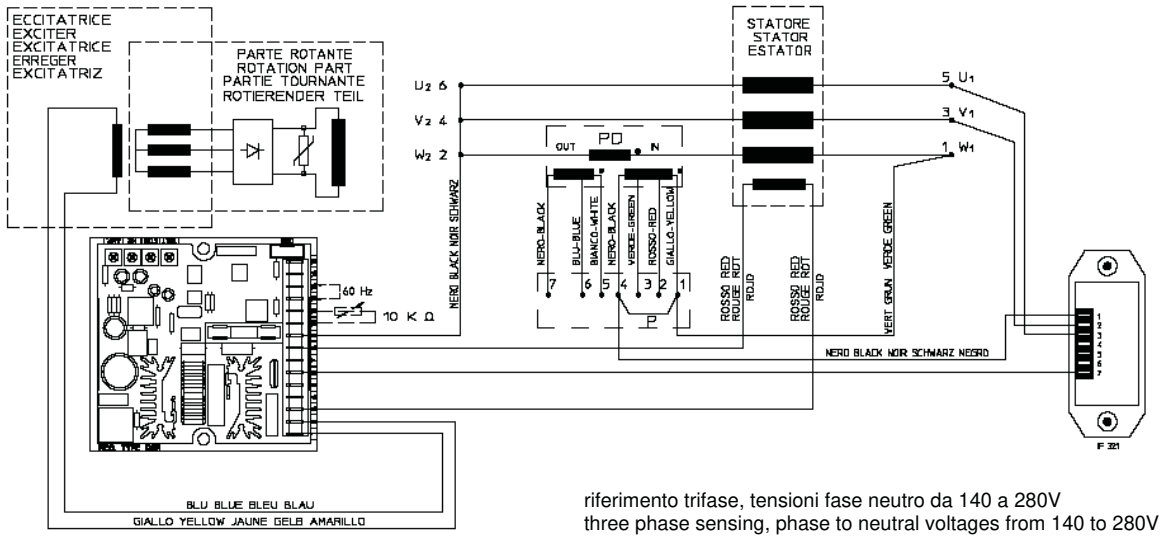
riferimento da 140V a 280V
sensing from 140V to 280V

Alternatori a 12 morsetti/***12 terminal alternators*** **SCC0100/00**



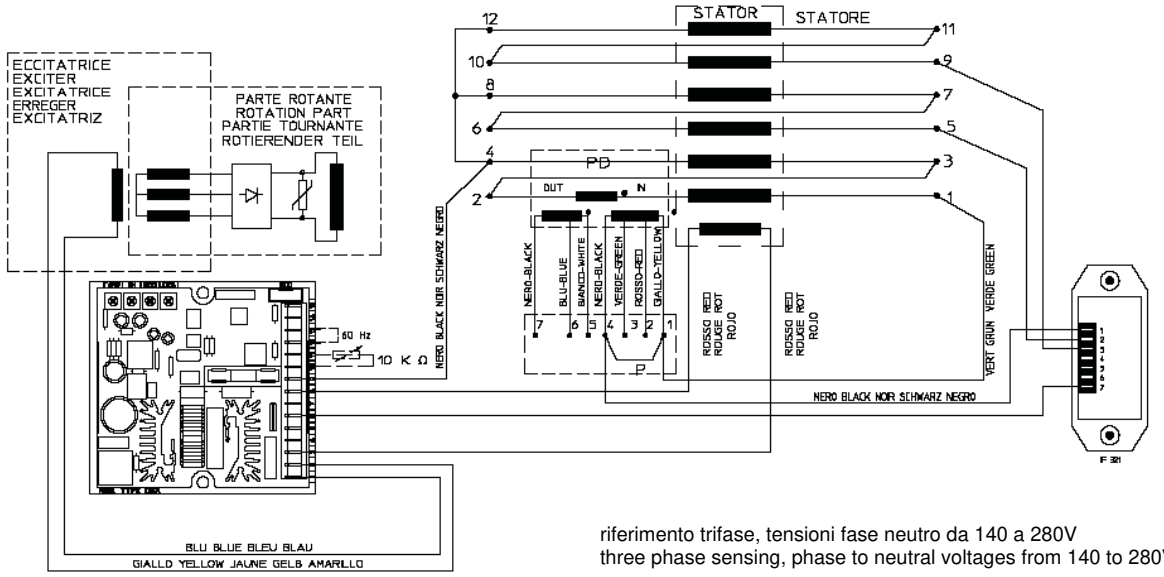
morsetto/terminal 4 : sensing 140V / 280V
morsetto/terminal 6 : sensing 70V / 140V

Alternatori a 6 morsetti, riferimento trifase/6 *terminal alternators, three-phase sensing* **SCC0104/00**



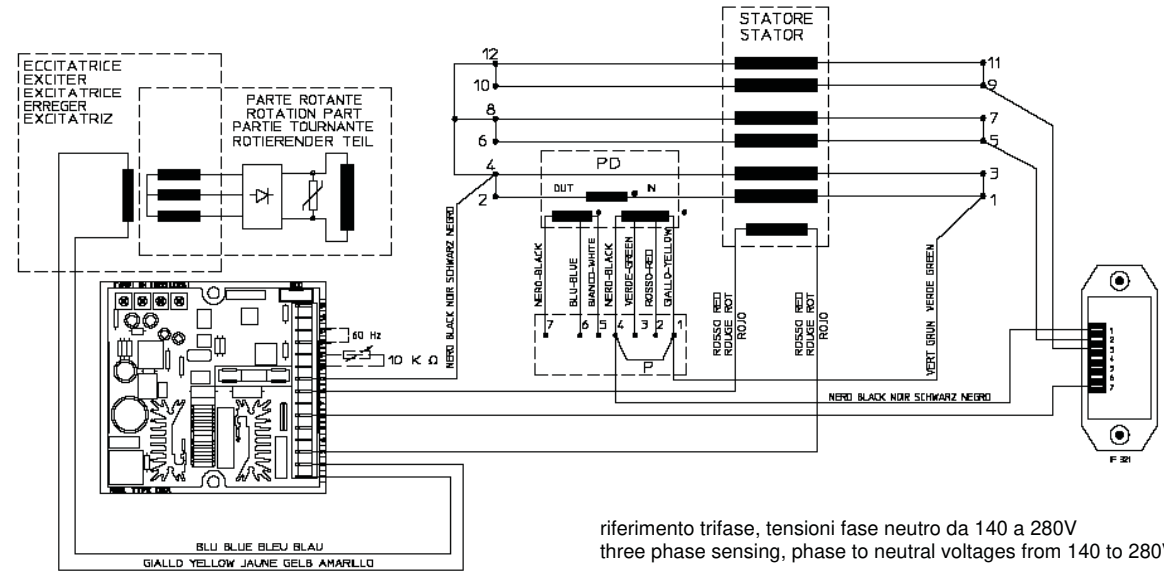
riferimento trifase, tensioni fase neutro da 140 a 280V
three phase sensing, phase to neutral voltages from 140 to 280V

Alternatori a 12 morsetti, riferimento trifase/*12 terminal alternators, three-phase sensing* **SCC0106/00**



riferimento trifase, tensioni fase neutro da 140 a 280V
three phase sensing, phase to neutral voltages from 140 to 280V

Alternatori a 12 morsetti, riferimento trifase/*12 terminal alternators, three-phase sensing* **SCC0105/00**



riferimento trifase, tensioni fase neutro da 140 a 280V
three phase sensing, phase to neutral voltages from 140 to 280V

GARANZIA

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.

WARRANTY

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
inadeguate storage;

2
repair or modification by unauthorized personnel;

3
use or maintenance conditions which do not conform whith 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.

GARANTIE

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.

GARANTIE

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
Wahrend der genannten Periode repariert oder ersetzt Mecc Alte zu seinen Kosten alle fehlerhaften Teile, ohne Rucksicht ob direkt oder indirekt.

C
Mecc Alte behält sich das Recht vor, die fehlerhaften Teile frei Mecc Alte Vicenza zurückzufordern, zur 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 fur nachstehende Faktoren ausgeschlossen:

1
nicht korrekte Lagerung;

2
Reparatur oder Modefizierung 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 Grunden auch immer, der Kunde in Zahlung überfällig ist.

GARANTIA

A
Mecc alte garantiza la buena construccion y calidad de los proprios productos por 24 meses desde la fecha de salida de sus fabricas o de sus filiales.

B
Durante disho periodo la Mecc Alte se obliga a reparar o sustituir a su cargo, en su establecimiento todas acquallas 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 manuntencion 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.

Equipment Source Inc.

1919 Van Horn Rd.
Fairbanks, AK 99701
Ph: (907) 458-9049

Engine Manual

BUILT ARCTIC TOUGH

Equipment Source Inc.

1919 Van Horn Rd.
Fairbanks, AK 99701
Ph: (907) 458-9049

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California Proposition 65

⚠ WARNING ⚠

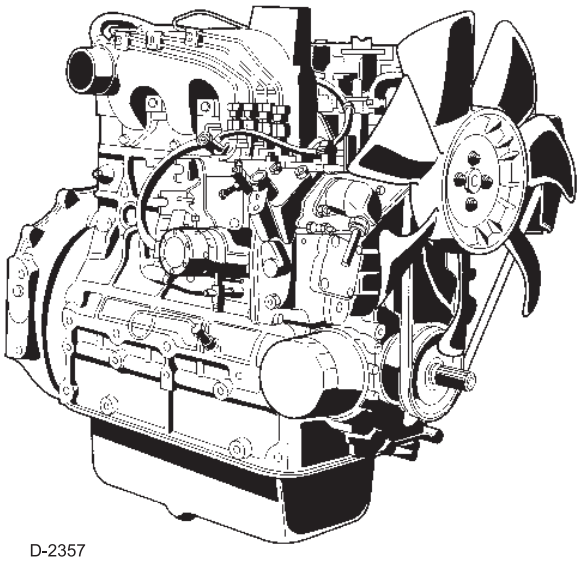
Engine exhaust, some of its constituents, certain vehicle components and fluids, contain or emit chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

ENGLISH

OPERATOR'S MANUAL

KUBOTA
DIESEL ENGINE

MODELS
D1503-M-E3·D1703-M-E3·D1803-M-E3
V2003-M-E3·V2203-M-E3·V2403-M-E3·V2403-M-T-E3
D1703-M-E3BG·V2003-M-E3BG·V2003-M-T-E3BG
V2203-M-E3BG·V2403-M-E3BG



D-2357

1J464-8916-4

READ AND SAVE THIS BOOK

Kubota

ENGLISH

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, may result in minor or moderate injury.
IMPORTANT :	Indicates that equipment or property damage could result if instructions are not followed.
NOTE :	Gives helpful information.

ENGLISH

CONTENTS

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.


1AEAAAAP0130

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. The machine may start in gear and move. Do not bypass or defeat any safety devices.


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 mix gasoline or alcohol with diesel fuel. The mixture can cause a fire or severe engine damage.
- Do not use unapproved containers e.g. buckets, bottles, jars. Use approved fuel storage containers and dispensers.

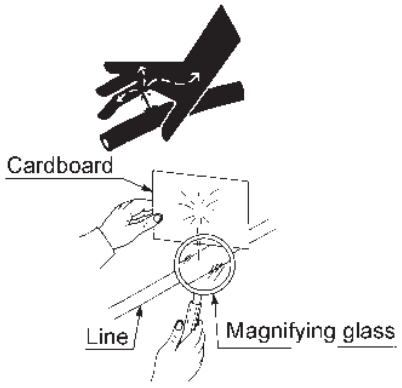
1AAACAAAP001A

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.


1AEABAAAP0080

- 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.


1AAAAABAP0230

- 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).


1ARAEAAAP0520

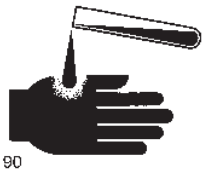
9. KEEP HANDS AND BODY AWAY FROM ROTATING PARTS

- 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.


1ABAAAAAP1470

10. ANTI-FREEZE & DISPOSAL OF FLUIDS

- Anti-freeze contains poison. Wear rubber gloves to avoid personal injury. 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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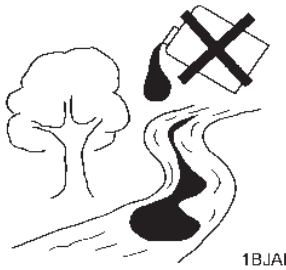

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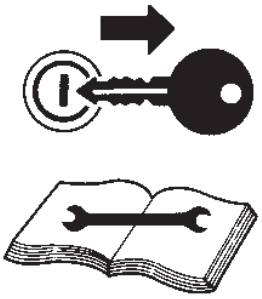
11. CONDUCTING SAFETY CHECKS & MAINTENANCE

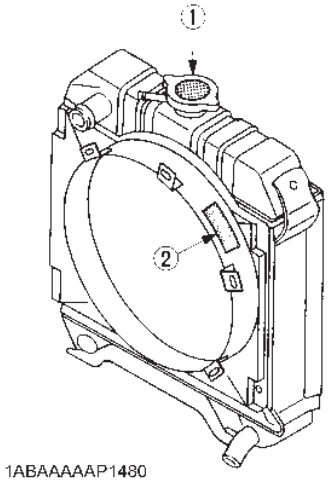
- When inspecting the engine or servicing, place the engine on a large flat surface. DO NOT work on anything that is supported ONLY by lift jacks or a hoist. Always use blocks or the correct stands to support the engine before servicing.
- Disconnect the battery from the engine before conducting service. 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



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

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

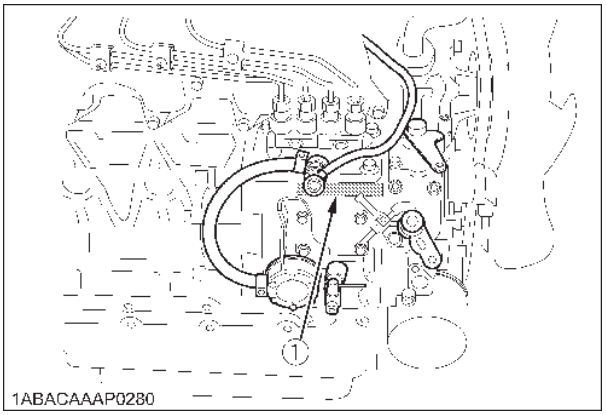
1. Keep warning and caution labels clean and free from obstructing material.
2. Clean warning and caution labels with soap and water, dry with a soft cloth.
3. Replace damaged or missing warning and caution labels with new labels from your local KUBOTA dealer.
4. If a component with warning and caution 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.

ENGLISH

SERVICING OF THE ENGINE

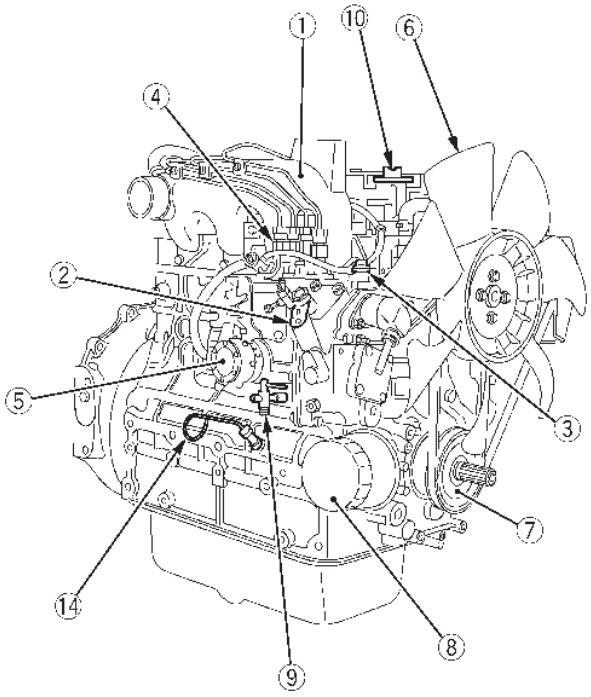
Your dealer is interested in your new engine and has the desire to help you get the most value from it. After reading this manual thoroughly, you will find that you can do some of the regular maintenance yourself.
However, when in need of parts or major service, be sure to see your KUBOTA dealer.
For 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)		



(1) Engine serial number

NAMES OF PARTS



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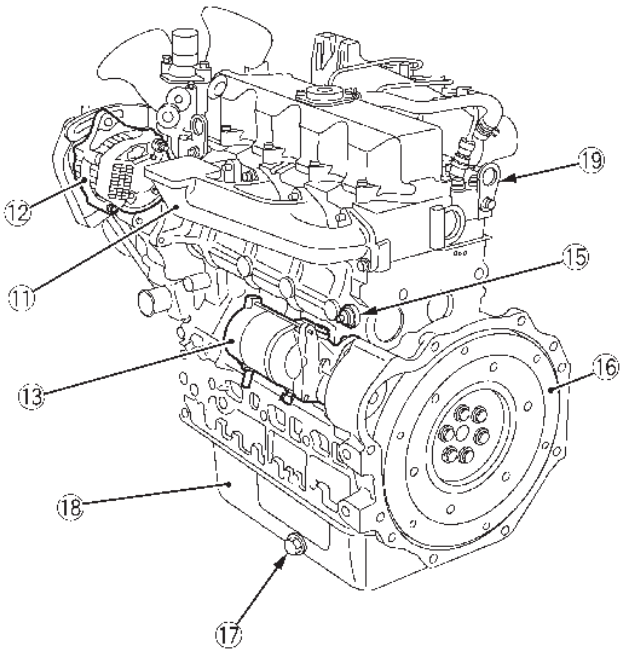

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(1) Intake manifold
(2) Speed control lever
(3) Engine stop lever
(4) Injection pump
(5) Fuel feed pump
(6) Cooling fan
(7) Fan drive pulley
(8) Oil filter cartridge
(9) Water drain cock
(10) Oil filler plug
(11) Exhaust manifold
(12) Alternator
(13) Starter
(14) Oil level gauge
(15) Oil pressure switch
(16) Flywheel
(17) Oil drain plug
(18) Oil pan
(19) Engine hook

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.

CAUTION

To avoid personal injury:

- **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	12
	(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	-
	(2) Proper function of glow lamp timer	-
4. By starting the engine	(1) Color of exhaust fumes	7
	(2) Unusual engine noise	7
	(3) Engine start-up condition	5
	(4) Slow-down and acceleration behavior	7

OPERATING THE ENGINE

STARTING THE ENGINE(NORMAL)

CAUTION

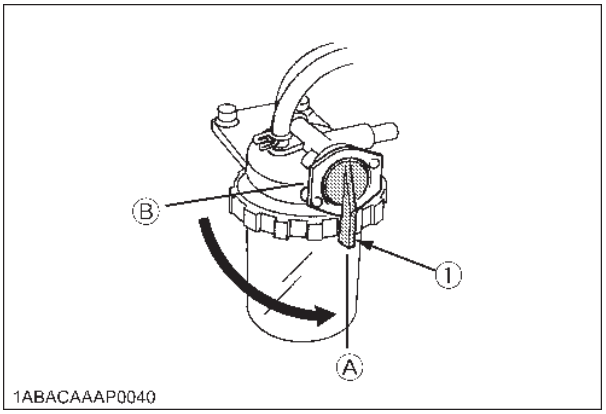
To avoid personal injury:

- **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 :

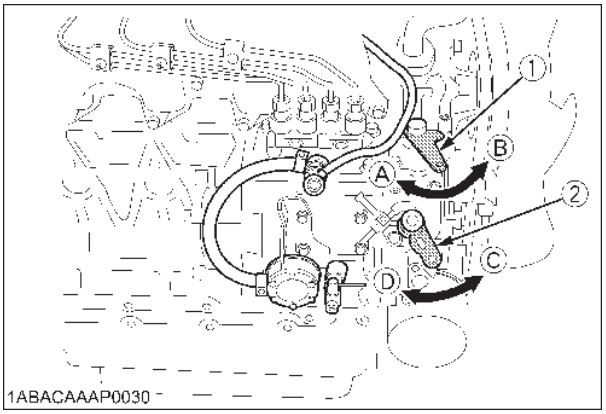
- Do not use ether or any starting fluid for starting the engine, or a severe damage will occur.
- When starting the engine after a long storage (of more than 3 months), first set the stop lever to the "STOP" position and then activate the starter for about 10 seconds to allow oil to reach every engine part.

1. **Set the fuel lever to the "ON" position.**



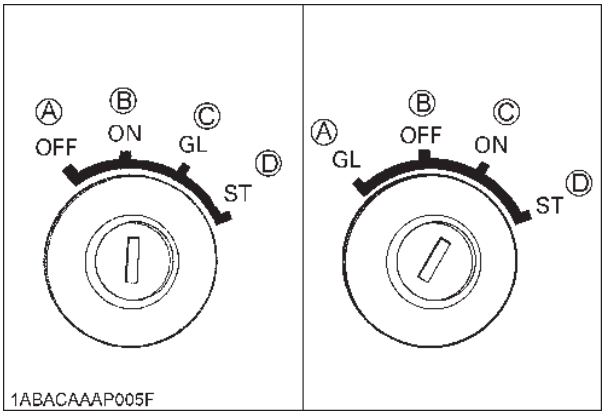
(1) Fuel lever
(A) "ON"
(B) "OFF"

2. **Place the engine stop lever to the "START" position.**
3. **Place the speed control lever at more than half "OPERATION".**



(1) Engine stop lever
(2) Speed Control lever
(A) "STOP"
(B) "START"
(C) "IDLING"
(D) "OPERATION"

4. Insert the key into the key switch and turn it to the "OPERATION" position.



(A) "OFF" SWITCHED OFF
(B) "ON" OPERATION
(C) "GL" PREHEATING
(D) "ST" STARTING

(A) "GL" PREHEATING
(B) "OFF" SWITCHED OFF
(C) "ON" OPERATION
(D) "ST" STARTING

5. Turn the starter switch to the "PREHEATING" position to allow the glow lamp to redden.

NOTE :
(with lamp timer in use)
- The glow lamp goes out in about 5 seconds when the lamp timer is up. Refer to this for pre-heating.
  Even with the glow lamp off, the glow plug can be pre-heated by turning the starter switch to the "PREHEATING" position.

6. Turn the key to the "STARTING" position and the engine should start. Release the key immediately when the engine starts.

7. Check to see that the oil pressure lamp and charge lamp are off. If the lamps are still on, immediately stop the engine, and determine the cause.
(See "CHECKS DURING OPERATION" in "OPERATING THE ENGINE" section.)

NOTE :
- If the oil pressure lamp should be still on, immediately stop the engine and check;
  - if there is enough engine oil.
  - if the engine oil has dirt in it.
  - if the wiring is faulty.

8. Warm up the engine at medium speed without load.

IMPORTANT :
- If the glow lamp should redden too quickly or too slowly, immediately ask your KUBOTA dealer to check and repair it.
- If the engine does not catch or start at 10 seconds after the starter switch is set at "STARTING" position, wait for another 30 seconds and then begin the engine starting sequence again. Do not allow the starter motor to run continuously for more than 20 seconds.

COLD WEATHER STARTING

If the ambient temperature is below -5°C(23°F)* and the engine is very cold, start it in the following manner:
Take steps (1) through (4) above.

5. Turn the key to the "PREHEATING" position and keep it there for a certain period mentioned below.

IMPORTANT :
- Shown below are the standard preheating times for various temperatures. This operation, however, is not required, when the engine is warmed up.

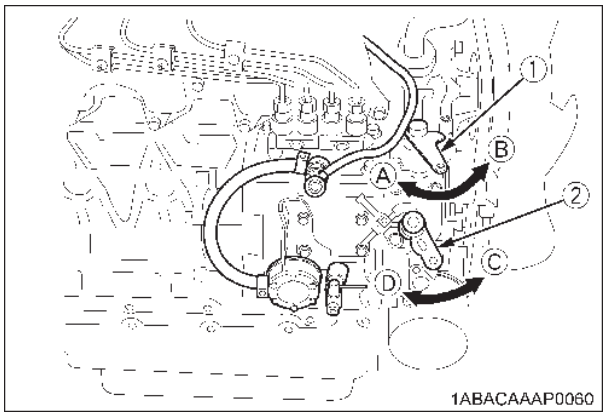
Ambient temperature	Preheating time
Above 10°C (50°F)	NO NEED
10°C (50°F) to -5°C (23°F)	Approx. 5 seconds
*Below -5°C (23°F)	Approx. 10 seconds
Limit of continuous use	20 seconds

6. Turn the key to the "STARTING" position and the engine should start.
(If the engine fails to start after 10 seconds, turn off the key for 5 to 30 seconds. Then repeat steps (5) and (6).)

IMPORTANT :
- Do not allow the starter motor to run continuously for more than 20 seconds.
- Be sure to warm up the engine, not only in winter, but also in warmer seasons. An insufficiently warmed-up engine can shorten its service life.
- When there is fear of temperature dropping below -15°C (5°F) detach the battery from the machine, and keep it indoors in a safe area, to be reinstalled just before the next operation.

STOPPING THE ENGINE

1. **Return the speed control lever to low idle, and run the engine under idling conditions.**
2. **Set the engine stop lever to the "STOP" position.**
3. **With the starter switch placed to the "SWITCHED OFF" position, remove the key. (Be sure to return the engine stop lever to the "START" position to be ready for the next start.)**



(1) Engine stop lever
(2) Speed control lever
(A) "STOP"
(B) "START"
(C) "IDLING"
(D) "OPERATION"

IMPORTANT :

- If equipped with a turbo-charger, allow the engine to idle for 5 minutes before shutting it off after a full load operation.
  Failure to do so may lead to turbo-charger trouble.

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:

- **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.)

■Fuel

CAUTION

To avoid personal injury:

- **Fluid escaping from pinholes may be invisible. Do not use hands to search for suspected leaks; Use a piece of cardboard or wood, instead. If injured by escaping fluid, see a medical doctor at once. This fluid can produce gangrene or a severe allergic reaction.**
- **Check any leaks from fuel pipes or fuel injection pipes. Use eye protection when checking for leaks.**

Be careful not to empty the fuel tank. Otherwise air may enter the fuel system, requiring fuel system bleeding. (See "FUEL" in "PERIODIC SERVICE" section.)

■Color of exhaust

While the engine is run within the rated output range:

- The color of exhaust remains colorless.
- If the output slightly exceeds the rated level, exhaust may become a little colored with the output level kept constant.
- If the engine is run continuously with dark exhaust emission, it may lead to trouble with the engine.

■Immediately stop the engine if;

- The engine suddenly slows down or accelerates.
- Unusual noises are suddenly heard.
- Exhaust fumes suddenly become very dark.
- The oil pressure lamp or the water temperature alarm lamp lights up.

REVERSED ENGINE REVOLUTION AND REMEDIES

CAUTION

To avoid personal injury:

- **Reversed engine operation can make the machine reverse and run it backwards. It may lead to serious trouble.**
- **Reversed engine operation may make exhaust gas gush out into the intake side and ignite the air cleaner; It could catch fire.**

Reversed engine revolution must be stopped immediately since engine oil circulation is cut quickly, leading to serious trouble.

■How to tell when the engine starts running backwards

1. Lubricating oil pressure drops sharply. Oil pressure warning light, if used, will light.
2. Since the intake and exhaust sides are reversed, the sound of the engine changes, and exhaust gas will come out of the air cleaner.
3. A louder knocking sound will be heard when the engine starts running backwards.

■Remedies

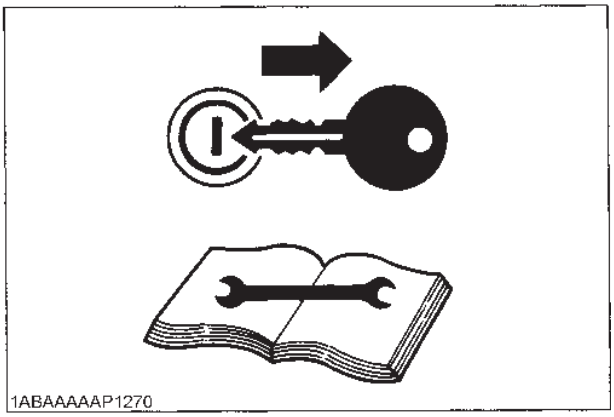
1. Immediately set the engine stop lever to the "STOP" position to stop the engine.
2. After stopping the engine, check the air cleaner, intake rubber tube and other parts, and then replace parts as needed.

MAINTENANCE

CAUTION

To avoid personal injury:

- **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.**
- **When cleaning any parts, do not use gasoline but use regular cleanser.**
- **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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SERVICE INTERVALS

Observe the following for service and maintenance.

Interval	Item	Ref. page		
Every 50 hours	Check of fuel pipes and clamp bands	14		@
See NOTE	Change of engine oil (depending on the oil pan)	15 to 17	◎	
Every 100 hours	Cleaning of air cleaner element	21	*1	@
	Cleaning of fuel filter	14		
	Check of fan belt tightness	22		
	Draining water separator	-		
Every 200 hours	Replacement of oil filter cartridge (depending on the oil pan)	17	◎	
	Check of intake air line	-		@
Every 200 hours of operation or six months	Check of radiator hoses and clamp bands	19		
Every 400 hours	Replacement of fuel filter cartridge	15		@
	Cleaning of water separator	-		
Every 500 hours	Removal of sediment in fuel tank	-		
	Cleaning of water jacket (radiator interior)	18 to 20		
	Replacement of fan belt	22		
Every year	Replacement of air cleaner element	21	*2	@
Every 800 hours	Check of valve clearance	-	*3	
Every 1500 hours	Check of fuel injection nozzle injection pressure	-	*3	@
Every 3000 hours	Check of turbo charger	-	*3	@
	Check of injection pump	-	*3	@
Every two years	Change of radiator coolant (L.L.C.)	18 to 20		
	Replacement of radiator hoses and clamp bands	19		
	Replacement of fuel pipes and clamp bands	14	*3	@
	Replacement of intake air line	-	*4	@

IMPORTANT :
- The jobs indicated by ◎ must be done after the first 50 hours of operation.

*1 Air cleaner should be cleaned more often in dusty conditions than in normal conditions.
*2 After 6 times of cleaning.
*3 Consult your local KUBOTA Dealer for this service.
*4 Replace only if necessary.

- The items listed above (@ marked) are registered as emission related critical parts by KUBOTA in the U.S. EPA nonroad emission regulation. As the engine owner, you are responsible for the performance of the required maintenance on the engine according to the above instruction.
  Please see the Warranty Statement in detail.

