



BOMBARDIER
RECREATIONAL PRODUCTS

REPAIR MANUAL

for ROTAX-engines type

FR 125 MAX

FR 125 Junior MAX

Version: FR 125 MAX (21 kW)
Engine configuration no.: 37.125.1301

Version: FR 125 Junior MAX (15 kW)
Engine configuration no.: 30.0125.130

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Preface

This Repair Manual contains essential advice and data for professional maintenance and repair of the ROTAX kart engines, type FR 125 MAX and FR 125 JUNIOR MAX.

The Repair Manual is based on the state of knowledge at the time of publication.

BOMBARDIER-ROTAX reserves the right to make technical modifications to the engine in view of further development without updating this Manual.

All data and procedures in this Repair Manual are described to the best of our knowledge, however excluding any liability.

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IMPORTANT INFORMATION

Repeating symbols

Pay attention without fail to the following symbols throughout the Manual emphasizing particular information.

- ▲ **Warning:** Identifies an instruction, which if not followed may cause injury or endanger the life of the rider, mechanic or third party.
- **Attention:** Denotes an instruction which if not followed may result in severe damage of the engine. Non-compliance might lead under certain conditions to health hazards.
- ◆ **Note:** Information useful for better execution and understanding of instructions.
- ⇒ Denotes a working instruction
- ✓ Denotes a checking instruction

General precautions and safety information

- ▲ **Warning:** The ROTAX engine Type FR 125 MAX is planned and has been developed solely for the use in karts, which are exclusively run on specified tracks. Any applications beside that is not as agreed and releases the manufacturer of any liability.
- **Attention:** Information stated in this Manual are based on data and experience of experts, applicable at standard working conditions. These guidelines are useful and necessary but they are never a substitute for proper theoretical and practical training.
- **Attention:** Replacement parts must meet the requirements defined by the engine manufacturer. This is only warranted by the use of GENUINE-ROTAX parts and / or accessories (see Replacement parts list). If using other than GENUINE ROTAX parts and / or accessories any warranty granted by ROTAX will lapse.
- **Attention:** modifications on engine and changes to sphere of engine (carburation, exhaust system etc.) not approved by ROTAX releases the manufacturer of any liability and warranty.
- **Attention:** to warrant proper repair, utilization of the specified special tools, fixtures, lubricating,-sealing,- and securing agents is required.
- **Attention:** Adhere to specified tightening torques without fail.
- **Attention:** Removed sealing rings, gaskets, circlips, O-rings and oil seals have to be always renewed at an engine overhaul.
- **Attention:** Use only clean screws and nuts. Check thrustfaces and thread for damage. If doubtful use new screws and nuts.
- **Attention:** Decisive for life span and instant troublefree operation is to meet the specified schedule of maintenance and to observe sundry technical data.

- **Attention:** Always secure engine safely on trestle.
- **Attention:** After assembly verify components for tight fit and check engine for flawless operation.
- **Attention:** Rectify minor defects without delay, thus preventing engine failure.
- **Attention:** Pay attention without exception to all additional safety measures of the kart manufacturer.

Technical data

Engine Type	FR 125 MAX FR 125 Junior MAX
Bore/Stroke	54,0 mm / 54,5 mm
Displacement	125,0 cm ³
Performance (max.) FR 125 MAX FR 125 Junior MAX	21 kW at 11.500 rpm 15 kW at 8.500 rpm
Torque (max.) FR 125 MAX FR 125 Junior MAX	21 Nm at 8.750 rpm 17 Nm at 8.500 rpm
Idle speed	1.500 rpm
Speed limit FR 125 MAX FR 125 Junior MAX	13.500 rpm (at operation on the track, under load) 12.200 rpm (at operation on the track, under load) ATTENTION: Do not operate the engine without load!
Ignition unit	Breakerless, digital battery ignition, DENSO
Spark plug	NGK BR10EG, M14x1,25 or DENSO IW31, M14x1,25
Electrode gap	0,5 - 0,6 mm (NGK) 0,6 - 0,7 mm (DENSO)
Fuel	Premium fuel, unleaded
RON (min.)	95 octan
Cooling system	Liquid cooled, cooling circuit by integrated coolant pump
Flowrate of the coolant pump	22 l / min. at 11.000 rpm.
Coolant mixture	50% Antifreeze (al - compatible) 50% Water (distilled)
Coolant quantity	0,6 l
Engine lubrication system	Mixture lubrication, super 2-stroke oil
Fuel mixing ratio	1:50 (2% oil)
Lubrication of the balance shaft drive	Motoroil SAE 15W- 40
Oil quantity for lubrication of balance shaft drive	0,05 l (= 50 ml)
Clutch	Centrifugal clutch, dry
Clutch engagement speed	Approx, 4000 rpm
Power transmission from centrifugal clutch to the rear axle of the kart	Roller chain
Chain dimension	7,75 x 4,6 x 4,5
Number of teeth of the drive sprocket	11, 12, 13 or 14 teeth
Weight (dry)	Approx. 12 kg without silencer, carburetor, fuel pump, radiator, muffler and battery
Table 1	

Check and service intervals of engine components

Component	Inspection or maintenance schedule	Checking, remedy
Chain sprocket	Inspection before each kart operation	Inspect for wear or deformation of teeth, renew as required
Exhaust system	After each kart operation	Apply oil against corrosion
Filter element in the intake silencer	Latest after every 10 hours of operation (depending on conditions of operation)	Clean and apply oil, Renew damaged filter element
Coolant pump	Inspection before each kart operation	Inspect for exit of oil or coolant from the leakage bore in the crankcase. In case of leakage let engine overhaul carry out by an authorized distributor or Service Center
Coolant elbow fitting on crankcase and cylinder head cover.	Inspection before each kart operation	Checking for tight fit and sealing, reseal with securing - and sealing agent ERGO 4052 as required
Function of exhaust valve	Latest after every 10 hours of operation	Check for easy moving of the valve and correct fit of the single components
Oil in the gear compartment	After every 2 hours of operation	Check oil level, replenish as required
Drive gears for the balance shaft	After every 10 hours of operation	Inspect for wear, renew worn parts
Oil in the gear compartment	After every 50 hours of operation or at least once a year	Oil change
Starter reduction gear assembly	Latest after every 10 hours of operation (depending on conditions of operation)	Clean and apply grease on bearing seats
Needle cage or bearing bush of clutch drum	After every 2 hours of operation	Clean and grease, replace worn parts
Friction lining of the fly weights	After every 10 hours of operation	Inspect for wear replace worn fly weights
Insulating mat of aftermuffler	After every 10 hours of operation	Replace
Engine overhaul	After 50 hours of operation, Inspection of the following components: Piston, piston pin and needle cage, oil seals of crank shaft, drive of balance shaft, sealing of the waterpump shaft	Let the engine overhaul carry out by an authorized distributor or Service Center.
Table 2		

▲ Warning: All maintenance and service activities have to be carried out by a trained mechanic only.

Special tools, securing and sealing agents

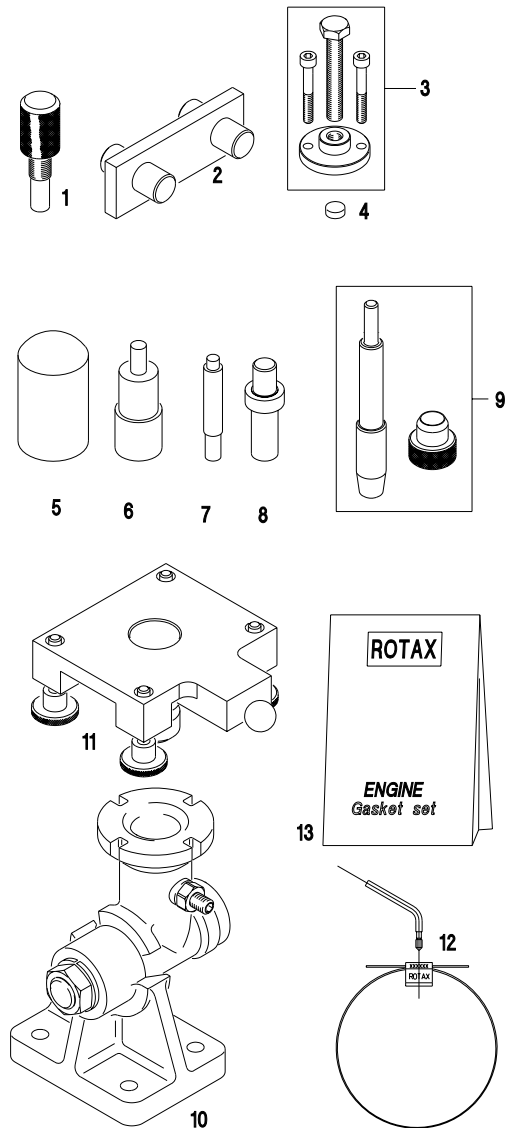


Figure 2

Figure 1

Pos.	ROTAX Teile-Nr.	Bezeichnung	Verwendung
1	277 380	crankshaft fixation tool	for locking of the crankshaft
2	277 362	sprocket fixation tool	for fitting of the sprocket
3	276 015	puller assembly	to pull off the starter gear from the crankshaft
4	944 230	cover 12	to protect the crankshaft end
5	676 010	fitting sleeve	installation of crankshaft oil seals
6	676 020	fitting punch	installation of waterpump oil seals
7	676 030	fitting punch	removal and installation of needle bushing for starter reduction gear
8	676 040	fitting punch	for plain bearing of sprocket with 11 t.
9	676 035	insertion pusher	piston pin circlip installation
10	876 762	trestle assy	engine support at service and maintenance work
11	676 050	mounting plate	for ROTAX engines type 100 and FR 125 MAX
12	297 040	"ROTAX" - seal	with registered serial no.
13	296 160	gasket set	for the engine
14	897 655	ERGO 4052	securing agent, medium strength (2 gr.)
15	297 434	LOCTITE Anti Seize	preventing fretting corrosion (50 ml.)
16	899 788	LOCTITE 648	securing agent, high strength (5 gr.)
17	897 161	MOLYKOTE 111	silicone grease (100 gr.)
18	297 386	SILASTIC 732 RTV	sealing compound (100 gr.)

Tabelle 3

Location of the engine serial number

The engine number is imprinted on the clutch side crankcase half. Always state the engine number on inquiries, when ordering replacement parts and in case of a warranty claim.

ENGINE REMOVAL FROM THE CHASSIS

- ◆ **Note:** There is no need to remove the engine from the chassis to repair the following components:
- Centrifugal clutch
 - Cylinder assy with combustion insert and cylinder head cover
 - Exhaust valve
 - Reed valve
 - Piston
- ▲ **Warning:** Before proceeding with repair work disconnect the battery (first the minus pole. Caution: High voltage at ignition unit!

Engine removal

▲ **Warning:** Strictly observe removal and installation directives of the kart producer

- ⇒ Let the engine cool down first
- ⇒ Clean the Kart
- ⇒ Disconnect the battery

▲ **Warning:** Disconnect the battery only with ignition switched off. First detach the cable from the minus terminal and then from the plus terminal

- ⇒ Remove the exhaust springs and remove the exhaust system
- ⇒ Remove the lower engine pedestal brackets
- ⇒ Remove the drive chain
- ⇒ Disconnect the plugs for ignition coil (1), for pick-up (2) and for the electric starter (3) from the cable harness by releasing the respective catch.

■ **Attention:** Pull only on the plug, never on the cable

- ⇒ Detach the ignition coil (4) by removal of the two lock nuts (5)
- ⇒ Pull off the fuel hose from the carburetor which connects fuel pump with carburetor
- ⇒ Pull off and plug the fuel hose from the fuel pump which connects fuel tank with fuel pump.

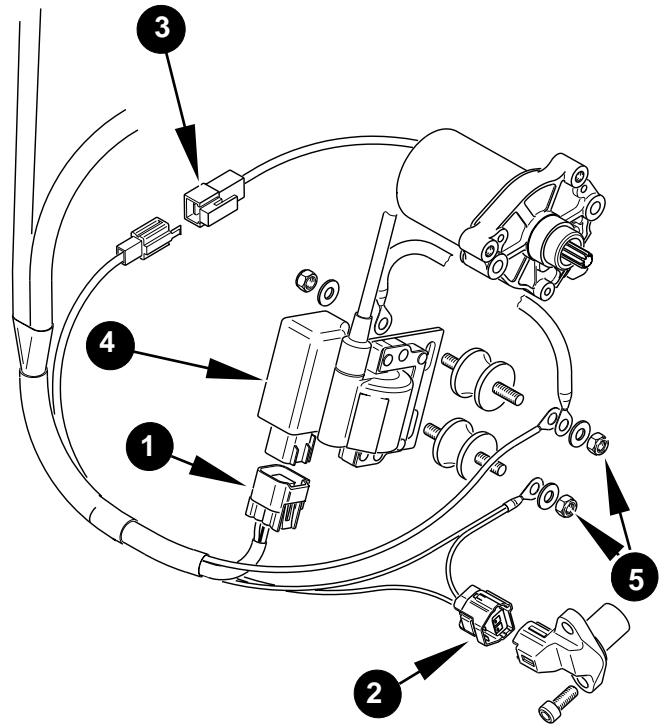


Figure 3

▲ **Warning:** Any spilled fuel must be absorbed at once with a bonding agent and disposed off ecologically

- ⇒ Slacken the clamps (6) and (7) and remove the carburetor

▲ **Warning:** When removing the carburetor fuel could flow out. Do not smoke or allow naked flames. Prevent any contact of fuel with hot engine parts or equipment – Risk of fire and explosion. Never handle fuel in closed rooms.

- ⇒ Remove the engine along with radiator and intake silencer.

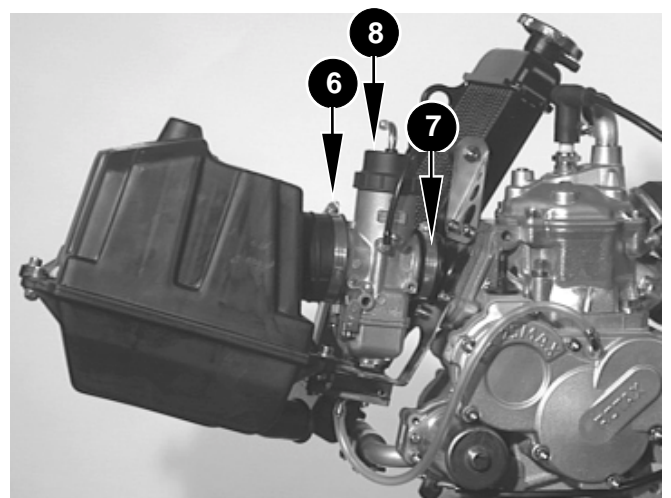


Figure 4

Setting up the engine on the trestle

⇒ Remove the engine pedestal from the cleaned engine, place the engine on the trestle and secure with 4 fixing screws.

◆ **Note:** Special tool – "trestle assembly"
ROTAX part no.: 876 762, 676 050

ENGINE DISASSEMBLY

Removal of the radiator

- ⇒ Loosen the two hose clamps on the coolant hose elbow fittings of the engine.
- ⇒ Remove the lock nut (1) from radiator support on engine side.
- ⇒ Pull off the hose along with the radiator from the lower 90° elbow fitting and drain the coolant.

▲ **Warning:** Risk of scalding when draining the coolant or removing the radiator cap at operating temperature. Let the engine cool down first.

⇒ Afterwards pull off the hose from the top elbow fitting.

Removal of the intake silencer and of the carburetor socket

- ⇒ Pull off the impulse hose (2) from the fitting on the gear cover
- ⇒ Remove the 5 Allen screws (M6) on the carburetor socket (3)
- ⇒ Remove the intake silencer (4) along with support bracket (5) and fuel pump (6)

Removal of the electric starter

- ⇒ Remove both Allen screw M6, securing the electric starter on the crankcase
- ⇒ Remove the electric starter (7)

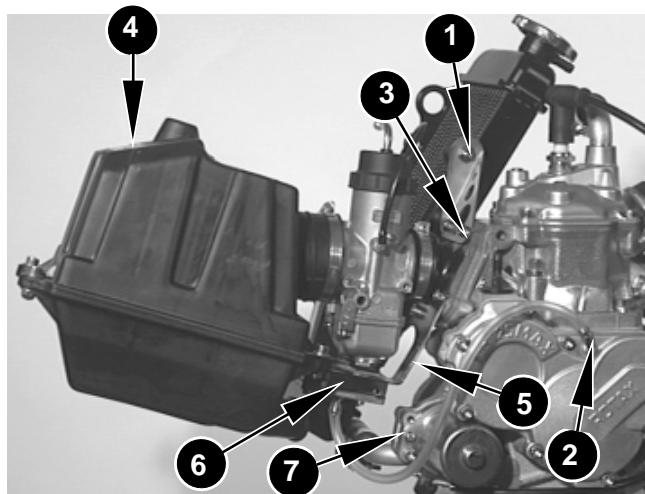


Figure 5

Removal of the centrifugal clutch

- ⇒ Remove the spark plug
- ⇒ Fit the crankshaft fixation tool (7) completely into spark plug tapping (fig. 7)

◆ **Note:** Special tool – "crankshaft fixation tool" ROTAX part no. 277 380

- ⇒ Remove the hex. nut (1)
- ⇒ Remove the thrust washer (2), clutch drum with chain sprocket (3), needle cage (4) and the thrust washer (5).

