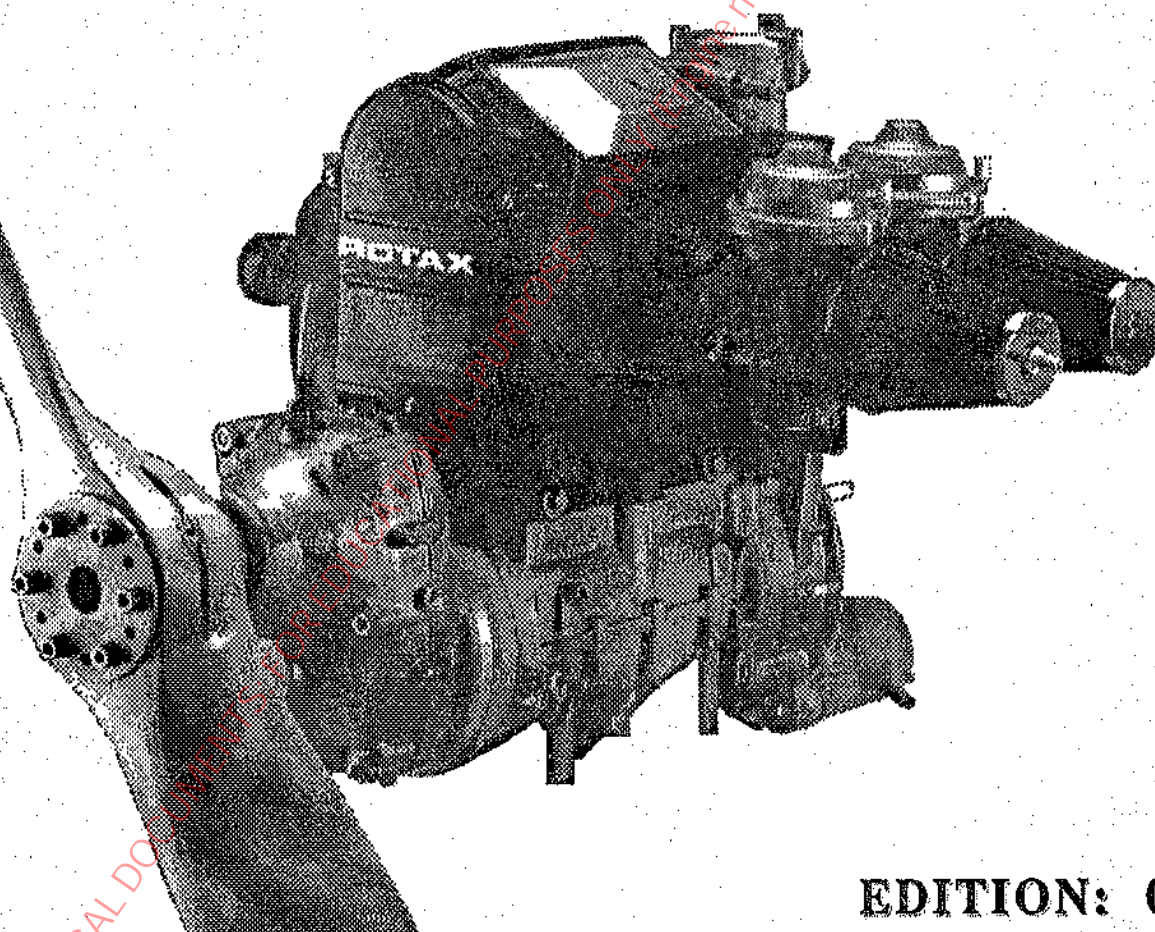




MANUAL FOR ROTAX ENGINE

TYPE 508 UL

configuration with contact breaker ignition
and 360 ° crankshaft



EDITION: 07 1989

This manual contains important safety and maintenance information concerning your engine. It must remain with the engine at time of resale

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TECHNICAL DATA OF ENGINE AND AUXILIARY EQUIPMENT

Engine:	2 cylinders in line, fan-cooled, 4 stroke with toothbelt driven single overhead camshaft (SOHC)		
Reduction gear:	flanged to engine, spur gear, standard gear ratio $i = 3$, integrated torsional shock absorber.		
Bore:	71 mm (2,80 in.)		
Stroke:	64 mm (2,521 in.)		
Displacement:	507 c.c. (31 cu.in.)		
Performance:	32 kW / 43 hp at 7800 r.p.m.		
Torque:	41 Nm (30 ft.lb.) at 7000 r.p.m.		
Permissible max. speed:	8000 r.p.m.		
Cylinder:	2 light-alloy cylinders with cast iron sleeve		
Piston:	cast, light-alloy, with 3 piston rings		
Cyl. wall to piston clearance:	0,04 mm (0,0016 in)		
Cylinder head:	mono-block-design, camshaft on roller bearings, roller rocker arms		
Compression ratio:	10,5 : 1		
Inlet valve:	36 mm (1,42 in.)		
Outlet valve:	30 mm (1,18 in.)		
Valve clearance, cold:	0,05 mm (0,002 in.) on both valves		
Camshaft:	Case hardened, opening angle 243 °		
Valve timing with 1 mm valve clearance:	inlet valve	opens	12 ° BTDC
	exhaust valve	opens	50 ° BBDC
	inlet valve	closes	51 ° ABDC
	exhaust valve	closes	13 ° ATDC
Crankshaft support:	4 ball-bearings		
Cooling:	axial fan cooled		
Lubrication:	dry sump, forced flow		
Oil pump:	trochoid pump driven by camshaft		

Oil tank capacity:2,5 litres (0,66 gal.us.)

Oil grade:.....SAE 20 W 40

Oil pressure:1 - 1,5 bar (14,5 - 21,8 psi) at 6000 r.p.m. and 140 ° C
(284 ° F) oil temperature

Lighting output:12 V 110W + 30W AC

Regulator-rectifiera) rectifier 866 080, for circuit with or without battery
(optional) as long as a minimum load of 12 W is provided
b) rectifier 264 870, for circuit with or without battery
but no necessity of any load.

Ignition timing:.....at start: 14 ° BTDC
at full load: 30 ° BTDC

Breaker gap:0,3 - 0,4 mm (0,012 - 0,016 in.)

Pole shoe gap:.....9 mm ± 2 mm (.35 in. +/- .08 in.)
24 mm (.95 in.) at start timing.

Spark plug:12 mm, D7 EA

Electrode gap:.....0,6 mm (0,024 in.)

Carburetor:2 x BING type 64, 32 mm constant depression

Air intake filter:2 x K&N micronic filter

Fuel pump:.....Pneumatic type DF 52

Fuel:.....Premium (knock-rating not below RON 95)

Starter:Rewind starter, optional: Electric starter

Reduction gear:i = 3 , optional i = 2,58 other gear ratios on request

Gear lubrication:.....gear oil SAE 140, API GL 5 or GL 6

Sense of rotationclockwise, looking towards propeller flange
on reduction gear:

Weight of engine:with reduction gear and exhaust manifold but without
carbs, air filters, muffler, oil container,
without oil:..... 38,0 kg (84 lb.)

Weight of auxiliary equipment:carbs, airfilters, fuel pump, muffler, oil container,
and oil: approx. 10,5 kg (23 lb.)

Weight of electric starter assy.:..... 3,5 kg (7,7 lb.)

PRESENTATION

The ROTAX powerplant 508 UL consists of a fan-cooled, 2 cylinders in line 4 stroke-engine and a flanged-on reduction gear 1:3 with prop shaft either above or below crankshaft centre.

Carefully and extensively tested design and rugged construction as well as the use of high quality parts warrant maximum reliability and durability. With the proper maintenance and care and with the use of suitable fuel and oil the engine will give you trouble-free service for many years.

The ROTAX design incorporates the latest technical developments. In order to take advantage of future developments we reserve the right to make modifications in the ROTAX design without notice.

