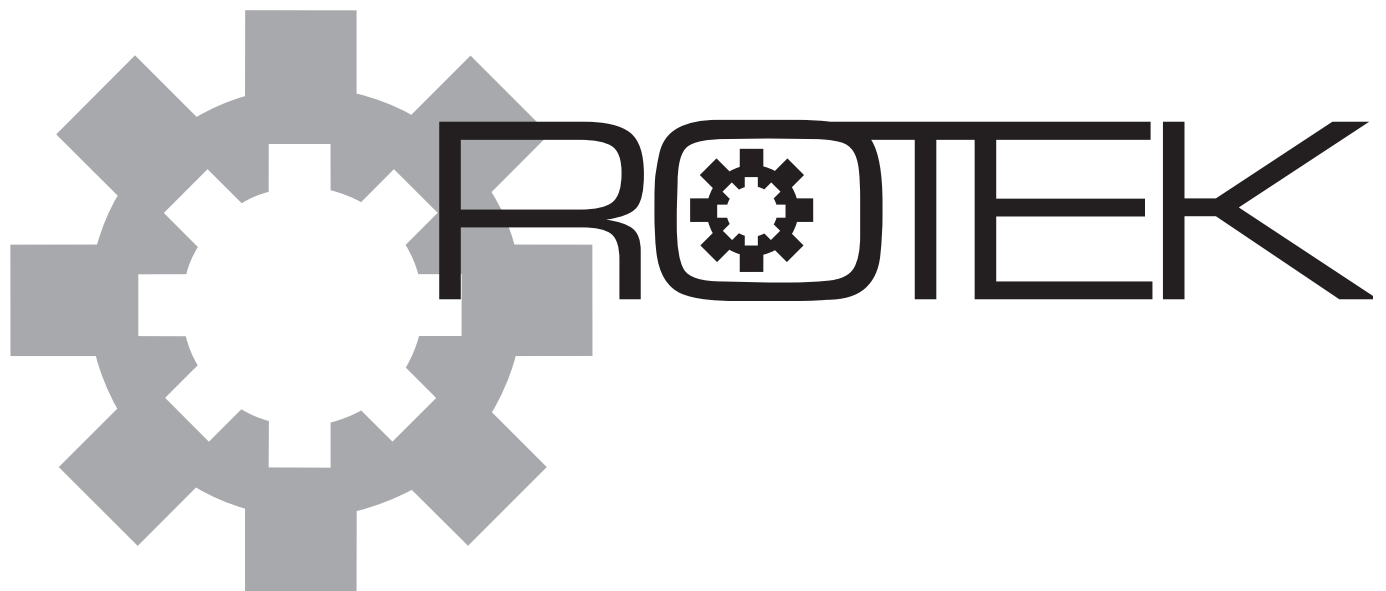
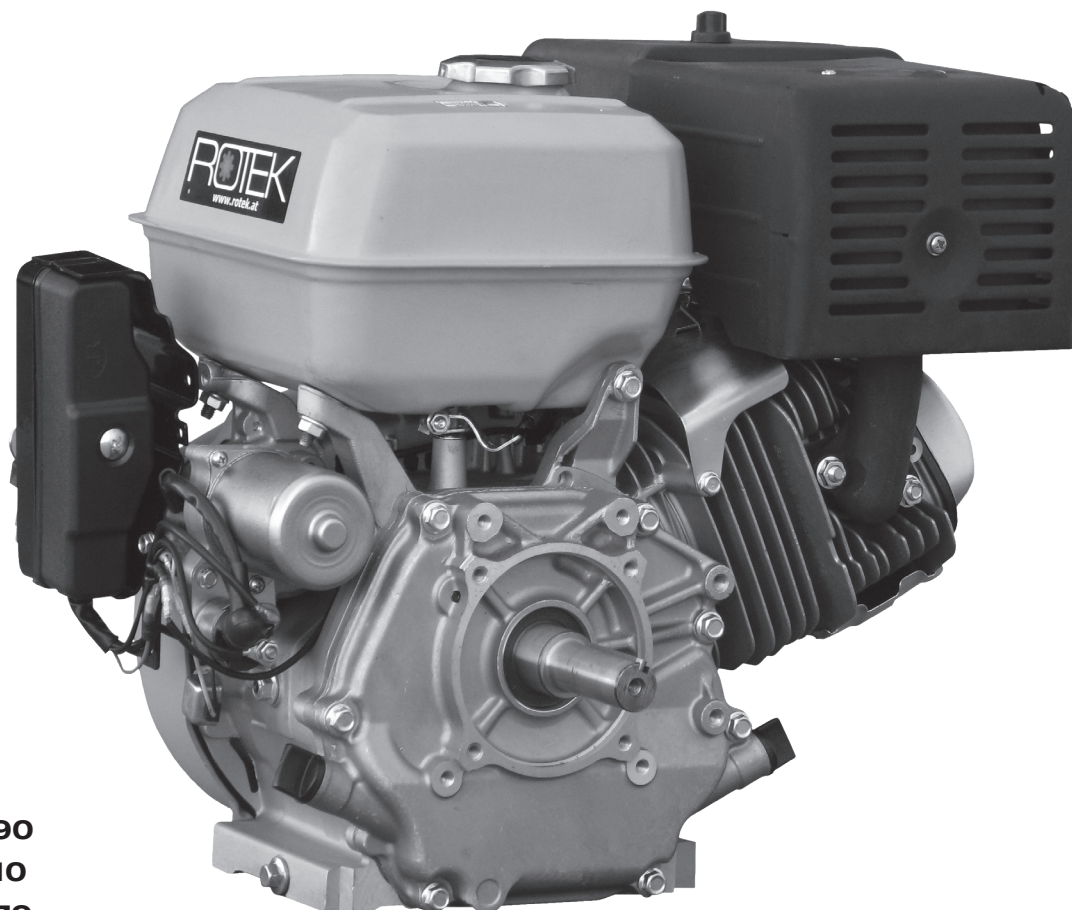




Air-cooled single cylinder gasoline engine EG4-series

User- and maintenance manual

LT1501, effective August 2015



EG4-0090
EG4-0210
EG4-0270
EG4-0420

Introduction

Dear Customer,

Please take time to read this manual carefully and thoroughly. It is important to know about the instructions for correct installation of your device, its components as well as proper and safe handling, before putting it into operation.

This manual should be kept close to your device, to use it as a reference if necessary and, if the device is sold on, to hand it on to subsequent owners.

Operation and maintenance of this device involves dangers, which are explained via symbols in this manual. The following symbols are used in this text. Please read these instructions very carefully.



Security precaution

Dangers are marked by this symbol.



General advice

User advice is marked by this symbol.

We worked on the contents of this handbook to make sure your device fits the described device. However, differences cannot be ruled out so that we do not guarantee entire congruence of device and manual. The information in this handbook is constantly reviewed and updated when necessary. Corrected versions are available on our website. Should questions come up about the device or its proper handling, please contact us before installing or using it.

All pictures are used as symbols and may not look exactly the same as your device. Technical changes, errors and misprints reserved.



Damage done to the device due to ignorance of the instructions in this manual will not be covered by its warranty. We assume no liability over damage caused by wrong handling.

This manual may not be reproduced in any form, neither partially nor completely, using any electronic or mechanical means whatsoever, without permission in written form by Rotek. Ignoring this is a violation of copyright laws and will be prosecuted. All rights, particularly the right of reproduction, reserved.



Inspection of delivered products

After receiving the device, it is recommended to check whether the goods correspond to the components mentioned in the order, waybill or delivery note. Remove the packaging carefully to make sure no damage is done to the device. Furthermore, make sure to check the device for any transport damage. If the delivery is incomplete or flawed, do not hesitate to contact your retailer.

Index

1. Safety Instructions	4	6. Maintenance	14
1.1. Equipment	4	6.1. Instructions about maintenance	14
1.2. Risks from noise development	4	6.2. Precautions	14
1.3. Risks posed by moving parts	4	6.3. Starter battery	14
1.4. Risks posed by gas emissions	4	6.4. Cleaning the crankcase	14
1.5. Risks posed by fuel	4	6.5. Upkeep	14
1.6. Risks posed by high temperatures	4	6.5.1. Changing the engine oil	14
1.7. Risks posed by exhaust gas	4	6.5.2. Check the ignition (spark)	14
1.8. Maintenance intervals	4	6.5.2.1. Spark plug chart	15
1.9. Disposal of toxic waste	4	6.5.2.2. Appearance of the spark plugs	15
2. Transportation and storage	5	6.5.2.3. Solving ignition problems	16
2.1. Transportation for assembly	5	6.5.2.4. Starter malfunction	16
2.2. Storage as new device	5	6.5.2.5. Battery does not charge	16
2.3. Storage after the device has been used	5	6.5.2.6. Circuit diagram - version "H"	17
2.3.1. Downtime for up to 2 weeks	5	6.5.2.7. Circuit diagram - version "E"	17
2.3.2. Downtime for up to 3 months	5	6.5.3. Fuel Supply	17
2.3.3. Downtime for up to 6 months	5	6.5.3.1. Cleaning the carburetor	18
2.3.4. Downtime for more than 6 months	5	6.5.4. Cleaning and exchanging the air filter	18
3. Specification	6	6.5.5. Proper timing/adjusting the valves	18
3.1. Technical data	6	6.5.6. Speed setting	19
3.2. Performance curves	7	6.5.7. Governing behaviour	19
3.3. Flange and shaft measurements	8	6.5.8. Muffler and colours of exhaust fumes	19
4. Installation	9	6.5.9. Other	20
4.1. Preparation	9	6.5.10. Engine torque and measured values	20
4.2. State of installation site	9	6.6. Possible errors and their solutions	21
4.2.1. In- and outtake Ventilation	9	6.7. Maintenance intervals	22
4.3. Motor mounting	9	7. Appendix	23
4.4. Exhaust gas system	9	7.1. Warranty conditions	23
4.4.1. Mounting the muffler	9	7.2. Declaration of conformity	23
4.4.2. Information about other exhaust gas systems	9		
4.5. Fuel System	9		
4.6. Coupling	10		
4.6.1. Maximum axial and radial load	10		
4.6.2. Balancing	10		
4.6.3. Direct coupling	10		
4.6.4. Operating with a pulley	10		
4.7. Concluding mechanical installation instructions	11		
4.8. Mounting the oil-sensor controller	11		
4.9. Electrical Assembly (only for "E" version)	11		
4.9.1. Electrical connection (chords)	11		
4.9.2. Starter battery	11		
4.9.3. Mounting of optional Startbox	11		
5. Usage	12		
5.1. Illustration	12		
5.2. Information about engine performance	13		
5.3. Information about starter battery (optional)	13		
5.4. Check-ups before every start-up	13		
5.4.1. Engine oil	13		
5.4.2. Fuel	13		
5.4.3. Other check-ups	13		
5.5. Start-up	13		
5.5.1. Special information about initial start-up	13		
5.5.2. Starting the engine	13		
5.5.2.1. Hand start (all versions)	13		
5.5.2.2. Electric start (only motor version "E")	13		
5.5.3. Stopping the engine	13		

1. Safety Instructions



The guidelines in this manual have to be added to the valid local legal requirements and technical standards. They do not replace any standards or additional (also legal) regulations, which were adopted as safety measures.

1.1. Equipment



Always wear tight-fitting clothes during maintenance and make sure their ends are closed with elastic bands.



When working on the device always wear safety shoes, gloves, a helmet and hearing protection in accordance with the applicable regulations to avoid accidents at work.



Make sure that a first aid kit and a working fire extinguisher are close by before starting to work on the device.

1.2. Risks from noise development



The operating noise of the motor can cause damage to your hearing. Do not linger around a running engine and always wear ear protection.



The engine must never be operated without a muffler.



Make sure that all legal regulations relating to the local noise level are obeyed before starting up the device.

1.3. Risks posed by moving parts



Never perform work on moving parts.



The engine must never be put into operation when the protective covers are open or loose.



Never approach the machine in operation wearing ties, scarves, bracelets etc. These could get caught on moving parts and cause serious injuries.

1.4. Risks posed by gas emissions

To avoid the risks posed by dangerous gases:



Make sure that the location of the unit is well ventilated (in emergencies using a forced ventilation system)



Avoid inhaling dangerous gases (by wearing breathing protection)



Verify that there are no hazardous gases present at the installation site.

1.5. Risks posed by fuel



It is necessary to shut down the engine during refuelling. Let the device cool down for at least 5 minutes before refuelling.



Do not smoke in close proximity to the device, keep it away from fire and ignition sources. Gasoline is flammable and poisonous! Moreover, lead acid batteries develop explosive gases when charging and discharging.



Never spill fuel onto the engine or the muffler when refuelling.



Never put the engine in operation when there are apparent leaks in the lines supplying oil or gasoline.



Never spill gasoline or oil. Do not inhale fumes, do not swallow and avoid skin contact. After swallowing any amount of gasoline or oil, immediate medical attention is required! Do not attempt to vomit after swallowing!



