



Repair Manual No. 4010.8 E/2
SACHS-Wankel Engine

KM 37 (discontinued)

KM 48

Edition September 1972

FICHTEL & SACHS AG · D-8720 SCHWEINFURT

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INTRODUCTION

This manual is designed to give dealers and their staff all guidance and information necessary to enable them to provide and efficient repair and maintenance service, but it is in no way intended as a substitute for the practical and theoretical training available to personnel at our Service Training School.

It will be found useful as a ready reference in day-to-day workshop practice.

Our illustrated Spare Parts List, which shows the various components in detail, will also be found helpful when used in conjunction with this booklet.

Naturally, good maintenance and repair work and efficient servicing call for good equipment, a well-equipped workshop and skilled personnel.

Dealers are requested to make this manual and all SACHS Service Bulletins, which contain technical modifications, available to every individual responsible for actual servicing. The proper place for this kind of technical information is in the workshop and not in the filing cabinet.

We hope that this manual will be of real practical assistance to all our dealers, agents and associates.

FICHEL & SACHS AG
D-8720 SCHWEINFURT

Service Department

CONSTRUCTION AND FUNCTION OF THE SACHS-WANKEL ENGINE

Construction

Basic elements of the engine are the rotor housing and the triangular rotor. All sealing elements are contained in the rotor which is supported by the eccentric shaft. The chambers formed between the rotor and the rotor housing are closed by two end covers. In the end covers as well as in the housing, ports for the gas flow are cast. Each working chamber is kept tight on all sides by the seals. They form a continuous sealing line comparable to the one produced by a piston ring. The apex seals warrant, in spite of the eccentric rotation of the rotor, positive tightness at all times.

Counterweights are provided eccentrically in the magneto and in the flywheel on the power take-off side, compensating any uneven centrifugal forces created by the rotor. This results in the advantage of building a mechanically completely balanced engine.

Function

While the rotor rides on the mainshaft and turns in an eccentrically manner, three chamber volumes are constantly decreasing and increasing.

Because of the 3:1 speed ratio from the shaft to the rotor, each revolution of the rotor delivers 3 power phases (each rotor face accomplishes a full four-stroke cycle). Per shaft revolution, one power impulse is produced which corresponds to a rotary angle of the rotor of 120° .

The pressure of the expanding gases acts on the lobes of the rotor and produces rotary motion that is transmitted over the eccentric bearings, which exert leverage, to the output shaft.

In the four-stroke Wankel engine, all three working chambers are in continuous action, as described and illustrated by the following sketches (rotor revolves clockwise):

Fig. 1

At the firing point, a few degrees before TDC¹, the chamber volume between A and C is at its smallest. Intake is going on through the ports between A and B.

Chamber between B and C has just started its exhaust phase.

¹) in comparison with the reciprocating engine:

TDC = minimum chamber volume

BDC = maximum chamber volume



Fig. 1

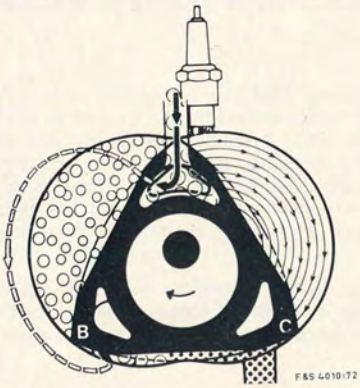


Fig. 2

The rotor face between B and C is just completing the exhaust phase and starts a new intake phase. That rotor face is at its top dead center, while both the exhaust and the intake port are open.

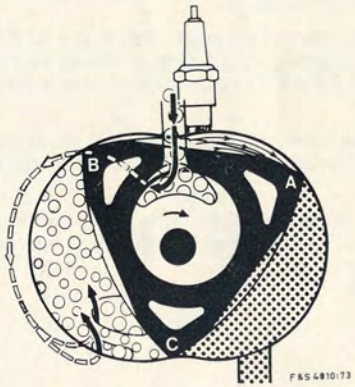


Fig. 3

The chamber between B and C is about to complete the intake phase, shortly before its bottom dead center. Ignition has taken place between A and C. Scavenging continues between A and C.

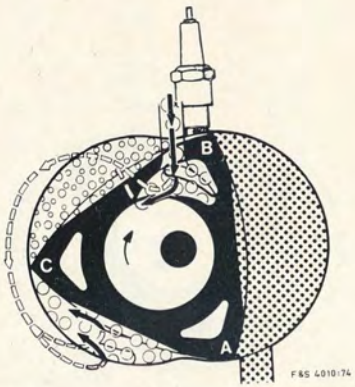


Fig. 4

The chamber between B and C goes ahead with compression. Chamber between A and B has just started exhaust phase. Intake is shown between C and A.

Fig. 5

The fuel-air mixture is produced by a conventional carburettor. Before entering the chamber, the fuel-air mixture is drawn, as depicted by the sketches, either through the ports in the eccentric, or through the ports in the rotor, for cooling and lubricating the moving parts.

The intake port shown in the first sketch, in the chamber between A and B, is in permanent communication with the carburettor.

Fig. 5 illustrates the direction of flow.

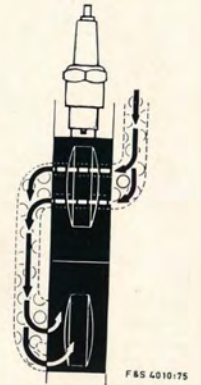
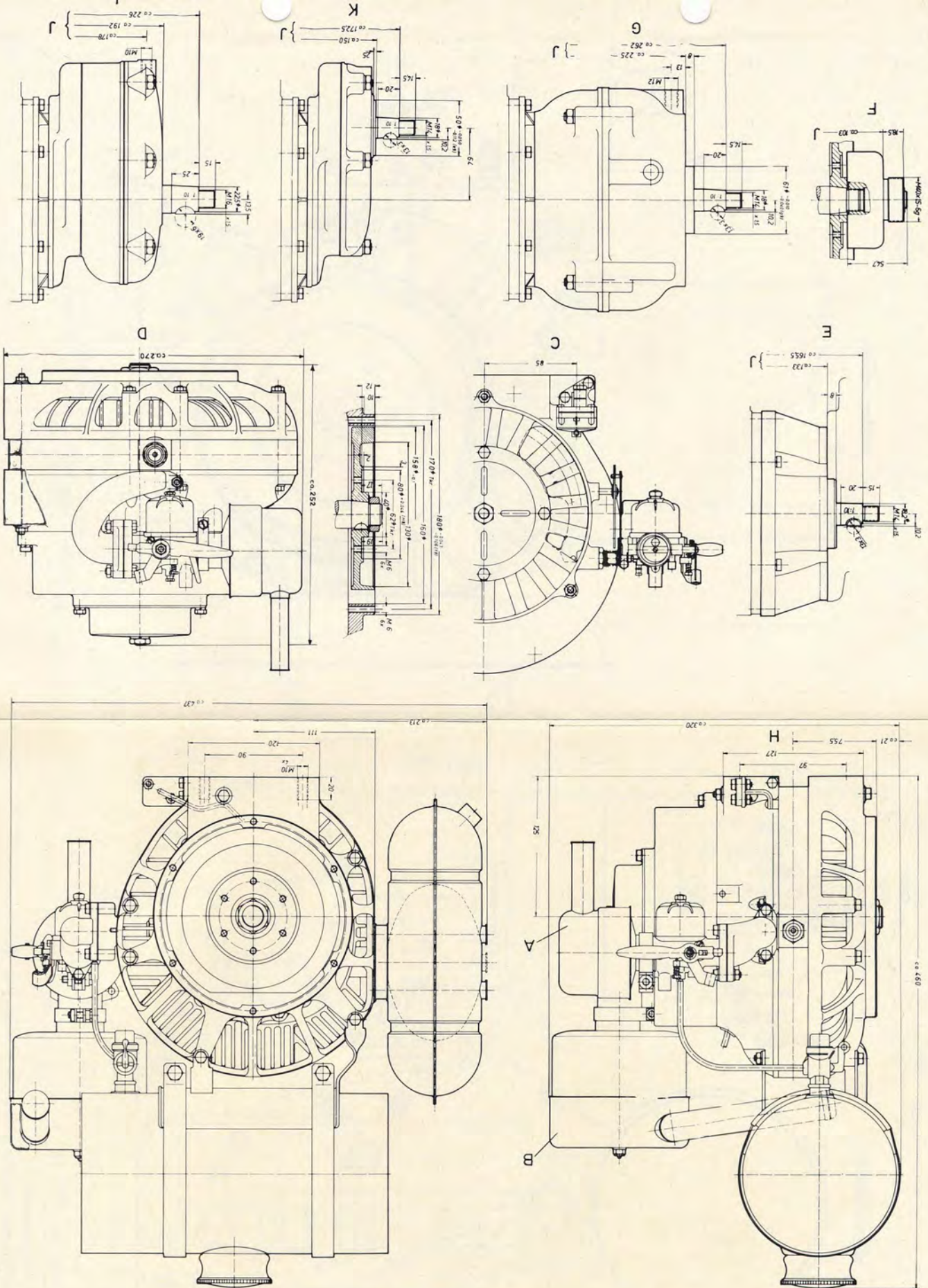


Fig. 5

INSTALLATION DIMENSIONS FOR SACHS-WANKEL ENGINE KM 37



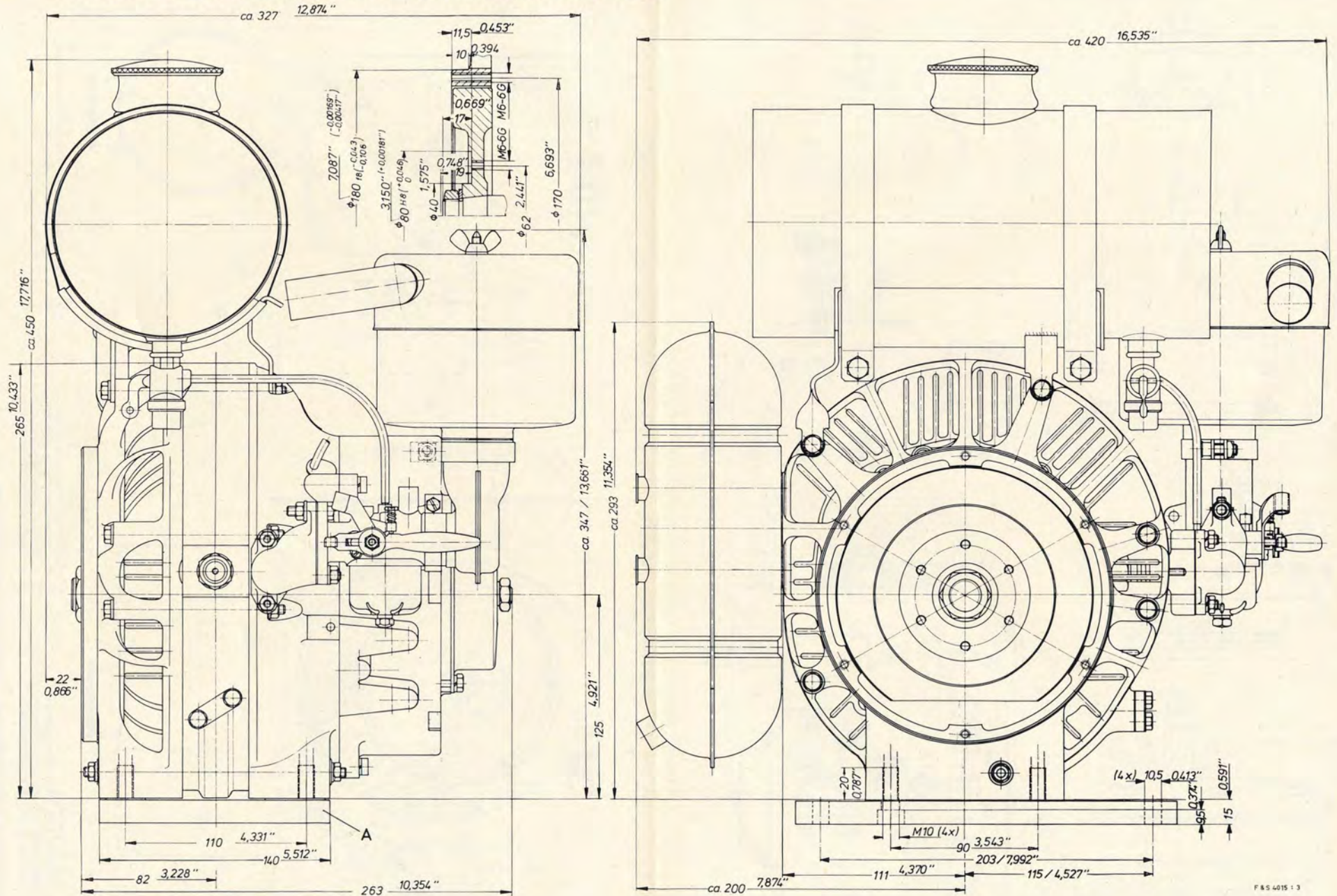
- A = Wet air cleaner
- B = Air filter with Micro-Star element
- C = Fuel pump and top speed limiting device
- D = Vertical mounting of the engine

- E = Built-in centrifugal clutch
- F = Centrifugal clutch with drum
- G = Built-in, lever operated clutch
- H = Center line of rotor housing

- J = Distance to center line of rotor housing
- K = Single stage gearbox
- L = Two-stage gearbox

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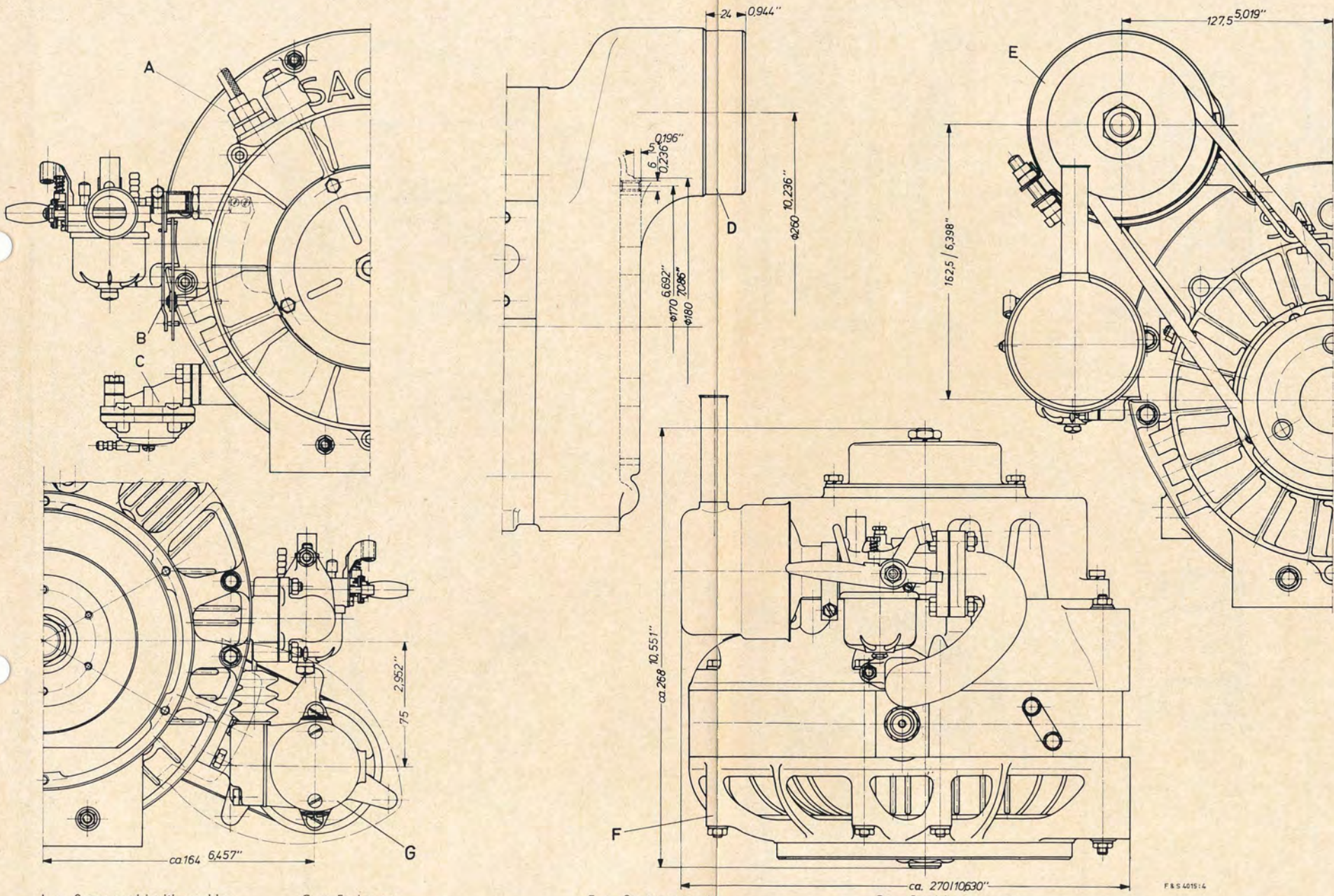
INSTALLATION DIMENSIONS FOR SACHS-WANKEL ENGINE KM 48



A = Pedestal plate

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INSTALLATION DIMENSIONS FOR SACHS-WANKEL ENGINE KM 48

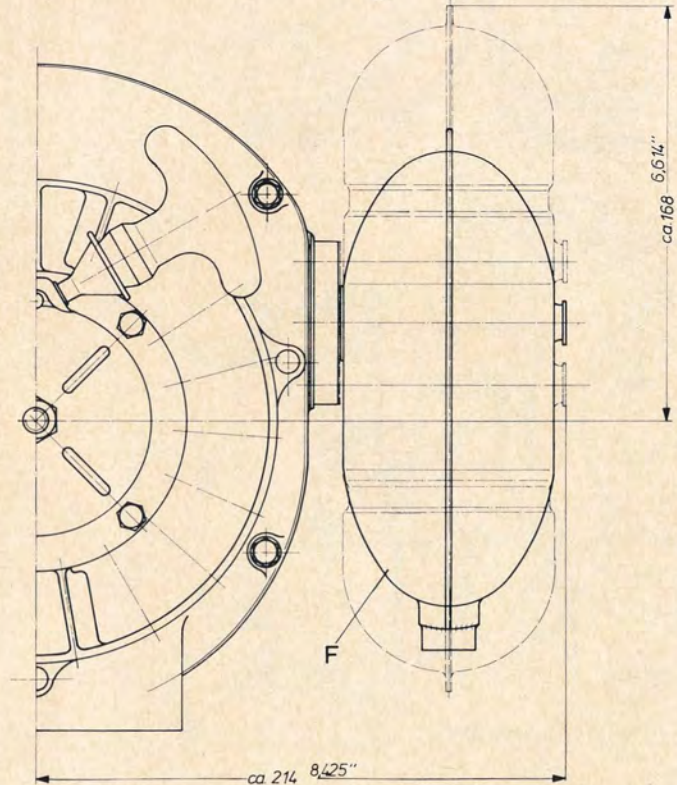
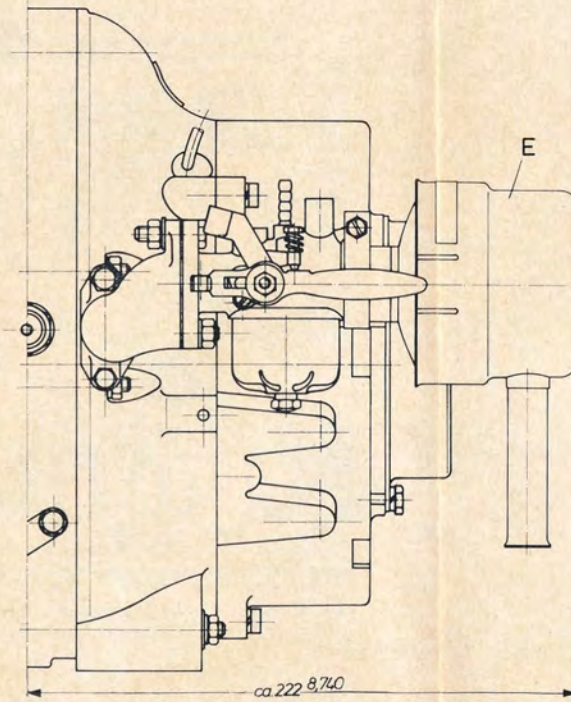
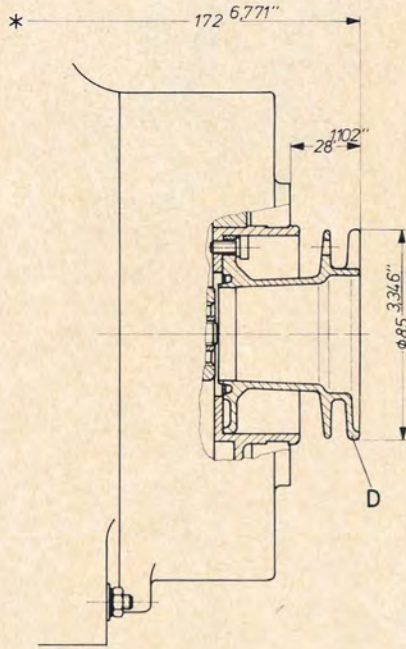
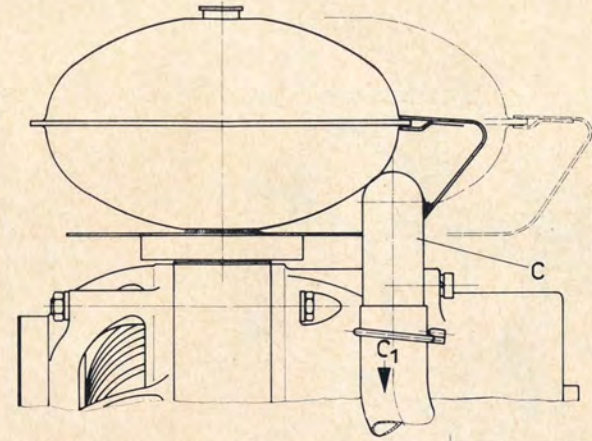
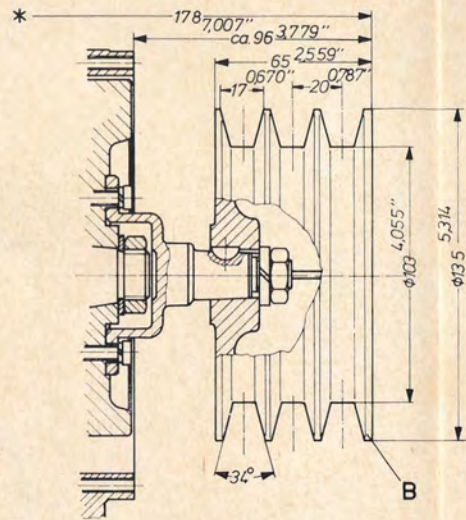
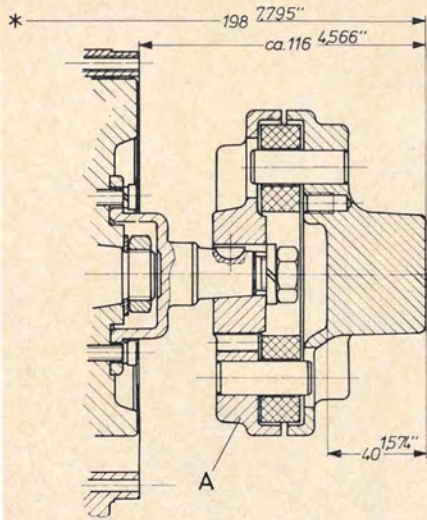


- A = Suppressed ignition cable
- B = Top speed limiting device
- C = Fuel pump
- D = Housing cover for air evacuation

- E = Starter-generator
- F = Engine for horizontal mounting
- G = Precision governor

