BOMBARDIER ROTAX®

Preliminary

OPERATOR'S MANUAL

ENGINE TYPE

618 UL DCDI

Equipped with
breakerless ignition system
and BING carburetor

EDITION: 06 1994

⚠ WARNING

Before starting the engine, read the Operator`s Manual. Failure to do so may result in **personal injuries including death**.
Consult the original equipment manufacturer`s handbook for additional instructions!

The manual must remain with the engine / original equipment in case of sale.

BOMBARDIER

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Modifications or special applications	Date

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Danger!

This engine, by its design, is subject to sudden stoppage! Engine stoppage can result in crash landings. Such crash landings can lead to serious bodily injury or death.

Never fly the aircraft equipped with this engine at locations, airspeeds, altitudes, or other circumstances from which a successful no-power landing cannot be made, after sudden engine stoppage.

Warning!

This is not a certificated aircraft engine. It has not received any safety or durability testing, and conforms to no aircraft standards. It is for use in experimental, uncertificated aircraft and vehicles only in which an engine failure will not compromise safety.

User assumes all risk of use, and acknowledges by his use that he knows this engine is subject to sudden stoppage.

1) Important preface:

Safety is everyone's business. We have included some of the important safety tips here, but the list is not complete. It would be impossible to list every way in which one may be injured. But we would rather risk your indignation by mentioning that "which every-one knows is dangerous" than take the chance that needless injury could occur. Please note the following symbols throughout the book:

▲ - Safety Warning: Failure to obey a safety warning may result in injury to you or others.

■ - Information vital to the operation or maintenance of your product (this should also be considered necessary for safety).

1.1) General safety points:

▲ - Make sure all engine controls are operative, that you know ON and OFF positions of throttle and ignition, that they are easily accessible, and that you can operate them instinctively without hesitation.

▲ - Never refuel if fuel could be spilled on hot engine components. Use only safety approved fuel containers and never transport fuel in an unsafe manner.

▲ - Check engine suspension frequently as well as the drive components, fuel lines, wiring, and fuel and air filters.

▲ - Check for fuel contamination, air vents, etc. Protect engine while not in use from any contamination entering fuel or carburetion system, but be sure to remove storage protection before starting engine.

▲ - Maintain your engine in top condition and assume it's going to quit running at any time. Leave yourself a way out in the event of unexpected failure.

▲ - Never run the engine on the ground with the propeller turning unless you are doing so in a run up area and can observe anyone or anything entering the danger area. An observer in a safe place is a definite asset.

▲ - Never leave your aircraft or other vehicle unattended while the engine is running. If operated by someone else you could be sued even if the use was unauthorized by you.

▲ - Keep an engine log and enter any unusual engine behaviour. Do not fly unless you have corrected a given problem and recorded the correction in the log.

2) Foreword:

The ROTAX engine is a liquid-cooled 2 stroke engine. Careful and extensively tested design and rugged construction as well as the use of high quality parts increase reliability and durability. With proper maintenance and care and with the use of suitable fuel and oil the engine should give you good 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.

■ NOTE: All fasteners are metric with the exception of the internal thread of the P.T.O. shaft which is 1/2" national fine thread and certain pipe fittings. It is to your advantage to read this manual carefully for the protection of your engine. There may be extreme differences from other types of two cycle engines you may have worked on.

■ Always use genuine ROTAX parts.

■▲ Never run engine without proper loading, e.g. correct propeller. Refer section 29, technical data.

3) Fuel and oil:

▲ Fuel contamination is a major cause of engine failure. The best place to avoid contamination is at the source. Once in your fuel container, a very harzadous potential exists.

Use a clean safety approved storage container. Filter all fuel entering and leaving this container. Do not over-fill container, allow for expansion.

▲ WARNING: Gasoline is flammable and explosive under certain conditions. Always perform procedures in a well ventilated area. Do not smoke or allow open flames or sparks in the vicinity. Never add fuel while engine is running.

■ Refer to technical data. The engine is designed to operate on a fuel mix with 2 % oil. Be sure to use products of at least the standard shown in the technical data section.

If the engine is to be used inverted (with spark plugs pointing down) select a lubricant which features low carbon deposits. Oil residues tend to drain to low points, i.e. spark plug cavities. If these residues fail to burn clean during normal operation, plug fouling will occur, possible pre-ignition also. Manufactures of suitable lubricants will guarantee their products in writing.

Oil specifications: SUPER two stroke oil (for high performance air cooled two cycle engines, proposed ASTM/CEC standard TSC3) for instance: Castrol TTS or Blizzard oil.

▲ Do not use fuel which has been stored for long periods of time. Do not leave fuel exposed to sunlight in translucent containers.

4) Starting Procedure

4.1) Pre-start check

Before starting engine, read section dealing with starting and engine break-in thoroughly. The service life of the engine is largely determined by how well you follow these instructions.

▲ Before starting engine be sure your installation is complete, ensure that all controls operate easily and smoothly, and that you can operate them instinctively.

▲ Always ensure that you are in a safe run-up area.

■ Ensure throttle linkage allows piston valve in carb to bottom in idle position. Screw out idle speed adjustment screw (see section 8, no.14) until carb piston (no.3) bottoms. Carefully turn in adjustment screw until it engages piston and turn in a further 3 to 3 1/2 full turns. Check if fuel line is connected and tank vent is open.

4.2) Procedure:

On cold engine apply choke fully. Ensure idle position. (Opening throttle will greatly reduce choke effect resulting in hard starting). Make sure ignition switch is on and that you can shut it off instantly if necessary. Pull starter until firmly engaged and then pull smartly through.

Above procedure should be repeated until engine begins to "fire". As soon as engine starts, shift the throttle slowly to low speed and remove choke as soon as possible. (Prolonged use of choke can cause engine to flood).

If the engine fails to start or operates only on one cylinder, check whether the ignition wiring is correctly connected to the spark plug connectors and the ignition switch is in ON position.

■ Ensure shorting switch is in correct position and wired correctly.

If preceding checks do not solve the problem, remove the spark plugs and inspect. Wet spark plugs indicate a flooded engine. To correct replace with dry plugs and discontinue use of choke.

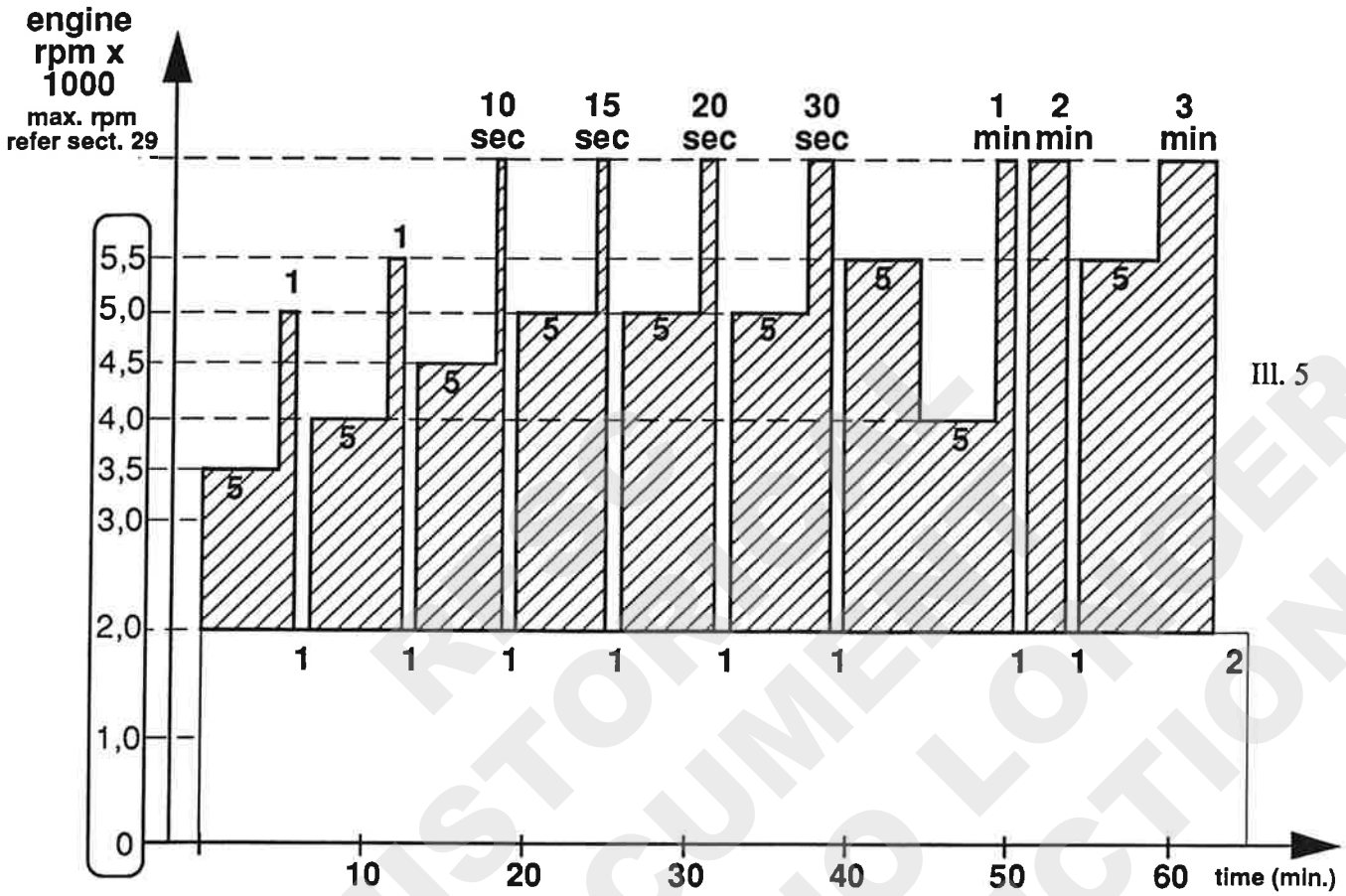
Switch off ignition; remove choke. Crank engine with throttle fully open to clear the excess fuel. Repeat start procedure.

Dry spark plugs indicate no fuel in engine. TO INSPECT: remove float bowl and ensure fuel is present in sufficient quantity. If not, inspect fuel level in tank, fuel valve and tank vent. Look for blockage or obstruction. Correct and repeat start procedure.

5) Break-in procedure

for aircraft installation (in other applications proceed accordingly)

The break-in has to be performed with the engine installed, properly loaded with matched propeller for max. R.P.M. In case of an aircraft, anchor the plane to the ground. Run the engine according to the following graph:



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▲ In case of a liquid cooled engine it is possible that the air flow (speed) on ground is not fast enough to provide the necessary cooling for a longer period. Therefore it is necessary to observe carefully the temperature of the cooling liquid during break-in procedure to avoid overheating. Before exceeding the maximum allowed liquid temperature on cylinder head (outlet) of 80 °C/180 °F interrupt the run-in and cool down the engine at idle for approximately one minute and continue where you have interrupted.

▲ Be sure to use a safe run-up area to anchor aircraft at those points approved by the airframe manufacturer, and to have someone present who is able to shut off the engine instantly and prevent people from entering the area. Proper clothing should be used at any engine run or ground test.

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

■ After initial break-in adjustment is performed, only normal maintenance is required (see maintenance schedule).

6) Operation in flight:
(or under working conditions-other applications)

It is recommended to use full throttle during take-off climb. Slight throttle reduction may create a leaner mixture and should be avoided. Select a cruising speed where the engine is running smooth.

Do not exceed maximum engine rpm. (refer technical data, section 29)!

During cruise and descending it is very important not to create a lean condition with high rpm and low throttle opening. The less fresh charge the engine gets, the more hot residual gas remains in the cylinder. This raises the temperatures to a critical level.

For this reason, you may also experience higher exhaust gas and cylinder head temperatures at reduced throttle openings.

Idling r.p.m. is 2000 minimum. Higher idle r.p.m. setting will reduce enrichment action of starting circuit in carburetor (choke) making cold starting difficult.

Prior to shutdown,engine should be run until latent heat build-up from previous high power settings has been dissipated (approx. 3000 r.p.m. or at nearest smooth running r.p.m. for a minimum of two minutes followed by a short period of idle - 2000 r.p.m.).

Do not idle for prolonged periods as normal rich condition present at this power setting can cause unnecessary carbon deposits and spark plug fouling. Additional shock loads present at idle cause gear box, propeller, and/or drive trains to operate in conditions which should be avoided whenever possible.

7) Rotary Valve:

7.1) Rotary valve marking:

From top end of magneto side inlet port, mark crankcase at β = closing time (see ill. below). For rotary valve timing see technical data, section 29.

7.2) Rotary Valve Adjustment:

Installation: To correctly install the rotary valve disc proceed as follows:

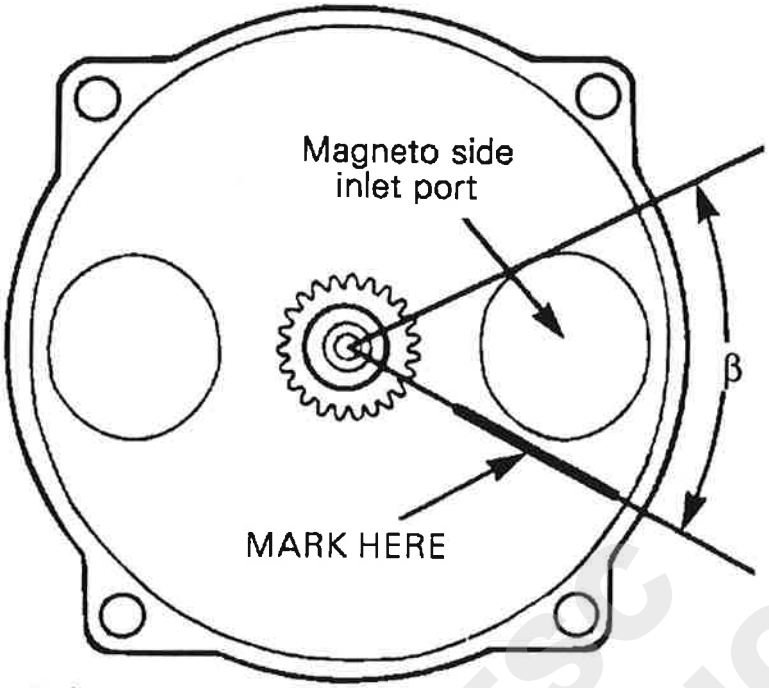
- Turning crankshaft counter-clockwise (p.t.o. side), bring magneto side piston to Top Dead Center using a T.D.C. gauge.

- Position the rotary valve disc on gear to have edge as close as possible to the mark.

NOTE: The rotary valve disc is asymmetrical, therefore, at assembly try positioning each side of disc on gear to determine best installation position (see ill. below).

7.3) Rotary valve values:

For rotary valve values and timing see technical data, section 29.