FUEL

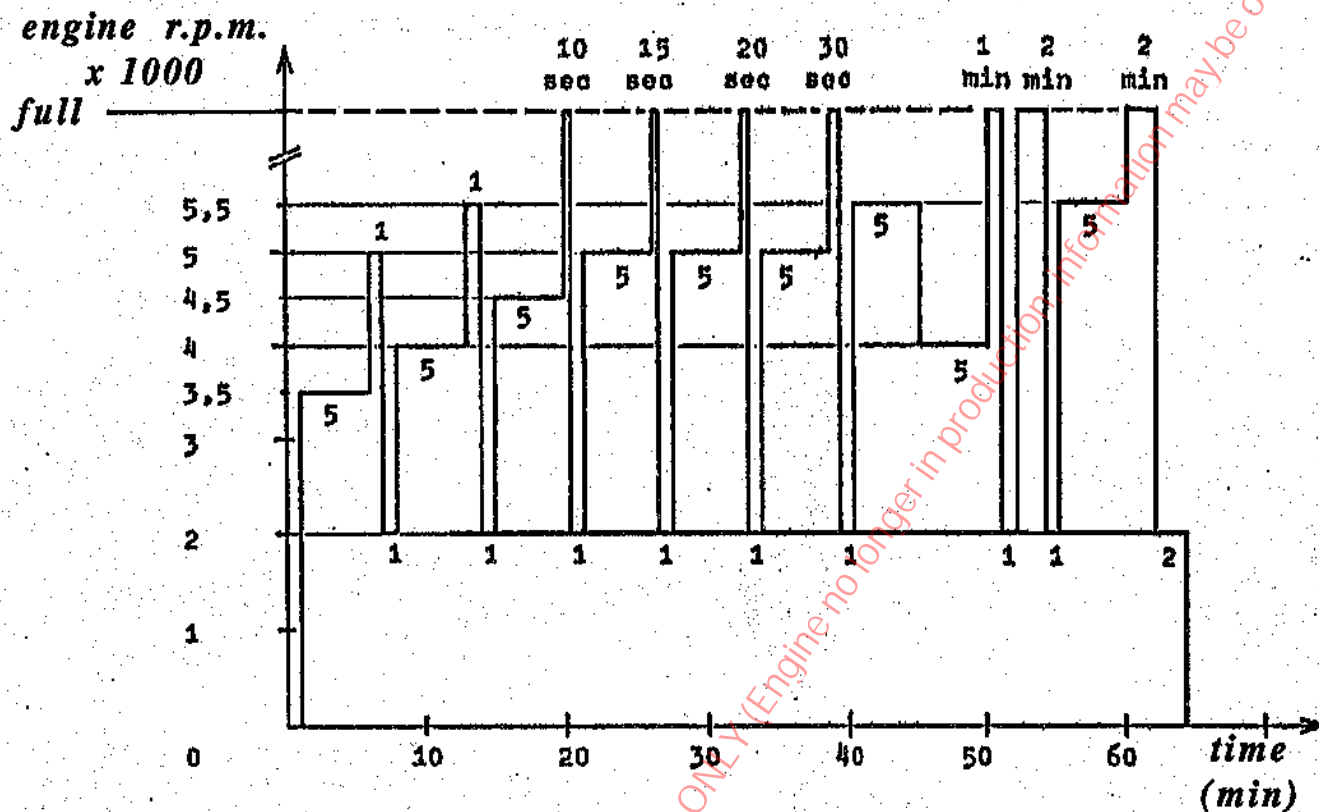
PREMIUM grade, leaded or unleaded. Knock-rating not below ROZ 95. If using leadfree gasoline, only well-known brands are permissible.

To compensate for the decreased knock-rating of leadfree fuels, alcohol like methanol, ethanol, isobutyl etc. is added. These additions bring on the other hand some disadvantages like reduction of storing stability due to higher water absorption, and gradual leaning down of fuel/air mixture which will eventually lead to higher engine temperatures. The alcohol content is limited to max. 10 % in alcohol-gasoline blends.

Higher contents could lead to vapour-locks in fuel lines due the higher vapour pressure of alcohol. Especially methanol acts aggressive on some plastic and metal parts and could therefore affect carb function.

RUNNING-IN PERIOD

The running-in has to be performed with the engine in the air-frame, loaded with the propeller. Tighten the plane to the ground and run the engine according to the following graph:



After this procedure the idle has to be adjusted
Then short take-offs can be conducted.

OPERATING SPEEDS

Operating speeds have to be watched over by a rev-counter.

Idle speed..... 2000 r.p.m.

Warming up period..... 3000 - 4000 r.p.m.

permissible max. speed..... 8000 r.p.m.

OPERATING TEMPERATURE

The cylinder head temperature readings taken with a thermocouple element under the spark plug to be in the following range:

normal..... 190 to 220 ° C (370 - 430 ° F)

Max. temperature on the hottest head:..... 250 ° C.....(480 ° F)

Max. difference between the cylinders:..... 20 ° C.....(36 ° F)

These operating temperatures must never be exceeded even with the ambient temperature at its peak.

ENGINE HANDLING

a) Attention:

Never start engine without propeller fitted to shaft.

b) Starting of the cold engine:

Open fuel cock, switch on ignition, actuate starting carb, set carb throttle to idling position, pull starter grip gently to the point feeling resistance and then pull firmly but not right up to the end.

Release rope for rewinding by spring. If electric-starter execution, push start button.

If the engine won't start immediately, repeat 2 to 3 times to make sure that the necessary delivery pressure on the fuel pump is reached.

As soon as engine runs, check oil pressure (manometer or indicator lamp) at 3000-4000 r.p.m..

c) Warming-up period:

Between 3000 - 4000 r.p.m. gradually close starting carb.

Warming-up time around 3 minutes or more, depending on ambient temperature.

d) Performance check:

After warming-up period a short full-throttle run with eyes on rev-counter is carried out to check if nominal full throttle speed, according to propeller layout, is reached.

e) Flight operation:

During flight the engine control is reduced to observation of oil pressure and rev. counter.

After take-off, don't operate the engine continuously at full load and try to run the engine within the marked speed range of 2000 to 7500 r.p.m..

f) Engine stop:

Never stop engine at high load all of a sudden, but let it cool down at part load and 2000 to 3000 r.p.m. for a few minutes and then actuate ignition shorting button. Close fuel cock at any longer period of stoppage.

g) Starting of the warm engine:

Proceed as under b) but with the carbs throttle slightly open. Keep starting carb closed.

ENGINE CHECKING AND MAINTENANCE

1) Daily check on following matter:

- a) Propeller for damage like impact marks
- b) Attachment of the propeller
- c) Throttle cables for easy action and sufficient movement
- d) Fuel storage, replenish. Check vent passage.
- e) Tightness of fuel lines and connections.
- f) Cause finding of any fuel or oil leaks
- g) Oil level in engine and gearbox

2) Various maintenance work after the first 10 hours of operation:

- a) Check of the timing belt tension
- b) Check and adjust valve clearance, 0,05 mm (0,002 in) on cold engine.
- c) Check ignition timing

3) Check list after 50 h in service:

- a) Open engine cowl and clean engine thoroughly.
- b) Check spark plugs.
Reset electrode gap to 0,6 mm (0,024 in)
Exchange excessively fouled or badly burned plugs.
- c) Check high tension leads and plug connections for abrasions, cracks and flashover signs.
- d) Check breaker contacts, but reset breaker gap only if erratic ignition was observed at high speed.
- e) Clean or renew fuel filter.
- f) Exchange oil and oil filter and vent lubrication circuit subsequently.
- g) Clean airfilter, intervals depending on dust accumulation.
- h) Check oil level in gearbox, if need be, replenish.