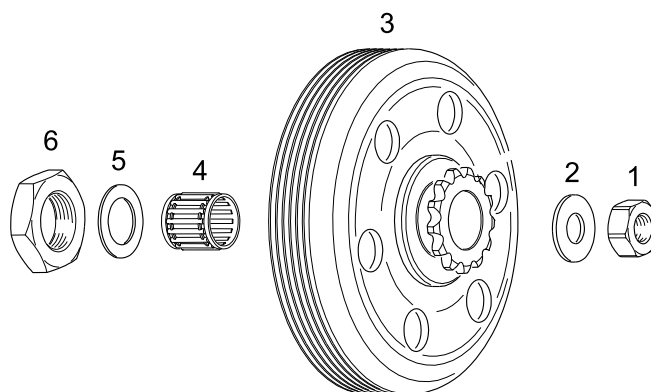


Figure 6

◆ **Note:** On the chain sprocket with 11 teeth a bearing bush pressed into the chain sprocket will be used instead of the needle cage (4).

- ⇒ Remove the hex. nut (6)
- ⇒ Incline the engine and with the crankshaft pointing upwards, place the cover 12 (8) on crankshaft end.

◆ **Note:** Special tool – "cover 12" ROTAX part No. 944 230

- ⇒ Attach the puller assy (9) with 2 Allen screws M6 x 20 on the starter gear.

◆ **Note:** Special tool – "puller assembly". ROTAX part no. 276 015

◆ **Note:** Turn in the M6 screws only so far into the starter gear that a gap of at least 1 mm will remain between the screws and crankcase.

- ⇒ Press off the starter gear by turning-in the puller screw M10 (fig 7)
- ⇒ Remove the two Allen screws securing the reduction gear cover (10) and remove the reduction gear cover.
- ⇒ Remove the starter reduction gear assembly (11) and the trustwasher (12) underneath.
- ⇒ Remove the crankshaft fixation tool (7) from the spark plug tapping.

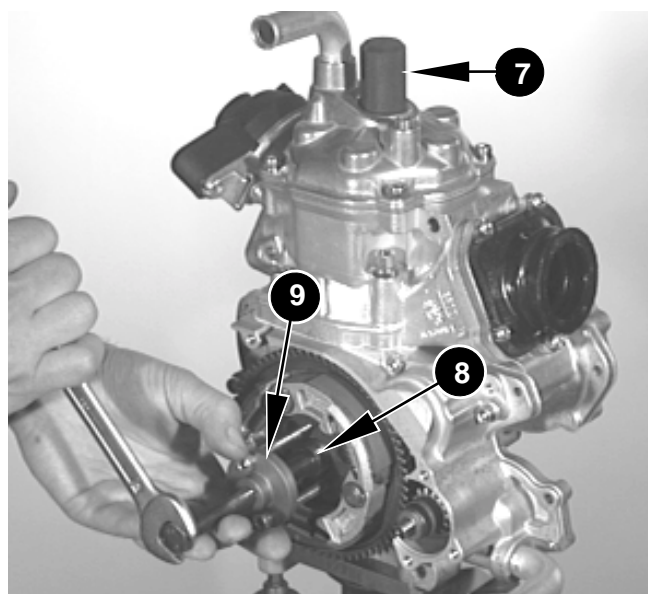


Figure 7

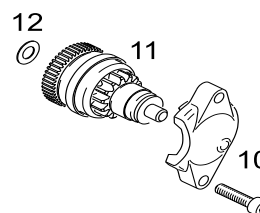


Figure 7.1

Removal of the cylinderhead cover and combustion chamber insert

◆ **Note:** If only the crankcase has to be taken to pieces the completely assembled unit of cylinder with reed valve, carburetor socket, exhaust valve assy, exhaust socket and combustion chamber insert and cylinderhead cover, can be removed from crankcase.

- ⇒ Remove 4 Allen screws M6 (1) (fig. 8)
- ⇒ Remove the cylinderhead cover (2)
- ⇒ Take off both O-rings (3) and (4)
- ⇒ Remove 5 Allen screws M8 (5) and lock washers
- ⇒ Remove the combustion chamber insert (6) and O-ring (7)

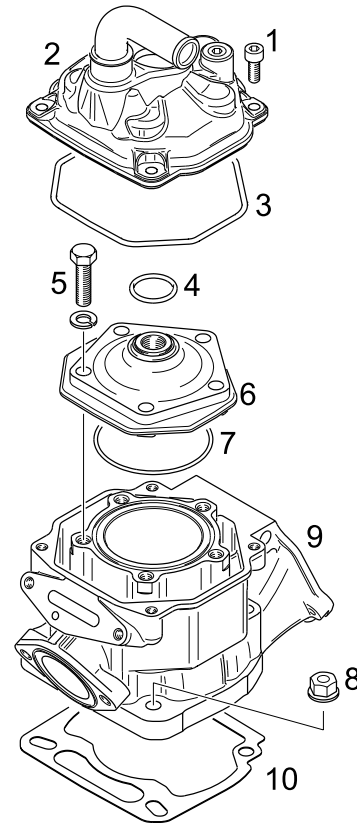


Figure 8

Cylinder-removal

- ⇒ Remove 4 hex. nuts(8) with a A/F 11 spanner
- ⇒ Remove the cylinder (9) from the crankcase

■ **Attention:** Take care not to damage the piston

- ⇒ Remove the cylinder base gasket (10)

Piston – removal

- ⇒ Force out the piston pin circlips (11) with a suitable tool

■ **Attention:** Prior to the removal of the piston pin circlips cover the crankcase opening with a clean rag (fig. 9) to prevent piston pin circlips from dropping into the crankcase.

- ⇒ Push out the piston pin (12) with the insertion pusher

◆ **Note:** Special tool – "insertion pusher" ROTAX part no: 676 035

■ **Attention:** Always support the piston by hand (fig. 9) whilst pushing out the piston pin to avoid a bending moment on the conrod.

- ⇒ Remove the piston (13) along with needle cage (14)



Figure 9

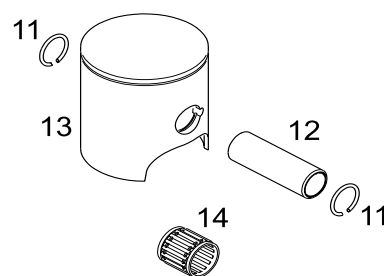


Figure 10

Disassembly of the drive for the balance shaft and waterpump shaft.

- ⇒ Remove the lowest Allen screw of gear cover (1) and sealing washer and drain the oil.

▲ **Warning:** Dispose of all operating fluids and cleaning agents in accordance with the effective environment issues.

- ⇒ Afterwards remove the remaining 7 Allen screws M6 and remove the gear cover (1) and the gasket (2)
- ⇒ Remove the waterpump pinion (3) and the waterpump idle gear (4)
- ⇒ Remove the needle pin (5) and the thrust washer (6) from the waterpump shaft
- ⇒ Remove the retaining rings (7) with a pair of snapping pliers

▲ **Warning:** At reassembly use new retaining rings without fail

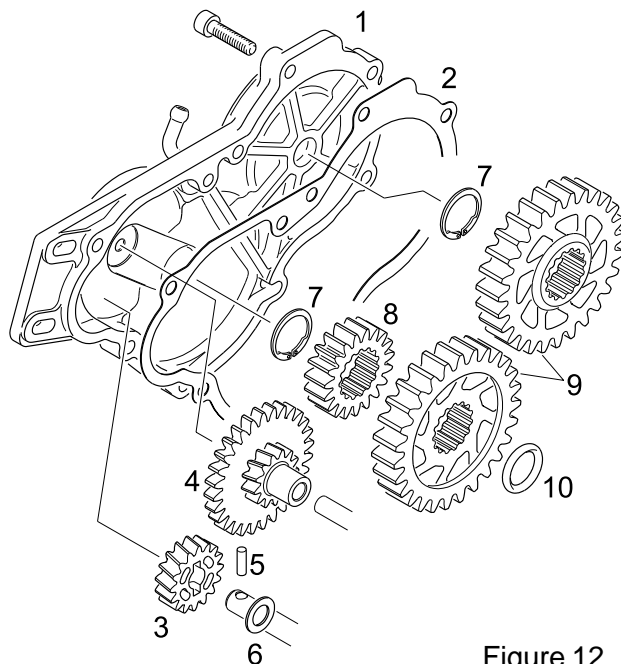


Figure 12

- ⇒ Remove the drive gear (8) from the crankshaft.
- ⇒ Preheat the two balance gears (9) uniformly with a hot air gun and remove them from the balance shaft
- ⇒ Remove the O-ring (10) from the crankshaft.

Separation of the crankcase halves

- ⇒ Remove all the 10 crankcase fasteners (M6)
- ⇒ Take off the engine from the trestle

◆ **Note:** For the separation of the crankcase halves the 2 Allen screws M6 x 60 of the puller assembly must be used.

◆ **Note:** Special tool "puller assembly" ROTAX part no. 276 015

- ⇒ Turn-in the 2 Allen screws (11) simultaneous thus separating the crankcase halves uniformly.
- ⇒ Remove the waterpump impeller (12) with the pump shaft.
- ⇒ Remove the balance shaft (13) from the crankcase
- ⇒ Take off the gasket from the crankcase joint.

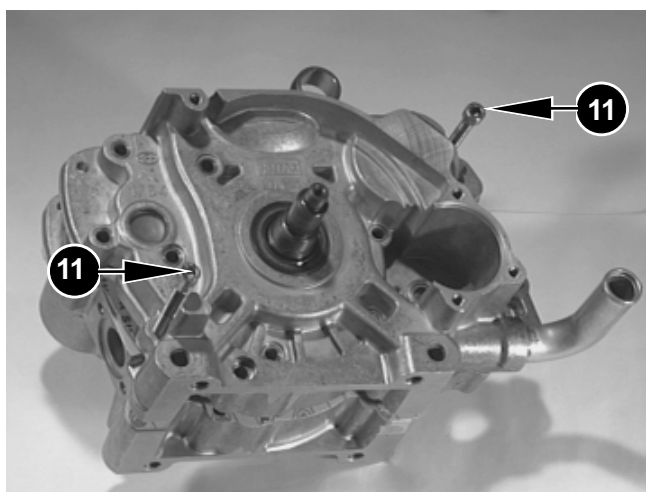


Figure 13

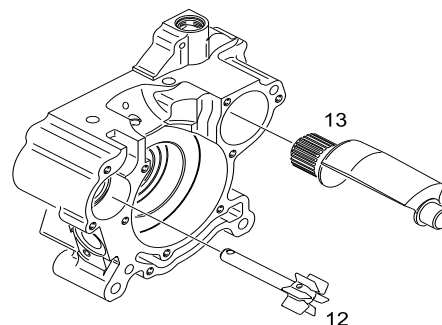


Figure 14

Crankshaft removal

⇒ Firmly hold the crankshaft with on hand. Remove the crankshaft from the crankcase half by smart blows with a mallet on the crankshaft end.

▲ **Warning:** Be aware of the weight of the forced out crankshaft. Risk of injury.

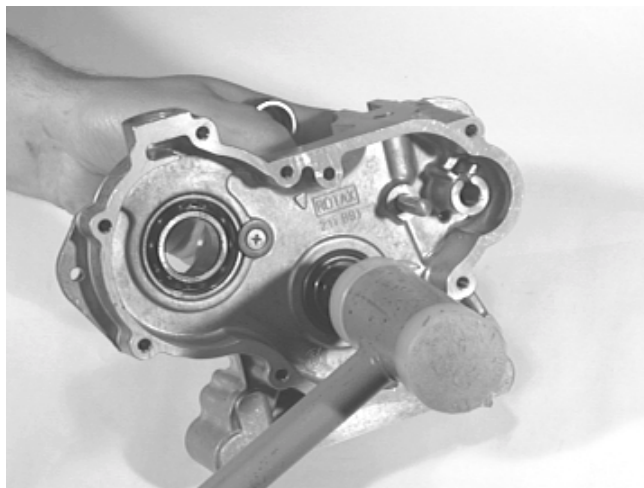


Figure 15

INDIVIDUAL COMPONENT MAINTENANCE

▲ **Warning:** Any component with wear in excess of the specified wear limit or with shortcomings detected at inspection which will impair engine operation has to be replaced.

■ **Attention:** Risk of burns when handling hot engine parts.

◆ **Note:** When taking dimensional readings in the order of accuracy of 0,1 mm or even more precise, the temperature of the part must be between 20°C-25°C.

Crankcase

⇒ Clean both crankcase halves, ball bearings and all bearing seals with a non-aggressive cleaning lotion.

■ **Attention:** Do not use degreasing or cold cleaning agents.

⇒ clean all sealing faces carefully.

✓ inspect both crankcase halves for cracks and damage.

✓ inspect all sealing surfaces for damage.

✓ verify all threads for good condition.

✓ check the oil ducts (1) for the main bearings for free passage and clear if necessary with compressed air.

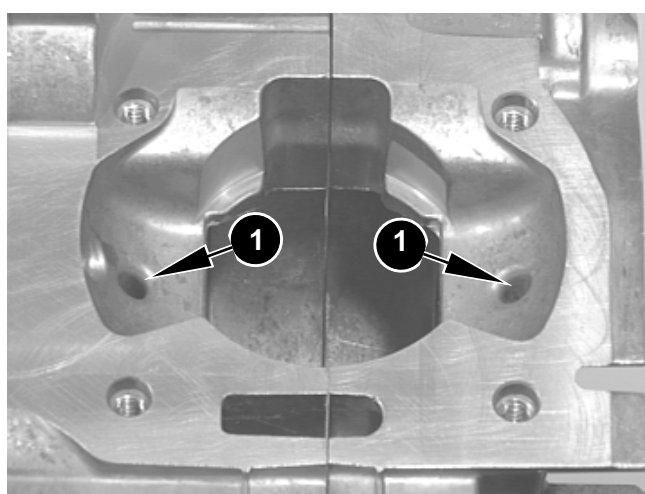


Figure 16

- ✓ check the leakage bore (1) of the sealing system of the waterpump shaft for free passage and if necessary clear with compressed air.
- ✓ inspect the bore for the waterpump shaft for traces of wear
- ✓ check all ball bearings and the needle bushing of the starter reduction gear for easy motion and pitting.

◆ **Note:** Before checking the ball bearings and the needle bushing oil them. The inner race of the bearings must rotate freely and without noise. In case of doubt renew the bearings.

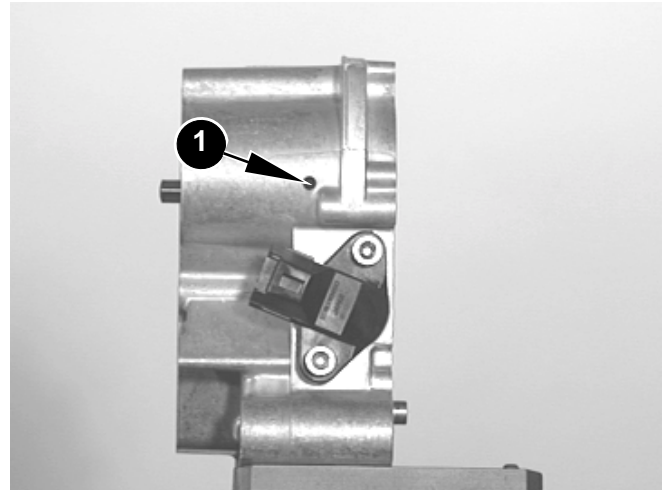


Figure 17

◆ **Note:** If one of the two ball bearings of the crankshaft or balance shaft is defective always renew both bearings.

◆ **Note:** At replacement of the crankshaft bearings or the balance shaft bearings renew all the associated oil seals too.

Removal and refitting of bearings and oil seals

- ⇒ remove the oil seals (2) and (3) for the crankshaft with a suitable tool from the two crankcase halves.
- ⇒ remove the two oil seals (4) of the waterpump with a suitable tool.
- ⇒ detach the pick-up (5) of the ignition unit by removal of the two Allen screws (6).
- ⇒ remove the venting screw (7)
- ⇒ remove the countersink screw (8) and the retaining washer (9)
- ⇒ preheat the two crankcase halves 30 min. in a hot-air heater set to 100°C

▲ **Warning:** Use heat protecting gloves when handling the hot crankcase

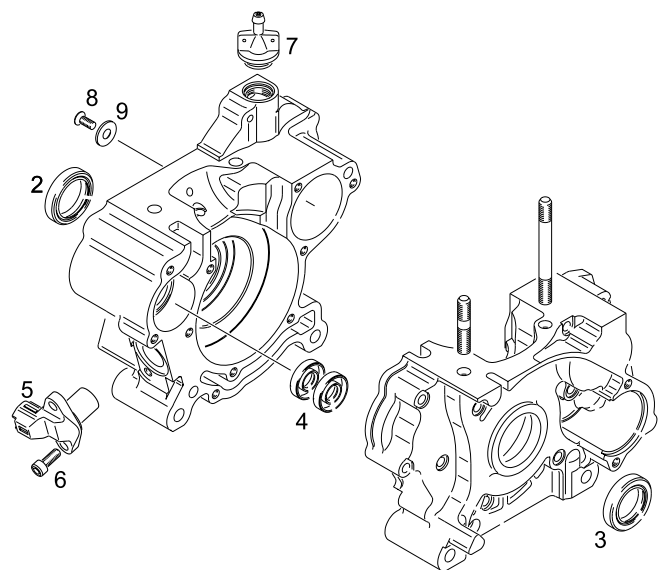


Figure 18

- ⇒ take the preheated clutch side crankcase half (1) from the heating unit and drop it on a plane wooden plate. The impact will release the ball bearing of the crankshaft (2) and of the balance shaft (3) from the crankcase half.
- ⇒ turn over the crankcase half and push out the needle cage (4) with the fitting punch (see fig.19.1).

◆ **Note:** special tool "fitting punch"
ROTAX part no.: 676 030

◆ **Note:** If the cooling water elbow will be replaced, screw - in the new elbow fitting only so far that one course of the thread remains visible.

- ⇒ Apply securing – and sealing compound ERGO 4052 on the decreased thread of the cooling water elbow fitting (5).