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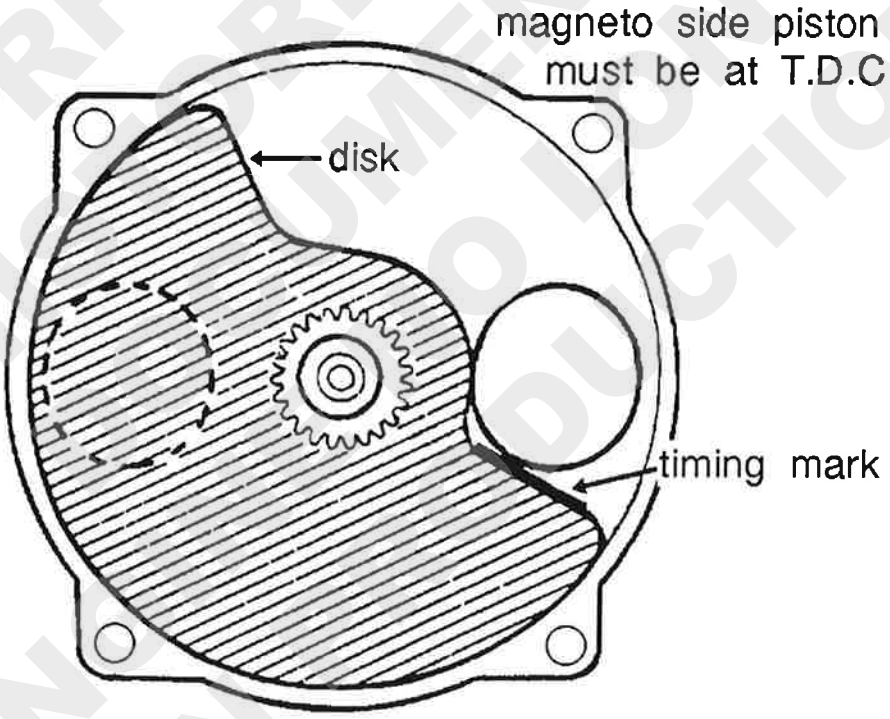
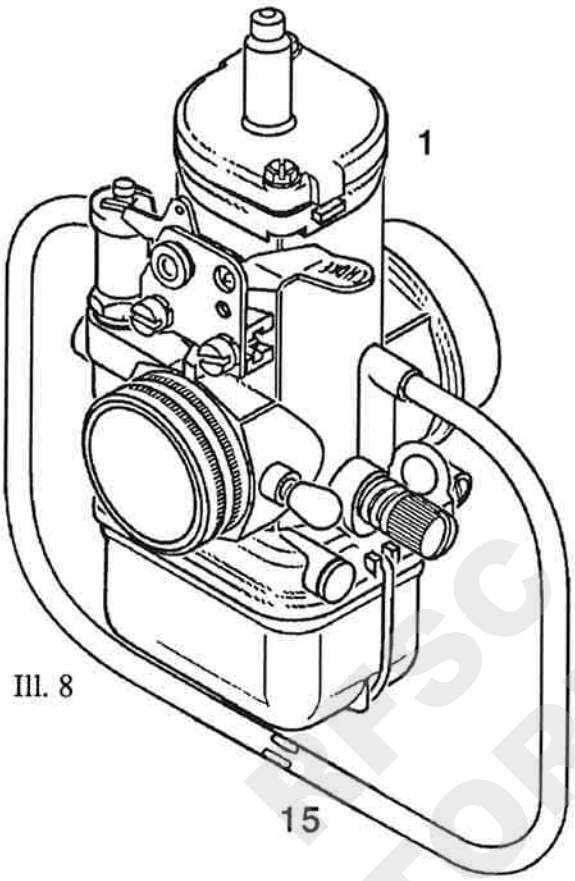


Ill. 7

8) Carburetion

BING Carburetor - typical description

(Note: this is not a parts list)



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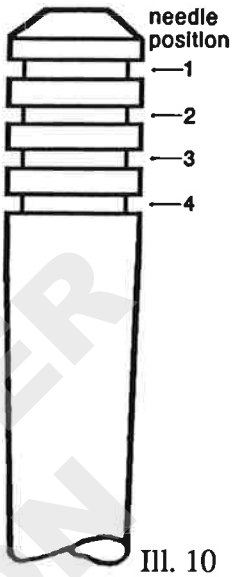

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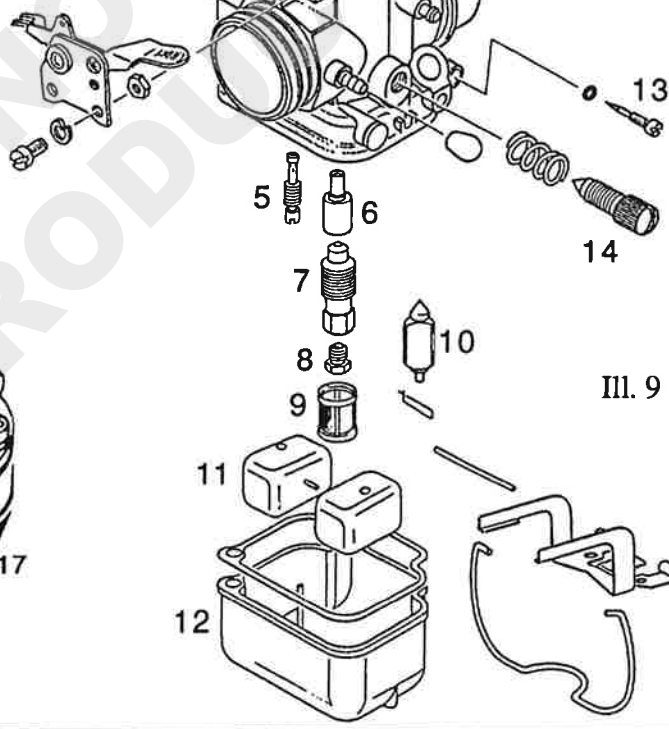

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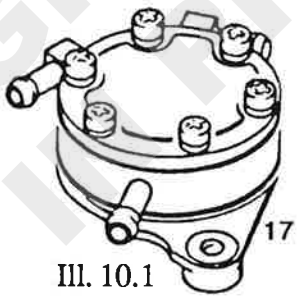
1) *BING-double float carburetor*
2) *carburetor housing*
3) *carburetor piston*
4) *jet needle*
5) *idler jet*
6) *needle jet*
7) *mixing tube*
8) *main jet*
9) *sieve sleeve*
10) *float needle valve*
11) *float*
12) *float chamber*
13) *air screw*
14) *idle adjustment screw*
15) *vent tube*
16) *starting piston*
17) *fuel pump assy.,*



Ill. 10.1

■ The BING carburetor is a piston type carburetor with float chamber. The carburetor can be adjusted by jet replacement of various approved sizes, by adjusting idle air/fuel mixture screw, carb piston stop adjustment, needle sizes, and needle position.

The air/fuel mixture at idle speed is adjusted by the air adjusting screw (see ill.9, no. 13). The idle r.p.m. is adjusted by the carburetor piston adjustment screw (see ill.9, no. 14).

■ NOTE - these idle adjustments interact, so adjusting one may require minor adjustment of the other.

■ NOTE - The carburetor should be in a right angle position in relation to the crankshaft in both views from top and from the intake side.
Changing parts should be done only after all other items have been checked, and then by an experienced two cycle mechanic.

▲ Ensure that throttle cable and linkage do not stick and that carb piston valve can be opened fully and closed to the point where the piston adjustment screw no. 14 controls piston opening and idle RPM. Minor adjustments can be made at cable adjustment screw and lock nut.

▲ Be certain that throttle linkage is not affected by engine or airframe movement. This could change throttle settings.

▲ Air intake filtration and noise reduction devices must be in place for proper carburetion. See section on special operating conditions.

■ Special operating conditions, such as severe climate or altitude change may require different jetting. Contact your dealer.

9) Exhaust systems:

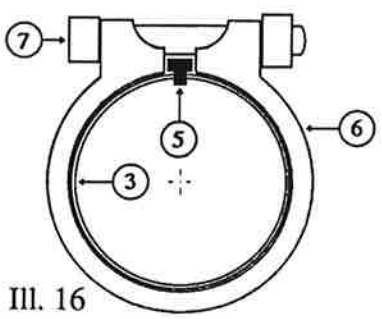
Considerable effort has gone into the design of the ROTAX exhaust systems. Any changes may severely deteriorate performance, reliability, engine life, fuel economy, and the system's ability to reduce noise to acceptable levels. Beware of any accessory systems that advertize an improvement over the stock components. Do not make any changes to the exhaust system supplied.

■ Vibration due to improper suspension is any exhaust system's worst enemy. Properly mounted and maintained, your exhaust system will provide a long service life.

▲ Never remove coupling spring with a sharp object which could mark the spring material. A rounded screw-driver shank or a hook fashioned from 1/4" bar is ideal. Safety-wiring of springs is highly recommended. Exhaust ball sockets should be kept lubricated by a heat resistant grease to allow movement between engine and muffler.

9.1) After-muffler:

For assembly of the after-muffler system, make 2 bores 5,7 ø for the securing bolts, after having decided in which position the after-muffler ❶ should be installed. The outside bores ❷ are already made standard. After drilling the bores remove all chips from the exhaust system. To assure correct position of the after-muffler during engine operation, the connections between exhaust muffler ❸ and connecting elbow ❹ and between connecting elbow ❹ and after-muffler ❶ must be secured with the bolts ❺ against twisting. For keeping the securing bolts ❺ in position, fit the clamps ❻ so that the Allen screw ❼ clamps the securing bolt ❺.



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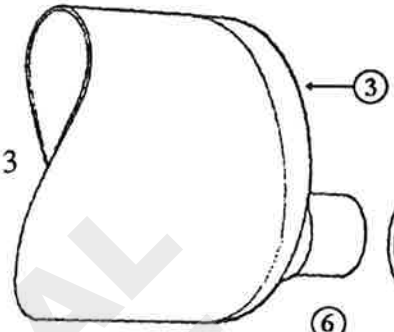

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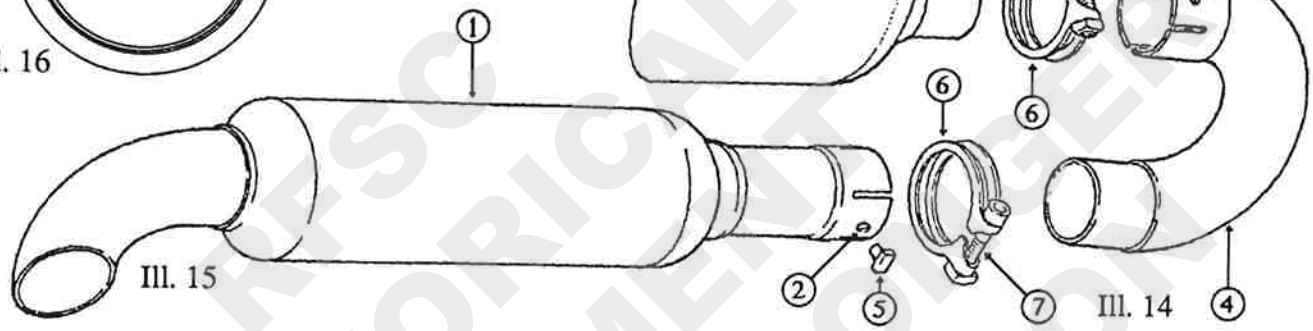

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Ill. 14

10) Instruments - how and why:

Instruments can be a valuable addition if they are of good quality, correctly installed, maintained, and the operator understands what they are telling him.

▲ Never use a tachometer which is connected to the ignition system. Use a tachometer operating on the lighting coil (ref. section 14, electronic tachometer). All instruments requiring power source must be overload protected. (ref. section 13.7 and 13.8).

All wiring and sensor leads must be properly routed, protected from vibrations and abrasion.

■ Cylinder head temperatures are taken at the spark plug seat. Exhaust gas temperatures are measured at 100 mm (3,94 in.) from the cylinder sleeve. See section 29 (technical data), for temperatures.

11) Oil Injection for engine lubrication:

11.1) Product description:

The engine is equipped with a gear driven oil pump to supply an adequate quantity of two stroke oil to each cylinder. The oil pump is a plunger type pump with metering system. The amount of oil is determined by engine RPM and pump lever position. This lever must be actuated by a Bowden cable connected with the throttle cable. The oil pump is gravity fed from an oil tank. In case of oil pump lubrication the engine carburetors are supplied with pure fuel (no mixture).

11.2) Technical data / characteristics:

11.2.1) Oil delivery: max 135 cc/h and discharge port at 1500 pump RPM.
11.2.2) Oil: High quality two-stroke injection oil with a pour point of 10 °C below lowest ambient temperature.
11.2.3) One oil inlet nipple
11.2.4) Two oil exit nipples with integrated check valve

11.3) Installation:

11.3.1) Oil tank capacity: It should be more thean 5 % of the fuel tank capacity .
11.3.2) An oil tank with above mentioned capacity with a bottom outlet not lower than the pump inlet nipple (see fig. 1, section 11.5).
11.3.3) A stiff suction pipe tube, oil resistant, with clamps in a way that no squeezing is possible.
11.3.4) An adeguate oil filter (eg.: Rotax part no. 956 330) between oil tank and oil pump inlet nipple
11.3.5) A Bowden cable to actuate the pump lever simultaneously with the carburetors.

11.3.6) Adjustment of oil injection pump alignment marks: At throttle lever idle position the marks must be aligned (see fig. 2).
11.3.7) Vent suction pipe before engine start by opening the vent plug (see fig. 2) until all air is vented from that line. Close vent plug thoroughly.
11.3.8) It is recommended to fill the first tank of fuel with a fuel / oil mixture at a ratio of 100 :1. This is for safety until the whole system is properly filled with oil.

11.4) Maintainance:

11.4.1) Check oil tank before every flight and refill if necessary.
11.4.2) Check oil lines, nipples, connections, oil pump lever adjustment at every preflight check.
11.4.3) Verify that the oil consumption is approximately of a ratio of 1 : 50 up to 1 : 70 of the fuel consumption.

NOTE: This oil injection will not affect or replace the rotary valve gear lubrication nor the propeller gear lubrication.

11.5) Examples of Installation:

Item numbers refer to both figures

❶ *Engine*
❷ *Oil tank*
❸ *Suction line*
❹ *Oil pump*
❺ *Discharge line*
❻ *Check valve*
❼ *Oil intake port*
❽ *Adjuster nuts*
❾ *Vent plug*
❿ *Oil filter*

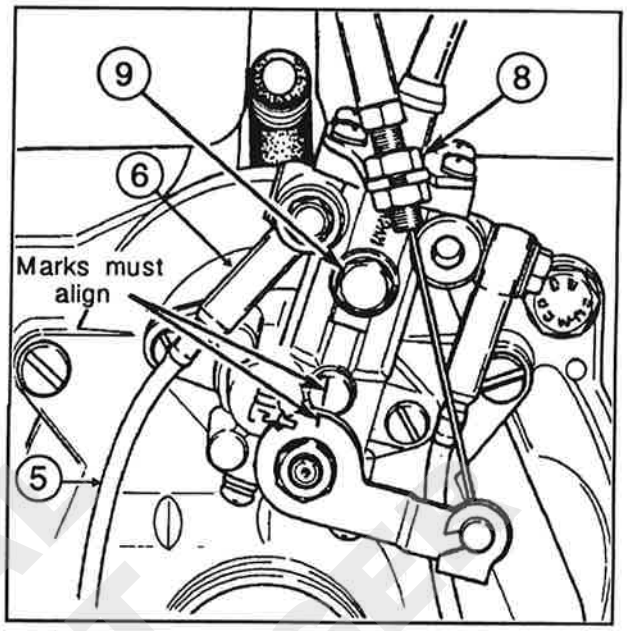

Fig. 2

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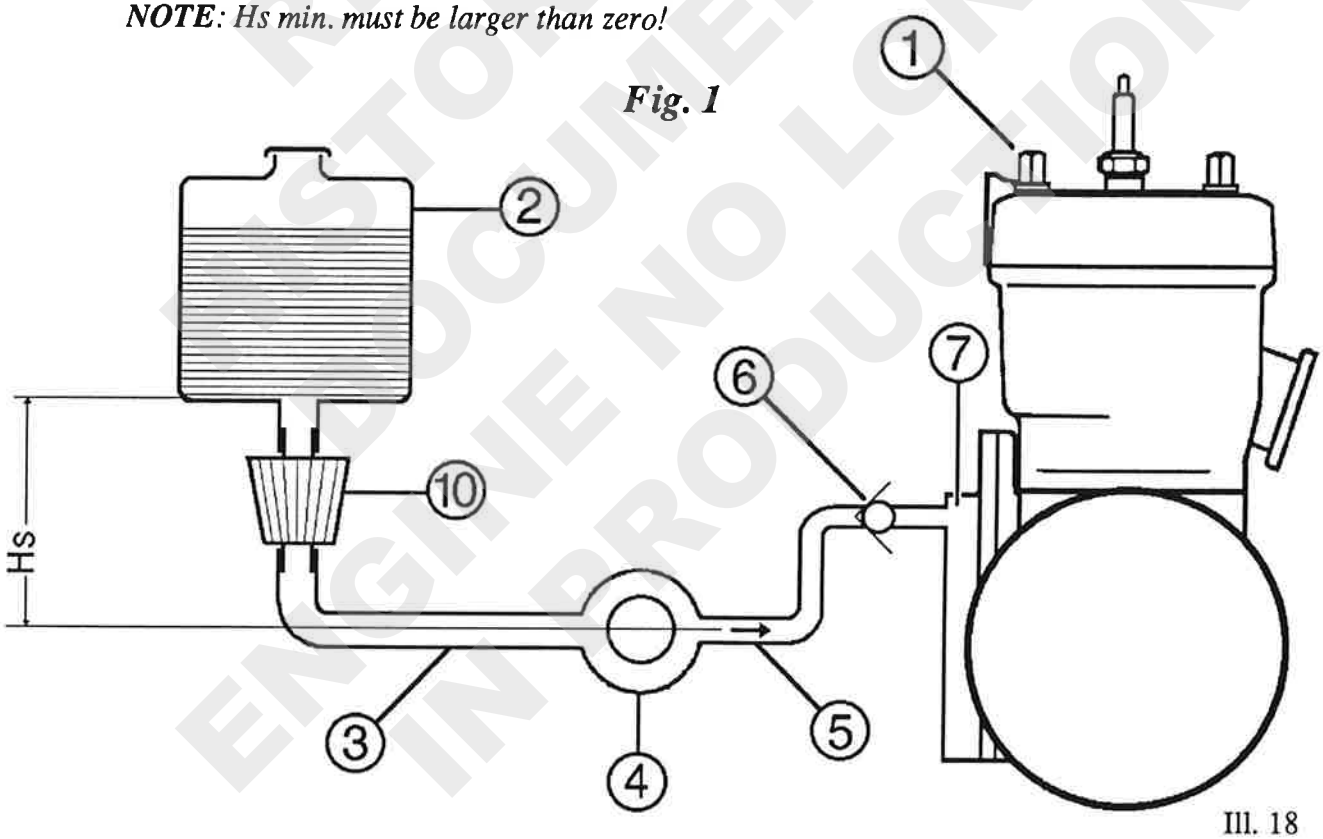
***NOTE**: Hs min. must be larger than zero!*

Fig. 1



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12) Prop gear , Type "C"

12.1) Mounting instructions:

1) Clean contact surfaces of gearbox and crankcase. Clean flywheel taper, crankshaft taper, 1/2" threads in crankshaft taper and threads of 1/2" screw with suitable degreasing agent. Fit the flywheel with 1/2" hex. screw and washer to the PTO side crankshaft taper. Secure the screw with LOCTITE 221 (torque 60 Nm / 530 in.lb.).