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INSTALLATION DIMENSIONS FOR SACHS-WANKEL ENGINE KM 48

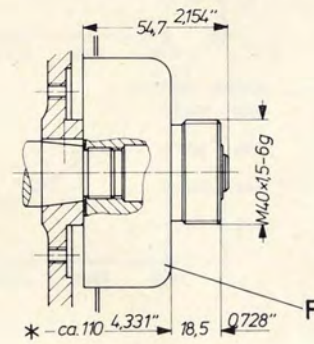
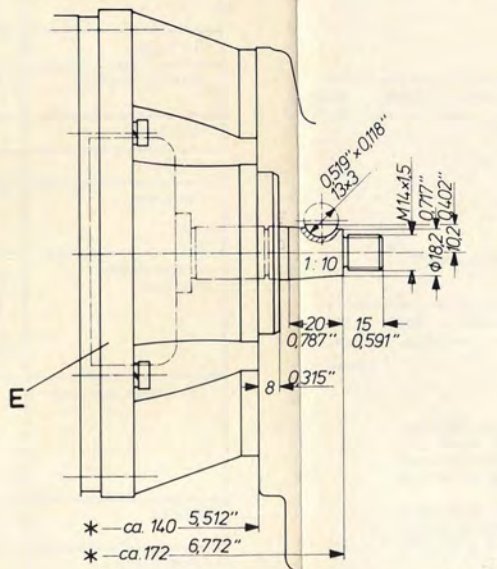
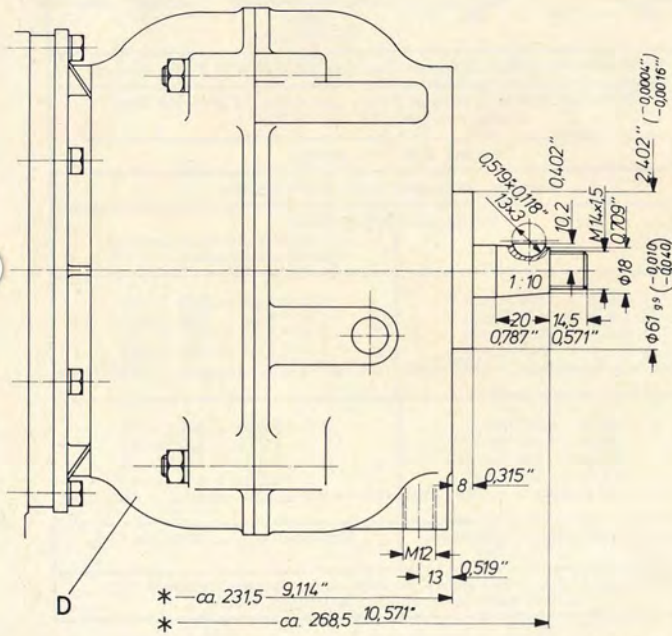
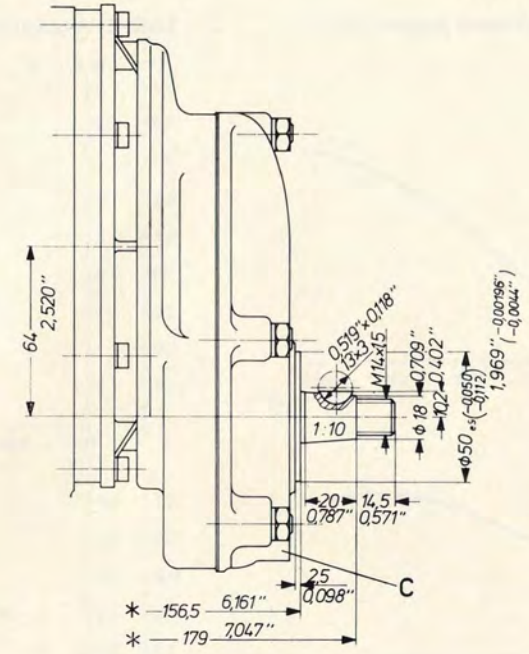
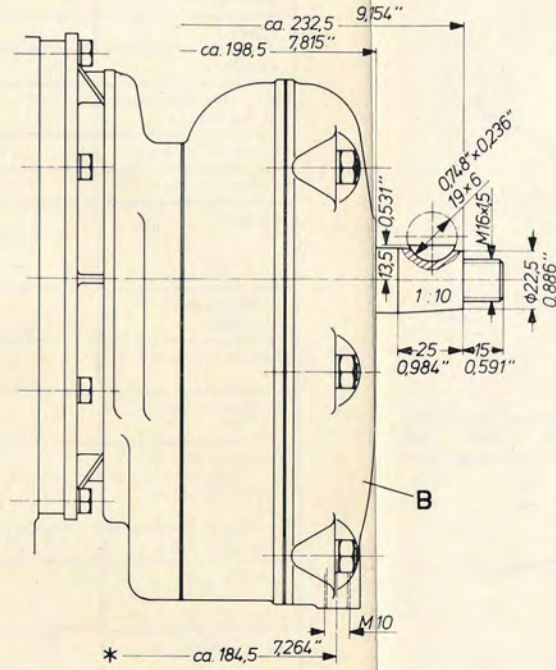
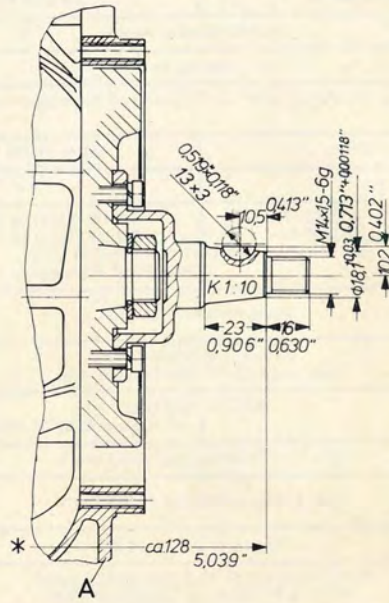


D = Starter pulley for rope starting
 E = Wet air cleaner
 F = Extra silent muffler
 (for horizontal or vertical mounting)

A = Flexible coupling
 B = V-belt pulley
 C = Device for heating the intake air
 C = Arrow points towards the air intake filter

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INSTALLATION DIMENSIONS FOR SACHS-WANKEL ENGINE KM 48



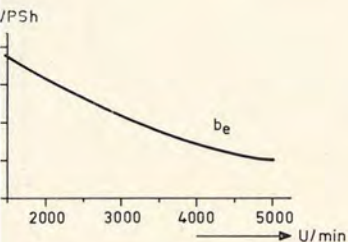
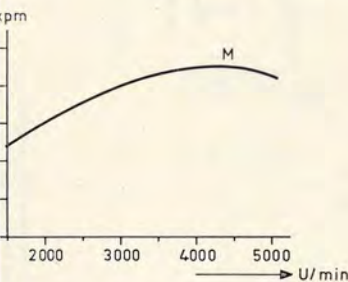
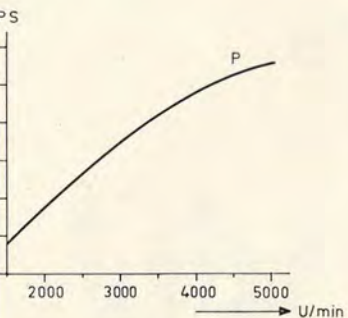
* = Built-in centrifugal clutch for mounting a gearbox
 F = Centrifugal clutch for use without gearbox
 = = = Distance to center line of rotor housing

A = Flange shaft on flywheel
 B = Two-stage gearbox
 C = Single stage gearbox
 D = Lever-operated clutch

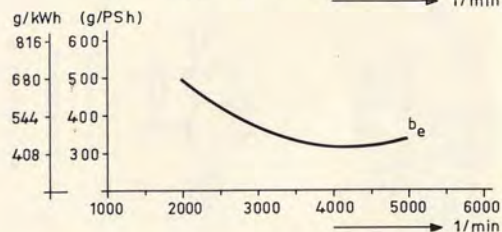
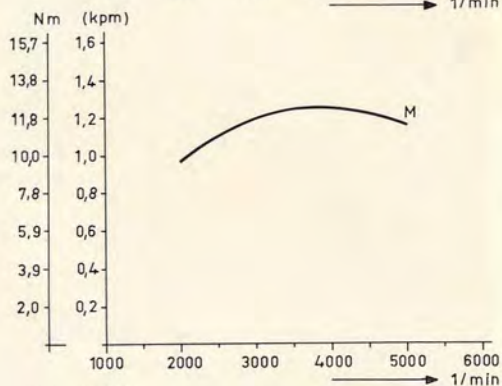
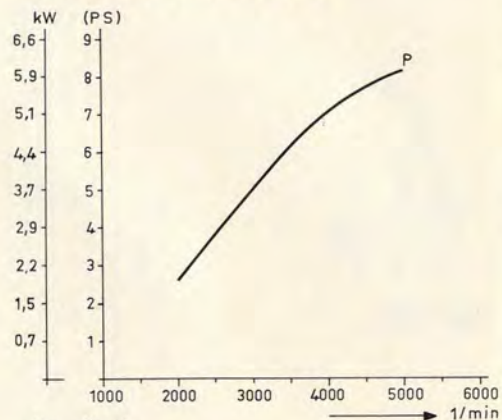
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TECHNICAL DATA

SACHS-Wankel engine KM 37



SACHS-Wankel engine KM 48



To ascertain the output according to the German Standard DIN 6270 ($b_o = 981 \text{ mbar}$ and $t_L = 20^\circ \text{ Centigrade}$), the above-mentioned output has to be multiplied by the corrective factor 0.97.
For continuous operation (e. g. for driving a generating set with governor) the engine should be run at not more than 90% of the DIN 6270 rating.

rpm) will be superseded by 1/min

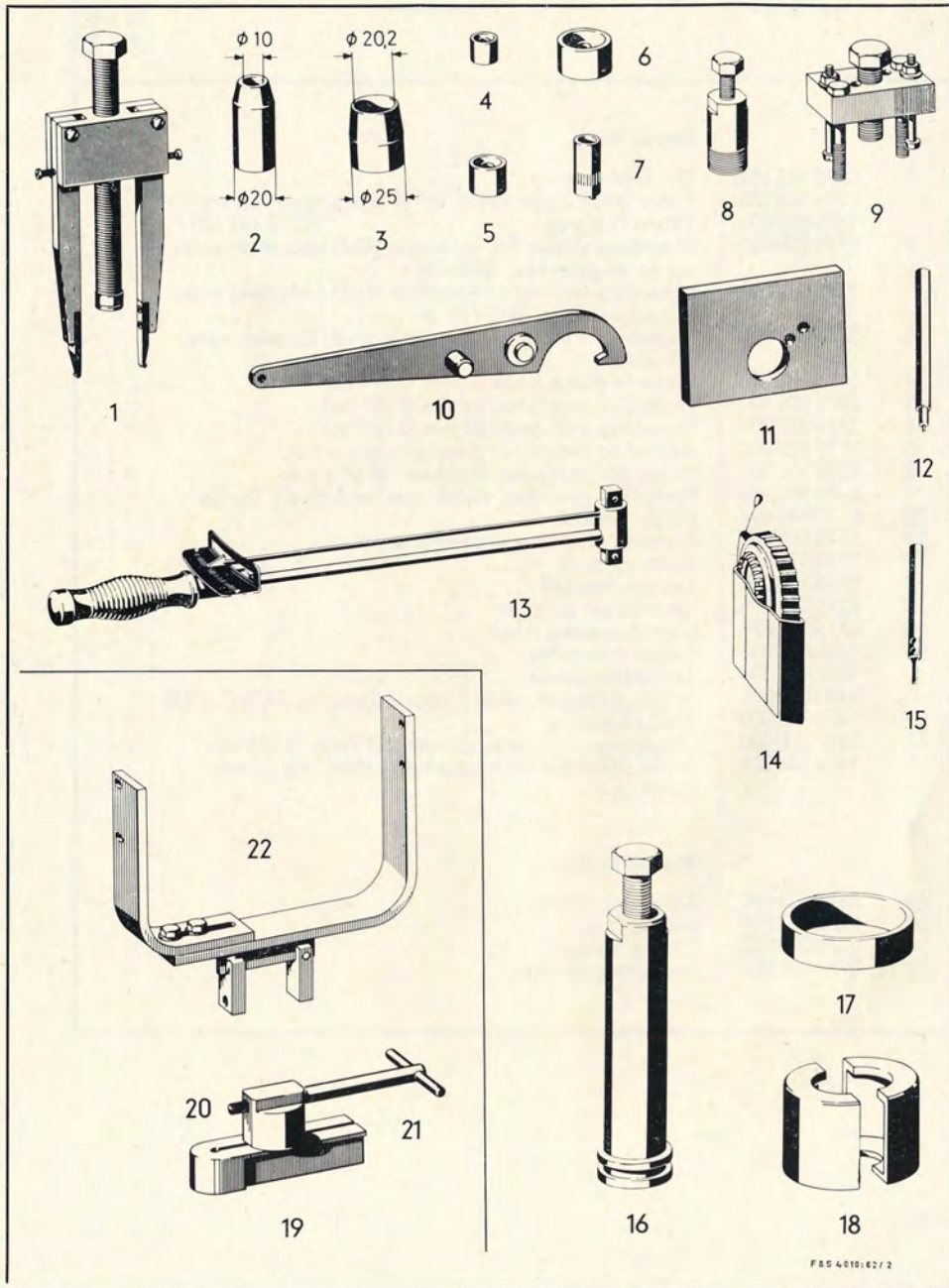
ne version

Flange mounted engine without gearbox
Counter-clockwise rotation
 pedestal mounted engine with single stage gearbox clockwise rotation
 pedestal mounted engine with two-stage gearbox counter-clockwise rotation
 stated power output applies to a fully running engine (5 ... 10 running hours) and to a meter reading $b_o = 1013 \text{ mbar}$ at an air temperature $t_L = 20^\circ \text{ Centigrades}$ (68° F).

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| Description: | SACHS KM 37 | SACHS KM 48 |
|--------------------------------------|---|---|
| Type: | SACHS-Wankel engine | |
| Cooling: | Air cooling by fan | |
| Direction of rotation of the engine: | Counter-clockwise, seen on PTO-side of the eccentric shaft | |
| Chamber volume: | 108 cc (6.590 cu. in.) | 160 cc (9.763 cu. in.) |
| Compression: | 8.5:1 | 8:1 |
| Output: | 3.45 HP (DIN) at 3000 1/min. 5.5 HP (DIN) at 4900 1/min. less 2% if an extra silent muffler is fitted | 5.0 HP (DIN) at 3000 1/min. 8.0 HP (DIN) at 4800 1/min. less 5% if a precision governor is fitted |
| Eccentric shaft bearings: | 2 anti-friction bearings | |
| Engine lubrication: | Mixture lubrication 1:50 (see page 72 for appropriate oils) | |
| Ignition system: | BOSCH magneto on request BOSCH magneto-generator | |
| Firing point: | 10° ... 12° before top dead center | |
| Contact breaker gap: | 0.4 ± 0.05 mm (0.016 ± 0.002 in.) | |
| Pole shoe gap: | 7 ... 10 mm (0.275 ... 0.394 in.) | |
| Spark plug: | BOSCH W 150 M 11 S (for partial load) BOSCH W 190 M 11 S (for full load) electrode gap 0.5 mm | |
| Carburettor: | BING butterfly valve carburettor ϕ 14 mm, with lever or cable control, on request with fuel pump (suction capacity max. 30 cm = 11.8 in.) | |
| Carburettor setting: | Main jet 85 Idle jet 60 | Idle air adjusting screw 1½ turn open Mixing tube ϕ 2.7 |
| Air filter: | Air filter with Micro-Star element or wet air cleaner with intake silencer | |
| Starting method: | Recoil starter, Starter pulley or Starter-generator 12 Volt 160 Watt (battery required 12 Volt 18 Ah) | |
| Fuel tank: | 4 litres (0.88 Imp. gallons) | |
| Muffler: | standard, on request extra silent version | |
| Governor: | Top speed limiting device on request precision governor precision accuracy ± 2.5% | |
| Single stage gearbox: | $i = 1.5$ (n = 2000 1/min) $i = 1.8$ (n = 1670 1/min) $i = 2.0$ (n = 1500 1/min) $i = 2.8$ (n = 1070 1/min) referred to engine speed n = 3000 1/min | $i = 1.5$ (n = 3000 1/min) $i = 1.8$ (n = 2500 1/min) $i = 2.0$ (n = 2250 1/min) $i = 2.8$ (n = 1600 1/min) referred to engine speed n = 4500 1/min |
| Two-stage gearbox: | $i = 5.6$ (n = 535 1/min) $i = 6.9$ (n = 440 1/min) $i = 7.8$ (n = 380 1/min) $i = 10.6$ (n = 280 1/min) referred to engine speed n = 3000 1/min | $i = 5.6$ (n = 805 1/min) $i = 6.9$ (n = 650 1/min) $i = 7.8$ (n = 575 1/min) $i = 10.6$ (n = 425 1/min) referred to engine speed n = 4500 1/min |
| Weight: | Flange-mounted engine without fuel tank 15.5 kg (34.2 lbs) | Standard engine 20 kg (44 lbs) |
| Attachments: | Flexible coupling, V-belt pulley, Built-in, lever-operated clutch K 160, Built-in centrifugal clutch, Centrifugal clutch | |

REPAIR TOOLS AND MOUNTING JIG



| Illustr. No. | Part Number | Description | Engine | |
|--------------|-------------|--|--------|-------|
| | | | KM 37 | KM 48 |
| | | Repair tools | | |
| 1 | 0276161101 | Oil seal puller | × | × |
| | 0276164100 | Puller hook 3 mm (0.118 in.) (1 piece) | × | × |
| | 1476012000 | Thrust bearing | × | × |
| 2 | 2776009000 | Mounting sleeve for eccentric shaft (magneto side) up to engine No. 6440768 | × | × |
| | 2776009001 | Mounting sleeve for eccentric shaft (magneto side) for engine No. 6440769 on | × | × |
| 3 | 2776010000 | Mounting sleeve for eccentric shaft (power take-off side) | × | × |
| 4 | 0276156000 | Protective cap, bore 10 mm (0.394 in.) | × | × |
| 5 | 0976088100 | Protective cap, bore 14 mm (0.551 in.) | × | × |
| 6 | 2776022000 | Protective cap, bore 20 mm (0.787 in.) | × | × |
| 7 | 2776025000 | Adjusting sleeve for precision governor | × | × |
| 8 | 0276150005 | Puller for magneto flywheel M 26 x 1.5 | × | × |
| 9 | 0976103100 | Puller for flywheel, clutch disc and clutch flange | × | × |
| 10 | 0277086404 | Hook wrench | × | × |
| 11 | 2776018000 | Riveting stock for eccentric shaft | × | × |
| 12 | 2776021000 | Riveting tool | × | × |
| 13 | 0276170000 | Torque wrench | × | × |
| 14 | 0276175000 | Revolution counter | × | × |
| 15 | 2776017000 | Decarbonizing tool | × | × |
| 16 | 1476013000 | Puller assembly | × | × |
| | 1476011000 | Threaded sleeve | × | × |
| | 1440027001 | Screw, hexagon head } spare parts for 1476013000 | | |
| | 1476012000 | Thrust bearing | × | × |
| 17 | 1447010000 | Clamping ring, inner diameter 75 mm (2.283 in.) | × | × |
| 18 | 1476014021 | Puller shells for driving pinion, shaft dia 25 mm (0.984 in.) | × | × |
| | | Mounting jig | | |
| 19 | 0276081000 | Clamping base | × | × |
| 20 | 0276082000 | Swivel unit | × | × |
| 21 | 0276085005 | Clamp screw | × | × |
| 22 | 2776007001 | Mounting bracket | × | × |

DISMANTLING THE ENGINE

Remove all connections from the engine to the equipment (control cables, electric connections etc.) as well as the air filter from the carburettor. Remove the engine and clean it thoroughly before dismantling.

Fuel tank, muffler and carburettor

Fig. 6

If there is one, unscrew the fuel tank (z) with support. Remove both plugs (x), unscrew with a hexagon Allen key the muffler (a), remove exhaust gasket and, if there is one, the device for heating the intake air. Unscrew the carburettor (h) with intake pipe (d), disconnect the governor rod and remove it together with gasket. If necessary, unscrew the intake pipe.

Note:

On engines with BOSCH starter-generator, proceed as explained on page 64.

Recoil starter, fan housing and starter housing

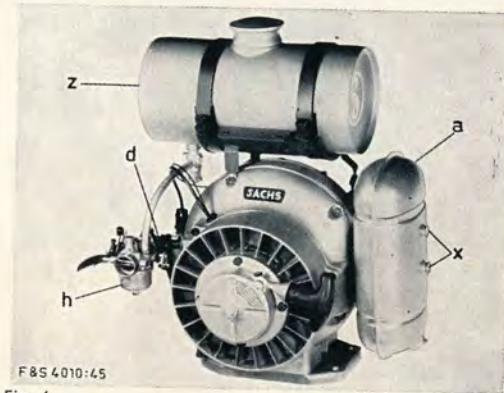
Fig. 7

Mount the engine, as illustrated, onto the jig (repair tool No. 19, 20, 21 and 22). Unscrew the pedestal plate (x), if there is one. Unscrew the recoil starter (a) and the fan housing (p), taking care of the dowel sleeves. Unscrew the starter drum from the magneto flywheel. On KM 48 engines, unscrew the fan wheel with cast starter drum. Remove cover plate.

Magneto flywheel

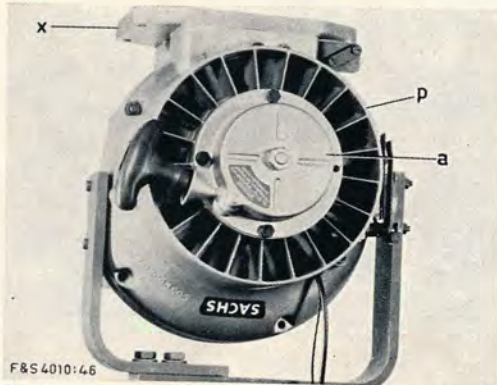
Fig. 8

Set the hook wrench (k, repair tool No. 10) on the magneto flywheel and unscrew the collar nut. Remove the spring washer. Place protective cap (repair tool No. 4) on the threaded end of the mainshaft and pull the magneto flywheel with puller (n, repair tool No. 8).



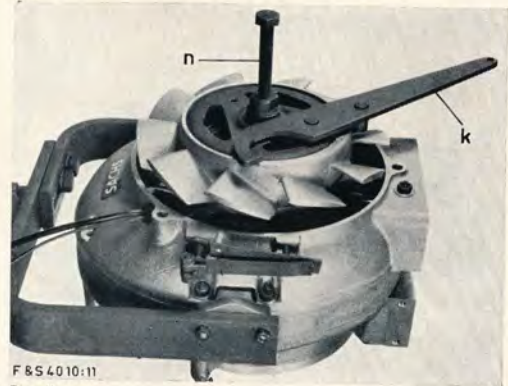
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Fig. 6



F&S 4010:46

Fig. 7



F&S 4010:11

Fig. 8

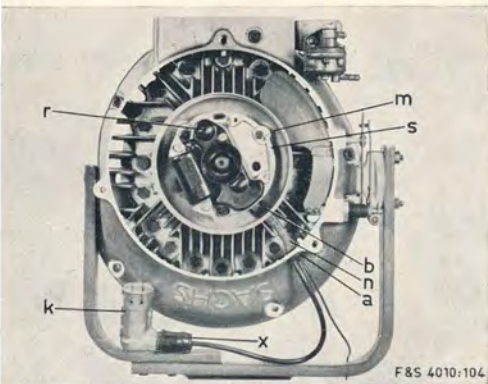


Fig. 9

Armature base plate

Fig. 9

Screw off spark plug cap (k) and remove rubber cap (x). Unscrew armature base plate (s) and lift it off with its cables. Take care of heat-resisting protective tube (n). Always fit armature base plate and the magneto flywheel together. Remove rubber grommets (a and b) and the key.

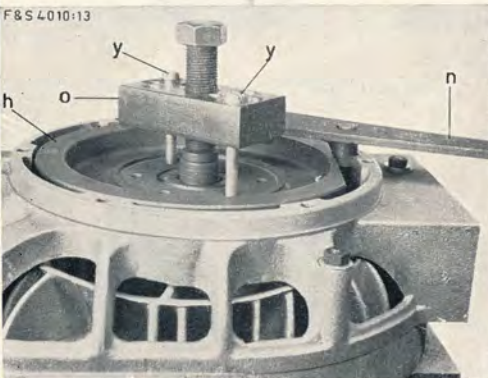


Fig. 10

Flywheel

Fig. 10

Place the hook wrench (n, repair tool No. 10) with its long stud between the flywheel face and the housing cover and unscrew the nut. Remove the spring washer. Set protective cap (repair tool No. 6), screw puller (o, repair tool No. 9) with 2 fillister head screws (y) M 6 x 60 and pull the flywheel. Remove the key.