◆ **Note:** ERGO 4052
ROTAX part no. 897 655

- ⇒ Screw - in and fix the elbow fitting into crankcase in horizontal position until the securing – and sealing compound has hardened.

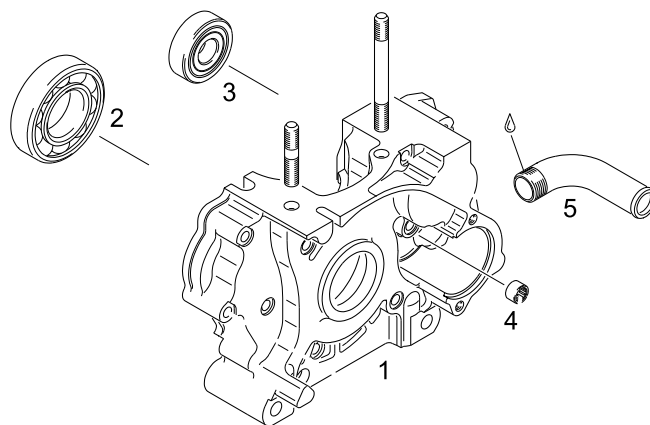


Figure 19

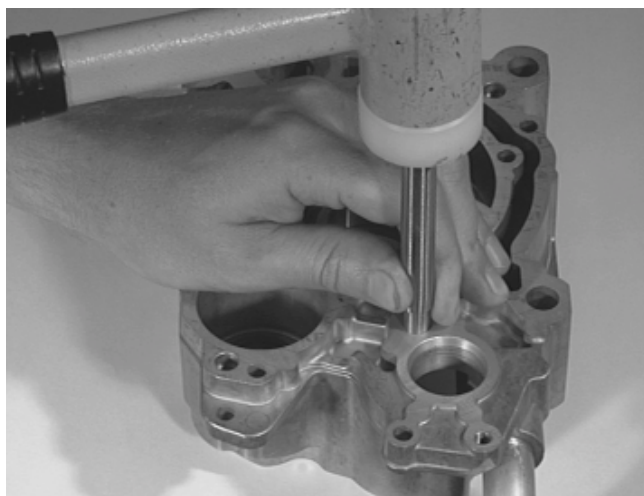


Figure 19.1

- ⇒ take the ignition side crankcase half (6) from the heating unit and drop it on a plane wooden plate. The impact will release the ball bearing (7) of the crankshaft from the crankcase half.
- ⇒ turn over to crankcase half and drop it with the sealing surface of the gear cover on to the plane wooden plate. The impact will release the ball bearing (8) of the balance shaft from the crankcase half.

◆ **Note:** The wooden plate must be with recesses for the two dowel pins (9) as well as for the locating pin (10) to warrant a plane support of the crankcase half on the wooden plate.

◆ **Note:** If the locating pin (10) needs renewal remove it from the hot crankcase with a pair of pliers.

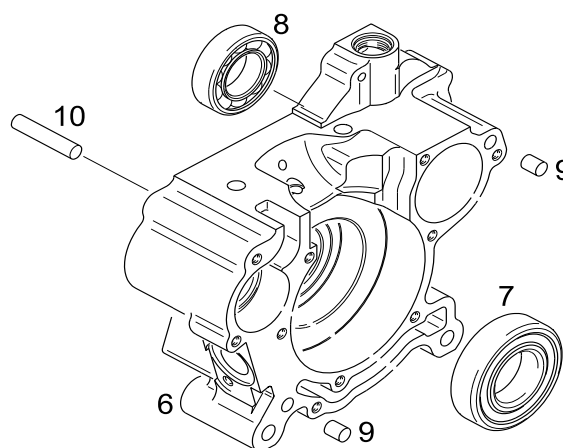


Figure 20

- ⇒ let the crankcase halves cool down to room temperature (20°C)
- ⇒ clean the bearing seat with a non-aggressive cleaning agent.
- ✓ measure the dia of the bearing seats in both crankcase halves.
- ✓ measure the outside dia of the new ball bearings
- ✓ calculate the interference fit between the ball bearings and the corresponding bearing seat in the crankcase.

■ **Attention:** The interference between the ball bearing outer race and the corresponding bearing seat in the crankcase must be at least 0,01 mm. If this is not the case, the crankcase has to be replaced.

- ⇒ preheat again both crankcase halves by hot air to 100°C
- ⇒ take the preheated clutchside crankcase half from the heating unit and place it with the crankcase joint surface down on a plane wooden plate
- ⇒ press the needle cage (1) fully home into the crankcase half with the inscription of the needle cage showing outwards, using the fitting punch (2).

◆ **Note:** special tool, "fitting punch"
ROTAX part no.: 676 030

- ⇒ turn over the crankcase half
- ⇒ apply grease between the sealing lip and the dust lip of the oil seal (25 x 38 x 7) for the clutchside crankcase half.
- ⇒ press oil seal fully home with the fitting sleeve from the inside of the crankcase half, with the open side of the oil seal pointing inwards.

◆ **Note:** special tool, "fitting sleeve"
ROTAX part no.: 676 010

◆ **Note:** On an engine with the crankshaft installed, the oil seal can also be fitted from outside with the help of the fitting sleeve.

- ⇒ push ball bearing (3) for crankshaft fully home into crankcase half, with the closed side of the ball cage pointing towards the crankshaft
- ⇒ push the ball bearing for the balance shaft fully home, with the closed side of the ball cage pointing towards balance shaft.
- ⇒ let the crankcase half cool down.

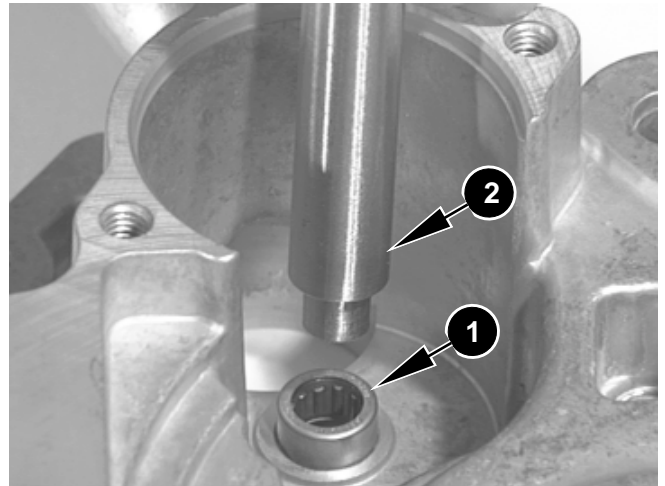


Figure 21

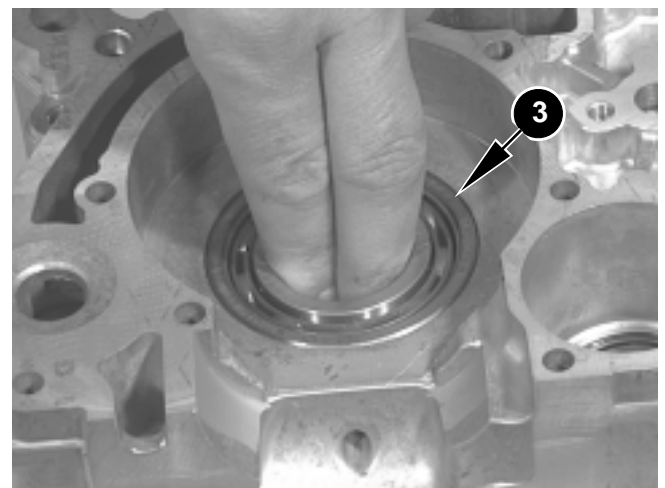


Figure 22

- ⇒ Take the ignition-side crankcase half from the hot air heater and place it with the crankcase joint surface down on a plane wooden plate
- ⇒ push the ball bearing (1) for the balance shaft fully home, with the closed side of the ball cage towards balance drive gear
- ⇒ fit the retaining washer (2) and the countersink screw (3) such that the chamfer side of the washer points towards the screw.

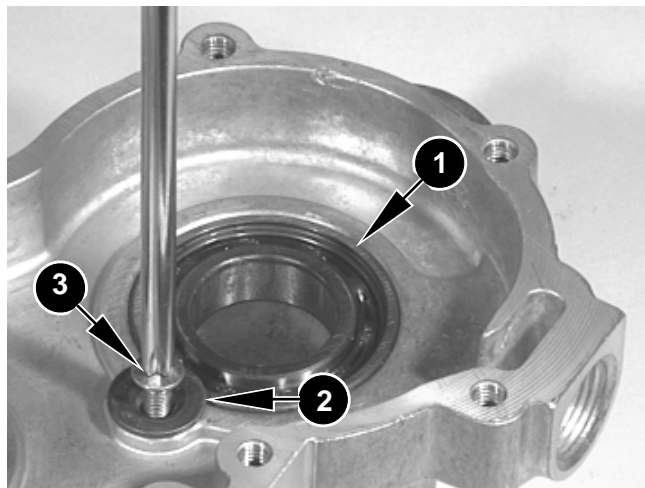


Figure 23

- ⇒ Apply grease between the sealing lip and the dust lip of the oil seal (28x38x7) for the ignition-side crankcase half.
- ⇒ Press the oil seal (4) fully home with the fitting sleeve (5) from the outside of the crankcase half with the open side pointing towards the balance shaft drive.

◆ **Note:** Special tool „fitting sleeve“
ROTAX part no.: 676 010

◆ **Note:** On an engine with the crankshaft installed the oil seal can also be fitted from the outside with the help of the fitting sleeve

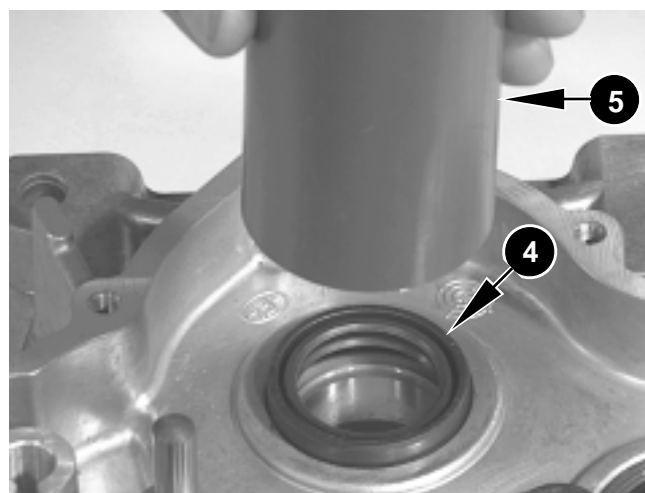


Figure 24

◆ **Note:** if the locating pin (9, see fig 20) has been removed, press the new locating pin with the chamfering leading, fully home into the crankcase.

- ⇒ Turn over the crankcase half
- ⇒ Push the ball bearing (6) for the crankshaft fully home into the crankcase half, with the closed side of the ball cage pointing towards the crankshaft.

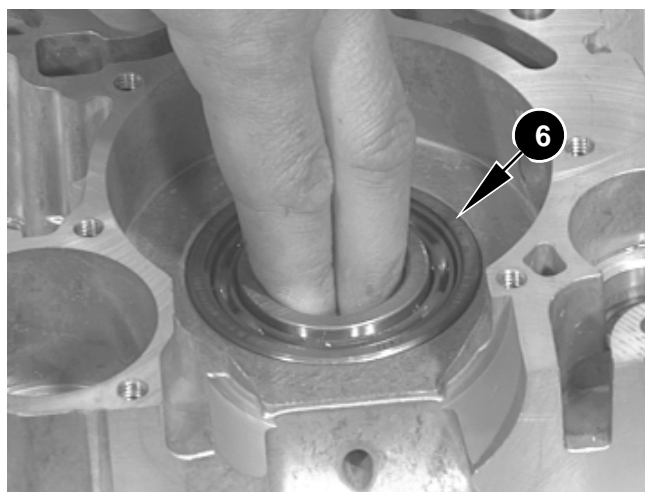


Figure 25

⇒ apply Molycotc 111 around the sealing lip of both oil seals (10 x 26 x 7).

◆ **Note:** Molycote 111
ROTAX part no. 897 161

⇒ press the first oil seal with the fitting punch (1) fully home such that the closed side of the oil seal is visible.

◆ **Note:** Special tool, "fitting punch"
ROTAX part no.: 676 020

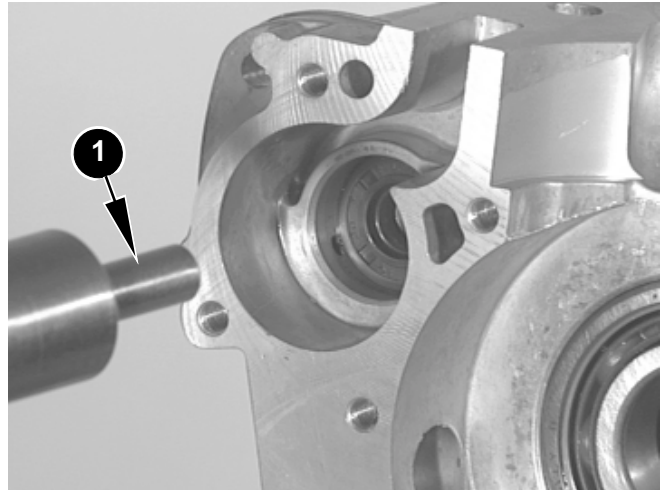


Figure 26

⇒ Press the second oil seal with the fitting punch (2) fully home such that the open side of the oil seal is visible.

◆ **Note:** Special tool, "fitting punch"
ROTAX part no.: 676 020

⇒ Let the crankcase half cool down.

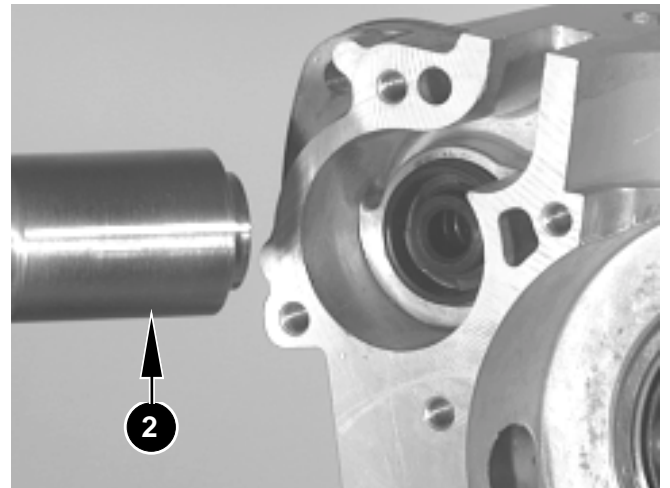


Figure 27

◆ **Note:** If the studs for the cylinder attachment will be replaced, the longer threaded end of the studs has to be screwed in the crankcase. Secure the studs with ERGO 4052 and tighten to the specified torque Mo1

◆ **Note:** ERGO 4052
ROTAX part no. 897 655

M01 = 10 Nm

Crankshaft

- ⇒ clean the crankshaft with a non-aggressive cleaning agent.
- ⇒ clean the taper for starter gear assy and the two threads from remains of the securing agent
- ✓ inspect the crankshaft for damage or traces of wear on,
 - threads
 - taper
 - bearing seats
 - running surface for bearings of centrifugal clutch and piston pin
 - contact surface of oil seals
 - groove for the retaining ring of the drive gear
- ✓ measure the dia of the two main bearing seats (M02), the bearing seat for the centrifugal clutch (M03) and of the piston pin bearing dia.(M04)

M02 = 29,96 mm

M03 = 14,95 mm

M04 = 18,97 mm

- ✓ measure the axial clearance (M05) of the conrod with a feeler gauge

M05 = 1,0 mm

- ✓ take readings of the radial clearance of the conrod bearing (M06)

M06 = 0,05 mm

- ◆ **Note:** If the wear limit is exceeded on M02 or M03 the complete crankshaft must be replaced. If the wear on M04, M05 or M06 is above the limit, replacement of the crankshaft repair set is appropriate (see section replacement by crankshaft repair kit!)

- ✓ check the out-of-roundness on the crankshaft (M07)

M07 = 0,03 mm

- ◆ **Note:** If the out-of-roundness on the crankshaft (M07) is above the limit the crankshaft must be realigned. (see section replacement of crankshaft repair set!)