Fix the preassembled unit of Hardy disk / coupling flange to the flywheel with 3 Allen screws (secured with LOCTITE 221) and parallel flats washers (kept with fork wrench 17 mm a/f in position, in order not to distort the Hardy disk). Torque 40 Nm / 350 in.lb.).
Attention: Now the steel clamping strap around the Hardy disk must be removed.

2) Remove the gearbox cover from gearbox housing, the pinion shaft and the shims.

Attention: These shims may adhere or fall down.
The end play of the shaft has been determined at the factory and compensated to zero by these shims. The necessary end play is obtained by the gasket between gearbox cover and gearbox housing.

3) Fit the gearbox housing to the crankcase. Insert the pinion shaft through the bearing into the coupling flange. Take care that all shims for end play compensation be fitted in the same quantity and position as fitted before, and that the splines of the pinion shaft be coated with LOCTITE Anti-Seize. Turn the Allen screw with lock-
washer for fixation of the pinion shaft by some turns of thread into the collar nut. Fix the gearbox housing with 8 hex. collar screws M8 (torque 24 Nm / 210 in.lb.). Apply ball bearing grease to the screw head contact surfaces. Then tighten Allen screw M8 x 35 at 24 Nm / 210 in.lb.

Fit the gearbox cover to the gear housing. Fit the gasket only dry! Tigtening torque for 11 Allen screws M6 x 30: 10 Nm / 90 in.lb.

4) Then fit the fill-, drain- and check screws and fill gearbox with oil.
Oil quantity: with propeller shaft downward: approx. 120 cm^3 / 7,5 $inch^3$
with propeller shaft upward: approx. 200 cm^3 / 12 $inch^3$

Oil quality: SAE 140 EP or SAE 85 W - 140 EP gear oil (of specification API-GL5 or GL6).

5) Secure the magnetic screw and capstan screws with wire-lock.

6) Please, observe all tightening torques and indications of Loctite and grease applications.

7) The propeller hub is drilled for 6 x 1/4" (or 6 x M8) bolts. These bolts are not supplied by ROTAX.
8) Safety is everyone's business. Help assure secure and troublefree operation by observing above instructions. In case of doubt contact your authorized workshop.

9) Mounting and maintenance operations must be done only by skilled personnel.

12.2) Preflight Instructions

▲ ATTENTION: As supplied by the factory, irrespective whether gear-box is loose or fitted to engine, there is no oil in the gear-box.

Fill with oil as specified to proper level. Tighten drain plug. Tighten vent plug and oil level screws and secure with approved safety wire before use! Check tightness of screws.

12.3) Maintenance

▲ 12.3.1) Every 10 operating hours:

Check oil level on respective oil level screw and secure again with wire.
Change oil after 1st 10 hours of operation, clean magnetic drain plug at each oil change.
Check propeller tracking and tip clearance.

Change oil every 100 hours or every 2 years (which occurs first).

▲ NOTE: Mounting and maintenance operations must be done by skilled personnel only.

13) Ignition System:

13.1) General:

The engine is equipped with a breakerless 12V 170W DUCATI capacitor-discharge dual ignition. It consists of a flywheel magneto generator, 2 double ignition coils with integrated control-circuit and 2 external triggers (pick-up).

The 12-pole flywheel generator is an outer rotor type with 12 integrated permanent magnetos. The stator is equipped with 12 coils. 8 of them are used for feeding auxiliary equipment and 4 are used for the dual ignition. The grey cable is foreseen for connection of a tachometer.

13.2) Function of the ignition unit:

Two charging coil pairs fitted on the generator stator and independant from each other feed one each ignition circuit. The energy supplied is stored in the ignition capacitor. At the moment of ignition the external triggers supply an impulse to the control circuits and the ignition condensors are discharged via the primary winding of the ignition coil. The secondary winding supplies the high voltage for the ignition spark.

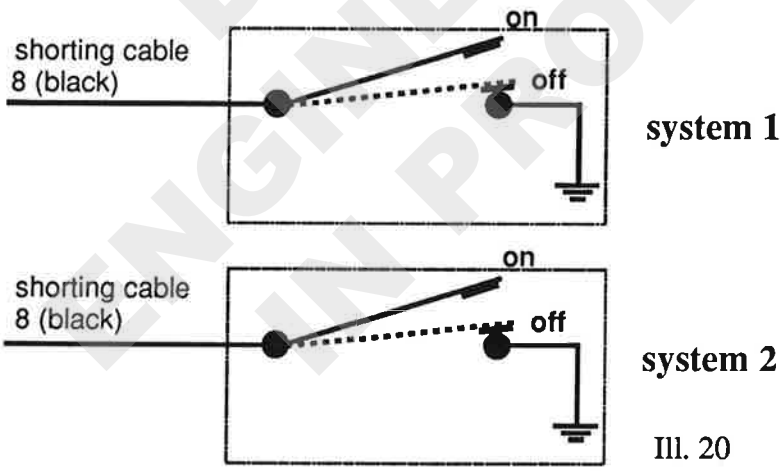
ATTENTION: When flying both ignition systems must be switched ON!

13.3) Checking of ignition unit:

Before every start the function of the two ignition systems has to be checked. For checking the ignition unit the engine must be operated at 3000 to 3500 l/min and alternately ignition system 1 and 2 must be switched off. The RPM-drop must not exceed max. 300 l/min.

ATTENTION: With engine running the trigger cable (red) must not be disconnected from the electronic box. This could destroy the electronic box.

Ignition Switches



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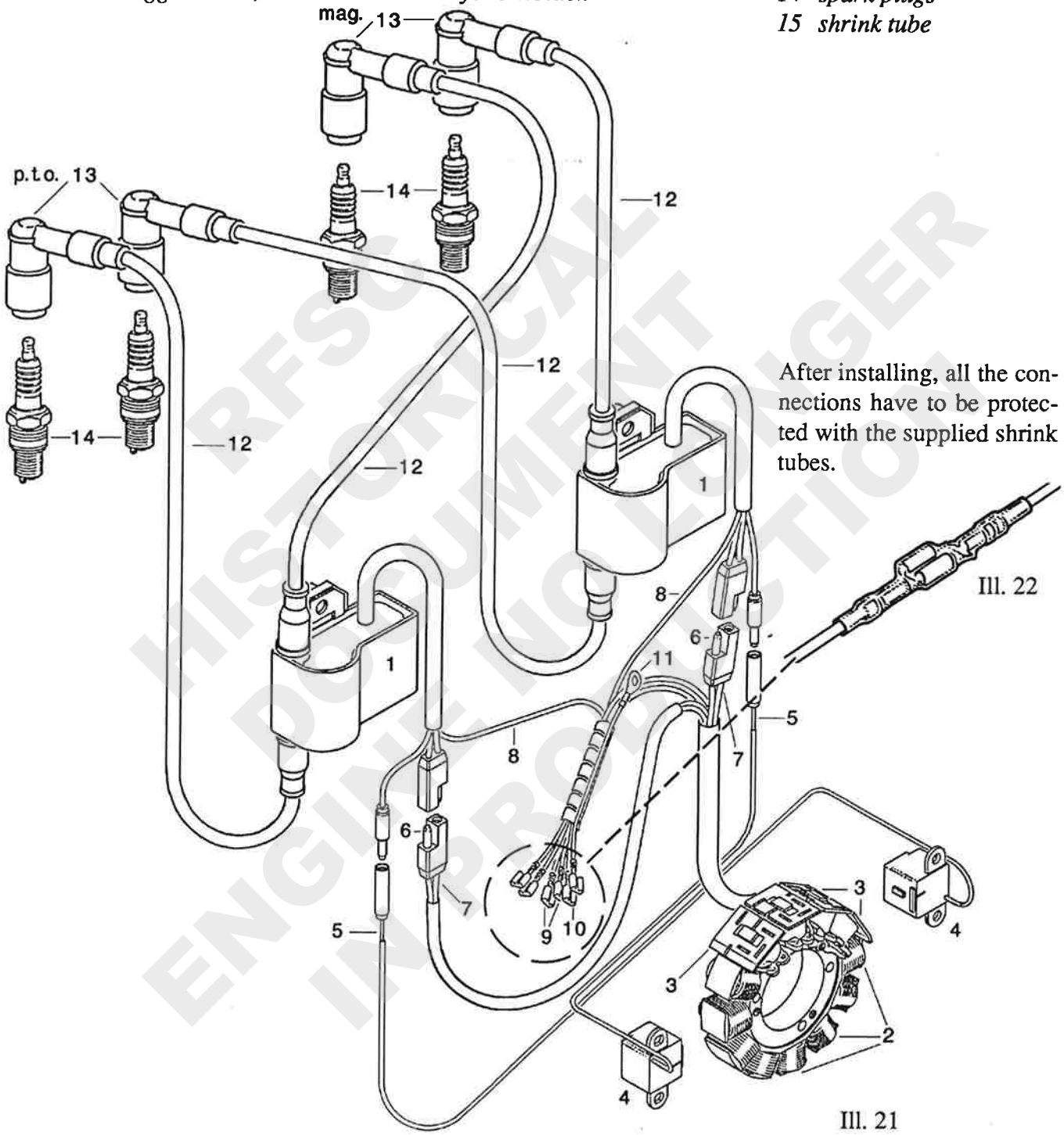
13.4) Wiring diagram:

NOTE: When replacing wiring on the ignition system, connections must be as per wiring diagram below.

1 Electronic box
2 eight lighting coils
3 four charging coils
4 pickup
5 trigger cable, red
6 charging cable, green
7 charging cable, white
8 shorting cables, black/yellow
9 lighting cables, yellow-yellow/black
10 rev.counter cable, gray
11 mass cable, brown
12 ignition cables
13 spark plug connectors
14 spark plugs
15 shrink tube



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After installing, all the connections have to be protected with the supplied shrink tubes.

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13.5) Spark plugs:

Due to varying fuel properties etc., check every 10 hours of operation. Replace as required or annually: Provided that spark plug heat range and the carburetor calibration are correct, the spark plugs will have a brownish tinge at the electrodes of both spark plugs after full load operation.

On engines with single carburetor, one sooty spark plug by itself usually indicates a bad plug or faulty ignition system to that plug in a sound engine. If both plugs are sooty with oil deposits, carburetion and air system should be checked. On engines with two carburetors you should switch the carburetor to trace the problem.

Always change both plugs. Never interchange plugs from one cylinder to the other.

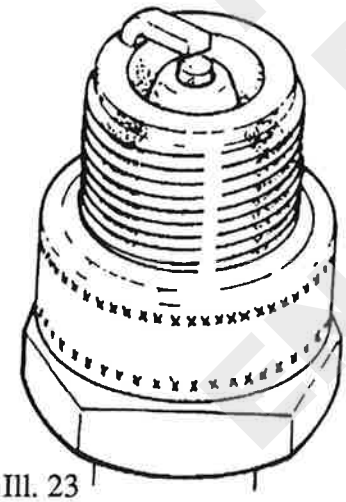
If both plugs have "white" electrodes with "melt" droplets, first suspect lean mixture. If calibration is correct and there is no evidence of manifold leaks, lack of fuel, or incorrect float settings, don't change the plugs to a colder range. Check if cooling system is operating correctly.

ATTENTION: Heavy oil deposits on the electrodes and insulator may cause engine problems, exchange regularly every 20 hours, or at any indications of trouble.

If, after cleaning or changing the spark plugs, you still have an ignition problem, check to see if only one cylinder is affected or both. Some thought to what is common to both systems or only one will isolate the problem more efficiently. If no external fault is found, the ignition unit must be checked.

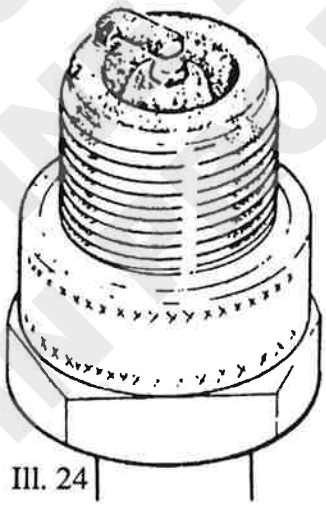
Never clean spark plugs with an abrasive cleaner.

Remember to correctly gap your plugs with a wire gauge (see technical data, section 29). Spark plugs must be torqued (see main torquing specifications, section 30). If problems occur too frequently, cause must be determined and rectified.



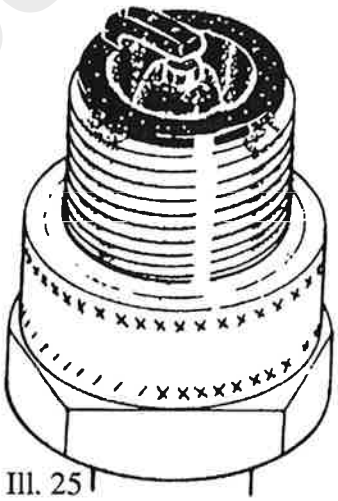
Ill. 23

Overheated (light grey)



Ill. 24

Normal (brownish)



Ill. 25

Fouled (black)

13.6) Lighting circuit:

In the stator 8 lighting coils are incorporated. The output is 170W A.C. and 13,5 V effective at 6000 l/min. This alternating current can be used directly to feed A.C. consumers, or via a rectifier-regulator for loading a battery and feeding direct current consumers.

To avoid the voltage to rise above permissible levels, a voltage regulator must be used.

To operate loads requiring direct current (e.g. charging 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 is provided.

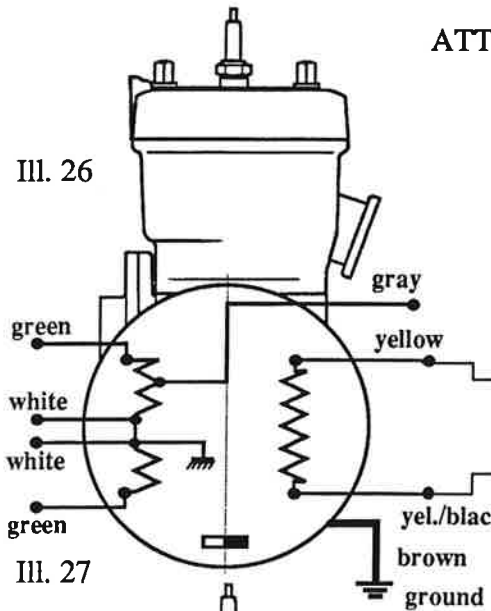
If a battery is used it has to be capable to absorb approx. 1 amp. minimum continuous charging load, even with full battery (suggested minimum battery capacity: 9 amp.h, resp. 16 amp.h with electric starter). Regulated voltage is 13.5 to 14.5 volts.

When using 3-phase rectifier-regulator 264 870 no minimum load is required.

13.7) Wiring diagram for rectifier-regulator 866 080

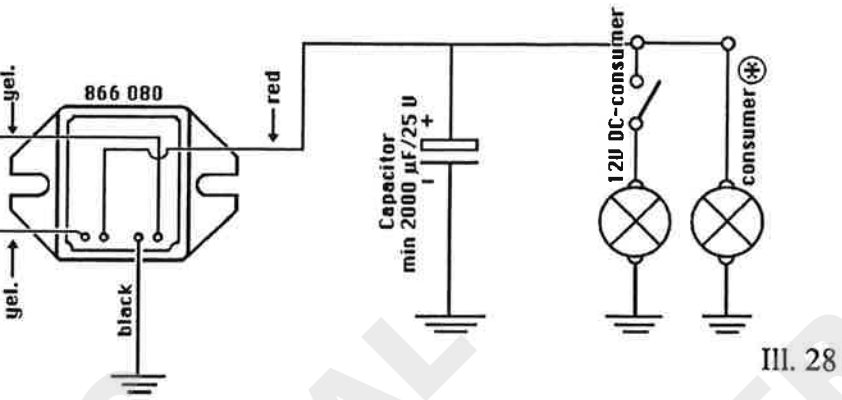
ATTENTION: ⊛ To avoid excessive voltage in conjunction with the rectifire regulator 866 080, a constant minimum ballast load of 1 amp is required (example: lamp 12 V 15 W).