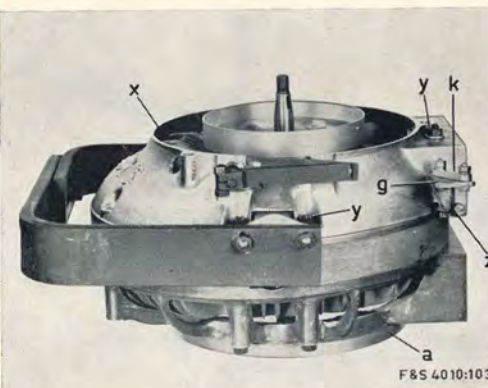


Fig. 11

Housing cover and fan cover

Fig. 11

Unscrew cover (k) or fuel pump with gasket. On KM 37 engines, unscrew bracket (g) from fan cover. Unscrew nuts (y) and remove hexagon head screws, each with 2 washers. Take off housing cover (a) and fan cover (x). Take care of dowel sleeves. On KM 37 engines, unscrew the connection pipe (z) from the magneto side end cover.

End cover on power take-off side

Fig. 12

Unscrew 18 nuts and remove the hexagon head screws, each with 2 washers. Lift off the end cover (p). Take care of seals, corner seals and springs that may have remained stuck (protect the end cover face from damages).



Fig. 12

Rotor and rotor housing

Fig. 13

Remove rotor (a), take care of seals, corner seals and springs that may have remained stuck (protect the rotor from damages). Undo screws (g), loosen the bracket of the mounting jig, push outwards, force out the dowel sleeves (s) upwards with a cylindrical pin and remove the rotor housing (x) (protect the rotor housing from damage).

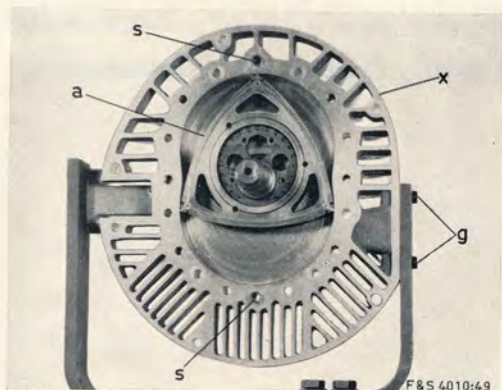


Fig. 13

Bearing cover

Fig. 14

Unscrew 3 hexagon socket head screws, remove bearing cover (f) and sealing ring. Remove circlip (n) and shims, if there are.

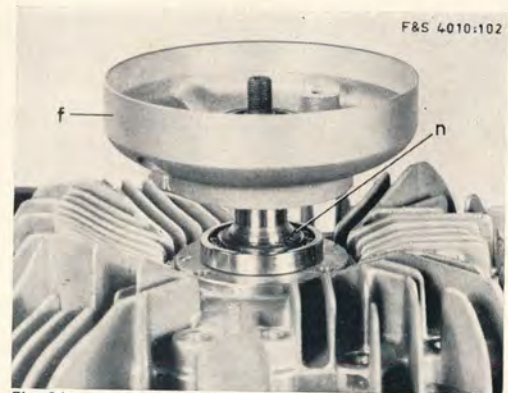
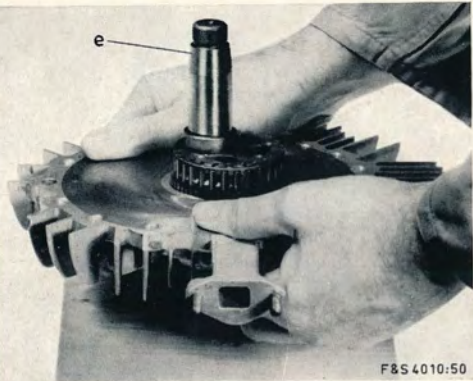


Fig. 14



Eccentric shaft

Fig. 15

Remove the magneto side end cover from the mounting jig. Take out eccentric shaft (e) from the end cover by tapping on a wooden block and remove deep groove ball bearing.

Fig. 15

Thoroughly clean all parts, check for wear (checking the end covers, the rotor and the rotor housing see page 15) and replace as needed. It is advisable to replace all gaskets when overhauling an engine.

Use only Genuine SACHS spare parts.

WORKING ON INDIVIDUAL PARTS

Exchange of seals without dismantling the engine

To pull out defective seals, a special seal puller (repair tool No. 1) is used.

Pulling the seals

Fig. 16

Always observe and note the seal's installation measurements x, o or y before pulling seals, so that the new seals can be pressed in with the identical measurements.

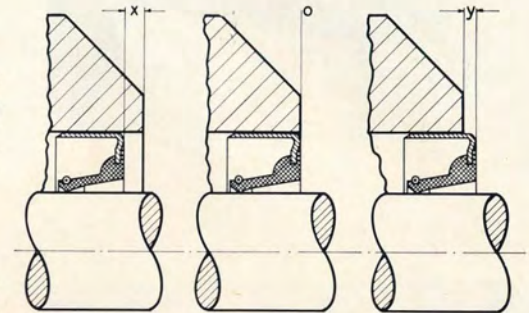


Fig. 16

Note:

The non-observance of the seal's installation measurements can result in engine troubles, through the closing of oil channels in the crankcase or through seizure of rotating parts.

Fig. 17

It is impossible to pull a seal from outwards, when it is blocked by a lip (a).

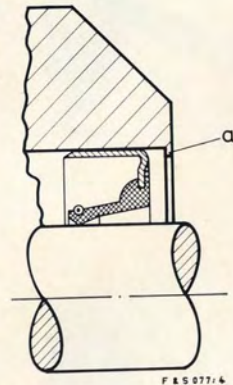


Fig. 17

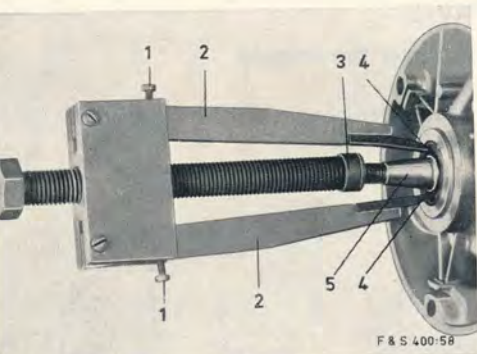


Fig. 18

Apply the seal puller assembly, so that both ends of the seal hooks (4) are seated behind the steel rim of the seal. Press the two arms (2) equally outwards by screwing the two screws (1) in, observing that the crankshaft (5) and thrust bolt (3) are aligned.

Fig. 18

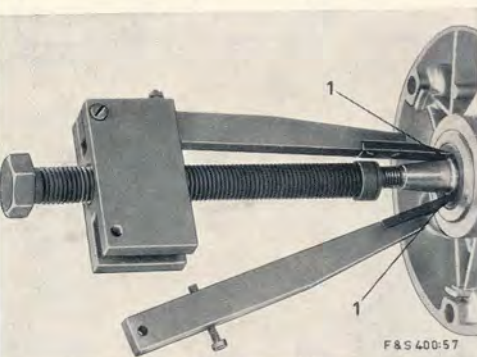


Fig. 19

If the distance between the shaft and the steel rim of the seal does not allow the seal puller to be inserted, remove one of the arms and insert both hooks (1) at an angle. Fasten arm and pull seal.

Note:

The steel rim of the seal can rip apart in the case of stuck or oxydized seals. It is therefore recommended to first loosen the seal from its seat by tapping it lightly with a piece of pipe.

Installation:

Fig. 20

Before installing the seal, fill the hollow space with high temperature grease and lubricate the sealing lip slightly.

To prevent damage to sealing lip from sharp edges on the shaft, use adapter sleeve. In case of need, the sharp edges can be covered with a piece of scotch tape.

Set the seal onto the shaft and tap it into place with a properly sized piece of pipe, observing the installation measurements x, y or o of Fig. 16.

Do not press in seal in an angular position.



Fig. 20

4

Inspecting the end covers, rotor and rotor housing for wear

1. End covers

The magneto side end cover and the power take-off side end cover can be refinished 3 times and replaced separately.

The end covers are available on a trade-in basis and are marked according to the number of refinishing with N I (= 1st refinishing), N II or N III and are to be obtained through a F & S representative.

The end covers are acceptable for trade-in, if they are free from breakage, cracks and do not have any damage caused by violence.

In foreign countries, where trade-in parts cannot be obtained for reasons of custom clearance or dispatching procedures, it is possible to refinish end covers when the following is observed:

- a) Refinishing is to be done on a rotating bed grinding machine.
- b) Roughness: $R_t = 6.3 \mu m$ (0.00248 in.) corresponds to $\blacktriangledown\blacktriangledown\blacktriangledown$ according to German Standard DIN 3142, row 2.
- c) Insert the end cover by its bore and adjust it in such a manner that the face run-out measured at the working area of the rotor on the end cover does not exceed 0.01 mm (0.0003937 in.).
- d) Permissible unevenness 0.02 mm (0.0007874 in.).

The end covers can be refinished 3 times (0.3 mm = 0.0118 in. each). The end covers are to be marked according to each refinishing process, for example:

- N I = 1st refinishing
- N II = 2nd refinishing
- N III = 3rd refinishing

Marking the end covers.

Fig. 21 and 22

Power take-off side end cover

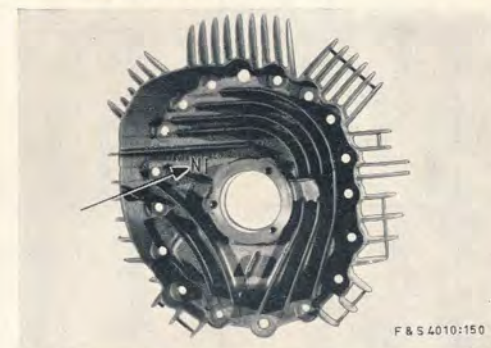


Fig. 21

Magneto side end cover

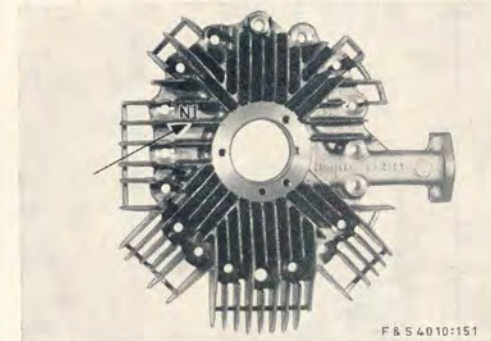
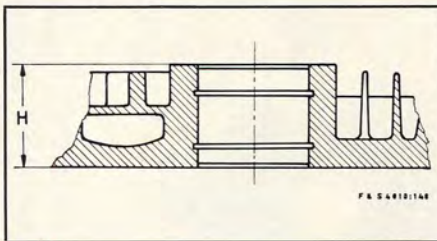


Fig. 22

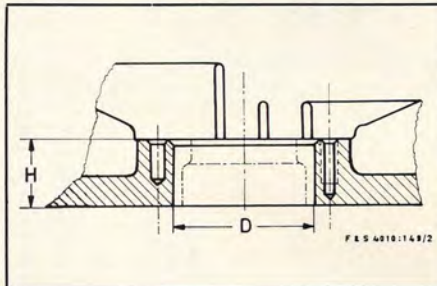
When mounting a refinished end cover, check the length of the dowel sleeves and when necessary shorten them

| | | | |
|-------|---------------------|----|------------------------------|
| | from | to | |
| KM 37 | 41.5 mm (1.634 in.) | 40 | -0.2 mm (1.575 - 0.0079 in.) |
| KM 48 | 54.5 mm (2.146 in.) | 53 | -0.2 mm (2.086 - 0.0079 in.) |



| | Standard | 1st refinishing | 2nd refinishing | 3rd refinishing |
|--------------------------|---------------------------------------|--|--|--|
| End cover (PTO side) No. | 2711 003 200 | 2711 003 202 | 2711 003 203 | 2711 003 204 |
| Height of hub "H" ← | 37.5 -0.1 mm 1.477 -0.0039 in. | 37.2 -0.1 mm 1.4649 -0.0039 in. | 36.9 -0.1 mm 1.4524 -0.0039 in. | 36.6 -0.1 mm 1.4406 -0.0039 in. |
| Distinctive marking | | N I | N II | N III |

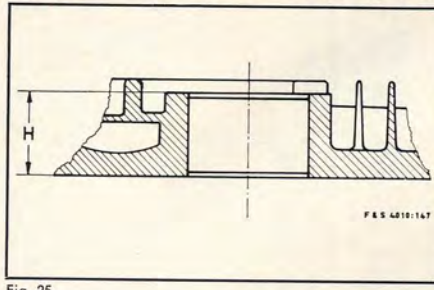
Fig. 23



| | Standard | 1st refinishing | 2nd refinishing | 3rd refinishing |
|------------------------------|---------------------------------------|--|--|--|
| End cover (magneto side) No. | 2711 016 202 | 2711 016 212 | 2711 016 213 | 2711 016 214 |
| Height of hub "H" ← | 22.0 $+0.1$ mm 0.866 $+0.0039$ in. | 21.7 $+0.1$ mm 0.8542 $+0.0039$ in. | 21.4 $+0.1$ mm 0.8424 $+0.0039$ in. | 21.1 $+0.1$ mm 0.8306 $+0.0039$ in. |
| Distinctive marking | | N I | N II | N III |
| Shim 0.3 mm (0.0118 in.) | | 1 x 2744 034 000 | 2 x 2744 034 000 | 3 x 2744 034 000 |

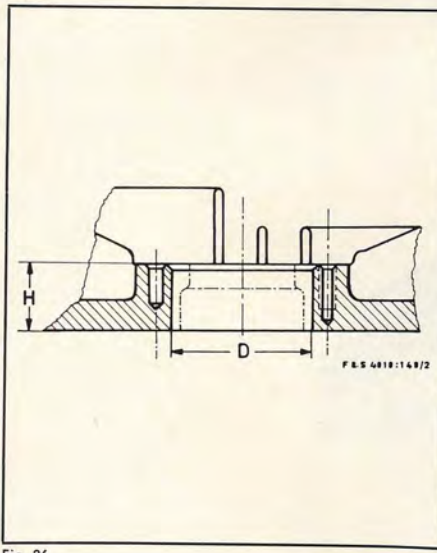
Fig. 24

Repair dimensions for SACHS-Wankel engine KM 48



| | Standard | 1st refinishing | 2nd refinishing | 3rd refinishing |
|--------------------------|---------------------------------------|---|--|-----------------------------------|
| End cover (PTO side) No. | 2711 018 200 | 2711 018 201 | 2711 018 202 | 2711 018 203 |
| Height of hub "H" ← | 30.0 -0.1 mm 1.181 -0.0039 in. | 29.7 -0.1 mm 1.1696 -0.0039 in. | 29.4 -0.1 mm 1.1577 -0.0039 in. | -0.1 mm 1.1459 -0.0039 in. |
| Collar bush No. | 2747 006 200 | 2747 006 200 | | |
| Height of collar bush | 41 mm (1.6142 in.) | 40 mm (1.5748 in.) The bush must be shortened by 1 mm (0.03937 in.). | | |
| Distinctive marking | | N I | N II | N III |

Fig. 25



| | | | | |
|---|---------------------------------------|--|--|--|
| End cover (magneto side) No. Bore "D" = ϕ 48 mm (1.890 in.) | 2711 016 300 | 2711 016 306 | 2711 016 307 | 2711 016 308 |
| End cover (magneto side) No. for precision governor Bore "D" = ϕ 48 mm (1.890 in.) | 2711 016 301 | 2711 016 309 | 2711 016 310 | 2711 016 311 |
| End cover (magneto side) No. Bore "D" = ϕ 46 mm (1.811 in.) | 2711 016 200 | 2711 016 206 | 2711 016 207 | 2711 016 208 |
| End cover (magneto side) No. for precision governor Bore "D" = ϕ 46 mm (1.811 in.) | 2711 016 201 | 2711 016 209 | 2711 016 210 | 2711 016 211 |
| Height of hub "H" ← | 22.0 $+0.1$ mm 0.866 $+0.0039$ in. | 21.7 $+0.1$ mm 0.8542 $+0.0039$ in. | 21.4 $+0.1$ mm 0.8424 $+0.0039$ in. | 21.1 $+0.1$ mm 0.8306 $+0.0039$ in. |
| Shim 0.3 mm (0.0118 in.) | | 1x2744 034 000 | 2 x 2744 034 000 | 3 x 2744 034 000 |
| Distinctive marking | | N I | N II | N III |

Fig. 26

Note:

After each refinishing of end covers, and in order to prevent the eccentric shaft from axial movements, a shim (F & S part No. 2744 034 000) of 0.3 mm thickness (0.0118 in.) each must be placed between the magneto side end cover and the spur pinion (o, Fig. 34).

- 1st refinishing — 1 shim
- 2nd refinishing — 2 shims
- 3rd refinishing — 3 shims

The collar bush in the power take-off side end cover in the KM 48 engine with 41 mm (1.6142 in.) length must be shortened to a total length of 40 mm (1.5748 in.) at the 1st refinishing. This shortening has to be operated on the side of the collar with ϕ 44 mm (1.732 in. dia.). At the 2nd and 3rd refinishing the bush must not be shortened again.

If the bush in an engine which has not yet been refinished, is already 40 mm (1.5748 in.) long, it must not be shortened.

2. Rotor

The rotor must be replaced if the ring gear is damaged. Spur pinion (o, Fig. 34) in the magneto side end cover must be replaced together with the rotor.

Note:

The rotor is only available together with the needle cage (k, Fig. 37).

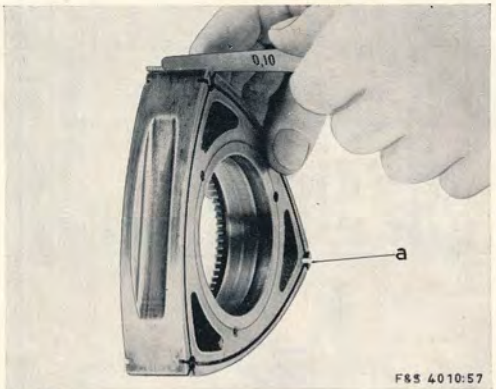


Fig. 27

Fig. 27

After decarbonizing the rotor (see page 25), set new apex seals into the grooves of the rotor and check the side play with a feeler gauge. The maximum permissible apex seal side play is 0.10 mm (0.003937 in.)

Attention!

The apex seal grooves are becoming gradually conical; the feeler gauge is not to be inserted more than approximately 2 mm (0.078 in.) into the grooves when measuring.

a) Apex seals

Fig. 28 and 29

The apex seals are to be measured at the positions (a, b and c) with a micrometer.

Original measurement for KM 37:

$$6.9 \text{ — } 0.15 \text{ mm}$$

$$0.2716 \text{ — } 0.0059 \text{ in.}$$

Permissible wear: 0.5 mm (0.020 in.) (at the measuring positions a, b and c)

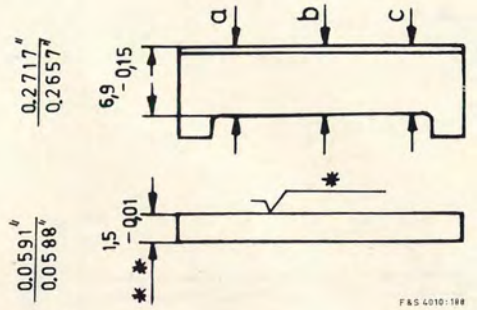


Fig. 28

Original measurement for KM 48:

$$5.5 \text{ — } 0.15 \text{ mm}$$

$$0.216 \text{ — } 0.0059 \text{ in.}$$

Permissible wear: 0.4 mm (0.016 in.) (at the measuring positions a, b and c)

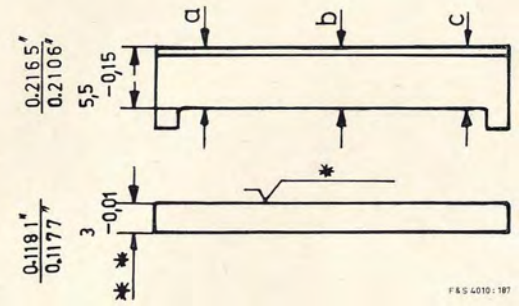


Fig. 29

For the KM 37/48, the permissible wear (unevenness) between the measuring positions a and c: maximum 0.2 mm (0.0079 in.).

- *) Permissible unevenness 0.02 mm (0.00079 in.)
- ***) Permissible wear up to 0.02 mm (0.0079 in.)

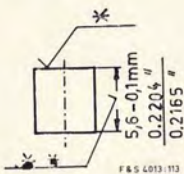


Fig. 30

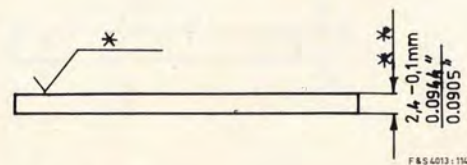


Fig. 31

b) Sealing pins

Fig. 30

The sealing pins must be evenly worn. Check with a micrometer.

The measurements relate to the KM 37 and KM 48.

*) Permissible unevenness 0.05 mm (0.0019685 in.)

***) Permissible wear up to 0.3 mm (0.0118 in.)

c) Side seals

Fig. 31

The measurements relate to the KM 37 and KM 48

Original measurement:

2,4—0,1 mm
(0.0945 — 0.00039 in.)

Permissible wear:
0.2 mm (0.0079 in.)

The side seals should not be worn more than 0.1 mm (0.0039 in.) at their ends, as compared with the rest of the side seal.

d) Apex seal springs, sealing pin springs and side seal springs must be replaced at every disassembly of the engine.

*) Permissible unevenness 0.1 mm (0.0039 in.)

***) Permissible wear up to 0.2 mm (0.0079 in.)

3. Rotor housing

The rotor housing must be replaced, when the elnisil-coating of the sliding surface has been damaged through dirt or foreign matters or when cracks (not hairline cracks) are perceptible.

When the above mentioned influences are not present, the wear of the sliding surface is very minor.

Note:

When replacing the rotor housing, the apex seals and their springs must also be replaced by new ones.

Replacing the needle bearing (KM 37), the collar bush (KM 48), the spur pinion and the oil seals.

When working on the end covers, utmost care must be taken not to damage the sliding surfaces. The smallest damages could lead to seizure of the engine or to leakiness and power loss.

Do not remove minor carbon deposits from the sliding surfaces of the end covers. Remove major carbon deposits carefully.

Inspect the end covers for mechanical damages especially at the edges of the ports and on the sliding paths of the side seals and sealing pins.

If the even faces of the end covers have been damaged by the seals, they can be refinished as outlined on page 15.

Power take-off side end cover (KM 37)

Fig. 32

Remove circlip (a), washer and needle cage (k).

Heat the end cover to approx. 150° Centigrades (300° F) and press out the bush for the needle cage.

Remove the second washer and the second circlip.

Press out the oil seals.

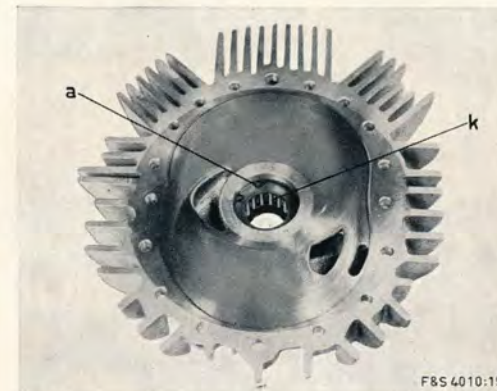


Fig. 32

Note:

When inserting the circlips, take utmost care that they are perfectly seated in their grooves.

Insert circlips and place washer.

Heat the end cover (approx 150° Centigrades = 300° F) and press in the bush.

Before mounting the oil seal, fill its groove with high viscosity grease (Alvania 3) and slightly coat the sealing lip.

Press the seal in flush, from outside.

Place the needle cage, second washer and insert the second circlip.