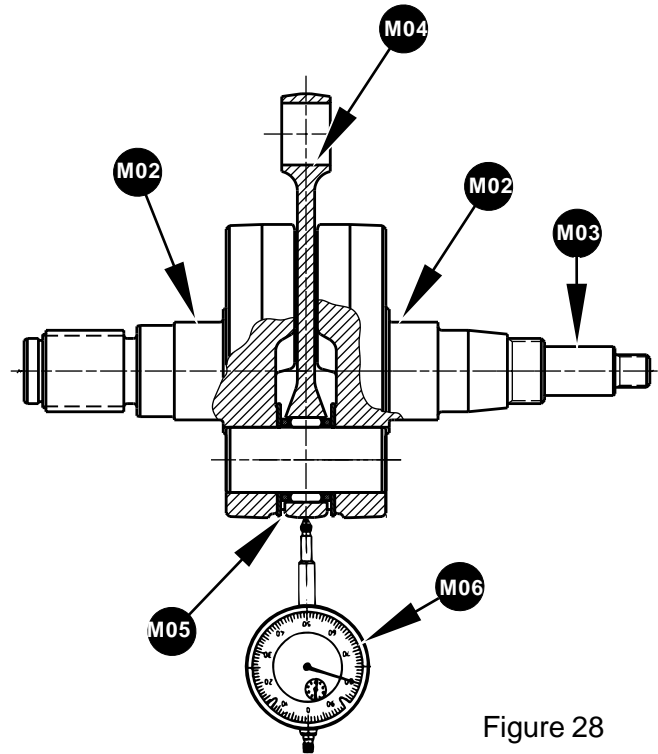


Figure 28

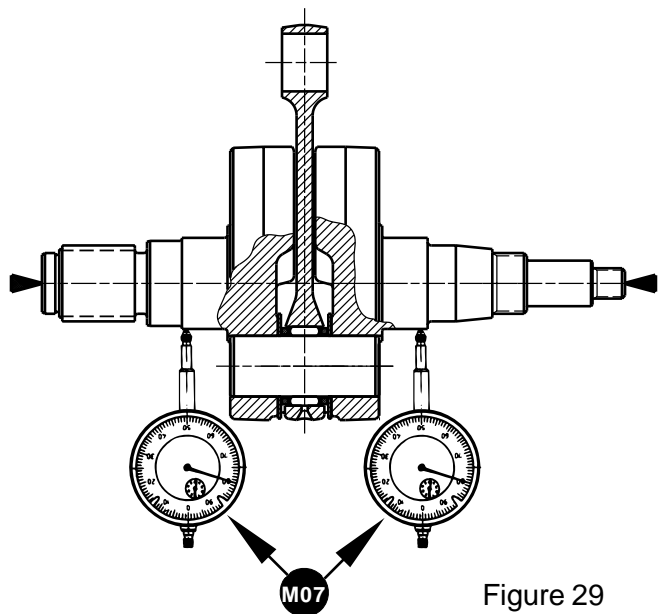


Figure 29

Replacement of the crankshaft repair set

■ **Attention:** Repair of the crankshaft requires special tooling and ought to be carried out exclusively by a Repair Shop with respective experience. If this repair service is not available, replace the complete crankshaft.

- ⇒ press apart the crankshaft under a press
- ✓ inspect the bore for the crank pin in both crankshaft webs for scoring

◆ **Note:** If any of the bores shows scoring the complete crankshaft has to be replaced.

◆ **Note:** The crankshaft repair set consists of: conrod, crankpin, needle bearing and the two thrustwashes.

■ **Attention:** The parts of the crankshaft repair set are matched and therefore replacement is only permitted as a complete set.

- ⇒ degrease the crankpin and the crankpin bore in the crankshaft webs.
- ⇒ place one crankshaft web on a press, utilize a guide sleeve for the crankpin and press the pin to positive stop into the crankshaft web
- ⇒ arrange thrustwasher, needle bearing, the conrod and the second thrustwasher on the crankpin.
- ⇒ press together the two crankshaft webs to the specified dimension (M09)

M09 = 48,95 – 49,05 mm

- ✓ verify alignment of the crankshaft (see fig. 29)

◆ **Note:** If the out of roundness on crankshaft is above the specified limit the crankshaft must be realigned.

◆ **Note:** to align the crankshaft the two crankshaft webs may be squeezed or spread accordingly on the required place. Crankshaft webs in a twisted position can be corrected by blows on the webs with a soft hammer.

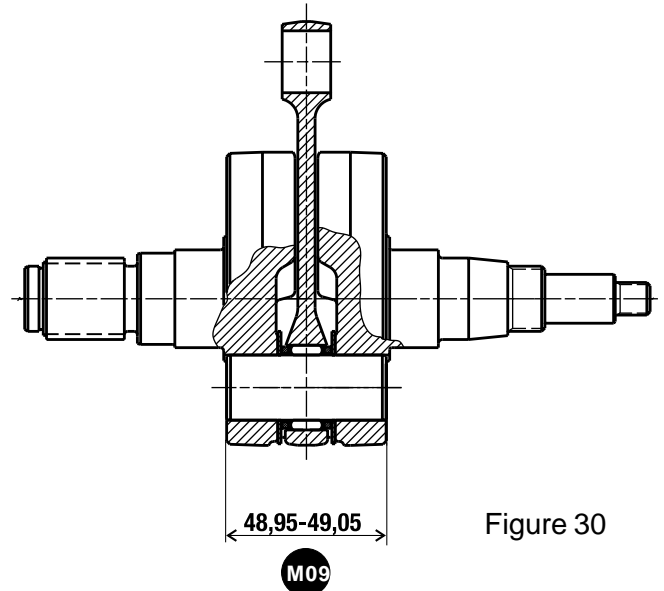


Figure 30

Balance shaft

- ✓ Inspect the groove (1) for the retaining ring for damage and wear
- ✓ Check the diameter of the bearing seats M10 and M11 for wear

M10 = 14,94 mm

M11 = 24,94 mm

- ◆ **Note:** If on any of the two bearing seats M10 or M11 the wear limit is exceeded, the balance shaft must be replaced.

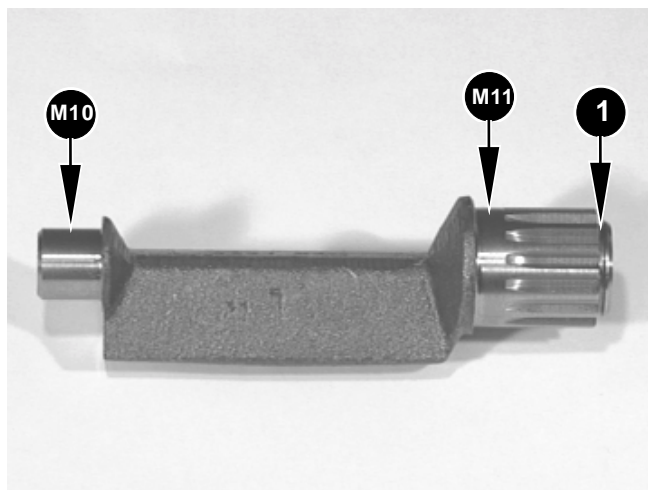


Figure 31

Drive of the balance shaft

- ✓ Inspect the balance gears for wear.
- ✓ Put the balance gears on the balance shaft and crankshaft and check the serration fit between shaft and gear for backlash

- ◆ **Note:** If any of the balance shaft drive gears shows cracks or if backlash of the serration is perceptible, both drive gears have to be replaced

- ✓ Inspect the gear tothing for traces of wear

- ◆ **Note:** If distinct traces of wear are detected on the tooth flanks of one gear, always renew the complete pair.

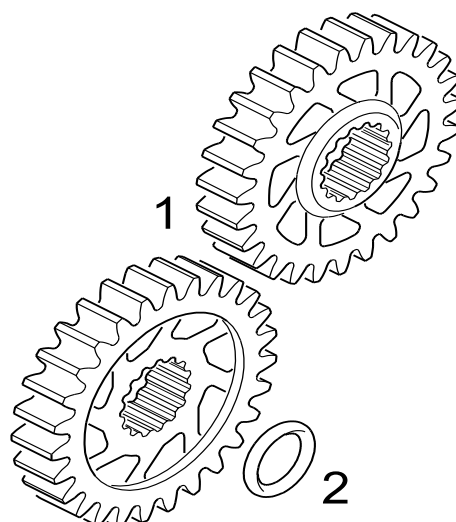


Figure 32

- ✓ Verify the O-ring (2) for good condition.

- ◆ **Note:** The balance gears (1) and the O-ring (2) ought to be renewed at least after every 50 hours of operation.

- ▲ **Warning:** A fracture of the balance gears will result in stopping of the waterpump, leading to overheating of the engine and possibly to piston seizure.

Drive of the waterpump

- ✓ Inspect the drive gear (1) the idle gear (2) and the waterpump pinion (3) for cracks.
- ✓ Inspect the tooth flanks of the idle gear (2) and of the waterpump pinion (3) for wear.

◆ **Note:** At detection of wear on the flanks of the idle gear (2) or waterpump pinion (3), always renew both gears as a pair.

- ✓ Inspect the bore and the two thrust faces of the idle gear (2) for traces of wear.
- ✓ Verify the groove in the waterpump pinion (3) accommodating the needle pin (4), for good condition.

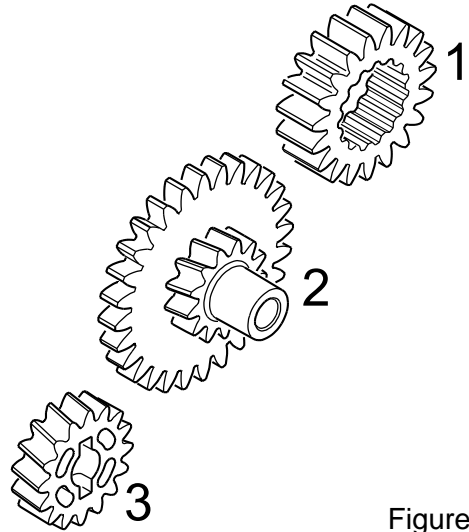


Figure 33

Waterpump shaft

- ✓ Inspect the waterpump shaft (5) on the contact surface of the two oil seals for wear. Renew as required.
- ✓ Inspect the waterpump impeller (6) for damage or deformation. Renew as required.

◆ **Note:** When pressing-in the split sleeve (7) pre-tension it so that impeller will not be damaged.

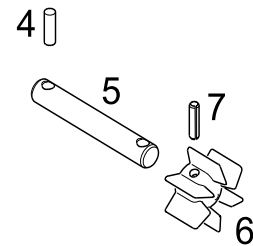


Figure 34

Centrifugal clutch

⇒ Remove the 3 retaining rings (1) and the washers (2) placed underneath.

■ **Attention:** Do not overstress the retaining rings at removal

⇒ Gradually remove the 3 flyweights along with the engaged springs from the bearing pins on the starter gear (5), utilizing a suitable tool (see fig. 35.1)

◆ **Note:** Never disengage the springs (4) with the flyweights installed, as spring removal in this situation might overstress the springs.

⇒ Disengage the 3 springs (4) from the flyweights (3)

⇒ Remove the 3 rubber sleeves (6) from the supporting pins of the starter gear (5)

✓ Verify the friction lining on the flyweights (3). The min. thickness of lining must be in no place below the dimension M12.

M12 = 1,0 mm

✓ Check the bearing bore of flyweights for wear (ovality)

◆ **Note:** If one of the flyweights is badly worn, always replace all three of them.

✓ Check the springs (4) for fracture and overstretching. Renew as required

◆ **Note:** If one of the springs is in bad condition, replace always the three of them.

✓ Inspect the rubber sleeves (6) for wear. Renew as required.

⇒ Remove rests of LOCTITE from the conical bore of the starter gear (5)

✓ Verify good condition of the conical bore of the starter gear (5)

✓ Inspect the tothing of the starter gear (5) for damage or deformation.

✓ Inspect the bearing pins of the starter gear (5) at bearing surface of the flyweights for wear

✓ Verify the retaining ring (1) groove on the bearing pins of the starter gear (5) for good condition.

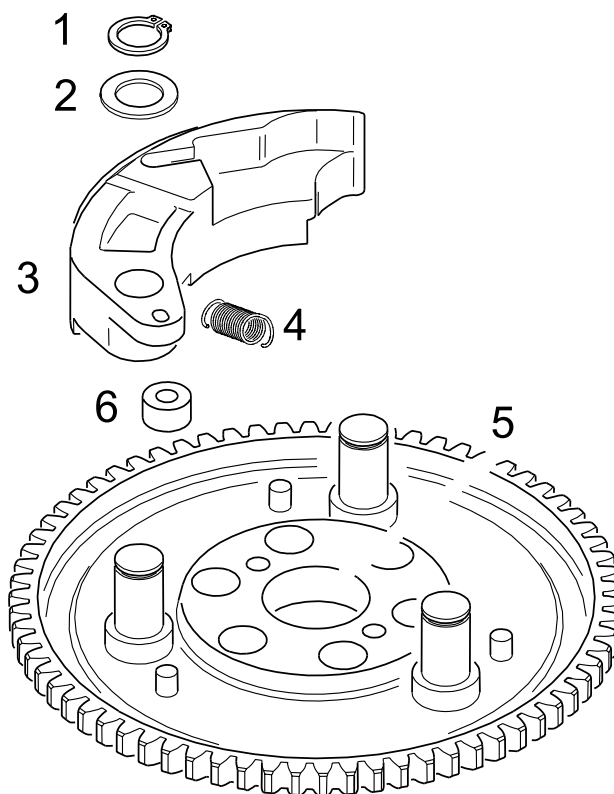


Figure 35

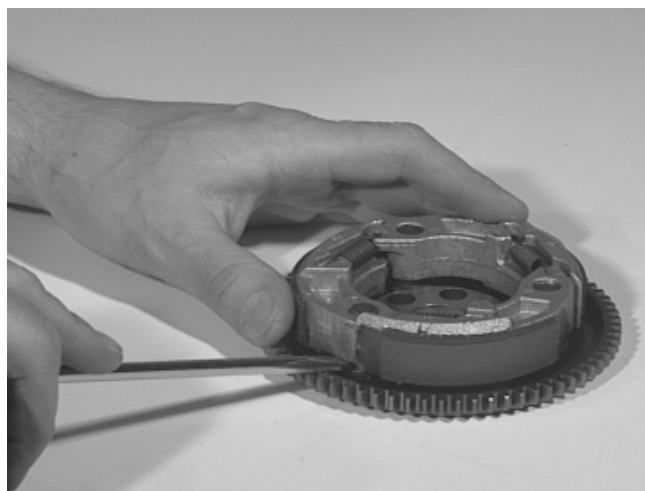


Figure 35.1

- ⇒ Place the 3 rubber sleeves (6) on to the supporting pins on the starter gear (5) (see fig 35)
- ⇒ Fit the 3 fly weights (3) on the bearing pins of the starter gear (see fig 35)

◆ **Note:** When fitting the flywheel set, take care not to deform the rubber sleeves (6) (see fig,35)

- ⇒ Engage the 3 springs on the fly weights, using a suitable pair of pliers.

■ **Attention:** The springs must not be overstressed during fitting.

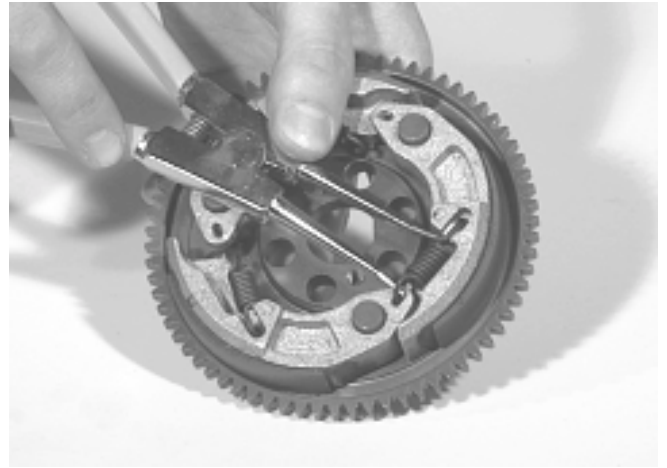


Figure 36

- ⇒ Place the washers (2) in position and fit the retaining rings (1) (see fig,35)

■ **Attention:** Do not overstress the retaining rings during removal and refitting. Renew as required.

◆ **Note:** The open side of the retaining rings (1) should point outwards when fitted



Figure 37

Bearing of the clutch drum assembly

- ✓ Inspect the thrustwasher (3) and (7) for wear. Renew as required.
- ✓ Inspect the needle cage (4) for wear. Renew as required.

◆ **Note:** For the chain sprocket with 11 teeth a pressed-in plain bearing (5) is used instead of the needle bearing (4)

◆ **Note:** Starting of wobbling movements of the clutch drum at idle speed indicate a worn plain bearing (5).

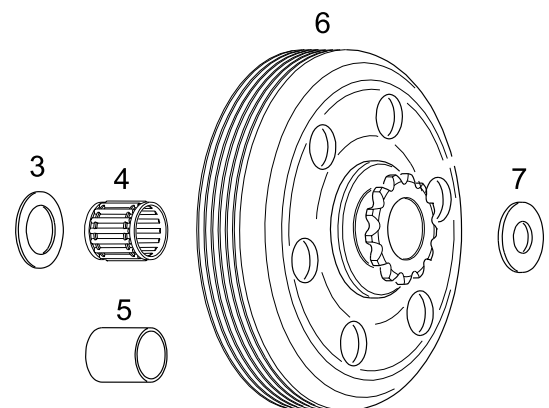


Figure 37.1

⇒ Press out the bearing using the fitting punch

◆ **Note:** special tool "fitting punch"
ROTAX part no.: 676 040

⇒ Place the new plain bearing (7) with the chamfered end (8) on the chain sprocket (with 11 teeth) and press it fully home into the chain sprocket.

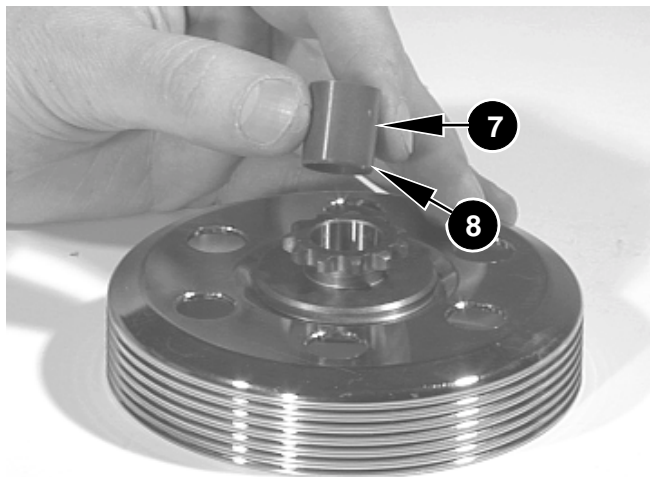


Figure 37.2

Clutch drum with chain sprocket assembly.

✓ Inspect the chain sprocket for wear, Renew as required.

✓ Inspect the surface on the inside of the drum mating with the friction lining on the flyweights, for wear. Renew as required.