Ill. 26

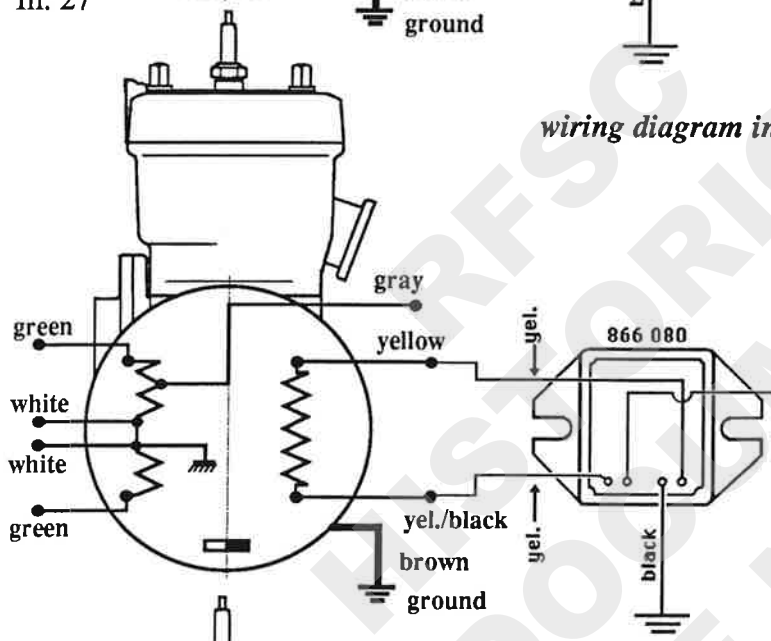


Ill. 27

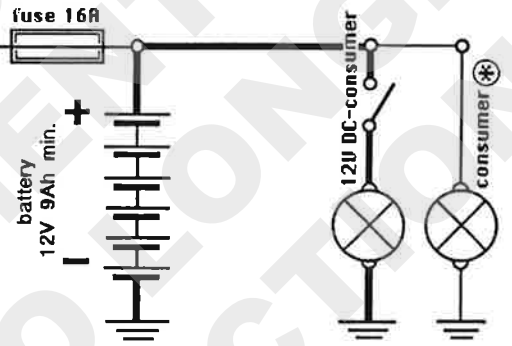
wiring diagram in a circuit w i t h o u t battery



Ill. 28

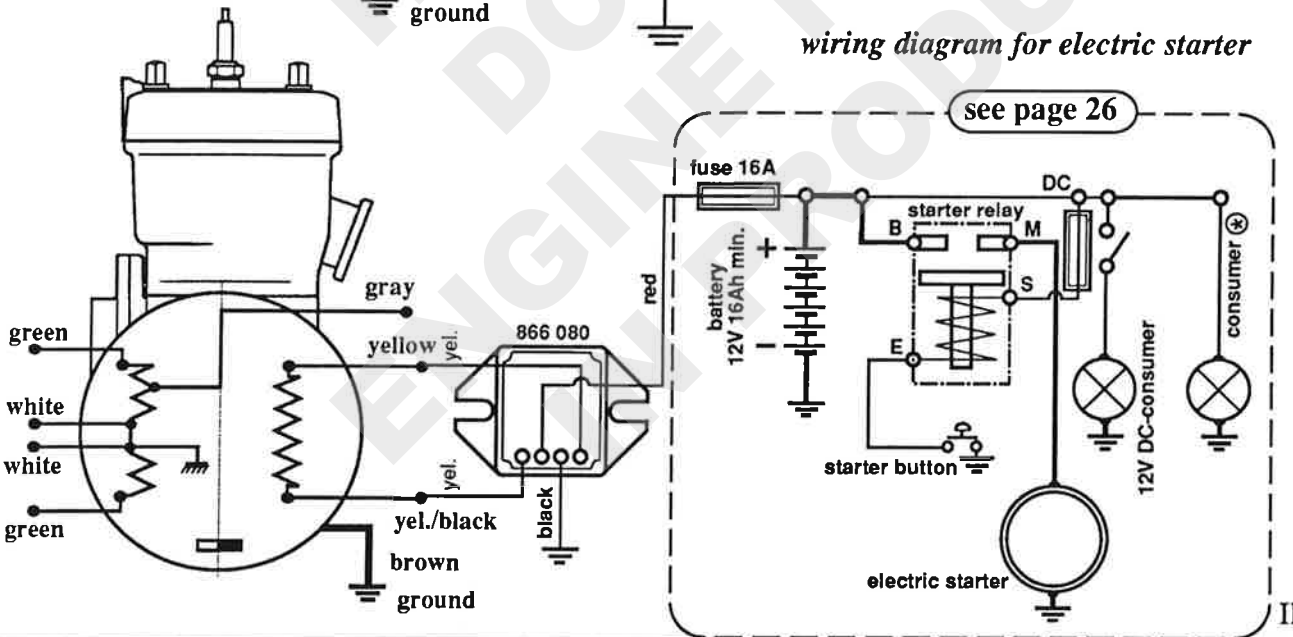


wiring diagram in conjunction w i t h battery



Ill. 29

wiring diagram for electric starter



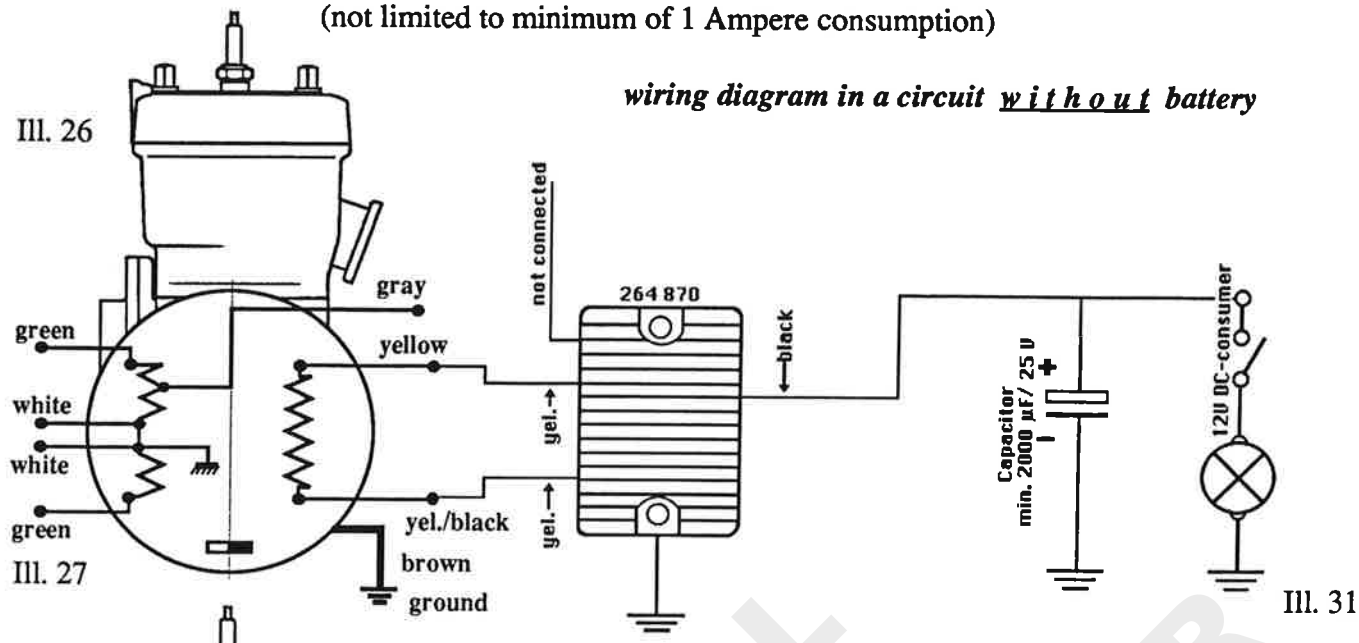
Ill. 30

13.8) Wiring diagram for rectifier-regulator 264 870

(not limited to minimum of 1 Ampere consumption)

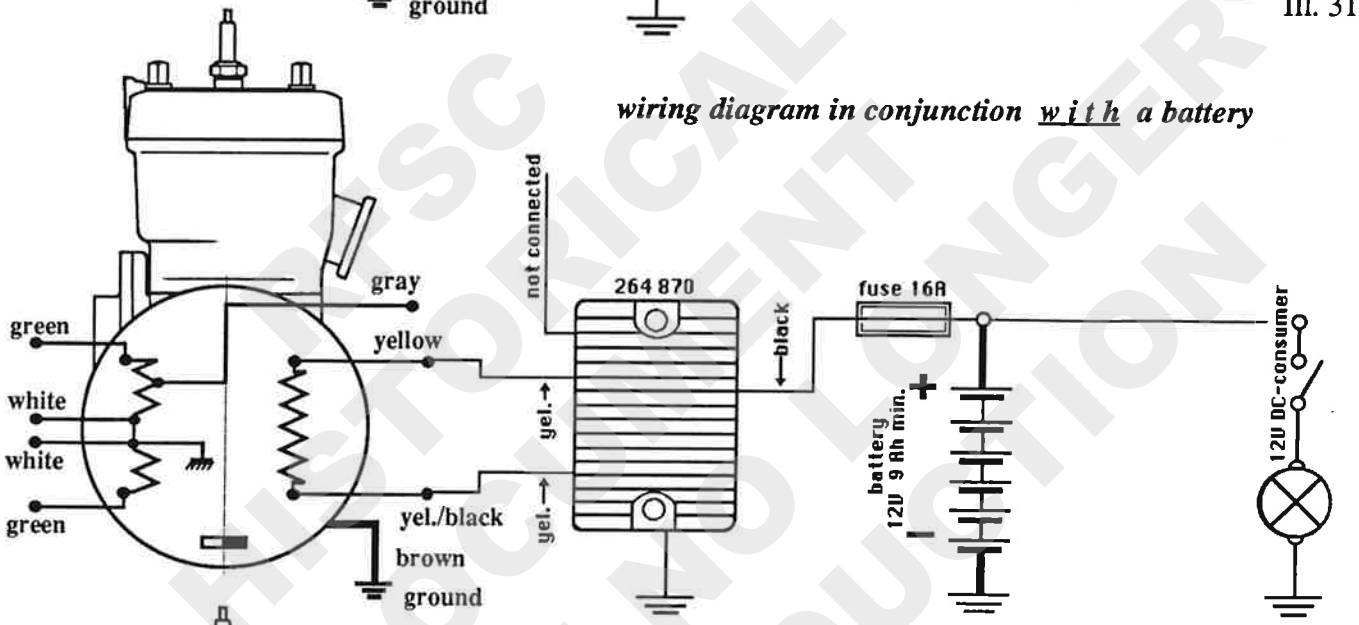
wiring diagram in a circuit w i t h o u t battery

Ill. 26



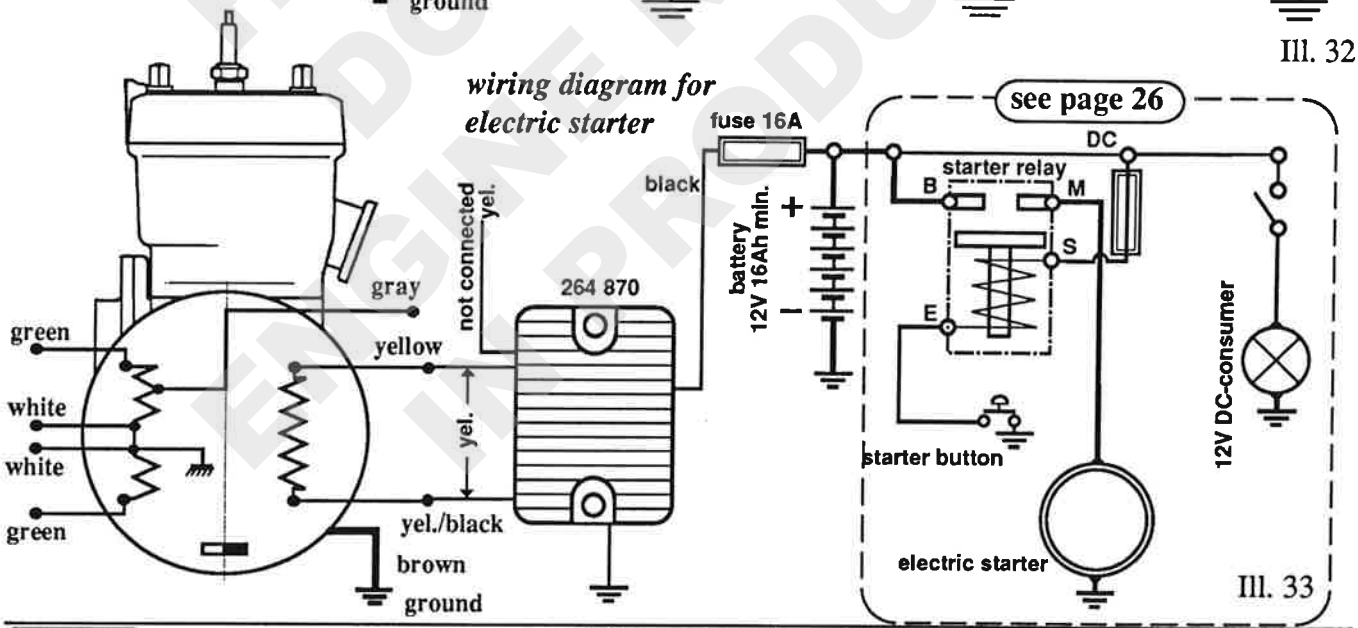
Ill. 31

wiring diagram in conjunction w i t h a battery



Ill. 32

wiring diagram for electric starter



Ill. 33

14) Electronic tachometer:

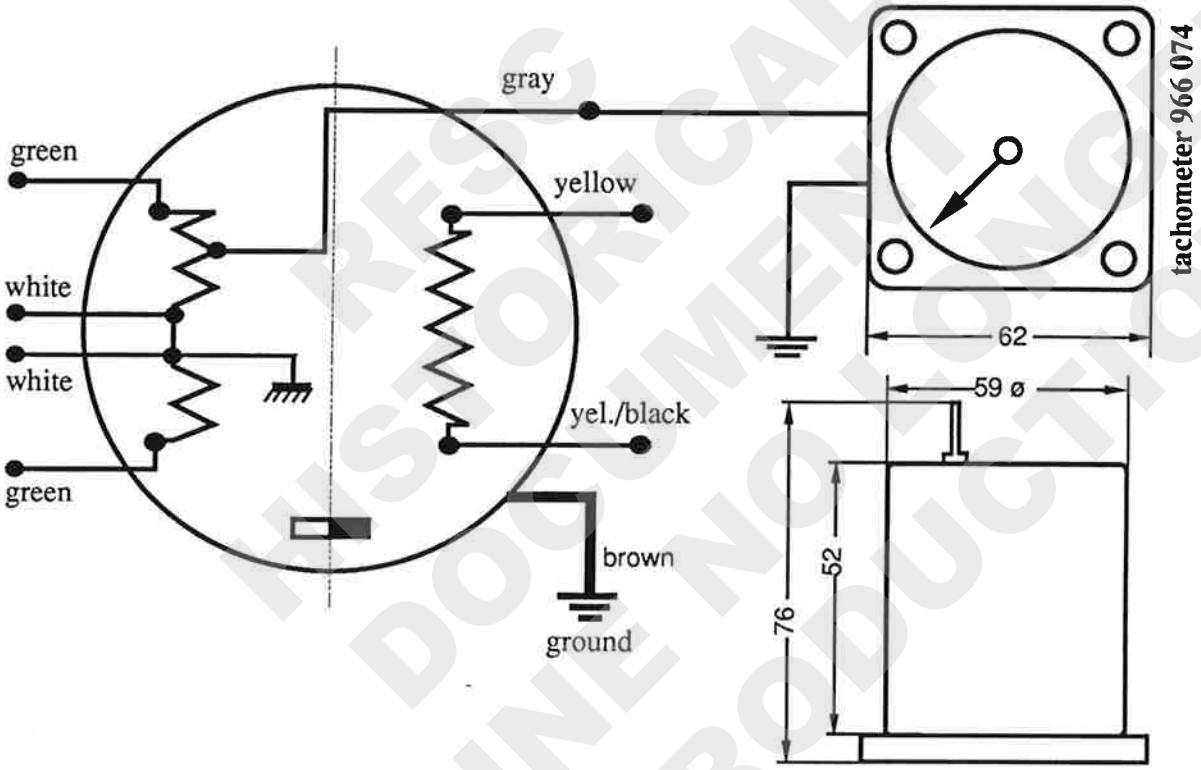
14.1) Introduction:

The Aviasport tachometer T8K12E, part no. 966 072, has been specifically designed to be connected to the 12 pole flywheel generator used on the Ducati CDI Systems.