4) Check list after 100 h of flying time:

- a) Clean oil tank, change oil and oil filter and subsequently vent lubrication system (refer to page 12).
- b) Adjust valve clearance
- c) Check timing belt, belt tension.
Renew as required.
- d) Adjust ignition, renew breaker set,
apply grease to cam.
- e) Renew spark plugs.
- f) Clean carbs.

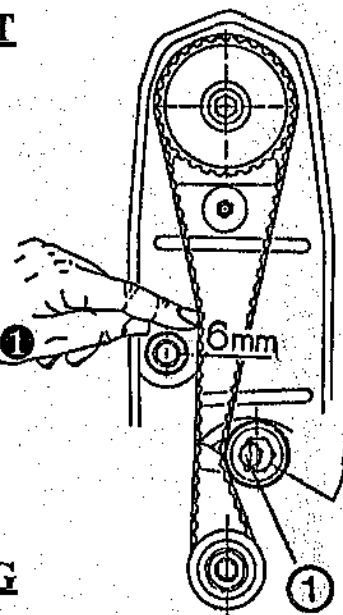
5) General engine overhaul after 500 h of flying operation:

Under severe flying conditions accordingly earlier recommended.

TENSIONING OF TIMING BELT

(on cold engine only)

Turn tensioning cam as far to the left to obtain a gap of 6 mm (.24 in.) between belt and guide pulley when applying a pressure of 20 N (4,5 lb.). Tighten M8 hex. nut ①

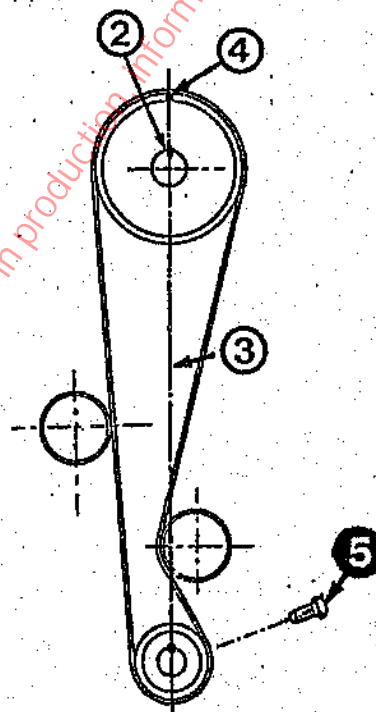


CHECKING OF VALVE TIMING

Set crankshaft to T.D.C. position using crankshaft locking screw ⑤

A line ③ through the centres of crankshaft and camshaft must align with the marks ② and ④ and on timing pulley and camshaft.

Remove crankshaft locking screw and fit M8 Allen screw with sealing washer instead.



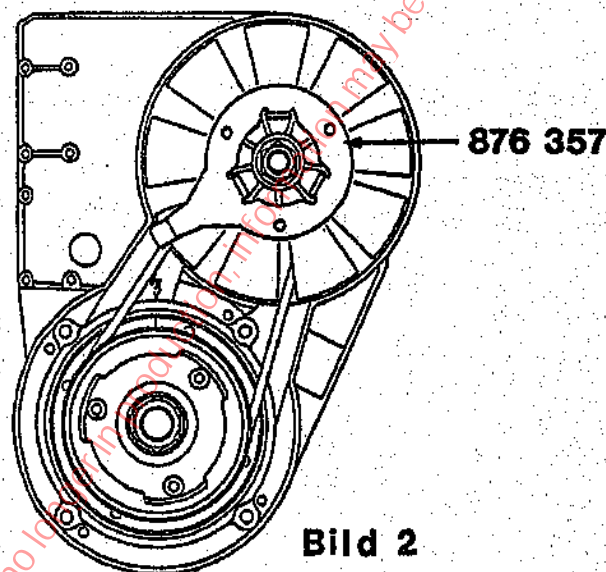
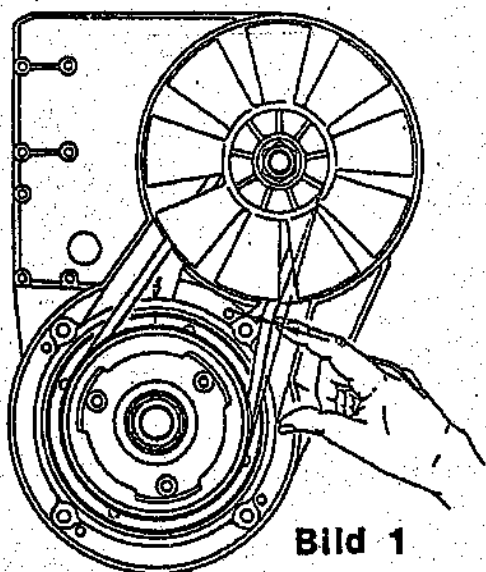
TORQUE SPECIFICATION FOR MAJOR BOLTS AND NUTS

		Nm	in.lb.
Cylinder head nuts	M8	22	195
Crankcase - screws	M6	10	90
	M8	22	195
Flywheel nut	M 22 x 1,5	105	930
Engine base nuts	M10	38	340
Exhaust manifold screws	M8	25	220
Hex. hd screw (drive gear on crankshaft)	1/2" U.N.F.	65	575

COOLING FAN, V-BELT DRIVE

Checking of V-belt tension:

The V-belt is correctly tensioned if it can be deflected at finger pressure (approx. 50 N = 11 lbs.) between the 2- V-belt pulleys by 8 - 9 mm (.32 - .35 in).



Adjustment of the V-belt tension:

If the belt tension is not within the above tolerance

- a) the tension can be increased by taking off shims between the pulley half and the fan,
- b) the tension can be reduced by adding shims between the pulley half and the fan.
- c) The removed shims should be stored behind the inner V-belt half to maintain belt alignment.

TOOL: Fan locking tool, socket spanner 21 mm a/f

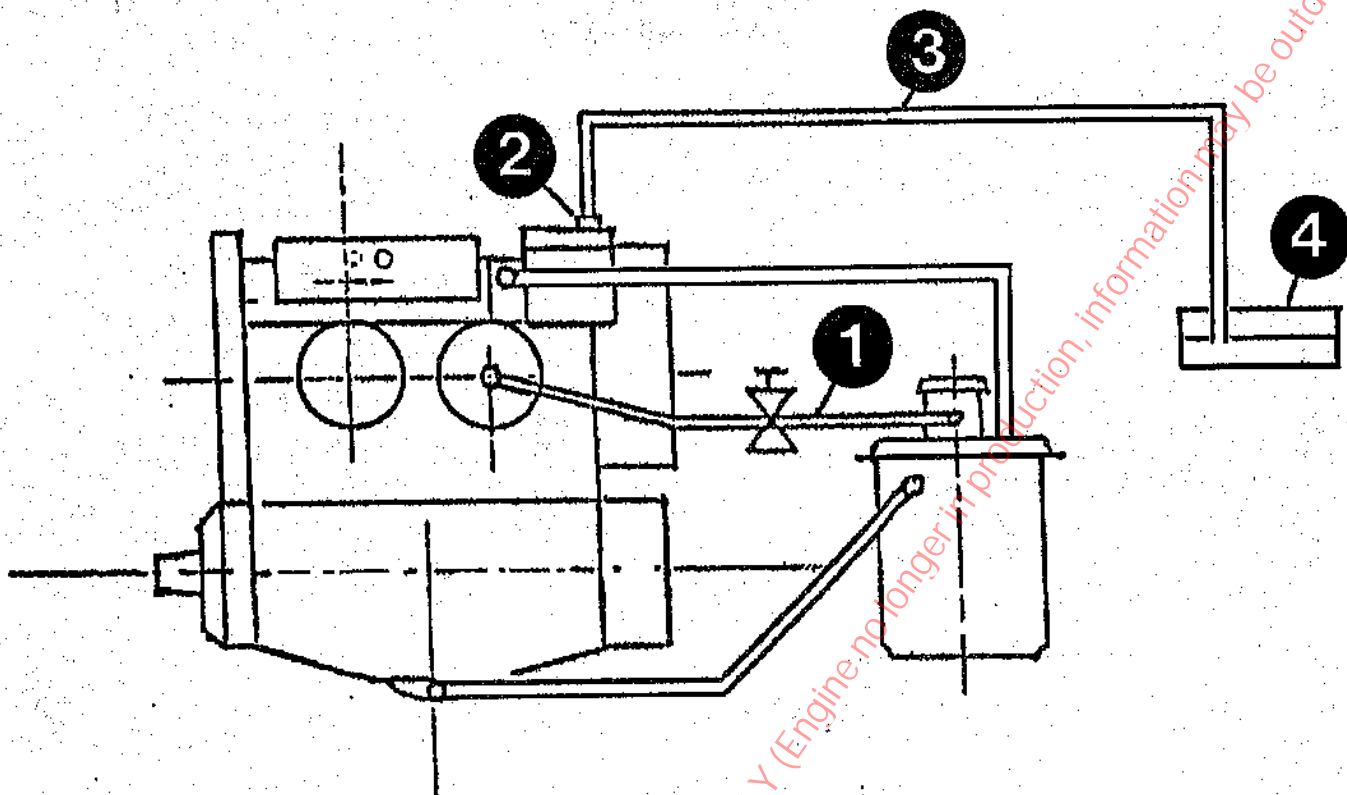
Attention: When fitting the hex. nut M16 x 1,5 take care not to squeeze the V-belt between the pulley halves. Tighten nut with 60 Nm (530 in.lb.).