Should fuel spill over your skin or clothes immediately rinse with soap and water, and change your clothes.



Always keep the floor on the site of the device clean – spilt oil or gasoline should be removed as soon as possible.



When using an additional external tank make sure it is installed and connected in accordance with the valid standards and regulations.

1.6. Risks posed by high temperatures



The engine must only be used in places where no untrained people, passers-by or children are at risk.



Children are not allowed to stay in close proximity to the engine.



Never store combustible or flammable substances (gasoline, oil, paper, wood chips etc.) in the vicinity of the device.



Note that gasoline, oil, engine and exhaust pipe are hot after operation – avoid skin contact – there is a risk of burning or scalding.



Always keep a minimum safety distance of 1 meter to walls or similar structures to avoid overheating the engine.



Never cover the engine during operation – there is a risk of overheating!

1.7. Risks posed by exhaust gas



The engine must not be used in poorly ventilated areas (such as enclosed spaces, tunnels, containers), unless those installations were expressly approved by ROTEK.



Exhaust gases are toxic. They can cause loss of consciousness or even death. When using the device in closed or partially closed spaces, make sure that the exhaust gases are led outside by means of a leak-free line. Regard the maximum permitted exhaust back pressure in order to prevent the motor from overheating. Make sure that the exhaust adaption (muffler, pipe) is free from combustible materials and that the escaping gases do not pose a threat. Observe the pertinent standards and regulations at all times.

1.8. Maintenance intervals



If the mandatory maintenance intervals were not complied with it is forbidden to start the engine – vapours of unspent fuel (developed by incorrectly adjusted valves for example) are explosive!



Never start the engine without an air filter – the engine could be damaged.



Only original spare parts may be used in the course of maintenance. The only exception are standardised parts (such as ball bearing, screws, nuts, etc.) which match the specifics of the original part.

1.9. Disposal of toxic waste



The incorrect disposal of toxic waste poses a threat to the environment and is prohibited by law. Hazardous wastes include: lubricants, fuels, filters and batteries.



Collect poisonous liquids in suitable sealed containers.

2. Transportation and storage

2.1 Transportation for assembly



Incorrect handling can cause serious damage to the device!

You can pick up the device using the motor base plate (using nooses) and move it.



Pay attention that the lifting point is not located in the centre of the device.



Persons have to keep a safety distance during lifting operation.



Make sure that the lifting gear and the supporting construction is suited to carry the weight of the device.

Please also consider following points:

- All used lifting means must be in good order.
- The loading capacity must be suited to the weight of the load.
- Wrong movements can cause personal injury or serious damage to the device.
- Make sure nobody is in the vicinity of the hanging motor.
- When picking up the device vertically it is important to position the lifting point exactly into the focal point. Additionally guide rope should be used.
- It is forbidden to pick up the device outside in unsafe weather conditions (i.e. strong wind, storms).
- Always put down the engine carefully onto an even surface that suits the weight of the device.

2.2. Storage as new device

- If the device is not used instantly, the engine has to be stored at a safe, clean, dry and vibration free location.
- If gasoline or motor oil were already filled into the motor, drain them and clean the fuel tank if necessary.
- Should there be a starter battery included in your order (which is not the default), please consider following points:



Make sure to disconnect the minus (-) pole first and the plus (+) pole second. During assembly the plus (+) pole is connected first, the minus (-) pole second.



When storing batteries without battery loader make sure the temperature of your storage room is at 20°C. Do not forget to charge the battery every 3 months. The self-drain can significantly shorten your battery's lifespan.

- The ball bearings does not have to be cared for when the device is in storage.

2.3. Storage after the device has been used

2.3.1. Downtime for up to 2 weeks

There are no specific precautions necessary for a downtime up to 2 weeks.

2.3.2. Downtime for up to 3 months

It is recommended to drain the float chamber or to use a suitable gasoline replacement - see the explanation under 2.3.3.



Alternatively the fuel cock can be closed during the last usage. Let the motor run until it stalls. Note whether this is possible/desirable with the load attached to the motor.

2.3.3. Downtime for up to 6 months

- Clean the outside of the engine.
- Drain the float chamber or use a suitable gasoline replacement.
- Drain the fuel tank and clean it or use a suitable gasoline replacement.



Gasoline is only durable for a certain amount of time. The flammable substances evaporate quickly and the fuel might not be fit to be used. That is why the carburetor must be emptied by running the engine with closed fuel-cock until it stalls or by draining the float chamber of the carburetor. The fuel tank must be drained as well. If you wish to do so you can use also a special kind of gasoline replacement which is storable for longer periods (e.g. ASPEN®, HUSQVARNA XP, ...)

2.3.4. Downtime for more than 6 months

- Do the earlier service instructed by the motor operation hour maintenance chart (e.g. after 120 operation hours the 200 hour service should be executed).
- Start the engine and let it get to operating temperature (about 5 minutes of running the engine).
- Stop the motor.
- Drain the lubricating oil using the drain plug.
- Drain carburetor and fuel tank, clean the tank if necessary.
- Maybe disconnect the battery and take it out of the device. If available, connect it to a battery loader.



Consider during disassembly the minus (-) pole is disconnected first and the plus (+) pole second. During assembly the plus (+) pole is connected first, the minus (-) pole second.



When storing batteries without battery loader make sure that the temperature of your storage room is at +20°C. Do not forget to charge the battery every 3 months. The self-drain can significantly shorten your battery's lifespan.

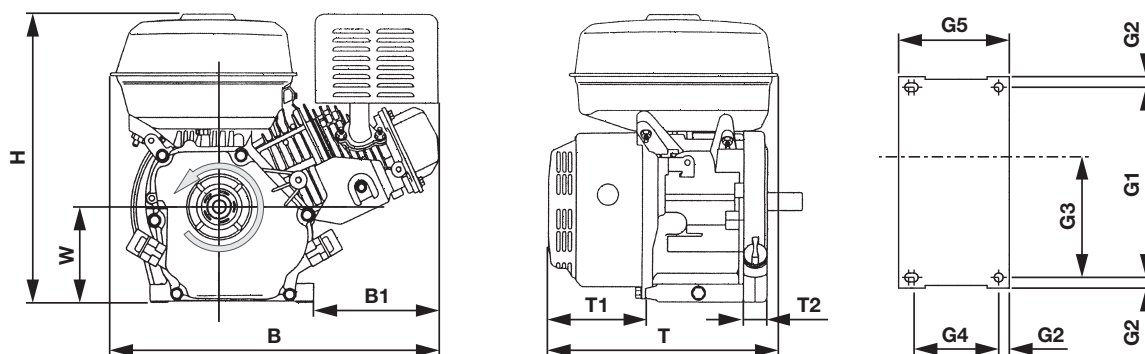
- Clean the device and conserve it with oil mist.
- Keep the device as dry as possible. If this is not an option remove air filter, exhaust pipe, starter and dynamo must be protected from moisture (either by disassembling them or by wrapping the device in shrinking foil).



To put the device back into operation follow the instructions for the initial start-up.

3. Specification

3.1. Technical data



Model		EG4-0090	EG4-0210	EG4-0270	EG4-0420
Build type		1-cylinder 4-stroke air-cooled gasoline engine			
Displacement		87 ccm	208 ccm	270 ccm	420 ccm
Bore x Stroke		54 x 38 mm	70 x 54 mm	77 x 58 mm	90 x 66 mm
Power ¹⁾ at 3.600 rpm		max. 1,79 kW cont. 1,64 kW	max. 5,10 kW cont. 4,30 kW	max. 6,56 kW cont. 5,52 kW	max. 9,60 kW cont. 8,75 kW
Type of output		using crankshaft			
Rotation direction		anticlockwise (see schematic picture)			
Fuel		Unleaded Standard-(ROZ91) /Super-(ROZ95) gasoline (Benzin) or special gasoline replacement (e.g. ASPEN®, HUSQVARNA XP, ...)			
Tank capacity		1,6 l	3,7 l	6,0 l	6,5 l
Fuel consumption		≥ 369 g/kWh	≥ 362 g/kWh	≥ 352 g/kWh	≥ 350 g/kWh
Speed regulation		integrated centrifugal governor acting directly onto the reducing damper of the carburator			
Speed preset		Factory preset: idle=1.300 ±50 rpm / full speed=3.100 ±50 rpm Allowed maximum adjustment: full speed 3.600 +50 rpm (Removed adjusting screw is about 3.900 rpm)			
Cooling system		Forced air cooling system using a fan wheel and air vents			
Lubrication system		Splash lubrication system			
Oil volume		0,4 l	0,6 l	1,1 l	1,1 l
Start system		Recoil-starter	depending on design: recoil-starter or combined recoil- and electric starter		
Dynamo		-	only in version "E" (= with electric starter): Dynamo for diode (included in startbox) and inherent charging current limitation. 100-400mA (max. 500mA) charging current - speed dependent		
Battery		-	only in version "E" (= with electric starter) - not included: 12 V / min. 9 Ah, recommended 12 Ah		
Overall width	B	295 mm	400 mm	430 mm	455 mm
Cylinder width	B1	95 mm	140 mm	165 mm	180 mm
Engine depth	T	215 mm	248 mm	380 mm	415 mm
Depth Backside	T1	95 mm	95 mm	95 mm	102 mm
Depth Frontside	T2	18 mm	24 mm	28 mm	37 mm
Overall Height	H	290 mm	370 mm	410 mm	440 mm
Height of shaft	W	89 mm	106 mm	133,5 mm	133,5 mm
Baseplate	G1	105 mm	162 mm	197 mm	196 mm
	G2	21 mm	11 mm	12,5 mm	12 mm
	G3	70 mm	70 mm	106 mm	106 mm
	G4	62 mm	75 mm	82 mm	86 mm
	G5	85 mm	104 mm	133 mm	144 mm
Net weight "H" / "E" version		12 kg	17 kg / 18 kg	25 kg / 27 kg	31 kg / 33 kg
Sound level		LWA 82 dB(A) 65 dB at 7m	LWA 88 dB(A) 67 dB at 7m	LWA 91 dB(A) 70 dB at 7m	LWA 96 dB(A) 73 dB at 7m

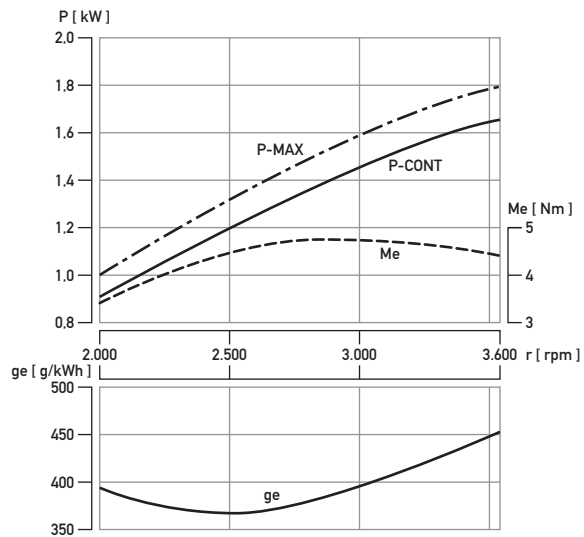
¹⁾Engine power data

All given information applies to the engine at 0m sea-level and a surrounding temperature of +20°C. The total capacity of the device must be reduced because of cooling issues when using the device in higher temperatures or in greater heights - see the derating chart for details. This also applies to the performance curves in 3.2.