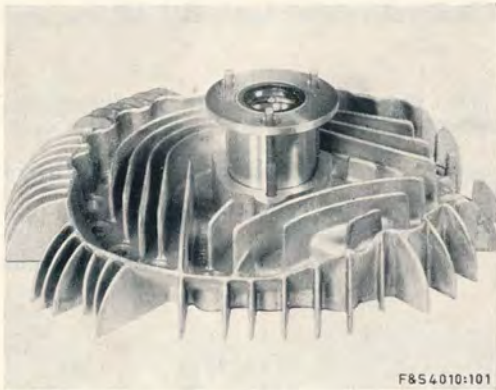


Fig. 33

F&S 4010:101

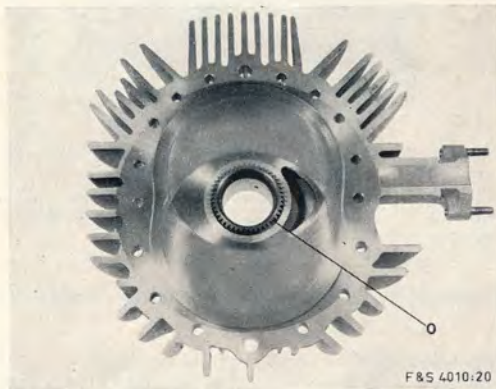


Fig. 34

F&S 4010:20

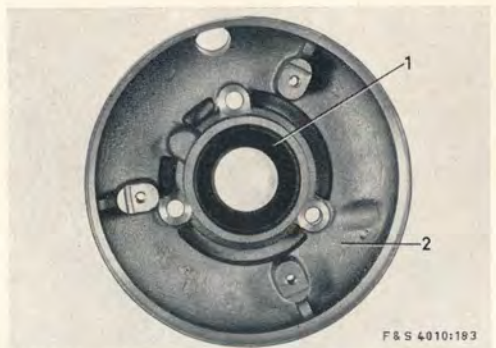


Fig. 35

F&S 4010:193

Power take-off side end cover

Fig. 33

(KM 48)

Unscrew 3 screws.

Heat the PTO side end cover (approximately 150° Centigrades = 300° F) and press out the collar bush with oil seal.

Screw 3 studs M 5×50 in the end cover, for centering the collar bush.

Heat the end cover (approx. 150° Centigrades = 300° F) and press in the collar bush to its stop.

Screw the collar bush tight with 3 screws M 5×15 (hexagon socket head).

Before mounting the oil seal, fill its groove with high viscosity grease (Alvania 3) and lightly coat the sealing lip.

Press the new oil seal flush.

With a refinished end cover, the collar bush must be shortened by 1 mm (0.03937 in.), see page 18.

Magneto side end cover

Fig. 34

For pressing in and out the spur pinion (o), heat the end cover to approx. 150° Centigrades (300° F).

For pressing in the spur pinion (o), take care of the alignment bore in the pinion and of the alignment pin in the magneto side end cover.

If that end cover has been refinished, see note on page 18.

Note:

If the teeth of the spur pinion (o) are damaged, the teeth of the rotor (h, Fig. 42) must be inspected and in case of damage the rotor assembly replaced.

When replacing the rotor, pay attention to the note under 2. Rotor on page 18.

Bearing cover

Fig. 35

Press the oil seal (1) out of the bearing cover (2) and press in the new oil seal, as illustrated, flush, with the sealing lip first.

Fill the groove of the oil seal with high viscosity grease (Alvania 3) and lubricate the sealing lip slightly.

Eccentric shaft

Bearings of the eccentric shaft

Fig. 36

Disassembly

Remove circlip (x) and needle cage (a).

On KM 48, remove circlip and needle cage also on the power take-off side.

Insert the eccentric shaft, as illustrated through the riveting stock (repair tool No. 11) and remove the tubular rivets (z) with riveting tool (repair tool No. 12).

Remove washers (b) and needle cages (k).

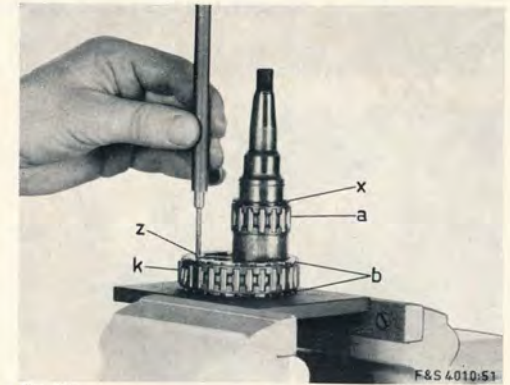


Fig. 36

F&S 4010:51

Fig. 37

Assembly

Slide the needle cage (k) onto the eccentric shaft, place washers (b) (chamfered bores pointing outwards), insert tubular rivets (z) from the magneto side (see arrow).

Place eccentric shaft on riveting stock (x) and caulk the rivets with riveting tool; the washers (b) must be tight.

Fit the needle cage (a, Fig. 36) and insert the circlip (x, Fig. 36). On KM 48, mount the needle cage and the circlip also on the power take-off side.



Fig. 37

F&S 4010:52

Disassembling, decarbonizing and assembling the rotor.

When the rotor seals are stuck in their grooves after a long period of running time, because of carbon build-up, it is advisable to dismantle the rotor as follows:



Fig. 38 F&S 4010:53

Disassembly

Fig. 38

Set the decarbonizing tool (repair tool No. 15) to the end of the apex seal (c) and remove the latter and its springs (d) by tapping lightly. (Observe page 20, para b and d)



Fig. 39 F&S 4010:54

Fig. 39

Loosen the sealing pin (e) by turning with the decarbonizing tool and force it out of its recess. Remove the 2 springs under the sealing pin. (Observe page 20, para c and d)

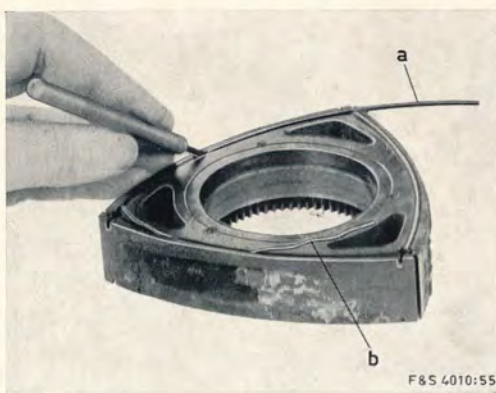


Fig. 40 F&S 4010:55

Fig. 40

Remove the side seals (a) by lightly tapping with the decarbonizing tool. Remove the side seal springs (b).

Decarbonizing

Fig. 41

When all seals and springs are removed, clean the grooves and the seals with the decarbonizing tool. Remove only major carbon build-up (flakes) from the combustion chamber faces of the rotor. Do never attempt to scrape the rotor faces completely clean to the bright metal.

Note: After decarbonizing, refer to the instructions on page 18 under "2. rotor".



Fig. 41 F&S 4010:56

Assembly

Fig. 42

Lubricate the grooves for the seals lightly with vaseline grease. Set two sealing pin springs (f) into each opening, so that the ends are pointing away from each other (align slots with grooves in rotor apex) and insert the sealing pins (e).

Note: The rotor is shown with only 1 of its 3 sets of sealing elements, the other two sets are already installed.

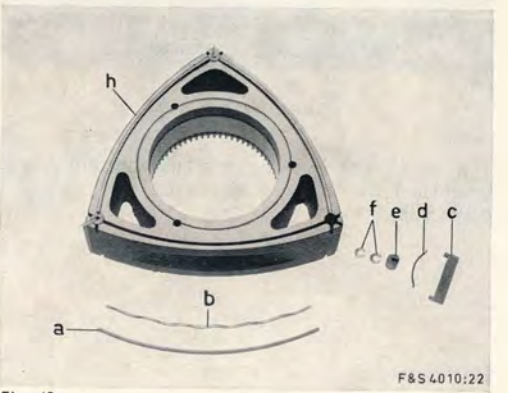


Fig. 42 F&S 4010:22

Fig. 43

Mount the side seal spring (2, or b, Fig. 42) in such a manner that its two outer bows (see arrows) come into contact with the ends of the side seal (1). Insert the apex seals (c, Fig. 42) and the springs (d, Fig. 42) only after mounting the rotor into its housing.

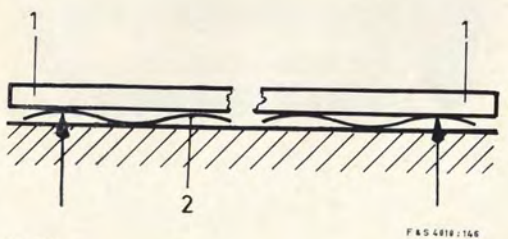
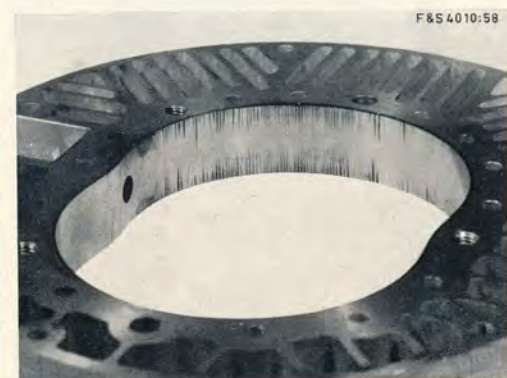


Fig. 43 F&S 4010:166

Decarbonizing the rotor housing

Decarbonizing

Remove the carbon build-up carefully from the exhaust port and the spark plug bore of the rotor housing with a screwdriver or a triangular scraper, taking care that no metal is scraped off. Cleanse the rotor housing, wash it when necessary.



Replacing

Fig. 44

The rotor housing must be replaced, when major chatter marks, as illustrated, are present and clogged with carbon deposit.

The sliding surface of the housing cannot be refinished. Therefore, a housing with a defective sliding surface must be replaced by a new one.

Fig. 44

Note:

The new rotor housing must be mounted with new apex seals only, after having inspected the apex grooves of the rotor for possible wear (see instructions on page 18).

(c, Fig. 42)

Muffler



Fig. 45

Do never modify or tamper with the inside of the exhaust system. Any such modifications not only have an adverse effect on fuel consumption, engine performance and noise, but are also against regulations and subject to penalty.

Fig. 45

Top speed limiting device

The top speed limiting device is fitted in the fan cover and protects the engine from over-speeding.

Operation

The air vane of that device is governed by the cooling air stream. When the engine load decreases, the engine speed raises, creating a stronger air stream that moves the air vane against the pressure of a spring. This movement is transmitted via a lever arrangement to the throttle valve of the carburettor and reduces or closes the intake. The engine speed will therefore decrease, producing likewise a smaller cooling air stream. The spring turns the air vane back to its original position, opening at the same time the throttle again.

Dismantling

Fig. 46

Unhook spring (a), loosen nut (f) and remove lever (x).

Remove washers (g) and spring (a).

Remove air vane (e) with shaft (l) and washer.

Knock out air vane bush (r) with copper pin, take care of tolerance ring.

Remove circlip (k), washer, fork lever (i), second washer and second circlip.

Press out pivot pin (m).

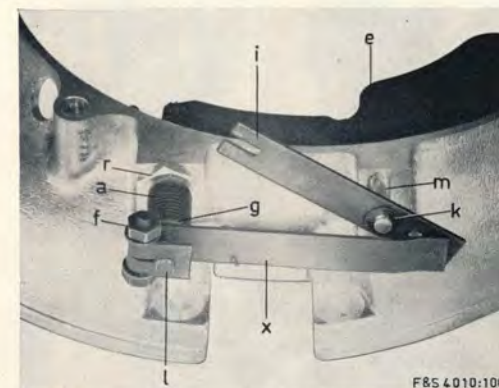


Fig. 46

Assembly

(See Fig. 46)

Press pivot pin (m) from the outside into the fan cover to a depth of 19 mm (0.748 in.) and press the air vane bush (r) with tolerance ring home.

Fit circlip (k), washer, forked lever (i), second washer and second circlip onto the pivot pin.

Insert air vane with air vane shaft and washer into the air vane bush.

Hook the spring (a) with its short end into the bore at the air vane bush and fit washers (g).

Slide lever (x) onto the air vane shaft, catching the lug into the recess of the forked lever (i). Hook spring (a) at the lever.

Adjusting

Fig. 47

Lift the air vane up to the stop pin, set the lever (2) so that the lower edge of the fork end of the lever (i, see arrow) is at the same height as the upper edge of the lever (2), as illustrated.

Press air vane shaft to the outside and clamp the lever (2) tight.

The air vane must operate easily, without rubbing anywhere.

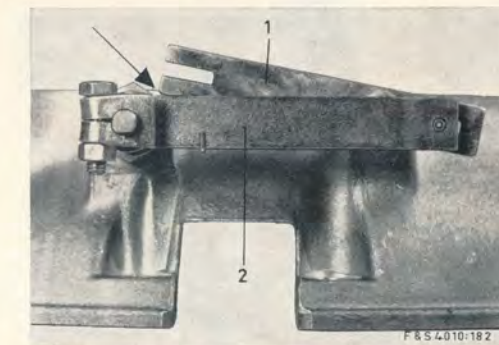
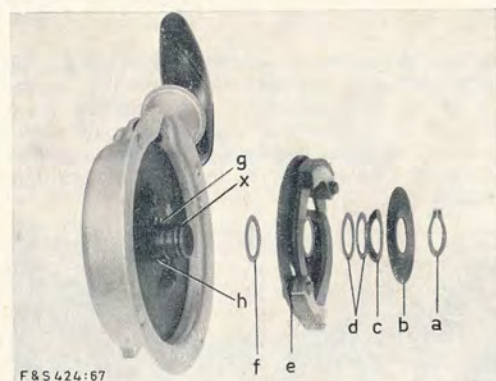


Fig. 47

Recoil starter



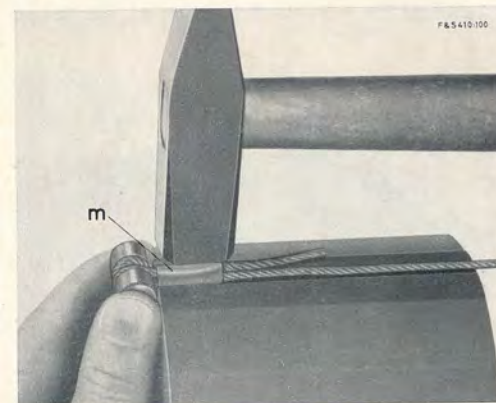
F&S 424:67

Fig. 48



F&S 424:68

Fig. 49



F&S 410:100

Fig. 50

Disassembly

Fig. 48

Grip the recoil starter in a vice, as shown in Fig. 49.

Remove circlip (a), washer (b), spring washer (c), shims (d), friction plate (e) assembly with driving levers, shim (f) and circlip (g).

Note:

On a former recoil starter model, the spring washer (c) is fitted underneath the friction plate and the circlip (g) is not used.

Fig. 49

Pull the starter cable approx. 50 cm (20 in.) and lock the cable pulley with a home-made tool (see illustration).

Fig. 50

Remove the retaining pin out of the starter handle and open the clamping sleeve (n) by tapping with a hammer. Pull retaining pin and starter handle from the starter cable.

Remove locking tool and allow the cable to recoil into the housing completely.

Carefully lift off the cable pulley, taking care that the spiral spring remains in position.

Remove ring (g, Fig. 53).

Fig. 51

To take out a defective spring, knock the starter housing with the open side down on the work bench and control its uncoiling with the housing.

Remove check plate (4, Fig. 52).



F&S 410:124

Fig. 51

Assembly

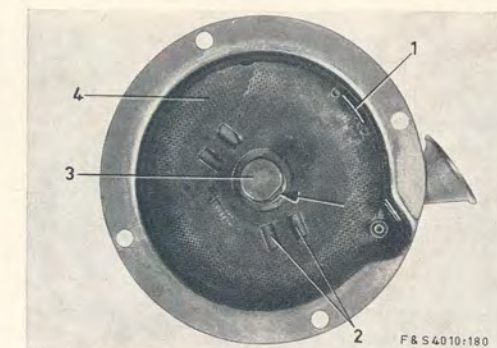
Fig. 52

Note:

When mounting a new bearing pin (3), make sure that its flat side (see arrow) points to the opening for the cable and parallel to the direction of pull of the starter cable.

Lubricate the bearing pin slightly with a film of "Anticorit 5" oil.

Insert the check plate (4) so that the bent-up lug (1) is slightly behind the spring anchoring point (in starting direction) and so that the pressed-out lugs (2) lock in with the corresponding ribs on the bottom of the starter housing.



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Fig. 52

Fig. 53

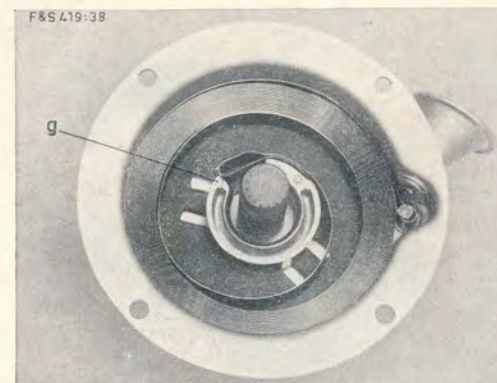
Fit the end of the spiral spring, as illustrated, and insert the spring winding after winding.

Note:

The first winding of the spiral spring must run outside the tab (1, Fig. 52), whereas all the remaining windings are inside of it. Make sure that the windings lie flatly on the check plate.

Place holding ring (g) so that the riveted end of the spring fits snugly in the recess of the spring.

Coat the spiral spring with a film of "Anticorit 5" oil.



F&S 419:38

Fig. 53



Fig. 54

Fig. 54

Fit cable disc onto the bearing pin, hook spiral spring into the driving tab and mount circlip (6, Fig. 55).

Coil the cable pulley with spiral spring in the starting direction with the self-made winding tool up to the stop. Release spiral spring 1 ... 2 turns, until the recess for the solder nipple in the cable pulley faces the opening in the starter housing for the starter cable.

In that position, lock the cable pulley or winding tool with an appropriate round material.

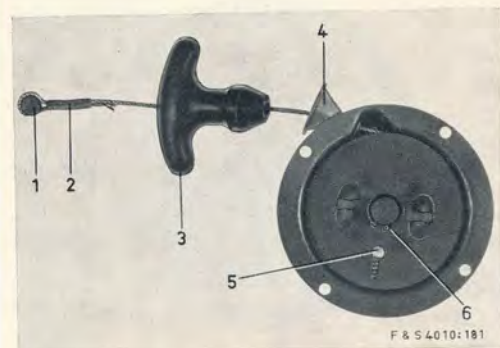


Fig. 55

Fig. 55

Insert the starter cable through the cable fitting point (5) in the cable pulley and through the cable guide (4) in the starter housing.

Pull the starter cable.

Place the solder nipple in position, making sure that the flat face of the nipple, when the cable is on the pulley, points to the starter housing.

Mount the starter handle (3) and the clamping sleeve (2) onto the cable, wind the cable twice around the retaining bolt (1) and fasten with the clamping sleeve.

Pull the retaining bolt into the starter grip and let the cable wind in.



Fig. 56

Fig. 56

Fit shims and friction disc (3) with driving levers (1), ensuring that the driving levers engage in the cable pulley.

Fit, one after the other, shims (d, Fig. 48), spring washer (c, Fig. 48), and covering washer (2), insert circlip (4).

Note:

If the driving levers do not move outwards when activating the starter, more shims must be fitted on the friction disc (3).

Flywheel magneto and magneto generator

Replacing the ignition and lighting armature.

Fig. 57

1. Remove dust protective cap.
2. Pass the cables through a hole in the centering unit and set the armature base plate on it.
3. Position the centering piece and secure the hexagon head screw by hand.
4. Remove defective armature and replace by a new one.
5. Set the centering ring on, press the replaced armature against the centering ring and tighten both screws.

After removal of the centering ring, the proper air gap between the pole shoes and the magneto flywheel has been set.



Fig. 57

Note:

The F & S centering device will no longer be available after exhaustion of present stocks.

New ignition or lighting coils must be installed according to the installation directions supplied with BOSCH spare parts.

An air gap of 0.25 ... 0.35 mm (0.00984 ... 0.0138 in.) must be strictly set between the pole shoes and the magneto flywheel, in order to achieve the best ignition and lighting efficiency.

Replacing the breaker points

The contact breaker must be replaced, when the breaker points, sliding bush or pivot pin are worn or when the bearing bush, breaker point lever or the lever spring are damaged.

1. Unscrew the short circuit cable, observing the proper order of insulating washers for the connecting bracket of the point holder.
2. Remove safety and point lever from pivot pin (observing shims).
3. Unscrew fillister head screw and remove point holder.
4. Unscrew pivot pin from armature plate.

Install new parts in the opposite order, observing the following points:

Swage the pivot pin after screwing it in.

Use only the breaker point contact set prescribed for this engine.

The breaker points should be of equal height and parallel to each other after the installation.

Lubricate the pivot pin with BOSCH grease Ft 1 v 8, before installing it.

Lubricate the lubricating pad and the cam follower with BOSCH grease Ft 1 v 4 (obtainable in tubes at BOSCH service centers).

Make sure that no oil or grease gets onto the breaker points.

Replacing the condenser

1. Unsolder both connecting wires.
2. Turn armature base plate over and press the condenser out with a wooden dowel.
3. Scrape the high spots on the bore caused from previous swaging.
4. Push the condenser into the bore and swage carefully.
5. Re-solder both wires.

Carburettor

The type of carburettor to be fitted to the engine and the choice of its jet sizes are determined by means of tests carried out at the factory. The carburettor setting, determined in this way, represents an optimum efficiency setting, and for this reason it is advisable not to make any changes of your own.

No arbitrary carburettor adjustments are to be made as long as the engine runs smoothly at idle speed, when opening the butterfly valve the engine speed increases steadily without sputtering or "coughing" and the engine reaches its full output. If the engine sputters or falters or if black fumes are emitted from the muffler, then the mixture is too rich. Short blowbacks or an unsteady running of the engine at a given speed or the engine back-firing through the carburettor with a blue flame and starting difficulties indicate that the mixture is too lean.

With correct carburettor setting, a correctly functioning air filter and a spark plug with the proper thermal value, the insulator of the spark plug should show a medium brown color. If the spark plug shows heavy carbon deposits or is oily or wet, it means that the air-fuel mixture is too rich. On the other hand, if the spark plug shows a grey or white color, it is an indication that the fuel-air mixture is too lean.

Warning! Do not adjust the mixture too lean, because with the reduction of the fuel, the lubrication quantity is also reduced, thereby endangering the lubrication of the moving parts. Observe that a reserve of the oil lubrication is present when adjusting the carburettor.

Always remember that the engine will run economically only when the carburettor is correctly tuned.

Carburettor adjustment corrections for compensating climatic conditions

When using the engine at altitudes above 3250 ft. (1000 meters), or in the tropics, adjustments to the carburettor setting will be required. As the air density is reduced at high altitudes, (mountains) the supply of fuel to the carburettor should be reduced by changing the main jet size. In tropical areas, however, the setting should be adjusted, to give a richer mixture.

Starting system

On the butterfly valve carburettor the choke is incorporated in the carburettor itself. The choke should be used to facilitate starting from cold. In warm weather conditions or warm engine, the choke should be neither partially nor fully closed (only with a cold engine). Through closing the choke a high vacuum develops in the mixing chamber producing a rich air-fuel mixture.

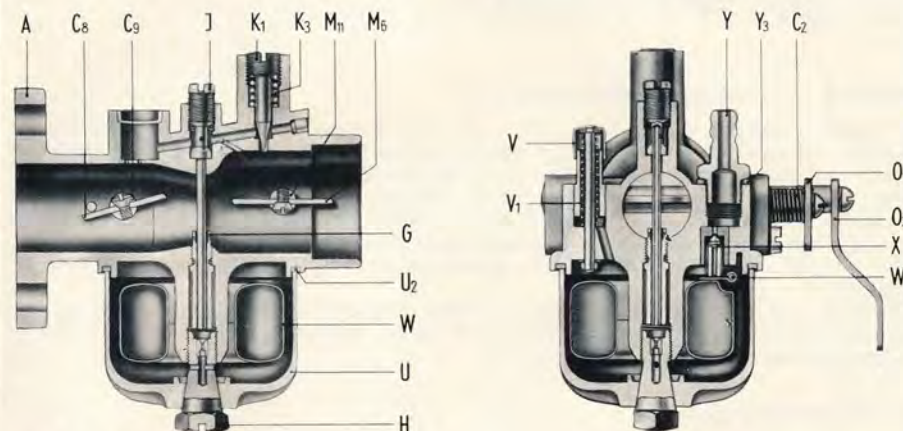
After the engine has started, open the choke slowly.