NOTE :
- **Changing interval of engine oil**

Models	*Oil pan depth	
	124 mm (4.88 in.)	*90 mm (3.54 in.)
All models	200 Hrs	150 Hrs
Initial	50 Hrs	

* 90 mm (3.54 in.) oil pan depth is optional.
(Standard replacement interval)

- American Petroleum Institute (API) classification: above CF-4 grade
- Ambient temperature: below 35°C (95°F)

NOTE :

Lubricating oil

With strict emission control regulations now in effect, the CF-4 and CG-4 engine oils have been developed for use with low sulfur fuels, for On-Highway vehicle engines. When a Non-Road engine runs on high sulfur fuel, it is advisable to use a "CF or better" classification engine oil with a high Total Base Number (a minimum TBN of 10 is recommended).

- **Lubricating oil recommended when a low-sulfur or high-sulfur fuel is employed.**

○ : Recommendable X : Not recommendable

Lubricating oil classification	**Fuel		Remarks
	Low-sulfur	High-sulfur	
CF	○	○	*TBN≧ 10
CF-4	○	X	
CG-4	○	X	
CH-4	○	X	
CI-4	○	X	

* TBN: Total Base Number

**Fuel

- Diesel Fuel Specification Type and Sulfur Content % (ppm) used, must be compliant with all applicable emission regulations for the area in which the engine is operated.
- Use of diesel fuel with sulfur content less than 0.10 % (1000 ppm) is strongly recommended.
- If high-sulfur fuel (sulfur content 0.50 % (5000 ppm) to 1.0 % (10000 ppm)) is used as a diesel fuel, change the engine oil and oil filter at shorter intervals. (approximately half).
- DO NOT USE Fuels that have sulfur content greater than 1.0 % (10000 ppm).
- Since KUBOTA diesel engines of less than 56 kW (75 hp) utilize EPA Tier 4 and Interim Tier 4 standards, the use of ultra low sulfur fuel is mandatory for these engines, when operated in US EPA regulated areas. Therefore, please use No.2-D S15 diesel fuel as an alternative to No.2-D, and use No.1-D S15 diesel fuel as an alternative to No.1-D for ambient temperatures below -10 ℃ (14 ℉).
  No.1-D or No.2-D, S15 : Ultra Low Sulfur Diesel (ULSD) 15 ppm or 0.0015 wt.%

- CJ-4 classification oil is intended for use in engines equipped with DPF (Diesel Particulate Filter) and is Not Recommended for use in Kubota E3 specification engines.

- Oil used in the engine should have API classification and Proper SAE Engine Oil according to the ambient temperatures as shown below:

Above 25℃ (77℉)	SAE30, SAE10W-30 or 15W-40
-10℃ to 25℃ (14℉ to 77℉)	SAE10W-30 or 15W-40
Below -10℃ (14℉)	SAE10W-30

- Recommended API classification
  Refer to the following table for the suitable American Petroleum Institute (API) classification of engine oil according to the engine type (with internal EGR, external EGR or non-EGR) and the Fuel Type Used : (Ultra Low Sulfur or High Sulfur Fuels).

Fuel type	Engine oil classification (API classification)	
	Engines with non-EGR Engines with internal EGR	Engines with external EGR
High Sulfur Fuel [0.05 % (500 ppm) ≤ Sulfur Content < 0.50 % (5000 ppm)]	**CF** (If the "CF-4, CG-4, CH-4 or CI-4" engine oil is used with a high-sulfur fuel, change the engine oil at shorter intervals. (approximately half))	---
Ultra Low Sulfur Fuel [Sulfur Content < 0.0015 % (15 ppm)]	**CF, CF-4, CG-4, CH-4 or CI-4**	**CF or CI-4** (Class CF-4, CG-4 and CH-4 engine, oils cannot be used on EGR type engines.)

EGR: Exhaust Gas Re-circulation

PERIODIC SERVICE

FUEL

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

CAUTION

To avoid personal injury:

- **Do not mix gasoline or alcohol with diesel fuel. This mixture can cause an explosion.**
- **Be careful not to spill fuel during refueling. If fuel should spill, wipe it off at once, or it may cause a fire.**
- **Do not fail to stop the engine before refueling. Keep the engine away from the fire.**
- **Be sure to stop the engine while refueling or bleeding and when cleaning or changing fuel filter or fuel pipes. Do not smoke when working around the battery or when refueling.**
- **Check the fuel systems at a well ventilated and wide place.**
- **When fuel and lubricant are spilled, refuel after letting the engine cool off.**
- **Always keep spilled fuel and lubricant away from engine.**

■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.

Flash Point, ℃ (℉)	Water and Sediment, volume %	Carbon Residue on, 10 percent Residuum, %	Ash, weight %
Min	Max	Max	Max
52 (125)	0.05	0.35	0.01

Distillation Temperatures, ℃ (℉) 90% Point		Viscosity Kinematic cSt or mm²/s at 40 ℃		Viscosity Saybolt, SUS at 37.8 ℃ (100 ℉)	
Min	Max	Min	Max	Min	Max
282 (540)	338 (640)	1.9	4.1	32.6	40.1

Sulfur, weight %	Copper Strip Corrosion	Cetane Number
Max	Max	Min
0.50	No. 3	40

- Cetane Rating : The minimum recommended Fuel Cetane Rating is 45. A cetane rating greater than 50 is preferred, especially for ambient temperatures below -20℃ (-4℉) or elevations above 1500 m (5000 ft).
- Diesel Fuel Specification Type and Sulfur Content % (ppm) used, must be compliant with all applicable emission regulations for the area in which the engine is operated.
- Use of diesel fuel with sulfur content less than 0.10 % (1000 ppm) is strongly recommended.
- If high-sulfur fuel (sulfur content 0.50 % (5000 ppm) to 1.0 % (10000 ppm)) is used as a diesel fuel, change the engine oil and oil filter at shorter intervals. (approximately half).
- DO NOT USE Fuels that have sulfur content greater than 1.0 % (10000 ppm).
- Diesel fuels specified to EN 590 or ASTM D975 are recommended.
- No.2-D is a distillate fuel of lower volatility for engines in industrial and heavy mobile service. (SAE J313 JUN87)
- Since KUBOTA diesel engines of less than 56 kW (75 hp) utilize EPA Tier 4 and Interim Tier 4 standards, the use of ultra low sulfur fuel is mandatory for these engines, when operated in US EPA regulated areas. Therefore, please use No.2-D S15 diesel fuel as an alternative to No.2-D, and use No.1-D S15 diesel fuel as an alternative to No.1-D for ambient temperatures below -10 ℃ (14 ℉).
  1) SAE : Society of Automotive Engineers
  2) EN : European Norm
  3) ASTM : American Society of Testing and Materials
  4) US EPA : United States Environmental Protection Agency
  5) No.1-D or No.2-D, S15 : Ultra Low Sulfur Diesel (ULSD) 15 ppm or 0.0015 wt.%

IMPORTANT :
- Be sure to use a strainer when filling the fuel tank, or dirt or sand in the fuel may cause trouble in the fuel injection pump.
- For fuel, always use diesel fuel. You are required not to use alternative fuel, because its quality is unknown or it may be inferior in quality. Kerosene, which is very low in cetane rating, adversely affects the engine. Diesel fuel differs in grades depending on the temperature.
- Be careful not to let the fuel tank become empty, or air can enter the fuel system, necessitating bleeding before next engine start.

■Air bleeding the fuel system

CAUTION

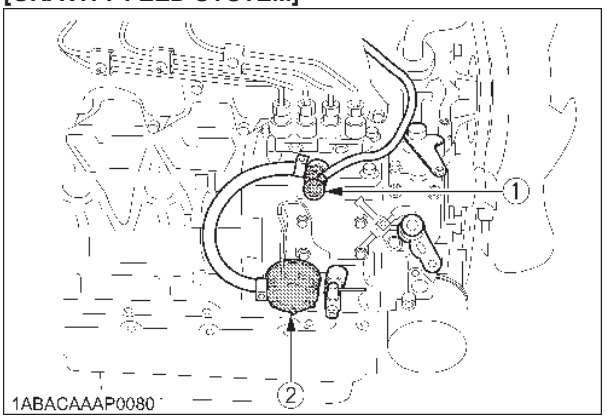
To avoid personal injury;
- **Do not bleed a hot engine as this could cause fuel to spill onto a hot exhaust manifold creating a danger of fire.**

Air bleeding of the fuel system is required if;
- after the fuel filter and pipes have been detached and refitted;
- after the fuel tank has become empty; or
- before the engine is to be used after a long storage.

[PROCEDURE Ⓐ] (gravity feed fuel tanks only)
1. Fill the fuel tank to the fullest extent. Open the fuel filter lever.
2. Open the air vent cock on top of the fuel injection pump.
3. Turn the engine, continue it for about 10 seconds, then stop it, or move the fuel feed pump lever by hand (optional).
4. Close the air vent cock on top of the fuel injection pump.

IMPORTANT :
- Always keep the air vent cock on the fuel injection pump closed except when air is vented, or it may cause the engine to stop.

[GRAVITY FEED SYSTEM]

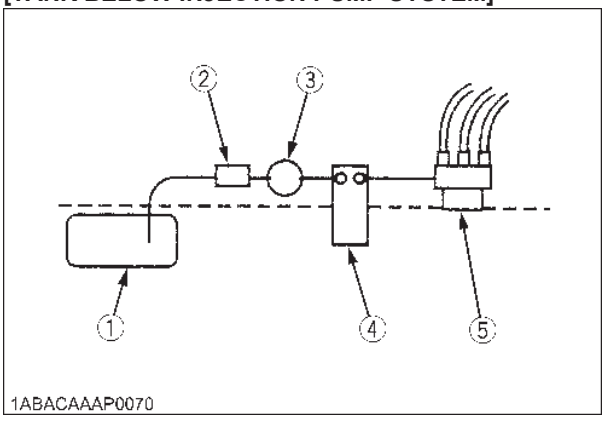


(1) Air vent cock
(2) Fuel feed pump

[PROCEDURE Ⓑ] (fuel tanks lower than injection pump)
1. For fuel tanks that are lower than the injection pump. The fuel system must be pressurized by the fuel system electric fuel pump.
2. If an electric fuel pump is not used, you must manually actuate the pump by lever to bleed.
3. The primary fuel filter must be on the pressure side of the pump if the fuel tank is lower than the injection pump.
4. To bleed, follow (2) through (4) above.

IMPORTANT :
- Tighten air vent plug of the fuel injection pump except when bleeding, or it may stop the engine suddenly.

[TANK BELOW INJECTION PUMP SYSTEM]



(1) Fuel tank below injection pump
(2) Pre-filter
(3) Electric or Mechanical pump
(4) Main Filter
(5) Injection pump

■Checking the fuel pipes

CAUTION

To avoid personal injury;

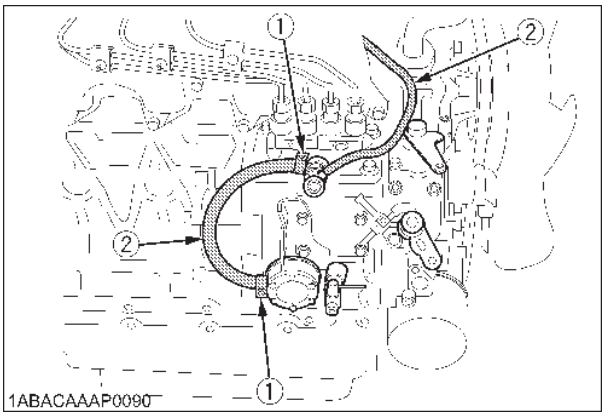
- **Check or replace the fuel pipes after stopping the engine. Broken fuel pipes can cause fires.**

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 2 years.
3. If the fuel pipes and clamp bands are found worn or damaged before 2 years' pass, replace or repair them at once.
4. After replacement of the pipes and bands, air-bleed the fuel system.

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 injection pump malfunction.

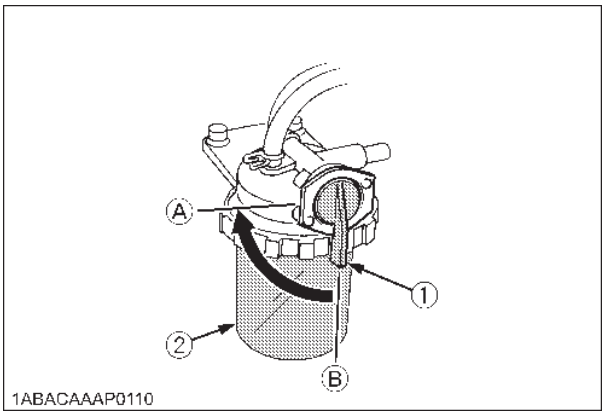


(1) Clamp band
(2) Fuel pipe

■Cleaning the fuel filter pot

Every 100 hours of operation, clean the fuel filter in a clean place to prevent dust intrusion.

1. Close the fuel filter lever.

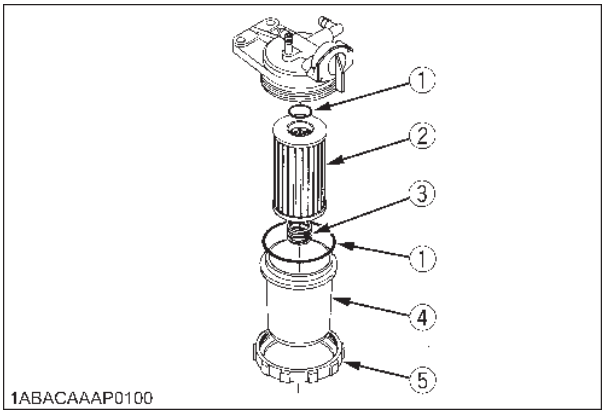


(1) Fuel filter lever
(2) Fuel filter pot
(A) "OFF"
(B) "ON"

2. Remove the top cap, and rinse the inside with diesel fuel.
3. Take out the element, and rinse it with diesel fuel.
4. After cleaning, reinstall the fuel filter, keeping out of dust and dirt.
5. Air-bleed the injection pump.

IMPORTANT :

- Entrance of dust and dirt can cause a malfunction of the fuel injection pump and the injection nozzle. Wash the fuel filter cup periodically.



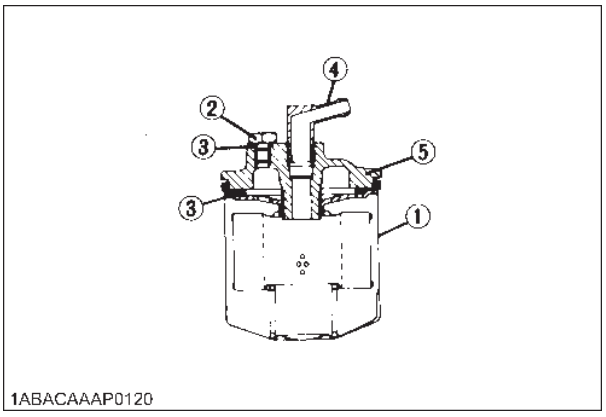
(1) O ring
(2) Filter element
(3) Spring
(4) Filter bowl
(5) Screw ring

■Fuel filter cartridge replacement

1. Replace the fuel filter cartridge with a new one every 400 operating hours.
2. Apply fuel oil thinly over the gasket and tighten the cartridge into position by hand-tightening only.
3. Finally, vent the air.

IMPORTANT :

- Replace the fuel filter cartridge periodically to prevent wear of the fuel injection pump plunger or the injection nozzle, due to dirt in the fuel.



(1) Fuel filter cartridge
(2) Air vent plug
(3) O ring
(4) Pipe joint
(5) Cover

ENGINE OIL

⚠ CAUTION

To avoid personal injury:

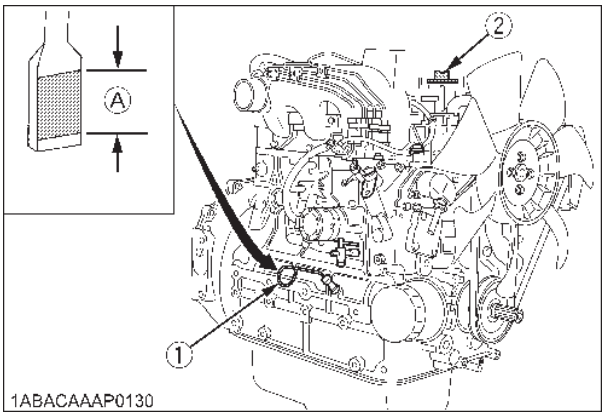
- **Be sure to stop the engine before checking and changing the engine oil and the oil filter cartridge.**
- **Do not touch muffler or exhaust pipes while they are hot; Severe burns could result. Always stop the engine and allow it to cool before conducting inspections, maintenance, or for a cleaning procedure.**
- **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.



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

4. If the oil level is too low, remove the oil filler plug, and add new oil to the prescribed level.
5. 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.

Engine oil quantity

Models	*Oil pan depth	
	124 mm (4.88 in.)	*90 mm (3.54 in.)
D1503-M-E3 D1703-M-E3 D1803-M-E3 D1703-M-E3BG	7.0 L (1.85 U.S.gals.)	5.6 L (1.48 U.S.gals.)
V2003-M-E3 V2203-M-E3 V2403-M-E3 V2403-M-T-E3 V2003-M-E3BG V2003-M-T-E3BG V2203-M-E3BG V2403-M-E3BG	9.5 L (2.51 U.S.gals.)	7.6 L (2.01 U.S.gals.)

* 90 mm (3.54 in.) oil pan depth is optional.
Oil quantities shown are for standard oil pans.

IMPORTANT :
- Engine oil should be MIL-L-2104C or have properties of API classification CF or higher.
  Change the type of engine oil according to the ambient temperature.

Above 25°C (77°F)	SAE30 or SAE10W-30 SAE15W-40
-10°C to 25°C (14°F to 77°F)	SAE10W-30 or SAE15W-40
Below -10°C (32°F)	SAE10W-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

CAUTION

To avoid personal injury:
- **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.**

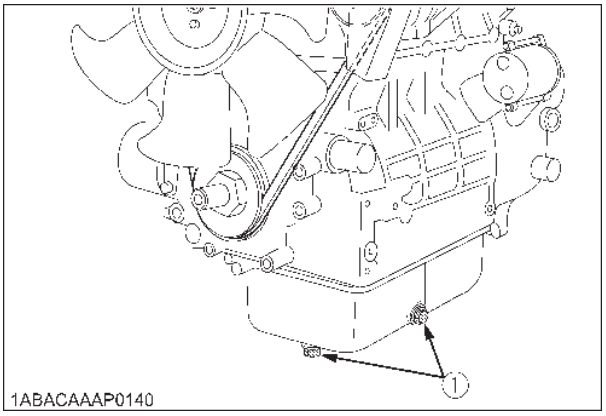
1. Change oil after the initial 50 hours of operation and every 200 hours thereafter. (See table below.)

NOTE :
- **Changing interval thereafter**

Models	*Oil pan depth	
	124 mm (4.88 in.)	*90 mm (3.54 in.)
All models	200 Hrs	150 Hrs
Initial	50 Hrs	

* 90 mm (3.54 in) oil pan depth is optional.
(Standard replacement interval)
- API classification : above CF
- Ambient temperature : below 35°C (95°F)

2. 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.



(1) Oil drain plug

3. Add new engine oil up to the upper limit of the oil level gauge.

■Replacing the oil filter cartridge

CAUTION

To avoid personal injury:

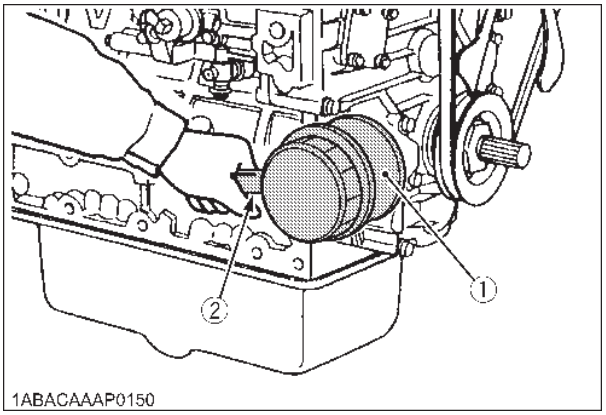
- **Be sure to stop the engine before changing the oil filter cartridge.**
- **Allow engine to cool down sufficiently, oil can be hot and cause burns.**

1. Replace the oil filter cartridge. Oil filter cartridge should be replaced, as following operation hours.

Models	*Oil pan depth	
	124 mm (4.88 in.)	*90 mm (3.54 in.)
All models	200 Hrs	150 Hrs
Initial	50 Hrs	

* 90 mm (3.54 in.) oil pan depth is optional.

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.



(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.

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.

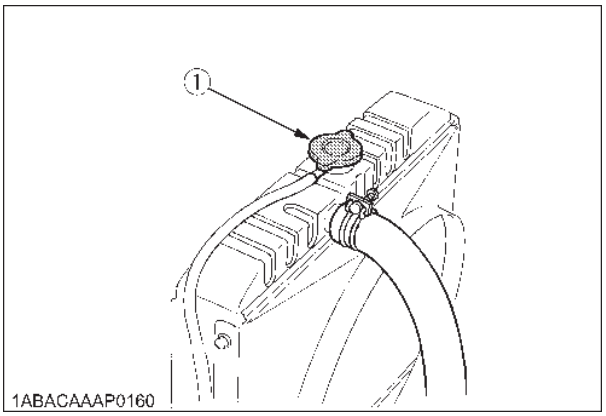
WARNING

To avoid personal injury:

- **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.

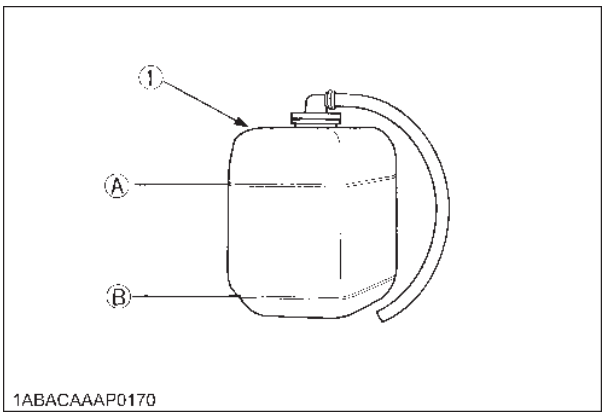
■Checking coolant level, adding coolant

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



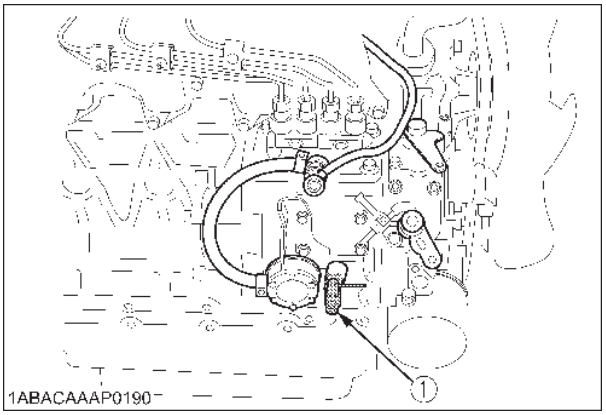
(1) Radiator pressure cap

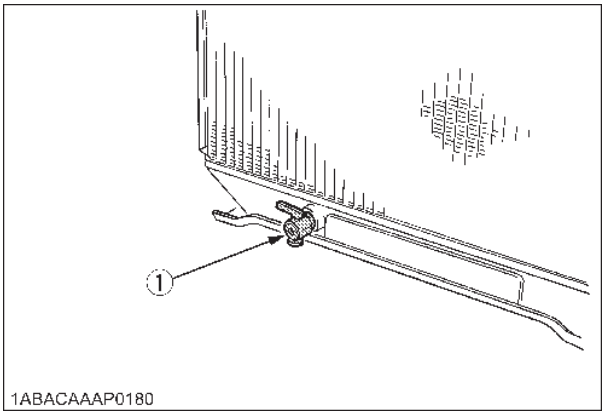
2. If the radiator is provided with a recovery tank, check the coolant level of the recovery tank. When it is between the "FULL" and "LOW" marks, the coolant will last for one day's work.



(1) Recovery tank
(A) "FULL"
(B) "LOW"

3. When the coolant level drops due to evaporation, add water only up to the full level.
4. Check to see that two drain cocks; one is at the crankcase side and the other is at the lower part of the radiator as figures below.





(1) Coolant drain cock

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 cocks 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
D1503-M-E3 D1703-M-E3 D1703-M-E3BG	5.5 L (1.45 U.S.gals.)
D1803-M-E3	5.8 L (1.53 U.S.gals.)
V2003-M-E3 V2203-M-E3 V2003-M-E3BG V2003-M-T-E3BG V2203-M-E3BG	8.1 L (2.14 U.S.gals.)
V2403-M-E3 V2403-M-T-E3 V2403-M-E3BG	8.4 L (2.22 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

CAUTION

To avoid personal injury:

- **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.

■Cleaning the radiator (inside)

1. Clean up the coolant line inside in the following cases.
   - As per the SERVICE INTERVALS list.
   - When changing the coolant.
2. Use a **radiator cleaning agent**. This helps wash away scale deposits.

■Anti-freeze

CAUTION

To avoid personal injury:

- **When using anti-freeze, put on some protection such as rubber gloves (Anti-freeze contains poison.).**
- **If should drink anti-freeze, throw up at once and take medical attention.**
- **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 *	
	℃	℉	℃	℉
50	-37	-34	108	226

*At 1.013 x 10^5Pa (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.

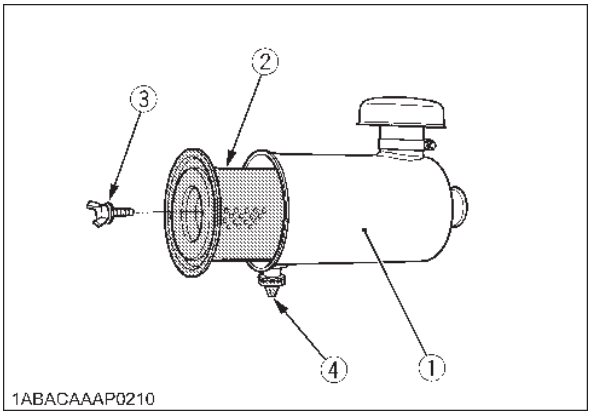
NOTE :

- 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 element every year or every 6 cleanings.



(1) Air cleaner body
(2) Element
(3) Wing bolt
(4) Evacuator valve

IMPORTANT :

- Make sure the wing bolt 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.

■Evacuator valve

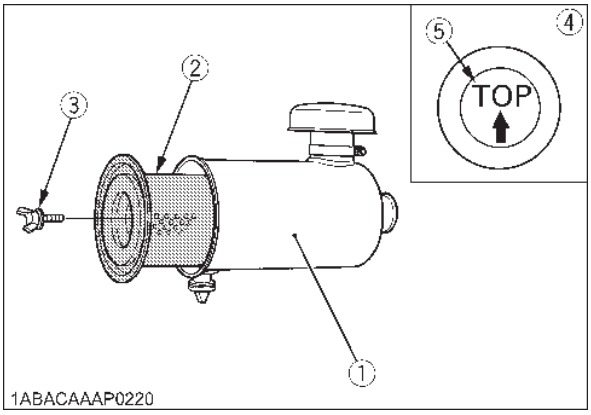
Open the evacuator valve once a week under ordinary conditions - or daily when used in a dusty place - to get rid of large particles of dust and dirt.

■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 :

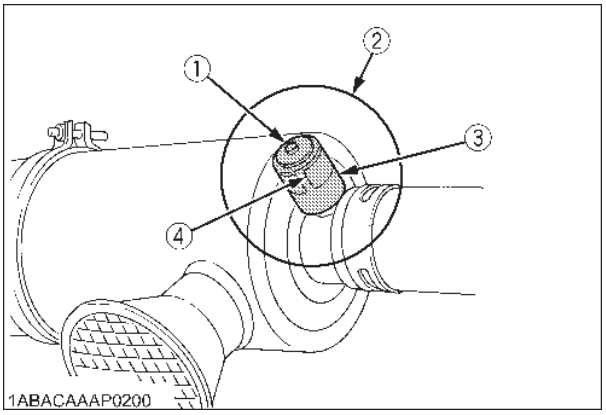
- If the dust cup is mounted incorrectly, dust or dirt does not collect in the cup, and direct attachments of the dust to the element will cause its lifetime to shorten to a great extent.



(1) Air cleaner body
(2) Element
(3) Wing bolt
(4) Dust cup
(5) "TOP" mark

■Dust indicator (optional)

If the red signal on the dust indicator attached to the air cleaner is visible, the air cleaner has reached the service level.
Clean the element immediately, and reset the signal with the "RESET" button.



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

ELECTRIC WIRING

CAUTION

To avoid personal injury:

- **◆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

CAUTION

To avoid personal injury:

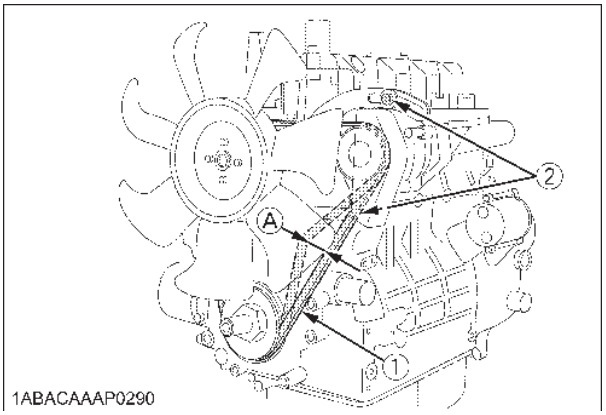
- **Be sure to stop the engine and remove the key before checking the belt tension.**
- **Be sure to reinstall the detached safety shield after maintenance or checking.**

Proper fan belt tension	A deflection of between 7 to 9 mm (0.28 to 0.35 in.) when the belt is pressed in the middle of the span.

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.