3.2. Performance curves

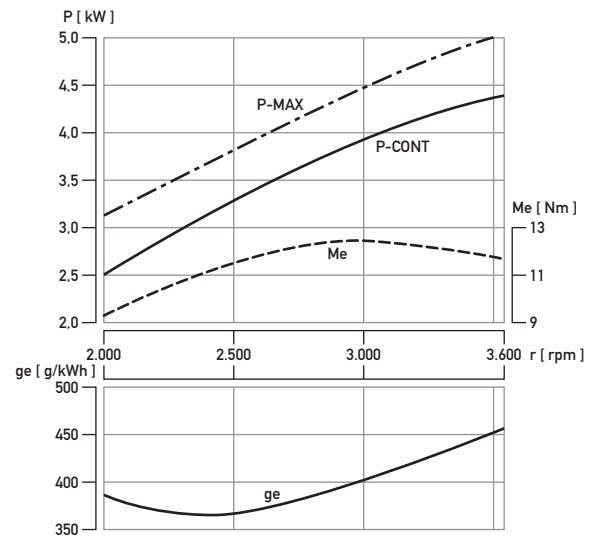
EG4-0090

P..power, Me..torque, ge..consumption



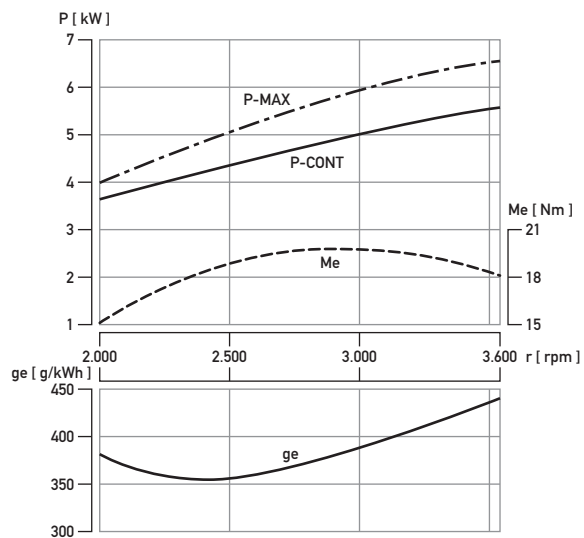
EG4-0210

P..power, Me..torque, ge..consumption



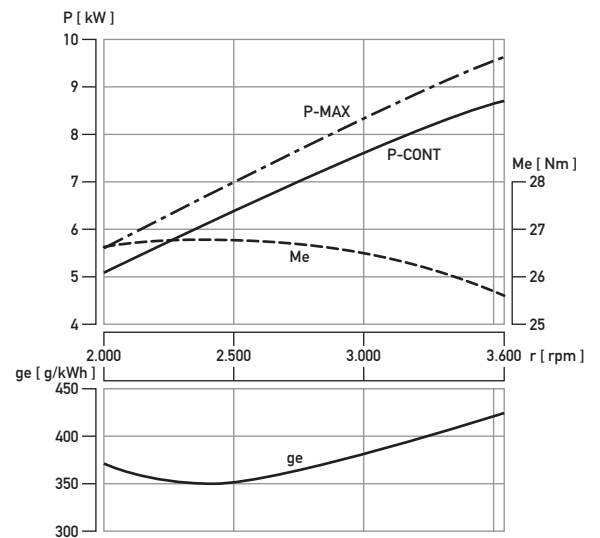
EG4-0270

P..power, Me..torque, ge..consumption

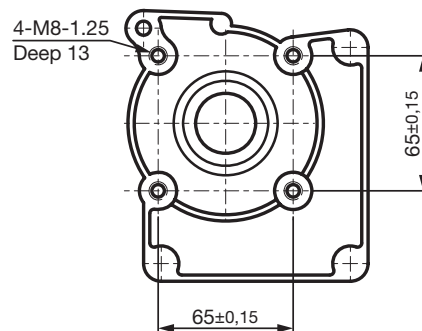


EG4-0420

P..power, Me..torque, ge..consumption



EG4-0090



5/16-24UNF

45,5

Q19,05^{+0.05}_{-0.05}

Q3/4"

Key 3/16"x3/16"

4,78

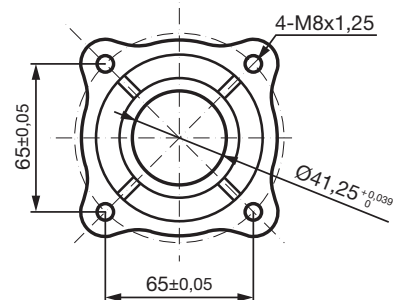
17

3,2

61,7

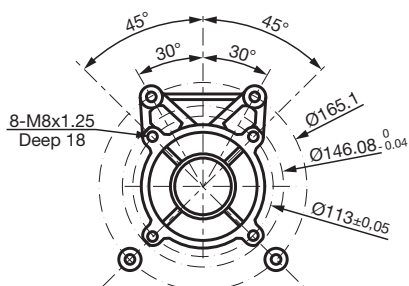
16,36^{+0.10}_{-0.0}

Technical drawing of a shaft assembly. The drawing includes a side view and an end view. The shaft has a diameter of $\varnothing 20$ with a tolerance of $^{+0.020}_{-0.020}$. The total length of the shaft is 53. The distance from the left end to the center of the first bearing is 35. The distance from the left end to the center of the second bearing is 23. The distance between the centers of the two bearings is 3.0. The shaft is labeled M8x1.25-6H. The end view shows a bearing with an inner diameter of 5 and a tolerance of $^{+0.03}_{-0.03}$. The distance from the center of the shaft to the center of the bearing is 17 with a tolerance of $^{+0}_{-0.10}$.

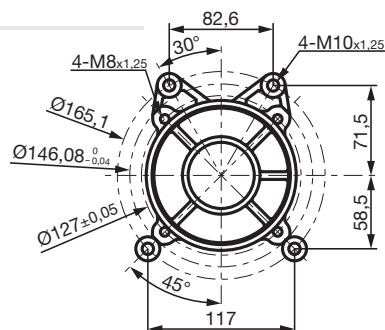


Technical drawing of a shaft with a keyway. The shaft has a diameter of $\varnothing 23$. The keyway has a depth of 26 and a width of 36. The key is labeled M8x1.25 (Deep 23). The shaft has a total length of 54.5. The keyway is chamfered with a 1:5 slope. A cross-section view shows the internal structure of the shaft, including a central hole with a diameter of $\varnothing 25 \pm 0.02$ and a keyway with a depth of 0.020.

Technical drawing of a shaft-hub assembly. The shaft is labeled M8x1.25-6H. Dimensions include a total length of 88.2, a distance of 56 from the left end to the start of the hub, a distance of 23 from the left end to the start of the keyway, a hub width of 16, a shaft diameter of $\varnothing 25 \begin{smallmatrix} -0.020 \\ -0.040 \end{smallmatrix}$, a keyway depth of 6 $\begin{smallmatrix} +0.03 \\ 0 \end{smallmatrix}$, and a distance of 21 $\begin{smallmatrix} 0 \\ -0.10 \end{smallmatrix}$ from the right end to the start of the keyway. The drawing shows a cross-section of the assembly with a key and a hub.



Technical drawing of a screw-on cap (M8x1,25-6H). The drawing shows a side view and a top view. The side view includes dimensions: 42 (total length), 28 (length of the cap body), 3 (thickness of the cap body), 63 (total length including the cap body), and 7 (length of the cap body). The top view shows a diameter of 25 with a tolerance of +0.03/-0.09 and a thickness of 21 with a tolerance of 0/-0.10.



Technical drawing of a 3/8"-24UNF threaded component. The drawing includes a side view and a cross-sectional view. Key dimensions are: 56 (total length), 28 (threaded length), 16.3 (unthreaded length), 88.5 (total length including flange), 21.82 (flange thickness), 6.3 (flange hole diameter), Q25.4 (flange hole diameter), and Ø1" (flange outer diameter).

Technical drawing of a shaft-hub assembly. The shaft is labeled M10x1,25-H. Dimensions and tolerances are as follows:

- Shaft diameter: $\varnothing 26_{-0.025}^{+0.025}$
- Hub inner diameter: $\varnothing 25_{-0.023}^{+0.025}$
- Hub outer diameter: $\varnothing 30$
- Shaft length: 47
- Hub length: 30
- Hub thickness: 4
- Key width: 4
- Key height: 1
- Key length: 17.5
- Surface texture symbol: $\sqrt{1.5}$

4. Installation



The installation has to be done by professionals. Poor installation can damage the device (ex. bearing failure because of inadequate parallelism). The professionals present are responsible for the observance of appropriate regulations and standards.



All operations on the device including maintenance and start-up must be done on a resting engine.

4.1. Preparation

- All devices are packed in a different way, depending on sales channel and method of transportation. Remove all packaging carefully, to avoid damaging the device.



Before installation, make sure that any protective coats, covers for transport (ex. shaft cover) or other protective means were removed.

4.2. State of installation site

- The installation site must be well ventilated with dry, clean, conditioned or ambient air, because the motor radiates heat that would raise the room temperature so high, it would have negative effects on the motor capacity.
- The installation site should be chosen so that normal maintenance is easily possible.
- The ground underneath the must be able to take the weight of the device. It should also be even and nonslip.
- The installation site must be designed so that accidental touching with the engine case, rotating or otherwise dangerous parts is impossible.
- The installation site must be protected from any natural forces (such as rain, snow, hail, storms, flooding, direct sun radiation, frost or heat) as well as air pollutants (such as abrasive dust, electric smog, fluff, smoke, oil, mist, exhaust gases or other pollutants).
- Consider the noise limits at the installation site.

4.2.1. In- and outtake Ventilation

Normally, the engine can draw enough air from its surroundings. However, the motor radiates heat that in closed spaces would raise the room temperature so high it would have negative effects on the motor capacity.

The ventilation plan must consider following aspects:

- diverting heat produced by the engine
- necessary air rate:
for the engine to consume properly
to cool any other devices



If the surrounding air is not suited due to dust, pollution or heat, an additional air vent must be installed.



If the engine is to be built into an enclosed space, the air vents must be large enough to make free air circulation possible. A guide value for non-forced air ventilation is 0.4m².



When installing for continuous operation or in places where the installation site is very hot, it is recommended to install an exhaust fan with appropriate volume.



To reach the highest capacity possible, the surrounding air must not rise above +25°C. In case of higher temperatures it is necessary to derate the power of the engine capacity.



Make sure that hot exhaust gas is not sucked in again by the engine

4.3. Motor mounting



The motor assembly must be done through four montage holes in the base plate. A mechanical assembly using the motor flange is not allowed.

Please also consider following points:

- The installation frame or foundation must be adequately dimensioned and torsion-resistant. It has to be robust enough to absorb vibrations and to maintain alignment.
- The foundation must be chosen so that all mounting feet are laid out evenly on the ground to avoid tension (possibly use underpinning).
- Make sure the dimensions of the attachment screws are appropriate.



In order to achieve a large enough surface area, use a large washer between the base plate and the mounting nut.

The engine plus any add-on device should be well balanced and attached onto a hard metal structure with vibration damper in between. This reduces vibration.

4.4. Exhaust gas system

4.4.1. Mounting the muffler



The muffler contained in the order is made to be used in industrial areas. If the engine is to be used uptown it might be necessary to replace it with a better one.

4.4.2. Information about other exhaust gas systems

When installing a different exhaust gas system please consider following points:



The exhaust back pressure has a significant effect on the engines power. Too high exhaust back pressure causes lower power, hotter exhaust gas and a hotter motor, and high consumption of fuel. The exhaust back pressure can be held to a minimum when the exhaust system is well dimensioned.

- Make sure that during the installation of the exhaust pipes the radiated heat cannot be sucked in by the motor. The pipes should be insulated. If the exhaust pipe go through walls, insulation is mandatory.
- The exhaust pipe should be kept as short as possible and have no bends. If this is not possible the radius of the curvature should be held as wide as possible.
- When using exhaust pipes up to 10 meters in length the radius of the pipes has to be about 30% higher than the diameter of the exhaust manifold or the muffler exhaust pipe. The diameter must not be smaller than that.
- If the exhaust pipe has a significantly larger radius than the device connection, a cone-shaped connector with an angle less than 30° should be installed additionally in order to avoid exhaust back pressure.
- The installed exhaust pipe has to be complete and 100% leak-proof in order to avoid heat, poisonous gases and power lost.
- It is recommended to install a screw at the lowest point of the exhaust pipe to drain the condensate.
- Between the outtake manifold of the motor/muffler and the exhaust pipe a flexible pipe should be installed in order to avoid vibration transmit and to enable thermal expansion of the pipes.
- Make sure that muffler and any exhaust pipes are free from flammable material (fire hazard).

4.5. Fuel System

The fuel system of the motor must provide a clean and continuous fuel supply. Pay attention to the following points during the installation of an additional fuel tank:

- Only use gasoline durable tubes with wire netting.
- Tank ventilation is necessary in order to avoid too high or too low pressure in the tank.
- Avoid too high pressure in the integrated tank. This can happen when the tank ventilation is clogged up or the overrun is connected to another external tank.
- Fuel tubes to and from the tank must have at least the same diameter as their counterparts on the motor. When the pipes are very long or the surrounding air cool, the diameter of the pipes has to be wider to let through enough fuel.

4.6. Coupling

Before the motor can be connected to a load their compatibility needs to be checked!

It is important to check

- whether motor and load are compatible in oscillation
- whether the measurements of shaft and flange of the motor are compatible with the measurements of the coupling.



Motor and load have to be levelled carefully! An incorrect levelling can lead to vibrations and bearing failure.



When starting up the motor BEFORE the montage of a coupling or a pulley the key has to be fixed to the nut very tightly!



Make sure that while assembling a coupling or a pulley all safety measures concerning touching rotational parts are obeyed. Consider the appropriate installation instructions from the manufacturer.



In no case whatsoever should pressure, hits or blows hit the shaft (for example with a hammer). This could damage the bearings.

Assembly and disassembly has to be done with suitable attachment and detachment tools!

4.6.1. Maximum axial and radial load

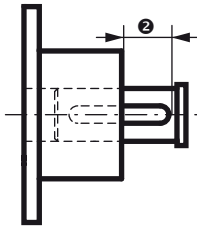
Make sure that the maximum axial and radial load of the motor main bearing aren't exceeded before operating. If you're using pulleys it is necessary to recalculate the life-span of both shaft bearings and to adjust maintenance intervals accordingly.!