The tachometer measures the frequency of the pulses provided by one of the transducers supply winding where it is connected. It does not require any external power supply. It is connected by two wires without polarity.

The indicating range comes up to 8000 r.p.m. The weight is 185 gram. The panel cut-out diameter should be 60 ∅ mm.

14.2) Connection to dual ignition system.



14.3) Calibration

A calibration potentiometer is located inside the instrument. The adjustment hole is covered by a blue label on the tachometer 966 074. It is possible to correct the scale factor by connecting the tachometer in parallel to a reference instrument or by using a precision mechanical, optical or electronic tachometer.

15) Electric starter:

15.1)

The engine is equipped with an electric starter fitted on magneto side. For use with engines utilizing ROTAX gear reduction unit,however this electric starter system prevents recoil start capability.

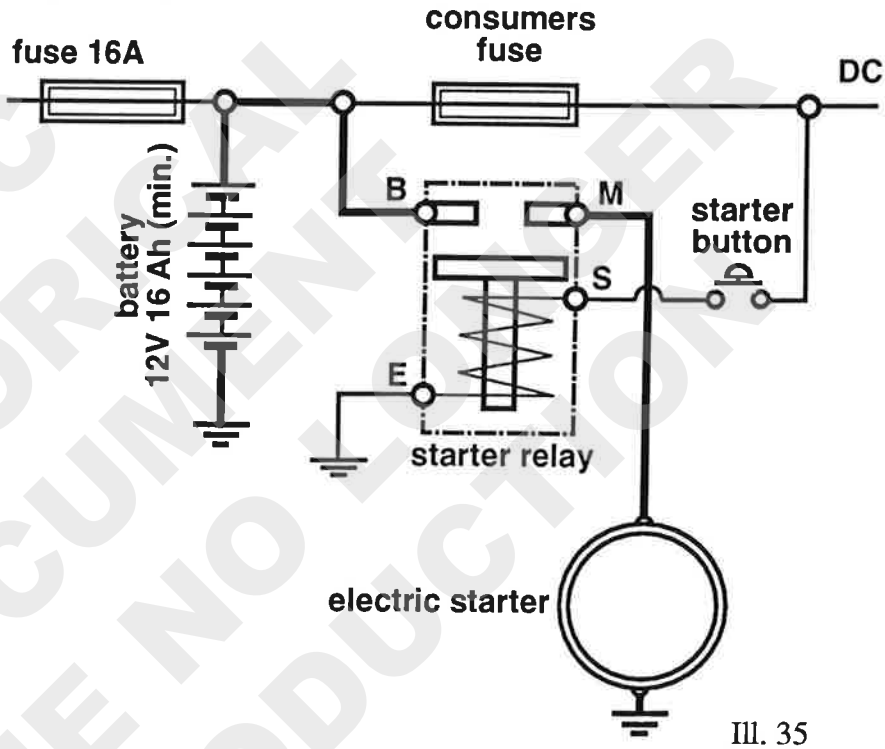
15.2) Battery:

Either case, to ensure reliable starting, a battery of least 16 Ah (high-discharge battery) should be utilized. A higher battery amp- hour-rate would be preferable. Cables supplying power to the starter from the battery and to ground should be a 10 mm^2 flexible multi-strand cable.

15.3) Power source:

see section 13.7 and 13.8

from rectifier regulator
(see section 13.7 and 13.8)



Ill. 35

15.4) Power relay:

Starter control should be via a power relay (supplied with starter kit) wired as shown above.

15.5) Fuse:

A 16 Amp fuse must be installed between battery charging circuit and main power terminal.

16) Special operating conditions:

Off water operation is a real pleasant experience - usually. However, there are dangers to your engine you won't experience on land. Some of these dangers are water ingestion on take-off or landing for example, due to spray and splash, corrosion, electrolysis, and worst of all,unintentional submersion.

▲■ The high carbon content of high quality bearings, crankshaft etc., are highly susceptible to corrosion. Synthetic oils, although good lubricants, often attract moisture rather than repel it.

A good quality air intake system (e.g. K. & N. oil impregnated filter) will prevent most problems.

▲ Dry filter elements (paper type) are not acceptable especially in moist conditions. They will absorb water and choke the engine causing over rich carburetion mixtures which result in engine power loss.

■ NOTE: Significant engine noise reduction can be obtained with an air intake silencer kit. Further noise reduction may be obtained by the use of an after-muffler kit. Be aware that modifications may require carburetor modification.

Enquire at your dealer for more information, and consult ROTAX spare parts list.

■ On aircraft equipped with engine cowlings you must ensure that blower inlet size is not restricted and exit is double the inlet area. There should be no circulation between inlet and exit on cowling. Neither should it create any considerable increase or decrease of air pressure.

▲ Winter can create additional problems such as carburetor icing, frozen gas lines, higher air densities etc. which may affect carburetor calibration, longer warm-up periodes.

17) Maintenance schedule:

17.1) Warning:

▲ a) Maintenance on engines and systems requires special knowledge and tools. It is therefore recommended to have these works performed by authorized service centers or dealers.

b) Disconnect spark plug leads for all maintenance and inspection procedures.

17.2) Service times:

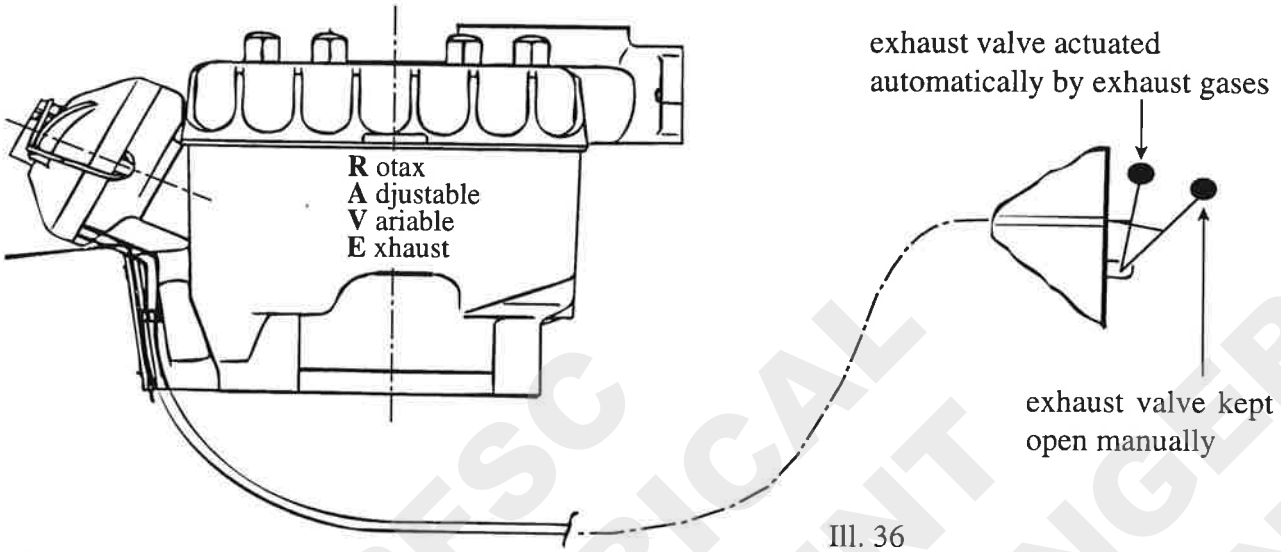
■ Service times are based on average use, assuming engine is run at least once per week for a normal duty cycle or average flight. Total time before teardown is determined by the frequency and conditions of usage. If the engine is not going to be used for a period of 2 months or more, consult storage procedures in this section.

After initial break-in period certain inspections and checks must be made to ensure all components and settings have remained tight and are within the specified tolerance. Failure to do so could lead to premature engine failure.

	✔
Post break-in inspection check list	
Engine timing check	
Spark plug(s) condition	
Carburetor adjustment	
Engine suspension nuts	
Muffler attachment	
Engine coolant system	
Air filtration system	
Fuel filtration system	
Electrical wiring (loose connections, stripped wires, damaged insulation), tighten all loose bolts, nuts and linkage.	

18) RAVE:

Exhaust valve (Rave) is fitted on both cylinders, actuated automatically by exhaust gas pressure waves at higher speed.
At higher altitudes (from C. 2500 m above S.L.) the exhaust pressure will drop due to decreacing performance, thus the exhaust valve wont keep open.
To prevent any loss of performance in these hights due to a closed valve, it will be necessary to keep exhaust valve open manually by cable.



Ill. 36

19) Liquid-cooling system:

The cooling liquid is supplied by a pump through the cylinders and the cylinder head to the radiator. In the cylinder head a two-way thermostat is installed. The short circuit returns directly to the water pump, the cooling circuit leads to the radiator. The cooling system has to be installed so that vapour coming from the cylinders and the cylinder head can be released to top through a tube either into the water tank of the radiator or to an expansion chamber.

Add anti-freeze up to -15° C also in summer to prevent corrosion. Make sure the anti-freeze is compatible with aluminum.

19.1) Attention:

19.1.l) Check cooling liquid before every operation and refill, if necessary.

19.1.2) The average temperature of cooling liquid should be 60÷80°C. In case of excessive temperature, look for the reason (liquid quantity, radiator or tubes blocked, pump resp. impeller defective, too much antifreeze in the water etc.).

19.1.3) The cooling effect is reduced by anti-freeze additives (under certain circumstances even considerably). This must be taken into consideration when chosing the radiator and for radiator installation.

19.1.4) Before opening the cooling tank cap, put a cloth over it and turn the cap only partially off. Sudden opening of the cap can result in water boiling over and scald injuries .

19.2) Cylinder head venting:

On engine installation with spark plugs up the cylinder head must be vented. For this purpose there are 2 venting bores M6 in the cylinder head, one on magneto side, one on p.t.o. side.

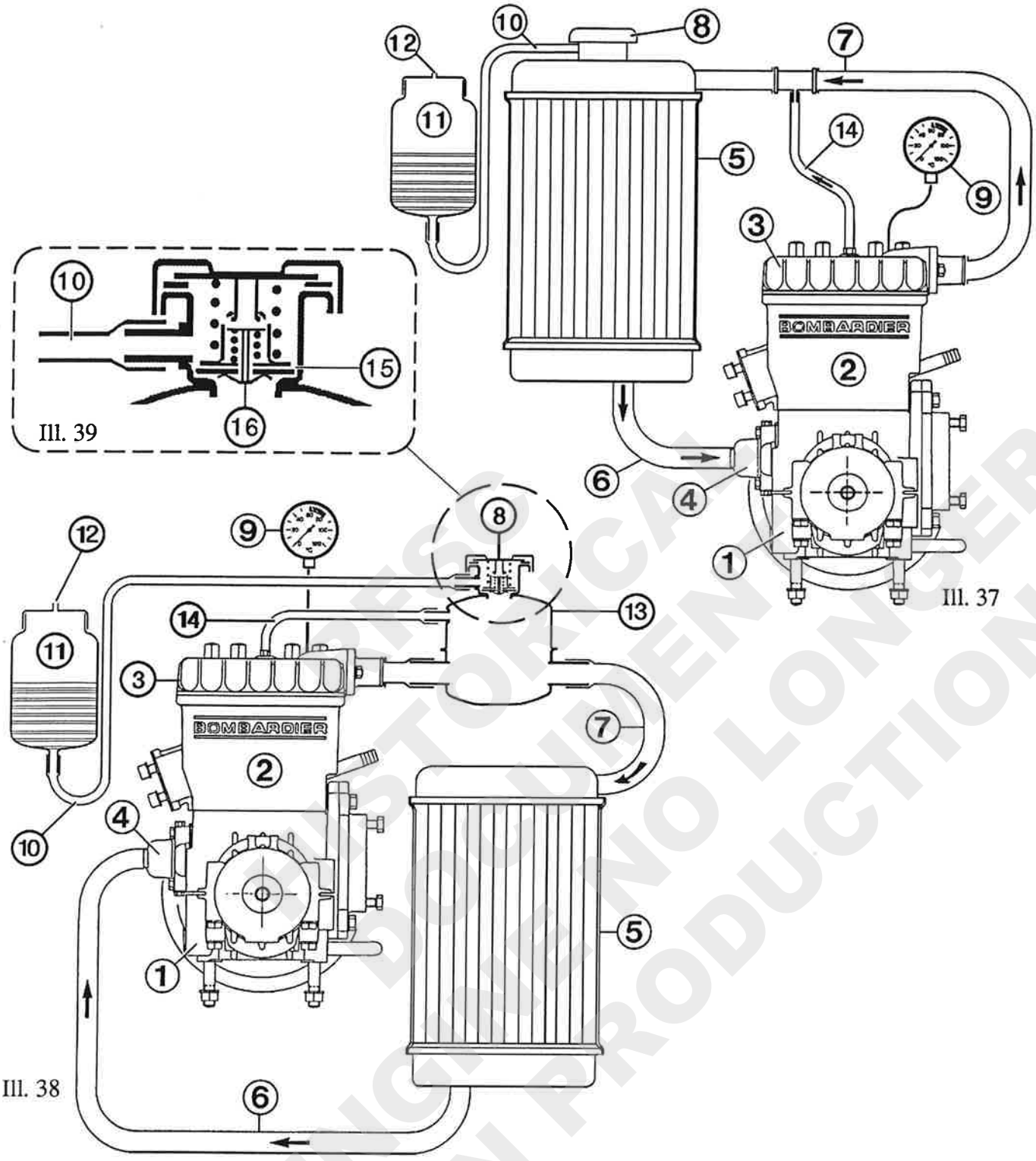
The nipple M6 with sealing ring is screwed into the venting bore which is usually on the higher position during flight. The second venting bore is closed with a hex. screw M6 x 8 and sealing ring.

In case of the double radiators supplied standard by ROTAX the p.t.o. side venting bore on cylinder head is closed and the magneto side bore is connected to the cooling system via a low-pressure tube (14) (6 x 11/335 mm length). This in principle applies to pusher propellers.

In case of tractor propeller installation the venting- and tapping screws have to be interchanged and the low-pressure tube (14) be shortened.