(1) Fan belt
(2) Bolt and nut
(A) 7 to 9 mm (0.28 to 0.35 in.) (under load of 10 kgf (22.1 lbs))

CARRIAGE AND STORAGE

CARRIAGE

CAUTION

To avoid personal injury:

- **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 crane when carrying the engine, or hurt your waist and yourself. Support the engine securely with rope not to fall while carrying it.
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

CAUTION

To avoid personal injury:

- **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 cock at the bottom of the radiator, and remove the pressure cap to drain water completely. Leave the cock 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

If the engine does not function properly, use the following chart to identify and correct the cause.

■ When it is difficult to start the engine

Cause	Countermeasures
Fuel is thick and doesn't flow.	* Check the fuel tank and fuel filter. * Remove water, dirt and other impurities. * As all fuel will be filtered by the filter, if there should be water or other foreign matters on the filter, clean the filter with kerosene.
Air or water mixed in fuel system	* If air is in the fuel filter or injection lines, the fuel pump will not work properly. * To attain proper fuel injection pressure, check carefully for loosened fuel line coupling, loose cap nut, etc. * Loosen joint bolt stop fuel filter and air vent screws of fuel injection pump to eliminate all the air in the fuel system.
Engine oil becomes thick in cold weather and engine cranks slow.	* Change grade of oil according to the weather (temperature.)
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.

■ When output is insufficient

Cause	Countermeasures
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.
Air cleaner is dirty	* Clean the element every 100 hours of operation.
Injection pump wear	* Do not use poor quality fuel as it will cause wear of the pump. Only use No. 2-D diesel fuel.(See "FUEL" in "PERIODIC SERVICE" Section)

■ 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.
Bad nozzle	* If necessary, replace with a new nozzle.
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. * At every 2 times of oil change, oil filter cartridge should be replaced.

■ When color of exhaust is especially bad

Cause	Countermeasures
Fuel is of extremely poor quality.	* Select good quality fuel. Use No. 2-D diesel fuel only.
Nozzle is bad.	* If necessary, replace with new nozzle.

■ When engine must be stopped immediately

Cause	Countermeasures
Color of exhaust suddenly turns dark.	* Check the fuel injection system, especially the fuel injection nozzle.
Bearing parts are overheated.	* Check the lubricating system.
Oil lamp lights up during operation.	* Check the lubricating system. * Check the function of the relieve valve in the lubricating system. * Check pressure switch. * Check filter base gasket.

NOTE :

- If the cause of trouble can not be found, contact your KUBOTA dealer.

■ **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.
Fan or radiator or radiator cap defective	* Replace defective parts.
Thermostat defective	* Check thermostat and replace if necessary.
Temperature gauge or sensor defective	* Check temperature with thermometer and replace if necessary.
Overload running	* Reduce load.
Head gasket defective or water leakage	* Replace parts.
Unsuitable fuel used	* Use the specified fuel.

SPECIFICATIONS

Model	D1503-M-E3	D1703-M-E3	D1803-M-E3
Type	Vertical, water-cooled, 4-cycle diesel engine		
Number of cylinders	3		
Bore and stroke mm (in.)	83 x 92.4 (3.27 x 3.64)	87 x 92.4 (3.43 x 3.64)	87 x 102.4 (3.43 x 4.04)
Total displacement L (cu.in.)	1.499 (91.44)	1.647 (100.51)	1.826 (111.43)
Combustion chamber	Spherical Type (E-TVCS)		
SAE NET Intermittent kW / rpm H.P. (SAEJ1349) (HP / rpm)	21.7 / 2800 (29.1 / 2800)	24.3 / 2800 (32.6 / 2800)	26.5 / 2700 (35.5 / 2700)
SAE NET Continuous kW / rpm H.P. (SAEJ1349) (HP / rpm)	18.8 / 2800 (25.2 / 2800)	21.1 / 2800 (28.3 / 2800)	23.0 / 2700 (30.8 / 2700)
Maximum bare speed rpm	3000		2900
Minimum bare idling speed rpm	750 to 850		
Order of firing	1-2-3		
Direction of rotation	Counter-clockwise (viewed from flywheel side)		
Injection pump	Bosch Type mini pump		
Injection pressure	13.73 MPa, 1991 psi (140 kgf/cm^2)		
Injection timing (Before T.D.C.)	0.28 rad (16.25°)	0.30 rad (17.25°)	
Compression ratio	22.8	22.0	24.3
Fuel	Diesel Fuel No.2-D		
Lubricant (API classification)	above CF		
Dimension mm (in.) (length x width x height)	572.1 x 499.0 x 643.0 (22.5 x 19.8 x 25.3)		575.9 x 499.0 x 684.0 (22.7 x 19.8 x 27.0)
Dry weight (BB Spec.) kg (lbs.)	148 (326.3)		151 (332.9)
Starting system	Cell starter (with glow plug)		
Starting motor	12 V, 1.4 kW		12 V, 2.0 kW
Charging generator	12 V, 480 W		
Recommended battery capacity	12 V, 70 to 80 AH		12 V, 100 to 120 AH

NOTE :
- Specifications are subject to change without notice.

Model	V2003-M-E3	V2203-M-E3
Type	Vertical, water-cooled, 4-cycle diesel engine	
Number of cylinders	4	
Bore and stroke mm (in.)	83 x 92.4 (3.27 x 3.64)	87 x 92.4 (3.43 x 3.64)
Total displacement L (cu.in.)	1.999 (121.94)	2.197 (134.07)
Combustion chamber	Spherical Type (E-TVCS)	
SAE NET Intermittent kW / rpm H.P. (SAEJ1349) (HP / rpm)	29.8 / 2800 (39.9 / 2800)	33.1 / 2800 (44.4 / 2800)
SAE NET Continuous kW / rpm H.P. (SAEJ1349) (HP / rpm)	25.9 / 2800 (34.7 / 2800)	28.7 / 2800 (38.5 / 2800)
Maximum bare speed rpm	3000	
Minimum bare idling speed rpm	750 to 850	
Order of firing	1-3-4-2	
Direction of rotation	Counter-clockwise (viewed from flywheel side)	
Injection pump	Bosch Type mini pump	
Injection pressure	13.73 MPa, 1991 psi (140 kgf/cm^2)	
Injection timing (Before T.D.C.)	0.30 rad (17.25°)	
Compression ratio	22.8	22.0
Fuel	Diesel Fuel No.2-D	
Lubricant (API classification)	above CF	
Dimension mm (in.) (length x width x height)	667.1 x 499.0 x 633.5 (26.3 x 19.8 x 24.9)	
Dry weight (BB Spec.) kg (lbs.)	180 (396.9)	
Starting system	Cell starter (with glow plug)	
Starting motor	12 V, 1.4 kW	
Charging generator	12 V, 480 W	
Recommended battery capacity	12 V, 100 to 120 AH	

NOTE :
- Specifications are subject to change without notice.

Model	V2403-M-E3	V2403-M-T-E3
Type	Vertical, water-cooled, 4-cycle diesel engine	
Number of cylinders	4	
Bore and stroke mm (in.)	87 x 102.4 (3.43 x 4.04)	
Total displacement L (cu.in.)	2.434 (148.53)	
Combustion chamber	Spherical Type (E-TVCS)	
SAE NET Intermittent kW / rpm H.P. (SAEJ1349) (HP / rpm)	33.9 / 2700 (45.4 / 2700)	41.2 / 2700 (55.2 / 2700)
SAE NET Continuous kW / rpm H.P. (SAEJ1349) (HP / rpm)	29.4 / 2700 (39.4 / 2700)	35.8 / 2700 (47.9 / 2700)
Maximum bare speed rpm	2900	2950
Minimum bare idling speed rpm	750 to 850	850 to 950
Order of firing	1-3-4-2	
Direction of rotation	Counter-clockwise (viewed from flywheel side)	
Injection pump	Bosch Type mini pump	
Injection pressure	13.73 MPa, 1991 psi (140 kgf/cm^2)	
Injection timing (Before T.D.C.)	0.30 rad (17.25°)	0.16 rad (9.25°)
Compression ratio	23.2	22.5
Fuel	Diesel Fuel No.2-D	
Lubricant (API classification)	above CF	
Dimension mm (in.) (length x width x height)	670.9 x 499.0 x 684.0 (26.4 x 19.8 x 26.9)	670.9 x 499.0 x 724.6 (26.4 x 19.8 x 28.5)
Dry weight (BB Spec.) kg (lbs.)	184.0 (405.7)	188.0 (414.5)
Starting system	Cell starter (with glow plug)	
Starting motor	12 V, 2.0 kW	
Charging generator	12 V, 480 W	
Recommended battery capacity	12 V, 100 to 120 AH	

NOTE :
- Specifications are subject to change without notice.

Model		D1703-M-E3BG	V2003-M-E3BG
Type		Vertical, water-cooled, 4-cycle diesel engine	
Number of cylinders		3	4
Bore and stroke	mm (in.)	87 x 92.4 (3.43 x 3.64)	83 x 92.4 (3.27 x 3.64)
Total displacement	L (cu.in.)	1.647 (100.51)	1.999 (121.94)
Combustion chamber		Spherical Type (E-TVCS)	
SAE NET Continuous H.P. (SAEJ1349)	kW / rpm	15.1 / 1800 (20.2 / 1800)	18.2 / 1800 (24.4 / 1800)
	(HP / rpm)	12.8 / 1500 (17.2 / 1500)	15.5 / 1500 (20.8 / 1500)
SAE NET Standby H.P. (SAEJ1349)	kW / rpm	18.1 / 1800 (24.3 / 1800)	21.8 / 1800 (29.2 / 1800)
	(HP / rpm)	15.0 / 1500 (20.1 / 1500)	18.1 / 1500 (24.3 / 1500)
Maximum bare speed	rpm	1800 / 1500	
Order of firing		1-2-3	1-3-4-2
Direction of rotation		Counter-clockwise (viewed from flywheel side)	
Injection pump		Bosch Type mini pump	
Governor		Electronic Governor	
Injection pressure	Mpa (kgf/cm^2, psi)	13.73 (140, 1991)	
Injection timing (Before T.D.C.)		0.27 rad (15.25°)	
Compression ratio		22.0	22.8
Fuel		Diesel Fuel No.2-D (ASTM D975)	
Lubricant (API classification)		above CF	
Dimension (length x width x height)	mm (in.)	608.4 x 490 x 642.8 (24.0 x 19.3 x 25.3)	700.6 x 490 x 633.3 (27.6 x 19.3 x 24.9)
Dry weight (BB Spec.)	kg (lbs.)	164 (361.6)	195 (430.0)
Starting system		Cell starter (with glow plug)	
Starting motor		12 V, 1.4 kW	
Charging generator		12 V, 480 W	
Recommended battery capacity		12 V, 70 to 80 AH, equivalent	12 V, 100 to 120 AH, equivalent

NOTE :

- Flywheel type is SAE clutch No. 7-1/2 or its equivalent.
- Flywheel housing type is SAE No. 4 or its equivalent.
- Continuous will operate at the stated rating continuously and have a 10% overload capability for one hour in 12 hours.
- Standby will operate at the stated full rating for one hour in 12 hours. No overload capacity is specified for this rating.
- Specifications are subject to change without notice.

Model	V2003-M-T-E3BG	V2203-M-E3BG
Type	Vertical, water-cooled, 4-cycle diesel engine	
Number of cylinders	4	
Bore and stroke mm (in.)	83 x 92.4 (3.27 x 3.64)	87 x 92.4 (3.43 x 3.64)
Total displacement L (cu.in.)	1.999 (121.94)	2.197 (134.07)
Combustion chamber	Spherical Type (E-TVCS)	
SAE NET Continuous H.P. (SAEJ1349) kW / rpm	24.5 / 1800 (32.8 / 1800)	20.2 / 1800 (27.1 / 1800)
SAE NET Continuous H.P. (SAEJ1349) (HP / rpm)	20.4 / 1500 (27.3 / 1500)	17.2 / 1500 (23.1 / 1500)
SAE NET Standby H.P. (SAEJ1349) kW / rpm	27.1 / 1800 (36.3 / 1800)	24.2 / 1800 (32.4 / 1800)
SAE NET Standby H.P. (SAEJ1349) (HP / rpm)	22.5 / 1500 (30.2 / 1500)	20.1 / 1500 (26.9 / 1500)
Maximum bare speed rpm	1800 / 1500	
Order of firing	1-3-4-2	
Direction of rotation	Counter-clockwise (viewed from flywheel side)	
Injection pump	Bosch Type mini pump	
Governor	Electronic Governor	
Injection pressure Mpa (kgf/cm^2, psi)	13.73 (140, 1991)	
Injection timing (Before T.D.C.)	0.28 rad (16.25°)	0.27 rad (15.25°)
Compression ratio	21.7	22.0
Fuel	Diesel Fuel No.2-D (ASTM D975)	
Lubricant (API classification)	above CF	
Dimension mm (in.) (length x width x height)	700.6 x 490 x 674 (27.6 x 19.3 x 26.5)	700.6 x 490 x 633.3 (27.6 x 19.3 x 24.9)
Dry weight (BB Spec.) kg (lbs.)	208 (458.6)	195 (430.0)
Starting system	Cell starter (with glow plug)	
Starting motor	12 V, 1.4 kW	
Charging generator	12 V, 480 W	
Recommended battery capacity	12 V, 100 to 120 AH, equivalent	

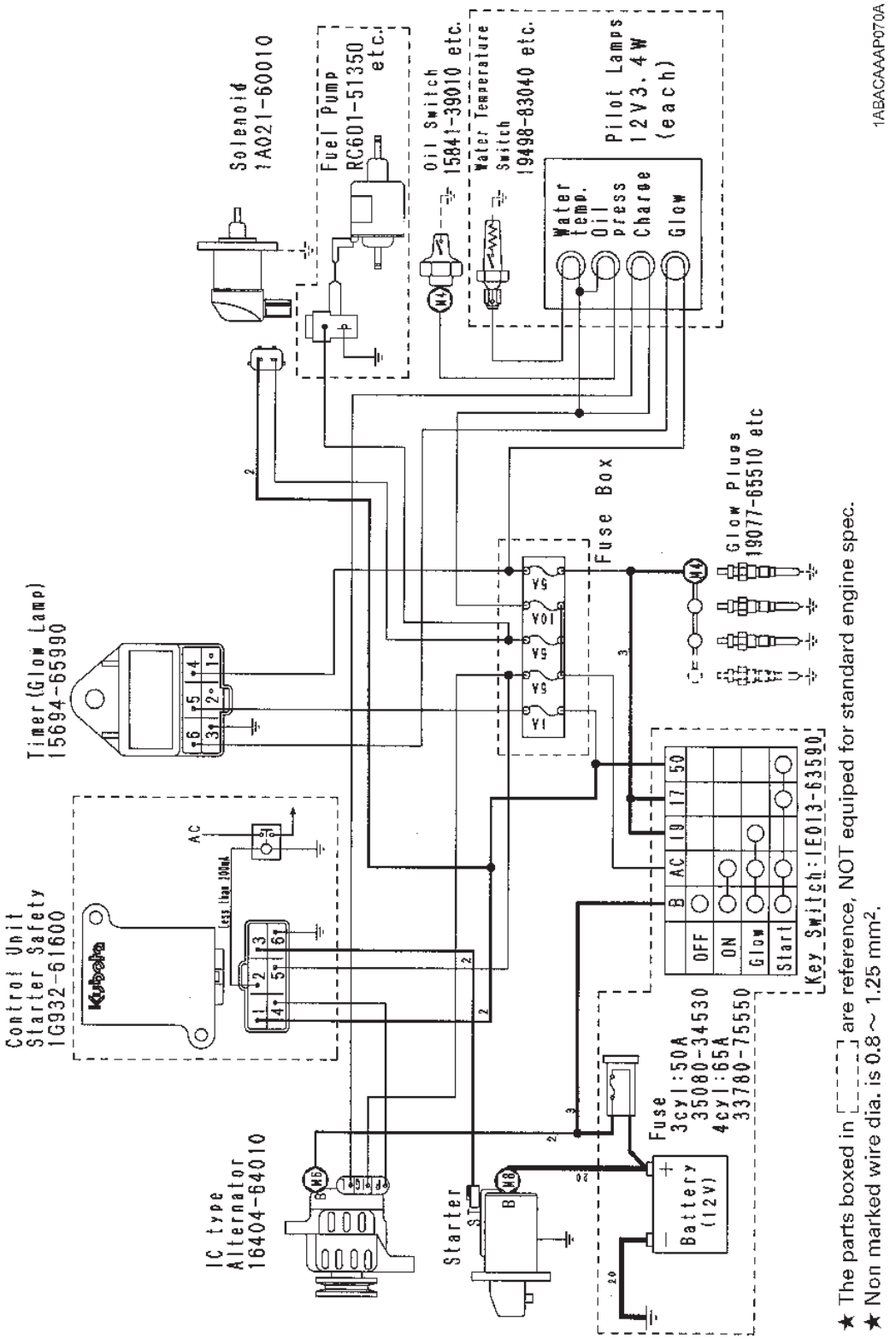
NOTE :
- Flywheel type is SAE clutch No. 7-1/2 or its equivalent.
- Flywheel housing type is SAE No. 4 or its equivalent.
- Continuous will operate at the stated rating continuously and have a 10% overload capability for one hour in 12 hours.
- Standby will operate at the stated full rating for one hour in 12 hours. No overload capacity is specified for this rating.
- Specifications are subject to change without notice.

Model	V2403-M-E3BG
Type	Vertical, water-cooled, 4-cycle diesel engine
Number of cylinders	4
Bore and stroke mm (in.)	87 x 102.4 (3.47 x 4.04)
Total displacement L (cu.in.)	2.434 (148.53)
Combustion chamber	Spherical Type (E-TVCS)
SAE NET Continuous H.P. (SAEJ1349) kW / rpm	22.1 / 1800 (29.6 / 1800)
SAE NET Continuous H.P. (SAEJ1349) (HP / rpm)	18.8 / 1500 (25.2 / 1500)
SAE NET Standby H.P. (SAEJ1349) kW / rpm	26.5 / 1800 (35.5 / 1800)
SAE NET Standby H.P. (SAEJ1349) (HP / rpm)	22.0 / 1500 (29.5 / 1500)
Maximum bare speed rpm	1800 / 1500
Order of firing	1-3-4-2
Direction of rotation	Counter-clockwise (viewed from flywheel side)
Injection pump	Bosch Type mini pump
Governor	Electronic Governor
Injection pressure Mpa (kgf/cm^2, psi)	13.73 (140, 1991)
Injection timing (Before T.D.C.)	0.27 rad (15.25°)
Compression ratio	23.2
Fuel	Diesel Fuel No.2-D (ASTM D975)
Lubricant (API classification)	above CF
Dimension mm (in.) (length x width x height)	700.6 x 490 x 684 (27.6 x 19.3 x 26.9)
Dry weight (BB Spec.) kg (lbs.)	199 (438.7)
Starting system	Cell starter (with glow plug)
Starting motor	12 V, 2.0 kW
Charging generator	12 V, 480 W
Recommended battery capacity	12 V, 100 to 120 AH, equivalent

NOTE :

- Flywheel type is SAE clutch No. 7-1/2 or its equivalent.
- Flywheel housing type is SAE No. 4 or its equivalent.
- Continuous will operate at the stated rating continuously and have a 10% overload capability for one hour in 12 hours.
- Standby will operate at the stated full rating for one hour in 12 hours. No overload capacity is specified for this rating.
- Specifications are subject to change without notice.

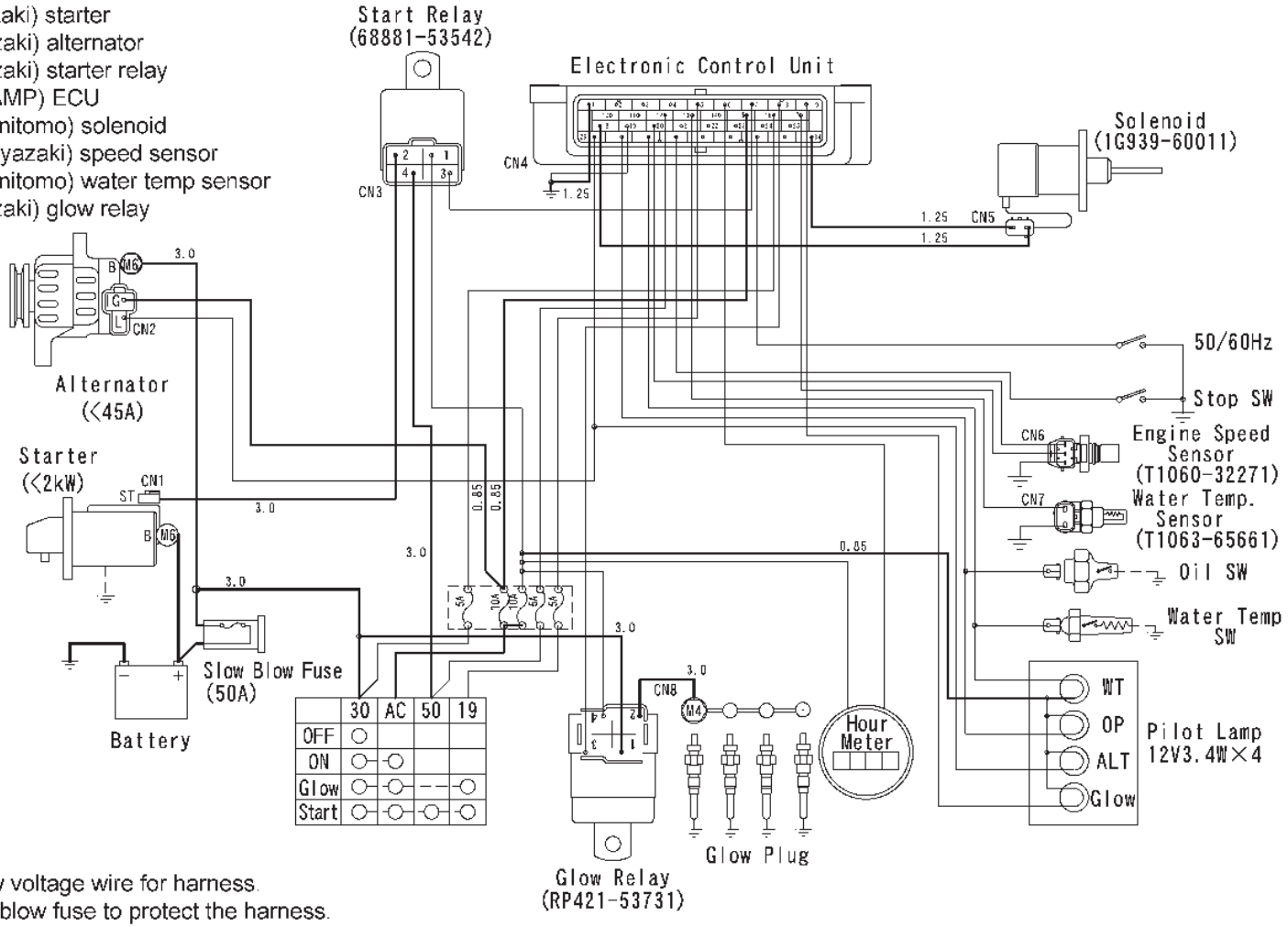
WIRING DIAGRAMS



[D1703-M-E3BG, V2003-M-E3BG, V2003-M-T-E3BG, V2203-M-E3BG, V2403-M-E3BG]

Harness Side Connector Number

CN1 : 7123-2115 (yazaki) starter
CN2 : 7123-2128 (yazaki) alternator
CN3 : 7123-2249 (yazaki) starter relay
CN4 : 3-1437290-9 (AMP) ECU
CN5 : 6189-0249 (sumitomo) solenoid
CN6 : 7283-8732-40 (yazaki) speed sensor
CN7 : 6189-0552 (sumitomo) water temp sensor
CN8 : 7123-9246 (yazaki) glow relay



1. Use automotive low voltage wire for harness.
2. Use fuse and slow-blow fuse to protect the harness.
3. The wire and fuse size shown in this drawing are our recommendation, consider wire length and condition for actual production.
4. Allocate slow-blow fuse close to battery, fuse box close to key switch.
5. Do not directly connect induction device, such as moter, to AC line.
6. Use more than 0.5 mm^2 wire for unspecified wires in this drawing.

1ABACAAAP069A

ENGLISH

Equipment Source Inc.

1919 Van Horn Rd.
Fairbanks, AK 99701
Ph: (907) 458-9049

Burner

Equipment Source Inc.

1919 Van Horn Rd.
Fairbanks, AK 99701
Ph: (907) 458-9049

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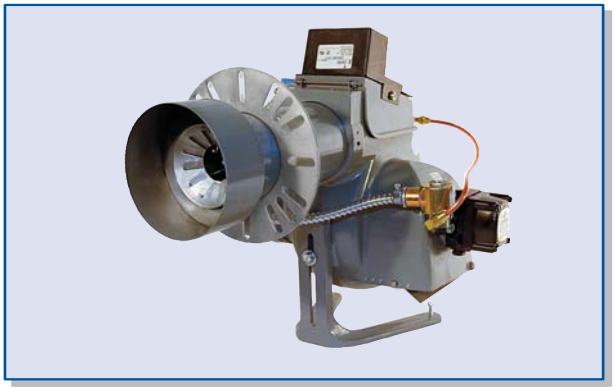
Carlin®
Combustion Technology, Inc.

MODEL **601CRD**

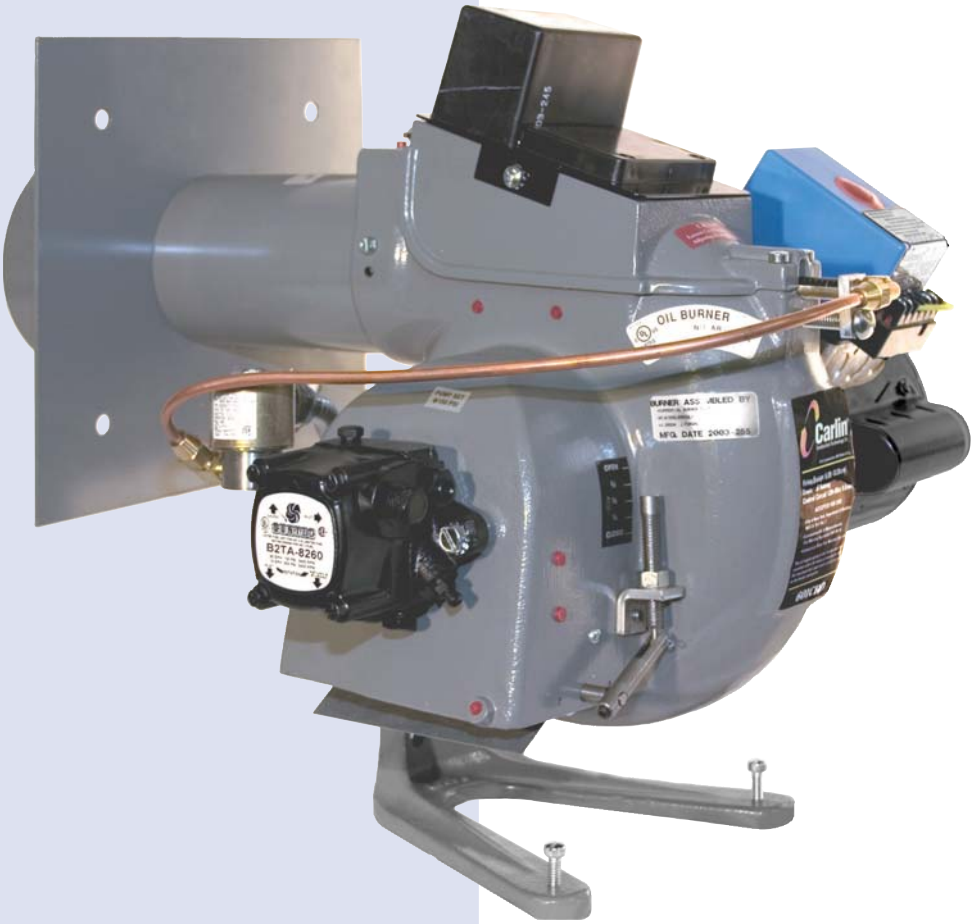
Advanced Oil Burners

6.0 to 13.2 GPH

Data sheet



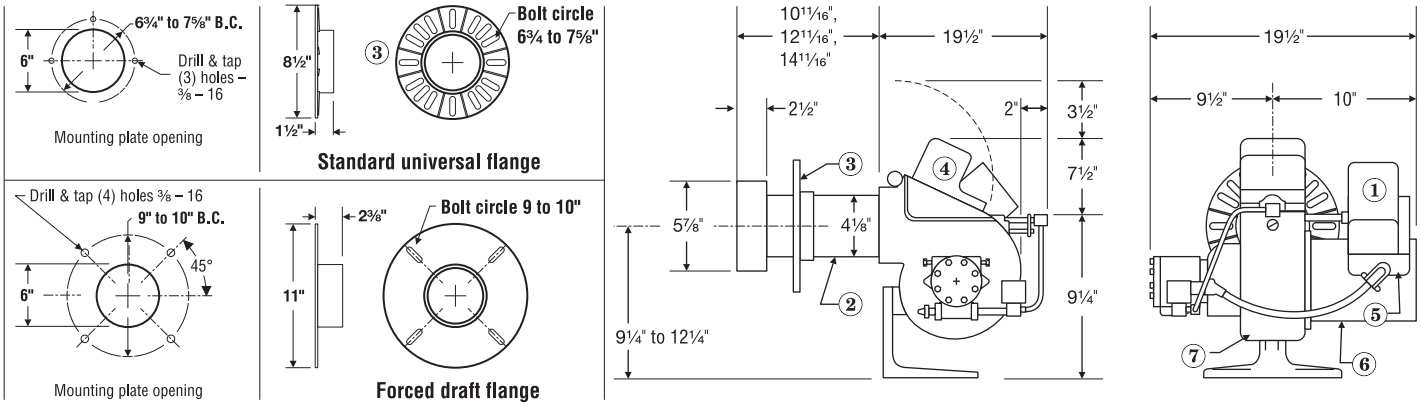
The **IDEAL** burner for even the toughest applications



CARLIN. THE TECHNOLOGY LEADER.

c UL US LISTED

Carlin **601CRD** Advanced Oil Burner



1. Carlin 60200 microprocessor control (standard)
2. Air tube
3. Universal flange (standard)
4. Carlin 41000 solid state ignitor
5. Junction box
6. Motor, 48-frame
7. Cast aluminum blower housing

Features

*The **601CRD** advanced oil burner features Carlin's adjustable combustion head assembly — for unmatched fuel/air mixing, smooth light-offs and quiet running.*

Proven for years in the field and in extensive boiler and furnace testing, these burners will meet your needs for commercial oil-burning applications.