4.6.2. Balancing

The crankshaft of the engine is dynamically balanced with half the key. Each element of the coupling also has to be balanced out accordingly.



When the coupling is too short the overhanging key part has to be worked off until it is the diameter of the shaft ② or covered up with rings using the key nut in the according size. If the coupling is too long the missing key part has to be filled out in the overhanging coupling.



4.6.3. Direct coupling



When directly attaching a moving element (ex. pump, ventilator) to the motor shaft, balance is extremely important!



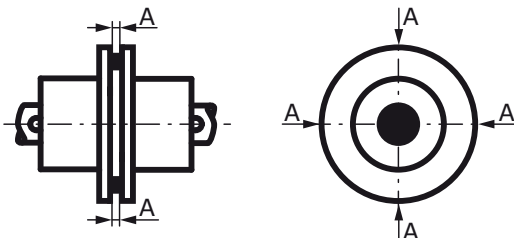
The coupling has to be chosen so that the transferred torque, the running characteristics of the engine and the necessary safety characteristics are considered.



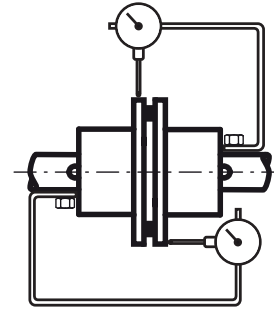
The motor plus the load should be balanced out so that out-of-rounds and deviations in balance of the two coupling halves comply with the tolerance of the manufacturer. Sloppy balancing can lead to vibrations, bearing failure or to the shaft breaking.

Instructions:

- Attach both coupling halves so that a movement is possible with both halves.
- Set up the parallelism of both shafts with a comparator or a thickness gauge at four points which are located 90° from each other (the distance set up equals the value A).
- Measure the distance between the two contact-areas of the coupling at four different points which are also set 90° from each other.
- The difference between the two values may not be greater than 0.05mm.



You can use two measure-devices to set up parallelism and coaxial at the same time. While turning the shaft slowly deviations can be measured precisely.



Alignment errors are corrected by using washers between the base and the foundation. After refastening the nuts the alignment has to be checked again.

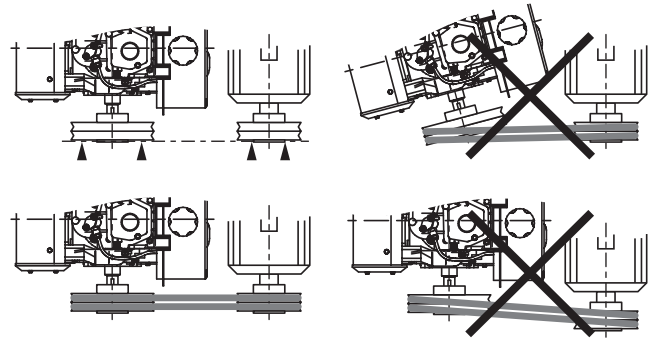


If you are using 2-part couplings you have to make sure to leave a distance of 1-2mm to the shaft in order to allow thermal expansion of both shafts.

4.6.4. Operating with a pulley



The axis of the motor shaft must be parallel to the axis of the moving device, in order to minimize the axial force on the bearing. Make sure the pulleys are set up in one line (see diagram below).

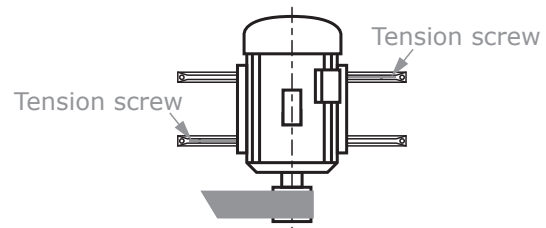


Assembly with a fixed axle distance:

- Attach an additional tension roller to the belt. The tension roller should be placed on the inside of the V-belt. In case a flat belt is used - the roller can also be placed on the outside of the belt.

Assembly with variable axle distance:

- Attach two clamping rails to the base. They must be parallel to the belt.
- Attach the load (not the motor) as shown in the diagram below. This way everything can be balanced out as precisely as possible.



The tension of the belt has to be set up very precisely. If the tension is too high the shaft bearing wears out very fast and the crankcase or the shaft might break. If the tension is too low, vibration can occur, which can also damage the device.



Starting at a pulley diameter of 315mm and a rotational speed of 3.000min⁻¹ we do not recommend using pulleys made from gray cast iron or using flat belts.



Please note that all moving (rotating) parts must be protected from touching anything before starting up the device!

4.7. Concluding mechanical installation instructions



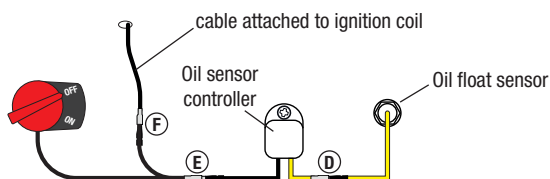
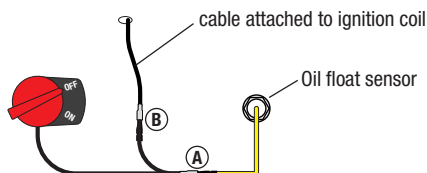
After the first start-up the correct alignment is to be checked while the motor is as warm as it usually is while operating..

- All screws, nuts and other clamped or bolted connections must be correctly assembled and fastened.
- The cooling air must be able to circulate without a problem.

4.8. Mounting the oil-sensor controller

If the optional available oil sensor controller (Order Nr. ZSP-MOT00442) be included, assemble it as follows:

- Open the plug connection (A) between the float switch and the main switch (ignition breaker), as well as the plug connection (B) between main switch and ignition coil connector.



- Mount the oil sensor controller on the crankcase.
- Connect:
 - Oil-sensor-controller and Oil-float-sensor (D)
 - Oil-sensor-controller and Main switch (E)
 - Main-switch and cable to ignition coil (F)

►► How the oil sensor controller works:

By default the motor is equipped with a oil float sensor (=switch sensor). When the oil level is too low, the float switch stops the motor. If the float switch only triggers shortly the switch is not guaranteed to successfully stop the engine. The oil sensor controller also stops the motor when the oil level is only briefly too low.

4.9. Electrical Assembly (only for "E" version)



ATTENTION - By default engines in version "E" are delivered WITHOUT stop-switch! The wiring MUST be adapted to one of the following. Otherwise the running engine cannot be stopped.

Depending on the version the engine is equipped with following electrical components:

- Version "H" (means only **H**and-start version):
No further electrical components
- Version "E" (means with additional **E**lectric-start):
Dynamo (without necessary diode) and electric starter.
ATTENTION: no stop-switch preinstalled!
- Special components (additionally available):
 - Startbox (with rectifier diode and main-switch)
 - Battery

4.9.1. Electrical connection (chords)

Only use stranded wire cable as a connection.

Battery(+) as well as battery(-) chords are to be held as short as because the current of the starter is very high.

Note that the motor and add-on-parts get hot when used. Always protect the cable from touching hot parts by using a protective hose.

Caused by motor vibration during operation all screw connections must be secured with spring washers or lock-nuts.

4.9.2. Starter battery

A starter battery and a battery cable are not included in the delivery, they can however be ordered separately as add-ons. Make note of following points:



Lead acid batteries contain sulfuric acid. If there are liquids escaping from the battery, do not touch or swallow them. Carefully dilute the acid with water and neutralize it with soda (sodium carbonate).



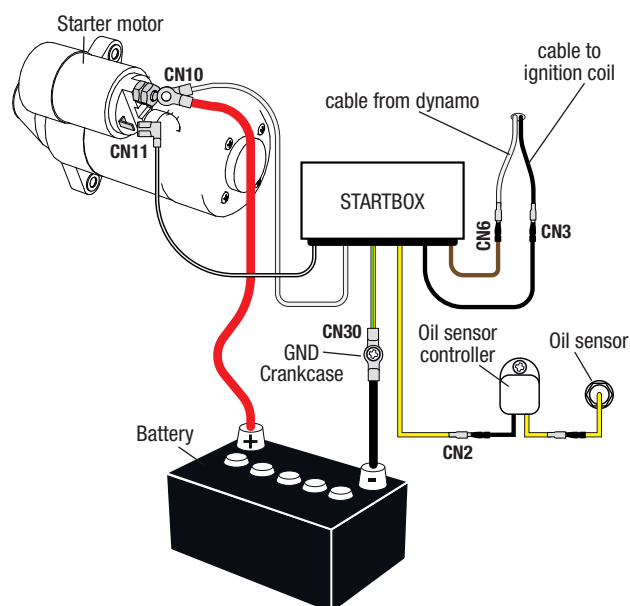
Always wear protective gloves and safety goggles when working with the starter battery.

- You can find the necessary capacities in the chart in chapter 3.1. The usage of valve-regulated (maintenance free) batteries is recommended.
- Always connect the plus(+) pole first, then the minus(-) pole. Fasten the connections properly.

4.9.3. Mounting of optional Startbox

The optionally available starter box (with rectifier diode and main-switch) is to be assembled as follows:

- Open all plug connections and assemble the starter box (see pictures in 5.1.)

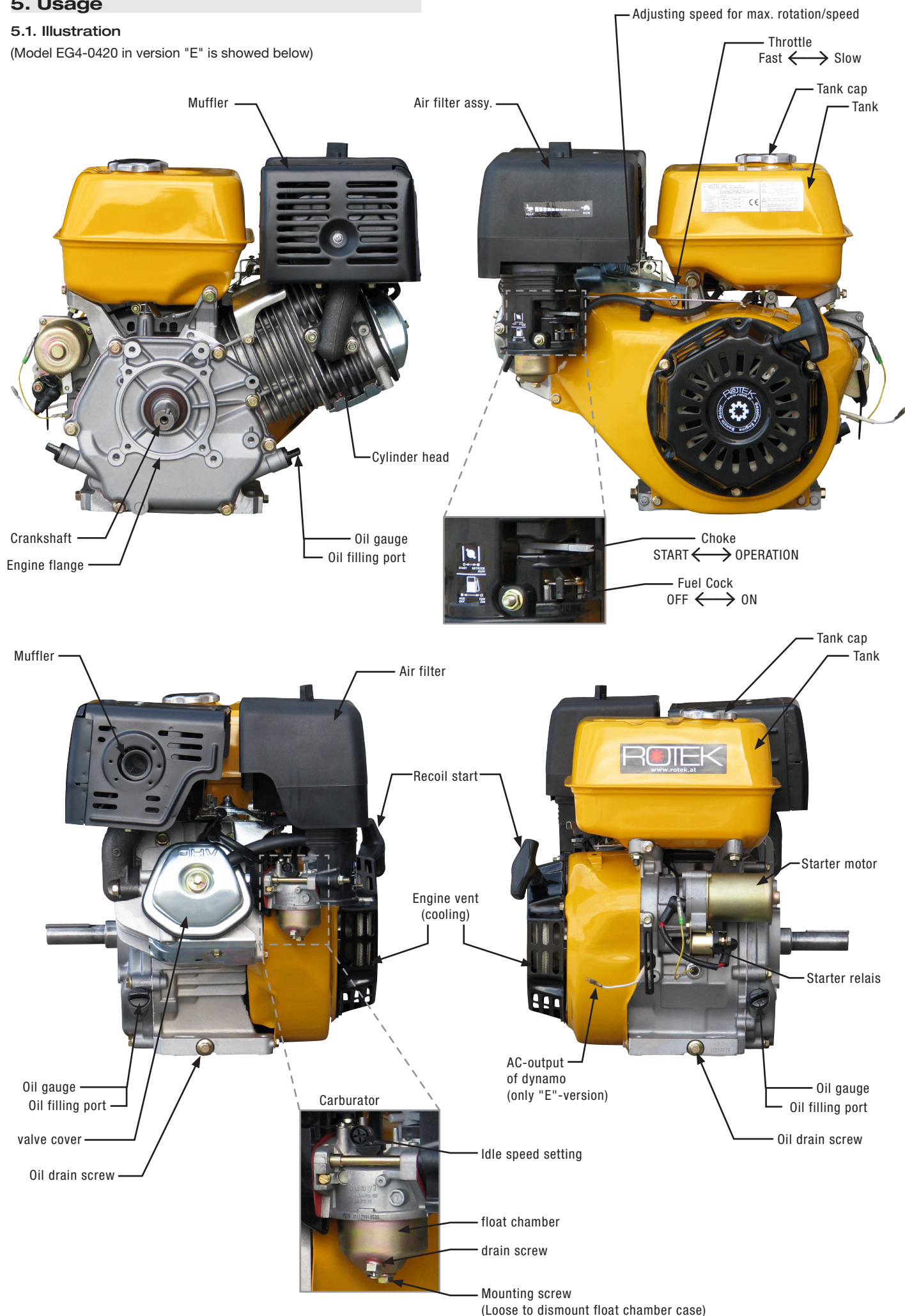


- Mount a cable lug on both battery cables.
- Mount battery(-) cable as well as CN30 (yellow/green marked cable with M6 cable lug) with any screw on the crankcase (crankcase is always ground/GND/0V).
- Connect CN2 (yellow marked cable with M4 cable lug) to oil-sensor-controller (if no oil-sensor-controller is equipped connect the cable with oil-sensor).
- Connect CN3 (black marked cable with M4 cable lug) to ignition coil.
- Connect CN6 (brown marked cable with M4 cable lug) to dynamo.
- Connect CN11 (black/white marked cable in heat protection tube with 6,35mm Faston lug) to relays of starter motor.
- Connect battery(+) cable with M6 cable lug to starter motor. Connect CN10 (white marked cable in heat protection tube with M6 cable lug) also to the same port of the starter motor.
- Secure all cables with the cable fixer und connect the battery cables to the batteries - see notes under 4.9.2.