If the radiator is installed lower than the cylinder head, it is absolutely necessary to use an expansion chamber (13) and to close the radiator with a screw tap w i t h o u t pressure valve (15) and return valve (16)

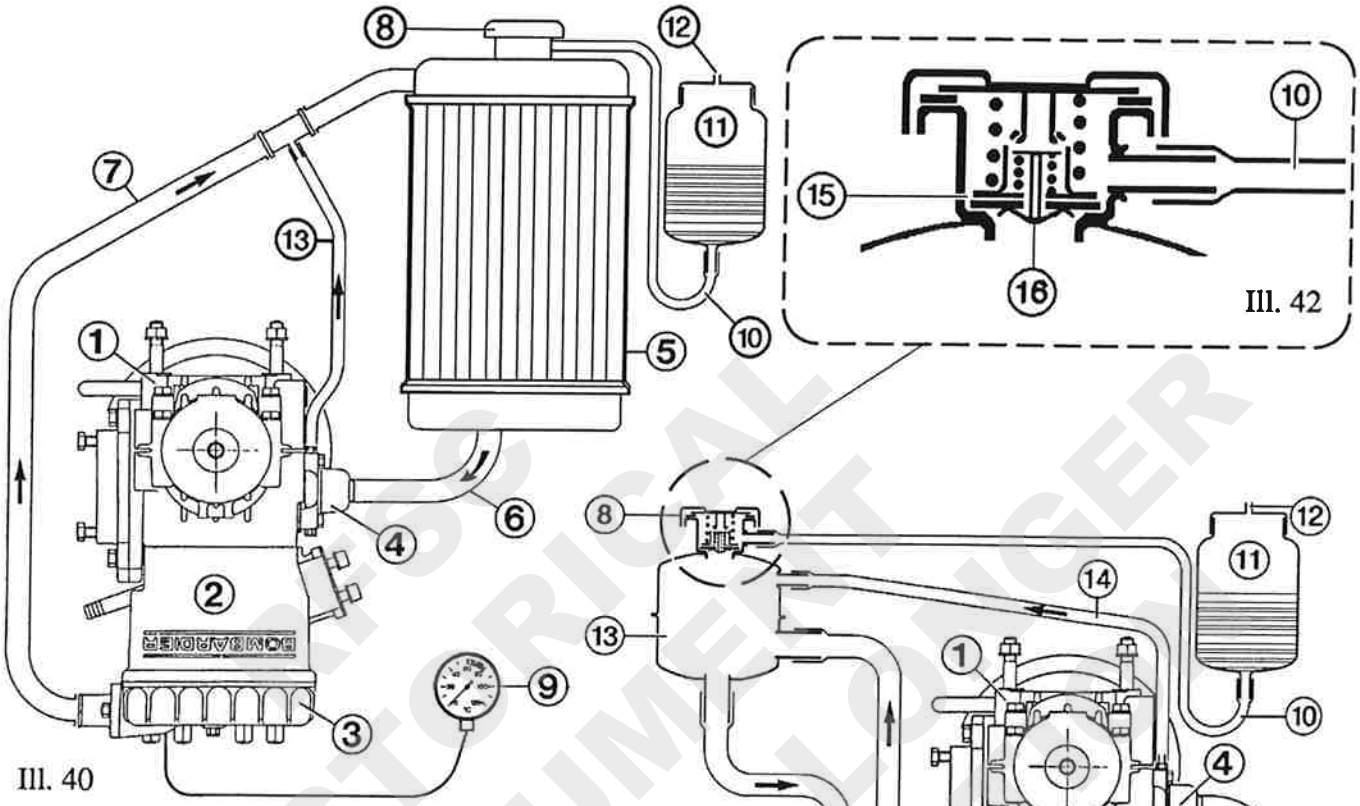
19.3) Cooling circuit for engine installation with spark plugs up:



1 crankcase
2 cylinder
3 cylinder head
4 water pump
5 radiator
6 tube from radiator to water pump
7 tube from cylinder head to radiator
8 radiator screw cap, with excess pressure valve and return valve
9 temperature gauge for cooling water
10 overflow tube
11 overflow reservoir
12 reservoir venting
13 expansion tank
14 cylinder head venting tube
15 excess pressure valve
16 return valve

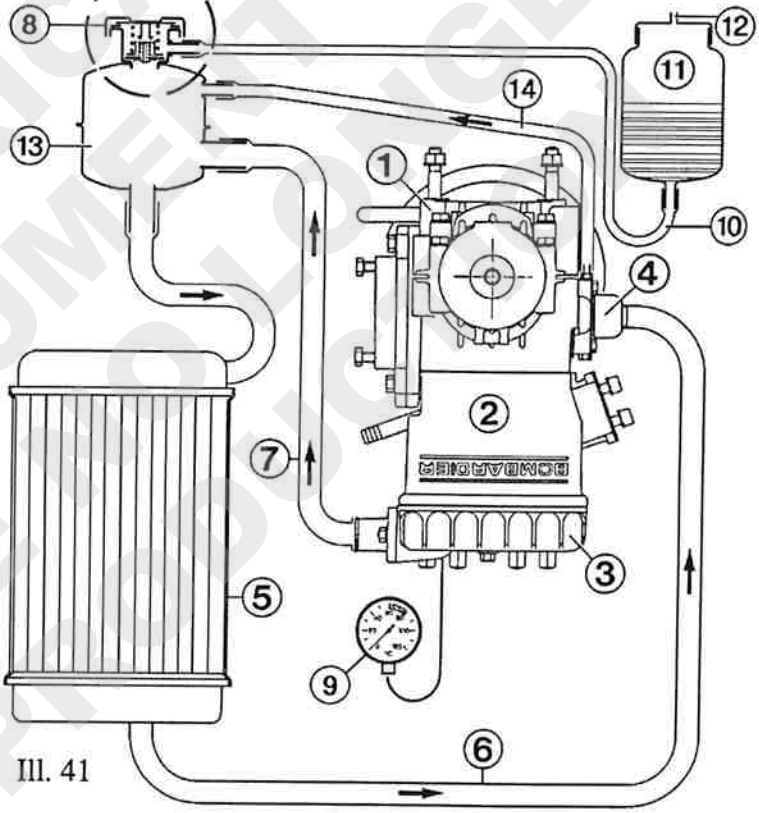
19.4) Cooling circuit for engine installation with spark plugs down:

For this installation, a vent tube has to be connected on top of the water pump housing ❹ leading to the expansion tank ⓭ resp. to the water chamber of the ratiator. The cooling system has to be vented well, to be checked after a short operating period, and cooling liquid has to be refilled, if necessary.
Only a perfectly vented cooling system will work satisfactory.



Ill. 42

Ill. 40



Ill. 41

1 crankcase
2 cylinder
3 cylinder head
4 water pump
5 radiator
6 tube from radiator to water pump
7 tube from cylinder head to radiator
8 radiator screw cap, with excess pressure valve and return valve
9 temperature gauge for cooling water
10 overflow tube
11 overflow reservoir
12 venting
13 expansion tank
14 water pump venting tube
15 excess pressure valve
16 return valve

20) Rotary valve and cooling liquid pump drive:

In the center of the crankcase there is a 90 ° gear with oil lubrication.

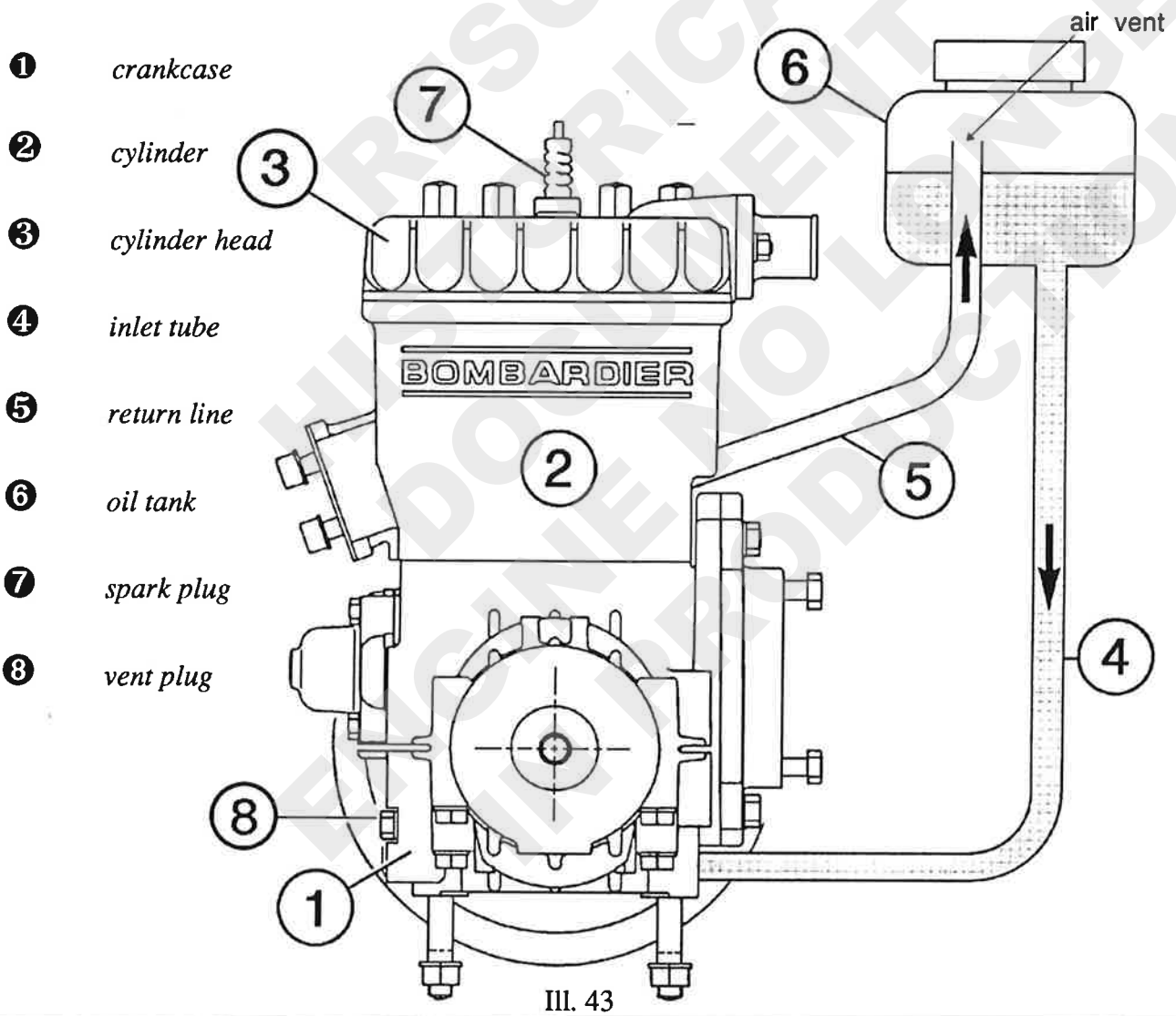
Use 2-stroke motor-oil for the rotary valve gear (same as used for 2-stroke fuel mixture). Oil quantity in case of new installation: approx. 310 cc.

An oil tube leads from the oil tank to the bottom side of the crankcase, and a return line from top of the gear leads back to the tank for air vent (see illustration).

Before every operation check the oil level (approx. medium height of the oil tank) as well as for tightness and good condition of oil tubes and connections.

In case of notable oil consumption (more than 1 c.c./hour) look for the leak and check the oil seals inside the crankshaft, if necessary.

20.1) Oil circuit for engine installation with spark plugs "up":



Ill. 43

20.2) Oil circuit for engine installation with spark plugs "down":

In this case the oil system for rotary valve drive and water pump drive has to be modified by the aircraft manufacturer as per the following illustration. The oil tank installation should not be below the oil inlet tube ❹.

Attention: For this inverted installation, the oil tank must be removed from the bracket and installed in a suitable location above the engine. Vent system by removing plug ❽ when filling the oil tank ❻.

❶ *crankcase*

❷ *cylinder*

❸ *cylinder head*

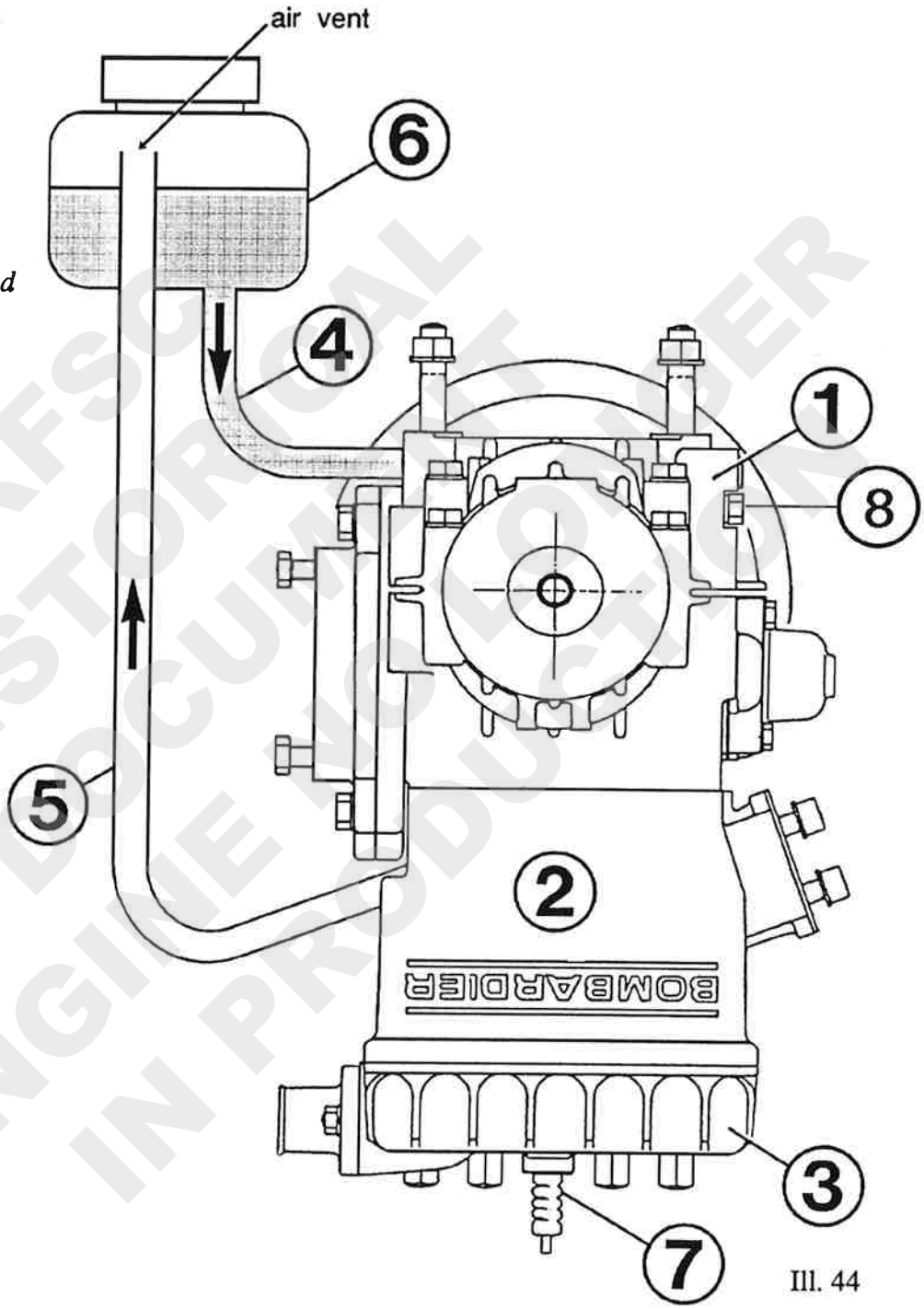
❹ *inlet tube*

❺ *return line*

❻ *oil tank*

❼ *spark plug*

❽ *vent plug*



Ill. 44

21) Engine suspension nut:

Inspect visually regularly (pre-flight check). Re-torque annually. Check procedure with airframe manufacturer.

22) Air filtration system:

Inspect frequently (10 hours) for cleanliness depending on type used (see special operation conditions).

23) Fuel filtration system:

Check at least every 10 hours (see fuel mixture). Ensure clean fuel at all times.

24) Check for carbon build up and piston ring condition:

After approximately 50 hours of use, the combustion chamber may require de-carbonizing. To inspect, remove exhaust manifold and check for deposits on piston crown. Decarbonizing is required if deposit thickness is in the range of 1 mm (.04 in.). On re-assembly of manifold, replace gaskets if necessary. To check for piston ring sticking in groove, move pistons only the minimum amount to determine free movement of the top ring.
For de-carbonizing remove the cylinders and the piston rings. Make a mark on cylinder and piston. Clean the piston ring grooves too. When reassembling the cylinders to the crankcase, it is important to have them properly aligned. Use new gaskets.

24.1) Cylinder head nuts:

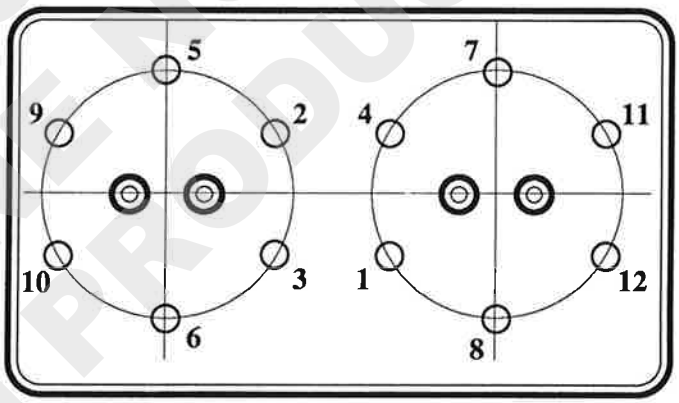
Torque cylinder head nuts following illustrated sequence when the manifolds are in place.

■ For this procedure the engine has to be cold.

TOOLS: insert 13 (socket wrench 13)
insert Allen head key 6
torque wrench

▲ NOTE: Use a cross-sequence for tightening the nuts. Consider both cylinders as one unit because they are joined by exhaust and intake manifolds.

Ill. 45

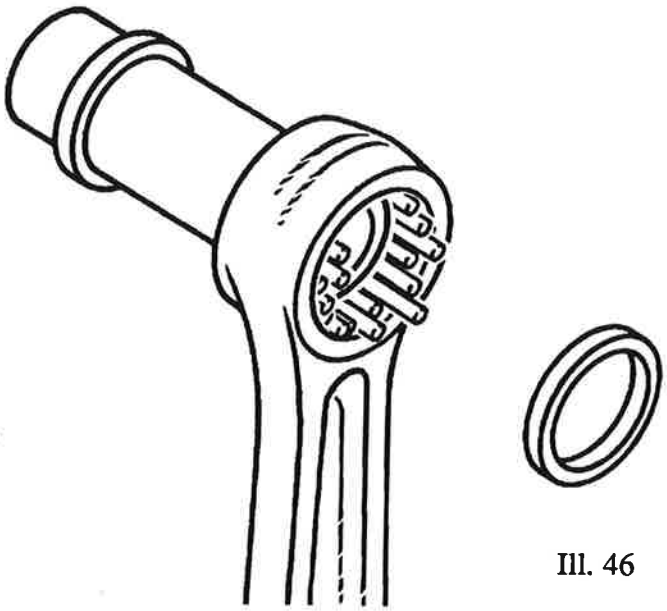


This procedure is considered to be a technical operation and should therefore be performed by an authorized service center only.