Easy adjustment and service . . . Unmatched performance . . .

- Only adjustments are the air shutter and the combustion head, set with Carlin's easy-access screw adjustment.
- Blower access cover allows full view of blower compartment.
- Burners use the same air handling parts for all firing rates.
- Compact design uses standard components, including Carlin electronic ignition, microprocessor primary control, and instant-open SVC oil valve.
- Jacob's-ladder electrode tips for wide spark pattern and reliable ignition.
- Positive ignition, stable operation, and compact flame.
- Compact flame for maximum versatility.
- Insensitive to draft or moderate back-pressure variations.
- Can operate in forced draft applications (up to 0.30 inches w.c. positive overfire pressure).
- High resistance to pulsation.
- Excellent performance when tested in appliances that do not use refractory combustion chambers.
- Rugged cast aluminum housing.

Specifications

Input

6.0 to 13.2 GPH

The maximum firing rates shown are for natural draft at elevations up to 2,000 feet above sea level. Reduce the rate for forced draft firing as given in the burner manual (up to 14% reduction for 0.40 inches w.c. overfire pressure). For altitudes higher than 2,000 feet, reduce capacity 4% per 1,000 feet above sea level.

Fuels

U. S. ..... **No. 1 or No. 2 Fuel oil**

Canada ..... **No. 1 Stove oil or No. 2 Furnace oil**

Oil nozzle, fuel unit & oil valve

Nozzle ..... **45° "SS" Hago**

Fuel unit ..... **2-STAGE "B" STYLE, 150 PSIG**

Carlin instant open valve .....

Electrical

Power **120 VAC/60 HZ/1-PHASE**

Limit circuit input (60200 primary) ..... **120 VAC/60 HZ**

Current ..... **Approximately 9.0 AMPS**

Motor ..... **1/2 HP, 3450 RPM, 115 VAC/60 HZ**

..... **(208–230 VAC/60 HZ optional)**

Motor frame ..... **48-frame, "N" flange**

Oil valve power ..... **120 VAC/60 HZ**

Ignition & primary control

Carlin Model 41000 solid state electronic ignitor

Ignition voltage ..... **14,000 VOLTS**

Primary control ..... **Carlin 60200**

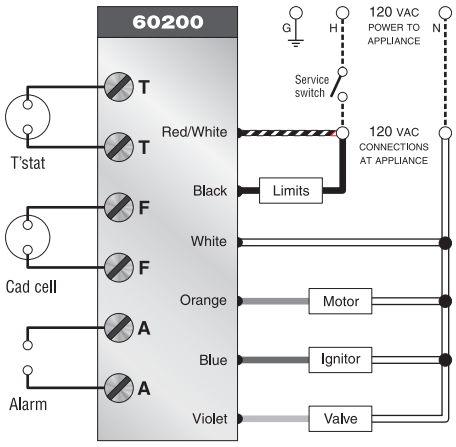
Agencies

UL Listed ..... **(US & Canada)**

Special notes

1. Available options:
   - Motor contactor (required for 208–230 VAC motor).
   - Carlin 40200, 50200 or other primary control, plus an electronic 4-second time delay relay, can be supplied in place of the standard 60200 microprocessor primary control.
   - Forced draft, adjustable flange or welded flange.
   - NEMA 1 control panel and/or special control systems (consult factory for options).
   - 2-stage "H"-style fuel unit.
2. Local approvals: City of New York MEA No. 35-76-E; State of Massachusetts Approval No. CAR-88-07.

Wiring (typical, using 60200 primary)



Warning — *For use only by a qualified service technician.*

1. Always disconnect power source before wiring to avoid electrical shock or damage to the control. All wiring must comply with applicable codes and ordinances.
2. Thermostat terminals (T–T) provide a current source. Never apply external power to these terminals under any circumstances.
3. Alarm terminals provide a 24 VAC-rated dry contact, suitable for use with security/fire alarm systems such as Carlin SecureHeat™.

TECH SUPPORT HOTLINE 800-989-2275

Carlin Combustion Technology, Inc.

70 Maple Street East Longmeadow, MA 01028 Phone 413–525–7700 Fax 413–525–8306

e-mail us at: *info@carlincombustion.com* vist our website: *www.carlincombustion.com*

Carlin part number MN601C Rev. 09/07/11

INSTALLATION and OPERATING INSTRUCTIONS

For Use By Qualified Service Technicians Only

CARLIN OIL BURNERS Models 501CRD and 601CRD (60-Hz)

DESCRIPTION

"CRD" burners feature a combustion head incorporating a new design concept which provides a means to control the air pattern to match the nozzle requirements. The aerodynamics for optimum combustion are easily adjusted for any nozzle size without changing the air-handling hardware. The flame front is initiated inside the air tube so that no erratic recirculating gasses from the main chamber area can quench the flame at the retention ring.

The letters "CRD" stand for "Controlled Retention—Double Speed."

Use of a small blower wheel (fan) operating at 3450 rpm provides a more positive, yet quiet, air flow which does not yield to normal draft variations and therefore assures a more constant air-fuel ratio for dependably clean combustion day after day.

SPECIFICATIONS

ITEMS	MODEL NUMBER 501CRD	601CRD
Fuel Specification	No. 2 CS12	No. 2 CS12
Firing Range	6.00–12.00*	6.00–13.20*
Motor HP, rpm	⅓, 3450 rpm	½, 3450 rpm
Motor Phase, Hz	Single, 60-Hz	Single, 60-Hz
Motor Amps	5.7 (approx.)	6.4 (approx.)
Motor Volts, Standard	120V	120V
Motor Volts, Optional	—	230V**
Motor Contactor	—	DPST-Optional**
Standard Control Type	R8184G	R8184G
Control Volts, Hz	120V, 60-Hz	120V, 60-Hz
Ignition Transformer	120/12,000	120/12,000
Burner Housing	Rugged Casting	Rugged Casting
Blower Wheel Diam. × Width	5¾" × 4"	$6^{5}/_{16}$" × 4"
2-Stage Fuel Unit Pressure	150 psi	150 psi
Oil Valve Volts, Hz	120V, 60-Hz	120V, 60-Hz
Oil Nozzle Specs.	45° SS	45° SS
Approximate Shipping Weight	65 lbs.	65 lbs.

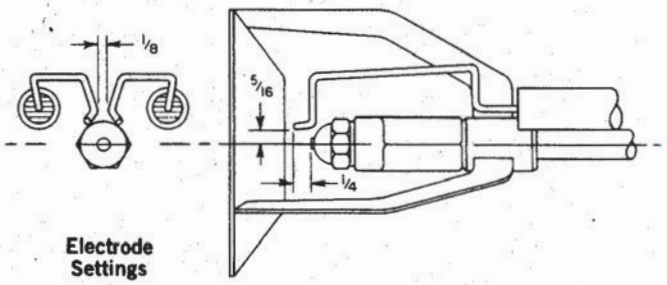
*The maximum high-fire capability shown is for natural draft. With forced draft the maximum firing rate is reduced.
**Motor contactor optional on Model 601CRD at an additional cost. Required when motor is for 230 volts.

ASSEMBLING THE BURNER (TWO-PAK)

1. Remove the air tube and nozzle line assembly from the smaller carton. If nozzles are not installed, see instructions under (4).
2. Remove the main housing assembly from the larger carton.
3. Install air tube assembly in housing using set screws provided.
4. Install and tighten the proper nozzles (45° SS Hago) in the adapter. Be careful not to damage the electrode insulators or to bend the wires.
5. Check the electrode settings specified as follows: $^{1}/_{8}$-inch to $^{3}/_{16}$-inch gap, $^{5}/_{16}$-inch above the nozzle centerline and $^{1}/_{4}$-inch ahead of the nozzle tips. See Fig. 1.

It is important that the installation of the oil burner, piping and fittings, safety devices, controls, electrical wiring and equipment be done in accordance with national and/or local regulations of the authorities having jurisdiction over such installation.

Fig. 1.



Electrode Settings

6. Swing open the transformer, and slide the nozzle line assembly into the air tube.
7. Place the nozzle line yoke in the groove in the adjusting screw.
8. Fasten the high tension leads to the transformer terminals.
9. Swing the transformer to the closed position and fasten.
10. Connect the flared fitting on the copper oil line to the nozzle line and tighten.

ABOUT COMBUSTION CHAMBERS

Models 501CRD and 601CRD operate with superior efficiency and cleanliness in properly designed refractory-type combustion chambers. Very wide tolerance to burner adjustments and other variables is found when these chambers are used. Noise levels are also reduced.

Tables 1 and 2, page 2 shows the recommended *minimum* inside dimensions for refractory brick, refractory pre-cast and pre-formed refractory fiber chambers. Due to their quick warm-up properties, the lightweight insulating-type materials are slightly preferable although these burners show less dependence upon refractory temperature than previous models. Refractory materials in boilers and furnaces should be capable of withstanding 2600°F (1427°C) or higher.

The notes accompanying Tables 1 and 2 provide further details relative to variations in dimensions and geometry. Refer to Fig. 3, page 2.

FIRING BOILERS WITHOUT REFRACTORY CHAMBERS

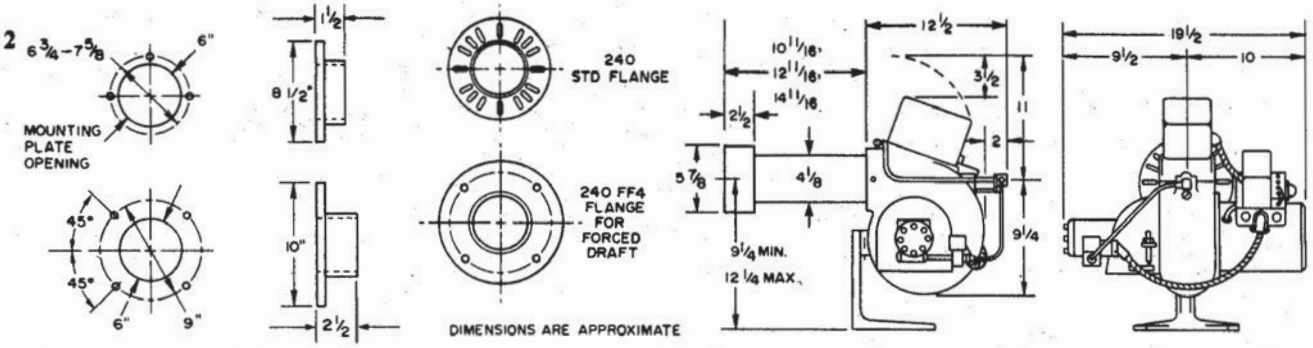
Depending upon the geometry of the combustion space some units perform better than others without refractory. When the back wall of the unit coincides approximately with the end of the flame, a target of refractory material is essential. Zero smoke readings are made easier if a refractory fiber "rug" or fill material is used on the base under the flame.

Tables 1 and 2, together with their footnotes, give the essential dimensions and information needed to provide conditions for satisfactory operation without complete chambers. Refer to Figs. 4 and 5, page 2.

INSTALLING THE BURNER: FLANGE MOUNTED

1. Measure, in the burner opening, the distance from the inside of the combustion chamber to the outside of the mounting plate to find the insertion length of air tube needed. Position flange on air tube at a point from end of burner corresponding to this measurement. Tighten set screws to anchor flange. The flange is now located so that the end of the burner will be flush, or almost flush, with the inside of the combustion chamber. See Fig. 3 (side view) page 2, and Fig. 6, page 2.
2. Slide the end of the air tube into the opening and secure the flange to the front plate.

Fig. 2



INSTALLING THE BURNER: PEDESTAL MOUNTED

1. Adjust the pedestal so that the height of the air tube matches the location of the burner opening.
2. Slide the end of the air tube into the opening so that it is flush or nearly flush with the inside of the combustion chamber. See Fig. 7.
3. From the outside of the unit, seal the space around the air tube with asbestos cement or equivalent.

Table 1. RECOMMENDED MINIMUM DIMENSIONS OF COMBUSTION CHAMBER FOR MODEL 501CRD (Inches)

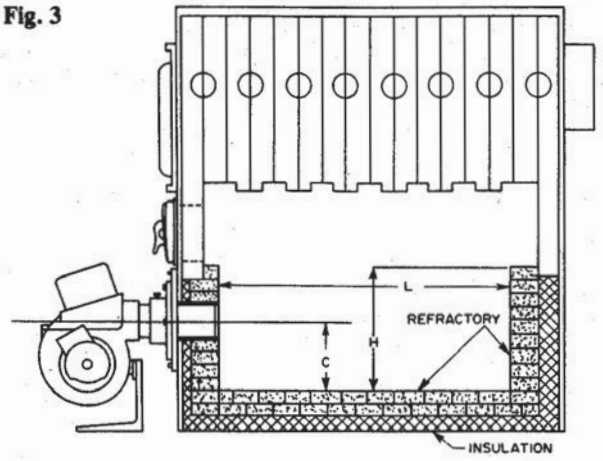
		Minimum Inside Dimensions In Refractory Type Combustion Chambers (Ins.)					Minimum Dimensions In Boilers Fired Without Refractory Chambers (Ins.)				
1 Nozzle Size	2 Firing Rate (GPH) At 150 psi	3 Length (L)	4 Width (W)	5 Dimension (C)	6 Height (H)	7 Vertical CYL.	8 Length (L) with Target	9 Length (L) without Target	10 Width (W)	11 Dimension (C)	12 Dimension (D)
5.00	6.00	18	16	7.5	15	16	18	22	18	8.5	10.5
5.50	6.60	19	16	7.5	15	17	19	23	18	8.5	10.5
6.00	7.20	20	17	8.0	16	18	20	24	19	9.0	11.0
6.50	7.80	22	17	8.0	16	20	22	27	19	9.0	11.0
7.00	8.40	24	18	8.5	17	22	24	29	20	9.5	11.5
7.50	9.00	27	18	8.5	17	25	27	33	20	9.5	11.5
8.00	9.60	30	20	9.5	19	28	30	36	22	10.5	12.5
8.50	10.20	33	21	10.0	20	31	33	40	23	11.0	13.0
9.00	10.80	36	22	10.5	21	34	36	43	24	11.5	13.5
9.50	11.40	40	22	10.5	21	38	40	48	24	11.5	13.5
10.00	12.00	44	23	11.0	22	42	44	52	25	12.0	14.0

Table 2. RECOMMENDED MINIMUM DIMENSIONS OF COMBUSTION CHAMBER FOR MODEL 601CRD (Inches)

		Minimum Inside Dimensions In Refractory Type Combustion Chambers (Ins.)					Minimum Dimensions In Boilers Fired Without Refractory Chambers (Ins.)				
1 Nozzle Size	2 Firing Rate (GPH) At 150 psi	3 Length (L)	4 Width (W)	5 Dimension (C)	6 Height (H)	7 Vertical CYL.	8 Length (L) with Target	9 Length (L) without Target	10 Width (W)	11 Dimension (C)	12 Dimension (D)
5.00	6.00	18	16	7.5	15	16	18	22	18	8.5	10.5
5.50	6.60	19	16	7.5	15	17	19	23	18	8.5	10.5
6.00	7.20	20	17	8.0	16	18	20	24	19	9.0	11.0
6.50	7.80	22	17	8.0	16	20	22	27	19	9.0	11.0
7.00	8.40	24	17	8.0	16	22	24	29	19	9.0	11.0
7.50	9.00	27	17	8.0	16	25	27	33	19	9.0	11.0
8.00	9.60	30	17	8.0	16	28	30	36	19	9.0	11.0
8.50	10.20	31	17	8.0	16	29	31	38	19	9.0	11.0
9.00	10.80	33	17	8.0	16	31	33	40	19	9.0	11.0
9.50	11.40	35	17	8.0	16	33	35	42	19	9.0	11.0
10.00	12.00	38	18	8.5	17	36	38	46	20	9.5	11.5
11.00	13.20	42	18	8.5	17	40	42	50	20	9.5	11.5

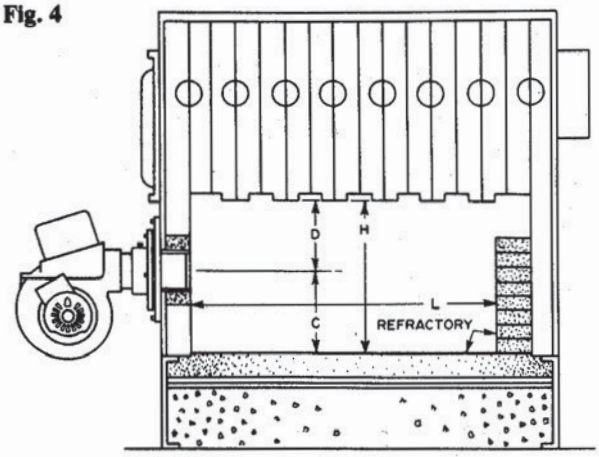
1. Flame lengths are approximately as shown in column (3) when using 45° SS nozzles. Flames approximately 10% shorter are attainable with 45° H nozzles. Often, tested boilers or furnaces will operate well with chamber shorter than the lengths shown in column (3).
2. As a general practice any of these dimensions can be exceeded without much effect on combustion.
3. Chambers in the form of horizontal cylinders should be at least as large in diameter as the dimension in column (4). Horizontal stainless steel cylindrical chambers should be 1 to 4 inches larger in diameter than the figures in column (4).
4. Wing walls are not recommended. Corbels are not necessary although they might be of benefit to good heat distribution in certain boiler or furnace designs.
5. A fiber-type refractory "rug" or fill material to cover the floor area of the combustion space in boilers fired without refractory chambers is recommended for cleaner combustion and to protect the base.
6. When a refractory or refractory fiber target is used the lengths in column (8) apply. If the lengths are equal to or longer than in column (9) no target material is needed unless recommended by the boiler manufacturer.

Fig. 3



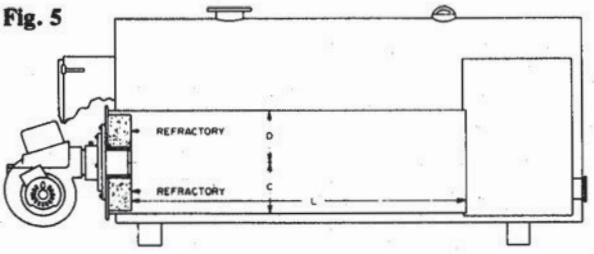
Brick combustion chamber, side view.

Fig. 4



Wet leg boiler. No combustion chamber, side view.

Fig. 5



Scotch Marine boiler. No combustion chamber.

Fig. 6.

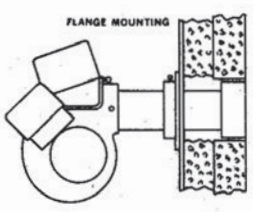
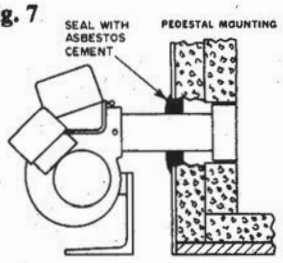


Fig. 7



WIRING

When the burner is furnished with a burner-mounted primary control, field connections are to be made in the 4" × 4" junction box under the control. The motor, transformer, oil valve, and flame detector are pre-wired. High limit, low water cut-off, fusible link switch, emergency and service switches are wired in series between the hot supply lead and the unwired black lead in the control. The thermostat or operating control, if used, is wired to "T" and "T." Otherwise, jumper "T" and "T."

When the primary control is mounted on the boiler or furnace, the motor, transformer, and oil valve connections are joined in the junction box mounted on the motor.

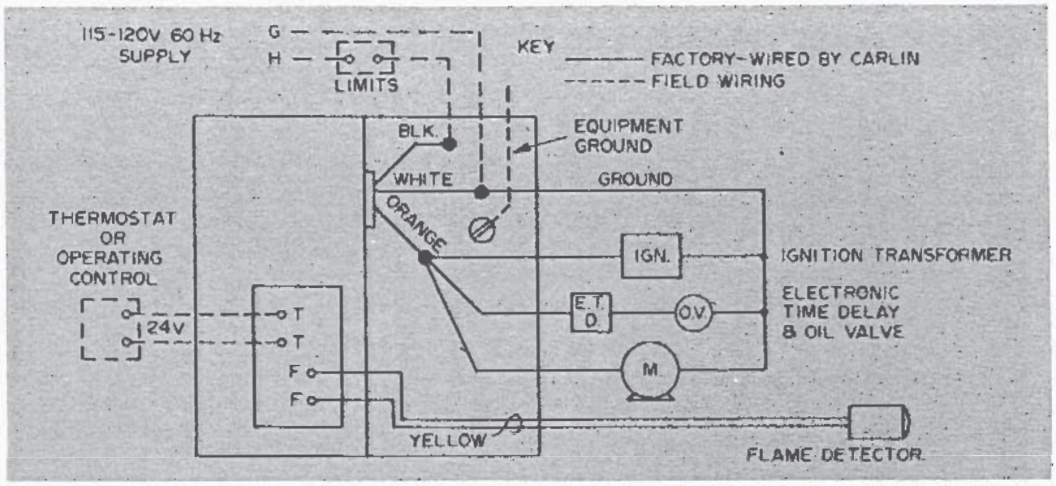


Fig. 8

HONEYWELL TYPE R8184G
CONSTANT IGNITION

NOTE: CONSTANT IGNITION= Spark "ON" during entire burning cycle.

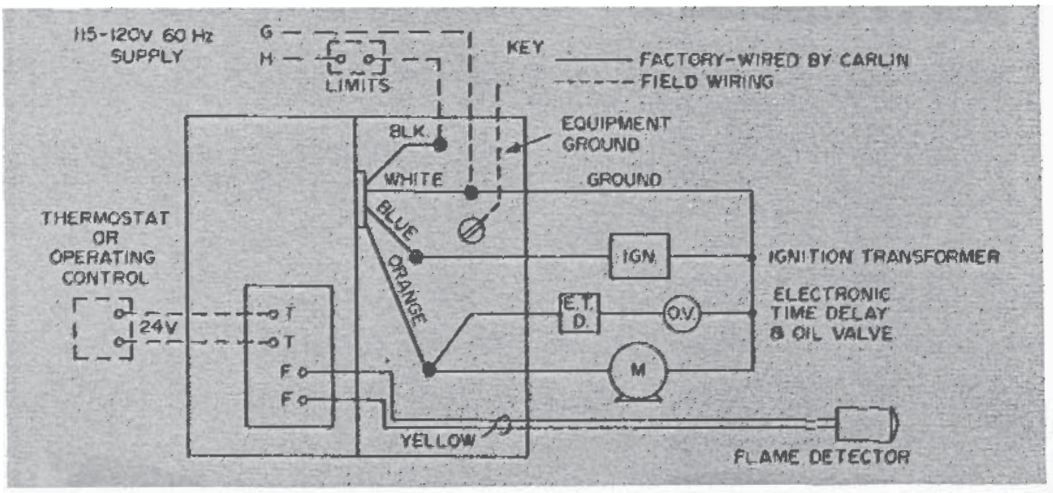


Fig. 9

HONEYWELL TYPE R8404A
OR WHITE-RODGERS TYPE 669

NOTE: INTERMITTENT IGNITION= Spark "ON" only at burner start.

Burners also available with electronic controls. Appropriate wiring diagram is shipped with each burner.

HOW TO ADJUST THE COMBUSTION HEAD

The retention ring position ahead of the throttle ring is adjustable from zero (flush) to 1 1/8-inches (Dimension "A," Figs. 10 and 11). Turning the adjustable screw in (clockwise) increases the distance "A" ahead. This distance is indicated by reading the scale on the nozzle line across the corners on sides of the channel guiding the nozzle line. Each division is 1/16-inch.

Fig. 10

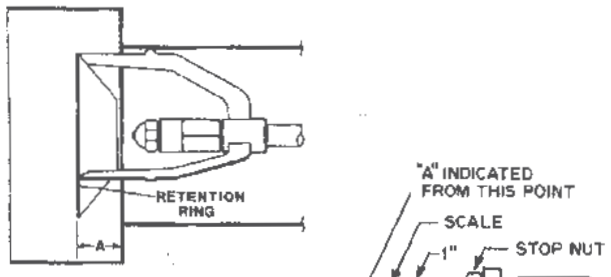
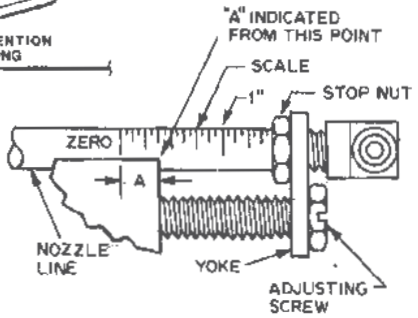


Fig. 11



RETENTION RING AND AIR SHUTTER ADJUSTMENTS

Tables 3 and 4 show for each firing rate the approximate recommended positions of the flame retention ring with the corresponding amounts of air shutter opening. Tables 3 and 4 are provided as a guide only. Final adjustments must be made to suit the conditions of the installation.

Table 3. APPROXIMATE SETTINGS FOR MODEL 501CRD (5¾" × 4" Blower Wheel)

Nozzle Size	Firing Rate (GPH) at 150 psi	Retention Ring Setting, Inches on Scale, Dimension "A"	Initial Air Shutter Opening (Percent)
5.00	6.00	3/16	50
5.50	6.60	¼	65
6.00	7.20	5/16	75
6.50	7.80	⅜	80
7.00	8.40	7/16	90
7.50	9.00	½	100
8.00	9.60	⅝	100
8.50	10.20	¾	100
9.00	10.80	⅞	100
9.50	11.40	1	100
10.00	12.00	1¼	100

Table 4. APPROXIMATE SETTINGS FOR MODEL 601CRD (6 5/16" × 4" Blower Wheel)

Nozzle Size	Firing Rate (GPH) at 150 psi	Retention Ring Setting, Inches on Scale, Dimension "A"	Initial Air Shutter Opening (Percent)
5.00	6.00	1/8	35
5.50	6.60	3/16	45
6.00	7.20	1/4	50
6.50	7.80	5/16	55
7.00	8.40	3/8	60
7.50	9.00	7/16	65
8.00	9.60	1/2	70
8.50	10.20	9/16	85
9.00	10.80	5/8	100
9.50	11.40	3/4	100
10.00	12.00	7/8	100
11.00	13.20	1 1/4	100

NOZZLE SPECIFICATIONS: 45° SS or 45° H HAGO

45 ° H (hollow cone spray) nozzles provide approximately 10% shorter flame than 45 ° SS nozzles.

Other makes of nozzles may or may not prove satisfactory. Sufficient test data is not available to make other recommendations. The correlation of nozzle sprays between different manufacturers is not consistent.

For special applications, other specifications might provide a more desirable pattern.

FUEL UNITS AND OIL LINES

Standard burners are provided with a two-stage 3450 rpm fuel unit *set at 150 psi*.

A *single-pipe system* is recommended whenever the bottom of the fuel tank is above the burner or is at the same level as the burner. This includes outdoor fuel tanks that are at such levels.

A *two-pipe system* is recommended when the fuel tank is below the level of the burner, and the fuel unit must pull (lift) the fuel up to the burner. For two-pipe installations the by-pass plug must be installed. Maximum recommended vacuum is 12 inches of mercury.

Table 5 shows, for the standard two-stage fuel unit, the allowable lift and lengths of 1/2" and 5/8" OD tubing for both suction and return lines in two-pipe systems.

Be sure that all oil line connections are absolutely airtight. Check all connections and joints. Flared fittings are recommended. *Do not* use compression fittings.

Open the air-bleed valve and start the burner. For clean bleed, slip a 3/16" ID hose over the end of the bleed valve and bleed into a container. Continue to bleed for 15 seconds after oil is free of air bubbles. Stop the burner and close the bleed valve.

Table 5. TWO-STAGE UNITS—TWO-PIPE SYSTEMS SUNTEC H3PB-B100 (150 PSI) WEBSTER 22R22OD-5EC3 (150 PSI)

Lift (feet)	Length of Tubing (feet) 1/2" OD	5/8" OD
0	100	100
2	88	100
4	78	100
6	69	100
8	59	100
10	49	100
12	39	100
14	29	82
15	24	68

LIGHT-OFF AND ADJUSTMENT

Before re-starting the burner, preset the air shutter and the retention ring position for the particular firing rate according to Table 3, page 3 for 501CRD or Table 4, page 4, for 601CRD.

If the fire is a little too rich, open the air shutter or move the combustion head forward by increasing dimension "A," Fig. 10, page 3. At the lower inputs, a very slight change is usually enough.

Adjust draft to 0.02 to 0.04 inches W. C. over the fire for natural draft units.

Run a smoke test. Strive for zero or a trace. Each time further adjustment of air or retention ring is made, reset the draft to 0.02 to 0.04 inches W. C. over the fire.

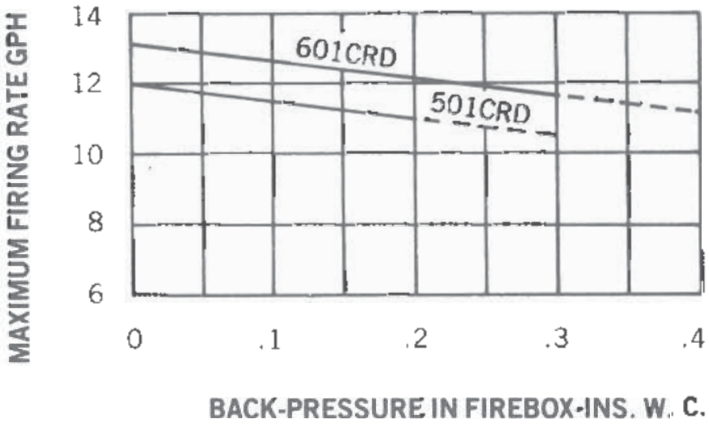
Check CO_2. This should be over 10 percent, and will often be over 13 percent, in a well-sealed unit.

Check for good ignition and clean cut-off. If cut-off continues to be poor, look for air leaks in the suction line and correct them.