On butterfly-valve carburettors, a primer button is situated on top of the float chamber which serves to flood the carburettor in cold weather; when using this, the instructions given on the fuel tank of the engine should be followed.

Bing butterfly-valve carburettor

The carburettor, which consists essentially of the mixing chamber and the float chamber, has a flanged connection. The supply of air-fuel mixture to the engine is controlled by means of a butterfly valve.

Fuel is supplied to the carburettor through a flexible pipe. The fuel supply is controlled by a float needle actuated by an annular float which is laterally pivoted, thus enabling an increased closing pressure of the float needle and an exact control to be obtained. The fall from fuel tank to carburettor should not be less than 100 mm (4 in.). An exception are engines with fuel pumps; see section "Fuel Pump". The fuel level is about 4...5 mm (0.157...0.196 in.) below the edge of the carburettor housing. The float chamber is vented through the primer guide (external venting).



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Fig. 58

- | | |
|---------------------------------------|---|
| A = carburettor housing | O ₁ = throttle arm |
| C ₂ = spring | O ₃ = choke arm |
| C ₈ = butterfly valve | U = float chamber |
| C ₉ = valve spindle | U ₂ = gasket |
| G = mixing tube | V = primer button |
| H = main jet | V ₁ = spring - primer button |
| J = idling jet | W = float |
| K ₁ = air regulating screw | W ₂ = pin |
| K ₂ = spring | X = float needle valve |
| M ₆ = choke | Y = fuel connection |
| M ₁₁ = choke spindle | Y ₃ = gasket |

Carburettor adjustment

The adjustment of the carburettor depends on the jet size appropriate to the operating speed required. It can only be corrected by a change of jets (larger or smaller jets).

The air-fuel mixture for idling can be regulated by means of the adjustable air regulating screw (K 1). The setting values for normal operating conditions are shown on page 6 under Specifications.

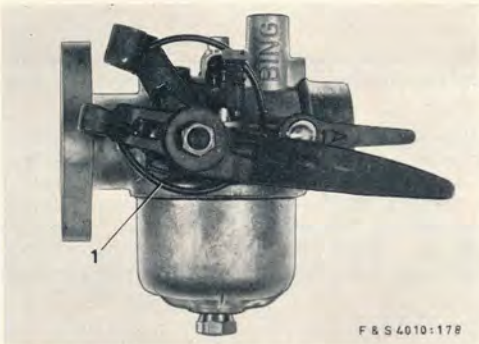


Fig. 59

Maintenance of the carburettor and air filter

At certain intervals every carburettor must be disassembled, cleaned and overhauled. All exterior dirt should be cleaned off with gasoline before disassembly. The holes, ducts, passages and jets must not be cleaned with hard objects (e. g., wire or drill), but should only be rinsed with gasoline and cleaned by air blast (remove diaphragms prior to blowing out). Before assembly, check that all carburettor components (especially jet seats) are in proper working order.

The instructions of the carburettor manufacturers must be observed in every respect

Checking and cleaning the fuel- and air filter in good time helps to achieve satisfactory functioning of the carburettor and longer engine service life, (see "Lubrication and Maintenance chart", page 70).

Special maintenance notes

1. Make sure that the butterfly valve always functions easily.
2. The hinge attachment of the annular float must on no account be distorted, as this will upset the correct fuel level of 4...5 mm (0.157...0.196 in.) below the edge of the carburettor housing.
3. Check that float needle valve functions smoothly and is not leaking.

Fig. 59

Attention!

On engines with lever controlled carburettor and precision governor, the spring (1) is not fitted. On carburettors with cable control, as illustrated, this spring must be fitted.

Fuel pump

The diaphragm of the fuel pump is activated through the vacuum and pressure, which is developed in the intake chamber of the engine, thereby sucking fuel from the tank and pumping it to the carburettor. The rise of the pump should not exceed 15¼ in. (0,4 meter).

The fuel pump can be dismantled for cleaning.

Disassembly

Fig. 60

Remove screw (1) with gasket ring.

Remove cover (7), gasket, sieve (6) and gasket.

Remove the 4 screws and separate the pump housing halves.

Remove diaphragm (3) and gasket.

Unscrew nipple (5).

Cleanse all parts thoroughly, check for defects and replace as necessary.

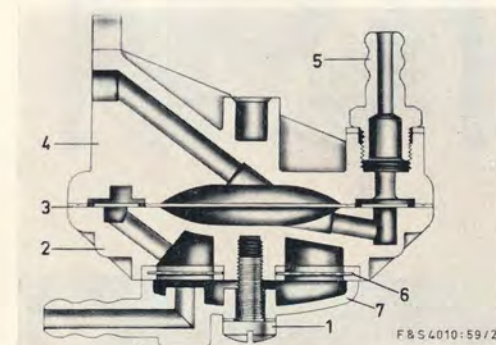


Fig. 60

Assembly

Set the gasket and diaphragm (3) onto the pump housing half (4), so that their contours coincide.

Mount pump housing half (2), observing the alignment pins and secure with 4 screws M 4x12.

Mount the gasket and sieve (6, with support ribs to cover 7), gasket and cover (7), secure with screw (1) M 4 x 12 and gasket ring.

Mount nipple (5).

Note:

The nipple mounted on the cover (7) is for the fuel line coming from the tank.

The nipple (5) is for the fuel line to the carburettor.

Attention!

For KM 37 or KM 48 on MAC outboard engines, a diaphragm with special slots must be used (see Spare Parts List).

The fuel pump with slotted diaphragm is marked with a red colour spot, for identifying purposes.

ASSEMBLING THE ENGINE

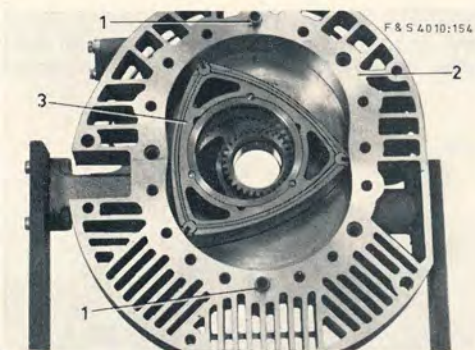


Fig. 61

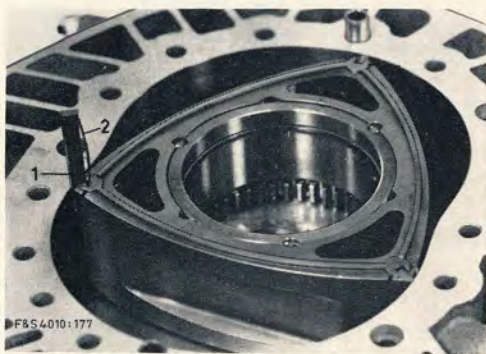


Fig. 62

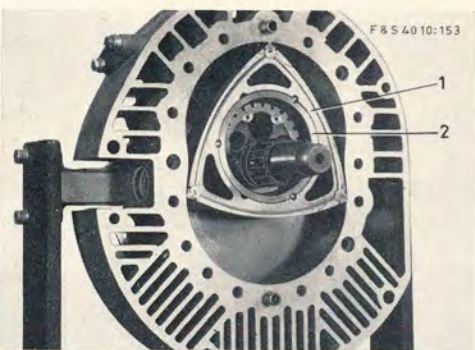


Fig. 63

End cover (magneto side), rotor housing and rotor.

Fig. 61

Mount the end cover (magneto side) to the mounting jig. Place the rotor housing (2), so that the spark plug hole is positioned above the intake port. Fit the dowel sleeves (1). (If the end covers have been refinished, observe the instructions on page 15).

Insert the pre-assembled rotor (3), ring gear downwards. Take care of sealing elements.

Apex seals

Fig. 62

Insert the apex seal (1) into the groove. Place the spring (2), as illustrated, and push the apex seal with its spring into the groove. Mount the other apex seals with their spring in the same way.

Eccentric shaft

Fig. 63

Engage the rotor (1) with the gears and fit the eccentric shaft (2), as illustrated.

End cover on power take-off side.

Fig. 64

Lubricate all working surfaces with an appropriate oil (see chart on page 72).

Fit the mounting sleeve (b, repair tool No. 3) and install the power take-off side end cover (y). Take care of dowel sleeves (1, Fig. 61).



Fig. 64

Fig. 65

Screw the engine block together.

| | |
|---------------------------------------|-----------|
| 15 hexagon head screws M 6 x 55 | } (KM 37) |
| 3 hexagon head screws (1) M 6 x 65 | |
| 15 hexagon head screws M 6 x 70 | } (KM 48) |
| 3 hexagon head screws (1) M 6 x 78 | |

with nuts and each two washers (the washers are placed under the screw head and under the nut).

Tightening torque 0.7 ... 0.9 kpm (5.1 ... 6.5 ft lb).

Fit the mounting bracket (2) to the rotor housing.

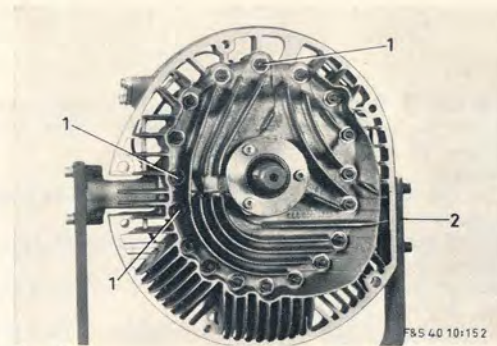


Fig. 65

Grooved ball bearing and bearing cover.

Fig. 66

Heat up the grooved ball bearing (4) and slide it onto the eccentric shaft. Insert the circlip (3).

Note:

On former engine versions, determine with a feeler gauge the play between the inner race of the grooved ball bearing and the circlip (3) and mount shims as required (see Spare Parts List). Place the round sealing ring (5) and fit the mounting sleeve (1, repair tool No. 2).

Press on the bearing cover (2) and screw it with 3 hexagon socket head screws M 6 x 25 with copper sealing washers.

Tightening torque 1.1 ... 1.3 kpm (8.7 ... 9.4 ft lb).



Fig. 66

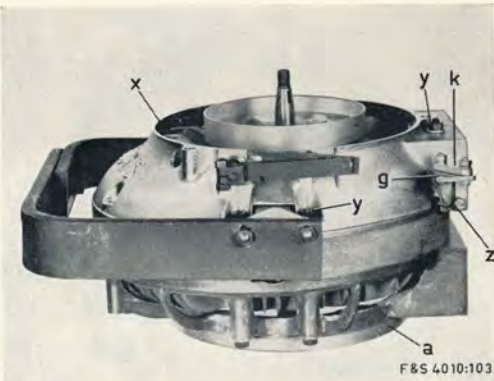


Fig. 67

F&S 4010:103

Bracket, fan cover and housing cover.

Fig. 67

On KM 37 engines, screw the connecting tube (z) to the magneto side end cover.

Take care of the position of the bracket (g).

Insert the dowel sleeves.

Mount the fan cover (x) with the overspeed control and the housing cover (a) and screw them tight with

- | | | |
|------------------------------------|---|---------|
| 5 hexagon head screws M 6 x 90 | } | (KM 37) |
| 1 stud M 6 x 145 | | |
| 5 hexagon head screws M 6 x 105 | } | (KM 48) |
| 1 stud M 6 x 158 | | |

with nuts and each with 2 washers.

Tightening torque 1.0 ... 1.2 kpm (7.2 ... 8.6 ft lb).

On KM 37, fasten bracket (g) with 2 hexagon head screws M 5 x 15 with washers. Place the gasket and fasten the cover plate or the fuel pump with 2 hexagon head screws M 5 x 15 with washers and nuts.

Note:

On KM 48 engines, the cover plate or fuel pump is fastened to the rotor housing.

Flywheel

Insert the key into the eccentric shaft. Degrease the tapers on the eccentric shaft and in the flywheel.

Mount flywheel (h, Fig. 10), hold it with hook wrench (n, Fig. 10), and secure with nut M 20 x 1 and washer.

Tightening torque 7.5 ... 8.0 kpm (56.4 ... 57.8 ft lb).

Armature plate and magneto flywheel

Fig. 68

Degrease the tapers on the eccentric shaft and in the magneto flywheel. Insert the key into the eccentric shaft.

Guide the ignition and contact breaker wires, protected by a heat-resisting tube, together with the rubber grommet (b) through the aperture. Mount the rubber grommet block, taking care that it is correctly seated.

Slide a second heat-resisting protective tube (n) and the rubber grommet (a) onto the ignition and contact breaker wires. Mount the rubber plug (take care of correct seat).

Secure the armature plate, paying attention to the marks (s).

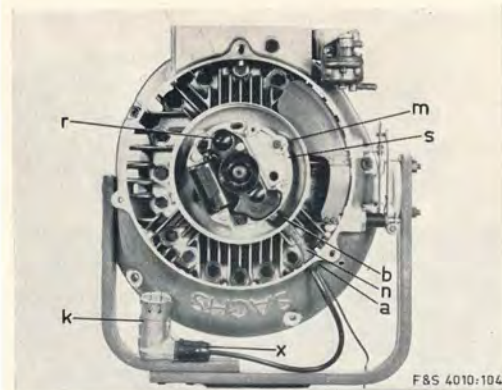


Fig. 68

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New armature plates do not have markings and must therefore be centered in their slots. Fasten the armature plate (m) with 3 Philips type screws M 4 x 14 with washers. Tightening torque 0.2 ... 0.3 kpm (1.4 ... 2.1 ft lb).

Slide the protective cap (x, Fig. 68) onto the ignition cable. Screw the suppressor cap (k, Fig. 68) on the ignition cable and pull the protective cap over the suppressor cap. Unscrew the protective cap (r, Fig. 68).

Mount the magneto flywheel (with fan on KM 37), onto the eccentric shaft, guiding the key into the keyway in the flywheel.

Timing the ignition.

It is recommended that the ignition system be checked each time that the engine is serviced, as the engine performance depends on it and various troubles in the lighting system are caused by an incorrect ignition setting.

The spark plug gap is also to be inspected and when necessary adjusted to 0.5 mm (0.020 in.).

- | | |
|------------------------|-------------------------------------|
| Spark advance: | 10° ... 12° before top dead center. |
| Contact breaker gap: | 0.4 ± 0.05 mm (0.016 ± 0.002 in.) |
| Pole shoe gap: | 7 ... 10 mm (0.276 ... 0.393 in.) |
| Measuring instruments: | feeler gauge 0.4 mm (0.016 in.) |

Marks for setting the ignition on KM 37.

Fig. 69

Marks are punched on the fan wheel and on the fan housing.

The mark (x) on the fan wheel coincides with the "O" when the rotor is at top dead center, the mark (x) on the fan wheel coincides with "M" at the firing position.



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Fig. 69

Marks for setting the ignition on KM 48.

Fig. 70

Marks are punched on the magneto flywheel and on the bearing cover.

"O" coincides with the notch (x) or chisel mark on the bearing cover, when the rotor is at top dead center,

"M" coincides with the notch (x) or chisel mark on the bearing cover at the firing position.



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Fig. 70

Adjustment procedure for ignition setting:

1. When cam is at its highest position, adjust contact breaker gap (b, Fig. 71) to 0.4 ± 0.05 mm (0.016 ± 0.002 in.).
2. Turn magneto flywheel against direction of rotation until the marks for the firing moment coincide (Fig. 69 and 70).
3. Turn magneto flywheel lightly into direction of rotation; now the contacts should begin to open. If not, the firing time can be adjusted by turning the armature base plate within its slots.
Turning the armature base plate against direction of rotation of the magneto flywheel advances the ignition, turning it in direction of rotation retards the ignition.
4. Always tighten the screws of the armature base plate well after such an adjustment.
5. If the ignition is correctly timed, the pole shoe gap (a, Fig. 71) at the firing position must be between 7 ... 10 mm ($0.276 \dots 0.393$ in.).

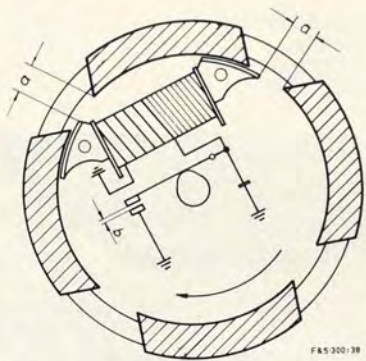


Fig. 71

After having adjusted the ignition, remove flywheel, screw on dust protector cap (r, Fig. 68) and replace magneto flywheel, guiding the key in the keyway of the magneto flywheel. Fit spring washer, screw collar nut M 10 x 1, place hook wrench (k, Fig. 8) into the magneto flywheel and tighten the collar nut. Tightening torque 4.3 ... 4.5 kpm (31.1 ... 32.5 ft lb).

Fig. 71

The pole shoe gap is measured where the magnet in the flywheel leaves the armature shoe edge of the ignition armature; (in direction of rotation of the magneto flywheel). Should the pole shoe gap be incorrect, it can be corrected by slightly adjusting the contact breakers in the range of 0.016 ± 0.002 in. (0.4 ± 0.05 mm).

Fan wheel KM 48

Fig. 72

Place the fan wheel in such a manner onto the magneto flywheel that the notch on the fan wheel (2) coincides with the red colour mark (1) on the magneto flywheel.

Attention!

If there is no colour mark, mount the fan wheel so that its notch is in line with the keyway in the magneto flywheel. Disregard produces heavy vibrations.

Fasten the fan wheel with 3 hexagon socket head screws M 6 x 10 with spring washers. Tightening torque 1.2 ... 1.3 kpm (8.7 ... 9.4 ft lb).



Fig. 72

Starter bell KM 37

Fig. 73

Place the cover plate onto magneto flywheel and fasten the starter bell (1) onto the magneto flywheel with 3 hexagon socket head screws (2) M 6 x 10 and spring washers. Tightening torque 1.2 ... 1.3 kpm (8.7 ... 9.4 ft lb)



Fig. 73

Fan housing and recoil starter.

Fig. 74

Fit 2 dowel sleeves into fan cover.

Mount fan housing (p) and fasten it with 3 hexagon socket head screws M 6 x 30 with spring washers.

Tightening torque 1.2 ... 1.3 kpm (8.7 ... 9.4 ft lb).

Fasten recoil starter (a) with 4 hexagon head screws M 6 x 15 and spring washers.

On stationary engines fit the pedestal plate with 4 hexagon socket head screws M 10 x 25.

Remove engine from mounting jig.



Fig. 74

Carburettor

Place gasket onto intake pipe and fasten carburettor with intake pipe with 2 hexagon socket head screws M 6 x 20 with spring washers, after having engaged the pin of the throttle valve lever into the fork end.

When the throttle valve is open, the air vane must touch its stop pin. If necessary, slacken the governor lever and adjust the air vane.

Fuel tank

On stationary engines, screw on the bracket with fuel tank.

Air cleaner

Mount the air cleaner to the carburettor.

Muffler

Fit gasket, fasten muffler with 2 hexagon socket head screws M 6 x 20 with spring washers.

Mount the plugs.

Note:

By fitting an intermediate flange (see spare parts list), the muffler can also be fitted in a horizontal position.

INTERMEDIATE FLANGE AND FLANGE SHAFT

Note:

Intermediate flange and flange shaft are used in conjunction with single or two-stage gearbox and lever-operated clutch K 160. Before removing the intermediate flange, pull the driving pinion as described on page 43.

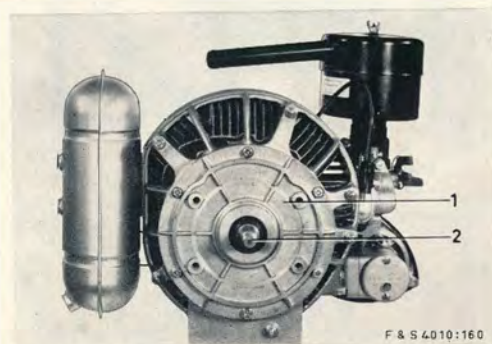


Fig. 75

Removal

Fig. 75

Unscrew intermediate flange (1) and flange shaft (2).

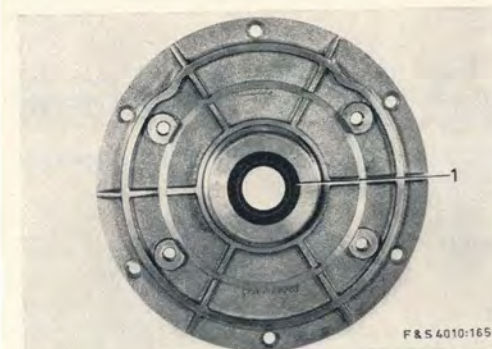


Fig. 76

Fig. 76

For pressing in and out the oil seal (1), heat the intermediate flange to approx. 100° Centigrades (212° F.). Press the oil seal, with its lip foremost, flush as illustrated.

Assembly

Fit the flange shaft (2, Fig. 75) onto the centering rim of the flywheel and fasten with 6 hexagon socket head screws M 6 x 14 and spring washers. Tightening torque 1.2 ... 1.3 kpm (8.7 ... 9.4 ft lb). Mount the intermediate flange (1, Fig. 75) and tighten with 6 hexagon socket head screws M 6 x 20 and spring washers. Tightening torque 1.2 ... 1.3 kpm (8.7 ... 9.4 ft lb).

SINGLE AND TWO-STAGE GEARBOX

Direction of rotation

When fitting a single stage gearbox, the direction of rotation of the output shaft of the gearbox is inverted.

If, for example, the power take-off shaft turns counter-clockwise and a single stage gearbox is fitted to the engine, the direction of rotation of the output shaft of the gearbox will be clockwise.

When fitting a two-stage gearbox, the direction of rotation of the output shaft of the gearbox is the same as that of the engine.

Removal

Fig. 77

On gearboxes with oil filling, remove oil drain plug and oil fill plug and drain the oil. Unscrew the nuts (b) with spring washers and remove the gearbox.

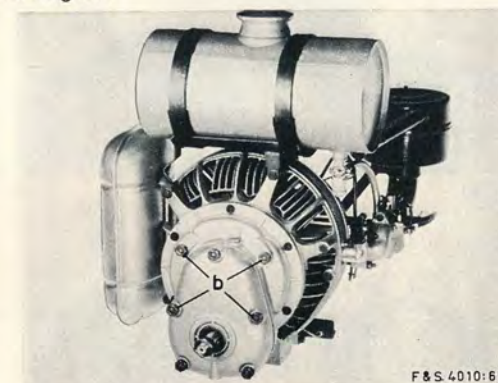


Fig. 77

Driving pinion

Fig. 78

Hold the pinion (2) with a strap wrench and unscrew nut with spring washer.

Pull the driving pinion (2) with puller sleeve (4), clamping ring (3) and puller shells (1, repair tools No. 16, 17 and 18) and remove key.

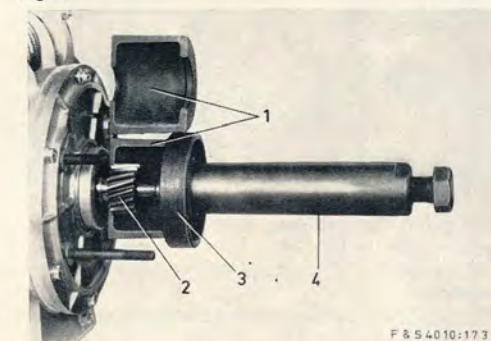


Fig. 78

Disassembly of single stage gearbox.

Fig. 79

Unscrew the nuts and remove the spring washers. Remove the round sealing ring (1).

Separate the gearbox (2) by screwing 2 screws M 8 x 80 and remove gasket.

Take care of dowels.

Heat up gearcase cover and/or gearcase to 100 ... 150° Centigrade (212 ... 300° F.) and remove mainshaft assembly.



Fig. 79



Fig. 80

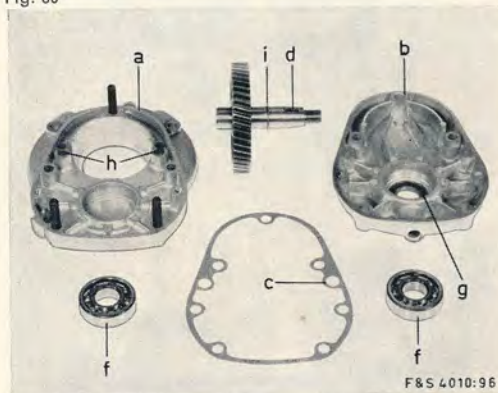


Fig. 81

Measuring the end play of the mainshaft.