24.2) Piston pin bearing:

The piston pin is supported in the con rod eye by 31 needle rollers, without a cage.

For disassembly a special piston pin puller and particular training for its use is necessary. Piston disassembly is allowed to be done only by an authorized workshop.



Ill. 46

25) Gearbox Maintenance (every 10 operating hours):

Check oil level on respective oil level screw and secure again with lock wire.
Change oil after 1st 10 hours of operation, clean magnetic drain plug at each oil change.
Change oil every 100 hours or every 2 years (which occurs first).
Check propeller tip clearance and tracking.

26) Storage:

If your engine is not going to be run for a period of 2 months or more, certain precautions must be taken to protect the engine and fuel system from heat, direct sun, corrosion and the formation of deposits.

The schedule below is a guide for storage procedure:

26.1) Internal engine components:

Remove air filtration system, start engine and allow to idle. Using an oil-can, flood the engine by injecting oil through the carburetor till the engine stalls, then proceed with fuel system draining.

26.2) Fuel system:

Drain float chamber, remove fuel from tank - drain fuel lines.

▲ Follow all safety rules and do not run for a prolonged period above idle.

26.3) After-storage check:

Ensure all residue oil is drained or removed by cranking the engine, and spark plugs are clean and gapped. Refill fuel tank, purge fuel lines and carburetor float chamber of air. Proceed with starting procedure (see section 4).

27) Trouble shooting:

Your ROTAX engine requires basicly two essentials to run. Spark and correct fuel/air mixture. The majority of problems quite often are a simple lack of one or the other.

Organize yourself and follow a set pattern to eliminate components to find your trouble.

Fuel: start by checking the supply (tank), fittings (loose?), filter (plugged?), float chamber (fouled?).

Spark: try new plugs.

Problems of a more complex nature are best left to a ROTAX engine technician: see your dealer.

28) Engine repair log:

Record any repairs or service on your ROTAX engine and use as a reference.

Purchase Date : _____

First Use : _____

Break-in Inspection: _____

	Engine repair log
Repair date	**Summary of work done**

	Engine repair log cont.:
Repair date	**Summary of work done**

29) Technical data:

DESCRIPTION:	2-cyl. 2-stroke liquid cooled engine with rotary valve inlet, with RAVE (adjustable variable exhaust), electronic dual ignition, integrated water pump and thermostat, exhaust system, carburetors, electric starter, gearbox C, intake silencer, fresh oil lubrication
BORE:	76,0 mm (2,99 in.)
STROKE:	68,0 mm (2,68 in.)
DISPLACEMENT:	617 cm^3 (37,65 cu.in.)
COMPRESSION RATIO:	theoretical: 11,5 - effective: 5,94
POWER OUTPUT:	55 kW (73,8 hp SAE) at 6750 1/min. Match propeller to achieve above indicated full load r.p.m. as per engine version.
TORQUE:	80 Nm (59 ft.lb.) at 6500 1/min.
MAX. RPM.:	7000 1/min.
DIRECTION OF ROTATION:	counter-clockwise, viewed towards p.t.o. (without reduction gearbox)
CYLINDER:	2 light alloy cylinders with cast iron sleeve
PISTON:	aluminium cast piston with 2 piston rings
PISTON/CYLINDER CLEARANCE:	0,06 mm (.0024 in.)
TEMPERATURES OPERATIONAL VALUES:	CHT: (cyl. head temperature) normal: ..... 110÷130 °C ..... (230÷270 °F) max.: ..... 150 °C ..... (300 °F) difference between 2 cyl. ..... 10 °C ..... (36 °F) EGT: (exhaust gas temperature) normal: ..... 500÷620 °C ..... (930÷1150 °F) max.: ..... 650 °C ..... (1200 °F) difference between 2 cyl. ..... 25 °C ..... (45 °F) crankcase temp. max.: ..... 80 °C ..... (175 °F) cooling liquid temperature, max.: ..... 80 °C ..... (175 °F)

IGNITION SYSTEM:	breakerless DUCATI capacitor discharge dual ignition with magneto generator
GENERATOR OUTPUT:	170W AC at 6000 1/min. and 13,5V RMS
IGNITION TIMING:	1,47 mm = 0,058 in. (15 °) BTDC
SPARK PLUG:	14 mm, BR8ES
ELECTRODE GAP:	0,5 mm (.02 in.)
ROTARY VALVE:	924 507, cut-off section 151 °
ROTARY VALVE TIMING:	opens: 140 ° BTDC - closes: 62 ° ATDC measured on crankcase openings, ± 4 ° tolerance
CARBURETOR:	2 x BING 36, cable choke
FUEL PUMP:	pneumatic fuel pump DF 52
FUEL:	premium gasoline, octane number not below MON 85 or RON 95 (unleaded preferred)
LUBRICATION OF ENGINE:	by oil pump (optional) with the same oil Super-two stroke oil, proposed ASTM/CEC Standard API-TC ATTENTION: pour point 10 ° C below lowest operating temperature
LUBRICATION OF REDUCTION GEAR:	gear oil API-GL5 or GL6, SAE 140 EP, or 85 W-140 EP
DIRECTION OF PROPELLER SHAFT:	clockwise, viewed towards propeller flange
STARTER:	electric starter
STANDARD VERSION INCLUDES :	engine with - carburetors with clamps - fuel pump - primer system - exhaust system - intake silencer - electric starter - gearbox "C"

WEIGHTS:

Engine: (without: exhaust system, carburetor, intake silencer, fuel pump, radiator)	31,0 kg	(68,3 lb.)
2 carburators with carburator flanges and clamps	1,8 kg	(4,0 lb.)
exhaust system assy.	6,0 kg	(13,2 lb.)
2 air filters	0,3 kg	(,6 lb.)
1 double air filter	0,5 kg	(1,1 lb.)
1 intake silencer with filter, for dual carb.,	1,1 kg	(2,4 lb.)
integrated 2-radiators kit	2,2 kg	(4,9 lb.)
electric starter kit, magneto side	3,5 kg	(7,7 lb.)
reduction gear box "C" , dry	8,0 kg	(17,6 lb.)
reduction gear box "E" , dry	11,2 kg	(24,7 lb.)
lighting generator 230 W DC	1,1 kg	(2,4 lb.)
oil tank 2,4 l	0,6 kg	(1,3 lb.)
after muffler	1,6 kg	(3,5 lb.)
HAC-kit	0,2 kg	(0,4 lb.)

OPTIONAL FEATURES

After-muffler: special after-muffler to be fitted in addition to the exhaust muffler.

High altitude compensator: automatic high altitude adjustment of carburetor calibration, with modified carburetor (on request)

Cooling system: 1) 2-radiators kit, fitted on engine (with gearbox) 0,6 lt. = .16 gal US (cooling system 2,35 lt. = .62 gal US)
2) l-radiator kit, not fitted on engine 0,8 lt. = (.21 gal.US)

30) Main torquing specifications:

			Nm	in.lb.
1)	Crankcase screws	M8	24	210
2)	Crankcase screws	M6	10	90
3)	Crankcase nuts (or screws)	M10	38	335
4)	Crankcase studs	M10	12	105
5)	Cylinder hex. coller screws	M8	24	210
6)	Cylinder head studs	M8	7	60
7)	Cylinder head nuts	M8	22	195
8)	Magneto housing nut	M22 x 1,5	95	840
9)	Allen screw for starting pulley	M8	22	195
10)	Hex. screws for rewind starter	M6	10	90
11)	Rotary valve cover screws	M8	22	195
12)	Intake rubber flange screws	M8	14	125
13)	Lock nut for oil pump gear	M6	7	60
14)	Banjo bolt for oil pump	M6	8	70
15)	Cyl. screw for oil pump	M5	5	45
16)	Spark plug (cold engine)	M14	27	240
17)	Allen screw for stator plate	M5	6	55
18)	Taptite screw for pickup	M5	6	55
19)	Lock nut for ignition coil,	M6	8	70
20)	Hex. screws for mounting plate,	M6	5	45
21)	Hex. screws for starter gear	M8	22	195
22)	Studs for water - outlet socket,	M6	3	25
23)	Hex nut for water - outlet socket,	M6	5	45
24)	Lock nut for water pump impeller,	M6	7	60
25)	Taptite screw for water pump housing,	M6	8	70
26)	Hex screws for gear box,	M8	24	210
27)	Hex collar screw for gear box housing,	M8	24	210
28)	Hex. screw for drive gear, 1/2-20 UNF		60	530

SUBJECT TO MODIFICATION WITHOUT NOTICE!

31) DAILY and PRE FLIGHT CHECK for all ROTAX UL-engines

	DAILY INSPECTION			PRE FLIGHT CHECK
1	Check ignition switched off.	→	1	Check ignition switched off.
2	Drain water from fuel tank sump and/or water trap (if fitted).	→	2	Check fuel content.
3	Check carburetter rubber socket or flange for cracks and secure attachment.		3	
4	Check carburetter float chamber for water and dirt		4	
5	Check security and condition of intake silencer and air filter.		5	
6	Check security of radiator mounting. Check radiators for damage and leaks.	→	6	Visual check for coolant leaks.
7	Check coolant overflow bottle level and security of cap.		7	
8	Check coolant hoses for security, leaks and chafing.		8	
9	Check engine for coolant leaks (Cylinder head, cylinder base and water pump).		9	
10	Check oil content for rotary valve gear lubrication and security of oil cap.		10	
11	Check oil hoses for security, leaks and chafing. (Rotary valve gear lubrication system and oil injection system.)	→	11	Check oil tank content (oil injection engines).
12	Check ignition coils / electronic boxes for secure mounting. Check ignition leads and all electrical wiring for secure connections and chafing.	→	12	Check spark plug caps for security.
13	Check electric starter for secure mounting, check cover for cracks.		13	
14	Check engine to airframe mounting for security and cracks.		14	
15	Check fuel pump mounting for security. Check all fuel hose connections filters, primer bulbs, & taps for security, leakage, chafing & kinks.		15	
16	Check fuel pump impulse hose for secure connections, chafing & kinks.		16	
17	Check wire locking of gearbox drain & level plugs.	→	17	Visual check of engine and gearbox for oil leaks.
18	Check rubber coupling for damage & ageing (C type gearbox only).	→	18	Visual check of engine and gearbox for loose or missing nuts, bolts and screws. Check security of gearbox to engine mounting.
19	Rotate engine by hand & listen for unusual noises. (Double check ignition OFF first.)		19	
20	Check propeller shaft bearing for play by rocking propeller.	→	20	Check propeller for splits and chips. If any damage, repair and/or rebalance before use.
21			21	Check security of propeller mounting.
22	Check throttle choke & oil pump lever cables for damage (end fittings, outer casing, and kinks).	→	22	Check throttle, oil injection pump and choke actuation for free and full movement. Check exhaust valves for free and full movement.
23			23	Check cooling fan turns when engine is rotated (air cooled engines).
24			24	Check exhaust for cracks, security of mounting, springs and hooks for breakage and wear, check wire locking of springs.
25			25	Start engine after ensuring area clear of bystanders.
26			26	Single ignition engines - check operation of ignition switch (Flick ignition off and on again at idling).
27			27	Dual ignition engines - check operation of both ignition circuits.
28			28	Check operation of all engine instruments during warm up.
29			29	If possible, visually check engine and exhaust for excessive vibration during warm up (indicates propeller out of balance).
30			30	Check engine reaches full power rpm during take off roll.

32) MAINTENANCE PLAN - for all ROTAX UL - engines

	Checks and work		2 h	10 h	every 12,5 h	25 h	50 h	75 h	100 h	125 h	150 h	175 h	200 h	225 h	250 h	275 h	300h
1	Retorque cylinder head nuts (only air-cooled engines)	1)	x														
2	Retorque exhaust manifold screws	1)	x														
3	Check rewind starter rope				x												
4	Check electric starter gear						x		x		x		x		x		
5	Inspect spark plugs				x												
6	Replace spark plugs					x	x	x	x	x	x	x	x	x	x	x	
7	Check and clean inside spark plug caps				x												
8	Check ignition timing (only breaker ignition)			x 2)				x						x			
9	Check contact breaker gap			x 2)				x						x			
10	Check ignition damping box							x			x			x			
11	Replace contact breakers and condenser										x						
12	Check V-belt tension			x		x	x	x	x	x	x	x	x	x	x	x	
13	Lubricate ball joints					x	x	x	x	x	x	x	x	x	x	x	
14	Replace exhaust muffler springs							x			x			x			
15	Oil control cables					x	x	x	x	x	x	x	x	x	x	x	
16	Check propeller balance and tracking	3)				x	x	x	x	x	x	x	x	x	x	x	
17	Inspect propeller mounting bolts	4)															
18	Clean and oil air filter					x	x	x	x	x	x	x	x	x	x	x	
19	Check fuel filter					x	x	x		x	x	x		x	x	x	
20	Replace fuel filter								x				x				
21	Check carburetor(s) and re-adjust (idle speed, cable tension, ...)		x			x		x		x		x		x		x	
22	Clean carburetor(s) and check for wear						x		x		x		x		x		
23	Replace jet needle and needle jet										x						
24	Clean and check fuel pump							x			x			x			
25	Check gearbox oil level					x	x	x		x	x	x		x	x	x	

	Checks and work	2 h	10 h	every 12,5 h	25 h	50 h	75 h	100 h	125 h	150 h	175 h	200 h	225 h	250 h	275 h	300 h	
26	Replace gearbox oil		x					x				x					
27	Check and adjust gearbox, preload of																
	washers (type A + B gearboxes)							x				x					
28	Check gearbox backplate screws (type A)							x				x					
29	Replace rotary valve lubrication oil							x				x					
30	Inspect cylinder head and piston crown 5)					x		x		x		x		x			
31	Inspect piston ring grooves 6)					x		x		x		x		x			
32	Check piston diameter 8)					x 7)		x 7)		x		x 7)		x 7)			
33	Piston ring: check gap 8)					x 7)		x 7)		x		x 7)		x 7)			
34	Piston ring: check axial play(rectang.ring) 8)					x 7)		x 7)		x		x 7)		x 7)			
35	Check cylinder diameter 8)					x 7)		x 7)		x		x 7)		x 7)			
36	Cylinder: check for roundness 8)					x 7)		x 7)		x		x 7)		x 7)			
37	Replace cylinder head-, cylinder base- and																
	exhaust-gasket 9)					x		x		x		x		x			
38	Inspect piston pin and bearing									x							
39	Inspect crankshaft and replace outer seals									x							
40	General overhaul of engine 10)															x	

1) and after every replacement of gasket(s)
2) and after every replacement of contact breakers
3) also after any damage
4) according to instructions of manufacturer
5) if carbon layer is more than 0,5 mm thick, decarbonize
6) if piston rings stick, clean and replace if necessary
7) if used in very dusty atmosphere
8) wear limit see Service Information 5 UL / 91
9) if cylinders get dismantled
10) contact authorized ROTAX distributors or service centers

33) ➤ Authorized Distributors and Service Centers for ROTAX Hovercraft and Aircraft Engines

Edition: 1996 01 01

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19 February 47 "A"
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- **WISCONSIN:**

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Maximo Tedesco (English)

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ARGENTINA / BOLIVIA / BRAZIL / CHILE / GUYANA / PARAGUAY / PERU / SURINAM / URUGUAY:

➤ ***MOTAX COMERCIO E REPRESENTAÇÂO LTDA.***
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22755 - RIO DE JANEIRO (RJ)
Tel.: (21) 447 7376 / 7376, Fax: (21) 447 6098
Contact person: J.M. Carneiro de Rezende

SERVICE-CENTERS of MOTAX in BRAZIL:

- **NORTH EAST: RECIFE, PERNAMBUCO STATE**

AEROTEX - ARTIGOS AERONAUTICOS LTDA.
Rodovia Br. 232, km 14,5 Cristo Redentor
C.E.P. 54.220, Jaboatao dos Guararapes-RECIFE-PE
Tel.: 081 / 455 - 3966, Fax: 081 / 455 - 1747
Contact person: Antonio Teixeira

- **NORTH: FORTALEZA, CEARA STATE**

ULTRASPORT- AERONAVES E MOTORES LTDA.
Rodovia BR 116 S/N - KM 3 - Aeroleve
Bairro Aerolandia
C.E.P. 60.830, FORTALEZA - CEARA
Tel. + Fax: 085 / 272 - 5158
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- **CENTRAL + WEST: GOIANIA, GOIAS STATE**