⇒ Clamp the sprocket fixation tool (1) at the flat bar in a vice.

◆ **Note:** special tool "sprocket fixation tool"
ROTAX part no. 277 362

⇒ Place the clutch drum with chain sprocket fitted such on the respective centering pin of the fixation tool, that the clutch drum can not rotate.

◆ **Note:** on the chain sprocket with 11 teeth the plain bearing has to be pressed out first (the plain bearing is allowed to be pressed-in only once)

⇒ Remove the hex nut (5) for the chain sprocket

⇒ Clean the clutch drum (4) and the hex, nut (5) from remains of LOCTITE and degrease them

⇒ Place the new chain sprocket on the respective centering pin of the fixation tool (1)

⇒ Insert the needle pin (3) into the chain sprocket

⇒ Apply LOCTITE 648, on clutch drum (4) at support face for hex. nut

◆ **Note:** LOCTITE 648
ROTAX part no. 899 788

⇒ Place clutch drum (4) on the chain sprocket

⇒ Fit the hex. nut (5) with the machined side towards the clutch drum and tighten to the specified torque M13.

M13 = 100 Nm

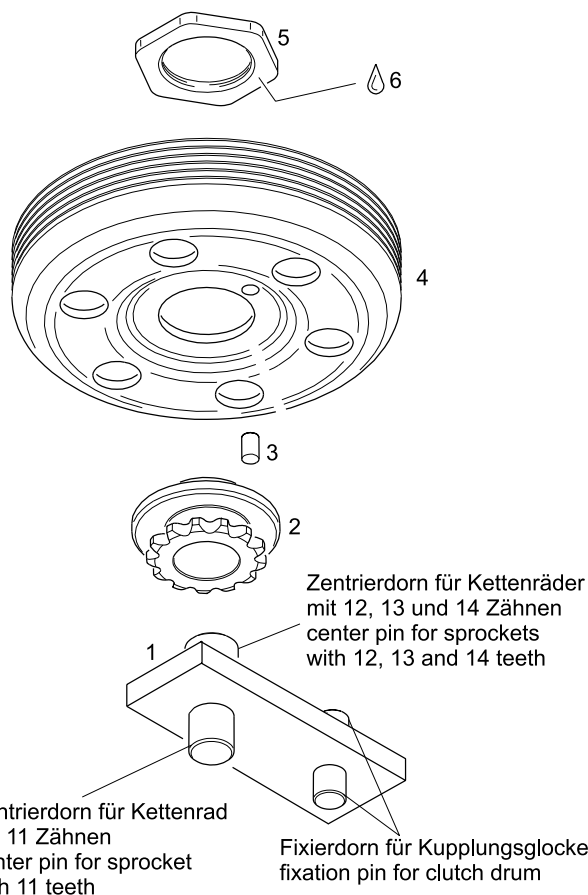


Figure 38

Cylinder assembly

- ◆ **Note:** If the cylinder assembly has been taken to pieces, it is recommended to check the following components

Exhaust valve assembly (only on engine version FR 125 MAX)

- ◆ **Note:** The cylinder is equipped with a pneumatic exhaust control which optimizes the performance characteristic. With rising engine speed the pressure of the exhaust gas increases and withdraws the projecting exhaust valve from the exhaust port at approx. 7.500 r.p.m.
- ◆ **Note:** The optimum timing of the exhaust valve can be set only under load, at operation on the racetrack. At engine operation on the racetrack different temperatures of the exhaust gas and exhaust system will be reached as at engine operation without load. The achieved temperatures have an essential influence on exhaust gas pressure in the exhaust system and therefore on the opening timing of the exhaust valve.

Disassembly of the exhaust valve (only on engine version FR 125 MAX)

- ⇒ disengage spring clip (1) and remove the valve cover (2) along with adjustment screw (3) and the compression spring (4) underneath.
- ⇒ Remove the two Allenscrews (5) and spring washers
- ⇒ Remove the valve rod housing assy (6) and gasket (7) from the cylinder
- ⇒ Remove the hose spring (8) from the bellows (9) and by applying by pressure remove the bellows from the exhaust valve piston (10)
- ⇒ Unscrew the valve piston (10) from the stud (11) and pull out the exhaust valve (12) along with stud (11) and o-ring (13) from the valve rod housing (6)

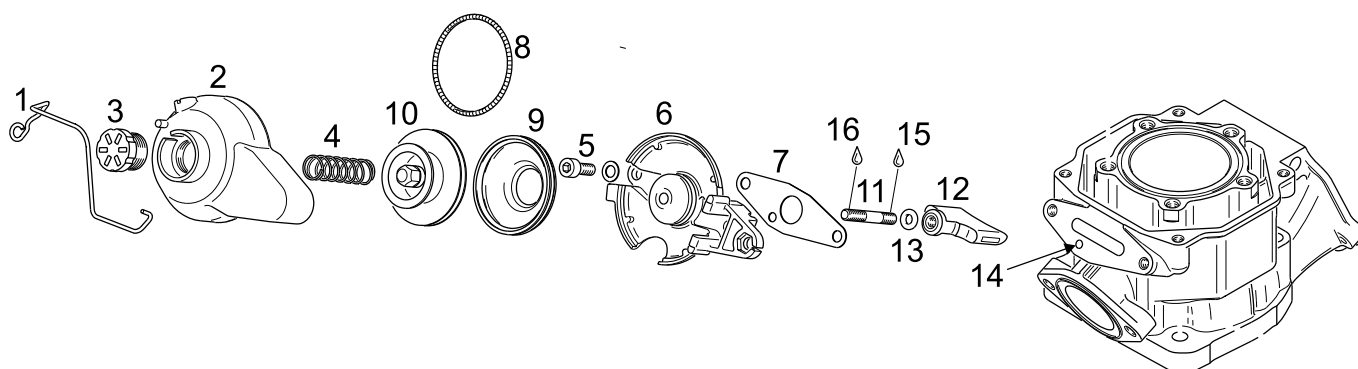


Figure 39

- ⇒ Clean all parts from oil and oil residues.
- ✓ Verify the exhaust valve (12) for easy movement in the cylinder.
Remove oil carbon deposits from the exhaust valve and cylinder as required.
- ✓ Verify the o-ring (13) for good condition.
- ◆ **Note:** If the exhaust valve (12) or the stud (11) is going to be replaced, the stud (11) must be secured again in the exhaust valve with LOCTITE 648 (15).
- ◆ **Note:** LOCTITE 648
ROTAX part no. 899 788
- **Attention:** Remove surplus LOCTITE from the stud and exhaust valve.
- ✓ Check the impulse bore in the valve rod housing (6) for free passage.
- ✓ Inspect the bellows (9) for cracks and porosity. Replace as required.
- ✓ Inspect the exhaust valve piston (10) for cracks or deformation caused by overheating, replace as required.
- ✓ Inspect the valve cover (2) for cracks or deformation by overheating.

Installation of the exhaust valve (only an engine version FR 125 MAX),,see fig. 39.

- ⇒ Slide the exhaust valve (12) with the fitted stud (11) into the cylinder in the specific position as depicted in the fig. 40.
- ⇒ Put the o-ring (13) on the stud (11).
- ⇒ Place a new gasket (7) such on the cylinder that the impulse bore (14) on the cylinder corresponds with the respective hole in the gasket (7).
- ⇒ Attach the valve rod housing (6) with the recess towards the exhaust socket on the cylinder, with the Allen screws (5) secured by spring washers.
- ✓ Verify the exhaust valve for free movement

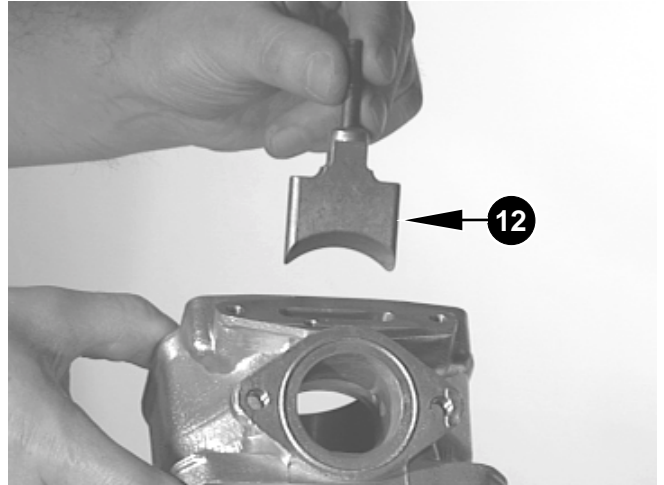


Figure 40

◆ **Note:** If the exhaust valve is sticking or hard to move the two fasteners of the valve rod housing have to be slackened and retightened.

- ⇒ Degrease the valve rod housing (6), the bellows (9) and the valve piston (10).
- ⇒ Fit the bellows (9) over the valve rod housing (6) until the lip of the bellows is inserted in the groove of the rod housing.
- ⇒ Apply some ERGO 4052 (16) on end of stud (11)

◆ **Note:** ERGO 4052
ROTAX part no. 897 655

■ **Attention:** Surplus ERGO can impair operation of the exhaust valve.

- ⇒ screw the bellows exhaust valve piston (10) onto the stud (11) until your feel the ending of the thread
- ⇒ pull the bellows (9) over the exhaust valve piston (10) until the lip of the bellows is inserted in the groove of the exhaust valve piston.
- ✓ Verify the exhaust valve for easy movement, improve if required by slight twisting of valve piston (10) and bellows (9).

- ⇒ Fit the hose spring (8) compression spring (4) and valve cover with adjustment screw (3). Secure with spring clip (1) on the cylinder (see fig 41).

◆ **Note:** Turn the adjustment screw (3) into the valve cover (2) so far that it ends flush with the valve cover. This is the standard adjustment.

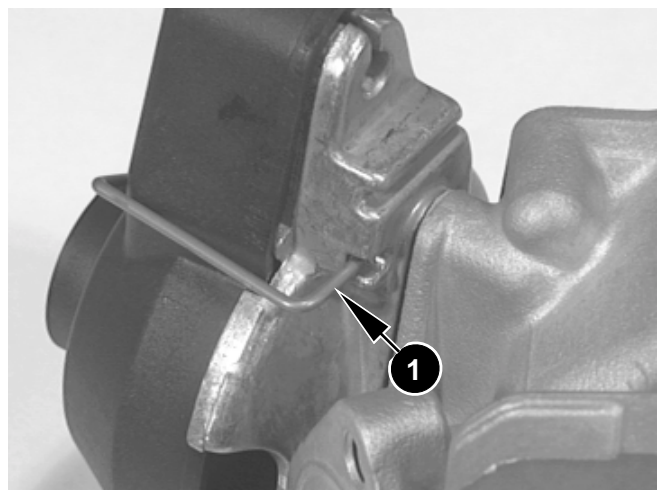


Figure 41

Exhaust socket

- ✓ Verify the joint between cylinder (1) and exhaust socket (2) for tightness. Renew the gasket (3) as required.
- ✓ Verify the tight fit of the exhaust socket (2) on the cylinder
- ✓ Inspect the ball joint of the exhaust socket (2) for wear. Replace as required.

◆ **Note:** A leaking ball joint between exhaust socket (2) and exhaust system can result in engine malfunction.

⇒ At replacement of the gasket (3) or the exhaust socket (2) tighten the two Allen screws (4) to the specified torque M14

M14 = 20 Nm

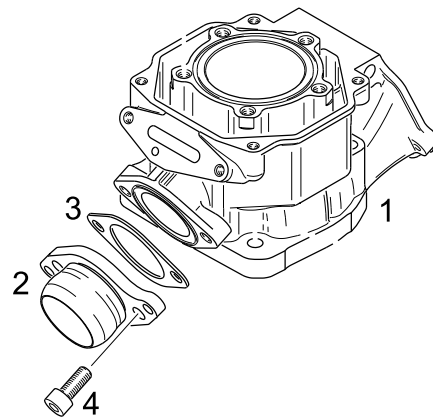


Figure 42

Reed valve assembly and carburetor flange

- ⇒ Remove the five Allen screws (5), the carburetor flange (6) and the hose clamp (7)
- ⇒ Remove the reed valve (8) and gasket (9) from the cylinder
- ✓ Inspect the rubber coating on the valve body (8) for peeling off.

Replace the reed valve assy as required.

- ✓ Verify the Philips screws (10) for tight fit
- ✓ Inspect both reed petals (11) for cracks and damage

◆ **Note:** The reed petals (11) have to rest neatly under slight pretension on the valve body. Check by light gap method. Renew reed petals as required .

◆ **Note:** The reed petals are not plane but slightly bent. At replacement of the reed petals ensure that the petals a fitted with pretension to close the valve.

Secure the Philips screws (11) with LOCTITE 648.

◆ **Note:** LOCTITE 648
ROTAX part no. 899 788

- ✓ Inspect the carburetor flange (6) for cracks, porosity or swelling.(see fig 43)
Renew as required
- ⇒ Fit a new gasket (9), the reed valve assy (8) carburetor flange (6) and hose clamp (7), with the Allen screws (5) on cylinder. Tighten the screws to the specified torque M15 (see fig 43)

M15 = 6 Nm

◆ **Note:** With the two upper Allen screws (5) the support bracket for the radiator has to be attached too.
With the three lower Allen screws (5) the support bracket for the intake silencer has to be attached too.

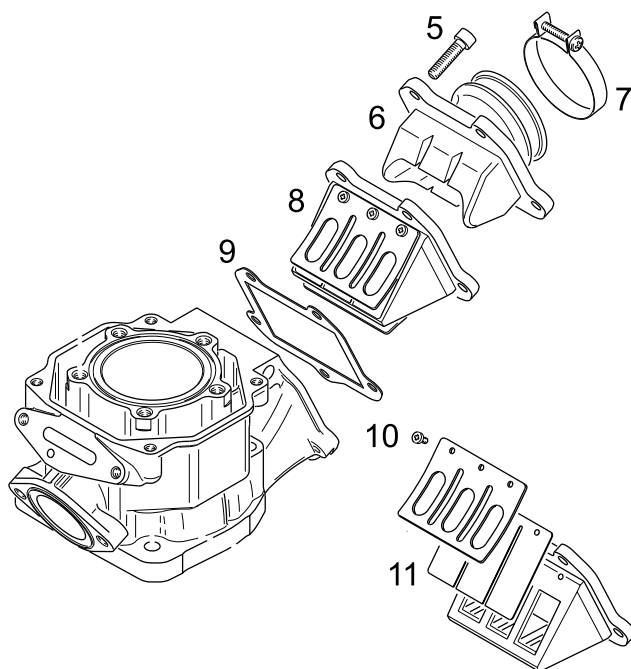


Figure 43

Cylinder

- ⇒ Remove calcareous deposits from the water jacket (1) of the cylinder.
- ⇒ Clean exhaust port and exhaust valve duct (2) from combustion deposits.
- ⇒ Clean the o-ring groove (3) and inspect for damage
- ✓ Inspect all threads for good condition
- ✓ Ensure that all sealing surfaces are clean and plane
- ✓ Inspect cylinder wall for wear
- ✓ Measure the conicity of the cylinder between T.D.C. position of the piston ring and 3 mm above top edge of exhaust port.
The wear limit for conicity M16 in this area must not be exceeded.

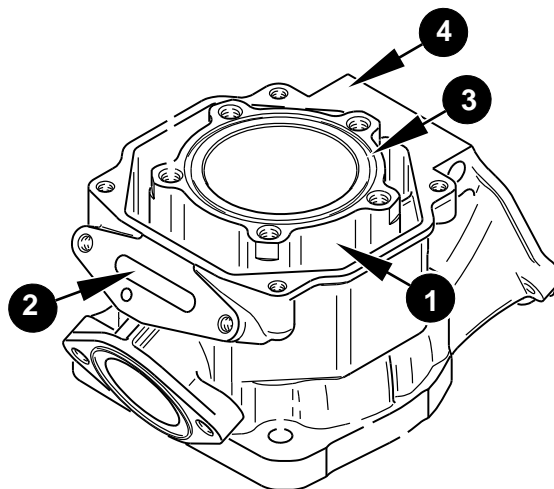


Figure 44

M16 = 0,030 mm

- ✓ Measure the ovality of the cylinder at T.D.C. position of the piston ring and 3mm above top edge of exhaust port.
The wear limit of ovality in this area M17 must not be exceeded.

M17 = 0,030 mm

- ◆ **Note:** In case the conicity or ovality is in excess of the wear limit the cylinder may be reworked by diamond-honing in a good repair shop.

- ✓ Measure the dia. of the cylinder 10 mm below top of cylinder. This dia. is decisive for selection of the mating piston.
The wear limit for the cylinder dia. M18 must not be exceeded

M18 = 54,035 mm

- ◆ **Note:** A cylinder with a dia. in excess of the wear limit has to be replaced

- ◆ **Note:** The code of the cylinder size is imprinted on the top side (4) of cylinder

Cylinder size „A“	dia. 54,000 - 54,010mm
Cylinder size „AB“	dia 54,010 - 54,015mm
Cylinder size „B“	dia. 54,015 - 54,025mm

Piston and piston ring

- ✓ Inspect the piston for cracks, pressure marks and piston seizure.
- ✓ Inspect the bore for the piston pin for wear and scoring
- ✓ Check the groove for the piston pin circlips for good condition
- ✓ Verify free movement of the piston ring in the groove

◆ **Note:** If the movement of the piston ring in the groove is stopped by oil carbon deposits, the groove can be cleaned with a redundant piston ring



Figure 45

- ✓ Measure the clearance M19 of the piston ring in the groove with a feeler gauge.(1)

M19 = 0,10 mm

◆ **Note:** If the clearance of the piston ring in the groove is in excess of the specified limit M19, the piston has to be replaced.