Fitting of the belt:

- 1) Place V-belt between fan blades, turn fan until belt comes to rest in the pulley halves.
- 2) Now place V-belt into pulley assigned to crankshaft and attach it just with one screw together with starting pulley to flywheel.
- 3) Turn the crankshaft until the V-belt pulley centres on the flywheel. With the pulley in centre position, fit the remaining 2 screws and tighten with 22 Nm (195 in.lb.).

LUBRICATION SYSTEM

Dry sump, low pressure lubrication. Pressure feed by a trochoid pump driven by the crankshaft and the return flow, due to a pressure drop from crankcase to oil tank.



Venting of the lubrication system:

Fill oil tank right to the top level mark with oil SAE 20 W/40 W. Block off line between oil tank and intake filter by means of a clamp e. g.. Remove vent screw from oil filter cover and connect via a screw nipple a hose to a collecting tray 4 .

Start engine and let it idle until oil emerges bubble-free from hose. Stop engine, remove nipple and hose from oil filter cover and refit vent screw. Reopen passage oil tank to air intake filter. Check oil level, replenish as required.

ATTENTION: Use only genuine ROTAX oil reservoir. It warrants the complete separation of the air and oil emulsion returning from the crankcase.

Position of the oil reservoir:

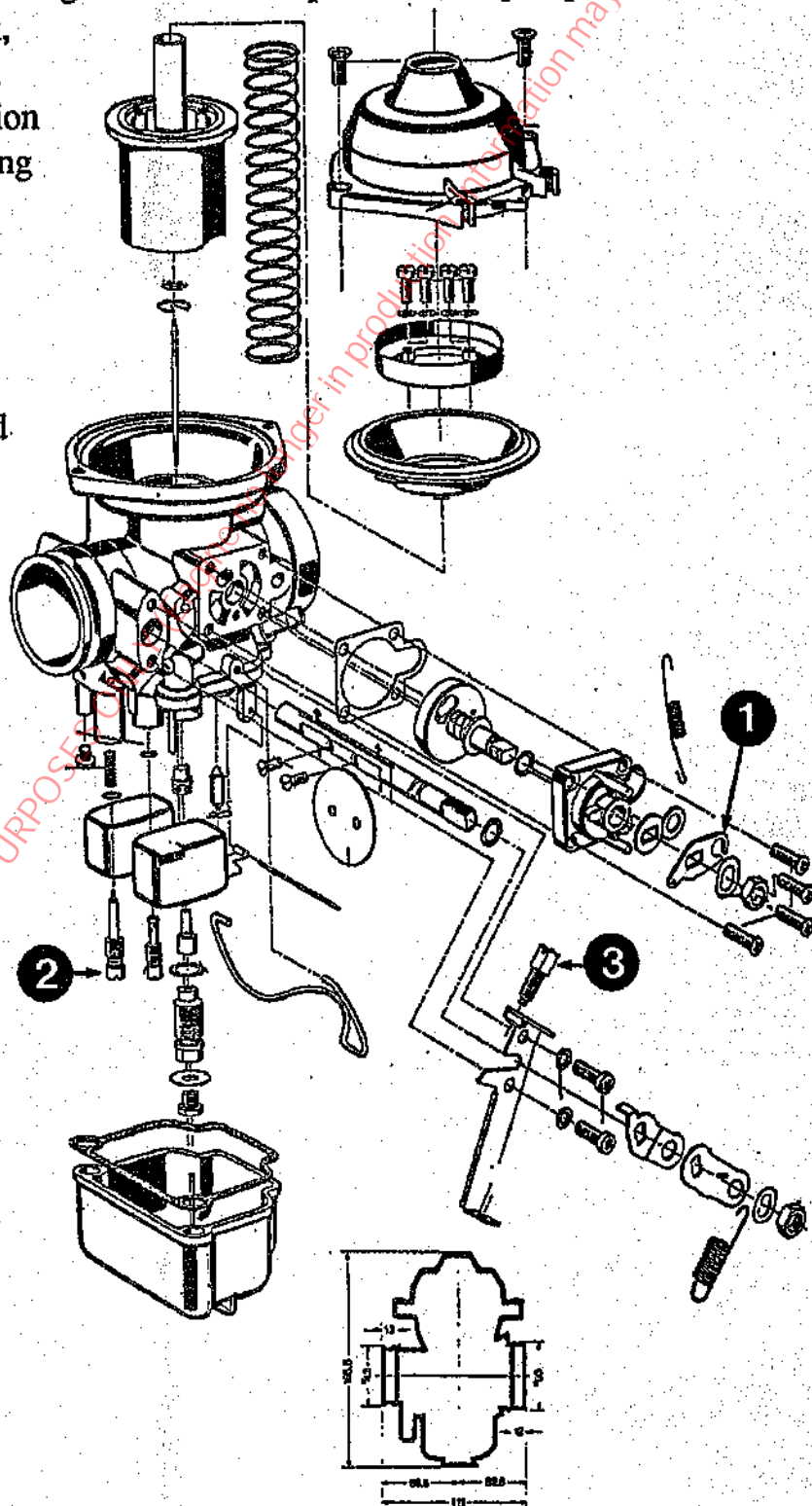
The level of the container bottom must not be more than 700 mm (28 in.) below the camshaft. But it may be located above oil pump.

CARBURETOR

The preparation of the fuel/air mixture takes place in 2 BING constant depression carbs size 32 mm, type 64. The fuel supply is ensured by a pneumatic fuel pump actuated by the pulsation in the intake manifold. To assure perfect functioning, the suction tube between carburetor flange and fuel pump should be of 1 m length, 6 mm inner dia., 2.5 mm wall thickness and of rather stiff material. This length also allows to place the fuel pump at distance from the engine and close to the fuel tank, which means higher pump pressure, lower temperature in the pump suction tube and less risk of pump scavenging due to air bubbles in the tube.

The carbs ass'y is furnished with a cable-operated starting carb.

The calibration of the carb is carried out at ROTAX and must not be changed without prior consulting ROTAX. Idle adjustment with air regulating screw and throttle stop adjustment screw.



IGNITION UNIT

The ROTAX engine 508 is equipped with a BOSCH magneto generator 12V 110 + 30W producing the current necessary for the spark. The ignition unit has been set most carefully and precisely by the factory. Make no changes unless absolutely necessary. In case of troubles observe the following:

If the ignition fails intermittently or if there are other troubles that are due to neither spark plug nor jets nor carburetor, the contact breaker may be the cause.