FORCED DRAFT FIRING

Due to the back pressure in forced draft units the maximum firing rate of a burner is reduced. The greater the pressure, the lower the maximum GPH capability becomes. Note that the graph below stops at 0.20 inches W. C. for Model 501CRD and at 0.30 inches W. C. for Model 601CRD; the maximum recommended back pressure for these models.

The combustion head settings for forced draft firing would be somewhat greater than those shown in Table 3, page 3, and Table 4, page 4, which are for zero pressure or natural draft.



Carlin®
Combustion Technology, Inc.
70 Maple Street
East Longmeadow, MA 01028
413-525-7700 Fax 413-525-8306

Equipment Source Inc.

1919 Van Horn Rd.
Fairbanks, AK 99701
Ph: (907) 458-9049

Blower

BUILT ARCTIC TOUGH

Equipment Source Inc.

1919 Van Horn Rd.
Fairbanks, AK 99701
Ph: (907) 458-9049

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THE NEW YORK BLOWER COMPANY
7660 Quincy Street
Willowbrook, IL 60527-5530
Visit us on the Web: http://www.nyb.com
Phone: (800) 208-7918 Email: nyb@nyb.com

INSTALLATION MAINTENANCE, OPERATING INSTRUCTIONS

IM 150

GENERAL PURPOSE FANS

WORD ABOUT SAFETY

Beginning in June 2012, the above **WARNING** signage has been placed on all **nyb** fans, as specified by ISO and recommended by the European Union. Air moving equipment involves electrical wiring, moving parts, sound, and air velocity or pressure which can create safety hazards if the equipment is not properly installed, operated and maintained. To minimize this danger, follow these instructions as well as the additional instructions and warnings on the equipment itself.

All installers, operators and maintenance personnel should study AMCA Publication 410, "Recommended Safety Practices for Air Moving Devices", which is included as part of every shipment. Additional copies can be obtained by writing to New York Blower Company, 7660 Quincy St., Willowbrook, IL 60527.

ELECTRICAL DISCONNECTS

Every motor driven fan should have an independent disconnect switch to isolate the unit from the electrical supply. It should be near the fan and must be capable of being locked by maintenance personnel while servicing the unit, in accordance with OSHA procedures.

MOVING PARTS

All moving parts must have guards to protect personnel. Safety requirements vary, so the number and type of guards needed to meet company, local and OSHA standards must be determined and specified by the user. Never start a fan without having all safety guards installed. Check regularly for damaged or missing guards and do not operate any fan with guards removed. Fans can also become dangerous because of potential “windmilling”, even though all electrical power is disconnected. Always block the rotating assembly before working on any moving parts.

SOUND

Some fans can generate sound that could be hazardous to exposed personnel. It is the responsibility of the system designer and user to determine sound levels of the system, the degree of personnel exposure, and to comply with applicable safety requirements to protect personnel from excessive noise. Consult **nyb** for fan sound power level ratings.

AIR PRESSURE AND SUCTION

In addition to the normal dangers of rotating machinery, fans present another hazard from the suction created at the fan inlet. This suction can draw materials into the fan where they become high velocity projectiles at the outlet. It can also be extremely dangerous to persons in close proximity to the inlet, as the forces involved can overcome the strength of most individuals. Inlets and outlets that are not ducted should be screened to prevent entry and discharge of solid objects.

Danger: Do Not Enter/Confined Space

ACCESS DOORS

The above DANGER decal is placed on all **nyb** cleanout doors. These doors, as well as access doors to the duct system, should never be opened while the fan is in operation. Serious injury could result from the effects of air pressure or suction.

Quick-opening doors must have the door handle bolts securely tightened to prevent accidental or unauthorized opening. Bolted doors must be tightened for the same reason.

RECEIVING AND INSPECTION

The fan and accessories should be inspected on receipt for any shipping damage. Turn the wheel by hand to see that it rotates freely and does not bind. If dampers or shutters are provided, check these accessories for free operation of all moving parts.

F.O.B. factory shipping terms require that the receiver be responsible for inspecting the equipment upon arrival. Note damage or shortages on the Bill of Lading and file any claims for damage or loss in transit. **nyb** will assist the customer as much as possible; however, claims must be originated at the point of delivery.

HANDLING AND STORAGE

Fans should be lifted by the base, mounting supports, or lifting eyes only. Never lift a fan by the wheel, shaft, motor, motor bracket, housing inlet, outlet, or any fan part not designed for lifting. A spreader should always be used to avoid damage.

Whenever possible, fans and accessories should be stored in a clean, dry location to prevent rust and corrosion of steel components. If outdoor storage is necessary, protection should be provided. Cover the inlet and outlet to prevent the accumulation of dirt and moisture in the housing. Cover motors with waterproof material. Refer to the bearing section for further storage instructions.

Check dampers for free operation and lubricate moving parts prior to storage. Inspect the stored unit periodically. **Rotate the wheel by hand every two weeks to redistribute grease on internal bearing parts.**

FAN INSTALLATION

nyb wheels are dynamically balanced when fabricated. Complete fans are test run at operating speeds to check the entire assembly for conformance to **nyb** vibration limits. Nevertheless, all units must be adequately supported for smooth operation. **Ductwork or stacks should be independently supported as excess weight may distort the fan housing and cause contact between moving parts.** Where vibration isolators are used, consult the **nyb** certified drawing for proper location and adjustment.

Slab-Mounted Units

A correctly designed and level concrete foundation provides the best means of installing floor-mounted fans. The mass of the base must maintain the fan/driver alignment, absorb normal vibration, and resist lateral loads. The overall dimensions of the concrete base should extend at least six inches beyond the outline of the fan. The weight of the slab should be two to three times the weight of the rotating assembly, including the motor. The foundation requires firmly anchored fasteners such as the anchor bolts shown in Figure 1. Hammer-drilled expansion fasteners can be used in less demanding applications

Move the fan to the mounting location and lower it over the anchor bolts. Shim and grout as required to level the fan. Fasten the fan securely.

Elevated Units

When an elevated or suspended structural steel platform is used, it must have sufficient bracing to support the unit load and prevent side sway. The platform should be of welded construction to maintain permanent alignment of all members.

V-BELT DRIVE

Installation

1. Remove all foreign material from the fan and motor shafts. Coat shafts with machine oil for easier mounting. Mount the belt guard backplate at this time if partial installation is required prior to sheave mounting.

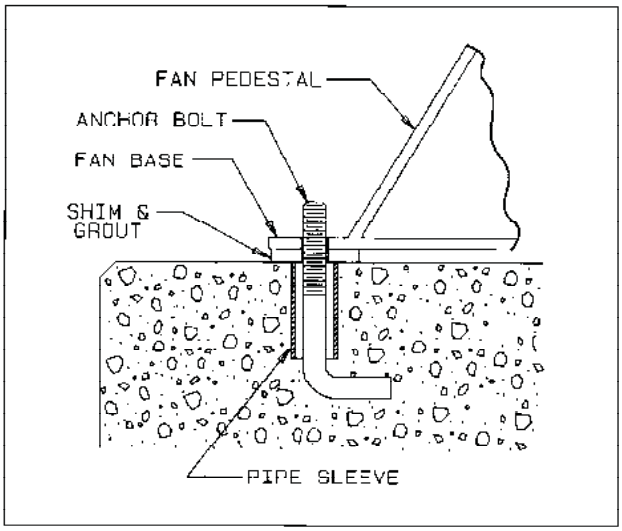


Figure 1

2. Mount sheaves on shafts after checking sheave bores and bushings for nicks or burrs. Avoid using force. If resistance is encountered, lightly polish the shaft with emery cloth until the sheave slides on freely. Tighten tapered bushing bolts sequentially so that equal torque is applied to each.
3. Adjust the motor on its base to a position closest to the fan shaft. Install belts by working each one over the sheave grooves until all are in position. Never pry the belts into place. On **nyb** packaged fans, sufficient motor adjustment is provided for easy installation of the proper size belts.
4. Adjust sheaves and the motor shaft angle so that the sheave faces are in the same plane. Check this by placing a straightedge across the faces of the sheaves. Any gap between the edge and sheave faces indicates misalignment. Important: This method is only valid when the width of the surface between the belt edge and the sheave face is the same for both sheaves. When they are not equal, or when using adjustable-pitch sheaves, adjust so that all belts have approximately equal tension. Both shafts should be at right angles to the center belt.

Belt Tensioning

1. Check belt tension with a tensioning gage and adjust using the motor base. Excess tension shortens bearing life while insufficient tension shortens belt life, can reduce fan performance and may cause vibration. The lowest allowable tension is that which prevents slippage under full load. Belts may slip during start-up, but slipping should stop as soon as the fan reaches full speed. For more precise tensioning methods, consult the drive manufacturer's literature.
2. Recheck setscrews, rotate the drive by hand and check for rubbing, then complete the installation of the weather cover/belt guard.
3. Belts tend to stretch somewhat after installation. Recheck tension after several days of operation. Check sheave alignment as well as setscrew and/or bushing bolt tightness

Safe operation and maintenance includes the selection and use of appropriate safety accessories for the specific installation. This is the responsibility of the system designer and requires consideration of equipment location and accessibility as well as adjacent components. All safety accessories must be installed properly prior to start-up.

Safe operating speed is a function of system temperature and wheel design. Do not under any circumstances exceed the maximum safe fan speed published in the **nyb** bulletin, which is available from your **nyb** field sales representative.

Procedure

1. If the drive components are not supplied by **nyb,** verify with the manufacturer that the starting torque is adequate for the speed and inertia of the fan.

2. Inspect the installation prior to starting the fan. Check for any loose items or debris that could be drawn into the fan or dislodged by the fan discharge. Check the interior of the fan as well. Turn the wheel by hand to check for binding.

3. Check drive installation and belt tension.

4. Check the tightness of all setscrews, nuts and bolts. Tighten hub setscrews with the wheel oriented so that the setscrew is positioned underneath the shaft.

5. Install all remaining safety devices and guards. Verify that the supply voltage is correct and wire the motor. “Bump” the starter to check for proper wheel rotation.

6. Use extreme caution when testing the fan with ducting disconnected. Apply power and check for unusual sounds or excessive vibration. If either exists, see the section on Common Fan Problems. To avoid motor overload, do not run the fan for more than a few seconds if ductwork is not fully installed. On larger fans, normal operating speed may not be obtained without motor overload unless ductwork is attached. Check for correct fan speed and complete installation. Ductwork and guards must be fully installed for safety.

7. Setscrews should be rechecked after a few minutes, eight hours and two weeks of operation (see Tables 1 & 2 for correct tightening torques).

Note: Shut the fan down immediately if there is any sudden increase in fan vibration.

FAN MAINTENANCE

nyb fans are manufactured to high standards with quality materials and components. Proper maintenance will ensure a long and trouble-free service life.

Do not attempt any maintenance on a fan unless the electrical supply has been completely disconnected and locked. In many cases, a fan can windmill despite removal of all electrical power. The rotating assembly should be blocked securely before attempting maintenance of any kind.

The key to good fan maintenance is regular and systematic inspection of all fan parts. Inspection frequency is determined by the severity of the application and local conditions. Strict adherence to an inspection schedule is essential.

Table 1 - WHEEL SETSCREW TORQUES

Setscrew Size Diameter (in.)	Carbon Steel Setscrew Torque*	
	lb.-in.	lb.-ft.
3/8	252	21
7/16	396	33
1/2	600	50
5/8	1164	97

*** Stainless Steel setscrews are not hardened and should not be tightened to more than 1/2 the values shown.**

Table 2 - BEARING SETSCREW TORQUE, In.-Lb.

Setscrew Diameter	Manufacturer				
	Link-Belt	Sealmaster	SKF	McGill	Dodge
#10	40	--	35	35	--
1/4	90	65	50	85	--
5/16	185	125	165	165	160
3/8	325	230	290	290	275
7/16	460	350	350	--	--
1/2	680	500	620	--	600

Regular fan maintenance should include the following:

1. Check the fan wheel for any wear or corrosion, as either can cause catastrophic failures. Check also for the build-up of material which can cause unbalance resulting in vibration, bearing wear and serious safety hazards. Clean or replace the wheel as required.

2. Check the V-belt drive for proper alignment and tension (see section on V-belt drives). If belts are worn, replace them as a set, matched to within manufacturer’s tolerances.

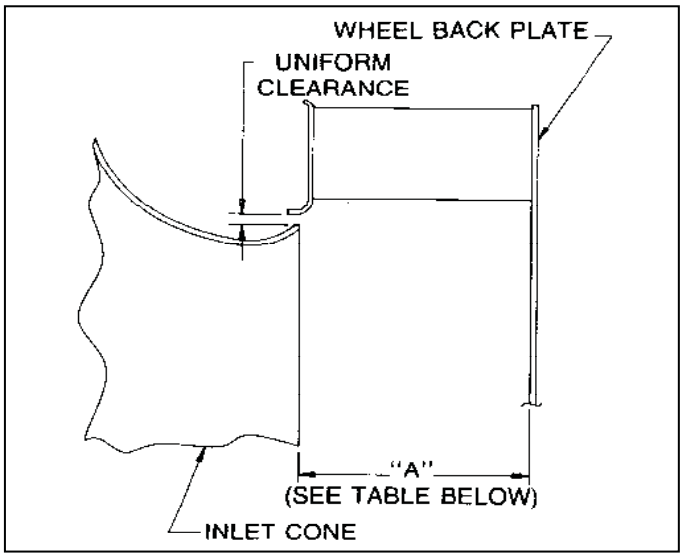
3. Lubricate the bearings, but do not over lubricate (see the bearing section for detailed specifications).

4. During any routine maintenance, all setscrews and bolts should be checked for tightness. See the table for correct torques.

5. When installing a new wheel, the proper wheel-to-inlet clearance must be maintained (see Figure 2).

WARNING: Do not remove or loosen the fan hub from the fan wheel. Removing or loosening the fan hub from the fan wheel will cause imbalance and void the warranty.

WHEEL-CONE CLEARANCES



Fan Size	"A" Dimension	Fan Size	"A" Dimension
12	4 1/2	27	10 1/8
15	5 1/2	30	11 1/4
18	7	33	12 1/4
22	8 1/4	36	13 3/8
24	9 1/4		

Figure 2

WHEEL BALANCE

Airstreams containing particulate or chemicals can cause abrasion or corrosion of the fan parts. This wear is often uneven and can lead to significant wheel imbalance over time. When such wear is discovered, a decision must be made as to whether to rebalance or replace the wheel.

The soundness of all parts should be determined if the original thickness of components is reduced. Be sure there is no hidden structural damage. The airstream components should also be cleaned to remove any build-up of foreign material. Specialized equipment can be used to rebalance a cleaned wheel that is considered structurally sound.

Balance weights should be rigidly attached at a point that will not interfere with the housing nor disrupt airflow. Remember that centrifugal forces can be extremely high at the outer radius of a fan wheel. Welding is the preferred method of balance weight attachment. Be sure to ground the welder directly to the fan wheel. Otherwise, the welding current could pass through the fan bearings and damage them.

BEARINGS

Storage

Any stored bearing can be damaged by condensation caused by temperature variations. Therefore, **nyb** fan bearings are filled with grease at the factory to exclude air and moisture. Such protection is adequate for shipment and subsequent immediate installation.

For long term or outdoor storage, mounted bearings should be regreased and wrapped with plastic for protection. **Rotate the fan wheel by hand at least every two weeks to redistribute grease on internal bearing parts.** Each month the bearings should be purged with new grease to remove condensation, since even a filled bearing can accumulate moisture. Use caution when purging, as excessive pressure can damage the seals. Rotate the shaft while slowly adding grease.

Operation

Check the setscrew torque before start-up (see table for correct values). Since bearings are completely filled with grease at the factory, they may run at an elevated temperature during initial operation. Surface temperatures may reach 180°F. and grease may bleed from the bearing seals. This is normal and no attempt should be made to replace lost grease. Bearing surface temperatures will decrease when the internal grease quantity reaches a normal operating level. Relubrication should follow the recommended schedule.

Lubrication

Use the table for relubrication scheduling according to operating speed and shaft diameter. Bearings should be lubricated with a premium quality lithium-based grease conforming to NLGI Grade 2. Examples are:

Mobil	- Mobilgrease XHP	Chevron	- Amolith #2
Texaco	- Premium RB	Shell	- Alvania #2

These greases are for bearing surface temperatures of 40°F. to 180°F. For surface temperatures of 181°F. to 230°F. use Mobilith SHC220.

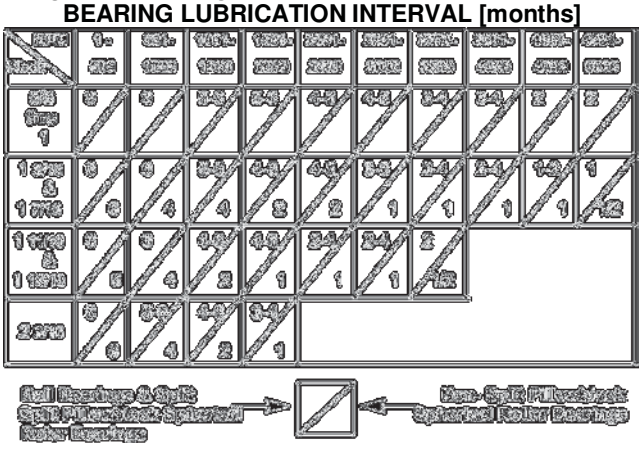
Do not use "high temperature" greases, as many are not formulated to be compatible with fan bearings.

Add grease to the bearing while running the fan or rotating the shaft by hand. Be sure all guards are in place if lubrication is performed while the fan is operating. Add just enough grease to cause a slight purging at the seals. Except on split pillowblocks. Completely filled bearings will run hotter until a sufficient amount of grease is purged out of the seals.

Split pillowblock bearings (Link-Belt P-LB6800 & P-LB6900, SKF SAF 22500, Dodge SAF-XT) should be cleaned and repacked at approximately every eighth lubrication interval. This requires removal of the bearing cap. Clean out old grease and repack the bearing with fresh grease. Pack the bearing fully and fill the housing reservoir to the bottom of the shaft on both sides of the bearing. Replace the bearing cap, being careful not to mix caps as they are not interchangeable from one bearing to another. **Do not over lubricate.**

Disposal of material should be made in accordance to local government regulations.

BEARING LUBRICATION INTERVAL [months]



NOTE:

1. **These are general recommendations only; specific manufacturer's recommendations may vary slightly.**
2. **Assumes clean environment, -20°F. to 120°F.**
   a. **Consult The New York Blower Company for operation below -20°F. ambient.**
   b. **Ambient temperatures greater than 120°F. will shorten bearing life.**
   c. **Under extremely dirty conditions, lubricate more frequently.**
3. **Assumes horizontal mounting configuration. For vertically mounted applications, lubricate twice as frequently.**

COMMON FAN PROBLEMS

Excessive Vibration

A common complaint regarding industrial fans is "excessive vibration". **nyb** is careful to ensure that each unit is precisely balanced prior to shipment; however, there are many other causes of vibration including:

1. Loose mounting bolts, setscrews, bearings or couplings.
2. Misalignment or excessive wear of couplings or bearings.
3. Misaligned or unbalanced motor.
4. Bent shaft due to mishandling or material impact.
5. Accumulation of foreign material on the wheel.
6. Excessive wear or erosion of the wheel.
7. Excessive system pressure or restriction of airflow due to closed dampers.
8. Inadequate structural support, mounting procedures or materials.
9. Externally transmitted vibration.

Inadequate Performance

1. Incorrect testing procedures or calculations.
2. Fan running too slowly.
3. Fan wheel rotating in wrong direction or installed backwards on shaft.
4. Wheel not properly centered relative to inlet cone.
5. Damaged or incorrectly installed cut off sheet or diverter.
6. Poor system design, closed dampers, air leaks, clogged filters, or coils.
7. Obstructions or sharp elbows near inlets.
8. Sharp deflection of airstream at fan outlet.

Excessive Noise

1. Fan operating near "stall" due to incorrect system design or installation.
2. Vibration originating elsewhere in the system.
3. System resonance or pulsation.
4. Improper location or orientation of fan intake and discharge.
5. Inadequate or faulty design of supporting structures.
6. Nearby sound reflecting surfaces.
7. Loose accessories or components.
8. Loose drive belts.
9. Worn bearings.

Premature Component Failure

1. Prolonged or major vibration.
2. Inadequate or improper maintenance.
3. Abrasive or corrosive elements in the airstream or surrounding environment.
4. Misalignment or physical damage to rotating components or bearings.
5. Bearing failure from incorrect or contaminated lubricant or grounding through the bearings while arc welding.
6. Excessive fan speed.
7. Extreme ambient or airstream temperatures.
8. Improper belt tension.
9. Improper tightening of wheel setscrews.

REPLACEMENT PARTS

It is recommended that only factory-supplied replacement parts be used. **nyb** fan parts are built to be fully compatible with the original fan, using specific alloys and tolerances. These parts carry a standard **nyb** warranty.

When ordering replacement parts, specify the part name, **nyb** shop and control number, fan size, type, rotation (viewed from drive end), arrangement and bearing size or bore. Most of this information is on the metal nameplate attached to the fan base.

For assistance in selecting replacement parts, contact your local **nyb** representative or visit: http://www.nyb.com.

Example: Part required: Wheel
Shop/control number: B-10106-100
Fan description: Size 27 General Purpose Fan Rotation: Clockwise
Arrangement: 10

Suggested replacement parts include:

Wheel
Shaft
Bearings
Shaft Seal

Component parts: Damper
Motor
Sheaves V-Belts

LIMITED PRODUCT WARRANTY

All products are warranted by **nyb** to be free from defects in materials and workmanship for a period of one (1) year after shipment from its plant, provided buyer demonstrates to satisfaction of **nyb** that the product was properly installed and maintained in accordance with **nyb**'s instructions and recommendations and that it was used under normal operating conditions.

This warranty is limited to the replacing and/or repairing by **nyb** of any part or parts which have been returned to **nyb** with **nyb**'s written authorization and which in **nyb**'s opinion are defective. Parts not manufactured by **nyb** but installed by **nyb** in equipment sold to the buyer shall carry the original manufacturer's warranty only. All transportation charges and any and all sales and use taxes, duties, imports or excises for such part or parts shall be paid for by the buyer. **nyb** shall have the sole right to determine whether defective parts shall be repaired or replaced.

This warranty does not cover any customer labor charges for replacement of parts, adjustments or repairs, or any other work unless such charges shall be assumed or authorized in advance, in writing, by **nyb.**

This warranty does not cover any product which, in the judgement of **nyb,** has been subject to misuse or neglect, or which has been repaired or altered outside **nyb**'s plant in any way which may have impaired its safety, operation or efficiency, or any product which has been subject to accident.

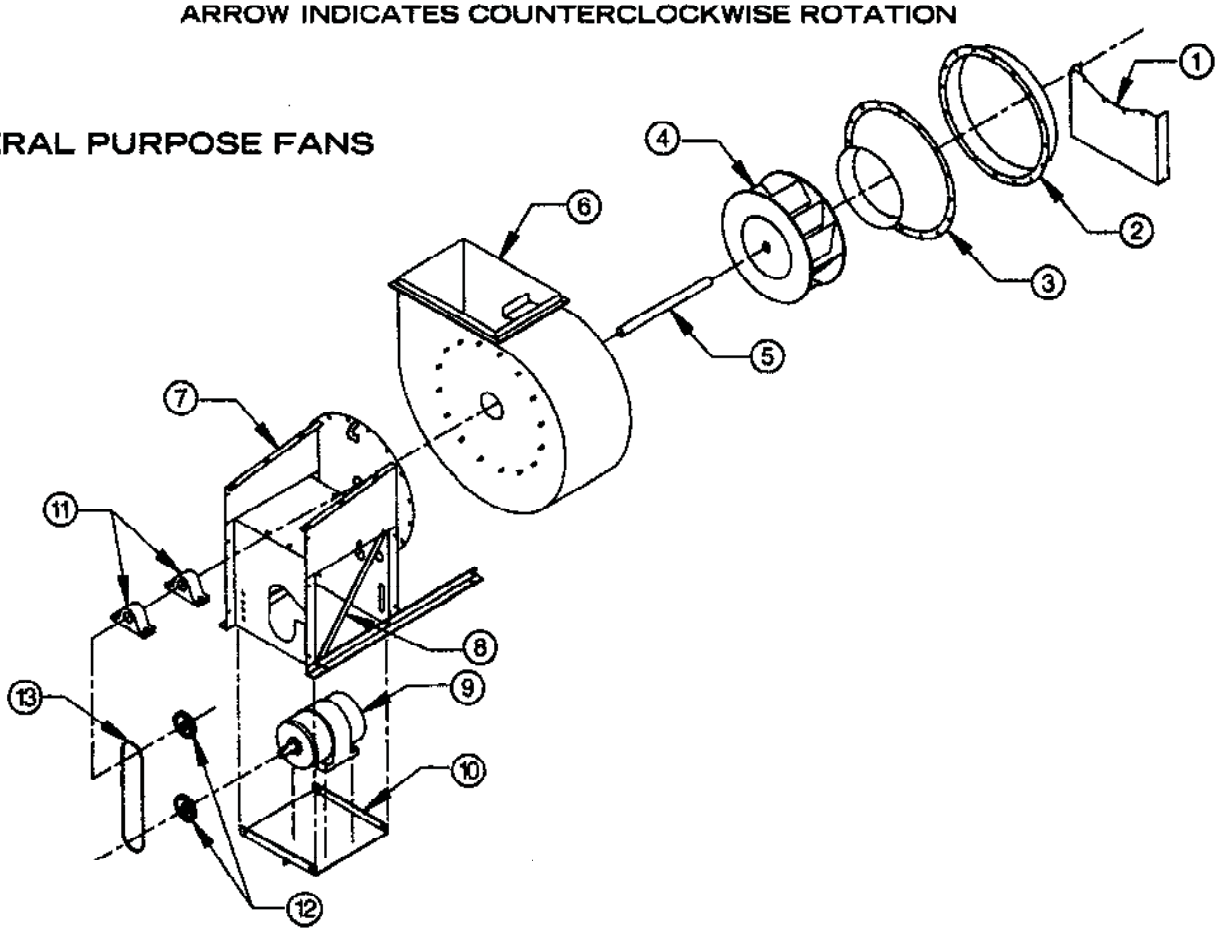
This warranty shall be null and void if any part not manufactured or supplied by **nyb** for use in any of its products shall have been substituted and used in place of a part manufactured or supplied by **nyb** for such use.

There are no warranties, other than those appearing on the acknowledgement form **INCLUDING NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE,** given in connection with the sale of the goods sold hereunder. The buyer agrees that his sole and exclusive remedy, and the limit of **nyb**'s liability for loss from any cause whatsoever, shall be the purchase price of the goods sold hereunder for which a claim is made.

SPECIFY ROTATION AS VIEWED FROM DRIVE SIDE

ARROW INDICATES COUNTERCLOCKWISE ROTATION

GENERAL PURPOSE FANS



Parts List

1. Inlet Hanger Panel
2. Inlet Collar
3. Inlet Cone*
4. Wheel*
5. Shaft
6. Housing*
7. Pedestal
8. Drive Side Hanger Brace
9. Motor
10. Motor Platform
11. Bearings
12. Sheaves
13. Belt

* Orders for parts must specify rotation.

For assistance in selecting replacement parts, contact your local **nyb** representative or visit: http://www.nyb.com.

Equipment Source Inc.

1919 Van Horn Rd.
Fairbanks, AK 99701
Ph: (907) 458-9049

Accessories

BUILT ARCTIC TOUGH

Equipment Source Inc.

1919 Van Horn Rd.
Fairbanks, AK 99701
Ph: (907) 458-9049

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CAUTION **CAUTION** **CAUTION**

GASOLINE IS INVOLVED AND VAPORS WILL SETTLE IN LOW AREAS. WORK IN A WELL VENTILATED SPACE AWAY FROM SPARKS OR OPEN FLAME SUCH AS A PILOT LIGHT. HAVE A CLASS 'B' FIRE EXTINGUISHER CLOSE BY.

TO ELIMINATE THE CHANCE OF FIRE OR PERSONAL INJURY, THE FUEL SYSTEM PRESSURE MUST BE RELIEVED BEFORE SERVICING ANY FUEL SYSTEM COMPONENT.

INSTALLATION INSTRUCTIONS FOR UNIVERSAL ELECTRIC FUEL PUMP

NOTE:

-Before replacing any electric fuel pump diagnose the cause of failure.
-Dirt is the major cause of pump failure, so the tank must be cleaned out or dirt may cause the replacement pump to fail as well.
-Exercise care so that no dirt falls into the tank during disassembly or reassembly.

-For safety reasons, it is recommended an Oil Pressure Safety Switch be installed. This will prevent engine damage and reduce the chance of fire in the case that the engine stops without the ignition switch in the "off" position.

-Installation of the replacement pump may require some of the mounting or electrical components be reused. Do not discard any parts.
-To prevent fuel pump failure, installation of a high quality fuel filter on the inlet side of the pump, is required.

A. FUEL PUMP INSTALLATION

1. Disconnect the negative battery cable.

2. Mount the fuel pump close to the existing fuel lines and tank, but away from any exhaust system component. Place the pump and bracket assembly as near to the bottom of the fuel tank as possible, but never more than 24 inches above the top of the tank.

3. Remove a section of fuel line where the pump is to be mounted. (A tube cutter is recommended when cutting fuel lines. Flush the fuel line to prevent metal chips from entering the fuel system.)

4. If pump has rubber hose fittings proceed to next step. If using a pump with threaded inlet/outlet fittings, assemble the (supplied) fuel fittings to the fuel pump (See Fig. A). (This pump is equipped with dry-seal fuel fittings. Do not use Teflon tape or pipe sealant on pipe fittings, or pump breakage will occur.)

5. Install mounting bracket onto vehicle's chassis/frame with self-tapping screw(s).

6. Install the fuel pump on the mounting bracket with the outlet towards the engine. Place ground (-) wire from pump under mounting screw or bolt.

7. Connect the fuel lines to the fuel pump, using supplied rubber fuel line and clamps provided. (To prevent fuel pump failure, installation of a high quality fuel filter on the inlet side of the pump, is required.) (See Fig. A.)