(letters refer to Fig. 81)
End play 0.1 ... 0.3 mm (0.0039 ... 0.0118 in.)

Example:

Distance from sealing surface of gearcase cover (b) to bearing seat 20.0 mm (²⁵/₃₂ in.)
Distance from wheel hub of the gear wheel (a) to sealing surface (with gasket) of gearcase housing 4.9 mm (³/₁₆ in.)
Width of bearing + 14.0 mm (⁹/₁₆ in.)

| | | |
|---------|---|--|
| 18.9 mm | — | 18.9 mm (³ / ₄ in.) |
| | | 1.1 mm (³ / ₆₄ in.) |
| | — | 0.2 mm (0.0079 in.) |
| | | 0.9 mm (¹ / ₃₂ in.) |

Difference
End play
Difference to be compensated

The difference of 0.9 mm (¹/₃₂ in.) is to be compensated by shims (l) on the main shaft (d).

Heat up second grooved ball bearing (f) to about 120° C (250° F) and slide it home onto the mainshaft (d).

After the bearing has cooled, heat up the gearcase cover (b) to about 100 ... 150° Centigrades (212 ... 300° F), press it on and secure it with 3 nuts M 8 and spring washers. Press in oil seal (g) so that it is flush with the outer edge of the gearcase cover (b) and fit round sealing ring (1, Fig. 79).

Fig. 80

If the grooved ball bearings remain on the main shaft, these can be taken off with a conventional extractor or by means of 2 large screwdrivers.

Heat up the gearcase cover in which the ball bearings are lodged and then remove latter. Press the oil seal out of the gearcase cover.

Note:

For replacement, gear wheels and shafts are only supplied as a unit.

Clean and inspect parts; replace faulty parts.

Assembling the single stage gearbox.

Fig. 81

Heat up ball bearing (f) to about 125° C (250° F) and press into position on the short end of the main shaft (d).

Fit main shaft (d) with pressed-on bearing into gearcase (a) which has been heated up to about 100 ... 150° Centigrades (212 ... 300° F).

Press in 2 adjusting sleeves (h) and replace gasket (c).

Fill gearcase with appropriate quantity of lubricant (see lubrication chart on page 70).

Disassembly of two-stage gearbox.

Fig. 82

Unscrew nuts and remove spring washers.

Remove round sealing ring out of the gearcase.

Heat the gearcase cover to 100° ... 150° Centigrades (212 ... 300° F) and separate it with 2 screws M 6 x 80.

Take care of dowel sleeves. Remove gasket.



Fig. 82

Fig. 83

If the grooved ball bearings remain on the main- or intermediate shafts, pull these with a conventional bearing puller or with 2 strong screwdrivers (see Fig. 80).

Remove the shims (k) from the mainshaft, washer (m, 0.5 mm = 0.020 in. thick) and deflector disc (z) from the intermediate shaft.

Heat the center section of gearcase to 100° ... 150° Centigrades (212 ... 300° F) and remove mainshaft.

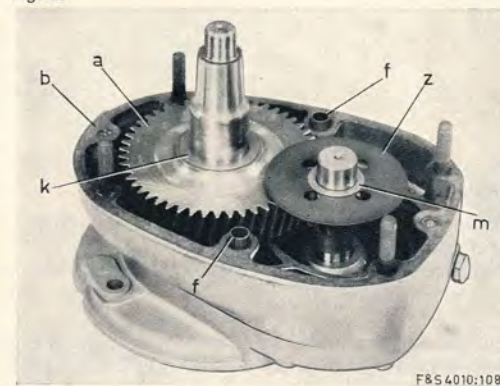


Fig. 83

Fig. 84

Unscrew nut (1) with spring washer.

Detach gearcase housing from the center section of the gearcase by means of 2 screws M 8 x 80, as shown in Fig. 79. Remove gasket.

Take care of dowel sleeves. Heat gearcase to 100° ... 150° Centigrades and remove intermediate shaft.

If the grooved ball bearings adhere to either the mainshaft or intermediate shaft, remove them with a conventional puller or with 2 strong screwdrivers (see Fig. 80).

Press the oil seals out of the gearcase cover.

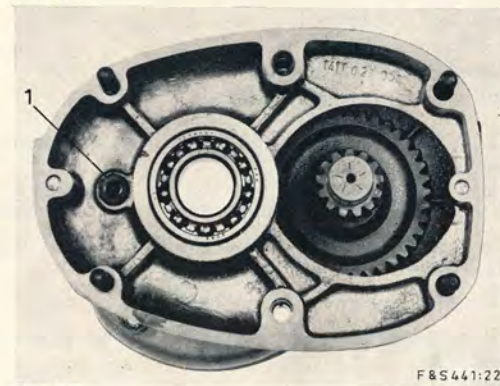


Fig. 84

Note:

For replacement the gear wheels and the shafts are supplied only as assemblies. Clean all parts, check for possible wear and replace as needed.

Reassembling the two-stage gearbox.

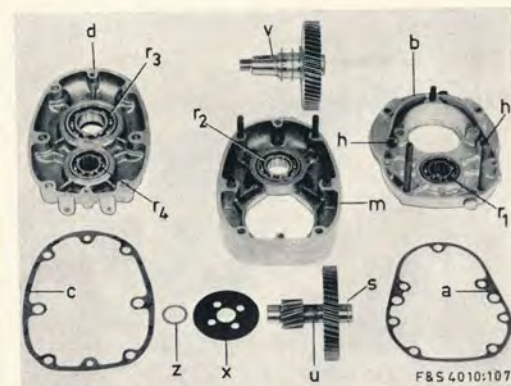


Fig. 85

Measuring the end play of the intermediate shaft.

End play:
0.1—0.3 (0.0039—0.0118 in.)

Fig. 85

Fit gearcase housing (b) with gasket (a) and gearcase centre section (m) together, replace gasket (c).

Example:

| | |
|--|---|
| Distance from sealing surface of the gearcase centre section (m) to bearing seat (r 1) | 64.4 mm (2 ¹⁷ / ₃₂ in.) |
| Distance from sealing surface of the gearcase cover (d) to bearing seat (r 4) | + 25.6 mm (1 in.) |
| | 90.0 mm (3 ³⁵ / ₆₄ in.) |

Distance of the intermediate shaft (u) from the wheel hub with centrifugal disk (x), washer (z) 0.5 mm (0.019 in.) thick

| | | | |
|--|---------|---|---|
| bearing width of the two grooved ball bearings (r 4 and r 1) | 60.8 mm | + 28.0 mm | = 88.8 mm (3 ¹ / ₂ in.) |
| Existing axial play | 88.8 mm | - 1.2 mm (3 ⁹ / ₆₄ in.) | |
| Permissible axial play | | - 0.2 mm (0.0079 in.) | |
| Difference to be compensated | | 1.0 mm (1 ¹ / ₃₂ in.) | |

The difference of 1.0 mm (1¹/₃₂ in.) is to be compensated by shims (s) on the intermediate shaft (u).

Heat up grooved ball bearing (r¹) to about 120° Centigrades (250° F), slide it onto the intermediate shaft up to the large gear wheel and allow to cool.

Heat up the gearcase housing (b) to 100 ... 150° Centigrades (212 ... 300° F) and fit intermediate shaft with pressed-on bearing.

Fit adjusting sleeves (h) and replace gasket (a).

Fit on gearcase centre section (m) and screw on nut M 8 (1, Fig. 84) with spring washer.

Heat up grooved ball bearing (r²) to about 120° Centigrades (250° F), slide it onto the mainshaft (v) and allow to cool.

Heat up gearcase housing with centre section to about 100 ... 150° Centigrades (212 ... 300° F) and fit in the mainshaft (v) with pressed-on bearing.

Measuring the end play of the mainshaft

End play: 0.1—0.3 mm
(0.0039—0.0118 in.)

Fig. 86

Replace gasket (b) and fit adjusting sleeves (f).



Fig. 86

F&S 4010:108

Example:

| | |
|---|--|
| Distance from the sealing surface of the gearcase cover (d, Fig. 85) to bearing seat (r ₃ , Fig. 85) | 28.0 mm (1 ⁷ / ₆₄ in.) |
|---|--|

| | |
|---|--|
| Distance from shoulder of the gear wheel (a) to the sealing surface of the gearcase centre section and the bearing width of the grooved roller bearing (r ₃ , Fig. 85) | - 27.2 mm (1 ⁵ / ₆₄ in.) |
|---|--|

| | |
|------------------------------|---|
| Existing end play | 0.8 mm (1 ¹ / ₃₂ in.) |
| Permissible end play | - 0.2 mm (0.0079 in.) |
| Difference to be compensated | 0.6 mm (0.024 in.) |

The difference of 0.6 mm (0.024 in.) is to be compensated by shims (k) on the mainshaft.

Fit centrifugal disk (z) with the raised triangle downwards and allow to engage with the toothing.

Fit washer (m) 0.5 mm (1¹/₆₄ in.) thick, heat up grooved ball bearings (r₃ and r₄, Fig. 85) to about 120° Centigrades (250° F), slide onto intermediate and main shafts and allow to cool.

Heat gearcase cover (d, Fig. 85) to about 100 ... 150° Centigrades (212 ... 300° F), refit and secure with 4 nuts M 8 and spring washers.

Press the oil seal (g, Fig. 81) in flush with the outer edge of the gearcase cover and install round sealing ring (1, Fig. 79).

Screw in the oil drain plug with sealing washer and oil fill plug.

Fill the gearbox with the appropriate quantity of lubricant (see Lubrication and maintenance Chart, page 70).

Installing

Fit key into the flange shaft.

Degrease the tapers of the drive pinion and of the flange shaft.

Fit drive pinion (2, Fig. 78), hold it with strap wrench and fasten with nut M 14 x 1.5 and lock washer.

Tightening torque 5.4 ... 5.6 kpm (39.1 ... 40.5 ft lb).

Mount single or two-stage gearbox (take care of round sealing ring in gearcase) and fasten with 4 nuts M 8 (b, Fig. 77) and lock washers.

PRECISION GOVERNOR KM 48
1st version up to engine No. 6440768.

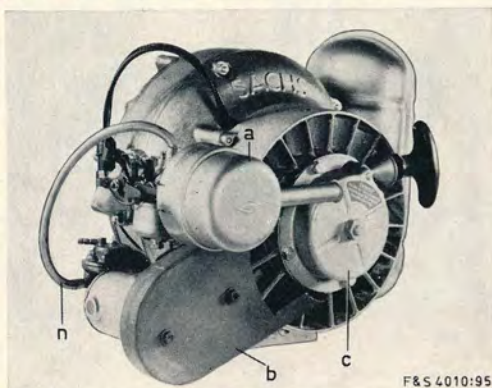


Fig. 87 F&S 4010:95

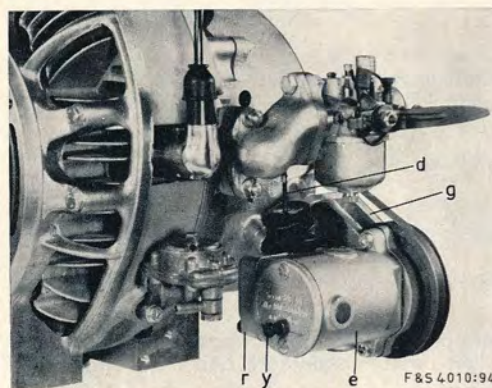


Fig. 88 F&S 4010:94

Dismantling the precision governor

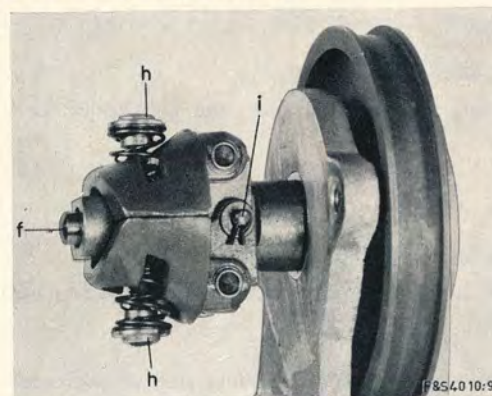


Fig. 89 F&S 4010:93

Removal.

Fig. 87

Unscrew air cleaner (a), guard (b) and recoil starter (c). Pull off fuel hose (n).

Fig. 88

Disconnect governor rod (d) from throttle lever and unscrew governor housing (e). Remove gasket. Unscrew governor guard (r) and cover with adjusting screw (y). Take out thrust pin (f, Fig. 89). Unscrew support (g) and remove flat belt.

Fig. 89

Unscrew both adjusting nuts (h) with the adjusting sleeve (repair tool No. 7), remove governor springs and spring cups. Unlock crossbolt (i) and remove it, taking care of the washers.

Fig. 90

Place the support with the governor head (g) on an appropriate tube and press the governor head out with an appropriate thrust bolt. Remove steel belt pulley (p) from the support (g). Prop up support and press out grooved ball bearing (m).

Note:

The steel belt pulley (p) has been superseded by an aluminium belt pulley and is interchangeable. Pressing in the governor head with the aluminium belt pulley is described under Fig. 93.

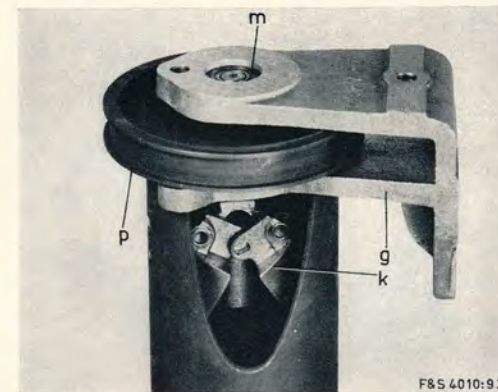


Fig. 90 F&S 4010:92

Fig. 91

Pull grooved ball bearing (o) with conventional puller (for example KUKKO-puller No. 20—1). Press out shaft (x) and remove both tolerance rings (n). Clean all parts, check for possible wear and replace as needed.

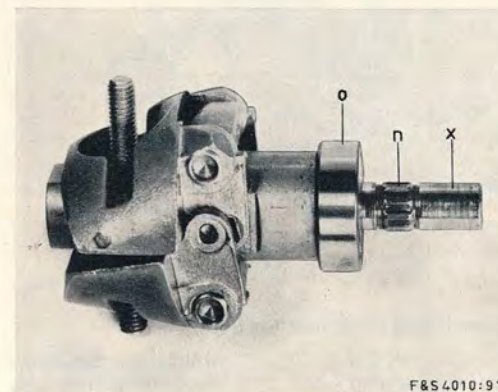


Fig. 91 F&S 4010:91

Assembling the precision governor.

Press the grooved ball bearing 608—2 RS (m, Fig. 90) home into the support (g, Fig. 90). Slide tolerance rings (n, Fig. 91) onto shaft (x, Fig. 91) and press the shaft home into the governor head. Fill grooved ball bearing 608 RS (o, Fig. 91) with high temperature grease Alvania 3 and heat the bearing to approx. 100° Centigrades (212° F) and press it on, sealing plate facing outwards (using a tube for driving the inner race of the bearing).

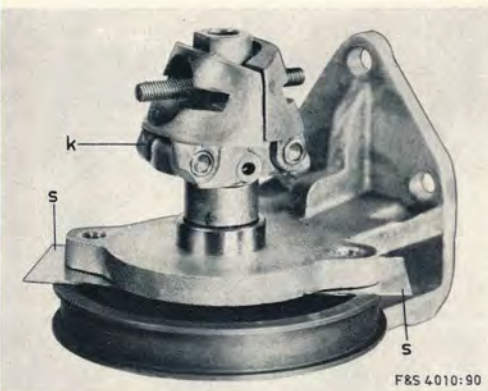


Fig. 92

Pressing the governor head with steel belt pulley

Fig. 92

Place belt pulley in the support, fit spacer sheets (s). Press the governor head (k), until the shaft is flush with the grooved ball bearing (m, Fig. 90).

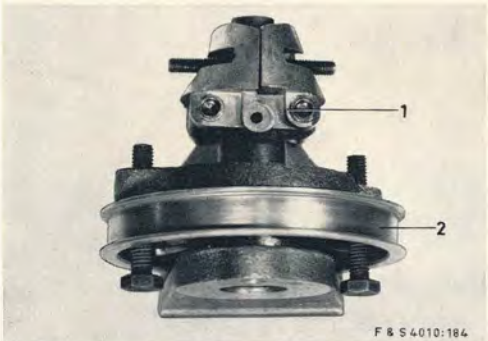


Fig. 93

Pressing the governor head with aluminium belt pulley

Fig. 93

Place belt pulley (2) in the support, screw in two hexagon head bolts M 6 x 30 as illustrated.

Note:

Supporting areas of the screws must coincide with the supporting area of the cover plate. Press the governor head (1), until the shaft is flush with the grooved ball bearing (m, Fig. 90).

Assembling the governor head.

Fit crossbolt (i, Fig. 89), mount washers and secure. Fit both spring cups and the appropriate sets of governor springs (see chart on page 55) and screw both adjusting nuts (h, Fig. 89) flush with the ends of the spindle.

Installation

Fasten support (g, Fig. 90) with 3 hexagon socket head screws M 6 x 20 and lock washers, fit thrust pin (f, Fig. 89), the collar facing outwards. Fit flat belt and check its tension. If necessary, fit shimming sheet (F & S Part No. 2744 016 000) between support and fan housing. Place gasket for governor housing. Fasten governor housing with fitted governor rod (d, Fig. 88) to the support, with 2 fillister head screws M 6 x 18 and lock washers. Adjust governor rod as described on page 54.

PRECISION GOVERNOR KM 48

2nd version from engine No. 6440769 on

Attention!

On engines with the following serial Numbers, the parts for the 1st version, support (g, Fig. 90), governor shaft (x, Fig. 91) and grooved ball bearing (m, Fig. 90) are fitted:

Engine No.: 6440 781 ... 6440 785, 6440 823 ... 6440 826, 6440 918 ... 6440 937.

Removal

Fig. 94

Unscrew air cleaner (1), guard (2) and recoil starter (3).

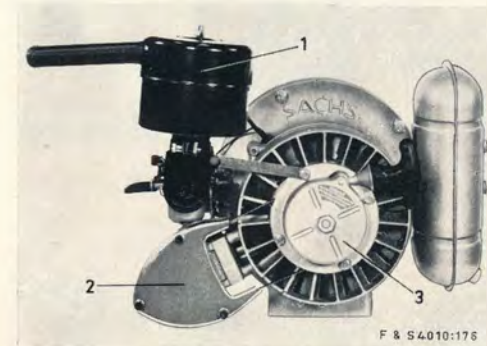


Fig. 94

Fig. 95

Disconnect governor rod (1) from throttle lever and unscrew governor housing (5). Remove gasket.

Unscrew governor guard (2) and cover with adjusting screw (4). Take out thrust pin (3, Fig. 102). Unscrew support (6) and remove flat belt.

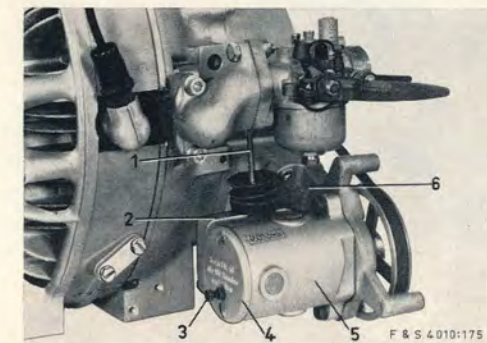


Fig. 95

Dismantling the precision governor

Fig. 96

Unscrew both adjusting nuts (2) with adjusting sleeve (3, repair tool No. 7), remove governor springs and spring cups. Unlock crossbolt (1) and remove it, taking care of the washers.

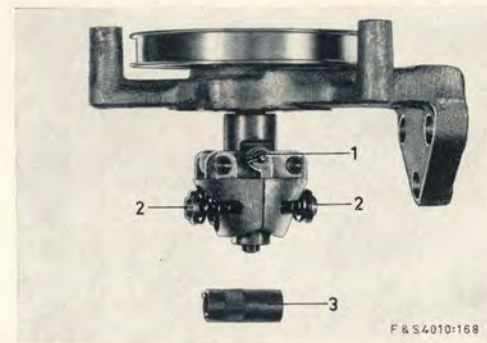


Fig. 96

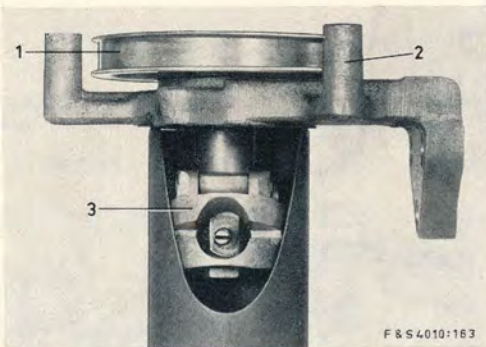


Fig. 97

Fig. 97

Place the support with the governor head (2) on an appropriate tube and press the governor head out with an appropriate thrust bolt. Remove belt pulley (1) and support (2), take out governor head (3). Remove the circlip out of the support, prop the support and press out the grooved ball bearing.

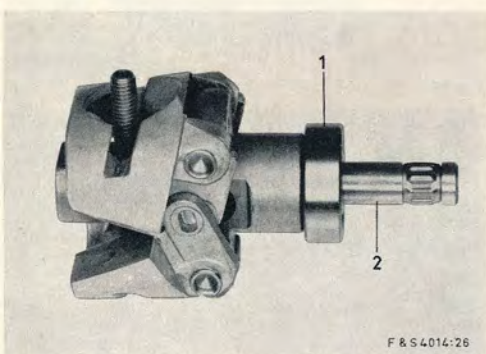


Fig. 98

Fig. 98

Pull the grooved ball bearing (1) with a conventional puller (for example KUKKO-puller No. 20-1). Press out shaft (2) and remove both tolerance rings (1 and 2, Fig. 99). Clean all parts, check for possible wear and replace as needed.

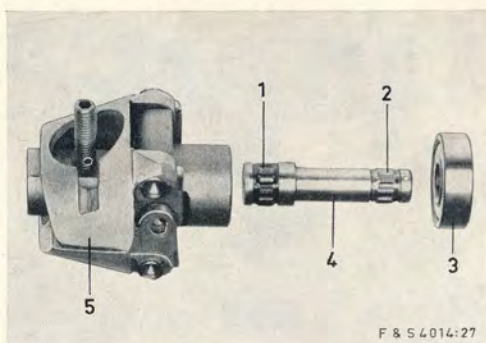


Fig. 99

Assembly

Fig. 99

Slide both tolerance rings (1 and 2) onto shaft (4). Press shaft (4) home into the governor head (5). Heat grooved ball bearing (3) to approx. 100° Centigrades (212° F) and press it home onto the shaft, sealing plate foremost (using a tube for driving the inner race of the bearing).

Fig. 100

Fit circlip into support (1). Fill grooved ball bearing with high temperature grease Alvania 3 and press governor shaft with governor head home into the support.

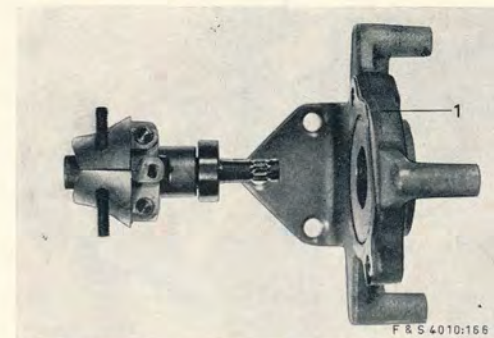


Fig. 100

Fig. 101

Fill grooved ball bearing (3) with high temperature grease Alvania 3 and press it in, sealing plate on top. Press flat belt pulley (1) flush with the shaft (2).

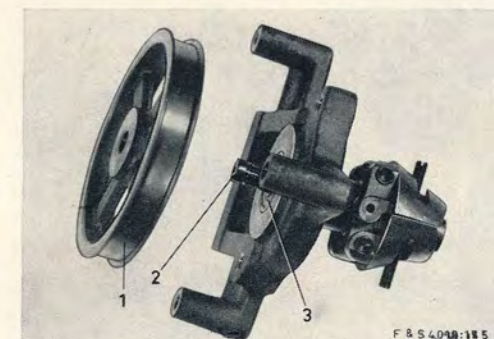


Fig. 101

Fit crossbolt (1, Fig. 96), mount washers and secure.