Contacts must be clean and not be burnt. With new engines the cam-follower of the contact breaker must still adjust itself. Re-setting of contacts may therefore be necessary after some time. The breaker contacts are accessible after removal of the rewind starter and the starting pulley. The magneto housing need not be removed.

The coordination of ignition timing to engine speed is governed by centrifugal force.

Checking of the ignition timing:

To check whether the ignition timing is correct, use a test lamp or buzzer connected to the shorting cable of the respective cylinder and to mass.

Timing marks are placed on magneto flywheel and fan housing. At the moment of ignition, when breaker contact opens and therefore test lamp glows darker or buzzer sounds deeper, the marks on the magneto housing must correspond with the arrow on the crankcase.

Setting of the ignition timing:

At the installation or setting of the ignition unit pay attention to the following data:

Ignition timing at start:1,22 mm (.048 in.) = 14 ° BTDC

Ignition timing at full load5,46 mm (.215 in.) = 30 ° BTDC

Contact breaker gap:0,3 - 0,4 mm (.016 ±.002 in.)

Pole shoe gap at start:.....24,0 mm (.95 in.)

Pole shoe gap at full load:.....9,0 mm (.35 in.)

To adjust the ignition timing, the two following ways are provided:

- Turning the armature plate ass'y along their elongated holes will affect ignition timing only.
- Any change of the breaker gap will also affect ignition timing and pole shoe gap.

For full load situation push centrifugal weight to outer position.

Procedure to install ignition unit to nominal ignition timing:

- 1) Fit armature plate ass'y to mid position.
- 2) Set breaker to open at nominal timing (refer to checking of ignition timing).
- 3) Checking of breaker gap, nominal 0,3 - 0,4 mm (.012 - .016 in.)

If the breaker gap is not within these limits, turn armature plate and repeat setting of the breaker opening as stated at 2).

If breaker gap is too small - turn armature plate in direction of engine rotation. And if too big - turn armature plate against sense of engine rotation.

- 4) Checking of the pole shoe gap:

This gap must be 9 mm (.35 in) at full load timing of 30° BTDC
resp. 24 mm (.95 in.) at start timing of 14° BTDC

Pole shoe gap:

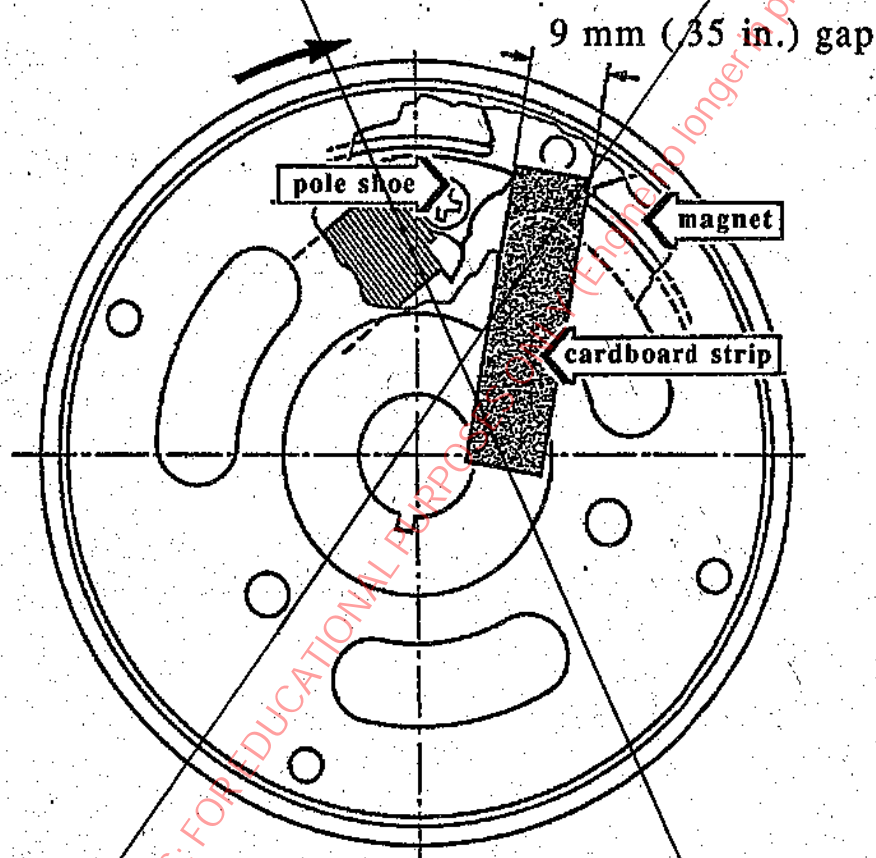
As soon as correct ignition timing is achieved, the pole shoe gap has to be checked and must be

9 mm (.35 in.) at full load timing of 30° BTDC resp.
24 mm (.95 in.) at start timing of 14° BTDC

(see illustration) when the timing marks correspond.

If the pole shoe gap is not within the above mentioned values, a possible cause may be the magneto flywheel displaced on the crankshaft. Remove magneto flywheel and check crankshaft taper and Woodruff key. Repair as required.

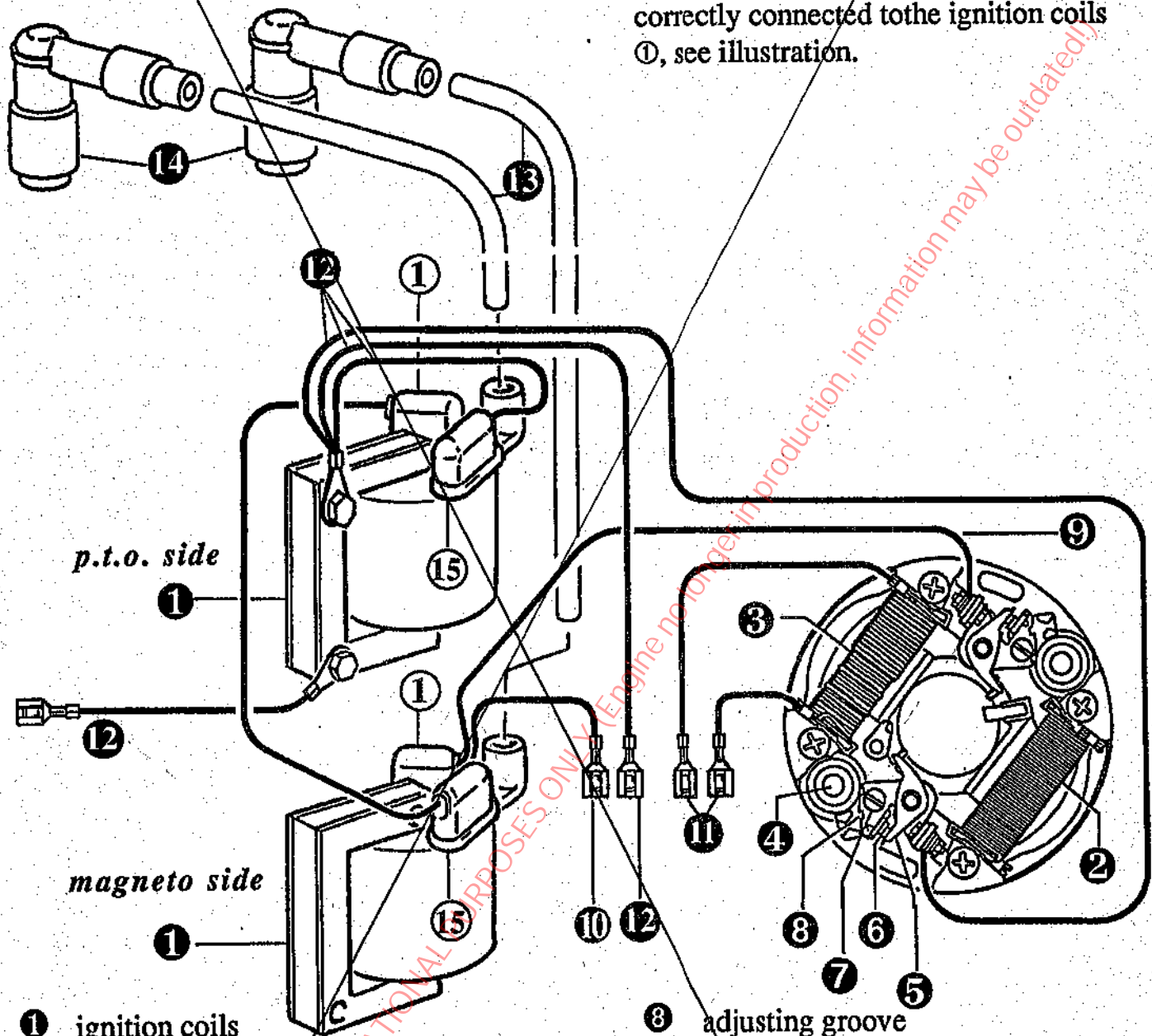
A pole shoe gap not within the above stated values would lead to bad starting behaviour and erratic ignition at higher speed.