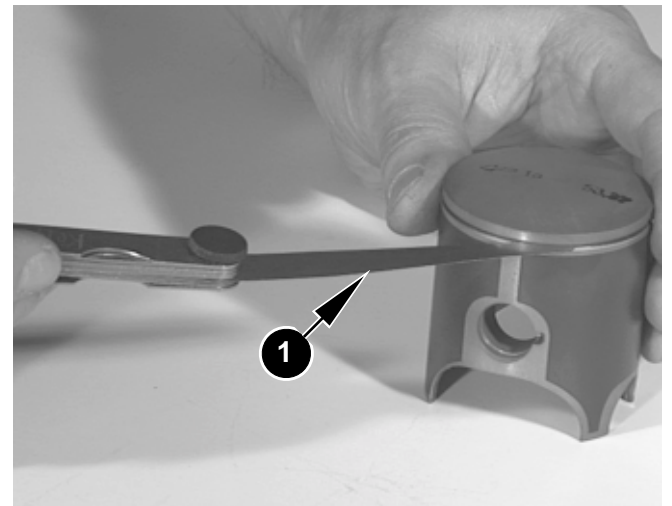


Figure 46

⇒ Remove the piston ring from the piston and position the ring in the cylinder bore above the exhaust port. For parallel alignment use the piston as pusher.

- ✓ Measure the end gap of the piston ring M20 with a feeler gauge (2)

M20 = 0,80 mm

◆ **Note:** If the end gap of the piston ring is more than the specified limit M20, at least the piston ring has to be renewed.

- ✓ Inspect the piston ring securing pin for wear. Renew the complete piston as required.

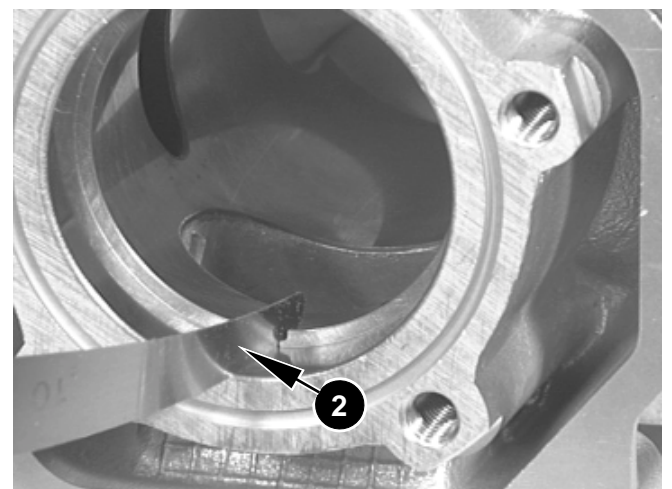


Figure 47

- ⇒ Take readings of the piston dia. using a micrometer, at 20 mm from bottom end of piston and 90 degrees to piston pin axis.
- ⇒ Determine the piston-to-wall clearance by deducting the piston dia. from the cylinder dia. The wear limit M21 must not be exceeded.

M21 = 0,080 mm

- ◆ **Note:** If the piston-to-wall clearance is above the specified limit, a new oversize piston of corresponding size (oversize piston) has to be used or the complete cylinder and piston must be replaced.

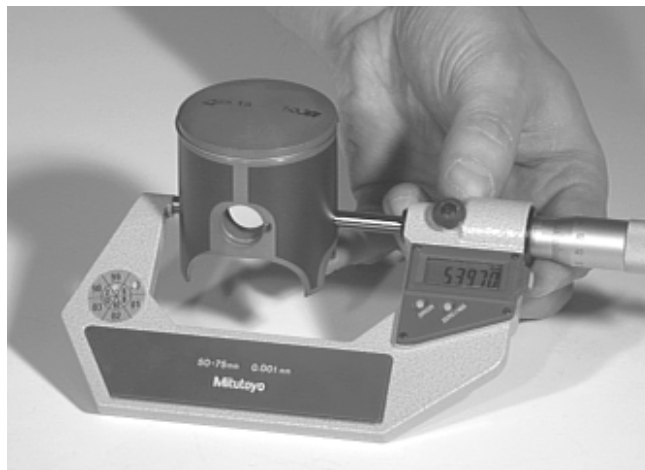


Figure 48

- ◆ **Note:** The nominal piston-to-wall clearance in new condition is defined with the value M22

M22 = 0,025 - 0,050 mm

- ◆ **Note:** On a new piston find the piston dia printed in colour on the piston crown. According to piston version find different printing on the piston.

On fully coated pistons find the following printing.

Printing 53,95= piston dia. 53,965 - 53,975 (standard)

Printing 53,96= piston dia. 53,975 - 53,985 (standard)

Printing 53,97= piston dia. 53,985 - 53,995 (oversize piston)

On partially coated pistons (see fig 48) find the following printing

Printing 53,97= piston dia. 53,965 – 53,975 (standard)

Printing 53,98= piston dia. 53,975 – 53,985 (standard)

Printing 53,99= piston dia. 53,985 – 53,995 (oversize piston)

- ◆ **Note:** If a piston will be replaced, also the piston pin (1) the needle cage (2) and the two piston pin circlips (3) have to be replaced.

Piston pin, needle cage, piston pin circlips

- ✓ Inspect the piston pin (1) for traces of wear and discoloration by overheating. Renew as required
- ✓ Inspect the needle cage (2) for cracks and discoloration by overheating. Renew as required.
- ✓ The piston pin circlips (3) are allowed to be used only once, they must renewed each time after removal.

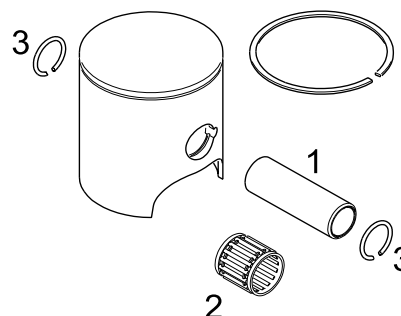


Figure 49

Combustion chamber insert

- ✓ Clean the combustion chamber (1) from combustion deposits and the water jacket surface from calcerous deposits.
- ✓ Inspect the combustion chamber insert for cracks and verify the spark plug thread (3) for good condition.
- ✓ Verify the sealing surfaces for planeness and inspect for damage.

◆ **Note:** The sealing surface of the combustion chamber insert is slight conical beginning at dia. 63 mm

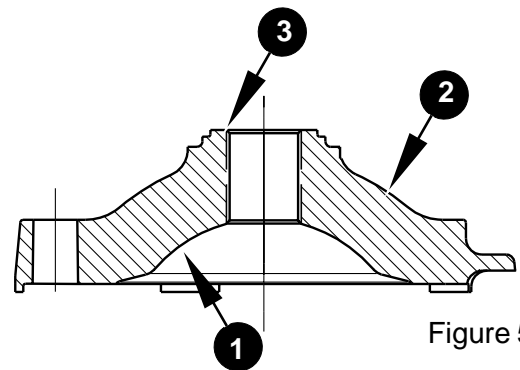


Figure 50

Cylinder head cover

- ✓ Inspect cylinder head cover for cracks
- ✓ Verify support face of the two o-rings (4 and 5) for good condition.
- ✓ Verify tapping (6) for the cooling water elbow fitting for good condition.

◆ **Note:** If the cooling water elbow fitting on the cylinder head cover will be replaced screw-in the new elbow fitting only so far that one course of the thread remains visible.

⇒ Apply securing -and sealing compound ERGO 4052 on the degreased thread of the cooling water elbow fitting.

◆ **Note:** ERGO 4052
ROTAX part no.897 655



Figure 50.1

⇒ Screw-in the and fix the elbow fitting on the cylinder head into 90° position to direction of travel until the securing -and sealing compound has hardened.

Ignition unit

- ◆ **Note:** Ignition timing is controlled by the digital battery ignition unit consisting of the trigger coil on the crankcase and an ignition coil with the integrated electronic. Manual ignition adjustment is neither required nor possible.

Components:

- 1 trigger coil (pick up)
- 2 ignition coil
- 3 wiring harness
- 4 resistance spark plug connector
- 5 spark plug
- 6 on/off circuit breaker (automatic fuse)
- 7 start button
- 8 battery
- 9 battery charger
- 10 electric starter assy
- 11 starter reduction gear assy
- 12 reduction gear cover

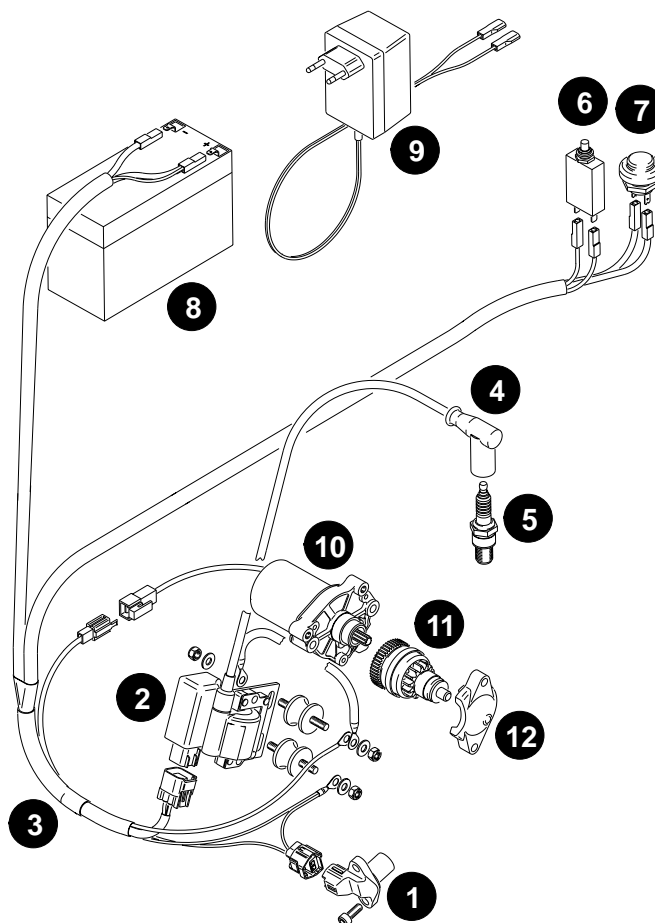


Figure 51

- ◆ **Note:** If the engine will not start and if the ignition unit does not generate the ignition spark or at indications that malfunctions of engine are caused by the ignition unit verify the following components in the stated sequence or trace error by method of elimination:

- ✓ check the battery charge, if necessary charge the battery or exchange it for a fully charged one
- ✓ verify all plug connections and cable harness for good condition.
in case of doubt replace the cable harness
- ✓ replace the spark plug
- ✓ replace the resistance spark plug connector
- ✓ replace the on/off circuit breaker (automatic fuse)
- ✓ replace the start button
- ✓ replace the trigger coil (pick up)
- ✓ replace the ignition coil

Spark plug

◆ **Note:** The engine from the serial production will be supplied with a spark plug of type NGK BR 10 EG or DENSO IW31

- ⇒ remove deposits from mass- and centre electrode with a wirebrush
- ✓ verify or adjust the electrode gap M23 of the spark plug with a feeler gauge.

M23 = 0,5 - 0,6 mm (NGK BR 10 EG)
0,6 - 0,7 mm (DENSO IW 31)

■ **Attention:** Bending of the mass electrode is only permitted to a small degree.

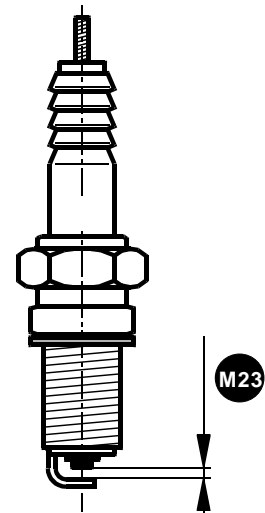


Figure 52

Starter reduction gear assembly

- ⇒ clean the starter reduction gear
- ✓ inspect the gears for wear
- ✓ check the function of the starter reduction gear

◆ **Note:** In one direction the two gears can counter-rotate freely, but in the other direction of rotation the gears move axially and finally lock.

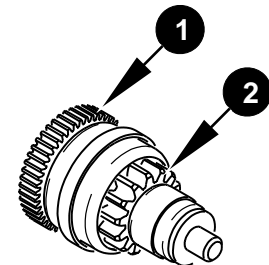


Figure 53

Electric starter

Inspect the tothing (3) for deformation and wear

◆ **Note:** The most common reason for malfunction of the electric starter are badly worn carbon brushes. In this case replace all the parts included in the repair kit of the electric starter. If the starter cable (4) is defective it can be renewed, but if any other components of the starter are defective the complete electric starter has to be replaced.

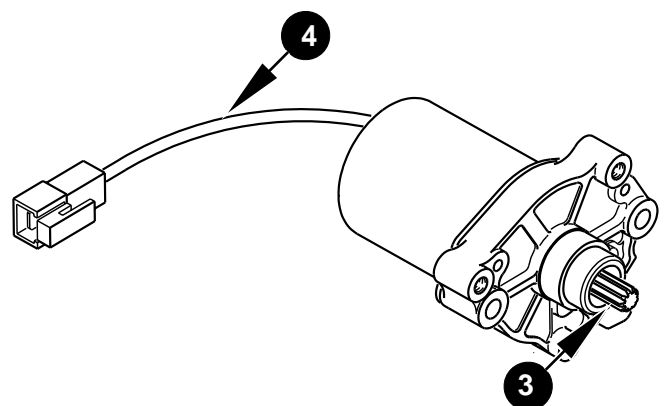


Figure 54

Radiator

- ⇒ Clean the cooling fins of the radiator from dirt.
- ✓ Inspect the radiator (1) for cracks and damage.
- ◆ **Note:** slight local deformation of the cooling lamination can be rectified by straightening out.
- ✓ Verify the gasket of radiator cap (2) for good condition
- ✓ Check the coolant hoses (3) for porosity and leakage
- ✓ Inspect the support bracket (5) of the radiator for cracks
- ✓ Verify the rubber mount (6) for good condition

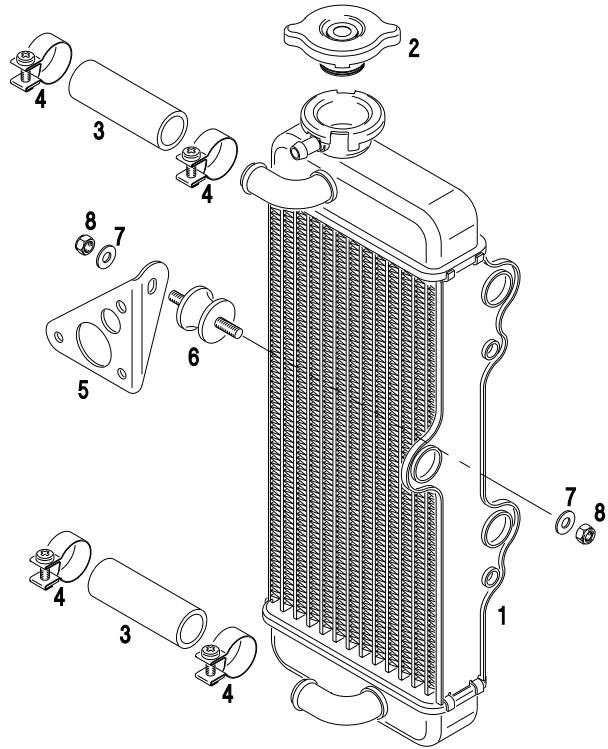


Figure 55

Intake silencer

- ✓ Inspect intake silencer bottom case (1) and intake silencer top case (5) for cracks
- ✓ Inspect intake silencer tube (2) and carburetor socket (6) for cracks and porosity.
- ⇒ Clean the filter element with gasoline/oil mixture
- ✓ Inspect the filter element for cracks
- ◆ **Note:** A filter element with cracks or signs of decomposition has to be renewed.
- ◆ **Note:** Prior to assembling of the intake silencer lubricate the filter element with common engine oil, and press out surplus motor oil afterwards.
- ⇒ Check support bracket (10) for cracks.

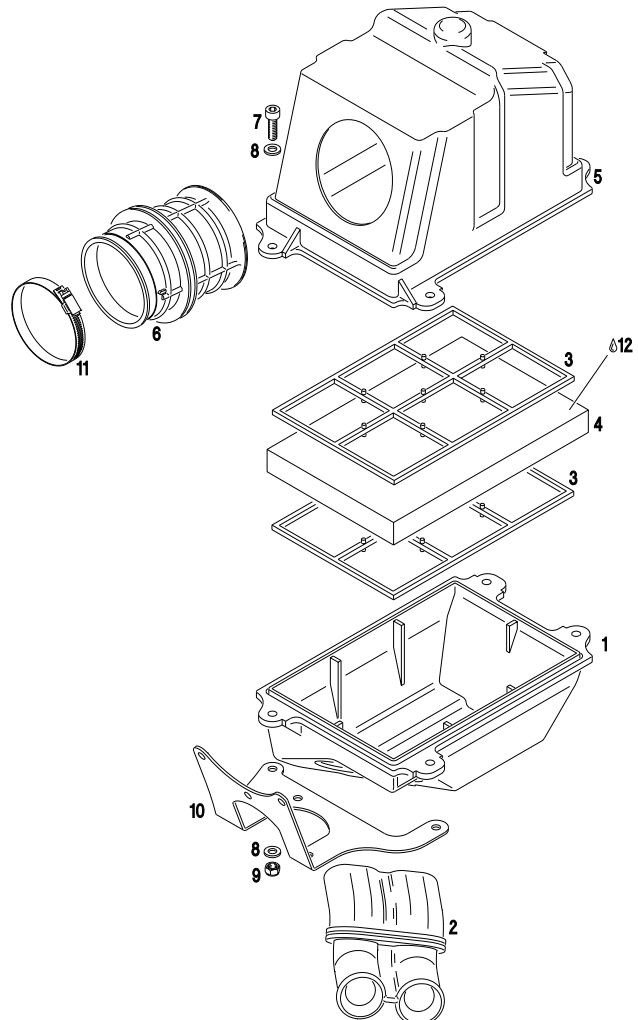


Figure 55.1

Carburetor

◆ **Note:** At malfunction of the engine caused by the carburetor take the carburetor to pieces, clean it and check some of the components

⇒ Take the carburetor into single parts as shown in fig. 56 and clean the parts with gasoline.