8. Using #14 or larger (lower gauge #) gauge wire, follow the wiring diagram (See Fig. A & B) and connect the pump to the vehicle's electrical system. If the vehicle has a pre-existing oil pressure safety switch which operates either a warning light or gauge, it is recommended that a T-adapter be installed into the engine block and both the O.E. and the Oil Pressure Safety Switch be used (See Fig. C). A 10-amp fuse should be installed between the pressure safety switch and the electric pump. (Route wires away from heat and road hazards, and anchor securely to prevent vibration and chafing. Full battery voltage must be available to the pump when the ignition switch is "on". Pump ground must be the same as the battery ground.)

9. If this pump is being used to replace a defective in tank pump, and it is not going to be removed, make sure the defective pump does not restrict the fuel supply.

10. If this pump is being used to replace a defective mechanical pump, the fuel lines should bypass the mechanical pump. Fuel pushed through a defective mechanical pump can cause severe engine damage. If mechanical pump is not removed from the engine, the mechanical pump inlet should be plugged.

WARNING **WARNING** **WARNING**

NOT FOR USE IN AIRCRAFT OR OTHER NON-AUTOMOTIVE USE. THE USE OF A PUMP FOR OTHER THAN THE APPLICATIONS LISTED WILL VOID THE WARRANTY AND COULD DO SEVERE ENGINE DAMAGE.

Fig. A

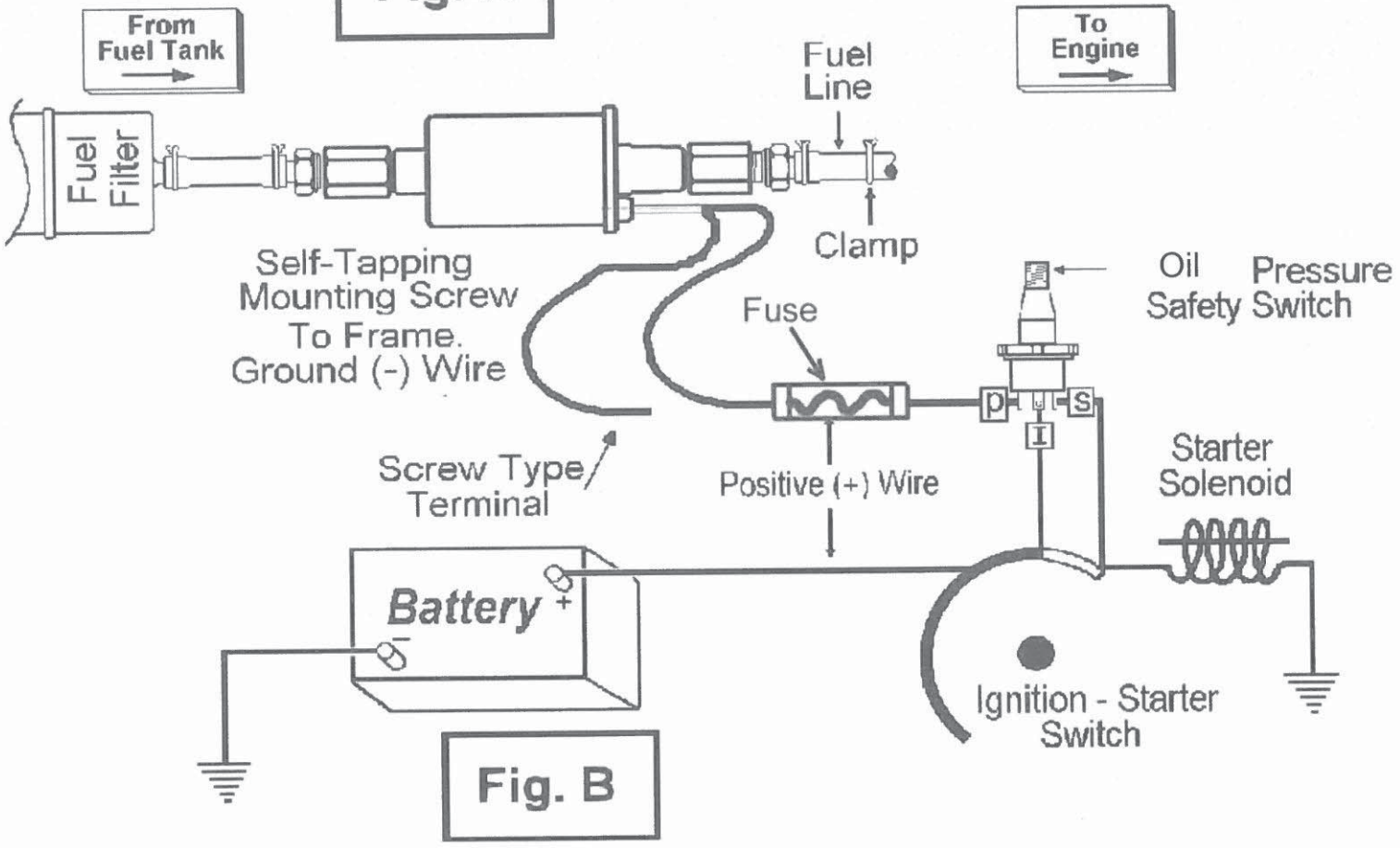
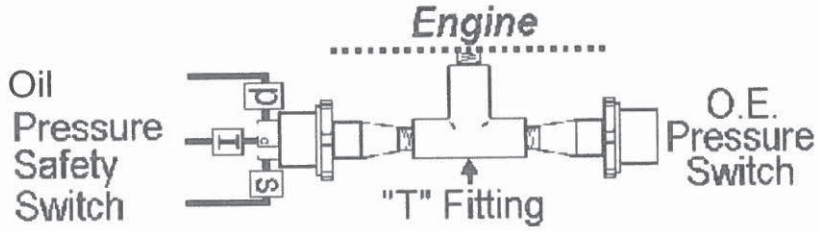

From Fuel Tank
To Engine
Fuel Line
Fuel Filter
Clamp
Self-Tapping Mounting Screw To Frame. Ground (-) Wire
Oil Pressure Safety Switch
Fuse
p
s
I
Screw Type Terminal
Positive (+) Wire
Starter Solenoid
Battery
+
-
Ignition - Starter Switch

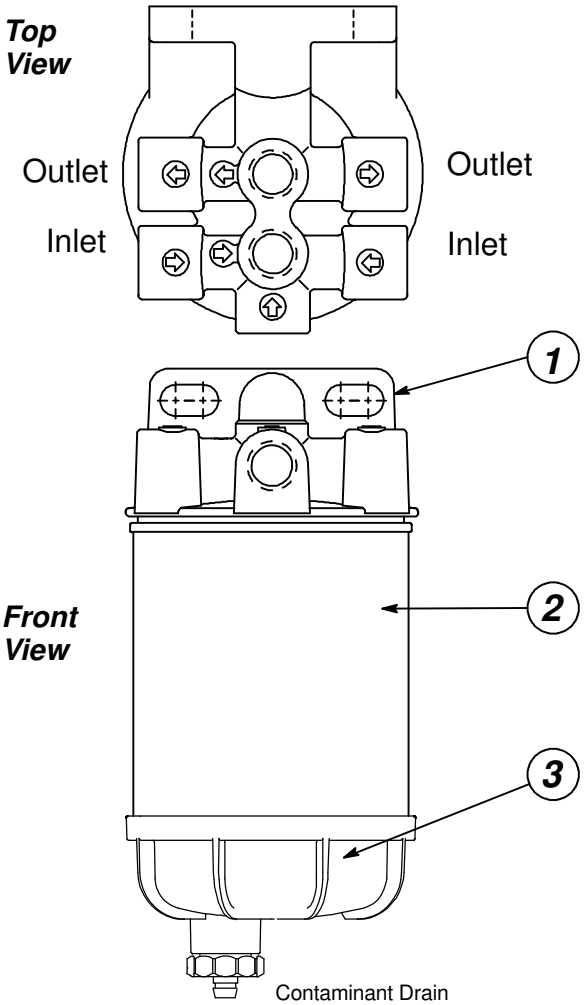
Fig. B


Engine
Oil Pressure Safety Switch
p
I
s
"T" Fitting
O.E. Pressure Switch

645/660/690R Spin-on Fuel Filter/Water Separators for Diesel Engines

RACOR®
Parker Hannifin Corporation
Racor Division
P.O. Box 3208, 3400 Finch Rd.
Modesto, CA 95353 USA
209/521-7860, 800/344-3286
FAX 209/529-3278

Parker
Filtration



Racor's new 645/660/690 Fuel Filter/Water Separators are specifically designed to handle todays tough diesel filtration problems.
These units may be used on the pressure or vacuum side of the fuel transfer pump: 40 PSI maximum for under-hood or 60 PSI for chassis mount applications. The fuel ports are standard 3/8" NPTF. Many varieties of fittings are available from Racor or hardware dealers. (Fittings are not supplied with this unit).

The head features seven fuel ports: four inlets and three outlets for unique versatility to adapt to just about any application.

The difference between the three models (645/660/690) is the flow capacities which are dictated by the size of the elements.
See specifications for fuel flow capacity and other information.

Engines will benefit from near 100% water separation and fuel filtration with Racor's proprietary *Aquabloc*™ water repelling media.
The replaceable spin-on filter Elements are available in 2, 10 and 30 micron ratings.

The reusable see-through contaminant Collection Bowl allows the operator to check contamination build-up at a glance. When water is present, the Drain valve is opened and the fluid is simply drained out.

An available option for these models is a water sensor package which alerts the operator when it's time to drain the bowl.

Additionally, a powerful 200 watt heater option is available to quickly warm the element fuel thus providing easier starting and optimum operating efficiency in cold weather or climates.

SPECIFICATIONS

Model 645

Fuel Ports	3/8"NPTF
Maximum Flow Rate	45 GPH / 170 LPH
Clean Vac./Press.Drop*	.01 PSI (.03 kPa)
Height	7.89" (200 mm)
Width	4.48" (114 mm)
Depth	4.48" (114 mm)
Weight, Dry	2.35lb.(1.07kg)

Model 660

Fuel Ports	3/8"NPTF
Maximum Flow Rate	60 GPH / 227 LPH
Clean Vac./Press.Drop*	.05 PSI (.3 kPa)
Height	9.63" (245 mm)
Width	4.48" (114 mm)
Depth	4.48" (114 mm)
Weight, Dry	2.58lb.(1.17kg)

Model 690

Fuel Ports	3/8"NPTF
Maximum Flow Rate	90 GPH / 341 LPH
Clean Vac./Press.Drop*	.29 PSI (2.0 kPa)
Height	10.63" (270 mm)
Width	4.48" (114 mm)
Depth	4.48" (114 mm)
Weight, Dry	2.65lb.(1.20kg)

** Specifications result from tests conducted at the maximum flow rate.*

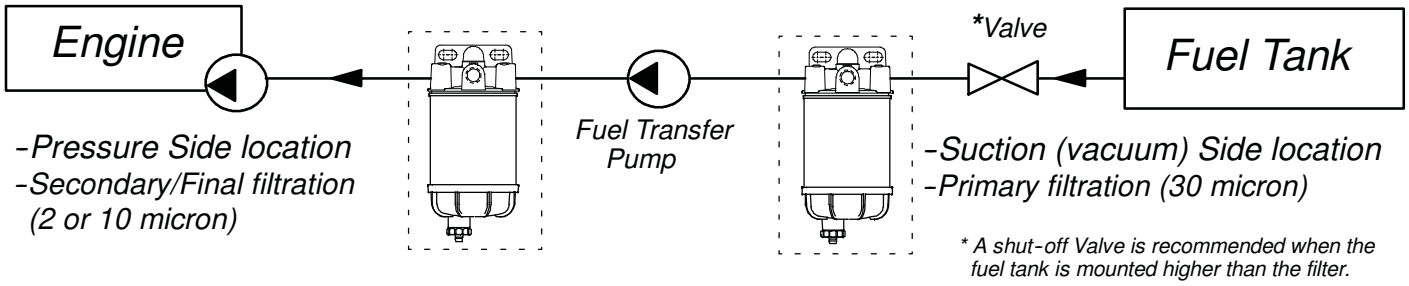
PARTS LIST

Item	Part No.	Description (Qty. is one each)
1	RK22098	Multi-port filter head
2	R45S	For 645, Rpl. Element, 2 micron
	R45T	Rpl. Element,10 micron
	R45P	Rpl. Element,30 micron
	R60S	For 660, Rpl. Element, 2 micron
	R60T	Rpl. Element,10 micron
	R60P	Rpl. Element,30 micron
	R90S	For 690, Rpl. Element, 2 micron
	R90T	Rpl. Element,10 micron
	R90P	Rpl. Element,30 micron
3	RK21113	See-thru Collection Bowl Kit
	RK21113-13	Bowl w/Water Sensor Probe**
	RK22266-03	Bowl w/Heater 12 vdc
	RK22266-04	Bowl w/Heater 24 vdc
	RK22266-01	Bowl w/Water Sensor & 12vdc Heater**
	RK22266-02	Bowl w/Water Sensor & 24vdc Heater**
	RK21156	Bowl O-ring & Seal Service Kit

***Must be used with Amplifier Modulue. See Optional Accessories.*

INSTALLATION INSTRUCTIONS

The Racor 645/660/690 Models may be ***located*** on the suction (vacuum) or pressure side of the fuel transfer pump, *or both* with two units. (40 PSI maximum, for under-hood or 60 PSI for chassis mount applications). Determine the ***filtration*** the unit will provide: Primary (30 micron) or Secondary/Final (10 or 2 micron) filtration. See the illustration below. *NOTE: Pipe thread sealant is recommended on port fitting connections. Do not use pipe tape.*



** A shut-off Valve is recommended when the fuel tank is mounted higher than the filter.*

OPERATING INSTRUCTIONS

PRIMING. With the element and bowl removed from the head, fill them with clean fuel and then spin them both back on to the head. Tighten snugly by hand only, do not use tools. Crank the engine until it starts (no more than 15-20 seconds at a time-allow an interval before cranking again to avoid damage to the starter motor) and check for leaks. Correct as necessary with the engine off.

DRAINING THE COLLECTION BOWL. Water is heavier than diesel fuel and will settle to the bottom of the bowl and appear different in color. Check the bowl daily and drain if water is present. Open the Drain to drain off contaminants. Close the drain. The optional Water Detection Package warns the operator when a high water level condition exists and draining is required. See Optional Accessories, below.

ELEMENT REPLACEMENT. Element replacement frequency is determined by the contamination level in diesel fuels. Fuel flow to the engine becomes restricted as the element slowly plugs with contaminants, resulting in noticeable power loss and/or hard starting. WHEN ANY ONE OCCURS, CHANGE THE ELEMENT AS SOON AS POSSIBLE.
Always carry an extra replacement element as one tankful of excessively contaminated fuel can plug a fuel filter.
Drain off some fuel by opening the Drain. Spin the element and Bowl off together. Remove the Bowl and clean the O-ring gland. Apply a coating of clean fuel or grease to the new O-ring and Element Seal. See Priming instructions above.

TROUBLESHOOTING PROCEDURES

A major cause of power loss or hard starting is the result of an air leak. If your unit will not prime or fails to hold prime, first check that the Drain is properly closed and that the Element and Bowl are snugly tightened. Next, check all fitting connections and ensure none of the fuel lines are pinched or clogged with contaminants. If problems persist and the element is new, feel free to call your Racor Distributor or Racor Customer Service for assistance.

OPTIONAL ACCESSORIES

WATER DETECTION PACKAGE. The in-bowl water sensor probe and solid-state amplifier work together to inform the operator when a high water level condition exists. Two models are available: RK20725* is an under dash mounted 12 volt amplifier which illuminates a LED when water is sensed. RK20726* is a 2" diameter 'gauge-type' amplifier which has a 2 second audible alarm and LED to warn of sensed water.
* *NOTE: Probe ready Bowl and Water Sensor Probe not included. See parts list for Bowl w/Water Sensor Probe.*

FUEL HEATER. An in-bowl 200 watt fuel heater is available and recommended for use in cold operating temperatures or climates. The thermostatically controlled heater applies heat directly under the filter element thus providing optimum operating efficiency. See parts list for the proper part number to order.

Racor's policy is one of continual improvement in design and manufacturing to insure still finer products; therefore, specifications, equipment and product information (while correct at the time of publication) is subject to change without notice. Product Brochure PN. 22249 Rev. A

600 Series

Spin-on Fuel Filter/Water Separators

Instruction Part Number 22249 Rev B

600 Series fuel filter/water separators are specifically designed to handle today's tough fuel filtration problems and can handle flow rates up to 120 GPH (454 LPH), depending on the model used.

Filter replacement intervals depend on fuel type, fuel quality, the application, and operating conditions. All filters eventually clog with contaminants; tracking a fuel filter's restriction saves money and avoids problems.

Model 690R1230 shown.

Contact Information:

Parker Hannifin Corporation
Racor Division
P.O. Box 3208
3400 Finch Road
Modesto, CA 95353

phone 800 344 3286
209 521 7860
fax 209 529 3278
racor@parker.com

www.parker.com/racor

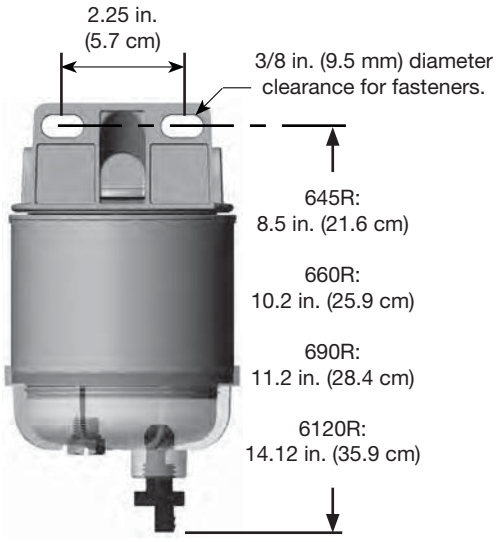
Product Features:

- **Proprietary, high-capacity, water-repelling Aquabloc® filters available in 2, 10, and 30 micron**
- **7-port die-cast aluminum head (four inlets, three outlets) and a unitized mounting bracket for installation convenience**
- **Reusable contaminant collection bowl with self-venting drain**
- **Optional 12 or 24 volt DC, 200 watt, in-bowl fuel heater, water detection kit -** *Danger! Not for use with gasoline applications.*
- **Optional water detection probes/kits also available**

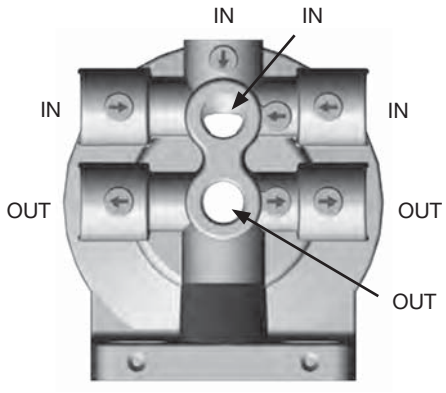
Parker Racor

ENGINEERING YOUR SUCCESS.

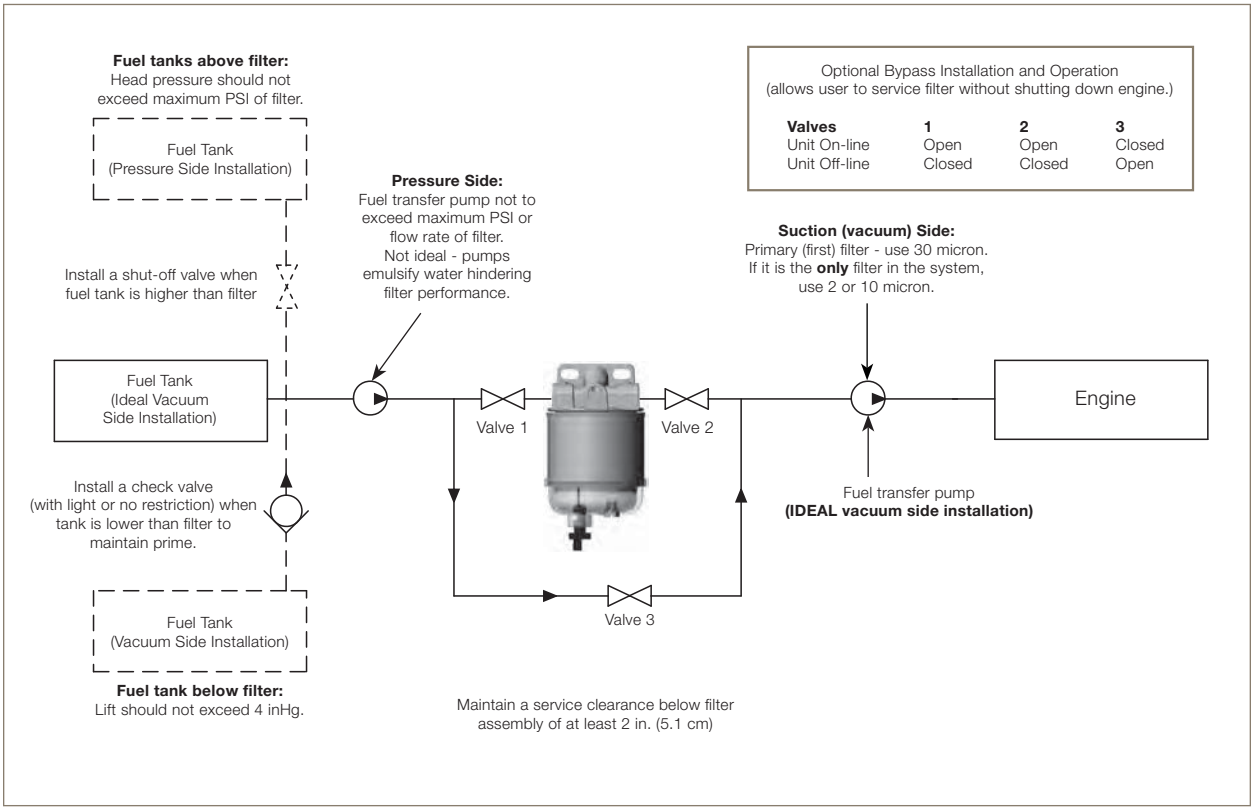
Mounting



Note: When installing mounting bolts (mounting head to frame/engine), limit impact wrench to 30 ft-lbs.



Installation Diagram



Installation Guidelines

READ ALL INSTRUCTIONS FIRST BEFORE BEGINNING INSTALLATION.

For new installations, refer to Mounting and Installation Diagram on previous page and install as follows:

1. Engine should be off and cool to touch. Ignition switch should be in the OFF position.
2. Apply thread sealant to NPT fittings (do not use thread tapes as particles may break off and contribute to clogging filter).
3. Thread fittings into appropriate fuel ports and tighten snugly. Plug unused ports (if any) with port plugs and tighten snugly.

   Important Note: Do not use impact wrenches when installing fittings into the mounting head.

4. Mount filter vertically in a protected area and away from heat sources. Maintain at least 2.0˝ (5.1 cm) of clearance below filter for draining water and servicing filter.
5. Attach fuel lines to filter (3/8˝ or larger is recommended). Avoid tight bends and rubbing areas when routing hoses.
6. Follow “Priming” instructions on this page.
7. Connect water probe and heater wires (if equipped).
8. Verify all other connections are tight and secure.
9. Start engine, inspect installation and correct any leaks with the engine off.

Service

Filter replacement frequency is determined by contamination level in fuels. Fuel flow to engine becomes restricted as filter gradually plugs with contaminants, resulting in noticeable power loss and/or hard starting. As a guideline, change filter every 500 hours, 10,000 miles, every other oil change, annually, or at first indication of power loss, whichever occurs first. Always carry extra replacement filters as one tankful of excessively dirty fuel can quickly plug a filter.

1. Engine should be off and cool to touch. Ignition switch should be in the OFF position.
2. Close all fuel valves, if applicable, to make sure excess fuel does not spill during servicing.
3. Disconnect water probe and heater connectors, if equipped.
4. Drain unit of fuel by opening the drain at the bottom of the filter bowl.
5. Remove bowl and filter. Dispose of filter properly. Bowl is reusable.
6. Lubricate new filter seals with motor oil or clean fuel and install only on new filter.
7. Re-install bowl onto new filter and tighten snugly with Racor bowl wrench (part number RK 22628).
8. To prime, fill filter (with bowl attached) with clean fuel.
9. Spin filter/bowl back onto mounting head. Tighten snugly with Racor bowl wrench (part number RK 22628).
10. Connect water probe and heater connectors, if equipped.
11. Open all fuel valves, if applicable.
12. Verify all other connections are tight and secure.
13. Start engine, inspect installation and correct any leaks with the engine off.

Draining the Collection Bowl

Water is heavier than fuel and will settle to bottom of bowl and appear different in color. In high humidity environments, check bowl frequently (daily if a poor fuel source is suspected). 600 Series bowls are equipped with a water sensor port that will accept a water probe (sold separately) and will alert operator of a high water condition in the filter.

1. Engine should be off and cool to touch. Ignition switch should be in the OFF position.
2. Drain water from filter by opening self-venting drain. Close as soon as all water has evacuated.

CAUTION! If drain is open too long, the entire filter may drain completely of water and fuel.

3. Follow Priming instructions below.

Priming

1. Always consult engine manufacturer’s priming instructions for priming the engine.
2. Remove filter and bowl from mounting head if not already off. Fill filter (with bowl attached) with clean fuel, lubricate filter gasket with motor oil or clean fuel and spin filter/bowl back onto mounting head. Tighten snugly with Racor bowl wrench (part number RK 22628).
3. Verify all other connections are tight.

Trouble Shooting

If filter fails to hold prime, first check drain valve, fittings, head, filter, and bowl are properly tightened. Next, check fuel line connections and verify they are free of pinches or unnecessary bends and check to see if fuel tank strainer (or pick-up tube) is clogged. If problems persist and filter is new, call Racor Technical Support at 800-344-3286, 8 AM to 5 PM, Pacific Time.

Installing the In-bowl Heater (if equipped)

CAUTION! Do not use electric heater in gasoline applications. Do not operate heater if no fuel is inside bowl. Ensure the filter is primed with fuel prior to applying power to the heater.

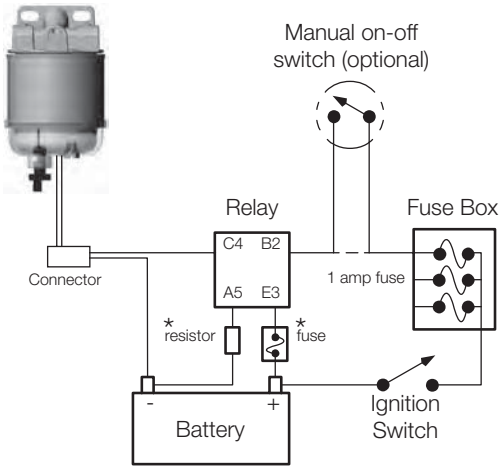
The in-bowl heater is a cold weather starting aid with an internal automatic thermostat that turns the heater on if fuel temperature drops below 45°F (7°C). Heat is supplied just below the filter to melt wax crystals and allow fuel to efficiently pass through. The heater will automatically turn off at about 75°F (24°C). The 200 watt heater is available in 12 or 24 vdc (volts, direct current). The heater is operated by turning on the ignition switch for a minimum of 5 minutes prior to starting the engine.

Customer Supplied Items

1. Because of the heater power demand, 20 amps for the 12 vdc and 10 amps for the 24 vdc, an additional relay is recommended for the safest method of installation. Racor offers two relay kits, available from your dealer, RK 11861 for the 12 vdc systems or RK 11862 for the 24 vdc systems. These kits include an in-line fuse holder (and fuse) and the RK 11862 kit also includes a resistor. Use the 25 amp fuse with the 12 vdc and the 15 amp fuse (and resistor) with the 24 vdc systems. See page 11 for more details.
2. Use an on-off toggle switch to control power to heater relay. This allows operator to cut power to heater relay in warmer climates.
3. All wires should be 14 AWG (American Wire Gauge), minimum.

Installation

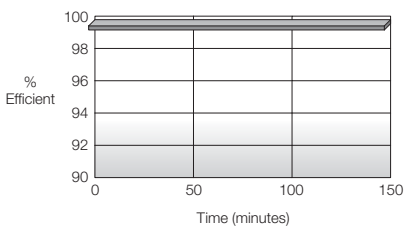
1. Either heater wire may be used for Hot (+) or Ground (-).
2. Wire/terminal connections should be soldered and crimped.
3. Run wires in protected locations. Avoid hot surfaces and places that could pinch or rub on the wires.



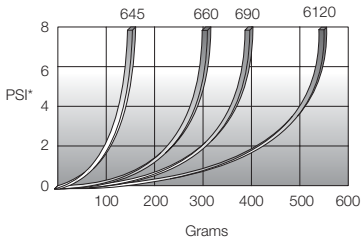
* Use 15 amp fuse and resistor with 24 vdc systems.

Performance Information

Test results are from controlled laboratory testing. Field results may vary.



SAE J1839 Water Separation



SAE J905 SOFTC-2A Contaminant Capacity, 10 micron Aquabloc® media

*PSI x 2.036 = inHg. (PSI x 6.895 = kPa)

Specifications

	645R	660R	690R	6120R
Max. Flow Rate	45 GPH (170 LPH)	60 GPH (227 LPH)	90 GPH (341 LPH)	120 GPH (454 LPH)
Fuel Port Size	3/8"-18 NPTF (SAE J476)	3/8"-18 NPTF (SAE J476)	3/8"-18 NPTF (SAE J476)	3/8"-18 NPTF (SAE J476)
Total Number of Ports: **(total inlets)** **(total outlets)**	7 4 3	7 4 3	7 4 3	7 4 3
Min. Service Clearance	2.0 in. (5.1 cm)	2.0 in. (5.1 cm)	2.0 in. (5.1 cm)	2.0 in. (5.1 cm)
Center Threads	1"-14	1"-14	1"-14	1"-14
Height	8.5 in. (21.6 cm)	10.2 in. (25.9 cm)	11.2 in. (28.4 cm)	14.1 in. (35.8 cm)
Width	4.5 in. (11.4 cm)	4.5 in. (11.4 cm)	4.5 in. (11.4 cm)	4.5 in. (11.4 cm)
Depth	4.5 in. (11.4 cm)	4.5 in. (11.4 cm)	4.5 in. (11.4 cm)	4.5 in. (11.4 cm)
Weight (dry)	2.4 lb (1.09 kg)	2.6 lb (1.18 kg)	2.7 lb (1.22 kg)	3.9 lb (1.8 kg)
Clean Pressure Drop	0.01 PSI (0.001 bar)	0.05 PSI (0.003 bar)	0.29 PSI (0.02 bar)	2.65 PSI (0.18 bar)
Max. Working Pressure[1]	30 PSI (2.07 bar)	30 PSI (2.07 bar)	30 PSI (2.07 bar)	15 PSI (1.03 bar)
Available Options:[2] **(water sensor)** **(heater)**[3]	 Yes Yes	 Yes Yes	 Yes Yes	 Yes Yes
Bowl Capacity **(water)** **(with heater)**	 4.0 oz. (118 ml) 3.5 oz. (104 ml)	 4.0 oz. (118 ml) 3.5 oz. (104 ml)	 4.0 oz. (118 ml) 3.5 oz. (104 ml)	 2.8 oz. (82 ml) 2.4 oz. (70 ml)
Water Removal Efficiency	99%			
Ambient Temp. Range	-40° to +255°F (-40° to +121°C)			
Max. Fuel Temp.	190°F (88°C)			

1 Pressure installations are applicable up to maximum PSI shown. Vacuum installations are recommended.
2 Do not use with gasoline applications.
3 Maximum power requirements for in-bowl heater option: 12 vdc (200 watt) = 16.6 amps, 24 vdc (200 watt) = 8.3 amps. See section on heater relay kits, if needed.