Fit both spring cups and the appropriate sets of governor springs (see chart on page 55) and screw both adjusting nuts (2, Fig. 96) flush with the ends of the spindle.

Installation

Fig. 102

Fasten support (2) with 3 hexagon socket head screws M 6 x 20 and lock washers. Fit thrust pin (3, the collar facing outwards). Fit flat belt (1) and check its tension. If necessary, fit shimming sheet (F & S part No. 2744 016 000) between support and fan housing.

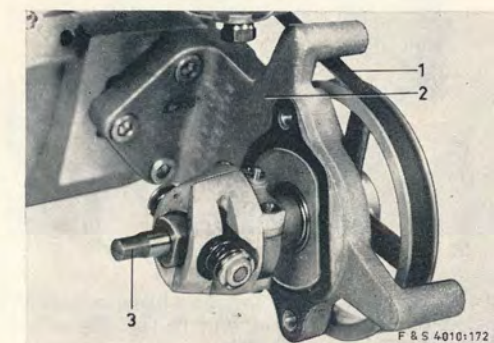


Fig. 102



Fig. 103

Fig. 103

Coat gasket with sealant No. 40, (F & S part No. 0999 107 000) and place governor housing. Fasten governor housing (2) with fitted governor rod (1) to the support with 2 fillister head screws M 6 x 18 and lock washers.

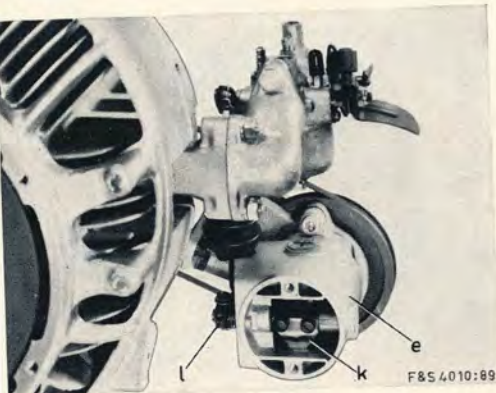


Fig. 104

Adjusting the governor rod

Fig. 104 and 105

Open throttle valve and slacken governor lever (l). Push plate (k) inwards up to the stop and hold it.

Distance "a" = 3 mm (0.118 in.) Fig. 105 must be set between top edge of the rod and top edge of the bore (in the governor lever).

Tighten governor lever (l). Unscrew governor housing (e), fasten guard (2, Fig. 95) with plug to the governor housing with 2 fillister head screws M 5 x 20 and lock washers.

Watch for correct seat of the bellows.

Fasten governor housing again to the support.

Hook governor rod into throttle lever.

Fill governor housing with 15 cc (0.528 fl oz) engine oil SAE 40 for summer operation or SAE 10 for winter operation.

Fit gasket and fasten cover (4) with adjusting screw with 2 countersunk head screws M 5 x 10.

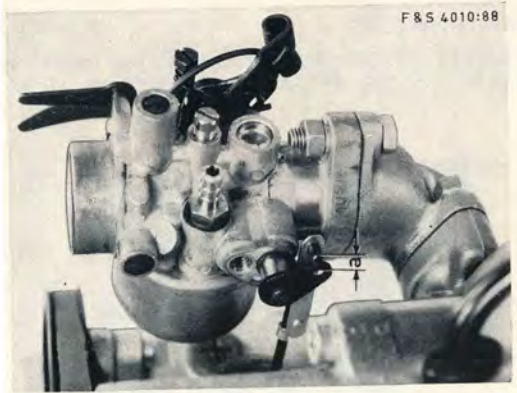


Fig. 105

Note:

Unscrew adjusting screw (3, Fig. 95) as far as possible.

Fit recoil starter with 4 hexagon head screws M 6 x 15 and lock washers. Fasten guard (2, Fig. 94 and b, Fig. 87) with 2 or 3 hexagon socket head screws M 6 x 10 and lock washers. Mount air cleaner to carburettor.

How the governor works

The centrifugal precision governor is designed for applications where a high governing accuracy is required. This amounts to $\pm 2.5\%$, representing a range of 2925 . . . 3075 1/min for a speed of $n = 3000$ 1/min.

The centrifugal precision governor is driven by a flat belt pulley machined onto the starter bell, a flat belt and a pulley pressed onto the governor shaft.

On the governor shaft is mounted the so-called governor head. This consists of 2 movable flyweights that are kept pressed together with springs.

When the engine starts up without load and tends to exceed the specified speed, the flyweights move outwards as far as the springs, which are selected for the required speed, will allow.

The movement of the flyweights is transmitted over a lever system to the carburettor linkage, which in turn activates the butterfly valve decreasing the opening in the mixing chamber. The result is a rpm reduction; the spring force on the flyweights becomes greater than the centrifugal force, pushing the flyweights together, opening the butterfly valve.

Sets of springs for precision governor.

| Revolutions for engine running | | Part number | Outer diameter | | Wire thickness | | Colour mark | Qty. | Comments |
|--------------------------------|----------------|--------------|----------------|--------|----------------|--------|-------------|------|----------|
| without load | with full load | | mm | in. | mm | in. | | | |
| 3150 | 3000 | 2739 009 000 | 9.0 | 0.3543 | 0.8 | 0.0315 | blue | 2 | |
| | | 0939 010 006 | 12.1 | 0.4763 | 1.0 | 0.0394 | violet | | |
| 3550 | 3400 | 2739 006 000 | 9.2 | 0.3621 | 0.9 | 0.0354 | grey | 2 | |
| | | 0939 010 006 | 12.1 | 0.4763 | 1.0 | 0.0394 | violet | | |
| 3750 | 3600 | 2739 006 000 | 9.2 | 0.3621 | 0.9 | 0.0354 | grey | 2 | |
| | | 2739 010 000 | 11.7 | 0.4606 | 0.9 | 0.0354 | red | | |
| 4200 | 4000 | 0939 010 007 | 12.4 | 0.4882 | 1.2 | 0.0472 | blue | 2 | |
| | | 0939 009 008 | 9.4 | 0.3700 | 0.8 | 0.0315 | brown | | |
| 4700 | 4500 | 0939 009 008 | 9.4 | 0.3700 | 0.8 | 0.0315 | brown | 2 | |
| | | 2739 005 000 | 12.3 | 0.4842 | 1.3 | 0.0512 | green | | |

CENTRIFUGAL CLUTCH (with gearbox)

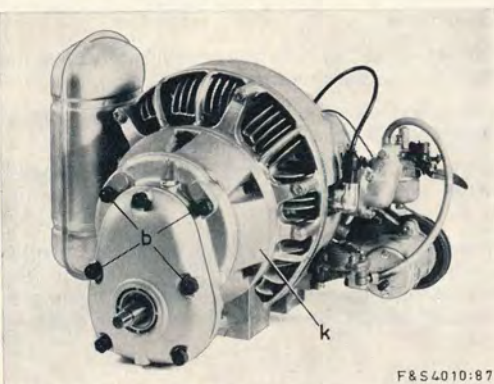


Fig. 106

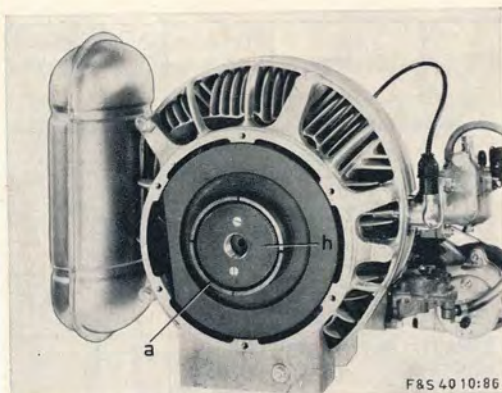


Fig. 107

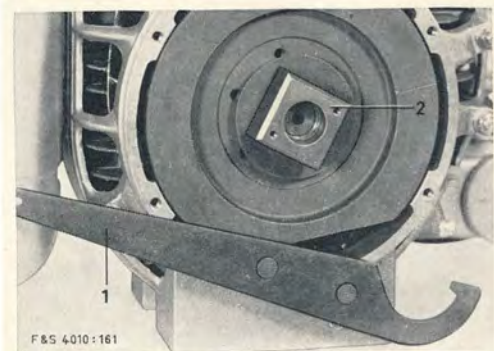


Fig. 108

Removal

Fig. 106

Unscrew nuts (b) with lock washers. Remove single- or two-stage gearbox. Unscrew intermediate flange (k).

Fig. 107

Unscrew disc (h). Force off 4 flyweights (a) with screwdriver. Take care of springs.

Note:

If the springs went off during forcing off the flyweights, see page 59 for fitting.

Fig. 108

Place hook wrench (1, repair tool No. 10) with its long bolt between the straight face of the flywheel and the housing cover and unscrew hub (2). Remove washer.

Disassembling the intermediate flange.

Fig. 109

Grip pinion in a vice (use protective jaws) and unscrew nut with lock washer. Pull pinion with puller sleeve, clamping ring and puller shells (1, 3 and 4, Fig. 78). Remove key.

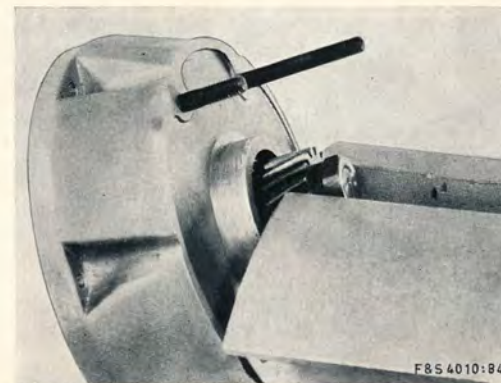


Fig. 109

Fig. 110

Remove circlips (a and k) and press out clutch case. Remove second circlip, warm up intermediate flange and press out both grooved ball bearings.

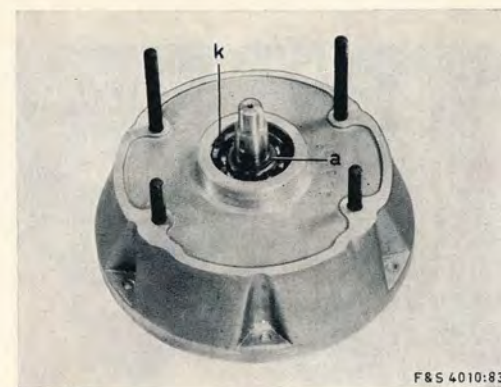


Fig. 110

Assembling the intermediate flange.

Insert circlip (k, Fig. 110). Heat up intermediate flange, fill grooved ball bearing with high temperature grease (Staburags NBU 30) and press it in in such a way that the sealing plate faces outwards. Fit second circlip, press clutch case and mount circlip (a, Fig. 110). Fit key and degrease tapers of shaft and pinion. Mount pinion, grip it in a vice (use protective jaws) and fasten with nut M 14 x 1.5 and lock washer. Tightening torque 5.4 ... 5.6 kpm (39.1 ... 40.5 ft lb).

Installation

Fit disc without holes onto eccentric shaft, place hook wrench (1, Fig. 108) and fasten hub (2, Fig. 108). Tightening torque 7.5 ... 8.0 kpm. Drive 4 flyweights with both springs by light blows (rubber mallet) onto the hub and fasten disc (h, Fig. 107) with countersunk screws M 5 x 8.

Intermediate flange and gearbox

Screw intermediate flange (k, Fig. 106) with 6 hexagon head screws M 6 x 25 and lock washers. Mount single stage or two-stage gearbox with 4 nuts M 8 and lock washers.

CENTRIFUGAL CLUTCH (without gearbox)

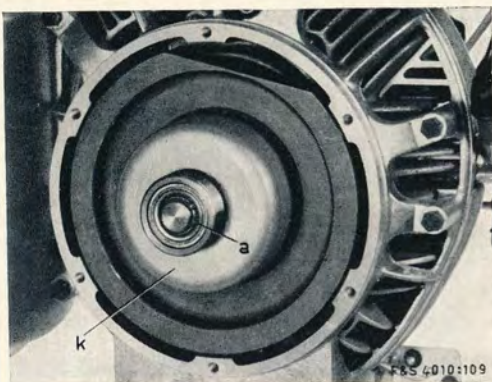


Fig. 111

Removal

Fig. 111

Remove circlip (a) and pull clutch case (slide fit). Take care of washer (1 mm = 0.039 in. thick).

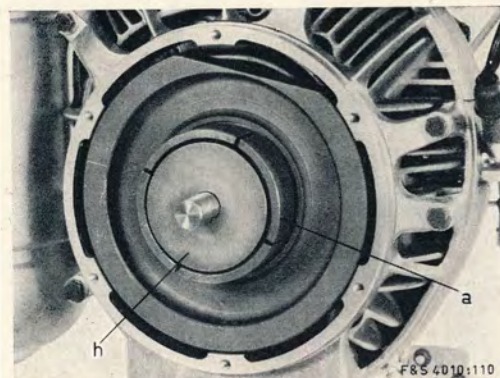


Fig. 112

Fig. 112

Remove washer (h). Force off 4 flyweights (a) with screwdriver.

Note:

If the springs went off during forcing off the flyweights, see page 59 for fitting.

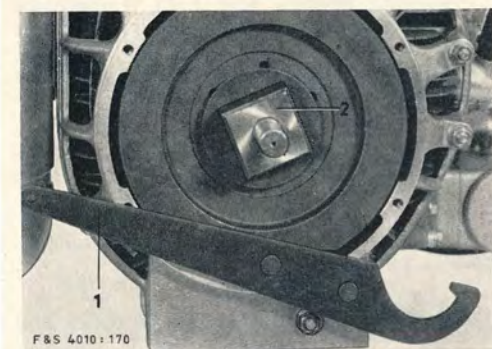


Fig. 113

Fig. 113

Place hook wrench (1, repair tool No. 10) with its long bolt between the straight face of the flywheel and the housing cover and unscrew hub (2). Remove washer.

Replacing the grooved ball bearings

Fig. 114

Pull one of the two grooved ball bearings (m) with an internal puller.

Press the second grooved ball bearing out.

Fill the grooved ball bearing with high temperature grease (Staburags NBU 30) and press it in, so that the sealing plate faces outwards.

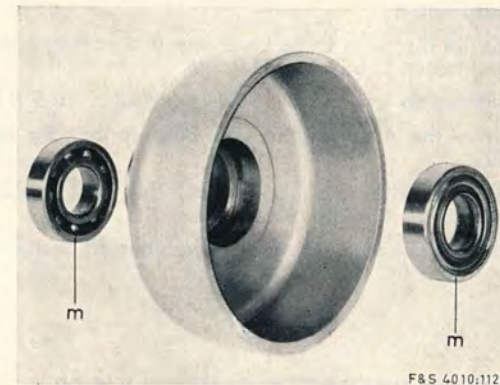


Fig. 114

Fitting the flyweight springs

Fig. 115

If the clutch case is available, Place the flyweights in it and fit the springs.



Fig. 115

Fig. 116

If the clutch case is not available, able, bind the flyweights together with a wire and fit the springs.



Fig. 116

Installation

Fit the disc with large bore onto the eccentric shaft, place hook wrench (1, Fig. 113) and fasten hub (2, Fig. 113).

Tightening torque 7.5 ... 8.0 kpm (54.2 ... 57.9 ft lb).

Drive the 4 flyweights with both springs by light blows (rubber mallet) onto the hub.

Fit disc with small bore onto the hub, place check plate, after having lightly lubricated it, in the clutch case.

Slide the clutch case onto the hub and fit circlip.

LEVER-OPERATED CLUTCH K 160

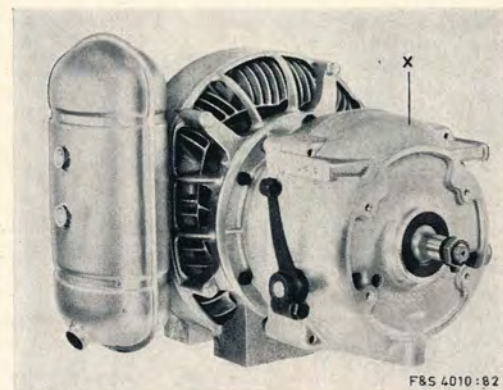


Fig. 117

Removal

Fig. 117

Unscrew power take-off side (x) of clutch case.

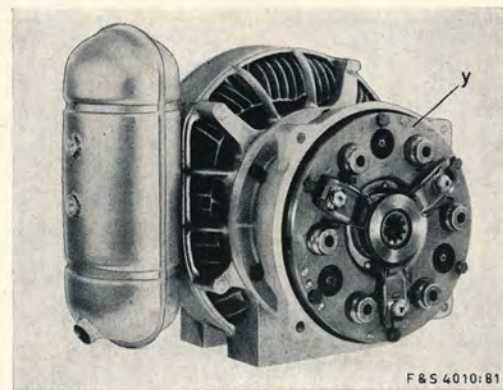


Fig. 118

Cover assembly

Fig. 118

Unscrew cover assembly (y), taking care of cylindrical pins (1, Fig. 119).

Remove driven plate.

Pull grooved ball bearing with conventional puller (for example KUKKO internal puller No. 21/2 with support No. 22-1).

Clutch plate

Fig. 119

Hold clutch plate with hook wrench (2, repair tool No. 10). Unscrew nut (3) and remove lock washer.

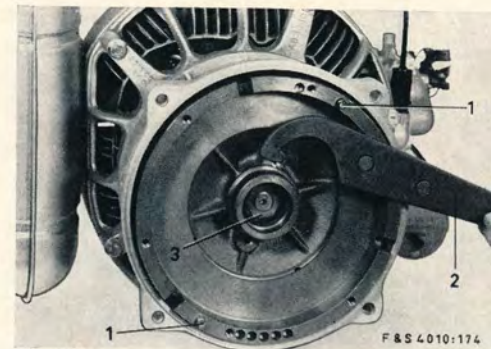


Fig. 119

Fig. 120

Fit protective cap (repair tool No. 6) onto threaded end and mount puller (2, repair tool No. 9) with 2 hexagon screws M 8 x 60.

Hold clutch plate (3) with hook wrench (4) and pull it off.

Unscrew puller (2).

Remove key, unscrew engine side half of clutch case (1).

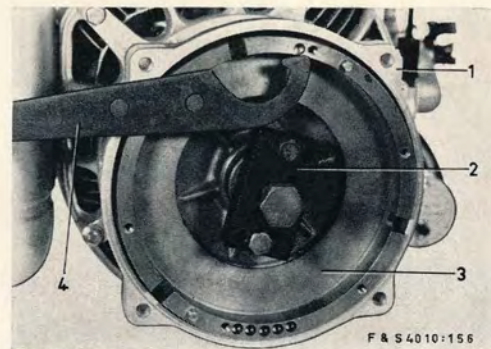


Fig. 120

Disassembling the power take-off side of clutch case.

Fig. 121

Remove springs (k) and release bearing (x).

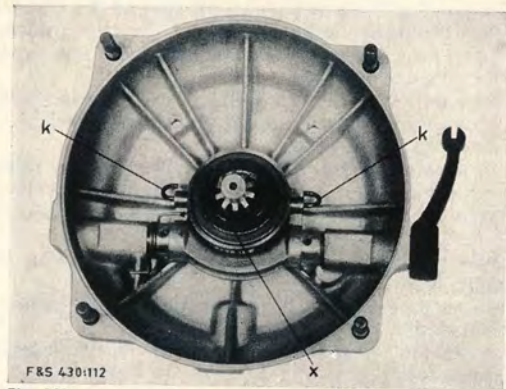


Fig. 121

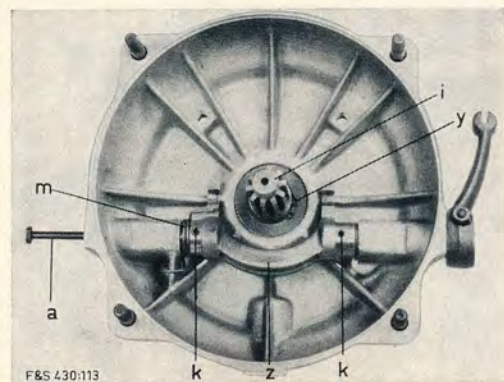


Fig. 122

Fig. 122

Chase sleeves (k).
 Pull out shaft with clutch lever, taking care of the round sealing ring.
 Screw stud (a) M 5 into the shaft, grip it in a vice and pull the shaft out.
 Remove release fork (z), return spring (m) and shims.
 Remove circlip (y), shims and sealing washer.
 Press the spigot shaft (i) to the outside, remove deflector disc.

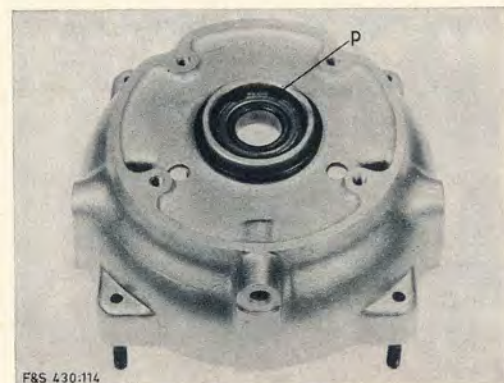


Fig. 123

Fig. 123

Remove circlip (p).
 Heat up power take-off side of the clutch case to approx. 100° Centigrades (212° F) and press out the grooved ball bearing.
 Clean all parts, check for possible wear and replace as needed.

Assembling the power take-off side of the clutch case.

Heat the power take-off side of the clutch case to approx. 100° Centigrades (212° F) and press the grooved ball bearing home (use protective block).
 Fit circlip (p, Fig. 123).
 Place deflector disc on grooved ball bearing and press the spigot shaft in.
 Place sealing washer and shims (as required).
 Fit circlip (y, Fig. 122).
 Place release bearing (x, Fig. 121) into the release fork (z, Fig. 122), fasten it with both springs (k, Fig. 121) and hook return spring (m, Fig. 122) onto release fork.
 Place the assembled release fork in the clutch case (return springs touches the rib in the case).
 Slide the check plate and the round sealing ring onto the supporting shaft with clutch lever.
 Fill recesses of both supporting shafts with grease (ALVANIA 3) and mount both shafts.
 Center the release bearing (x, Fig. 121) with regard to the spigot shaft and fit shims as needed.
 Fit both sleeves (k, Fig. 122) and cover supporting shaft with rubber block.

Installation

Mount engine side of the clutch case (1, Fig. 120) and tighten with 4 nuts M 8 and lock washers.
 Fit key to the flange shaft.
 Degrease tapers of clutch plate and flange shaft.
 Mount clutch plate (3, Fig. 120), hold it with hook wrench (4, Fig. 120) and fasten with nut M 14 x 1.5 and lock washer.
 Tightening torque 5.4 ... 5.6 kpm (39.1 ... 40.5 ft lb).
 Press grooved ball bearing home into the clutch plate.
 Mount driven plate and center it with home-made centering bolt.
 Fit both cylindrical pins (1, Fig. 119) into the clutch plate, mount cover assembly (y, Fig. 118) and tighten with hexagon head screws M 6 x 18 and lock washers.
 Tightening torque 0.8 ... 1.1 kpm (5.8 ... 7.9 ft lb).
 Fit power take-off side of clutch case (x, Fig. 117) and tighten with 4 nuts M 8 and lock washers.

DEVICE FOR HEATING THE INTAKE AIR

Fig. 124

The 1st version is mounted onto the fan housing.

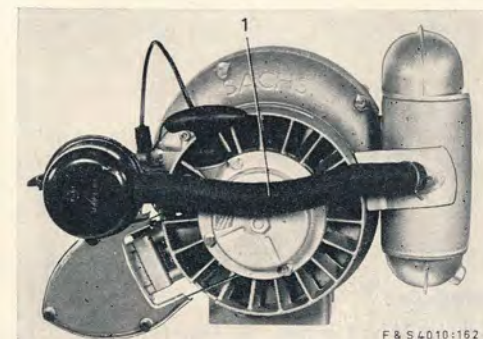


Fig. 124

Fig. 125

The 2nd version is mounted between muffler and rotor housing with 2 gaskets.