Timing adjustment and repair of ignition units should best be left to a skilled mechanic. Improper handling can easily cause more troubles with such delicate parts.

Wiring diagram:

Particular care has to be taken that the ignition generator cable 9 and the mass cables 12 be correctly connected to the ignition coils ①, see illustration.



- ① ignition coils
- ② generator coil (bottom)
lighting coil 30W (top)
- ③ lighting coil 110W
- ④ capacitor
- ⑤ contact breaker lever
- ⑥ breaker contacts
- ⑦ fixing screw

- ⑧ adjusting groove
- ⑨ generator cable (blue)
- ⑩ shorting cables (black)
- ⑪ lighting cables (yellow, green)
- ⑫ mass cables (blue)
- ⑬ ignition cable
- ⑭ spark plug connector

To cut off the ignition, the shorting cable ⑩ (magneto side ignition coil ①) have to be connected to ground.

Spark plugs:

If the engine fails to start or operates only on one cylinder, it should be checked whether the ignition wiring is disconnected from the spark plug connector or from the spark plugs. Then the condition of the spark plugs has to be examined (bridged between the electrodes, oily, sooty, etc.)

If the spark plug heat range and the carburetor calibration are correct, the spark plugs look brownish.

With too high heat range (cold plug) and too rich carburetor calibration, they look black and sooty.

With too low heat range (hot plug) or too lean carburetor calibration the spark plugs are burnt white and the electrodes are covered with fusion beads.

ATTENTION: The plug face reveals the condition of the engine and operation conditions. For this reason it is advisable to inspect the spark plugs at regular intervals.

Lighting circuit:

The BOSCH magneto generator produces, apart from the electric current required for the ignition, 12V / 140W alternating current which can be directly used for feeding lights and/or other users that can be operated with alternating current. To avoid the voltage to rise above permissible levels, either users amounting to 140 watts have to be connected, or a voltage regulator has to be used.

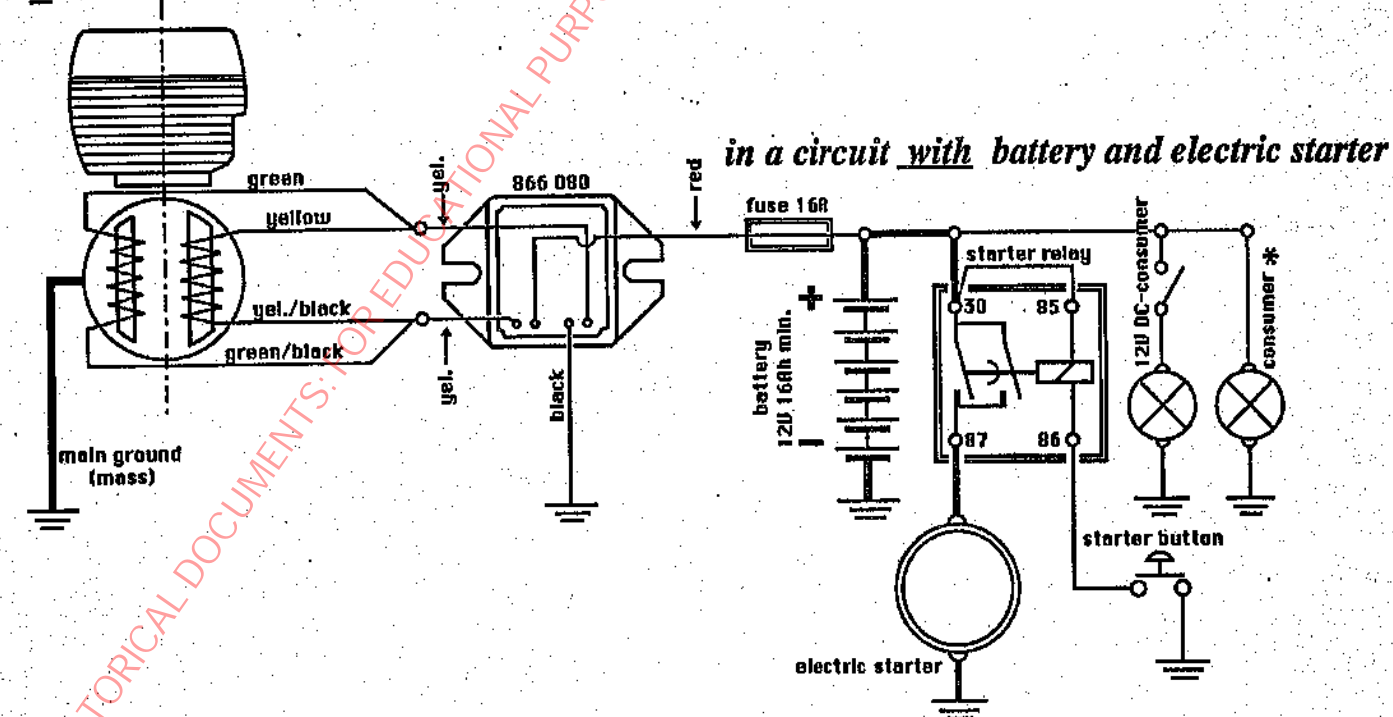
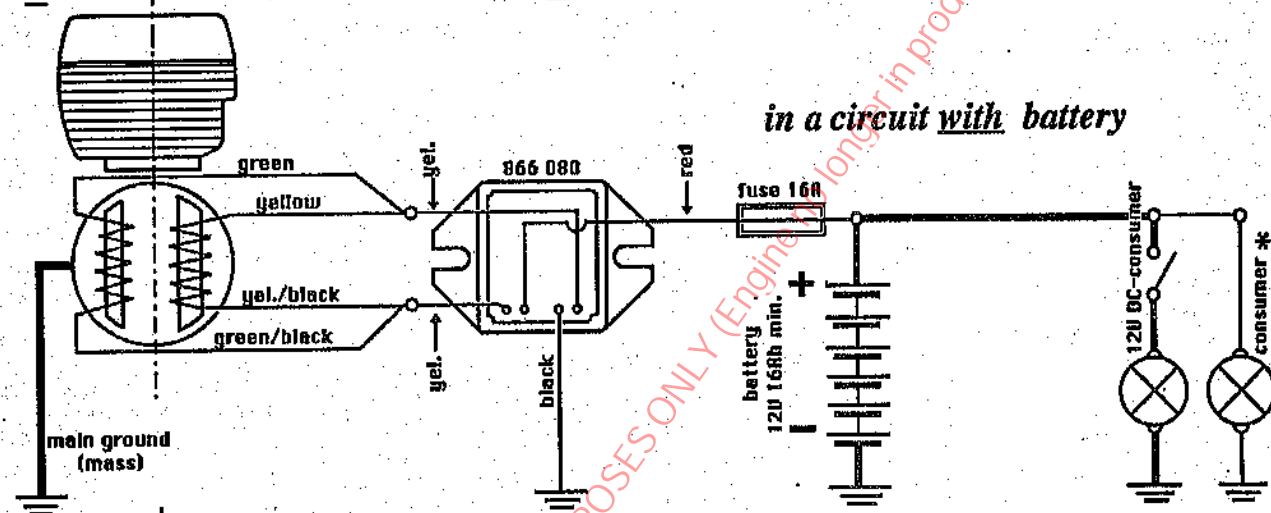
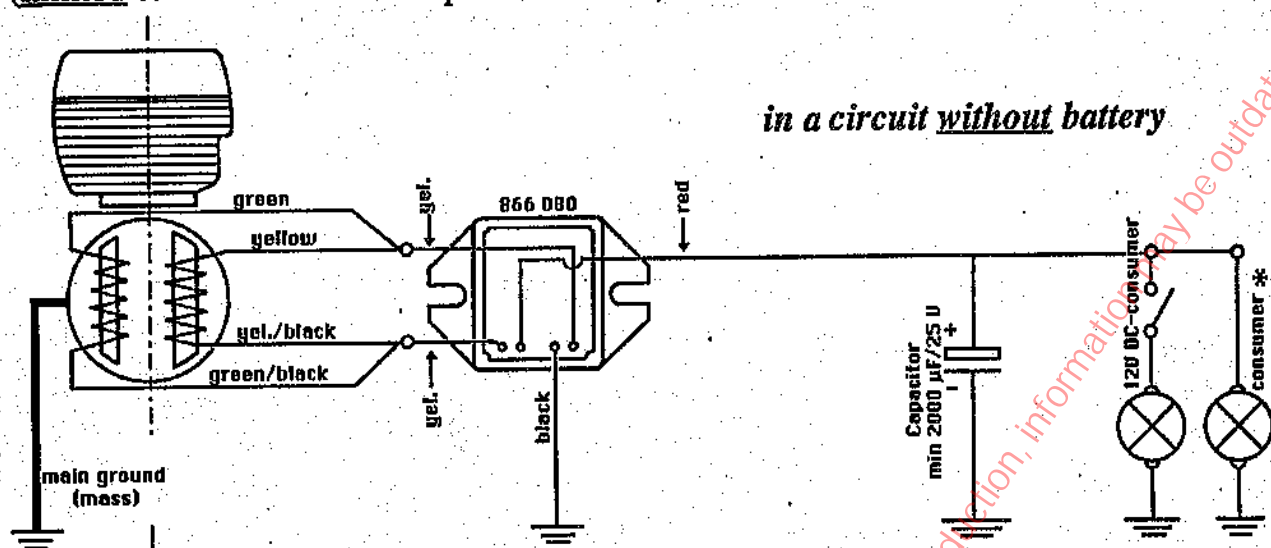
To operate users requiring direct current (e.g. battery), a rectifier regulator is required.