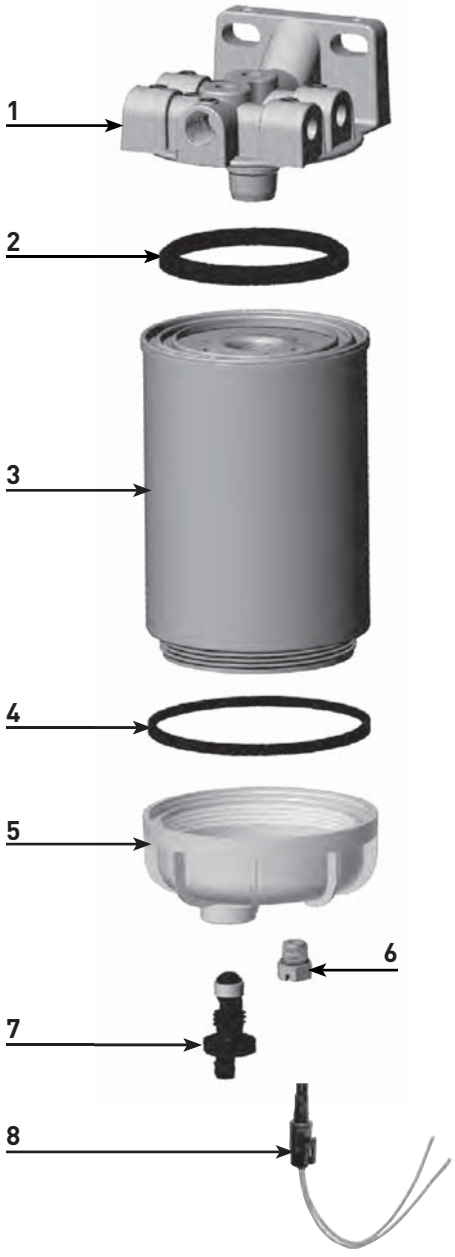
645R, 660R, and 690R Replacement Parts

Part Number	Description	
1. RK 22098	Mounting Head Kit (with 3/8”-18 NPTF fuel ports)	
2. RK22998	Filter Gasket Kit	
3. Replacement Filters		
645R	R45S or R47S	2 micron
	R45T	10 micron
	R45P	30 micron
660R	R60S	2 micron
	R60T	10 micron
	R60P	30 micron
690R	R90S	2 micron
	R90T	10 micron
	R90P	30 micron
4. RK 22333	Bowl Gasket Kit	
5. Replacement Bowl Kits		
RK 21113-13-11	Clear Bowl Kit	
RK 22616-01[1]	Heated Bowl Kit (Clear bowl with 12 vdc heater)	
RK 22616-02[1]	Heated Bowl Kit (Clear bowl with 24 vdc heater)	
6. RK 20126	Bowl Plug Kit (1/2”-20 SAE)	
7. RK 30476	Self-Venting Drain Kit	
8. RK 30964	Water Probe/Sensor Kit	

Additional Parts (not shown)

RK 22323[1]	Heater Connector Kit
01SP-6S	Metal Port Plug (3/8” NPTF)

[1] In-bowl heater may require a Heater Relay Kit.
Maximum power requirements: 12 vdc = 16.6 amps, 24 vdc = 8.3 amps.
Note: Do not use heater in gasoline applications.



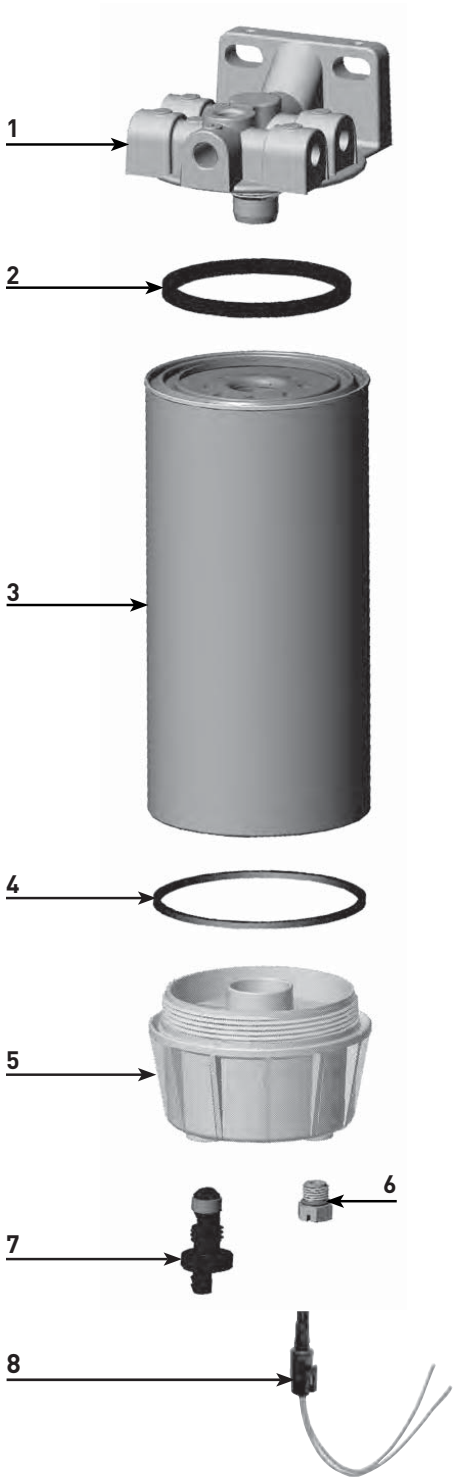
6120R
Replacement Parts

Part Number	Description	
1. RK 22098	Mounting Head Kit (with 3/8”-18 NPTF fuel ports)	
2. RK22998	Filter Gasket Kit	
3. Replacement Filters	R120S	2 micron
	R120T	10 micron
	R120P	30 micron
4. RK 30965	Bowl Gasket Kit	
5. Replacement Bowl Kits		
RK 30063	Clear Bowl Kit	
RK 30900[1]	Heated Bowl Kit (Clear bowl with 12 vdc heater)	
RK 30925[1]	Heated Bowl Kit (Clear bowl with 24 vdc heater)	
6. RK 20126	Plug Kit (1/2”-20 SAE)	
7. RK 30476	Self-Venting Drain Kit	
8. RK 30964	Water Probe/Sensor Kit	

Additional Parts (not shown)

RK 30876[1]	Heater Connector Kit
01SP-6S	Metal Port Plug (3/8” NPTF)

[1] In-bowl heater may require a Heater Relay Kit.
Maximum power requirements: 12 vdc = 16.6 amps, 24 vdc = 8.3 amps.
Note: Do not use heater in gasoline applications.



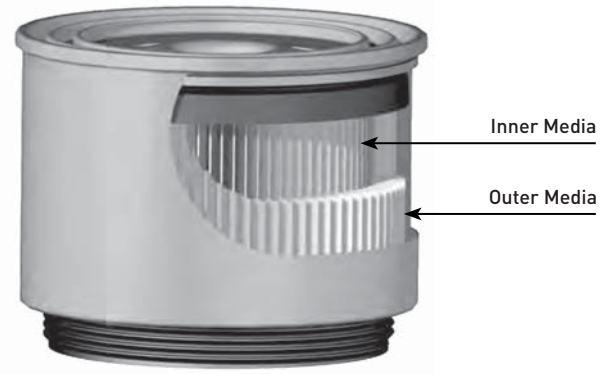
Replacement Filters

Model Number	2 micron (Final Filtration)	10 micron (Secondary Filtration)	30 micron (Primary Filtration)
645R	R45S or R47S	R45T	R45P
660R	R60S	R60T	R60P
690R	R90S	R90T	R90P
6120R	R120S	R120T	R120P

Optional Dual Layer Media Filter

Dual-layer media offers enhanced dirt-holding capacity, extended filter life, and ensures a more complete removal of all size contaminants. The R47S filter replaces the R45S and provides removal efficiencies of 99.98% (nominal) on 2 micron particles, still much greater than the 50-90% efficiency of most single-stage filters.

R47S



Remote Vacuum Gauges

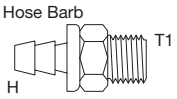
Vacuum gauges are available to monitor filter condition and as the filter slowly becomes clogged with contaminates the restriction (resistance to flow) increases. The fuel pump tries to draw fuel (suction) but because of restriction, less fuel is delivered to engine and instead more air is pulled from it (fuel de-gassing). Results can cause engine to lose power and eventually stall.

By installing a vacuum gauge in the fuel system on the outlet side of the filter, visual monitoring of filter condition is possible.

Specifications	RK 11233	1606B
Description	Silicone dampened, 0-30 inHg. Instrument panel installation.	Includes gauge and two fittings. Instrument panel installation.
Threads	1/4” NPT back bracket mount.	1/4” NPT back bracket mount.
Dimensions	2.0” W x 1.9” D	2.0” W x 1.9” D
Dial	2 in.	2 in.
Weight	0.4 lb (0.2 kg)	0.4 lb (0.2 kg)

Special Notes: For severe vibration applications, mount gauge on stable, remote location and connect using flexible tubing. Additional gauges available - contact your local distributor.

Fittings

Filter Part Number	Description	Hose (H)/ Thread (T)	T1	Part No.
For all models		3/8” 1/2”	3/8” NPT 3/8” NPT	951-N6-H6 951-N6-H8

Note: The T1 side of the fitting threads into the mounting head ports.

Water Probe Kits

Racor offers a wide selection of water probes, each designed for use with particular models and installation requirements. These probes are available in various configurations to fit every Racor filter/ separator. The water probe is only a component in the water detection system and will not work without a Racor electronic detection module.

RK 30880E has an electronic detection module built-in to its design and has the simplest installation procedure. Wiring instructions are supplied with each water detection module.

Specifications	RK 30964	RK 30880E
Threads	1/2”-20 Threads	1/2”-20 Threads
Description	Includes detachable 2-wire connector. Requires a detection module.	Includes detachable 3-wire connector, built-in detection electronics and under-dash warning light. Probe sends ground signal to light.
Voltage	12 or 24 vdc	12 or 24 vdc
Power Draw: ***(12 volt)*** ***(24 volt)***	N/A	5 Milliamps 10 Milliamps
Maximum Load	N/A	1 Amp
Weight	0.02 lb (0.01 kg)	0.4 lb (0.2 kg)

CAUTION! Never wire a water probe directly to voltage or another brand of detection module.

Water Detection Modules

Racor Water Detection Kits are available for under dash, in-dash and remote mount installation. These units may be used with any Racor fuel filter/water separator and water probe. An electric detection module analyzes electrical resistance at the water probe and determines if water is present. Units reset automatically after removing water (unless specified). All water detection module kits include an RK 21069 water probe.

Under Dash Modules

Specifications	RK 12870	RK 12871
Voltage	12 vdc	24 vdc
Features	Light and Buzzer	Same as RK 12870
Description	Lamp illuminates and buzzer sounds when water is detected. Water must be drained to reset light and stop buzzer.	
Dimensions	1.4" H x 1.25" D x 1.4" W	
Power Draw	1 Milliamp	
Max. Internal Load	30 Milliamps	
Weight	0.2 lb (0.1 kg)	

Note: Additional modules available - contact your Racor distributor.

In-Dash Modules

Specifications	RK 20726
Voltage	12 or 24 vdc
Features	Light and Buzzer
Description	Red DRAIN lamp illuminates continuously and buzzer sounds momentarily when water is detected. Power-up self diagnosis feature and circuit protection included.
Dimensions[1]	2.2" Diameter x 3.2" Depth
Power Draw: *(12 volt)* *(24 volt)*	 3 Milliamps 13 Milliamps
Max. Internal Load	30 Milliamps
Weight	0.4 lb (0.2 kg)

[1] Cut 2.0" diameter hole to mount gauges in instrument panel.

Note: Additional modules available - contact your Racor distributor.

Remote Mount Modules

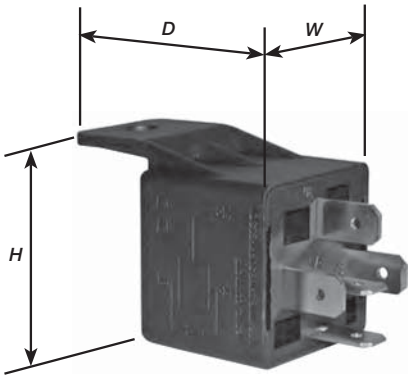
Specifications	RK 14329	RK 14321
Voltage	12 vdc	24 vdc
Features	Sends Hot (+) Signal	Sends Hot (+) Signal
Description	Receives signal from water probe or vacuum switch (not included) then sends a signal to horn or lamp. Must use with relay if power draw is over 1 amp.	Same as RK14329 but sends a 24 vdc hot (+) signal.
Dimensions[1]	0.7" H x 2.5" D x 2.8" W	1.0" H x 1.5" D x 2.0 W
Power Draw:	14 Milliamps	10 Milliamps
Max. Internal Load	30 Milliamps	30 Milliamps
Weight	0.3 lb (0.1 kg)	0.4 lb (0.2 kg)

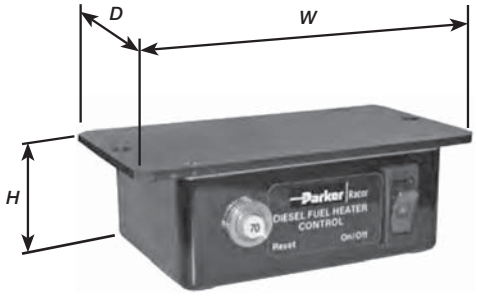
Note: Additional modules available - contact your Racor distributor.

Electrical Heater Relay Kits

CAUTION! Do not use electric heater in gasoline applications. Do not operate heater if no fuel is inside bowl. Ensure the filter is primed with fuel prior to applying power to the heater.

The following relay kits may be necessary when installing Racor Heater Kits due to power demand. Standard OE fuses, wiring and alternators may be unable to carry the load without overheating or shorting, creating a serious condition. Wire/terminal connections should be soldered and crimped.





Specifications	RK 11861	RK 11862	RK 19490-12	RK 19490-24
Description	Heater Relay Kit, Includes fuse and holder.	Heater Relay Kit, Includes fuse and holder.	Heavy-Duty Relay Kit	Heavy-Duty Relay Kit
Voltage	12 vdc	24 vdc	12 vdc	24 vdc
Detection Module	Remote Mount	Remote Mount	Under Dash	Under Dash
Maximum Watts	300	360	600	900
Maximum Amps	25	15	50	37
Dimensions	1.3” H x 1.6” D x 1.1” W	1.3” H x 1.6” D x 1.1” W	1.7” H x 2.9” D x 5.1” W	1.7” H x 2.9” D x 5.1” W
Weight	0.3 lb (0.1 kg)	0.3 lb (0.1 kg)	1.6 lb (0.7 kg)	1.6 lb (0.7 kg)

Caution: If you are uncertain if your electrical system can provide the additional power draw, consult your equipment distributor or qualified electrician.

Limited Warranties Statement

All products manufactured or distributed by Racor are subject to the following, and only the following, LIMITED EXPRESS WARRANTIES, and no others: For a period of one (1) year from and after the date of purchase of a new Racor product, Racor warrants and guarantees only to the original purchaser-user that such a product shall be free from defects of materials and workmanship in the manufacturing process. The warranty period for pumps and motors is specifically limited to ninety (90) days from date of purchase. A product claimed to be defective must be returned to the place of purchase. Racor, at its sole option, shall replace the defective product with a comparable new product or repair the defective product. This express warranty shall be inapplicable to any product not properly installed and properly used by the purchaser-user or to any product damaged or impaired by external forces.

THIS IS THE EXTENT OF WARRANTIES AVAILABLE ON THIS PRODUCT. RACOR SHALL HAVE NO LIABILITY WHATSOEVER FOR CONSEQUENTIAL DAMAGES FLOWING FROM THE USE OF ANY DEFECTIVE PRODUCT OR BY REASON OF THE FAILURE OF ANY PRODUCT. RACOR SPECIFICALLY DISAVOWS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED INCLUDING, WITHOUT LIMITATION, ALL WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE (EXCEPT FOR THOSE WHICH APPLY TO PRODUCT OR PART THEREOF THAT IS USED OR BOUGHT FOR USE PRIMARILY FOR PERSONAL, FAMILY, OR HOUSEHOLD PURPOSES), WARRANTIES OF DESCRIPTION, WARRANTIES OF MERCHANTABILITY, TRADE USAGE OR WARRANTIES OR TRADE USAGE.

Warning

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The following statement is required pursuant to proposition 65, applicable in the State of California: 'This product may contain a chemical known to the State of California to cause cancer or reproductive toxicity'.

March 2012

Parker Racor

ENGINEERING YOUR SUCCESS.

Cleveland Controls
Division of UniControl Inc.

Model AFS–222–112

AIR PRESSURE SENSING SWITCH WITH ADJUSTABLE SET POINT RANGE

APPLICATION

Model AFS-222-112 Air Pressure Sensing Switch is a general purpose proving switch designed for HVAC and Energy Management applications. It may be used to sense positive, negative, or differential air pressure. The AFS-222-112 is equipped with convenient barbed sample line connectors that accept flexible tubing.

GENERAL DESCRIPTION & OPERATION

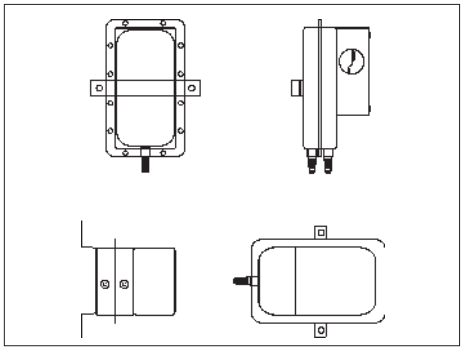
The plated housing contains a diaphragm, a calibration spring and a snap-acting SPDT switch.The barbed sample line connections located on each side of the diaphragm accept flexible tubing.

An enclosure cover guards against accidental contact with the live switch terminal screws and the set point adjusting screw. The enclosure cover will accept a ½" conduit connection.

MOUNTING (SEE FIGURE 1)

Select a mounting location which is free from vibration. The **AFS-222-112** must be mounted with the diaphragm in any vertical plane in order to obtain the lowest specified operating set point. Avoid mounting with the sample line connections in the "up" position. Surface mount via the two 3/16" diameter holes in the integral mounting bracket. The mounting holes are 3-7/8" apart.

(Figure 1)



AIR SAMPLING CONNECTION (SEE FIGURE 2)

The **AFS-222-112** is designed to accept flexible tubing by means of barbed 1/4" slip-on connections. For sample lines of up to 10 feet, ¼" OD tubing is acceptable. For lines up to 20 feet, use ¼" ID tubing. For lines up to 60 feet, use ½" ID tubing. Locate the sampling probe a minimum of 1.5 duct diameters downstream from the air source. Install the sampling probe as close to the center of the airstream as possible. Refer to Figure 2 to identify the high pressure inlet (H) and the low pressure inlet (L). Connect the sample lines as follows:

POSITIVE PRESSURE ONLY: Connect the sample line to inlet H; inlet L remains open to the atmosphere.

NEGATIVE PRESSURE ONLY: Connect the sample line to inlet L; inlet H remains open to the atmosphere.

TWO NEGATIVE SAMPLES: Connect the higher negative sample to inlet L. Connect the lower negative sample to inlet H.

TWO POSITIVE SAMPLES: Connect the higher positive sample to inlet H. Connect the lower positive sample to inlet L.

ONE POSITIVE AND ONE NEGATIVE SAMPLE: Connect the positive sample to inlet H. Connect the negative sample to inlet L.

Cleveland Controls
DIVISION OF UNICONTROL INC.
1111 Brookpark Rd
Cleveland OH 44109

Tel: **216-398-0330**
Fax: **216-398-8558**
Email:**saleshvac@unicontrolinc.com**
Web page: **http://www.clevelandcontrols.com**

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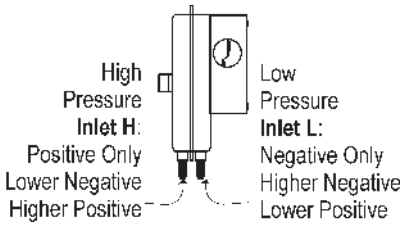
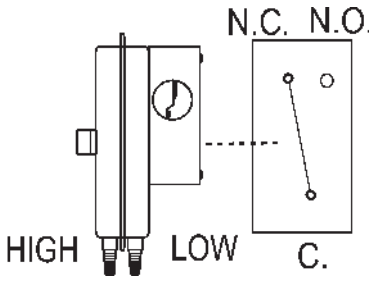
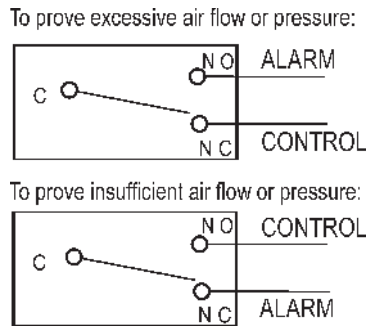
(Figure 2)



(Figure 3)



(Figure 4)



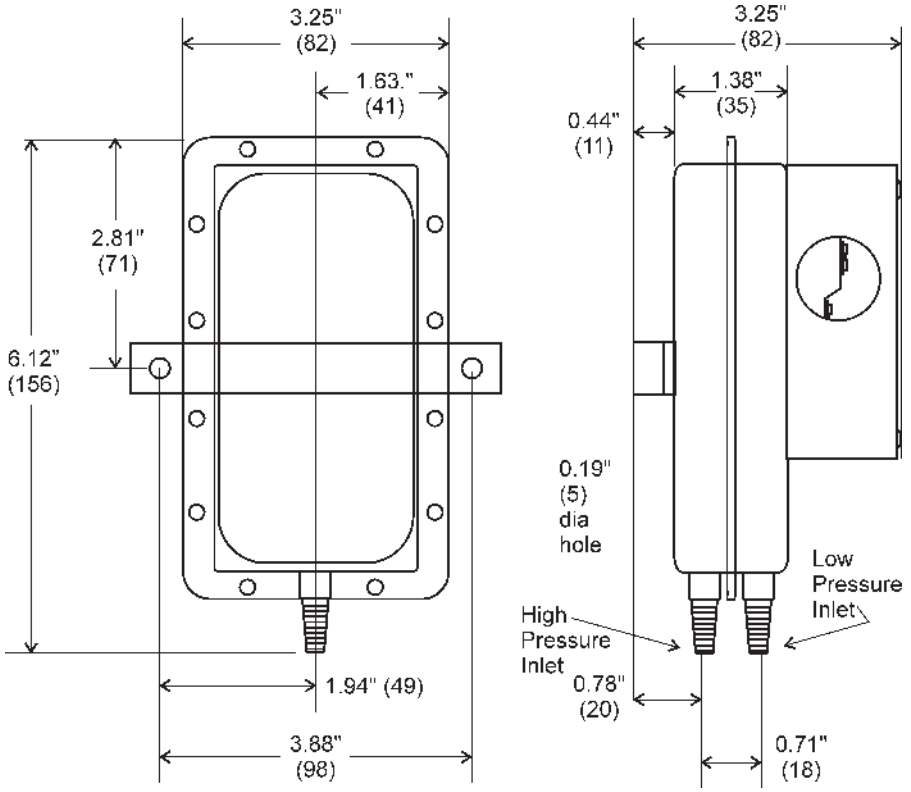
ELECTRICAL CONNECTIONS (SEE FIGURE 3)

Before pressure is applied to the diaphragm, the switch contacts will be in the normally closed (NC) position. The snap switch has screw top terminals with cup washers. Wire alarm and control applications as shown in Figure 4.

FIELD ADJUSTMENT

The adjustment range of an **AFS-222-112** Air Switch is 0.05±.02" w.c. to 12.0" w.c. To adjust the set point, t urn the adjusting screw counterclockwise until motion has stopped. Next, turn the adjusting screw 4 complete turns in a clockwise direction to engage the spring. From this point, the next ten turns will be used for the actual calibration. **Each full turn represents approximately 1.2" w.c.**

Please note: To properly calibrate an air switch, a digital manometer or other measuring device should be used to confirm the actual set point.



Nominal Dimensions in Inches (Millimeters)

SPECIFICATIONS

MODEL AFS-222-112 AIR PRESSURE SENSING SWITCH WITH ADJUSTABLE SET POINT RANGE

Mounting Position: Mount with the diaphragm in any vertical plane.

Set Point Range: 0.05 ± 0.02" w.c. to 12.0"w.c.

Field Adjustable "Operate Range": 0.07"w.c. to 12.0" w.c.

Field Adjustable "Release Range": 0.04"w.c. to 11.2" w.c.

Approximate Switching Differential: Progressive, increasing from 0.02 ± 0.01"w.c. at minimum set point to approximately 0.8 " w.c. at maximum set point.

Measured Media: Air, or combustion by-products that will not degrade silicone.

Maximum Pressure: ½ psi (0.03 bar).

Operating Temperature Range: -40F to 180F (-40 to 82C).

Life: 100,000 cycles minimum at 1/2 psi maximum pressure each cycle and at maximum rated electrical load.

Electrical Rating: 300 VA pilot duty at 115 to 277 VAC, 15 amps noninductive to 277 VAC, 60 Hz.

Contact Arrangement: SPDT.

Electrical Connections: Screw-type terminals with cup washers.

Conduit Opening: 7/8" diameter opening accepts ½" conduit.

Sample Line Connectors: Two barbed ¼" connectors will accept flexible tubing.

Sample Line Connections: Two barbed ¼" connectors will accept flexible tubing.

Approval: UL, FM, CSA, CE

Shipping Weight: 1.2 lbs.

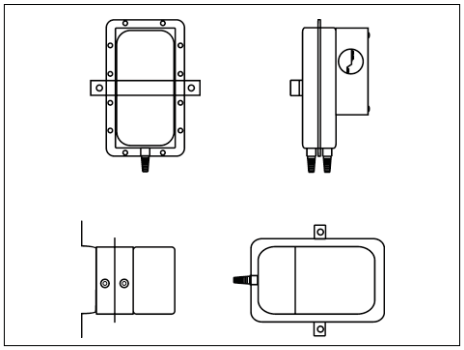
Accessories:

- Sample line probes.
- Orifice plugs (pulsation dampers).

Cleveland Controls – Test Model

Division of UniControl Inc. AFS–222–112

AIR PRESSURE SENSING SWITCH WITH ADJUSTABLE SET POINT RANGE



airstream as possible. Refer to Figure 2 to identify the high pressure inlet (H) and the

TWO POSITIVE SAMPLES: Connect the

Cleveland Controls
DIVISION OF UNICONTROL INC.
1111 Brookpark Rd
Cleveland OH 44109

Tel: **216-398-0330**
Fax: **216-398-8558**
Email:**saleshvac@unicontrolinc.com**
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APPLICATION

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GENERAL DESCRIPTION & OPERATION

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An enclosure cover guards against accidental contact with the live switch terminal screws and the set point adjusting screw. The enclosure cover will accept a ½" conduit connection.

MOUNTING (SEE FIGURE 1)

Select a mounting location which is free

from vibration. The **AFS-222-112** must be mounted with the diaphragm in any vertical plane in order to obtain the lowest specified operating set point. Avoid mounting with the sample line connections in the "up" position. Surface mount via the two 3/16" diameter holes in the integral mounting bracket. The mounting holes are 3-7/8" apart.

(Figure 1)

(SEE FIGURE 2) AIR SAMPLING CONNECTION

The **AFS-222-112** is designed to accept flexible tubing by means of barbed 1/4" slip-on connections. For sample lines of up to 10 feet, ¼" OD tubing is acceptable. For lines up to 20 feet, use ¼" ID tubing. For lines up to 60 feet, use ½" ID tubing. Locate the sampling probe a minimum of 1.5 duct diameters downstream from the air source. Install the sampling probe as close to the center of the

low pressure inlet (L). Connect the sample higher positive sample to inlet H. Connect lines as follows: the lower positive sample to inlet L.

POSITIVE PRESSURE ONLY: Connect the sample line to inlet H; inlet L remains open to the atmosphere.

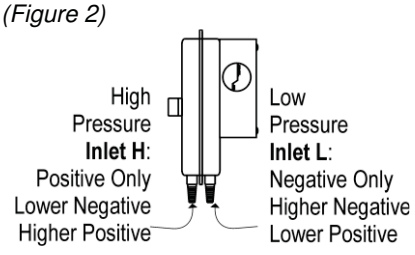
NEGATIVE PRESSURE ONLY: Connect the sample line to inlet L; inlet H remains open to the atmosphere.

TWO NEGATIVE SAMPLES: Connect the higher negative sample to inlet L. Connect

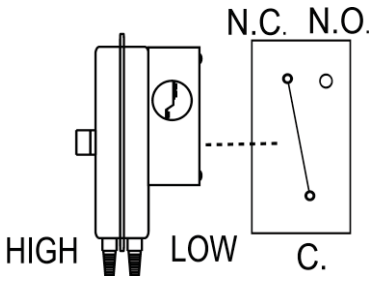
the lower negative sample to inlet H.