5. Usage

5.1. Illustration

(Model EG4-0420 in version "E" is showed below)



5.2. Information about engine performance



The performance refer to standard conditions (0m sea level, +25°C ambient temperature). For higher temperature or usage at higher sea level it is necessary to calculate a derating of the maximum performance.

5.3. Information about starter battery (optional)

Please consider following points:



Lead acid batteries contain sulfuric acid. If there are liquids escaping from the battery do not touch or swallow them. Carefully dilute the acid with water and neutralize it with soda (sodium carbonate).



Always wear protective gloves and safety goggles when working with the starter battery.



When correctly set up, the battery will be charged via the built in dynamo.



If the motor is operated without a battery (ex. when using an external battery to start up), the plus cable from loading regulator has to be isolated against the crankcase. A shortcut could damage the dynamo or loading regulator.



When using a car battery to jump start the engine, first disconnect the starter battery of the motor. If the built in battery is completely drained the car battery could load an extremely large current into the starter battery. This seriously damages the battery, in extreme cases the battery might even explode.



Be very attentive when handling starter cables, if it comes to an electrical shortcut very large currents can be transmitted. Therefore remember: always connect the plus(+) pole first, then the minus(-) pole.

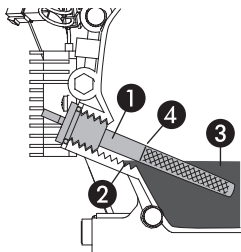
5.4. Check-ups before every start-up

5.4.1. Engine oil

Oil is the most important resource of the motor. Only use high quality, synthetic motor oil of specification API SL/SM, for gasoline engines.



Check the oil level befor every start up! **ATTENTION** – when delivered the engine is **NOT** supplied with oil and must not be started up under any circumstance!!



Remove the oil dipstick ① and wipe it with a clean piece of cloth. Reinsert the clean dipstick ① completely, then remove it again. The correct oil level ③ is now marked by the oil film covering the dipstick. The line has to be close to the maximum mark ④. If necessary add more oil, in order to achieve the correct oil level ② (lower edge of the thread in the crankcase).



Do not add too much oil – too much oil is damaging and must be drained! Different types of oils and brands may not be mixed together! Note the maintenance intervals of the oil change.

5.4.2. Fuel

Fill up the tank completely with fresh, lead-free premium or normal gasoline.



Please note that gasoline usually should not be stored for longer than 3-6 months. Always use fresh gasoline. See the instructions for storage in chapter 2.3. For further information.

5.4.3. Other check-ups

- Remove any dirt or dust, so that the engine cooling cannot suck in any foreign matter.



Note that the motor must **NOT** be started up if the protective covers are not attached properly.

- Check that the device does not have any leaks (fuel, oil, battery acid). Fasten leaking sealing caps appropriately.
- Make sure the device is well ventilated. The exhaust gas of the motor can be damage your personal health.

5.5. Start-up

5.5.1 Special information about initial start-up



The motor must only be started up when the device was installed following the rules and instructions of this manual and the engine base is fixed properly to a stable mounting frame.

- Let the motor run on half rated rotational speed (aprox. 1.500-1.800 min⁻¹) for 1 hour after starting up for the first time.
- Turn off the engine after initial start-up and check the oil level.
- Check all screws, nuts and clamp connections after initial start-up. Refasten if necessary.

If the engine behaves abnormally (noise, smoke) turn off the motor immediately and solve the cause of error before putting the engine into operation again.



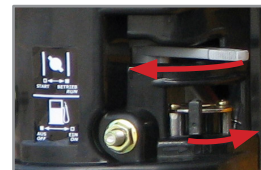
To ensure a maximum life-span of the motor it is recommended not to operate above 3.000 min⁻¹ in the first 50 hours of operation. Only change the speed slowly during this 50 hours (change governor position slowly)!

5.5.2. Starting the engine



It is forbidden to start up the motor without properly assembled air filter and muffler!

- Open the fuel cock
- Shift the choke lever to "Start"

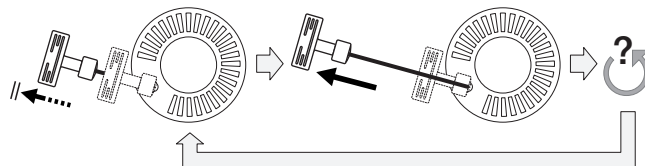


- Move the throttle lever to full-speed (=Start)



5.5.2.1. Hand start (all versions)

- Pull the recoil-starter slowly until you feel some resistance. Bring the recoil handle slowly back.
- Pull the recoil handle hard and fast.
- Repeat until the motor starts up.



5.5.2.2. Electric start (only motor version "E")

- Turn the start key to "START". Let go of the key as soon as the motor starts up.



Only start up for a maximum of 10 seconds! If the engine doesn't start, wait one minute until trying to start-up again. This process may only be repeated for a maximum of 3 times, then the electric starter has to be left to cool down for at least 15 minutes. Contravening can result in damaging the starter and/or motor. Never start into the running engine!



Generally you should not connect a load higher than 50% of the nominal load when the engine is cold.

- Observe the engine run and the colour of the exhaust gas after starting up. The engine should run smoothly after a few seconds.
- Slowly bring back the chocke lever to position "RUN"/"BETRIEB"

5.5.3 Stopping the engine

- Let the engine run without load for about five minutes after being used for heavy load – this way the motor can cool down.
- Bring stop-switch or main-switch to position "OFF" to turn off the engine.
- Close the fuel cock.



When the device is not to be used for longer than two weeks, consider the instructions in chapter 2.3.

6. Maintenance

Regular service and maintenance prolongs the life-span of your device and enables an undisturbed user experience.



The staff responsible for maintaining and cleaning the device must be trained to do so. Never let unable people handle the device in any way at all.

6.1. Instructions about maintenance

If you hire a specialised company to maintain the device, please get a conformation from them.



Any damage done to the device due to inappropriate maintenance or not maintaining the device at all do not carry warranty.

Fixing issues that can be fixed by the user himself do not carry warranty either but fall into the normal maintenance of this device.

6.2. Precautions

Before cleaning, oiling or servicing the device follow these instructions:

- Turn off the motor. The motor must be at rest.
- Use appropriate measures to keep the motor from starting up again.
- The motor and all of its add-on parts must have cooled down to the surrounding temperature.



Pay attention while working in close proximity to moving parts and parts that might be hot.

6.3. Starter battery

If you are using a battery that needs to be maintained, make sure to regularly check the state of the connectors and the water level. If necessary fill distilled water up to the maximum mark.



After a long storage period the loading condition of the battery must be checked before putting the device into operation. Weak batteries must not be used.

6.4. Cleaning the crankcase

Clean the engine block from the outside with compressed-air or with suitable detergents.



Electric parts (clamps, electric starter, etc.) must not be cleaned with compressed-air or any liquid cleaners. This could lead to a short or other disruptions.



It is extremely important to have free air ventilation in order to cool the motor down. Therefore you must clean the bars and ribs of the air vents immediately, even if they're only slightly dirty.

6.5 Upkeep

Engines are technologically complex mechanisms with many moving parts. There parts are subjected to strong mechanical, thermal and chemical forces because of the environment and the combustion process. Choosing the correct fuel and oil as well as thoroughly servicing and maintaining the device significantly prolongs the life-span of your device. Small mistakes can cause huge problems – even break the device entirely.

Here you will find instructions how to properly identify and maybe even correct some disruptions. However, some difficulties can only be handled by trained staff or professionals. If you have a problem go over this list point by point – often the problem is small and easily solved.

A gasoline engine needs 5 things to work:

► OIL ► IGNITION ► GASOLINE ► AIR ► CORRECT TIMING

You should check in this order to find the cause of a possible problem.

6.5.1 Changing the engine oil



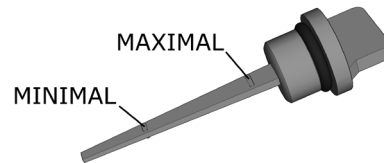
Always check the oil level before starting up! There are marks on the dipstick marking the minimum and maximum – when the device is set up on an even surface the oil level should be between these two marks.



Do not overfill! Too much oil can cause damage and must be drained.



Oil is the most important resource of the motor. Stick to the maintenance intervals and its schedule!



Put a suitable container under the drain screw, open the drain-screw and drain the motor oil. Always change the motor oil while it is warm!



Normally, the oil should be black because of the combustion residue of the motor. There should be no foreign substances, white colouring (water in the oil) or foaming visible.



The spent oil taken from the motor has to be brought to a collecting point for toxic waste!

Close the drain screw after draining.

Fill new oil into the motor, make sure to use the correct one (see 5.4.1.).



After changing the oil, start up the engine and let it run for 5 minutes. Then check the oil filter and the drain-screw for any leaks. Check the oil level again and refill oil if necessary.



If the oil level increased from one check to the other do NOT start the machine. Fuel or water might have gotten into the motor oil – this can damage your device. In those cases drain the oil completely and try to identify pollutants such as water or fuel (check the smell, maybe try to set small amounts on fire, see whether water separates from the oil). Find out why there is leakage into your oil and fix it. Wash out the crankcase with fresh oil and change the oil.

6.5.2. Check the ignition (spark)

Pull the spark plug connector from the spark plug. Remove the spark plug using a spark plug socket.

- Inspect the state of the electrodes as well as the distance between the electrodes according to the chart below. The spark plug should be coloured somewhere in between grayish-white and yellowish-gray. There should be no residue such as carbon or soot visible.
- Clean the spark plug with a delicate wire brush and establish the suitable distance between the electrodes (this works best by gently tapping the diodes with the back of the wire brush).



The colour of the residue (the appearance of the spark plug) is very informative about the state of the motor. Check the appearance according to the following diagrams to find the cause of a problem.

If necessary replace the spark plug according to the type mentioned in the chart.

- Place the spark plug into the spark plug connector and hold the ground electrode against the crankcase while the ignition is on.
- Turn on the main switch (ignition break, ignition lock) and quickly pull the hand start. There should be sparks visible between the electrodes of the spark plug. If there are no sparks visible also exchange the spark plug and repeat the process.

6.5.2.1. Spark plug chart

Technical data	EG4-0090	EG4-0210 EG4-0270 EG4-0420
Thread	M14x1.5	M14x1.5
Length	12,7 mm	19,0 mm
Electrode distance	0,7 mm	0,7 mm
Manufacturer		
BONON	E6TC	F7TC F6RTS
BOSCH	W7AC	W7DC
CHAMPION	L9G	N9YC
NGK	B5HS	BPR6ES

6.5.2.2. Appearance of the spark plugs



Normal state

This spark plug is in good state. The insulator is grayish-white to yellowish-gray. The plug is working under optimal temperatures. Here the heating value, the ignition and the alloy are well adjusted, the electrodes are not worn, they only have little residue and the electrodes have the perfect distance.



In the past the ideal colour of the spark plugs was to be brownish-red. This goes back to the time when lead was added to the gasoline and is not the case nowadays.



Worn electrodes

In this picture you see extreme burn-off of the electrodes. This leads to bad correspondence with the motor, as well as problems starting up. Although there is barely any residue and the plug has the right colour you will have to replace it. Actually, it would have been necessary long ago! Use a spark plug with the same heating value as the previous one, which corresponds to the specification in this manual.



Soot residue

In this picture you see sooty residue. This is not dangerous, indicating a too heavy fuel air alloy. This residue is particularly prominent when the motor is used with a light load. After a few minutes of using the motor with its maximum load the residue should pass. If it does not the heat-value of the spark-plug is incorrect (wrong spark plug). Also, the air filter could be dirty or clogged, the valves lose or the choke not fully deactivated.



Spilt/glass-like residue

Small dashes of residue indicate that there is dirt in the intake, which is sucked in and melts. The problem is solved by cleaning the carburetor and replacing the air filter. A yellowish, glass-like shiny glaze accumulates on the tip of the insulator from gasoline or motor oil residue and melt during maximum load. The resulting problems with ignition should be avoided during prolonged use with lower power.