✓ Clean and verify the fuel filter (30) for good condition

✓ Clean all the bores and ducts in the carburetor body (1) and the jets (11,13,14,15, and 16) with compressed air and verify free passage.

✓ Verify tight fit of the clip (4) on the jet needle (3)

✓ Verify tip of the valve needle (17) for good condition

⇒ Reassemble the carburetor in accordance with fig 56

◆ **Note:** The gaskets (8,18,22,24,31 and 35) are all included in the carburetor gasket set and are be renewed at each repair of the carburetor.

✓ Verify the position of the float bracket (19) in fitted condition

◆ **Note:** When you hold the carburetor upside down (float chamber (23) and floats (21 not fitted yet) the unloaded float bracket has to be in horizontal position and the two ends of the bracket have to be at the same level. Slightly bend ends of the bracket as required.

◆ **Note:** The word "ALTO" on the floats (21) has to be visible when the floats are installed.

◆ **Note:** Fit and adjust the Bowden cable for actuating the carburetor piston in accordance with the Operator's Manual of the engine.

◆ **Note:** Set the adjustment screws (29) and (34) according to the Operator's Manual of the engine.

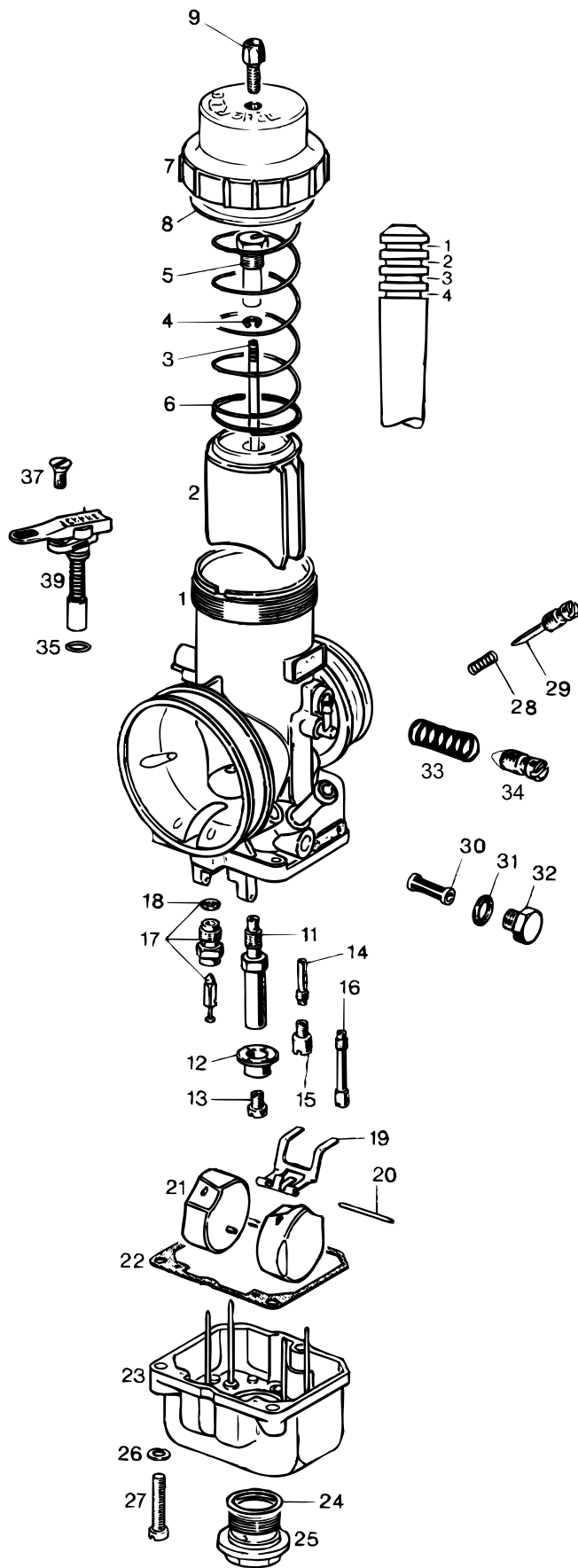


Figure 56

Fuel Pump

◆ **Note:** Only the diaphragm and gasket set of the full pump can be replaced. If the cause for an engine malfunction is suspected to be the fuel pump, it can be found out only by replacement of the pump.

✓ Verify the impulse line (1) the fuel supply line (2) and the fuel outlet line (3) for good condition. Renew as required.

◆ **Note:** If the fuel pump is attached on the support bracket of the intake silencer than oil condensate could settle in the impulse line during engine stops.

⇒ Pull off the impulse line (1) from the fuel pump, remove any oil condensate and dispose of it ecologically.

■ **Attention:** If the pump is attached in a position from where the oil condensate can not drain, it could impair the operation of the fuel pump and consequently result in engine malfunction or engine damage.

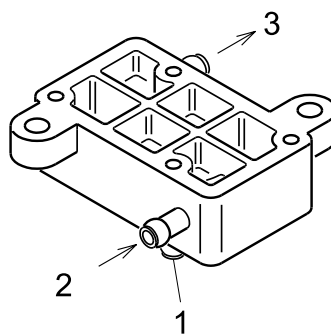


Figure 57

Exhaust system

◆ **Note:** Distinguish between two different exhaust systems which differ mainly in the diameter of the connecting bend between muffler and after-muffler.

- ✓ Inspect exhaust system for cracks
- ✓ Clean the ball joint from combustion deposits and inspect for wear
- ✓ Verify the riveting of the cover (3 or 6) for tight fit.

◆ **Note:** If the noise emission of the exhaust system increases, the damping mat (2 or 5) may be renewed.

- ⇒ grind open the riveting of the cover (3 or 6)
- ⇒ remove the old damping mat
- ⇒ roll the damping mat into a cylindrical shape and fit it into the after-muffler
- ⇒ fit the cover (3 or 6) and secure by rivets.

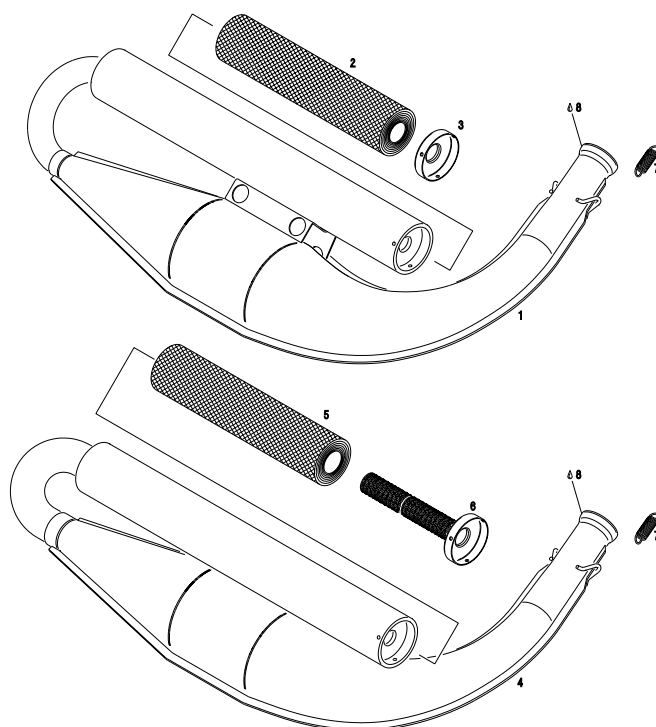


Figure 58

ENGINE REASSEMBLY

■ **Attention:** Always renew removed gaskets, circlips, O-rings and oil-seals at engine repair.

■ **Attention:** Risk of burns at handling of hot components

Crankcase assembly

⇒ preheat both crankcase halves with bearings and oil-seals already fitted in a hot air stove at 50°C for 30 min.

▲ **Warning:** Use heat-protective gloves when handling the hot crankcase

⇒ place the preheated ignition-side crankcase half with the surface for gear cover on a plane wooden plate

⇒ apply LOCTITE Anti-Seize on the main bearing seats of the crankshaft

◆ **Note:** LOCTITE Anti Seize
ROTAX part no. 297 434

⇒ fully insert the crankshaft (1) into the ignition-side crankcase half

⇒ apply LOCTITE Anti-Seize on bearing seats of the balance shaft

◆ **Note:** LOCTITE Anti Seize
ROTAX part no. 297 434

⇒ fully insert the balance shaft into the ignition-side crankcase half

⇒ apply MOLYCOTE 111 on water pump shaft with the impeller already fitted, around bearing seat.

◆ **Note:** MOLYCOTE 111
ROTAX part no. 897 161

⇒ fully insert the water pump shaft (3) into the ignition-side crankcase half

⇒ place a new gasket (4) on the ignition-side crankcase half

◆ **Note:** No need to adjust the axial clearance of the crankshaft.

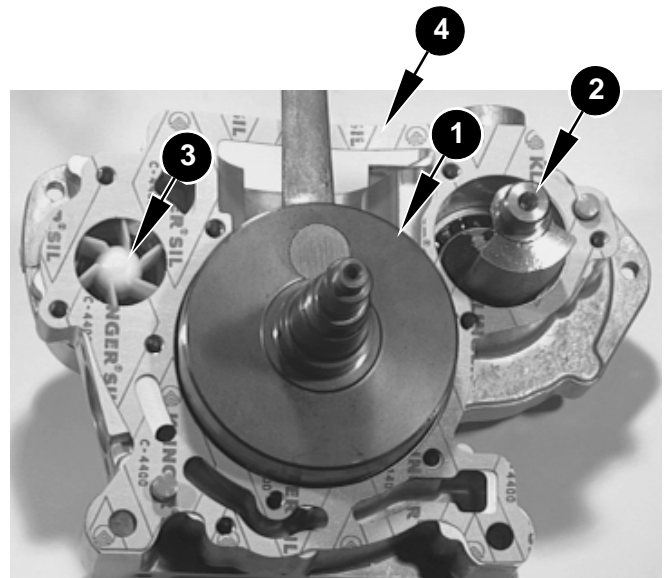


Figure 59

▲ **Warning:** Always wear heat-protective gloves when handling the hot crankcase

⇒ Place the preheated clutch-side crankcase half on the ignition side crankcase half.

⇒ bolt together the two crankcase halves with 9 Allen screws

◆ **Note:** Observe the different length of the Allen screws. Tighten the Allen screws to the specified torque M24 in a crosswise sequence and with the torque step-wise increasing, starting at the middle of the crankcase.

M24 = 10 Nm

⇒ Let the crankcase cool down

⇒ Place the crankcase on the trestle and secure with the 4 fixing screws.

◆ **Note:** special tool, "trestle assembly"
ROTAX part no.: 876 762, 676 050

⇒ carefully cut off with a knife projecting parts of the crankcase gasket at cylinder flange and cylinder centering, but make sure not to damage the sealing face.

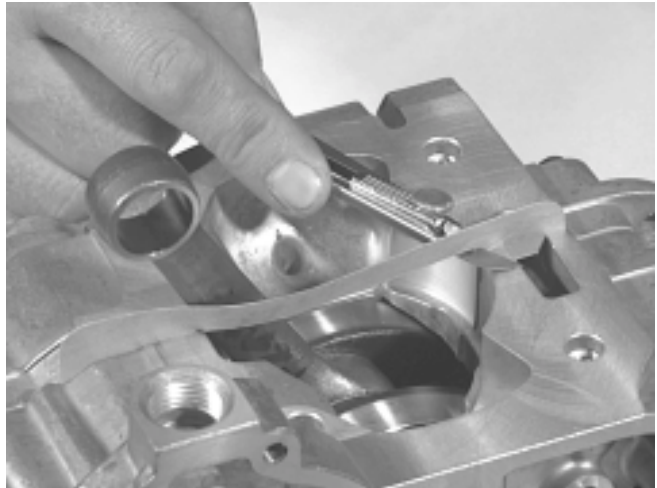


Figure 60

Installation of the balance shaft and water pump drive

- ⇒ Insert the o-ring (1) into groove on the crankshaft
- ⇒ preheat the balance gears (2) and (3) to 50°C
- ⇒ fit the preheated balance gear (2) with hub collar outwards, on the crankshaft such that the markings (4) on crankshaft and balance gear align
- ⇒ fit the preheated balance gear (3) with hub collar inwards on the balance shaft such that the markings (5) on balance shaft and balance gear align.

◆ **Note:** The balance gears (2) and (3) have to mesh in the position in which the markings (5) point towards "high noon" and the markings (4) point towards the marking (6)

- ⇒ Fit the drive gear (7) on the crankshaft
- ⇒ Fit new retaining rings (8) on the balance shaft and the crankshaft

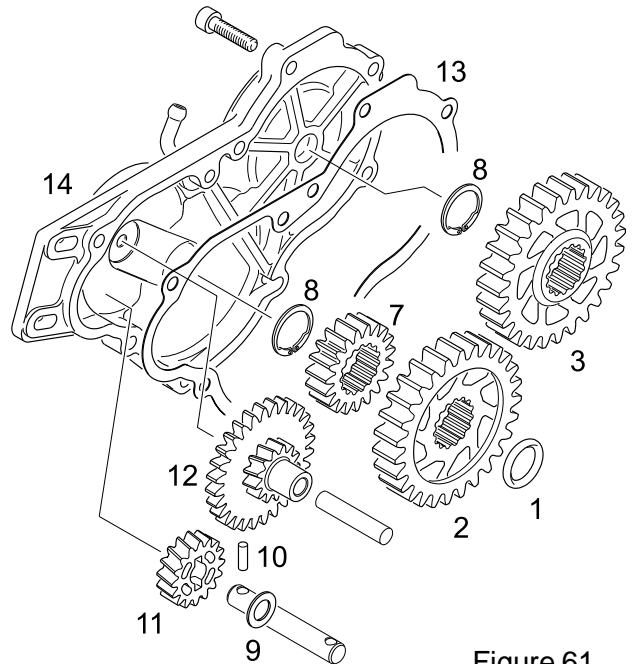


Figure 61

■ **Attention:** Do not overstress the retaining rings during fitting.

- ✓ Verify proper fit of the retaining rings (8) in the groove of balance shaft and crankshaft.
- ⇒ fit the thrust washer (9) the needle pin (10) and the water pump pinion (11) on water pump shaft.
- ✓ Verify proper fit of needle pin in recess of the water pump pinion
- ⇒ fit the water pump idle gear (12) on locating pin in crankcase
- ⇒ place a new gasket (13) on the crankcase
- ⇒ attach the gear cover (14) with 8 Allen screws M6 x 25 and tighten to the specified torque M25

M25 = 10 Nm

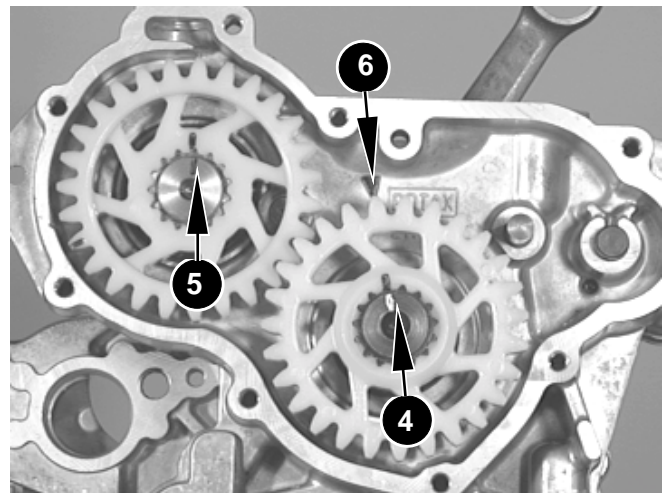


Figure 62

◆ **Note:** Use sealing rings on the oil drain screw and oil level screw (see fig 73).

Piston installation

⇒ Apply engine oil to lubrication ducts for the crankshaft main bearings and to big-end conrod bearing as well as to piston pin and needle cage.

◆ **Note:** Cover the crankcase with a clean rag to prevent any foreign matter from dropping into crankcase.

⇒ fit needle cage, piston and piston pin on conrod

■ **Attention:** Make sure to fit the piston such that the piston ring securing pin points towards intake port.

⇒ place a new circlip on a plane plate and push the locating sleeve over the circlip (sec fig. 63)

◆ **Note:** Special tool „circlip installation tool assy“
ROTAX part no.: 676 035

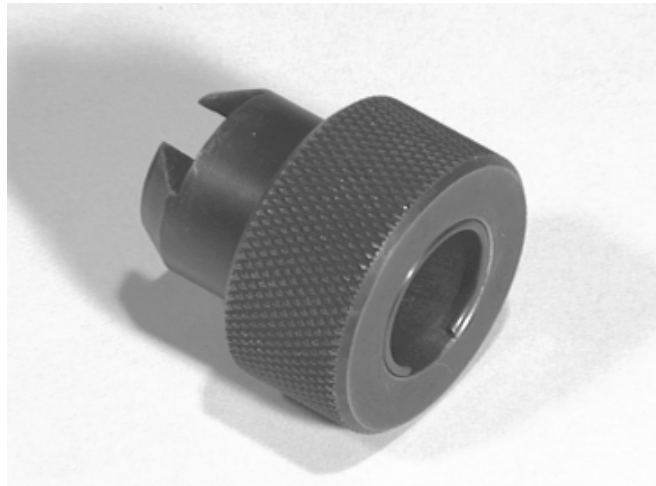


Figure 63

⇒ push the piston pin circlip with the conical end of the insertion punch further into the locating sleeve (sec fig 64)



Figure 64

⇒ Turn a round the insertion punch and push circlip further into locating sleeve until the circlip snaps into the recess in the locating sleeve (see fig 65)



Figure 65

- ⇒ Place the circlip insertion tool such on the piston that the open ends of circlip point to 6 o'clock position

◆ **Note:** The insertion punch centers itself in the piston pin

- ⇒ support piston with one hand and push the circlip from the locating sleeve into the piston (see fig. 66)
- ✓ Verify proper fit of the circlip in piston groove and correct position of circlip ends (6 o'clock position)
- ⇒ fit the second circlip the same way and verify proper fit
- ⇒ remove the covering of the crankcase opening.