PROLAZER - PROMOCOES

REP. E VENDAS DE ULTRALEVE LTDA.
Rua T-68, Quadra 134, Lote 12 - Setor Bueno
C.E.P. 74610, GOIANIA - GO
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- **CENTRAL + EAST: RIO DE JANEIRO, RJ STATE**

ULTRAPLANNA-INDUSTRIA E COMERCIO LTDA.
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Tel..: 021 / 325 - 8197
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- **SOUTH EAST: SAO PAULO, MATO GROSSO STATE**

ULTRAMOTORES INDUSTRIA E COMERCIO LTDA
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- **SOUTH EAST: CURITIBA, PARANA STATE**

GRACIOSA-COMERCIO DE ULTRALEVE DO PARANA LTDA.
Tenente Brigadeiro Francisco Assis
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- **SOUTH: TAPES, R.G. DO SUL STATE**

CENTENO - ULTRALEVES COMERCIO E INDUSTRIA LTDA.
Estrada Estadual, KM 0,8 - Capivaras
C.E.P. 96760. 1° Distrito - TAPES - R.G. SUL
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Tel.: (074) 63 2755, Fax: (074) 63 2987
Tlx.: 40826 ulaust
Contact person: Jim Fenton

SERVICE-CENTER of AIRCRAFT ENGINE DIST.:

DENIS BEAHAN & CO.
P.O. Box 406
ROMA, QLD. 4455
Tel.: (076) 22 2742, Fax: (076) 22 2291

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7, 36 New Street
RINGWOOD, VICTORIA 3135
Tel.: 03 / 87 93 511, Fax: 03 / 87 96 575,
Tlx.: 36444 brtfld
Contact person: Bert Flood

NEW ZEALAND:

➤ *TIPPINS INTERNATIONAL*
P.O. Box 192, Tuakau
SOUTH AUCKLAND
Tel.: 09 / 233 - 4898, Fax: 09 / 233 - 4798
Contact person: Murray Tippins

4) AFRICA

EGYPT:

➤ *SALEM BALLOONS*
40 Talaat Harb St.
CAIRO
Tel.: (2) 2991 946 / (2) 3453 244, Fax: (2) 2430 541
Contact person: Weaam Salem, General Manager

ANGOLA / BOTSWANA / LESOTHO / MADAGASCAR / MALAWI / MOZAMBIQUE / NAMIBIA / SOUTH AFRICA / SWAZILAND / ZAMBIA / ZIMBABWE:

➤ *MICROLIGHT ENGINES AND ACCESSORIES*
P.O.Box 8053, 1513 Putfontein
JOHANNESBURG
Tel.: 011 / 968 2728, Fax: 011 / 968 2731
Contact persons: Mike Blyth

SERVICE-CENTER of M ICROLIGHT in NAMIBIA:

HOUSEHOLD APPLIANCES
P.O. Box 2798,
WINDHOEK, 9000
Tel.: (061) 35431, Fax: (061) 231245
Contact person: Wolfgang Rapp

SERVICE-CENTERS of MICROLIGHT in SOUTH AFRICA:

LINK ENGINEERING
P.O. Box 15258, Vlaeberg
CAPE TOWN, 8018
Tel.: (021) 47 - 9410, Fax: (021) 47 - 9773
Contact person: Cecil Link

SOLO WINGS
P.O. Box 214, Gillits
DURBAN 3603
Tel.: (031) 700 - 2806, Fax: (031) 700 - 5502
Contact person: David Miller

5) ASIA

CHINA / HONG KONG / MACAO:

➤ *DUEN MU CO.*
9/F Unit 42 Pacific Trade Centre
2 Kai Hing Road, Kowloon Bay
Kowloon, HONG KONG
Tel.: 2756 5725, Fax: 27544774
Contact person: W. C. Choi

CIS:

➤ *AVIAGAMMA JSCo.*
P.O. Box 51
125 057 MOSCOW
Tel.: 095 / 158 31 23, Fax: 095 / 158 65 73
Contact person: Vladimir Andriytschuk
General Director

SERVICE-CENTERS of AVIAGAMMA:

"Aviakecht" JSCo.
443022 Zavodskoe shosse 18
SAMARA, Russia
Tel.: 846 2 51-89-53, Fax: 846 2 34-76-55
Contact person: Ewgony Shistorow

for UKRAINE:

ATC „LIGHT-KONTINENT"
1B ploschad Zavodska, P.O. Box 1152
327052, Nikalaew
Tel. / Fax: 0510-252-217, 0510-356-468
Contact person: Firsov N. Alexandr

for REPUBLIC BELARUS:

MINIAVIA
Minskaja ATB MVL PANH
220065 Aerodromnaja 4, MINSK/BELARUS
Tel./Fax: 0172/255-937
Contact person: Liach Alexander

➤ *REDA-MDT ltd.*
Matrossskaia tishina str. 23/7 k.5, MOSKOW 107 076
Tel. + Fax. 095/ 268-0036 (268-4664)
Contact person: Alexey Tormakhov

INDIA:

➤ *GREAVES LIMITED*
22-A, Janpath
NEW DELHI - 110 001
Tel.: 11/338 50 61/338 26 53 (Dir.), Fax:11/37 82 553
Tlx.: 031-62663
Contact person: Wg Cdr S.N. Chhabra
Divisional Manager

SERVICE-CENTERS of GREAVES LTD., New Delhi:

GREAVES LTD
16/3 Ali Asker Road, P.B. No. 113
BANGALORE 560 052
Tel.: 080/22 65 873/22 68 773, Fax: 080/225 3472,
Tlx.: 0845-2365
Contact person: Wg Cdr B. Chandran
Dy. Gen. Manager

GREAVES LTD
10-B Madan Mohan, Malviya Marg
LUCKNOW 226 001
Tel.: 0522/283 410/283 406, Fax: 0522/283 067,
Tlx.: 0535-321
Contact person: R.N. Singh
Deputy General Manager

GREAVES LTD
1, Dr V.B. Gandhi Marg, P.B. No. 91
BOMBAY 400 023
Tel.: 022/267 44 07/267 15 24, Fax: 022/267 7 850,
Tlx.: 011-82517
Contact person: H.L. Shah
Marketing Manager
Marine Systems Grp.

GREAVES LTD
Thapar House, 25 Brabourne Road, P.B. No. 702
CALCUTTA 700 001
Tel.: 033/24 21 459/24 23 805, Fax: 033/24 24 325,
Tlx.: 021-5055/5130
Contact person: K. K. BARKAR

INDONESIA / MALAYSIA / SINGAPORE:

➤ ***P.T. ESACON TRADA***
Jl. Wolter Monginsidi 91
JAKARTA 12180
Tel.: (021) 715 906 / 739 8109, Fax: (021) 739 8109,
Tlx : 62580 jlf ia

IRAN:

➤ ***ALPAZEL - TASHAR CO. LTD.***
54 Khaled Eslamboli Ave.
TEHERAN 15117
Tel.: 21 / 624-787 / 801-1222, Fax: 21 / 886-3336,
Tlx.: 223708 tshr

ISRAEL:

➤ ***CONDOR-AVIATION INDUSTRIES LTD.***
34 Arlozorov St.
IL-52481 RAMAT - GAN
Tel.: 03 / 6 724 884; Fax: 03 / 6 723 753
Contact person: David Viernik

JAPAN:

➤ ***JUA, LTD.***
1793 Fukazawa, Gotemba City
SHIZUOKA PREF 412
Tel.: 550 / 83 8860, Fax: 550 / 83 8224
Contact person: Michio Oiwa, General Manager

KOREA:

➤ ***HWA YOUNG MEDICAL & SCIENCE CO.***
401 KeumKang Building
1439-1, Seocho 1 dong, seocho-ku, SEOUL 137-071
Tel.: 02 / 3472-0271-5,
Fax: 02 / 3472-0276 (02/3471-4753)
Contact person: John Lee, President

PAPUA NEW GUINEA:

➤ ***BERT FLOOD IMPORTS PTY. LTD.***
7, 36 New Street
RINGWOOD, VICTORIA 3135
AUSTRALIA
Tel.: 03 / 87 93 511, Fax: 03 / 87 96 575,
Tlx.: 36444 brtfld
Contact person: Bert Flood

PHILIPPINES:

➤ ***PHILIPPINE AIRCRAFT CO, INC.***
P.O. Box 7633, Domestic Airport Post Office Lock Box,
1300 Pasay City, METRO MANILA
Tel.: 2/832-2777, Fax: 2/833-0605,
Tlx.: 66621 wpac pn
Contact person: Rolando P. Moscardon

TAIWAN:

➤ ***TAIWAN MAXIEM INDUSTRIES***
7/1 Tung Feng Street
TAIPEI, 10 651
Tel.: 2 / 704 6163, Fax: 2 / 702 84 85
Contact person: Lester Lin

THAILAND:

➤ ***JONES COMPANY LIMITED***
942/20-21 Rama 4th Road
P.O. Box 686
BANGKOK
Tel.: 2 / 233 9088 / 233 3628, Fax: 2 / 238 4965
Contact person: Kit Chong

UNITED ARAB. EMIRATES:

➤ ***AL MOALLA***
P.O. Box 7787
ABU DHABI
Tel.: 2 / 723 248, Fax: 2 / 788 073
Contact person: Hussain Al Moalla

34) The BOMBARDIER-ROTAX non-certified aircraft engines limited warranties

1) PERIOD

BOMBARDIER-ROTAX as manufacturer, warrants through their authorized BOMBARDIER-ROTAX distributors FROM THE DATE OF SALE TO THE FIRST CONSUMER, every BOMBARDIER-ROTAX non-certified aircraft engine, sold as NEW AND UNUSED, and **delivered by an authorized BOMBARDIER-ROTAX distributor** for a period of the earliest of:

- 6 consecutive months for private use owners
- or 12 consecutive months from date of shipment of the manufacturer
- or the first 100 operation hours.

2) WHAT AN AUTHORIZED BOMBARDIER-ROTAX DISTRIBUTOR WILL DO

The authorized BOMBARDIER-ROTAX distributor will, at its option, repair and/or replace components defective in material and/or workmanship under normal use and service, with a genuine BOMBARDIER-ROTAX component without charge for parts or labour, during said warranty period. All parts replaced under warranty become the property of BOMBARDIER-ROTAX.

3) CONDITION TO HAVE WARRANTY WORK PERFORMED

You must present to an authorized BOMBARDIER-ROTAX service-center, the hard copy of the BOMBARDIER-ROTAX warranty registration card and/or proof of purchase delivered to the customer from the selling dealer at time of purchase.

4) EXCLUSIONS - ARE NOT WARRANTED

- Normal wear on all items
- Replacement parts and/or accessories which are not genuine BOMBARDIER-ROTAX parts and/or accessories.
- Damage resulting from the installation of parts other than genuine BOMBARDIER-ROTAX parts.
- Damage caused by failure to provide proper maintenance as detailed in the Operator's Manual. The labour, parts and lubricants costs of all maintenance services, including tune-ups and adjustments will be charged to the owner.
- Aircraft engines designed and/or used for racing or commercial purposes.
- All optional accessories installed on the aircraft engine (The normal warranty policy for partsa n d accessories, if any, applies).
- Damage resulting from running the aircraft engine without propeller.
- Damage resulting from modification to the aircraft engine not approved in writing by BOMBARDIER-ROTAX
- Damage caused by electrolysis.
- Cold seizure and piston scuffing.
- Use of a gear reduction not designed by BOMBARDIER-ROTAX.
- Use of propellers which exceed the inertia and balance limits as specified by BOMBARDIER-ROTAX.
- If engine instruments recommended by BOMBARDIER-ROTAX have not been installed.
- Losses incurred by the aircraft engine owner other than the parts and labour, such as, but not limited to, mounting and dismounting of the engine from the aircraft, loss of use, transportation, towing, telephone calls, taxis, or any other incidental or consequential damage.
- Damage resulting from accident, fire or other casualty, misuse, abuse or neglect.
- Damage/rust/corrosion premature wear to the engine caused by water ingestion.
- Damage resulting from sand/stones infiltration.
- Damage resulting from any foreign material ingestion.
- Damage resulting from service by an unqualified mechanic.

5) EXPRESSED OR IMPLIED WARRANTIES

This warranty gives you specific rights, and you may also have other legal rights which may vary from state to state, or province to province. Where applicable this warranty is expressly in lieu of all other expressed or implied warranties of BOMBARDIER-ROTAX, its distributors and the selling distributor, including any warranty of merchantability or fitness for any particular purpose; otherwise the implied warranty is limited to the duration of this warranty. However, some states or provinces do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply.

Neither the distributor, nor any other person has been authorized to make any affirmation, representation or warranty other than those contained in this warranty, and if made, such affirmation, representation or warranty shall not be enforceable against BOMBARDIER-ROTAX or any other person.

BOMBARDIER-ROTAX reserves the right to modify its warranty policy at any time, being understood that such modification will not alter the warranty conditions applicable to aircraft engines sold while the above warranty is in effect.

6. CONSUMER ASSISTANCE PROCEDURE

If a servicing problem or other difficulty occurs, please contact:- authorized BOMBARDIER-ROTAX service-center or- authorized BOMBARDIER-ROTAX distributor.

7. Warranty will only be valid if the end user completes this registration card as soon as the aircraft engine goes into service, and returns it to the national authorized BOMBARDIER-ROTAX distributor (marked with „ ➤" in section 33) of the area in which the aircraft engine is firstly operated.

8. This warranty will be effective for all non-certified aircraft engines delivered by BOMBARDIER-ROTAX as of June 1st, 1992.

9. DANGER!

This engine, by its design, is subject to sudden stoppage! Engine stoppage can result in crash landings. Such crash landings can lead to serious bodily injury or death.

Never fly the aircraft equipped with this engine at locations, airspeeds, altitudes, or other circumstances from which a successful no-power landing cannot be made, after sudden engine stoppage.
Aircraft equipped with this engine should only fly in DAYLIGHT VFR conditions.

WARNING!

This is not a certificated aircraft engine. It has not received any safety or durability testing, and conforms to no aircraft standards. It is for use in experimental, uncertificated aircraft and vehicles only in which an engine failure will not compromise safety.

User assumes all risk of use, and acknowledges by his use that he knows this engine is subject to sudden stoppage.

WARRANTY REGISTRATION CARD

Issue 92 06 01 ROTAX.

1. To be eligible for warranty, this registration card must be returned completed and signed by the end user to the authorized ROTAX distribution partner (marked with "➤" in section 33) of the area of the permanent residence of the end user and / or in which the aircraft engine is firstly operated, within 30 days as of date of purchase.

2. No other warranties and / or guarantees than defined in the actual warranty conditions are made.

3. Engine type: .....

Engine no.: .....

Gearbox: ..... Reduction i = ...

Inv.no.: ..... date of purchase: .....

Warranty expires: .....

Buyer: .....

Seller: .....

I have read and understood the operator's manual in its entirety and carefully followed the described break-in procedure.

Date: ..... Signature: .....

WARRANTY REGISTRATION CARD

Issue 92 06 01

1. To be eligible for warranty, this registration card must be returned completed and signed by the end user to the authorized ROTAX distribution partner (marked with "➤" in section 33) of the area of the permanent residence of the end user and / or in which the aircraft engine is firstly operated, within 30 days as of date of purchase.
2. No other warranties and / or guarantees than defined in the actual warranty conditions are made.

3. Engine type: .....

Engine no.: .....

Gearbox: ..... Reduction i = ...

Inv. no.: ..... date of purchase: .....

Warranty expires: .....

Buyer: .....

Seller: .....

I have read and understood the operator's manual in its entirety and carefully followed the described break-in procedure.

Date: ..... Signature:

Customer copy, keep for your records

Marke
Timbre

Postkarte
Carte postale

Postleitzahl - Code postal Bestimmungsort - Lieu de destination

Bestimmungsland - Pays de destination

DANGER!

This engine, by its design, is subject to sudden stoppage! Engine stoppage can result in crash landings. Such crash landings can lead to serious bodily injury or death.

Never fly the aircraft equipped with this engine at locations, airspeeds, altitudes, or other circumstances from which a successful no-power landing cannot be made, after sudden engine stoppage. Aircraft equipped with this engine should only fly in DAYLIGHT VFR conditions.

WARNING!

This is not a certificated aircraft engine. It has not received any safety or durability testing, and conforms to no aircraft standards. It is for use in experimental, uncertificated aircraft and vehicles only in which an engine failure will not compromise safety. User assumes all risk of use, and acknowledges by his use that he knows this engine is subject to sudden stoppage.

Absender:
Expéditeur:

Postleitzahl - Code postal

ENGINE TYPE: _____

SERIAL NO.: _____

PURCHASE DATE: _____

INSTALLATION IN: _____

_____

_____

DEALER IMPRINT AREA

Bombardier-Rotax GmbH

A-4623 GUNSKIRCHEN Telefon: (0)7246/271-0*
Welser Straße 32 Telefax: (0)7246/370