Combustion residue

These light brown crusts on the electrode and the insulator are caused by residue from gasoline and motor oil. The spark plug does not work properly and the combustion gets worse. Often larger amounts of oil get into the combustion chamber, are not burnt entirely and leave behind this residue. Check the valve guide and valve seat and do not use gasoline additives. Changing the brand of gasoline you are using can also help.



Bridged electrodes

In older motor cycle times, then the fuel was low in quality, this was a common problem. The residue accumulated to a kind of bridge between the electrodes. Two-cycle engines were particularly prone to this problem. Here cleaning the spark plug helps, as well as using high quality fuel and oil. Of course, there might be a more deep-seated problem such as a worn piston or worn cylinders.



Overheating

The insulator is chalky white and there is absolutely no residue visible. The motor got way too hot! The cause could be a too low heating value of the spark plug or a too light fuel air alloy. Check all of these points and replace the spark plug with a new one according to the chart.



Oil residue

Oily and greasy residue is an indicator of large amounts of oil getting into the combustion chamber. The cause of this could be a problem in the valve guide, a worn piston, piston ring or cylinder liner. Checking the compression can help find the problem. Usually this causes a greater engine overhaul. In two-cycle engines this state can also occur when the crank case seal fails and gear oil is sucked in.



Gasoline residue

The plug is very similar to the one depicted above. When removed however, the wet spots dry quickly and only soot residue is left. This is not oil but fuel. The motor was flooded because there was too much fuel in the combustion chamber. Here cleaning the spark plug and opening the choke helps. If there still is a problem check the ignition and the needle valve.



Broken insulator because of back fire

When the motor backfires hard the insulator can break and even spall. Check whether you used gasoline with the correct octane value. A problem in the cooling system or an incorrect distance between the electrodes can cause problems. Other causes are bad ignition timing (too early) or too light fuel air alloy (additional air or valves clogged). A wrong spark plug (wrong heating value) can cause this also.



Molten electrodes because of a knocking engine

If the electrodes have molten, uncontrollable ignition and very high temperatures were the cause. The wrong heating value, overheated valves, light carburetor settings, additional air, too much carbon residue and sharp edges in the combustion chamber could be the cause. Check all of these points and replace the spark plug according to the chart.



Electrodes and insulator molten

If you ignore engine knocking for a longer amount of time the electrodes and even the insulator will melt. The wrong heating value, light carburetor settings, way too early ignition, additional air, too much carbon residue and sharp edges in the combustion chamber could be the cause. Check all of these points and replace the spark plug according to the chart.



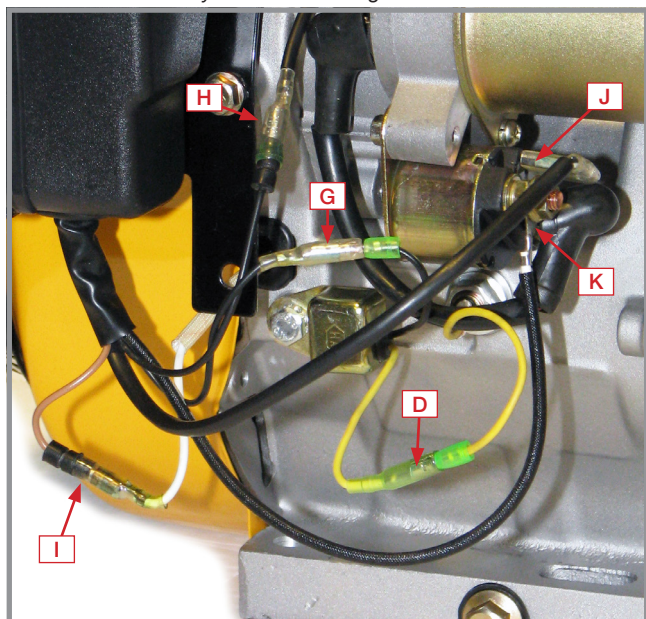
Mechanical destruction

Rare, but it has happened! This spark plug was completely destroyed because it touched parts in the combustion chamber. It is extremely important to find the cause of this. Maybe the piston or the valves are broken, or large amounts of carbon residue got loose. However, you might have used a spark plug that was too long and touched the valves of the piston. Check all of these things and replace the spark plug with a new one.

6.5.2.3. Solving ignition problems

If there are still problems after exchanging the spark plug and there is no spark, follow these instructions:

- Check the spark-plug connector for any damage or moisture and if necessary clean or exchange it.

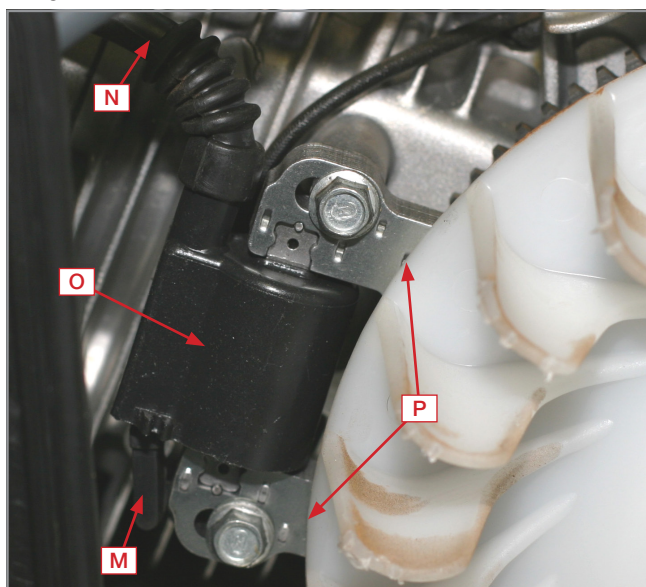


Disconnect connector (G) - by doing this you're deactivating the oil-sensor-controller. The electrical connector must not touch the crankcase during operation. Also check the oil level, because in this condition there is no oil-level monitoring.

If the engine is running normally now, connect (G) while the motor is operating. If the motor is still running the oil float was stuck - the problem was just solved because the motor oil become warm and loosen the stuck float. If the motor stalls when (G) is connected, open (D) and restart (let G connected). If you cannot start, the oil-sensor-controller is broken. If you can start, the oil sensor (float switch) is broken. The oil sensor can only be exchanged by opening the crankcase, from the outside only the cable connection to the oil sensor is visible.

If that is not the problem open (H) (=contact between stop-switch and ignition coil). Try to start the motor. If the ignition is not working the cable to the switch or the switch itself have an electrical short against ground. Solve the problem accordingly.

If there is still a problem remove the cover of the flywheel to get to the ignition coil:



Disconnect the Faston-connector (M) - the cable coming from the connector (H). If the ignition is working now, the cable has an electrical short between (H) and (M). If that is the case, correct the problem.

If there is a problem, measure (M) against ground (crankcase). There should be a resistance of 1,0-1,5 Ohm. Now measure (N) (=spark plug connector) against ground. There should be a resistance of 10-11 kOhm. Check the state of the ignition cable (no frets, brittleness etc. as well as proper assembly of the spark plug connector on the ignition cable (tight fit). If necessary exchange damaged parts. (M) may not have any connection to ground when the ignition is "ON". When the stop-/main-switch is in position "OFF" there must be an electric short against the ground.

Lastly, check the permanent magnet at the flywheel. Remove the pollutants and set up a distance at (P) of

EG4-0090-series: 0,2-0,4 mm

EG4-0210/0270/0420-series: 0,4-0,6 mm

between ignition coil and flywheel. The ignition magnet may not grind against the flywheel. The distance of both sides (P) has to be identical! The timing of the ignition is fixed and cannot be changed.

6.5.2.4. Starter malfunction

If the starter is spinning during startup (if the starter turns but the motor does not turn with it) the starter gear is probably broken. In that case, please contact your retailer.

If the starter does not react at all during startup, please consider following instructions:

- Check the voltage of the battery
If the voltage is above 12V, please check the connection between minus pole of the battery and the crankcase.
- Measure the Voltage at (K) (battery plus cable=the thick cable connected to the starter - measurements are always conducted against the crankcase). There must be battery voltage. If there is not, the cable connection between the battery and the starter relays is loosen or broken.
- Measure the Voltage at (J). If the main-switch is set to "OFF" or "ON" the voltage should be 0V - if it is set to "START" there should be battery voltage. Exchange the damaged parts.

If the measured values for (J) and (K) are within the limits, the starter itself is probably broken and has to be exchanged.

If the measured values are not in order, check the connectors of the startbox. If there is no mistake - open the startbox.

- Check the 5A fuse.
- If the fuse is in proper condition, measure the voltage on the main-switch: White cable should be battery voltage - follow the cable wiring and check the solder points.
- If the measured values are in order, measure the voltage on the black-white cable. At key-position "OFF" there should be 0V. At key-position "ON" and "START" there should be battery voltage.

6.5.2.5. Battery does not charge

If the motor has started up successfully, the starter battery should be charged by the built-in dynamo. If this is not the case, follow these instructions:

Check the circuit breaker at the starter box and press it. If the switch triggered or triggers again (2A pushbutton fuse), the current transferred from the dynamo to the battery is too high. Either the battery is worn or there is any shortcut against ground.

If the circuit breaker is ON, open the connector (I) (white to brown cable) and start the engine. Measure at running engine and opened connection (I) the voltage on white cable against crankcase.

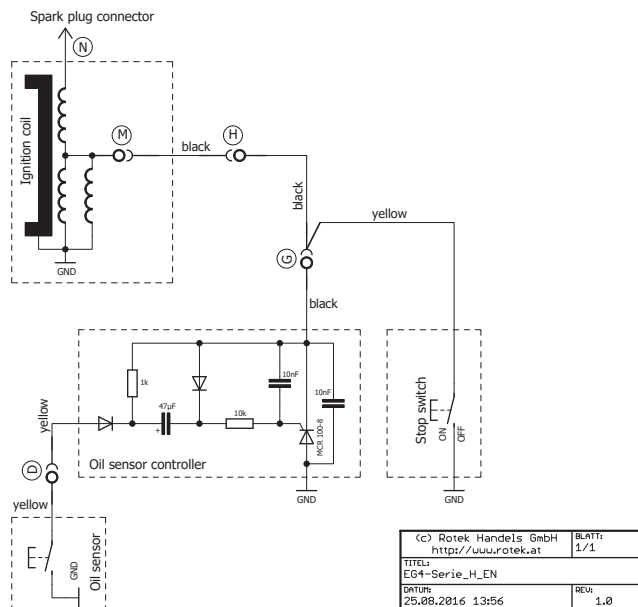
Measures of the dynamo:		at engine speed (rpm)		
		1.500	2.000	3.000
Idle voltage before diode	V _{AC}	11,7	14,3	20,9
Shortcut current before diode	A _{AC}	0,57	0,58	0,59
Idle voltage after diode	V _{DC} TRUE RMS	4,6	5,8	8,0
Shortcut current after diode	A _{AC} TRUE RMS	0,49	0,52	0,58

The dynamo starts charging the battery at about 1000 rpm, although the True RMS value of the direct current after the diode is only 5.8V. The diode is now conductive at the peak-voltage point and charges the battery.

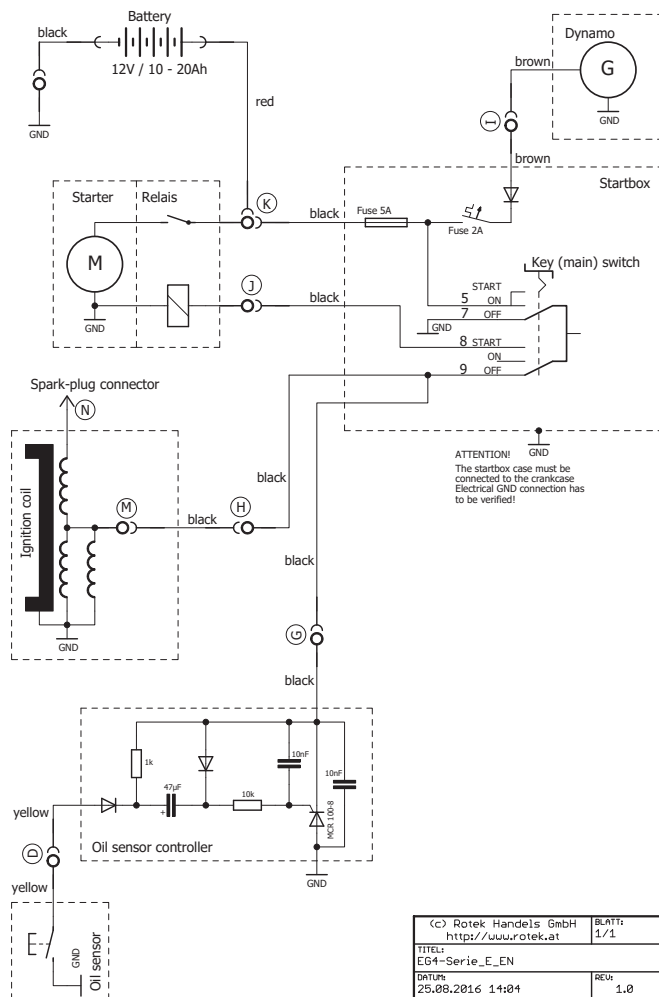
The dynamo has a high inner resistance in order to be able to charge the battery with little current and without charge controller while not doing any damage to the battery by overcharging it.