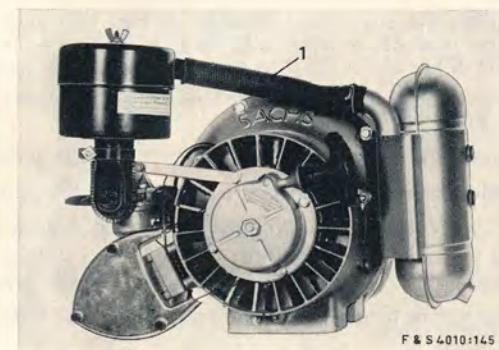


Fig. 125

Note:

The device for heating the intake air prevents the carburettor from freezing when operating the engine at cold temperatures (winter).
 At warm temperatures (summer) pull off the tube (1), so that the engine cannot take in hot air.

BOSCH STARTER-GENERATOR

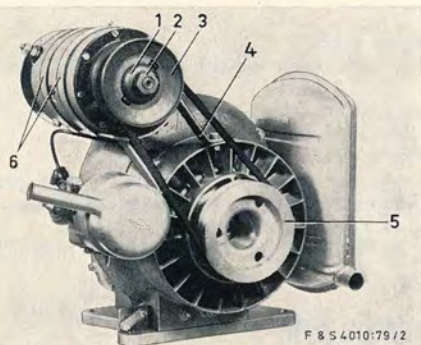


Fig. 126

Removal

Fig. 126

Unscrew nut (2).
Remove lock washer, thrust washer (1), profile washer, V-belt pulley half (3), V-belt, profile washers and second V-belt pulley half.

Force the hub off with two screwdrivers and remove key.
Unscrew both fastening bands (6) and remove starter-generator with rubber damper.
Unscrew supporting bracket (4) and V-belt pulley (5).

Installation

Tighten V-belt pulley (5, Fig. 126) with 3 hexagon socket head screws M 6 x 14 (KM 37) or M 6 x 15 (KM 48).

Tightening torque 0.9 ... 1.2 kpm (6.5 ... 8.6 ft lb).

Fasten the supporting bracket (4, Fig. 126) with 2 hexagon head screws M 6 x 15, lock washers, washers and nuts, as well as with one hexagon head screw M 6 x 95 (KM 37) or M 6 x 105 (KM 48) with lock washer to the fan cover.

Place both rubber dampers and starter-generator and fasten with 2 fastening bands (6, Fig. 126).

Take care of proper alignment of the V-belt pulleys.

Install key into the armature shaft and fit the hub, short end first.

Mount V-belt pulley half and profile washers for achieving the belt tension.

Fit the V-belt and the V-belt pulley half (3, Fig. 126), profile washers for aligning both pulleys, and tighten with lock washer and nut M 14 x 1.5.

Tightening torque 3.5 ... 5.0 kpm (25.6 ... 37 ft lb).

Note:

For tightening the nut (2), the V-belt pulley (5, Fig. 126) must be turned, to prevent pinching the V-belt.

Check the pulley alignment and the V-belt tension (belt should have a "give" of approximately 10 ... 20 mm = 0.39 ... 0.79 in. under thumb pressure) and adjust when necessary.

INSTRUCTIONS AND WIRING DIAGRAM FOR BOSCH STARTER-GENERATOR

The starter-generator serves for starting the engine and for providing current for the electrical system.

Output:

- a) as starter approx. 1 HP (DIN) at 12 Volt
- b) as generator 160 Watt at 12 Volt continuous output or
240 Watt at 12 Volt for short-time operation

Voltage governing is achieved by control box (F & S part No. 2771 003 000; BOSCH Ref. 0190 219 002).

Required battery: 12 Volt 18 Ah

When the starter-generator is fitted subsequently to an engine, or when wires are replaced, ensure that these have the correct cross-section (see wiring diagram).

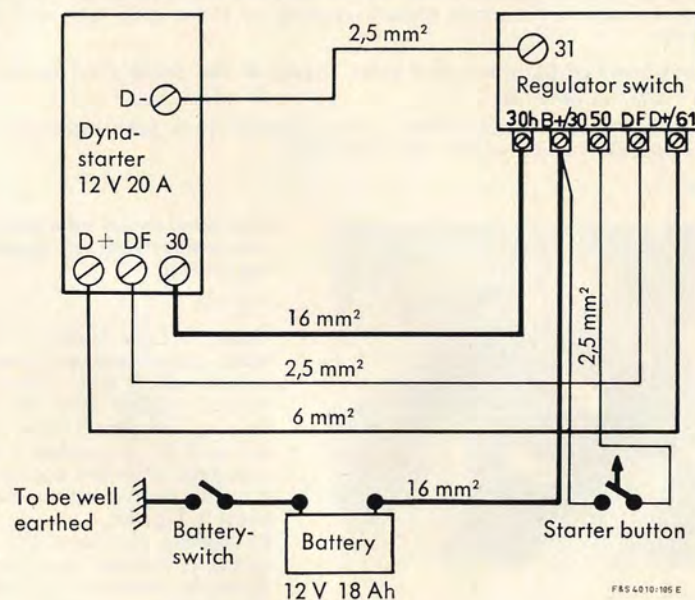


Fig. 127

| | | |
|----------------------|---|-----------------|
| 2.5 mm ² | = | 0.003875 sq in. |
| 6.0 mm ² | = | 0.00930 sq in. |
| 16.0 mm ² | = | 0.02480 sq in. |

TEST RUNNING THE ENGINE AND RUNNING-IN PERIOD

Test run

Start the engine and let it warm up (as soon as the engine has started, open the choke).

On engines with governor, it will be necessary to adjust not only the idling speed, but also the maximum speed.

Speed adjustments must always be carried out when the engine is warm.

Note:

A low idling speed is absolutely essential for all engines fitted with a centrifugal clutch. The centrifugal weights are only completely clear of the clutch housing when the engine is idling slowly, thus avoiding undue overheating and premature wear of the clutch.

Idling speed adjustment.

Close the control lever or throttle lever, set the required idling speed by means of the idle adjustment screw and correct smooth running of the engine with the idle air adjusting screw.

On cable controlled carburettors, the outer casing of the cable must have a play of 1 . . . 2 mm (0.039 . . . 0.079 in.).

A well adjusted, lowest possible idling speed helps to save fuel, especially when the engine is operated under widely varying load.



Fig. 128

Maximum speed adjustment. (on engines with top speed limiting device)

Fig. 128

Open throttle lever or control lever completely and check the engine speed with a revolution counter (repair tool No. 14). If the required speed is not obtained, or if it is exceeded, it can be adjusted, while the engine keeps running, by turning the air vane pivot (r, Fig. 46).

By turning clockwise the return spring is relaxed and the speed drops, by turning anti-clockwise, the speed is increased.

Maximum speed adjustment. (on engines with precision governor)

Open throttle lever or control lever completely and check the engine speed with a revolution counter (repair tool No. 14). If the required speed is not attained or exceeded, stop the engine and remove the screw plug on the governor housing. Through the aperture, the adjusting nuts (2, Fig. 96) can be screwed in or out with the adjusting sleeve (3, Fig. 96).

By turning them clockwise, the speed increases; by turning them anti-clockwise, the speed decreases.

Note:

By adjusting the governor springs (effected by screwing the adjusting nuts in or out), the engine speed can be varied by about 200 . . . 250 1/min. By this means it can always be established for what speed the governor has been equipped. (See chart for governor springs on page 55). An important requirement is that the two adjusting nuts (2, Fig. 96) are screwed in or out by an equal number of turns, as otherwise the centrifugal weights will not move out uniformly, thus impairing a reliable function of the governor.

Start the engine and check the speed again. If necessary, repeat the above procedure until the required speed is attained.

If the on-load speed of the engine fluctuates, although the governor is correctly set and the governor parts and the throttle valve are easily moving, slacken nut and adjust the adjusting screw (3, Fig. 95) until the engine runs quietly and smoothly.

Lock the adjusting screw again with the nut.

When r. p. m. fluctuations cannot be corrected with the adjusting screw, the cause is to be sought either in general engine troubles or worn parts.

If the engine is removed from its machinery, the speed is to be set for the engine operating without load, according to the chart on page 55.

It is important that no over-revving occurs while adjusting the operating speed, as this may result in damage to the bearings and a loss of efficiency accompanied by starting difficulties.

Running-in period

Even the most finely machined surfaces of the rotor's sealing elements, side plates and rotor casing are rougher than parts that have been rubbing against each other for a long period of time, therefore the moving parts must undergo a running-in period.

There is no need however, to be overcautious. The engine should not be driven to its maximum speed for the first 5 hours, but should be driven at half-throttle in the middle rpm range. It is important that no unnecessary rpm are obtained, as this can result in bearing damage and a loss of efficiency accompanied with starting difficulties.

It is not necessary to use an extra mixing proportion of fuel and oil or to use special additives during the running-in period.

INSTALLING OR MOUNTING THE ENGINE

The SACHS KM 37 and KM 48 engines can be used for a wide variety of purposes, such as driving generating sets, pumps, boats etc. The conditions of installation applicable for each combustion engine will have been fulfilled by the manufacturer, if you obtained an equipment with the built-in engine. In cases where a SACHS KM 37 or KM 48 engine is to be used for a special purpose, it is essential that the following points be observed when installing or mounting the engine.

1. The cooling air drawn in by the fan must be able to flow freely away from the engine, especially if the engine is installed under a protective cowling or bonnet. The cowling should always allow fresh air to enter, and hot air to escape, in sufficient quantities, or else the engine will not be cooled properly.
2. The engine in its finally installed position must not, even temporarily, be tilted at an angle of more than 30°. If this angle is exceeded, fuel consumption will be adversely affected.
3. All lubrication points of the engine such as gearbox, starter, governor and governor linkage must be exposed for servicing.
4. To prevent dirt being deposited on and in the engine, the air drawn in by the air cleaner and fan should be taken from a dust-free zone. In the case of agricultural machinery, the engine should, moreover, be protected by suitable mudguards from dirt thrown up by the wheels of the vehicle. Although the engine is not affected by atmospheric conditions, a cover to protect it from rain should be provided, as this will help to keep the engine in good running order.
5. If the engine is installed in an enclosed space, the exhaust should be discharged into the open air through a pipe of not less than 1.575 in. (40 mm) internal diameter and free from sharp bends. A condensation trap must be installed when using long exhaust lines that prohibit condensation from flowing back into the muffler. The room in which the engine is located must also be ventilated to prevent condensation from forming in the engine, leading to unpleasant results.
6. If the engine is fitted with a recoil starter, or a starter pulley, sufficient space should be provided for operating the starter.
7. Furthermore, it is important to see that the engine be securely flange-mounted or that the pedestal stands on a hard, firm base. The strength of the installation mounting should be such as to prevent any distortion between the engine and the mechanism it drives. The engine shaft and the shaft of the driven machinery should, when coupled directly, be perfectly aligned. The frame of the machinery should be supported at the foundation by rubber damping pads.
8. Strong engine vibration, mainly at the fuel tank, disturb the flow of fuel. The vibrating tank causes the fuel to foam and the air bubbles are fed through the fuel line. When it is impossible to prevent the engine or machinery from vibrating, preventive measure should be taken to assure that the tank is free from vibration.

EFFECTS OF LOCATION ON ENGINE PERFORMANCE

Performance data are based on an intake air temperature of + 20° Centigrades (68° F), relative air humidity of 60% and an altitude of about 300 m (1000 ft.) above sea level. Any deviation from the above values will affect the engine performance and the carburettor setting. In cases where an engine is used in a warm or humid climate, or at a high altitude, the following rules can be used as a rough guide for estimating the effect on the power output of the engine:

1. For every 100 m (330 ft.) above the reference of 300 m (1000 ft.) the output will be reduced by about 1.4%.
2. For every 10% increase in the intake air temperature above 20° Centigrades (68° F) the output will be reduced by about 4%.
3. With extremely high humidity (90—100%), a further reduction in output of 1.5—2% will occur for every 10° increase in the intake air temperature above 20° Centigrades (68° F).

Example:

Engine operating at altitude of 1200 m (4000 ft.), air temperature + 30° Centigrades (86° F), relative air humidity 95%.

The performance drop will then be:

- | | |
|--|----------------------------|
| 1. Difference in altitude (1200 m) | $12 \times 1.4\% = 16.8\%$ |
| 2. Difference in air temperature (30° C — 20° C = 10° C) | $1 \times 4\% = 4.0\%$ |
| 3. Increased air humidity (95% at 30° C) | $1 \times 2\% = 2.0\%$ |
| | <hr/> <hr/> <u>22.8%</u> |

Hence the total drop in power output will be about 23.0%, i. e., the original output of the KM 37 of 3.45 h.p. will be reduced to 2.66 h.p. at 3000 1/min.
5.50 h.p. will be reduced to 4.20 h.p. at 4900 1/min.
of the KM 48 of 5.50 h.p. will be reduced to 3.90 h.p. at 3000 1/min.
8.00 h.p. will be reduced to 6.20 h.p. at 5000 1/min.

LAYING-UP THE ENGINE







If the engine is laid-up for some considerable length of time, there arises danger of rust. For such cases we provide the following instructions for preserving the engine:

1. Unscrew the muffler.
Then, by means of an oil syringe, squirt 10 cc (0.352 fl oz) of SAE 30 oil (e. g. ENSIS-oil 30 of SHELL), while cranking the engine 5...6 times, into the exhaust port.
The sliding course of the rotor housing, the bearings and the rotor are thus sufficiently protected against corrosion.
2. To protect the outside of the engine, and possibly the equipment, we recommend anti-corrosion oils of well-known oil companies, such as:
Anticorit 5 of Messrs. FUCHS D-6800 Mannheim, Germany
Lubrication-Oil MIL-L-644 B of MOBIL-OIL
Shell ENSIS Fluid 260 of SHELL
RUST BAN 395 of ESSO



Attention!

If the engine is laid-up for some considerable length of time with fuel in the tank, segregation of the oil / petrol mixture may occur. In such cases we strongly recommend, before starting the engine again, to mix the oil / petrol mixture anew by stirring or shaking, or to replace it.
Resinificated (gummed) fuel feed and carburettor systems as well as damages by oxidation (rust) inside and/or outside of the engine are not covered by our warranty.

LUBRICATING AND SERVICING CHART

| Point of servicing or lubricating | Lubricant and quantity or servicing operations | Service | runn. hrs. | | | | On installing |
|---|---|------------------------|------------|----------|-----------|-----------------|---------------|
| | | | Daily | Every 50 | Every 100 | Every 200 | |
|  1 | Wet air cleaner Pull off filter cap. As soon as dust deposit appears on filter element (n), remove it, wash it in petrol, dip it in engine oil SAE 30 or 40 and let excess oil drip away. | | | | | | X |
|  2 | Micronic air filter Screw off filter cap. Replace the Micronic filter (a) if very dirty; if only slightly dirty blow the filter element with caution or tap it slightly on a soft surface in order to remove dust deposit. | under dusty conditions | | | | | X |
|  2 | Spark plug A quick cleaning of the spark plug from carbon deposit can be made at the insulator and between the electrodes. A correct cleaning can only be achieved with a sand blower. Checking Remove the spark plug. Connect it to the ignition cable, hold the plug thread in contact with earth and work the starter. If the plug is in perfect condition, a strong spark must appear at the electrodes. Gap at the electrodes 0.5 mm (0.02 in.). See arrow. | | | | | | X |
|  7/2 | Single stage and two-stage gearbox Oil check Screw out oil level check plug (2). If the oil level in the gearbox is lower than the bottom edge of the oil check hole, screw out the oil filler plug (1) and pour in as much SACHS gear oil SEA 80 until oil is coming out of the oil check hole. Screw the plugs in again. | | X | | | | |
|  7/2 | Oil change Screw out the oil drain plug (3). Drain the oil and close the oil drain hole again. Fill in 100 cc = 3.5 fl oz (for single stage gearbox) 200 cc = 7.0 fl oz (for two-stage gearbox) 300 cc = 10.6 fl oz (two-stage gearbox; horizontal version) of SACHS gear oil (F & S Part-No. 0263 015 005) or SAE 80, as outlined under "Oil check". | | | | X | initial filling | |
|  3 | Top speed limiting device Clean the lever of the bearing bolt (x) and lubricate it slightly. | | | | | | X |

LUBRICATING AND SERVICING CHART

| Point of servicing or lubricating | Lubricant and quantity or servicing operations | Service | runn. hrs. | | | | On installing |
|---|---|---------|------------|----------|-----------|-----------|---------------|
| | | | Daily | Every 50 | Every 100 | Every 200 | |
|  4 | Precision speed governor Remove the cover (e) and replenish with engine oil SAE 40 up to the edge (a). When operating the engine during winter, replace the engine oil SAE 40 by SAE 10. Initial filling: 15 cm ³ (0.5 fl oz) Replenishment: up to the edge (a) | | | | X | | X |
|  5 | Fuel strainer: Empty fuel tank. The fuel filter is directly fitted to the fuel tap. To clean the former, screw off tap from fuel tank, rinse filter (i) thoroughly in fuel. If necessary, rinse out tank. Fit the fuel tap back to the tank and fill the tank. | | | | | | X |
| Ignition system | Check the contact breaker and adjust if necessary. Apply BOSCH Ft 1 v 4 special grease to the lubricating felt pad for the contact breaker cam. | | | X | | | |
| Decarbonizing (see page 26) | Check the exhaust port and the spark plug hole for carbon deposit and clean if necessary. | | | X | | | |
| Blower | After heavy dirt deposit on the cooling-air inlet and on the cooling fins, clean with compressed air. | | | | | | X |
| Carburettor | Clean and adjust. | | | | | | X |
| Recoil starter | Lightly lubricate spiral spring and bearing bolt with Anti-corit 5. | | | | | | X |
| Oil seals | Fill with grease (ALVANIA 3) | | | | | | X |
| Rotor sliding surface, eccentric shaft bearings | These are lubricated by two-stroke mixture, SACHS special oil for Wankel engines (cans of 250 cc = 0.5 liqu. pt., pre-mixed, F & S part number 2769 008 000) mixed with branded petrol at a ratio of 1:50. Note: Instead of SACHS special oil for Wankel engines, the oils listed in the chart on page 72 can also be used. | | | | | | |

APPROPRIATE LUBRICATING OILS FOR SACHS-WANKEL ENGINES

All branded oils listed in this chart, preferably special SACHS oil for Wankel engines, F & S part number 2769 008 000, or all Super outboard engine oils (with synthetic components).

| | Australia | Belgium | Denmark | Germany | England | Finland | France | Italy | Netherlands | Austria | Sweden | USA |
|------------------------------------|-----------|---------|---------|---------|---------|---------|--------|-------|-------------|---------|--------|-----|
| AGIP-F 1-MARINEMIX | | | | x | | | | | | | | |
| BP Super Outboard Motor-Oil | x | x | x | x | x | x | x | x | x | x | x | x |
| CALTEX Outboard-Motor-Oil | x | | | | | | | | | | | |
| ESSOLUB HD 30 | | x | x | x | x | x | x | x | x | x | x | x |
| ESSO-Outboard-Extra-Motor-Oil | | | | x | | | | | | | | |
| EVINRUDE 50 to 1 SAE 40 | | | | | | | | | | | | x |
| MOBILMIX TT | | x | x | x | x | x | x | x | x | x | x | x |
| MOBILOIL TT | | x | x | x | x | x | x | x | x | x | x | x |
| SHELL-Oil (1763) 0236 PAE 4884 | | | | x | | | | | | | | |
| SHELL-PREMIUM Outboard Motor-Oil | x | | | | | | | | | | | |
| SHELL-Rotella SAE 30 | | x | x | x | x | x | x | x | x | x | x | x |
| VALVOLINE-Super Outboard Motor-Oil | x | | | | | | | | | | | |

TIGHTENING TORQUES FOR BOLTS AND NUTS

Bolts

| F & S No. | Number | Used for component | Size | Tightening torques | |
|--------------|--------|------------------------------|----------|--------------------|-------------|
| | | | | kpm | ft. lb. |
| 1940 114 002 | 3 | Bearing cover | M 6 x 25 | 1.1 ... 1.3 | 8.0 ... 9.4 |
| 0240 106 100 | 3 | Armature base plate | M 4 x 14 | 0.2 ... 0.3 | 1.4 ... 2.1 |
| 2740 002 001 | 3 | Starter housing | M 6 x 10 | 1.2 ... 1.3 | 8.6 ... 9.4 |
| 2740 003 001 | 3 | Fan housing | M 6 x 30 | 1.2 ... 1.3 | 8.6 ... 9.4 |
| 0240 104 002 | 6 | Flanged shaft | M 6 x 14 | 1.2 ... 1.3 | 8.6 ... 9.4 |
| 1940 134 002 | 6 | Intermediate flange | M 6 x 20 | 1.2 ... 1.3 | 8.6 ... 9.4 |
| 0240 104 002 | 3 | V-belt pulley (magneto side) | M 6 x 14 | 0.9 ... 1.2 | 6.5 ... 8.7 |
| 1815 008 000 | 6 | Pressure plate | M 6 x 18 | 0.8 ... 1.1 | 5.8 ... 8.0 |

Nuts

| F & S No. | Number | Used for component | Size | Tightening torques | |
|--------------|--------|---------------------------------------|------------|--------------------|---------------|
| | | | | kpm | ft. lb. |
| 2742 001 101 | 1 | Eccentric shaft (power take-off side) | M 20 x 1 | 7.5 ... 8.0 | 54.4 ... 58.0 |
| 0942 072 100 | 1 | Eccentric shaft (magneto side) | M 20 x 1 | 4.3 ... 4.5 | 31.2 ... 32.6 |
| 0316 057 003 | 18 | End covers | M 6 | 0.7 ... 0.9 | 5.1 ... 6.5 |
| 0316 057 003 | 7 | Fan cover — housing cover | M 6 | 1.0 ... 1.2 | 7.2 ... 8.7 |
| 0942 020 100 | 1 | Pinion | M 14 x 1.5 | 5.4 ... 5.6 | 39.2 ... 40.6 |
| 0942 020 100 | 1 | Clutch plate | M 14 x 1.5 | 5.4 ... 5.6 | 39.2 ... 40.6 |
| 0942 020 100 | 1 | Centrifugal clutch | M 14 x 1.5 | 7.5 ... 8.0 | 54.2 ... 57.8 |

ENGINE TROUBLES

The following is a list of possible engine troubles which may occur.

A. Engine will not start

There is no ignition spark because

1. Spark plug is oiled-up, wet, bridged or damaged,
2. Spark plug is wet (outside),
3. Ignition cable loose or fractured,
4. Contact-breaker points oiled-up, wet or burnt,
5. Short-circuit switch jammed,
6. Ignition armature or condenser defective.

Engine does not get any fuel because

1. Fuel tank empty,
2. Fuel tap is closed,
3. Strainer in fuel tap clogged with dirt,
4. Jet clogged.

Engine does not get suitable explosive mixture because

1. Water in carburettor,
2. False air infiltrating through loose carburettor.

B. Drop in engine power

because of dirt

1. Air cleaner clogged with dirt,
2. Fuel tank gets no air (filler cap).

Engine has been subjected to over-speed

Overspeeding must be avoided even for short periods.

C. Other engine troubles

Engine vibrates badly, because

1. Fan wheel wrongly fitted (see page 40).

STARTER TROUBLES

When defects arise it should be borne in mind that the cause of these defects need not necessarily lie with the starter itself, nor in an insufficient electrical connection of the vehicle earthing points, but also in the fuel supply. The following remedial hints are limited to the starter system itself.

A. When the ignition is switched on, the armature shaft does not rotate:

1. Battery exhausted,
2. Batterie defective,
3. Battery terminals loose, oxydized, earth connection insufficient,
4. Starter terminals or brushes have ground contact,
5. Carbon brushes of the starter do not lie on the commutator, are jammed in their guides, are worn, broken, oily or dirty
6. Starter switch damaged (parts loose),
7. Loss of current in leads is too high, leads damaged, lead connections loose.

B. When the ignition is switched on, the starter armature rotates, but the engine does not start:

1. Battery insufficiently charged,
2. Pressure of carbon brushes insufficient,
3. Loss of current in the leads is too high,
4. Insufficient V-belt tension (on engines with starter-generator only).

APPENDIX

Housing cover for evacuation of air; execution for Messrs. ROTO-MARIN and SKICRAFT.

Fig. 129

Disassembly and re-assembly is the same as for the basic engine.

The following hexagon head screws are required for the housing cover:

- 4 hexagon head screws M 6 x 38
- 1 hexagon head screw M 6 x 65 (KM 37)
- 5 hexagon head screws M 6 x 70 (KM 48) and washers.

Tightening torque 1.0 ... 1.2 kpm (7.2 ... 8.7 ft lb).



Fig. 129