A rectifier-regulator, part no. 866 080, is available. For feeding lights only, this rectifier-regulator can also be used without battery. In this case the regulated RMS voltage will be between 11 and 12 Volts as long as a minimum load of 1 Amp. (= 12 watts) is provided.

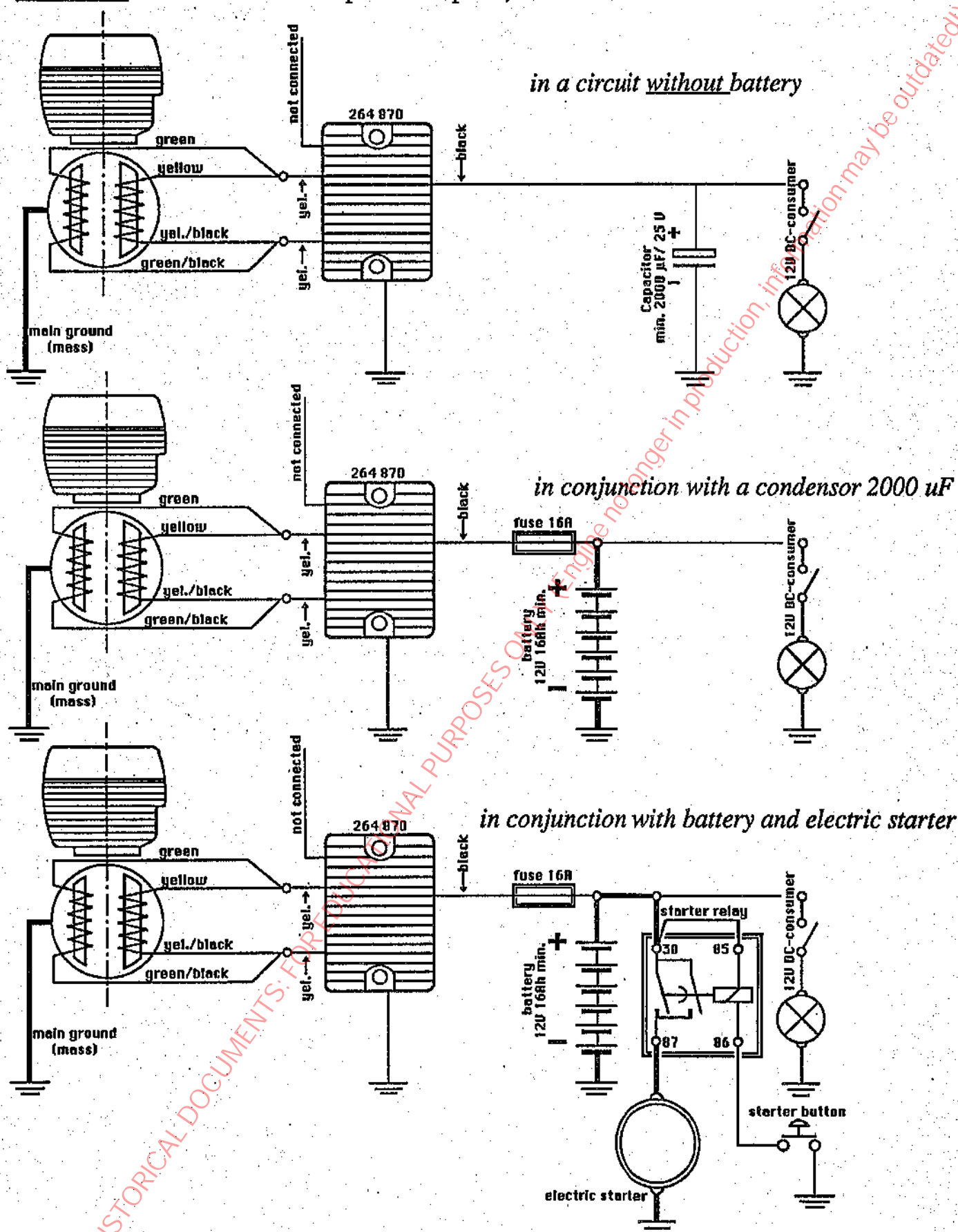
In case of a battery it has to be capable to absorb approx. 1 Amp. minimum continuous charging load, even with full battery (suggested min. battery capacity: 9 Amp.h). Regulated voltage is 13.5 to 14.5 volts.

In circuits where a load of at least 1 Amp. is not warranted, the rectifier-regulator, part no. 264 870, has to be used.