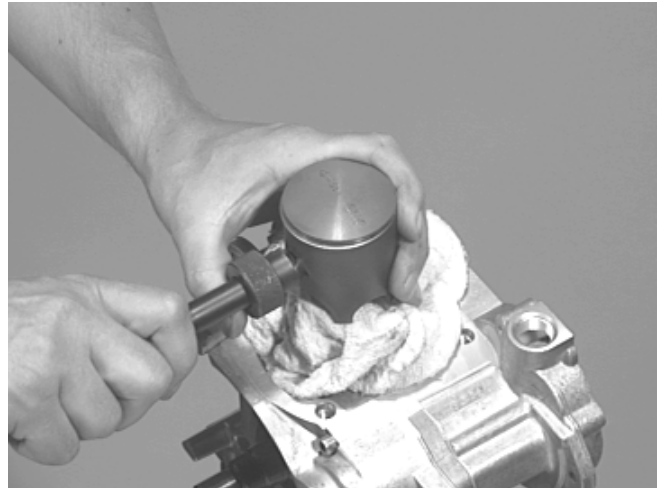


Figure 66

Cylinder installation

- ⇒ place a new cylinder base gasket of 0,5 mm thickness on the crankcase

◆ **Note:** The sealing face on the crankcase for the cylinder flange must be plane, otherwise it could lead to leakage in this area of the cooling circuit.

- ⇒ apply 2 stroke motor oil on piston contact surface
- ⇒ turn the piston ring such that the ends of the ring are on piston ring securing pin
- ⇒ push the piston ring into the piston ring groove with two fingers and fit the pre-assembled cylinder over the piston on the crankcase

▲ **Warning:** Pairing of piston and cylinder only such that it results in the appropriate piston-to-wall clearance (refer to Section "Cylinder" and "Piston")

- ⇒ attach the cylinder with 4 collar nuts and tighten the nuts crosswise to the specific torque M26

M26 = 24 Nm

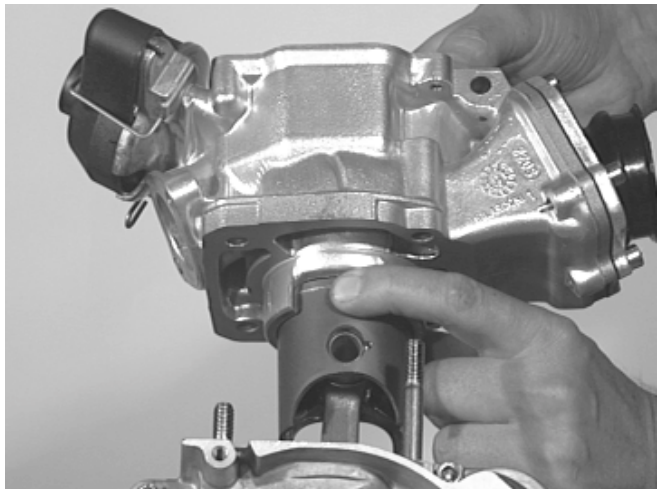


Figure 67

Installation of combustion chamber insert and cylinder head cover

- ⇒ Place the o-ring (1) into groove of cylinder
- ⇒ Put on the combustion chamber insert (2) and attach with 5 hex. screws M8 (3) and lock washers. Tighten the screws crosswise to the specified torque M27

M27 = 30 Nm

◆ **Note:** When fitting the combustion chamber insert (2) make sure that the o-ring (1) rests proper in the groove and will not get squeezed

- ⇒ place the o-ring (4) on combustion chamber insert
- ⇒ place the o-ring (5) into the groove of cylinder head cover (6)

◆ **Note:** Slightly grease the o-ring (5) so it will remain better in the groove of the cylinder head cover

- ⇒ attach the cylinder head cover (6) with 4 Allen screws M6 (7) and tighten the screws crosswise to the specified torque M28

M28 = 10 Nm

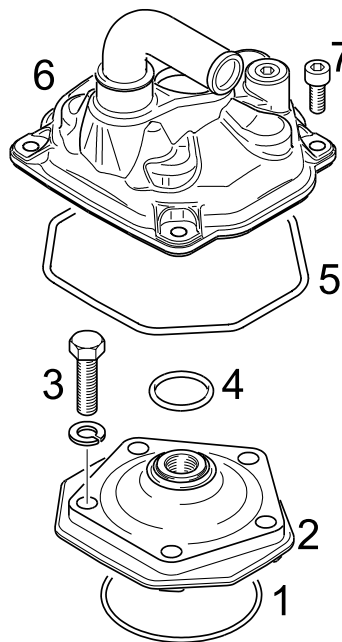


Figure 68

Checking and adjustment of the squish gap between piston and combustion chamber insert.

◆ **Note:** The gap between the piston (in T.D.C.) and the combustion chamber insert is defined as squish gap and is of essential influence on performance characteristic of the engine.

■ **Attention:** A precondition for the exact checking of the squish gap is a piston cleared from combustion deposits.

- ⇒ turn the crankshaft by hand to position of piston approx. 5 mm before T.D.C.
- ⇒ bend a bit of soldering tin of appropriate dia. (M29) as shown on fig 69 and insert it through the spark plug tapping until it touches the cylinder wall

M29 = 1,5 mm (only for version FR 125 MAX)
2,0 mm (only for version FR 125 JUNIOR MAX)

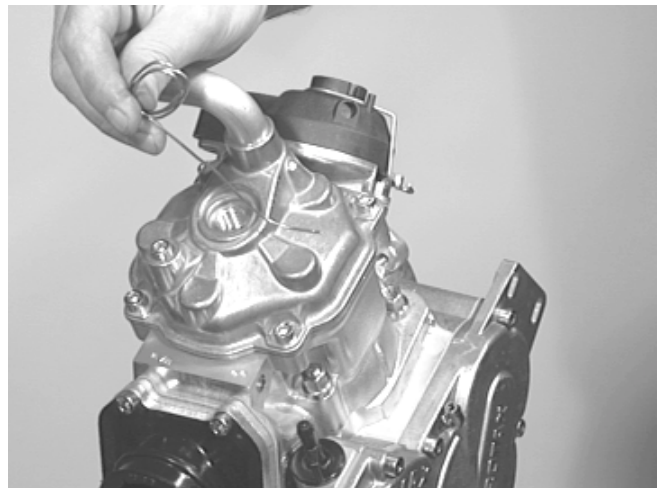


Figure 69

◆ **Note:** The squish gap has to be always measured in the piston pin axis. Measuring of this gap in intake / exhaust direction would be falsified by the tilting of the piston and is not permitted therefore

- ⇒ turn the crankshaft by hand into T.D.C. position

◆ **Note:** By this action the soldering tin will be squeezed between piston and combustion chamber insert

- ⇒ Remove the soldering tin from the combustion chamber and measure the squeeze end (= squish gap) with a vernier caliper

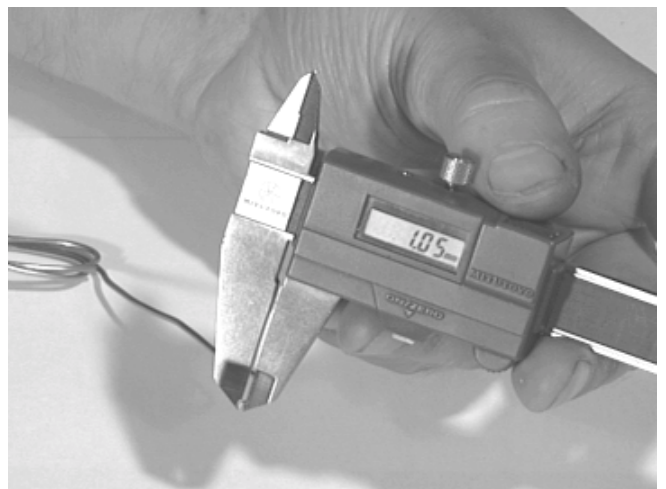


Figure 70

◆ **Note:** This measuring procedure needs a vernier caliper of 1/100 mm precision

■ **Attention:** The squish gap must be within the specified range M30

M30 = 1,05 mm +0,25/-0,15 mm (only for version FR 125 MAX)
1,45 mm +0,25/-0,15 mm (only for version FR 125 JUNIOR MAX)

■ **Attention:** The smaller the squish gap the higher the compression of the engine and the more critical the engine reaction on jetting of the carburetor at changing ambient conditions (temperature, atmospheric pressure, humidity)

◆ **Note:** It is recommended to set the squish to the larger end of the respective range.

◆ **Note:** The squish gap can be adjusted by a cylinder base gasket of different thickness. Cylinder base gaskets of the thickness 0,3 mm, 0,4 mm, 0,5 mm and 0,8 mm are readily available.

Example: On an engine a cylinder base gasket of the thickness 0,5 mm is fitted. With this cylinder base gasket a squish gap of 0,8 mm was measured. In this particular case it needs a cylinder base gasket of 0,8 mm thickness to achieve a squish gap within the specified range M30

◆ **Note:** If a cylinder base gasket of a different thickness has to be fitted, the cylinder can be removed after removal of the 4 collar nuts. At refitting of the cylinder observe the instructions in section "Cylinder installation"

Starter reduction gear installation

- ⇒ apply grease on bearing seats and on tothing of the starter reduction gear assembly (2).
- ⇒ Fit the starter reduction gear (2) together with the thrust washer (1) onto bearing in the crankcase.
- ⇒ Attach the reduction gear cover (3) with the two Allenscrews M6x25, secure with ERGO 4052 and tighten the screws to the specified torque M31

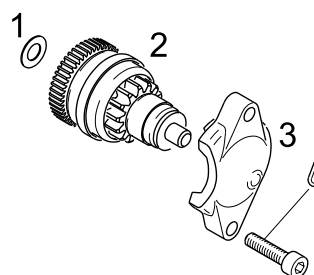


Figure 71

◆ **Note:** ERGO 4052
ROTAX part no. 897 655

M31 = 5 Nm

Centrifugal clutch installation

⇒ Screw the fixation tool (see fig 7) fully into the spark plug tapping

◆ **Note:** special tool – " crankshaft fixation tool"
ROTAX part no.277 380

⇒ Degrease the bore of starter gear (see fig 35) and the taper of the crankshaft.

⇒ apply LOCTITE 648 on taper bore of starter gear and fit the starter gear assembly (fly weights already fitted) on the crankshaft taper.

◆ **Note:** LOCTITE 648
ROTAX- part no 899 785

⇒ remove surplus LOCTITE

⇒ tighten the hex. nut (4) to the specified torque M32

M32 = 100 Nm

⇒ apply Lithium-base grease on crankshaft at the contact surface for the needle cage (6) (or for plain bearing on sprocket with 11 teeth).

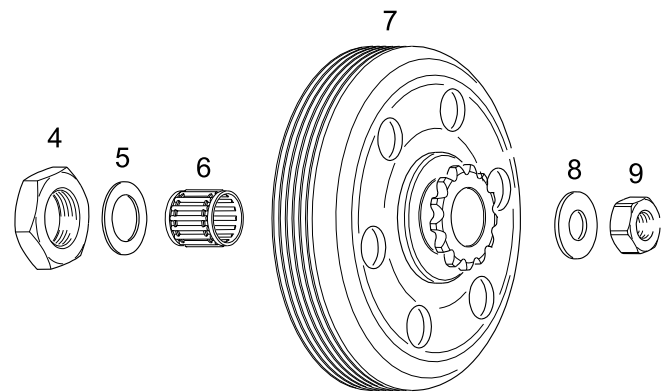


Figure 72

◆ **Note:** Lithium base grease
ROTAX part no. 897 330

⇒ Fit thrust washer (5) needle cage (6), clutch drum with chain sprocket (7) and thrust washer (8) on crankshaft.

⇒ degrease the thread of hex. nut (9) and the thread of crankshaft

⇒ apply ERGO 4052 on thread of hex.nut (9) and tighten this nut to the specified torque M33

◆ **Note:** ERGO 4052
ROTAX part no. 897 655

M33 = 60 Nm

⇒ remove surplus ERGO from the crankshaft.

⇒ remove the crankshaft fixation tool from the spark plug tapping.

Pick-up coil for ignition unit - installation

◆ **Note:** The pick-up coil for the ignition unit is attached with 2 Allen screws M6x16 on the sand-cast crankcase. On the crankcase in die-casting this pick-up coil is attached with 2 taptite (self tapping) screws M6x16.

- ⇒ position the pick-up coil such on the crankcase that the connection for the cable harness points towards gear cover
- ⇒ attach the pick-up coil for the ignition unit with the 2 Allen screws or taptite screws and tighten the screws to the specified torque M34

M34 = 10 Nm

◆ **Note:** If the two taptite screws will be fitted on an used crankcase take care that the taptite screws will engage proper in the already cut thread courses.

◆ **Note:** The ignition coil will be attached on the engine not before engine installation onto chassis

Spark plug - fitting

- ⇒ screw the spark plug into the tapping of the combustion chamber insert and tighten to the specified torque M35

M35 = 24 Nm

Electric starter - installation

- ⇒ grease the o-ring on the centering of electric starter.
- ⇒ fit the electric starter in centering on crankcase by rotating the starter to and fro until the toothing of the starter engages in starter reduction gear. Attach the electric starter with the 2 Allen screws M6x30. Tighten the screws to the specified torque M36

M36 = 10 Nm

Radiator and intake silencer- installation

- ◆ **Note:** The support bracket for the radiator and the support bracket for the intake silencer are attached on the cylinder together with the reed valve assy and the carburettor flange (see section reed valve and carburetor flange)
- ⇒ connect the radiator with the two coolant elbow fittings on the engine according to fig. 55 and attach the radiator on the support bracket (pos.5, fig 55)
- **Attention:** The coolant fitting on the radiator and on the engine must not touch each other. A flexible connection between engine and radiator must be established.
- ⇒ Install the intake silencer as depicted in fig 55,1 and attach on the assigned support bracket (pos. 10, fig 55,1)

Fuel pump-installation

- ⇒ attach the fuel pump with two Allen screws M6x20 and self-securing nuts on the underside of the intake silencer support bracket.
- ◆ **Note:** Install the full pump such that the fitting for the impulse line points downwards and the fuel supply line points towards the driver seat.

Carburetor installation

- ⇒ Push the carburetor fully home into carburetor flange and fasten with the hose clamp on the carburetor flange
- ⇒ Push the carburetor socket of the intake silencer over socket on carburetor and fasten on carburetor with the clamp.

Filling of gear compartment with oil

- ⇒ Remove the venting screw (3)
- ⇒ fill gear oil of specified quality M37 and quantity M38 through the opening into the gear compartment.

M37 = SAE 30

M38 = 50 cm³

◆ **Note:** The Allen screws (1) can be used for verification of the oil level. With the engine in horizontal position (without engine pedestal) pour in oil until it starts to flow out through the tapping of Allen screw (1). This amount of oil corresponds with the specified filling capacity M38.

◆ **Note:** On the Allen screws (1 = oil level screw) and on the Allen screw (2 = oil drain screw) sealing rings have to be fitted.

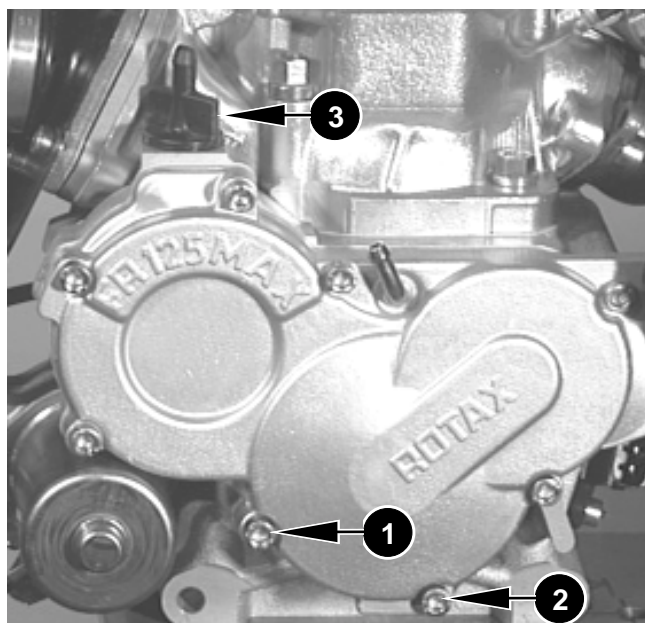


Figure 73

- ⇒ fit the venting screw (3) hand tight

ENGINE INSTALLATION ON CHASSIS

- ⇒ Remove the engine from the trestle
- ⇒ Install the engine on the chassis

▲ **Warning:** Prior to engine installation on chassis read and observe the installation instructions for the engine as well as instructions of the chassis builder regarding the engine installation.

- ⇒ start with engine operation

▲ **Warning:** Prior to engine operation read and observe the Operators Manual for the engine and the Manual of the chassis builder.