If a stronger dynamo is required in order to operate side aggregates or lights, an external dynamo has to be assembled. Either you use a standard dynamo with a pulley or a small generator with permanent magnets, like the ones we use in our diesel engines.

6.5.2.6. Circuit diagram - version "H"



6.5.2.7. Circuit diagram - version "E"

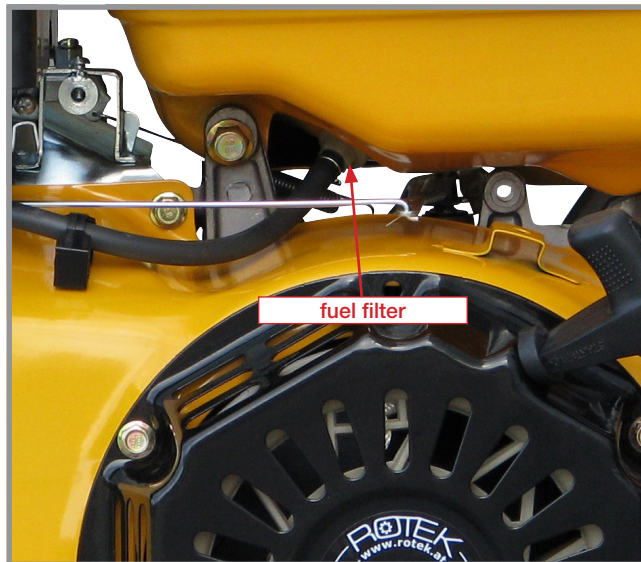


6.5.3. Fuel Supply

During check-ups of the appearance of the spark plug you may have noticed that the gasoline supply is too less. (spark plug is dry, almost no residue, insulator is white).

Check whether there is enough fuel in the tank. Look into the tank to check for dirt, rust or, during winter, small ice crystals. If you find any of the above drain the tank completely and fill it up with new gasoline.

Remove the float chamber cover of the carburetor and open the fuel cock. Gasoline should run out. If this is not the case, remove the tank and take out the filter. Wash out the filter in clean gasoline.



6.5.3.1. Cleaning the carburetor

Close the fuel cock and drain the gasoline using the drain-screw of the carburetor or by unscrewing the float chamber of the carburetor. Drain the gasoline into a glass container and check the drained gasoline for pollutants as well as water.

To clean the carburettor the air filter assembly must be removed.

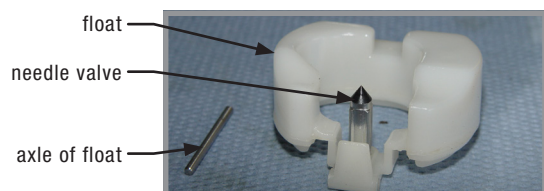
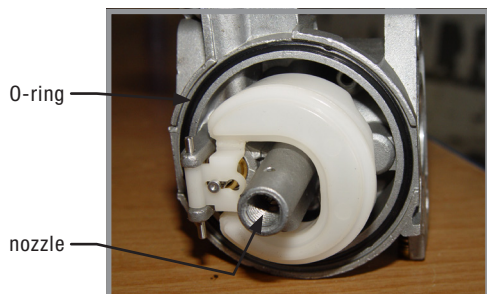
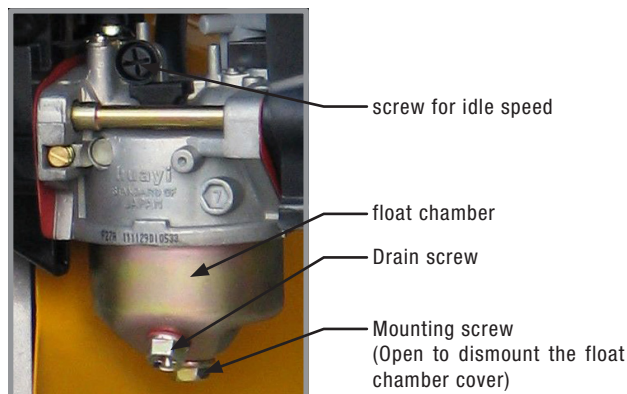
Now unscrew the float chamber. Check and clean the float chamber. The float must easily move up and down. The float is hollow and must not be filled with gasoline. In that case the float is leaky - close the hole with gasoline proof glue after removing any gasoline residue or change the carburetor.

The float triggers a needle valve. When you push the float upwards and open the fuel cock - the gasoline may not flow on. If the float pushed downwards the needle valve opens up and gasoline flows into the float chamber. When the needle valve does not work properly the axis of the float can be removed and both the valve seat and the needle should be cleaned accordingly. If the needle valve is broken or the float has a hole, too much gasoline is released into the float chamber.

Generally the carburetor can only be set up in very narrow borders. The default is set by the used factory-needle. If necessary for special usage (for example for usage at high sea level) the main nozzle must be changed for one with a different diameter.

The adjusting screw for idle speed is responsible for mixing the alloy during idle. The standard set-up is 2,5 turns open.

The carburetor is fixed to the device with two long screws below the air filter case. Check that the nuts are all well-fastened in order to avoid additional air getting into the device through the seals between intake pipe and carburettor. If necessary, open the screws and the seals between carburettor and intake pipe.



6.5.4. Cleaning and exchanging the air filter

If the air filter is loose or dirty the engine performance will be low (ex. motor produces black gas under load). Therefore you must always change the filter according to the maintenance intervals.

Open the nut on the top of the air filter box and take off the cover. Also remove the nut from the air filter. The filter can now be taken out of its base.

The filter element can be washed out in gasoline. Let the filter dry completely after washing it. Check for any tears or other damage. If the filter is damaged it must be replaced. Additionally clean the inside of the air filter case with a dust cloth. Then place the filter element on the base fix it with the screw and close the air filter case.



Sometimes tiny dirt particles are not visible with the naked eye. Indicators for pollution are when the motor is producing black smoke (not enough air). In that case exchange the air filter. Never put the motor into operation without an air filter - this could damage your device.

6.5.5. Proper timing/adjusting the valves

Improper valve clearance is noticeable by restless engine run, back fire or low performance.

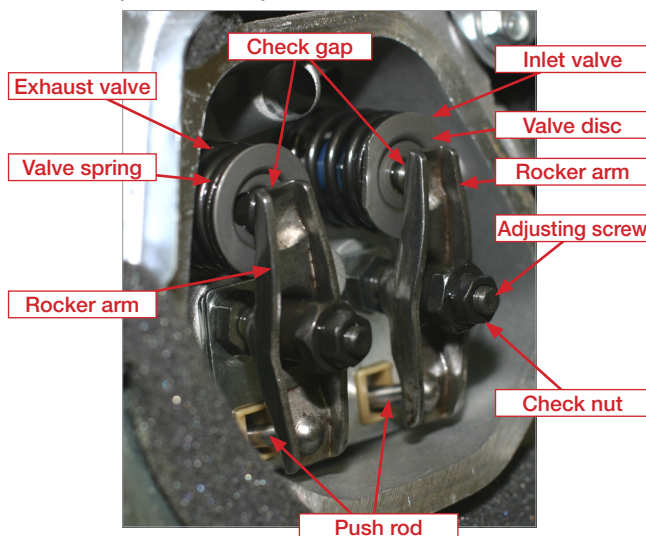
To set up the valves follow these instructions:

- Remove the valve bonnet.
- Press the outtake-valve and turn the shaft manually using the hand start until both valves are closed (valves completely out/push rods at their lowest point).
- The push-rods should be easy to move. Check the valve clearance with a feeler gauge. The valve clearance should be 0,10-0,15 mm when the engine is cold for both valves.



Should there be no feeling gauge available normal typewriter paper is fine (meaning two layers of paper).

- Unscrew the check nut in order to set up the valves. Set up the valves with the adjusting-screw so that if the feeler gauge is moved through the gap there is a noticeable resistance. Then hold the screw until the check nut is refastened.
- Check the valve clearance again and repeat the process if necessary - check allways both valve clearance values.



When reassembling the push-rods they have to lay on appropriate tapers of the camshaft (in the engine). Check whether the valves are working properly by turning the camshaft.



The timing of this device is fixed and cannot be changed.



It has to be easy to move or turn the push rods. The valve springs must not be broken and the push rod guides must not be worn. The position (how deep the nut is) of the check nuts should be nearly the same. Significant differences of nut depths are a sign of incorrect assembly or a damaged rocker arm, push-rod or valve. In that case remove the rocker arm entirely and pull out the pushrod. Always replace damaged or deformed parts.

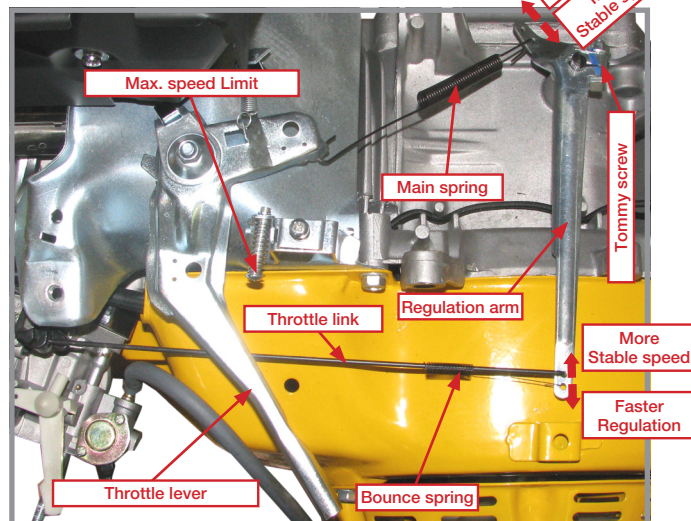
- After setting up the valves reassemble the bonnet assembly. Check whether the bonnet gasket is properly mounted.

6.5.6. Speed setting

The actual speed of the motor is set up over a mechanically adjustable speed governor. If there are just small deviations the rotational speed can be set via the adjusting screw. Because the mechanical regulator always has a negative deviation, adjust the rotational speed without load to about 2-4% above the target speed. At full load the rotational speed can be 2-4% below the set.

If the deviation is too big, try if the engine reacts on speed changes by changing the throttle setting.

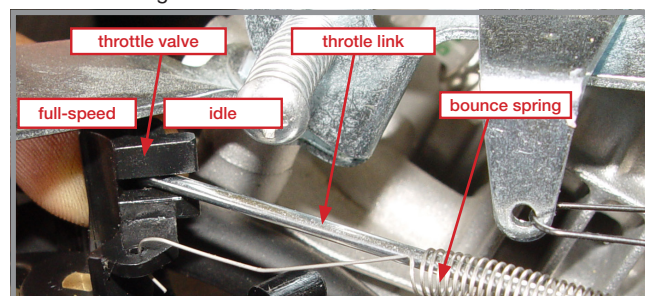
The change of the throttle mechanism has to be effortless and should not be in idle or full-gas position. If the engine don't react on throttle changes - stop trying to change the speed setting. Proceed with below described procedure.



Is the deviation too big, the link can be readjusted. At still standing engine the regulation arm will be pulled to full-gas position by the main spring.

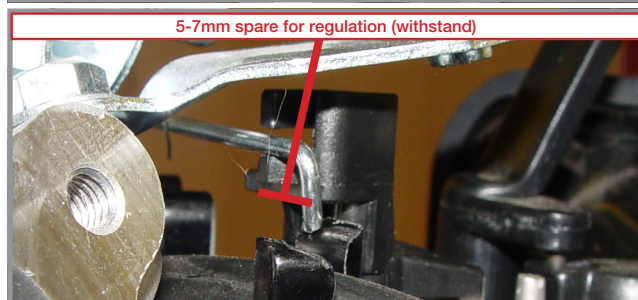
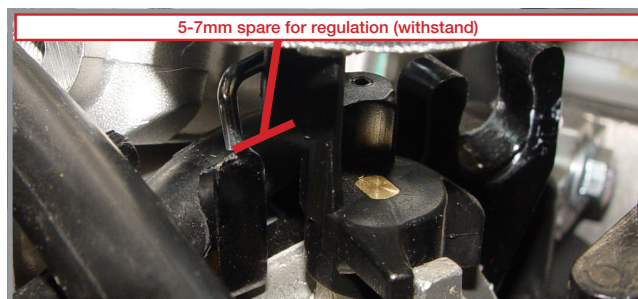
Unhook the throttle link at the carburetor (unhook bounce spring - pull carburetor throttle valve to idle position and remove the throttle link to the top).

If you turn the carburetor throttle valve to full-speed position, the end of the throttle link should withstand 5-7mm to full-speed position (needed spare for regulation). If not you have to open the tommy screw on the regulation arm.



Adjust the regulation arm to reach the needed spare for regulation - end of throttle link must withstand 5-7mm over the full-speed position of throttle valve. The axle of the regulation arm have to be in position full-speed (standard arm position at still standing engine).

Fasten the tommy screw and replace throttle link and bounce spring to the carburetor. Restart the engine and adjust the speed like described above.



If the tommy screw is too short you can also longer the main spring by bending the ends of the spring.

The main spring has no influence to the engine speed. It prevents only fluttering of the throttle link (the throttle link is always under tension)

6.5.7. Governing behaviour

The mechanical governor can be influenced in its regulation in different ways. The governing (how much the actual speed deviates from the ideal speed) and the oscillating (engine speed oscillates around ideal speed) are important. These two characteristics disagree with each other. Optimal balance is reached when the speed changing causes a 1-time low oscillation.

This means: set up the speed without load. Then burden the motor up with maximum load. Now the speed must first sink, then become higher than the rated speed and then final go back to rated speed. Engine speed should not oscillate around the rated speed.

To improve the governing, the regulating spring as well as the bounce spring can be hung on different positions - see schematics under 6.5.6. Normally a already marked rated speed has to be reset after changing the spring position.

Normally it is not necessary to change the speed or the behaviour. At too low engine speed first check for any other causes of error (air filter, fuel, valves, etc.)!

6.5.8. Muffler and colours of exhaust fumes

Backfire can be a result of loose screws on the outtake-manifold or the muffler. In that case the fit of the screws as well as the state of the gaskets should be checked. The exhaust pipe should be leak and damage free

Residue must be removed from the exhaust pipe and the muffler. However, such residue indicates that either the wrong fuel is being used or that oil is being burnt.



Too much exhaust back pressure can overheat the engine.

The colour of the exhaust gas can be an indication of the current operation state of the motor:

motor is smoking white or grey	water in the fuel	drain the fuel tank
motor is smoking blue	motor oil is being burned	check the oil level, valve guides, compression and the fuel (no 2-stroke fuel!)
motor is smoking black	too heavy load (too much fuel)	check the air filter, carburetor, choker-setting and spark-plug. Maybe reduce the load

6.5.9. Other

Unusual noises might be caused by worn piston, piston-rings, cylinder, piston bolt, bearings, etc..

Metallic tingling is caused by the motor misfiring. Causes are residue on piston/crankcase, extremely early ignition, worn spark plug, too light alloy or bad gasoline quality.

Too little compression might be caused by worn pistons, broken cylinders, incorrect set up or leaking valves.

Possible causes for an overheating motor are a too light alloy, a too heavy load, badly timed ignition or a clogged up ventilation system.

If there is water in the fuel the engine does not start up, it smokes white or it runs very restlessly. In this case drain the fuel.

6.5.10. Engine torque and measured values

	EG4-0090	EG4-0210 EG4-0270	EG4-0420
Cylinder head	22-24 Nm	34 Nm	35 Nm
Pleuelstange	10-12 Nm	14 Nm	15 Nm
Flywheel	70-80 Nm	113 Nm	115 Nm
Inlet valve	Opening: 10° aTDC, Closing: 20° aBDC		
Outlet valve	Opening: 30° bBDC, Closing: 10° bTDC		
Inlet Valve clearance	0,10-0,15 mm cold		
Outlet Valve clearance	0,10-0,15 mm cold		

6.6. Possible errors and their solutions

	Problem	Cause	Solution
Engine does not start	Electrical problem in version "E"	Main switch turned off	Turn on the main switch
		Battery broken or too weak	Charge battery externally and check the state of the battery again.
		Wiring damaged or loose	Check the battery cables to the starter as well as the control cables to the starting relays
		Electric starter is broken	Test electric starter according to maintenance instructions
	Bad fuel delivery	Too little fuel in the tank	Refuel
		Wrong fuel	Drain the fuel and refuel
		Fuel filter clogged	Change the fuel filter
		Carburetor clogged or dirty	Clean/change the carburetor
	Bad ventilation	Air filter clogged	Clean or replace the air filter
	Bad timing	Wrong valve clearance	Check the valve clearance of both valves
Abnormal exhaust gas colour	Black smoke	Intake valve does not close properly	Check the valve clearance as well as whether the intake valve is leak-free
		Piston or piston rings worn out	Send in device for repairs
		Generally the motor is overloaded when it is releasing black smoke. On the one hand it can truly be caused by overload– in this case lower the load. Note that the motor does not perform as well over temperatures over 25°C or at heights above 1.000m. Another cause is a flaw in the motor – but here the motor is overloaded as well, for example if the air filter is broken and the motor is getting too little air and therefor has too low performance.	
		Air filter clogged	Clean or replace the air filter
		Wrong fuel	Remove all fuel from the tank and replace it with gasoline
		Too little fuel	Refuel. Check whether the carburetor is getting enough fuel.
		Wrong valve clearance	Check the valve clearance of both valves
	Blue smoke	Intake valve does not close correctly	Check the valve clearance and whether the piston and the piston rings are worn or leaking
		Piston or piston rings worn out	Send in the device for repairs
		When the motor is releasing blue smoke motor oil is being burnt. This flaw has to be treated with special care as it could destroy the entire motor.	
		Oil level too high	Check the oil level and if necessary drain some oil via the drain screw
		Breather gasket of the crankcase broken or wrongly adjusted	Check the breather gasket of the crankcase
	White smoke	Valve gaskets worn	Check the valve gasket (primarily the intake valve gasket)
		Cylinder head gasket worn	Change the cylinder head gasket
		When the motor is producing white smoke there is water in the fuel system. For possible causes see below.	
		Surrounding temperature below 5°C	White smoke is normal during start-up when operating in cold conditions. However, the white smoke must vanish at operating temperature.
		Water in the fuel system	There is water in the tank because of condensation. This produces the white smoke. Drain the tank and refuel.
Too little engine performance	Bad ventilation	Air filter and/or intake clogged	Clean or exchange air filter. Clean the air intake.
	Bad fuel delivery	Too little fuel in the tank	Refill the tank. Check also fuel pipe.
		Clogged fuel filter	Change the fuel filter
	Bad timing	Wrong valve clearance	Check the valve clearance of the intake and outtake valve
	Too little compression	Intake valve does not close properly	Check the valve clearance as well as the intake valve for leaks
		Piston or piston rings worn	Have it checked by professionals
	Wrong reading of motor performance	Using the device above 1.000m sea level	All nominal motor measurements only apply below 1.000m sea level. Above 1.000m sea level you must derate the motor.
		Surrounding temperature above 25°C	All nominal motor measurements only apply below 25°C. Above 25°C you must derate the motor.
	Restless engine because the governor is blocked	throttle lever blocked	Check whether the throttle lever can move freely.
		Speed governor wrongly adjusted	Check the setscrew for maximum speed - see 6.5.6.
Motor overheating	Oil temperature too high	Engine overload	Reduce the load
		Surrounding temperature too high	
		Cooling lamella clogged	Clean following the maintenance instructions
		Wrong oil level	Check the oil level
		Wrong motor oil	Only use suitable oils abiding the specification
		Piston or piston rings worn	Have it checked by professionals.
Abnormal running noise	Dejantage or worn out parts	Wrong valve clearance	Check the valve clearance of both valves
		Piston or piston rings worn	Have it checked by professionals
		piston pin bearing worn	
		piston rod bearing worn	

6.7. Maintenance intervals

		before each start (daily)	after 25h running in	every 200h or 6M	every 400h or 12M	every 800h or 24M	every 1.600h or 36M
Fuel	Refuel	●					
	Check the fuel tube for leaks	●					
Oil	Check oil level	●					
	Check whether any oil is leaking	●					
	Change the Oil		●	●			
Cooling	Clean cooling lamellas			●			
Air	Clean the air filter and the filter housing			● ¹⁾			
Tubes	Replace fuel tube						○
Electrics only version "E"	Check the electric connections whether they are well attached and in good state		●	●			
	Check the electric cables for scrub marks or burn marks		●		●		
	Check loading state of the battery		●		●		
Muffler	Check muffler and exhaust manifold for leaks		●		●	○	
	Check muffler and exhaust manifold for clogs					○	
Screws	Check all screws (including coupled device and the screws of the pedestal)				●		
	Check all screws which are easily accessible		●		●		
	Refasten cylinder head- and flywheel screws					○	
Governing	Check easy moving of the throttle lever	●					
Cylinder head	Check valve clearance		●/○		●/○		
	Check valve sunk deep						○
	Check compression					○	
	Change piston rings						○
Other	Check for abnormal noise during operation	●					

- to be done by the user
○ to be done by a professional

¹⁾ Air filter cleaning interval

The mentioned cleaning interval applies to the normal surrounding air. In dusty, dirty surrounding the intervals for cleaning and exchanging the filter must be adjusted accordingly. Possibly replace the single layered standard paper filter with a different one suited for the surroundings (cyclone filter, oiled filter, etc.)

7. Appendix

7.1. Warranty conditions

The warranty duration of this device lasts 12 month, starting at the delivery to the end-user, at most 14 months after delivery date of Rotek.

Or, if the engine is used professionally and very often, the warranty expires after 1.000 hours of operation. In devices that do not have a working hour meter the general engine condition is used as a reference. At least 3 hours of operation every day are assumed in this calculation.

The warranty duration of spare parts lasts 6 months, starting at the delivery to the end-user. The receipt of the delivery note is proof for the delivery date.

Inside of the previously mentioned borders Rotek mandates themselves to repair or replace parts that after being examined by Rotek or an authorised service subsidiary prove to have production or material errors. Repairing or exchanging broken parts does not prolong the warranty duration of the device. All during the warranty duration repaired or replaced parts have the same warranty end-date as the original part.

Excluded from warranty is any damage that was caused by following reasons:

- Ignoring the instructions and rules in this manual. Improper usage.
- Forbidden environmental conditions.
- Overload
- Normal wearout
- Unauthorized changes on the device
- Using not original spare parts
- Insufficient or wrong cleaning or maintenance
- Damage because of missing resources (engine oil, etc.)
- Damage because of using unsuitable fuels or oils
- Damage at the bearing because of too little lubrication or wrong assembly

Furthermore, all wearing parts, resources like oil, filter (oil- and fuel filter), shaft bearings, lubricating fats and shaft seals are excluded from warranty.

Smaller flaws (scratches, miscolouring) can happen, however do not impair the usage of the device and are therefore excluded from warranty.

Rotek can not be hold responsible for costs, damage, direct or indirect losses (including possible loss of profit, loss of contract or loss of production), which are a result of using the device or not being able to use the device.

The warranty repair will be done at the location of Rotek or at the location of a from Rotek authorized service subsidiary.

Transport costs of any possibly broken parts that are required by Rotek to be evaluated are to be paid for by the customer. The transport costs to the location of the device or to an authorized service subsidiary for parts where the warranty is accepted is paid for by Rotek.

The broken, within the warranty period replaced parts automatically transfer into the ownership of Rotek after being replaced.

7.2. Declaration of conformity



Hiermit erklären wir,
We herewith declare,

Rotek Handels GmbH
Handelsstraße 4
2201 Hagenbrunn
Österreich / Austria

Dass das nachfolgend bezeichnete Gerät aufgrund seiner Konzipierung und Bauart sowie in der von uns in Verkehr gebrachten Ausführung den einschlägigen, grundlegenden Sicherheits- und Gesundheitsanforderungen der EG-Richtlinien entspricht.

That the following Appliances complies with the appropriate basic safety and health requirements of the EC Directive based on its design and type, as brought into circulation by us.

Bezeichnung	1-Zylinder 4-Takt Benzinmotor
Description	1-cylinder 4-stroke gasoline engine

Modell (Subnummer / Ausführung) Type (Subnumber / Buildnr.)	EG4-0090 (Q1 / LT1306)
	EG4-0210 (Q1, S1, S1E, V1, V5 / LT1501)
	EG4-0270 (S2, S2E, P4E / LT1312)
	EG4-0420 (S1E, S2, S2E, Q1E, V2E, V3E / LT1306)

Einschlägige EG-Richtlinien	2006/42/EG 2004/108/EG
Applicable EC Directives	2002/88/EG

Angewandte harmonisierte Normen	EN ISO 14314:2010-01
Applicable harmonized standards	EN 55012:2010-04

Bei einer nicht mit uns abgestimmter Änderung des Gerätes verliert diese Erklärung ihre Gültigkeit.

In a case of the alternation of the machine, not agreed upon by us, this declaration will lose its validity.

ROTEK Handels GmbH
Handelsstraße 4
A-2201 Hagenbrunn
Tel.: +43 (2246) 20791-0 Fax.: DW 50
http://www.rotek.at Email: office@rotek.at
(Robert Rernböck, Geschäftsführer)