Wiring diagrams for rectifier-REGULTOR 866 080 (limited to minimum of 1 amp. consumption)

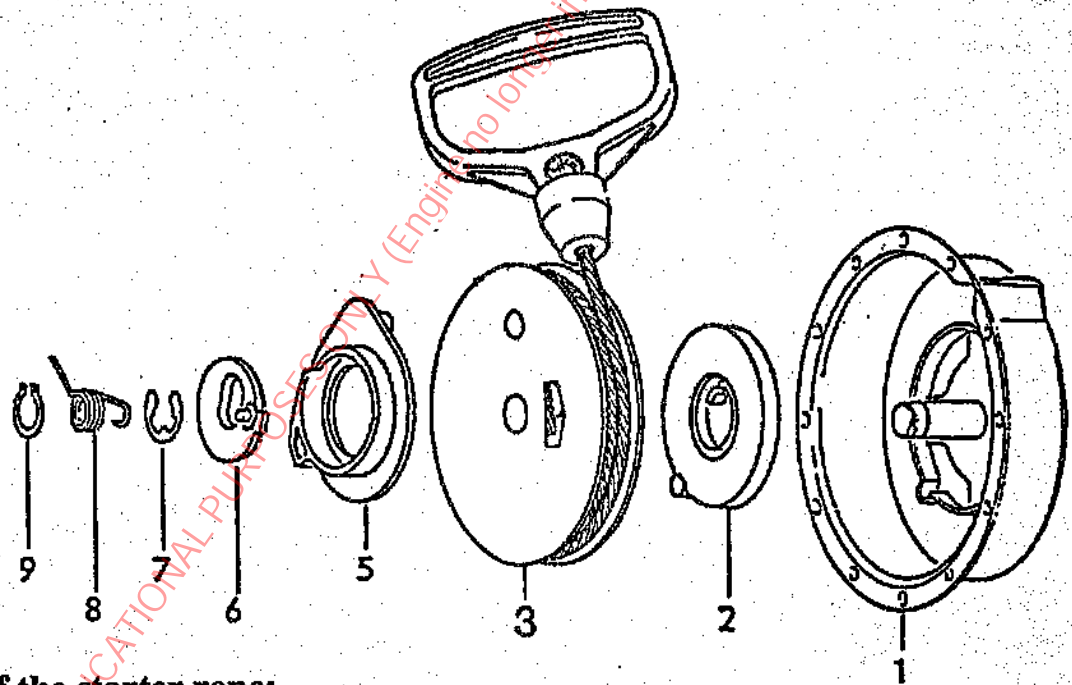
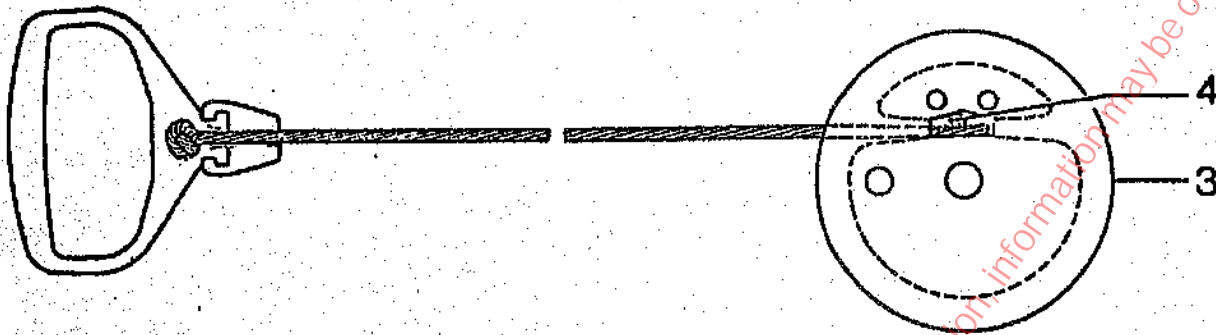


Wirng diagram for rectifier-regulator 264 870
(not limited to minimum of 1 amp. consumption)



REWIND STARTER

Pull starter grip gently to the point where resistance is felt, and then pull firmly but **not** right up to the end. Try to keep direction of pull conform to given alignment between sheave and rope guide. Release, but not all of a sudden, for rewinding by spring.



Exchange of the starter rope:

First remove snap ring ⑨ followed by loop spring ⑧, circlip ⑦, pawl lock ⑥ and the pawl ⑤. Pull out the starter rope right to the end and hold sheave in this position against rewind spring, push out the rope clamp visible in the sheave opening, against rope pulling direction and remove the rope.

Insert the new starter rope into the sheave, fit the rope clamp such a way that by pulling it will engage even further. Slowly release the rewind spring thus winding the rope on sheave, and then refit components ⑤, ⑥, ⑦, and ⑨ in right sequence.

CAUTION: Don't remove spring cartridge. Spring could escape, causing injuries.

TROUBLE SHOOTING

To facilitate your task we recommend to consult the following

Fault-tracing-schedule

Probable fault

Open the fuel cock

Does fuel reach the carburetor? ----no---->

yes

Does gasoline reach engine? ---no---->

yes

Does the carburetor keep flooding?

---yes--->

no

Has the engine become wet with oil? ☒ ---yes--->

no

Is there a spark at the spark plug connector? ---no --->

yes

1. Fuel tank empty
2. Blockage in vent hole of tank cap
3. Blockage in fuel cock
4. Blockage in fuel line
5. Needle valve blocked
6. Insufficient supply of fuel pump
7. Pump temperature too high, excessive suction height, unsuitable impulse tube

- ### 1. Blockage in carburetor

1. Float stuck
2. Float leaks
3. Needle valve does not seal properly

1. Too much use of starter
2. Faulty ignition system
3. Incorrect fuel mixture

1. Poor contact between ignition coil and ignition cable
2. Ignition cable broken or short-circuiting
3. Faulty ignition coil

Is there a spark at the spark plug?

----no---->

1. Electrode gap too large
 2. Bridging between electrodes
 3. Insulator broken or wet
 4. Spark plug fouled
- Change the spark plug

yes

Is the engine difficult to start?

---yes----->

1. Faulty ignition timing
2. Float needle does not seal properly.
3. Air cleaner blocked
4. Fault in carburetor
5. Defective spark plug
6. Loss of compression due to defective gasket, valves or no valve seats.
7. No valve clearance
8. Insufficient preload on spring pack in reduction gear

no

Knock tendency of engine?

----yes----->

1. Carb calibration too lean
2. Ignition time too advanced
3. Insufficient fuel supply
4. Knockrating of fuel too low
5. Pume temperature too high, excessive suction height, unsuitable impulse tube

no

Sound of detonations on intake side?

---yes----->

1. Insufficient fuel supply
 - a) Fuel filter blocked
 - b) Dirt in carb
 - c) Dirt on needle valve
 - d) Needle position too low
2. Intake valve not tight
3. Incorrect valve timing
4. Incorrect ignition timing
5. Additional air intake via loose fittings or leaks

no

Does the engine run unsteady, misfiring, with smoky exhaust emission?

---yes----->

1. Carb calibration too rich.
 - a) Worn needle jet
 - b) Jet too large
 - c) Starting carb still in action
 - d) Needle position too high

no

2. Dirty air filter element
3. Incorrect ignition timing
4. Loose or fouled spark plug
5. Incorrect electrode gap
6. Incorrect heat range of spark plug
7. Badly connected or poorly insulated ignition cables
8. Piston rings broken or stuck
9. Too low compression

Excessive mechanical noise emission?

---yes----->

1. Camshaft wear
2. Valve clearance too big
3. Piston pin clearance
4. Wear on big end bearing or cylinder bore

no

Does the engine run well at idle speed?

---no----->

1. Bad idle adjustment
2. Incorrect ignition timing
3. Faulty spark plugs

yes

Excessive engine vibration?

---yes----->

1. Unbalance of propeller
2. Engine suspension damaged or loose

Remember to work in a methodical sequence when tracing faults.

INSPECTION LIST

[illegible]

HISTORICAL DOCUMENTS: FOR EDUCATIONAL PURPOSES ONLY (Engine no longer in production, information may be outdated!)

ENGINE TYPE: _____

SERIAL NO.: _____

PURCHASE DATE: _____

INSTALLATION IN: _____

DEALER IMPRINT AREA



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