ONE POSITIVE AND ONE NEGATIVE SAMPLE: Connect the positive sample to inlet H. Connect the negative sample to inlet L.

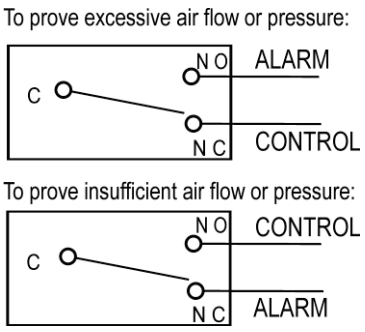
(Figure 2)



(Figure 3)



(Figure 4)



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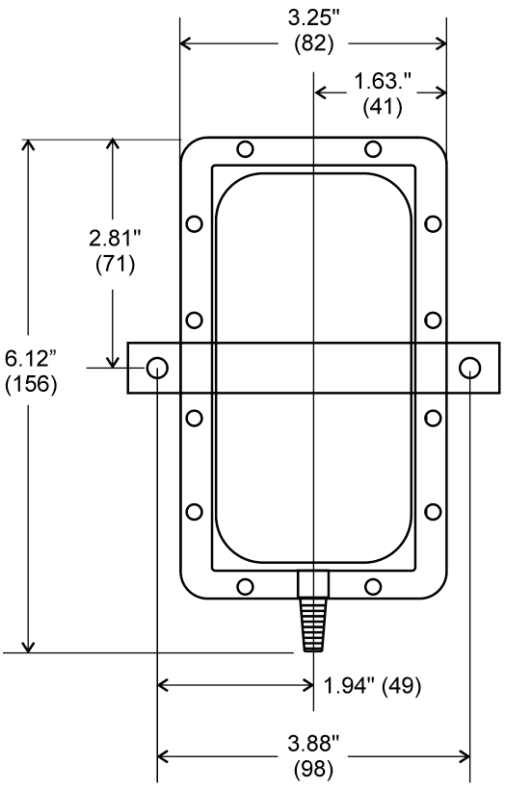

Nominal Dimensions in Inches (Millimeters)

SPECIFICATIONS

MODEL AFS-222-112 AIR PRESSURE SENSING SWITCH WITH ADJUSTABLE SET POINT RANGE

Mounting Position: Mount with the diaphragm in any vertical plane.

Set Point Range: 0.05 ± 0.02" w.c. to
12.0"w.c.

Field Adjustable "Operate Range":
0.07"w.c. to 12.0" w.c.

Field Adjustable "Release Range":
0.04"w.c. to 11.2" w.c.

Approximate Switching Differential:
Progressive, increasing from 0.02 ± 0.01"w.c. at minimum set point to approximately 0.8 " w.c. at maximum set point. **Measured Media:** Air, or combustion byproducts that will not degrade silicone.

Maximum Pressure: ½ psi (0.03 bar). **Operating Temperature Range:**
-40F to 180F (-40 to 82C).

Life: 100,000 cycles minimum at 1/2 psi maximum pressure each cycle and at maximum rated electrical load. **Electrical Rating:**
300 VA pilot duty at 115 to 277 VAC,
15 amps noninductive to 277 VAC, 60 Hz. **Contact Arrangement:** SPDT. **Electrical Connections:** Screw-type terminals with cup washers.

Conduit Opening: 7/8" diameter opening accepts ½" conduit.

Sample Line Connectors: Two barbed
¼" connectors will accept flexible tubing. **Sample Line Connections:** Two barbed
¼" connectors will accept flexible tubing. **Approval:** UL, FM, CSA, CE **Shipping Weight:** 1.2 lbs.

Accessories:

- Sample line probes.
- Orifice plugs (pulsation dampers).

Equipment Source Inc.

1919 Van Horn Rd.
Fairbanks, AK 99701
Ph: (907) 458-9049

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Honeywell

SUPER TRADELINE L4064B
Universal Combination Fan and Limit Controllers

PRODUCT DATA

APPLICATION

The L4064B controls the on and off operation of the heating unit's fan motor and provides high limit control of the main burner. It is suitable for all types of forced air heating systems.

The L4064B's bimetal sensing element turns fan on and off according to plenum temperature.

The L4064B has a manual switch to provide continuous fan operation, mounting adapters for replacing competitive devices, adapters for wiring convenience, and a strain relief bushing for protecting the wiring from damage due to field abuse.

Limit contacts are suitable for line voltage, low voltage or millivoltage circuits.

The fan-on timing can vary depending on applied voltage and switch ambient.

INSTALLATION

When installing this product...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions.

⚠ WARNING

Failure to remove brass jumper, if limit switch is in low voltage circuit, can cause electrical shock hazard or damage low voltage controls.

⚠ CAUTION

1. Disconnect power supply before connecting wiring to prevent electrical shock or equipment damage.
2. When connecting cable or conduit to control, avoid straining the control case.

Follow furnace or burner manufacturer's instructions, if available. The L4064B has a maximum switch temperature of 190°F (88°C), maximum element temperature of 350°F (177°C). Do not exceed these temperatures or the following electrical ratings (amperes):

	120 Vac		240 Vac	
	FAN	LIMIT	FAN	LIMIT
Full Load	14	8	7	4
Locked Rotor	84	48	42	54

Pilot Duty: 2 A at 24 Vac; 0.25 A at 0.25 to 12 Vdc. Maximum Combined Connected Load: 2000 VA. 75°C (167°F) (min.) field wiring required. Wiring must conform to NEC Class 1 requirements.

LOCATION

If this is a replacement installation, locate the L4064 in the same location as the control being replaced. Sensing tube length should be same as old control. If this is a new installation, the element should be installed only by a trained, experienced service technician according to the furnace manufacturer's instructions. The element must not touch any internal part of the furnace.

NOTE:

The electrical rating is at maximum switch temperature of 190°F (88°C). If plenum surface temperature exceeds 190°F (88°C), heat insulating material or a mounting bracket must be used.

MOUNTING

The device may be mounted either on the plenum surface or with a bracket (rigid or swivel).

SURFACE MOUNTING

Hole in plenum should be just large enough to accommodate the 3/4 in. (19.1 mm) diameter element tube, Fig. 1. For adequate clearance, a 13/16 in. (20.6 mm) diameter hole is reccomended.

1. Remove cover by squeezing sides and pulling off. Insert element in plenum and mark location of mounting holes. Make sure the case is snug against the plenum before marking the mounting screws.
2. Punch or drill holes for mounting screws.
3. Place insulation between plenum and case if necessary.
4. Fasten controller securely with mounting screws.

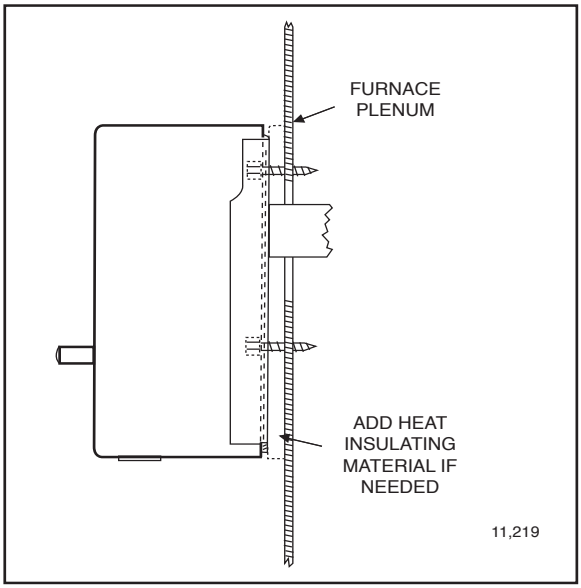

Fig. 1 - Surface mounting requires a hole 13/16 in. (20.6 mm) diameter for element insertion.

SWIVEL MOUNTING

L4064 may also be swivel-mounted. The swivel bracket requires a 1-9/16 in. (39.7 mm) hole in the plenum (Fig. 2).

1. Use bracket as a template to mark the location of mounting holes in plenum. Drill or punch holes for mounting screws.
2. Fasten the brackets in place with furnished screws. Start the screws but do not tighten.
3. Insert element tube through bracket, straighten controller, and fasten. Tighten the mounting screws securely. It may be necessary to rotate the bracket to tighten all screws securely.

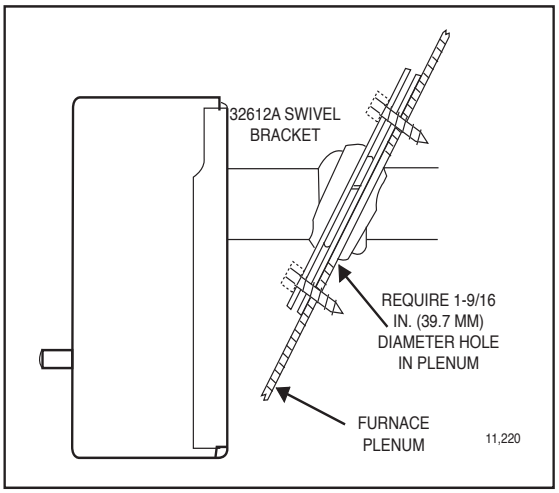

Fig. 2 - Swivel mounting requires a 1-9/16 in. (39.7 mm) diameter mounting hole for element insertion.

RIGID BRACKET MOUNTING

WARNING

When mounting control on bracket, setscrew must strike tube frame *not* sensing element to prevent bypassing the safety limit function.

L4064 may be mounted using a rigid bracket. The rigid bracket requires a hole 13/16 in. (20.6 mm) diameter for element insertion (Fig. 3).

1. Use bracket as a template to mark the location of mounting holes in plenum. Drill or punch holes for mounting screws.
2. Fasten bracket in place with furnished screws. Tighten the screws securely.
3. Insert element tube through bracket, straighten controller and fasten by tightening setscrew. Be sure screw strikes tube frame and does not strike sensing element.
4. For replacement installations with existing 1 in. (25.4 mm) diameter hole. SUPER TRADELINE models are supplied with split steel bushings and wire snap ring. Follow the instructions below for using the steel bushing adapter.

STEEL BUSHING ADAPTER

1. Insert one-half of the split steel bushing (Fig. 4), through the wire ring. It may be necessary to spread the ring slightly.
2. Insert the other half of the steel bushing into the ring making sure tabs and ears are at the same ends.
3. Place bushing assembly on element, ear end first.
4. Holding bushing at seams, push firmly to the control end of element.
5. Insert element tube with adapter through bracket, straighten controller and fasten. Tighten setscrew. Be sure screw strikes bushing not coiled bimetal sensing element.

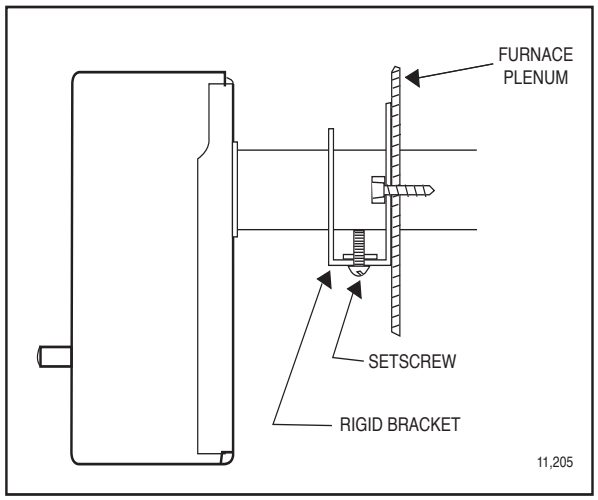

Fig. 3 - Rigid bracket mounting requires a hole 13/16 in. (20.6 mm) diameter for element insertion.

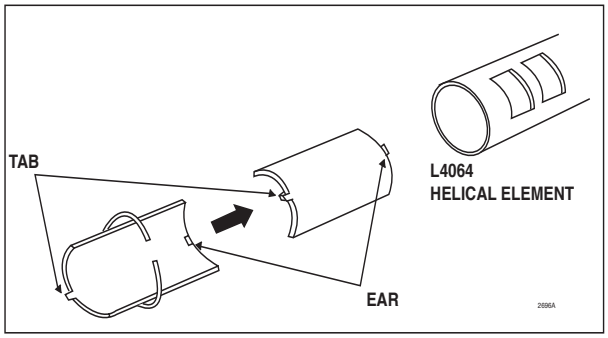

Fig. 4 - Using SUPER TRADELINE adapter.

WIRING

Disconnect power supply before beginning installation to prevent electrical shock or equipment damage.

All wiring must comply with local electrical codes and ordinances or in the absence of local codes with the National Electrical Code ANSI C1-1981-NFPA 70. Follow burner or furnace manufacturer's instructions if available; otherwise, see Fig. 10 and proceed as follows.

IMPORTANT

The brass jumper is the breakaway type. It must be removed when the limit is used in the low voltage circuit. To remove jumper, break with a needlenose pliers and remove completely, Once removed, it is not replaceable. See Fig. 8 for location.

The slotted knockouts on the bottom of the case and the strain relief bushing are provided to simplify the installation procedure and to protect the wires.

1. To remove the slotted knockout(s), use a needlenose pliers as shown in Fig. 5 and pull straight down.
2. If cable is used, we recommend using a strain relief bushing in the knockout (Fig. 6). Pass the wires through bushing before connecting.

Fig. 5 - Removing slotted knockouts.

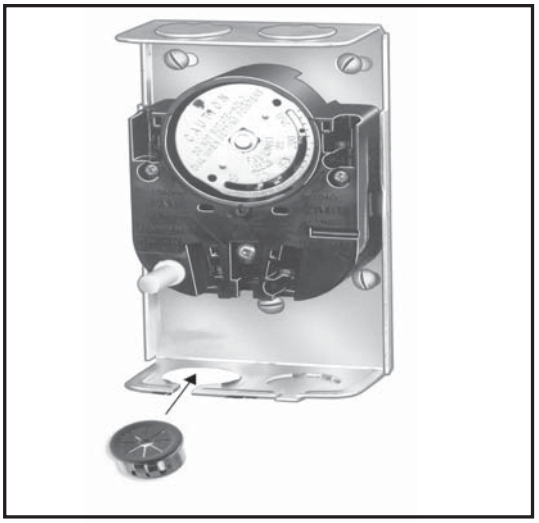

Fig. 6 - Insert strain relief bushing.

3. Refer to the following section for type of wiring connections (standard wire push-in terminals or female receptacle).

WIRING CONNECTIONS

When connecting cable or conduit to this controller, use care to avoid strain on the control case. Connections can be made to standard wire push-in terminals or female receptacles for 1/4 in. (6.4 mm) male flag connectors on both the fan and limit switches (Fig. 8).

FOR STANDARD WIRE PUSH-IN TERMINALS

Connect wires to the terminals as follows:

1. Use Nos. 14,16, or 18 solid wire or Nos. 14 or 16 stranded wire, depending on electrical requirement.
2. Strip insulation from wires the distance shown by the strip gauge on the controller.
3. Solid wire may be inserted directly into the terminal holes. If stranded wire is used, insert a small screwdriver into the slot next to the terminal. Push screwdriver in and hold while inserting wire into terminal (Fig. 8). Remove screwdriver. If stranded wire is solder-dipped, it can be pushed directly into terminal holes.

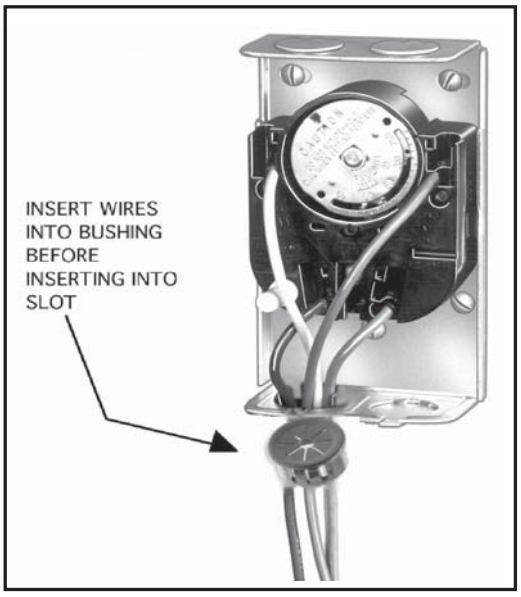

Fig. 7 - Closing the strain relief bushing.

FOR FEMALE RECEPTACLES -

It is recommended that the female receptacles be used for wiring accessory equipment; i.e., electronic air cleaner, humidifier, etc.

Connect wires to the receptacles as follows:

1. Use Nos. 14 to 18 size wire, depending on electrical requirement.
2. Attach 1/4 in. (6.4 mm) male flag connector to each wire. Two male connectors with leadwires are supplied.
3. Push male flag connector directly into the female receptacle. Make sure that the flag is forced to the bottom of cavity and wire is in the channel (Fig. 8).

IMPORTANT

Make certain all wires are clear of rotating scaleplate.

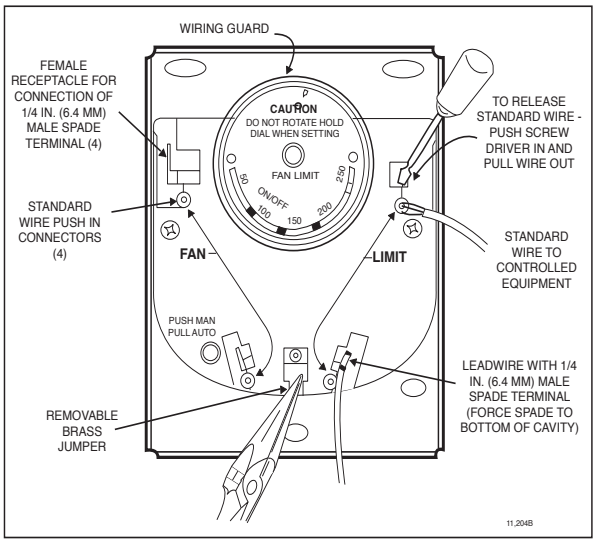

Fig. 8 - Location of wiring connections.

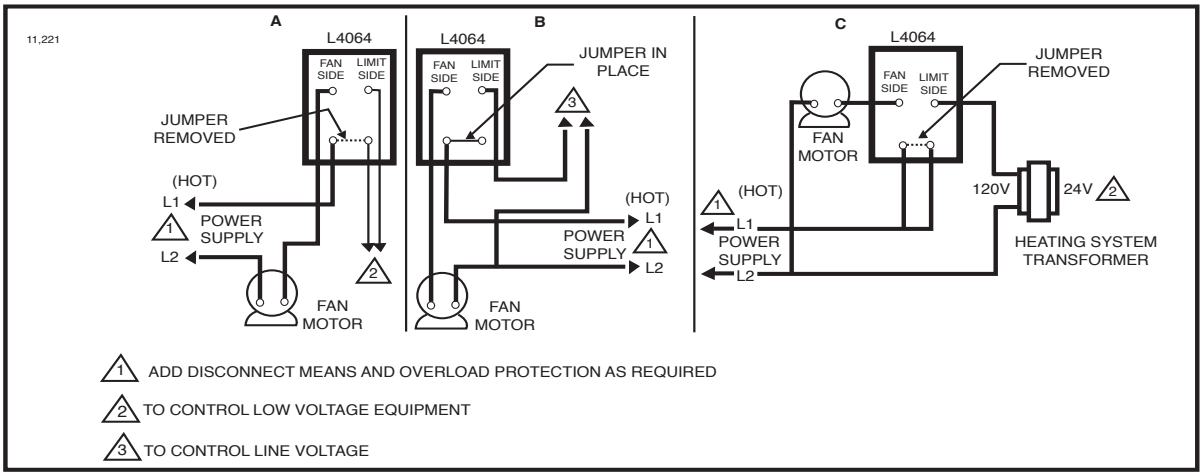

Fig. 9 - A: Limit in low voltage circuit.
B: Limit in line voltage circuit.
C: Limit in line voltage circuit without jumper.

SETTINGS AND ADJUSTMENTS

⚠ CAUTION

When adjusting the fan and limit set point levers (Fig. 10), hold the scalepale dial to keep it from turning and straining the sensing element.
Move each indicator lever to the control point recommended by the burner or furnace manufacturer. Use gentle finger pressure.

FAN SETTING ADJUSTMENT

1. Move the FAN OFF lever to the temperature at which the fan is to stop to prevent circulation of cool air.
2. L4064B - Move the FAN ON lever to the temperature at which the fan is to come on.

MANUAL FAN SWITCH

For constant fan operation, push the FAN switch button in. For fan to cycle automatically, pull button out.

LIMIT SETTING ADJUSTMENT

These controllers have a limit stop which prevents the limit indicator lever from being adjusted beyond the equipment manufacturer's specifications.

1. Push the small end of Limit Adjust Tool (196722) through hole in scaleplate (located at caution marking) to depress the stop disc not more than 1/16 in. (1.6 mm) to release stop lock (Fig. 10). Stop disc is on back of scaleplate.
2. While depressing the stop disc, insert the long end of Limit Adjust Tool next to limit stop (Fig. 10) and move the stop to desired setting. *If the L4064 is a replacement control, high limit stop setting should be the same as that of the control being replaced.* (Move stop clockwise ↷ to lower the setting, counterclockwise ↶ to raise it.) Then remove the limit stop adjust tool.
3. Set the LIMIT OFF lever to the temperature at which the high limit switch is to open to stop the burner. If the high limit stop has been properly set, the LIMIT OFF lever should be as high as the stop permits.

OPERATION

As the plenum temperature rises, the bimetal sensing element of the control wraps and mechanically makes the fan contacts (at the FAN ON temperature setting). During normal operation, the call for heat end before the LIMIT setting is reached, and the fan contacts break as the plenum temperature falls and the FAN OFF setting is reached.

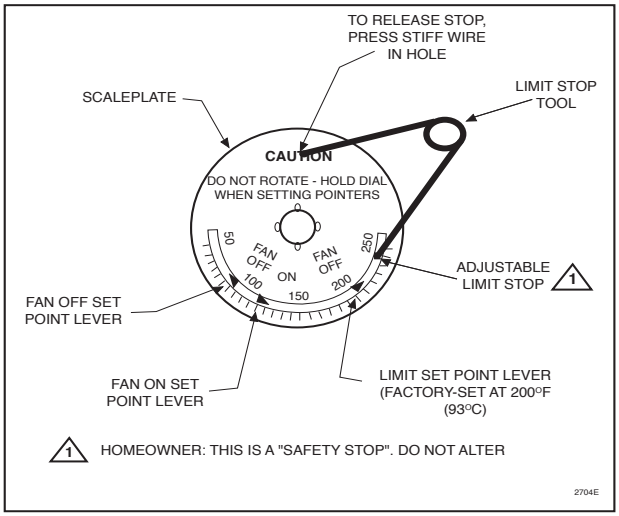

Fig. 10 - Changing the high limit stop.

If the call for heat continues until the temperature in the plenum rises to the LIMIT setting, the bimetal element will mechanically break the limit contacts and de-energize the gas control circuit.

CHECKOUT

When installation is complete, disconnect the fan motor circuit at the L4064. Turn on power and set thermostat to call for heat. Burner should come on and limit controller should shut burner off when plenum temperature reaches the limit set point. Turn off power, recconnect the fan switch, turn on power and again set thermostat to call for heat. Fan should come on when plenum temperature has reached fan-on setting.

Automation and Control Solutions
Honeywell International Inc.
1985 Douglas Drive North
Golden Valley, MN, 55422
www.honeywell.com/building/components
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69-0117-3

Honeywell

A19 Series Temperature Controls -- Single-Pole, Single-Throw and Single-Pole, Double-Throw Models with NEMA 1 Enclosure

Application

These controls are designed to cover a broad range of general purpose operating temperature control applications in the refrigeration, air conditioning and heating field with a minimum number of models. Typical applications are: frozen food cases, display cases, beverage coolers, milk coolers, etc. Various control ranges are available.

Controls are supplied with an adjustable range (except models with factory sealed settings) and adjustable or nonadjustable differential.

All Series A19 temperature controls are designed for use *only* as operating controls. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (alarm, supervisory systems) that protect against, or warn of, control failure.

Installation

Follow equipment manufacturer's instructions if provided. If instructions are not provided proceed as follows:

Mounting

Controls are normally mounted to a surface through holes in back of case.

⚠ CAUTION: On rough mounting surfaces use the top two mounting holes only. When these controls are mounted on an uneven surface using screws in all four holes, the case can be twisted enough to affect the control's calibration and operation.

For closed tank applications without well assembly Part No. FTG13A-600R packing nut assembly may be supplied. See Fig. 2 for sequence of installation. Put parts over support tube section of element, placing bulb into tank. Tighten 1/2 in. NPT adapter. Screw packing nut into adapter with the retaining washers and packing in place as shown.

To install models supplied with bulb well, first install bulb well into tank. Remove bushing from bulb well and slide bushing over capillary. Replace bushing into bulb well. Push bulb into position in bottom of well. Tighten set screw in end of adapter to hold bulb in position. See Fig. 3 for bulb well illustration.

⚠ CAUTION: Do not dent or deform the sensitive bulb of this control. A dent or deformation will change the calibration and cause the control to cycle at a temperature lower than the dial setting. When the bulb mounting clip is used to mount the bulb near the refrigerant tubing, be sure the sheet metal screw does not pierce the tubing.

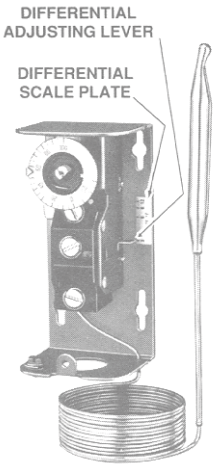

Fig. 1 -- An A19 with external range adjustment and screwdriver slot.

Adjustments

The A19 temperature controls may be supplied with an external range adjustment and screwdriver slot as shown in Fig. 1, range adjustment knob or solid cover. Solid cover models with calibrated dial are adjusted by removing the cover and moving dial so the desired setting is in line with the dial pointer on the stop bracket. (See Fig. 5.) Convertible adjustment models can be field converted from concealed screwdriver slot adjustment to knob adjustment or external screwdriver slot adjustment. They are supplied with a snap-in plug in the cover to provide concealed screwdriver slot adjustment. For knob adjustment remove the snap-in plug and press the knob onto the slotted shaft. For external screwdriver slot adjustment remove the snap-in plug. The convertible adjustment models with remote bulb include a bulb mounting clip.

Code No. LIT-121015
Part No. 997-349

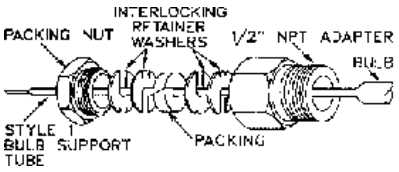

Fig. 2 -- Part No. FTG13A-600R packing nut assembly. (Used with swaged bulb with support tube for direct immersion application.)

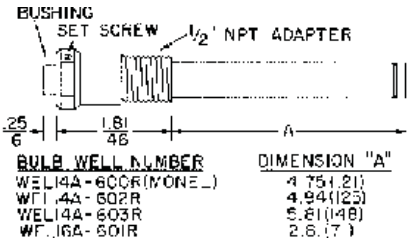

Fig. 3 -- Bulb well for liquid immersion applications where a temperature bulb may be removed without draining tank.

Dial settings normally indicate the cutout setting unless otherwise specified by the equipment manufacturer. Models with SPDT contacts are normally set so the red (common) to yellow contacts open at the dial setting.

Models with adjustable differential and ranges of 20/80°F (-5/28°C), -30/50°F (-35/10°C) and -30/100°F (-35/40°C) have a differential scale plate showing increments of differential. Other ranges have a scale plate with a multiplier. For example when "MIN" differential is 5F° (2.8C°) then x2 is 10F° (5.6C°), x3 is 15F° (8.3C°), etc. The controls are supplied with adjusting lever at minimum differential stamped on the control. To adjust move the lever to the differential required.

Low cutout or high cutout stop supplied on certain models (specified by the equipment manufacturer).

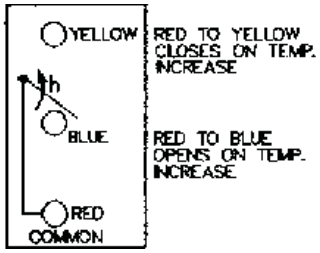

Fig. 4 -- Terminal arrangement of SPDT models.

If high or low cutout stop adjustment is required proceed as follows:

1. Set dial to temperature at which stop is desired.
2. Remove cover of the control.
3. Loosen the cutout stop screw, slide the screw to the front of the temperature control against the plastic step behind the dial and tighten the screw. (See Fig. 5.) Sometimes an exact stop setting is not possible and stop must be set to the closest stop corresponding to dial setting required.
4. Replace cover.

Wiring

> ⚠ CAUTION: Disconnect power supply before wiring connections are made to avoid possible electrical shock or damage to equipment.

All wiring should conform to the National Electrical Code and local codes. Single-pole, double-throw models should be wired as shown in Fig. 4. Use copper conductor only.

> ⚠ CAUTION: Use terminal screws furnished (8-32 × 1/4 in. binder head). Substitution of other screws may cause problems in making proper connections.

Checkout Procedure

Before applying power, make sure installation and wiring connections are according to job specifications. After the necessary mechanical adjustment and electrical connections have been made, an operational checkout is recommended.

Adjust the control setpoint to put the system in operation and observe at least three complete operating cycles to be sure that all components are functioning correctly.

If the system fails to operate, recheck the wiring and components.

Repairs and Replacement

Field repairs must not be made. For a replacement control contact the nearest Johnson Controls representative.

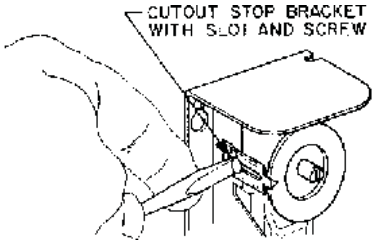

Fig. 5 -- All models have a screw type cutout stop. The stop screw must be loosened and moved to the stop setting desired. Tighten screw after setting is made.

JOHNSON CONTROLS

Controls Group
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53202

Printed in U.S.A.

Equipment Source Inc.

1919 Van Horn Rd.
Fairbanks, AK 99701
Ph: (907) 458-9049

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NOTES: