OPERATOR'S MANUAL

FOR ROTAX ENGINE

TYPE 277

ENGINE EXECUTION WITH

- BOSCH CONTACT BREAKER IGNITION SYSTEM
- BING CARBURETOR

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BOMBARDIER-ROTAX GMBH
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TECHNICAL DATA

Specification	Single-cylinder-, two-stroke Otto engine, lubricated by fuel-oil mixture, fan-cooled
Cylinder	Light alloy cylinder with cast iron sleeve
Bore	72 mm
Stroke	66 mm
Displacement	268,7 c.c.
Compression ratio	11,8
Ignition unit	BOSCH magneto generator SCP2 12V 75/23W (alternating current)
Ignition timing	2,03 ÷ 2,53 mm BTDC (0,08 ÷ 0,1 in)
Contact breaker gap	0,30 ÷ 0,40 mm (0,012 ÷ 0,015 in)
Spark plug	NGK B8ES or equivalent, electrode gap 0,4 ÷ 0,5 mm (0,015 ÷ 0,02 in)
Carburetor	BING slide carburetor 54/36
Fuel pump	MIKUNI
Starter	Rewind starter
Fuel	Regular grade gasoline, octane number not below MON 83 or RON 90
Lubrication	- If engine is installed with cylinder upright (spark plug on top): Super 2-stroke oil, mixing ratio 1 : 50 e.g. Castrol Super TT - If engine is installed with cylinder downward (spark plug at bottom): Outboard oil (BIA TCW), mixing ratio 1 : 50 e.g. Castrol Biolube

GENERAL

The ROTAX engine is a fan-cooled 2-stroke engine. Careful and extensively tested design and rugged construction as well as the use of high quality parts warrant maximum reliability and durability. With proper maintenance and care and with the use of suitable fuel and oil the engine will give you trouble-free service for many years.

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

FUEL - OIL - MIXTURE

The ROTAX engine is operated by a mixture of standard grade gasoline and

- Super 2-stroke oil, if the engine is installed with cylinder upright (spark plug on top)
- Outboard oil (BIA TCW), if the engine is installed with cylinder downward (spark plug at bottom)

the oil lubricating the moving engine parts.
Mixing ratio fuel - oil is 50 : 1; this mixing ratio has to be respected.

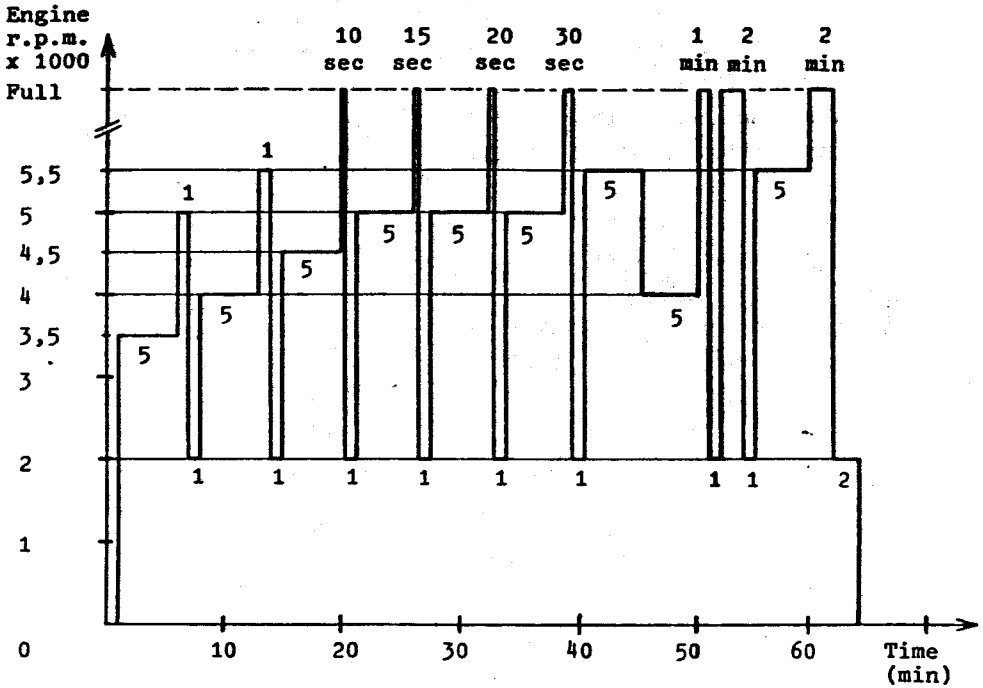
Too much oil will cause carbon deposits on the spark plug, on the piston, in the cylinder ports and in the muffler and will cause problems. In addition, the piston rings may stick.

If too little oil is used, lubrication will be insufficient, the piston will seize and the bearings will be damaged.

Note: Poor oil quality cannot be compensated by using more oil!

BREAK-IN PROCEDURE

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



After this procedure the idle has to be adjusted.
Then short take-offs can be conducted.
After a few short full-load take-offs, but not later than 2 hours total running time, the cylinder head nuts have to be re-tightened to 18 ÷ 24 Nm (160 ÷ 210 in.lb). For this procedure the cylinder cowl has to be taken off.

Tools: Screwdriver
insert 13 (socket wrench 13)
torque wrench

Note: Use a cross-sequence for tightening the nuts.

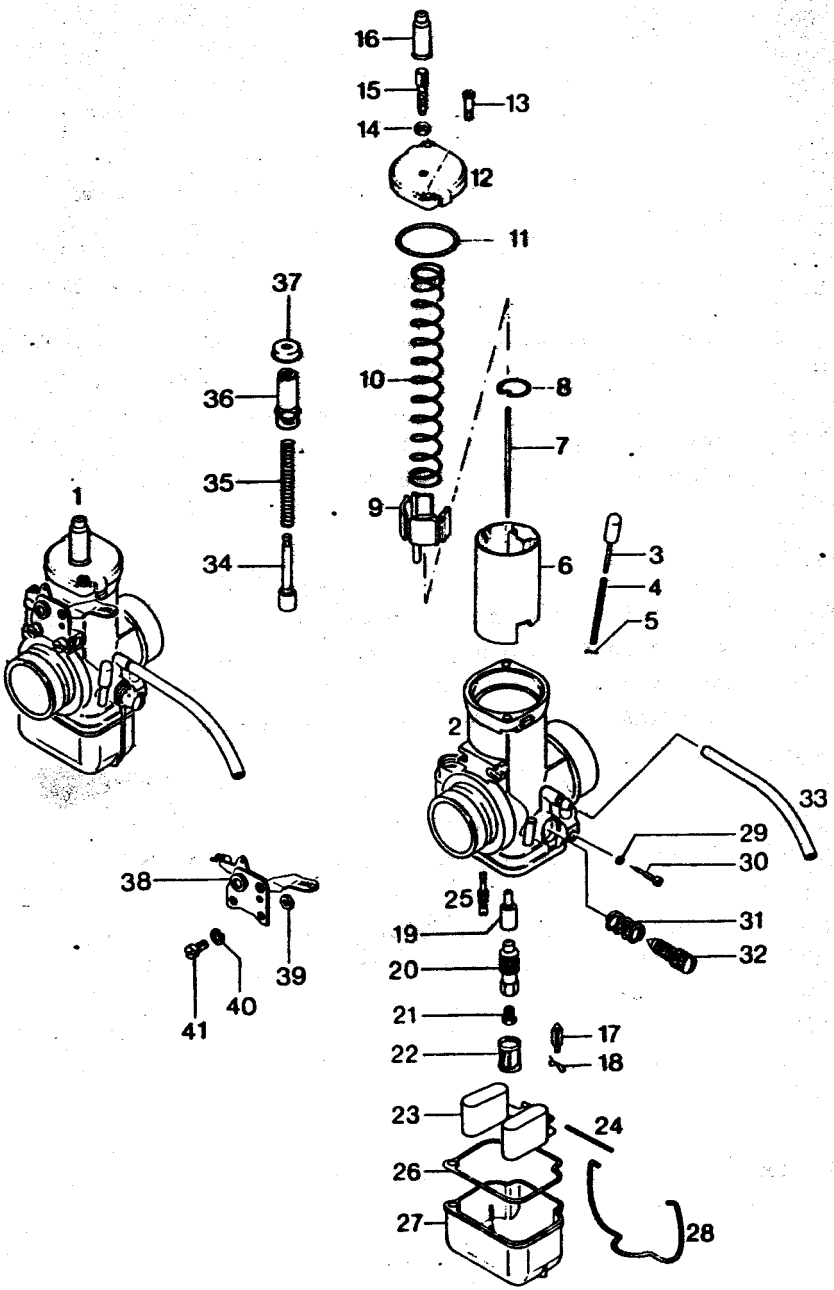
CARBURETOR

The BING carburetor is a piston type carburetor with float chamber. The carburetor can be adjusted by jets and adjusting screws. Changing of jets should only be done by a specialist or after consulting the engine manufacturer.

The air-fuel mixture at idle speed is adjusted by the air adjusting screw (see ill. no. 30).

The idle r.p.m. is adjusted by the carburetor piston adjustment screw (ill. no. 32).

BING CARBURETOR



STARTING THE ENGINE

On cold engine use choke.
Don't set throttle.
Start the engine.
After the first ignitions open throttle and shortly after close choke.

Attention: Throttle opening reduces the effect of the choke.

If the engine is started too long with the choke, the engine gets flooded with fuel. If this happens, the spark plug has to be unscrewed, cleaned, dried and the engine has to be started (cranked through) several times. If the engine still does not start, see chapter "Fault Tracing Schedule".

SPARK PLUG

If the engine fails to start it should be checked whether the ignition wiring is disconnected from the spark plug protector or from the spark plug. Then the condition of the spark plug has to be checked (bridged between the electrodes, oily, sooty etc.).

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

With too high heat range (cold plug) and too rich carburetor calibration it looks black and sooty.

With too low heat range (hot plug) or too lean carburetor calibration the spark plug is burnt white and the electrodes are covered with melt drops.

ATTENTION: Heavy oil deposits on the electrodes and insulator cause engine troubles and have to be removed regularly (every 10 hours).

If even after cleaning or changing the spark plug there is no spark, the spark plug protector and the ignition cable and finally the ignition unit should be checked.

IGNITION UNIT

The ROTAX engine is equipped with a BOSCH magneto generator 12V 75/23W producing the current necessary for the spark. The ignition unit has been set most carefully and precisely by the factory. Make no changes unless absolutely necessary.

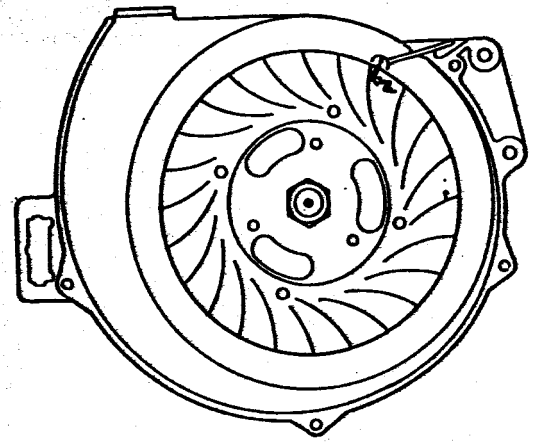
In case of troubles observe the following:

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

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

To check whether the ignition timing is correct there is a mark on the crankcase. Further there is an arrow on the fan. At the moment of ignition (i.e. when breaker contacts open, check with test lamp, buzzer etc., connected to shorting cable and to mass), the mark on the crankcase must correspond with the arrow on the fan (see illustration).

buzzer = Summer



ADJUSTMENT OF IGNITION TIMING

The ignition timing is adjusted after loosening the fixing screw of the breaker point next to the adjusting groove, so that the contact breaker starts opening when the piston is 2,03 ÷ 2,53 mm (0,08 ÷ 0,1 in) before T.D.C.

Check with test lamp or buzzer as described before. When cranking the engine, the breaker contacts must open 0,30 ÷ 0,40 mm (0,012 ÷ 0,015 in). If this is not the case, turn the stator plate and repeat the above procedure.

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

IGNITION DAMPING BOX

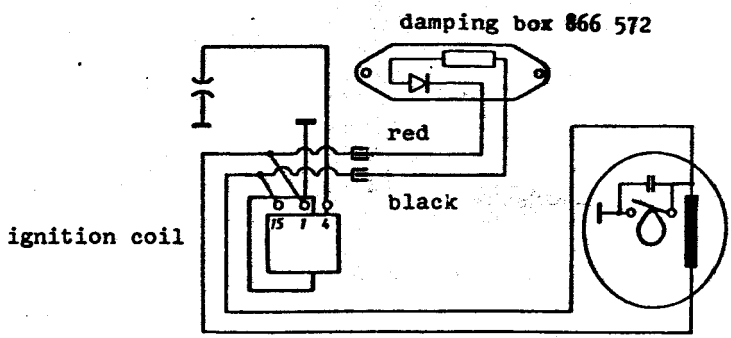
To prevent piston failures caused by glowing of deposits on spark plug (due to certain fuel additives) it is necessary

a) to clean the spark plug every approx. 10 hours of operation or to replace it.

b) An ignition damping box, part no. 866 572, is mounted on the engine to reduce the spark energy and the glowing of the spark plug deposits.

WIRING DIAGRAM FOR MOUNTING IGNITION DAMPING BOX 866 572

- red cable to ignition coil, connection 1
- black cable to ignition coil, connection 15



Damping box check

a) precaution check: Connect damping box with reversed polarity. There must be no spark on the plug when cranking the engine. If there is still a spark, the damping box is defective.

b) in case of ignition troubles (no spark): Disconnect damping box, if there is now a spark, the damping box is defective.

LIGHTING CIRCUIT

The BOSCH magneto generator produces, apart from the electric current required for the ignition, 12V 75/23W alternating current which can be directly used for feeding lights and/or other users that can be operated with alternating current.

To avoid the voltage to rise above permissible levels, either users amounting to 75/23 watts have to be connected, or a voltage regulator has to be used.

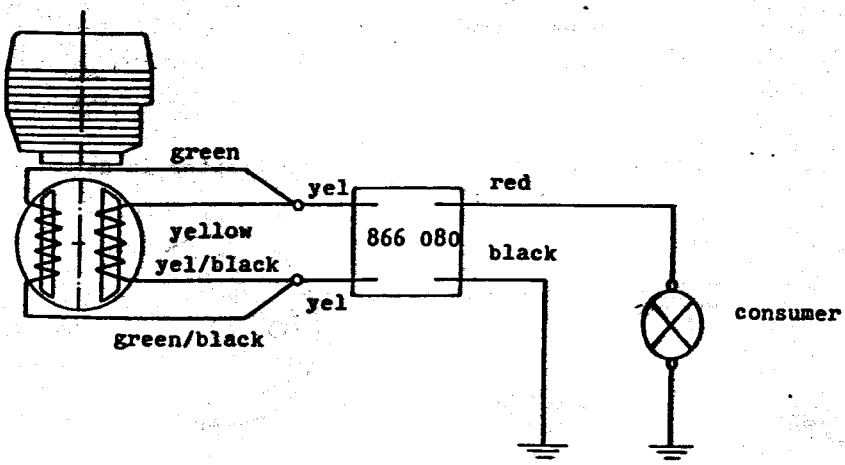
To operate users requiring direct current (e.g. battery), a rectifier-regulator is required.

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

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

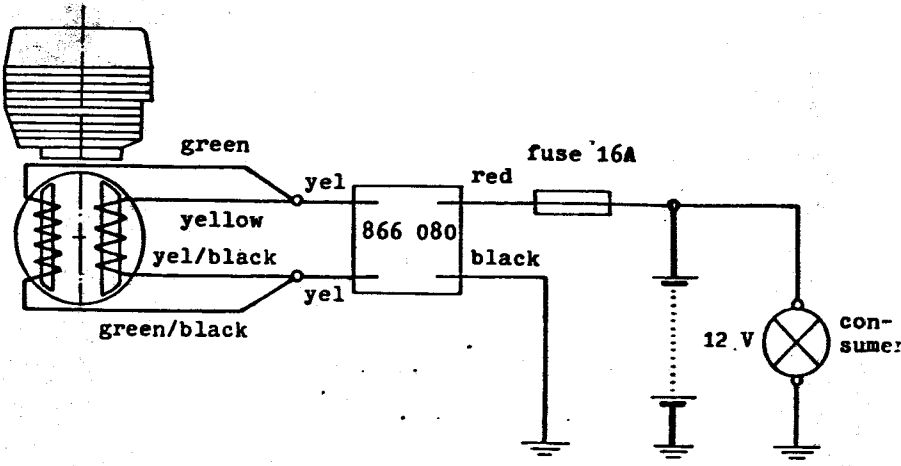
WIRING-DIAGRAM FOR RECTIFIER-REGULATOR 866 080

in a circuit without battery



WIRING DIAGRAM FOR RECTIFIER-REGULATOR 866 080

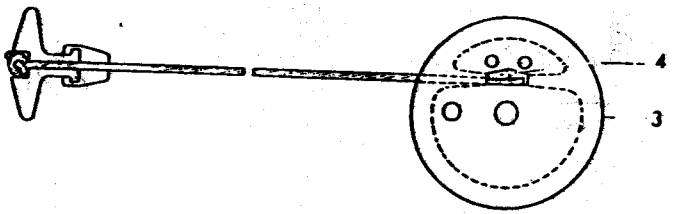
in conjunction with a battery

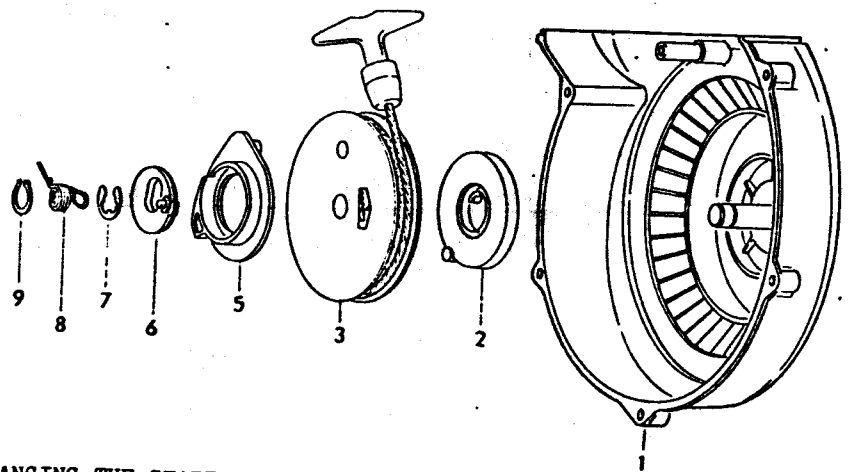


REWIND STARTER

Pull starter grip out slowly until resistance is felt, then pull out vigorously but not fully up to the end. As far as possible pull in the direction the rope comes out of the sheave. By a rewind spring the starter grip returns to its original position. Don't let the starter grip fly back.

Do not operate the engine if the rewind starter is defective.





CHANGING THE STARTER ROPE

(The numbers stated in brackets refer to the illustration)

First remove snap ring (9), loop spring (8), circlip (7), pawl lock (6) and the pawl (5).

Tools: Snap ring tongs
screwdriver

Pull out the starter rope fully to the end, hold fan cowl (1) and rope sheave (3) together in their position. There is an opening in the rope sheave. The key clamp (4) visible in the opening has to be pushed out in the opposite sense of the pulling direction. Pull the rope out of the rope sheave.

Then insert the new starter rope into the rope sheave, mount the key clamp in the same position as it was before and remount the parts 5, 6, 7, 8 and 9.

Caution! Do not remove spring container (2), this might cause injuries!

DECARBONIZING

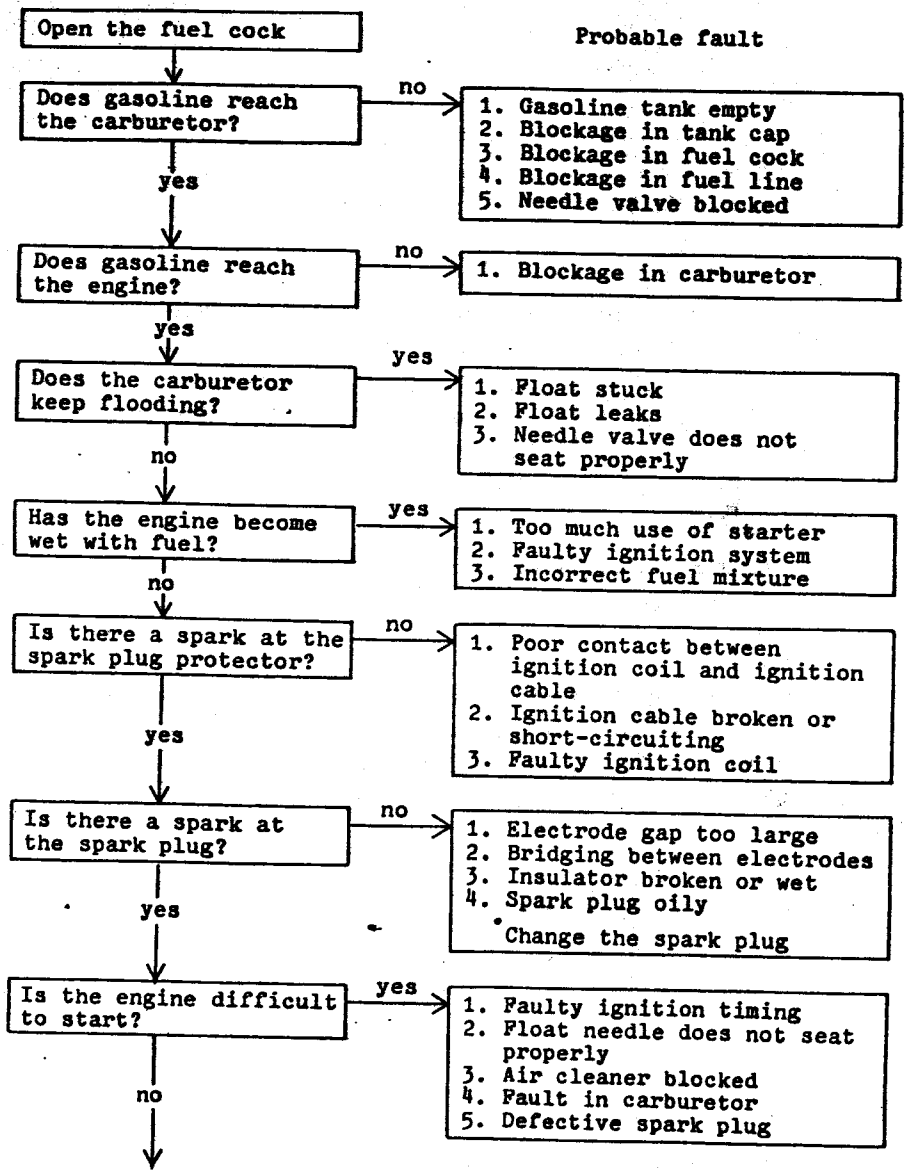
After approx. 50 hours of use the combustion chamber should be de-carbonized.

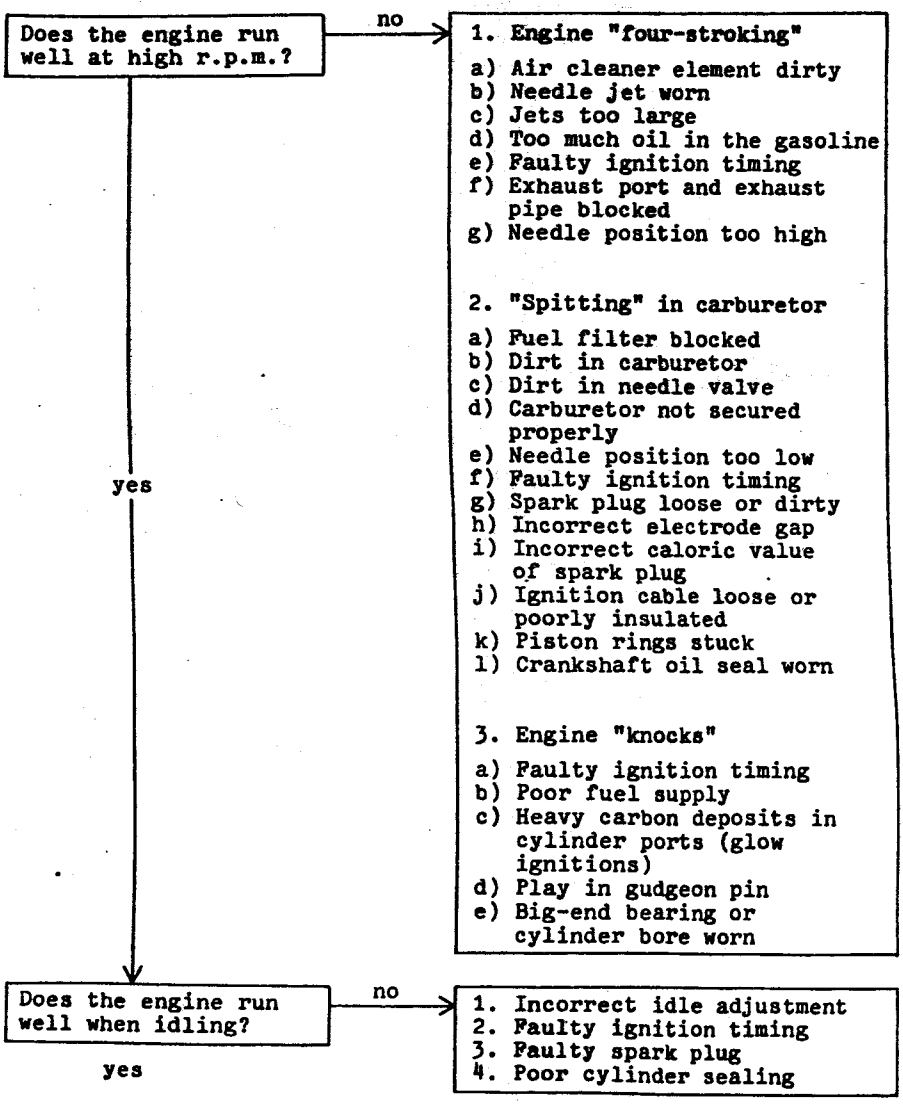
To do so:
Remove cylinder top cowling and -head. Hold cylinder in place by suitable means. Using a scraper, the carbon scales on the combustion chamber of the cylinder head and on the top of the piston should be removed. Piston at top dead center.

MAIN TORQUING SPECIFICATIONS

	Nm	in.lb
- Cylinder head nuts M8	18 ÷ 24	160 ÷ 210
- Crankcase screws M8	18 ÷ 24	160 ÷ 210
- Magneto housing nut M18 x 1,5	75 ÷ 85	660 ÷ 750
- Crankcase nuts (or -screws) M10	36 ÷ 40	320 ÷ 354
- Exhaust manifold screws M8	18 ÷ 24	160 ÷ 210

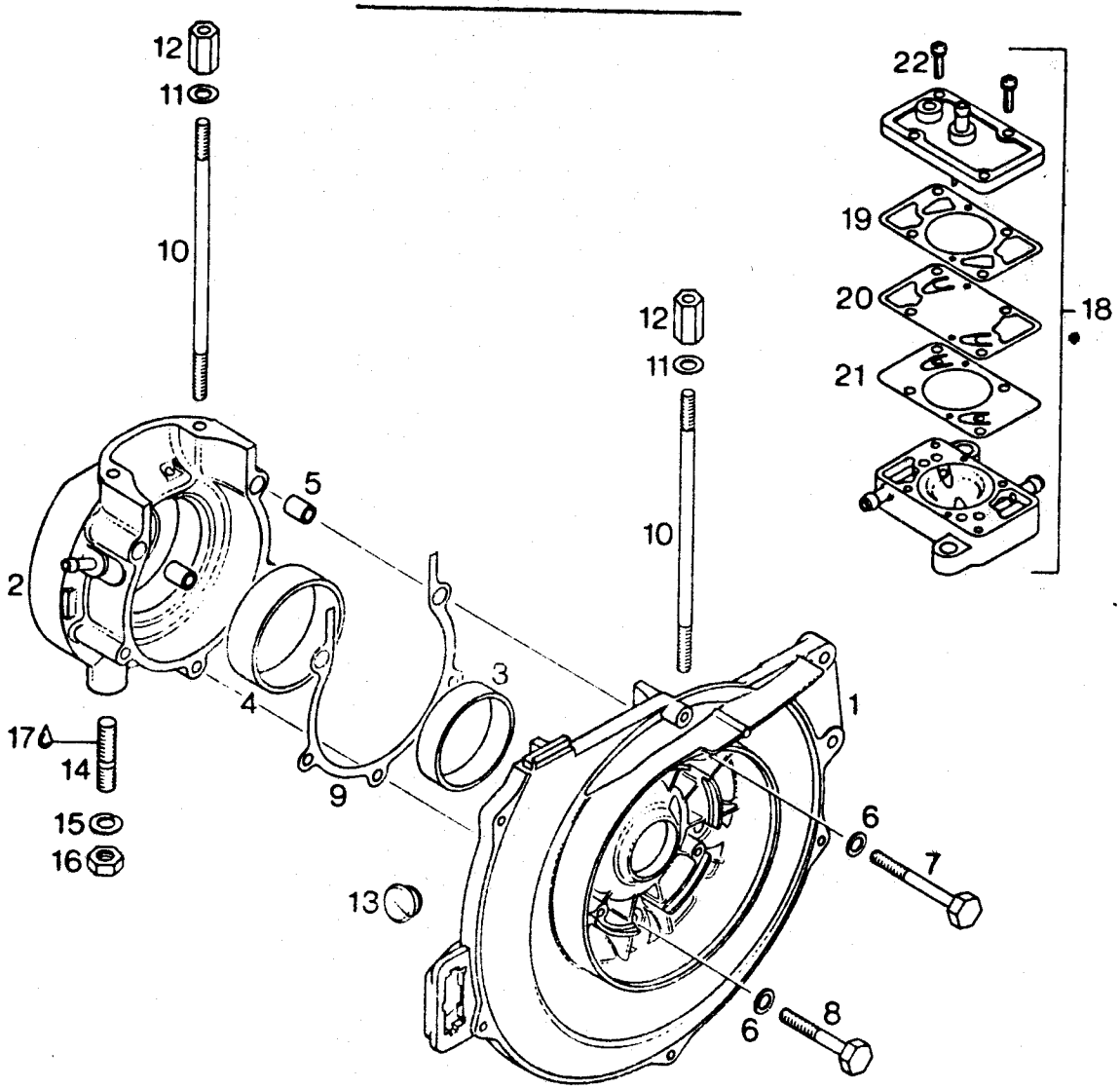
FAULT-TRACING SCHEDULE





Now all should be well, but remember to work in a methodical sequence when tracing faults.

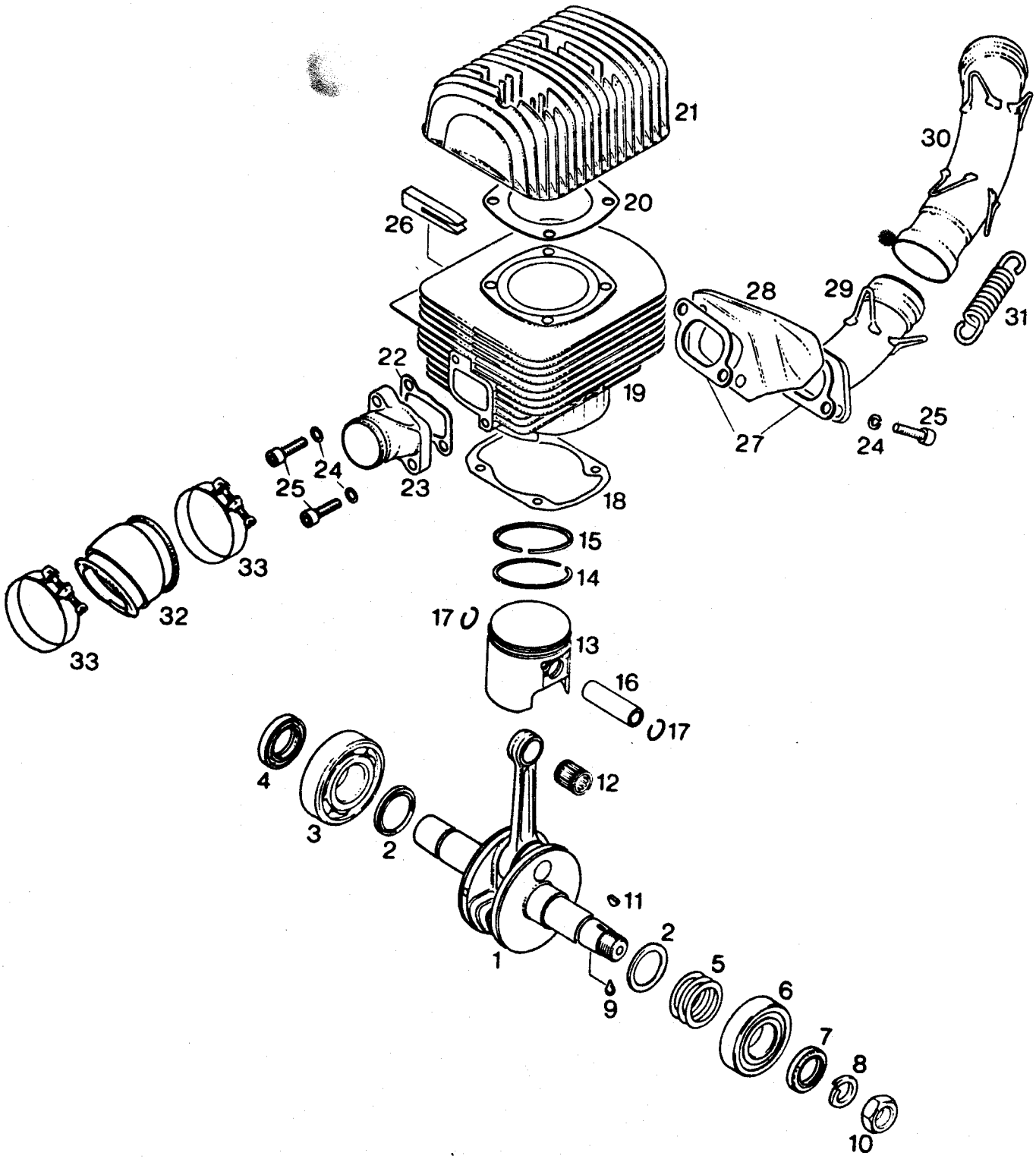
Crankcase, Fuel Pump



Ill. No.	Part No.	D e s c r i p t i o n	Qty
1 - 8	995 291	crankcase assy.	1
3	960 765	ring, crankcase, magneto side	1
4	260 470	ring, crankcase, p.t.o. side	1
5	229 150	dowel tube 11,8 Ø x 15	2
6	945 752	lock washer A8	5
7	841 311	hex. screw M8 x 74	2
8	240 320	hex. screw M8 x 55	3
9	850 060	gasket, crankcase	1
10	840 620	stud M8 x 175	4
11	250 311	washer 8,4	4
12	842 010	distance nut M8 x 27,5	4
13	960 285	cable grommet 20,5	1
14	940 190	stud M10 x 29	4

Ill. No.	Part No.	D e s c r i p t i o n	Qty
15	945 753	lock washer A10	4
16	242 090	hex. nut M10	4
17	899 786	means of securing LOCTITE blue	as requ.
18	994 482	fuel pump assy.	1
19	831 935	gasket	1
20	861 135	diaphragm	1
21	861 137	sealing diaphragm	1
22	841 460	combined screw M4 x 16	4

Crankshaft, Pistons, Cylinder, Exhaust Elbow

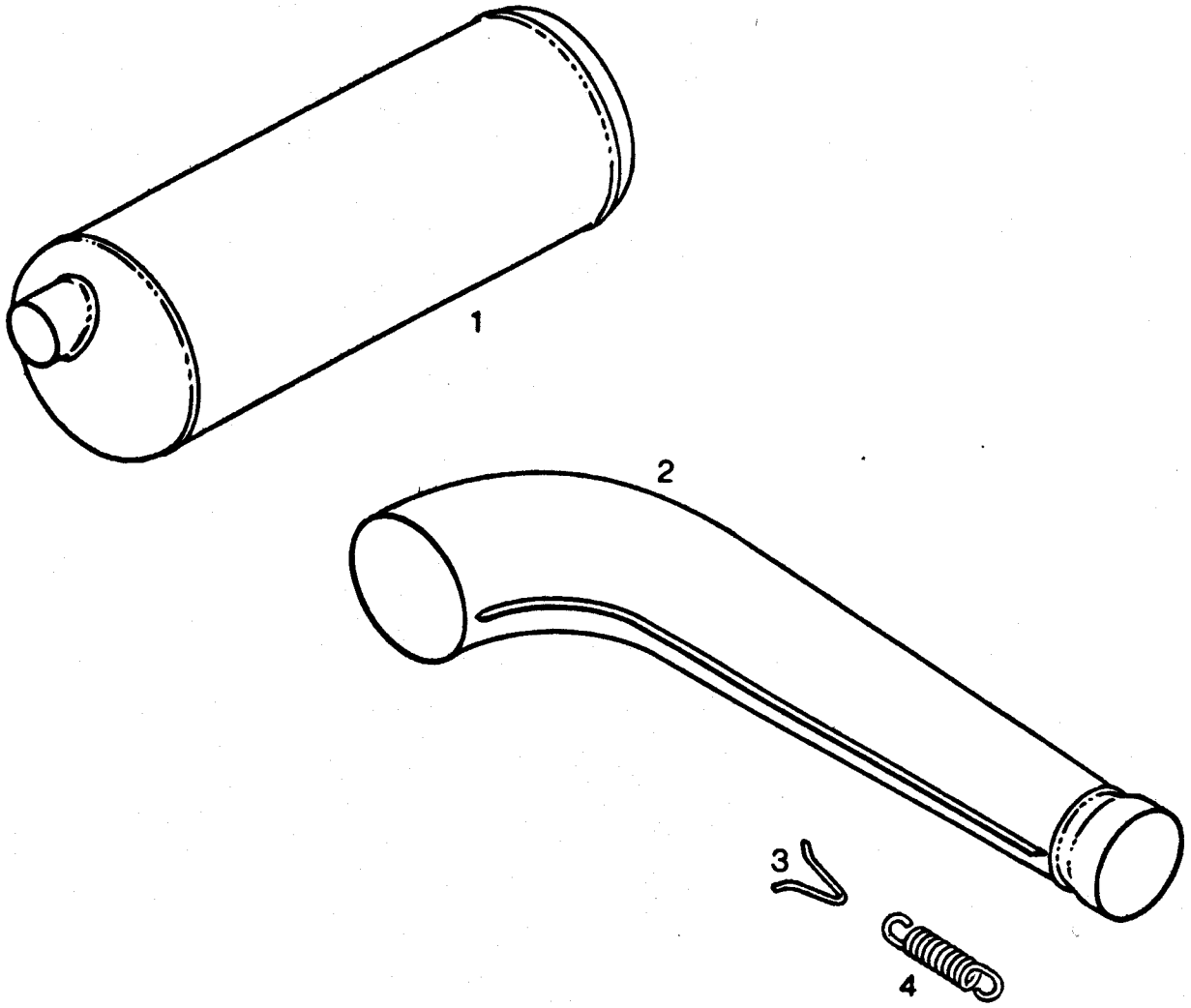


Ill. No.	Part No.	D e s c r i p t i o n	Qty
1	995 307	crankshaft assy.	1
2	827 440	distance ring 30,5/42/2, p.t.o. side .	2
3	932 571	ball bearing 6306, p.t.o. side	1
4	850 050	oil seal 30x47x7/7,5, p.t.o. side . .	1

Ill. No.	Part No.	D e s c r i p t i o n	Qty
5	944 582	shim 30,4/40,5/0,3	as requ.
	944 583	shim 30,4/40,5/0,1	as requ.
	944 584	shim 30,4/40,5/0,5	as requ.
	944 586	shim 30,4/40,5/0,2	as requ.
6	932 581	ball bearing 6206, magneto side	1
7	230 425	oil seal 28x38x7, magneto side	1
8	945 757	lokc washer A18	1
9	899 786	means of securing LOCTITE blue	
10	942 220	hex. nut M18 x 1,5	1
11	246 050	Woodruff key 3 x 3,7	1
12	932 904	needle cage	1
13,14,15,	995 280	piston assy. 72,0 mm w. 2 rings, standard	1
	995 281	piston assy. 72,25 mm w. 2 rings, 1st oversize	1
	995 282	piston assy. 72,5 mm w. 2 rings, 2nd oversize	1
14	915 850	rectangular ring 72,0 mm, standard . . .	1
	915 851	rectangular ring 72,25 mm, 1st oversize	1
	915 852	rectangular ring 72,5 mm, 2nd oversize .	1
15	215 230	SEMI-trapez ring 72,0 mm, standard . . .	1
	215 231	SEMI-trapez ring 72,25 mm, 1st oversize	1
	215 232	SEMI-trapez ring 72,5 mm, 2nd oversize .	1
16	916 185	gudgeon pin	1
17	945 735	circlip 18, gudgeon	2
18	831 855	gasket 0,4, cylinder flange	1
19	823 765	cylinder with sleeve	1
20	850 080	gasket, cylinder head	1
21	823 780	cylinder head	1
22	831 860	gasket, intake manifold	1
23	867 421	intake manifold	1
24	945 752	lock washer A8	4
25	840 991	cyl. screw M8 x 30	4
26	860 100	rubber, fins	1
27	831 846	gasket, exhaust socket	2
28	975 720	air deflector	1
29	879 050	exhaust socket assy.	1
30	879 100	exhaust elbow assy.	1
31	938 790	spring	3

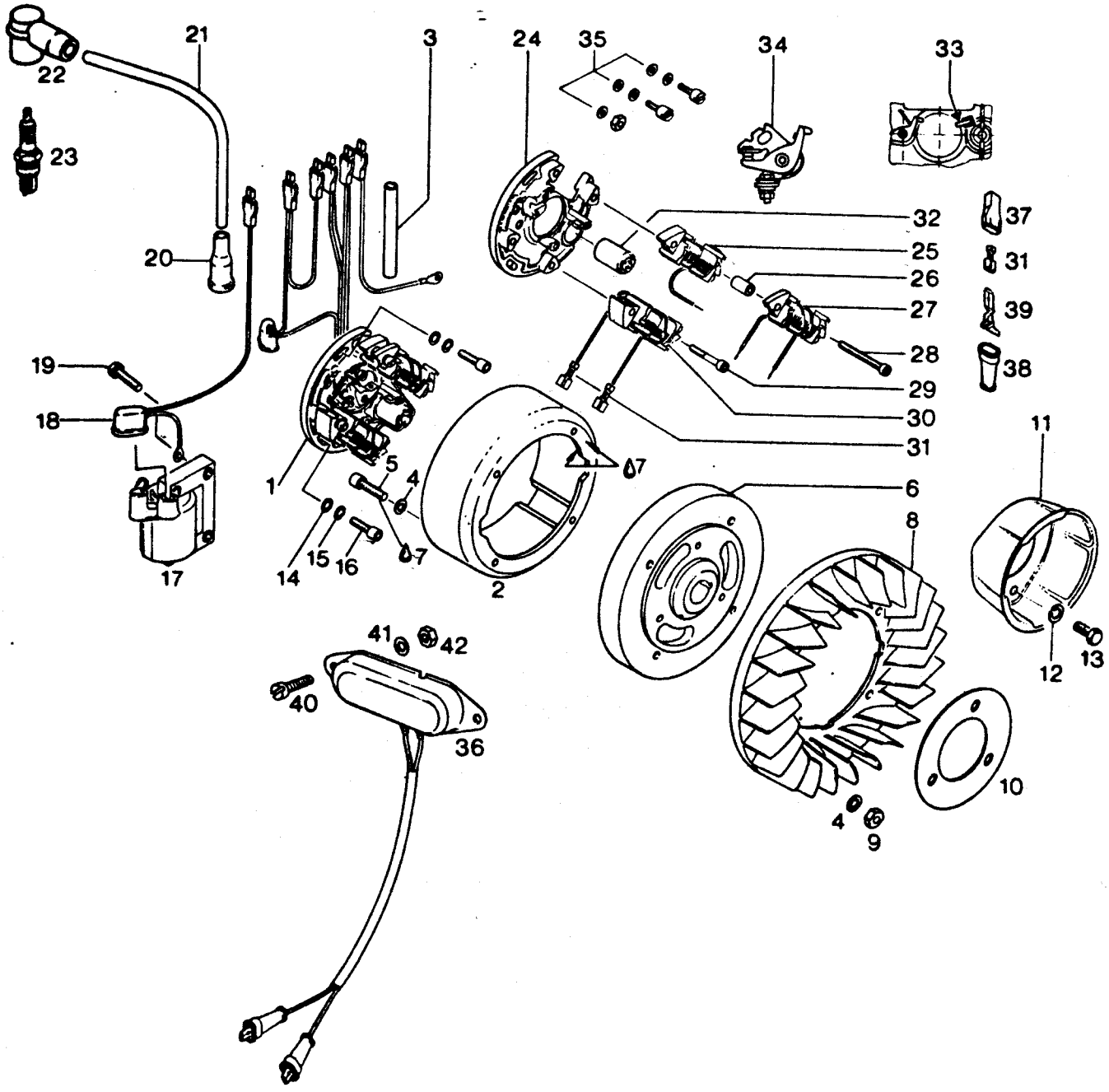
Ill. No.	Part No.	D e s c r i p t i o n	Qty
32	867 486	rubber socket	1
33	251 850	hose clamp 51 assy.	2

Exhaust System



Ill. No.	Part No.	D e s c r i p t i o n	Qty
1	879 691	muffler assy.	1
2	879 830	inlet cone assy.	1
3	853 355	hook	3
4	938 790	spring	3

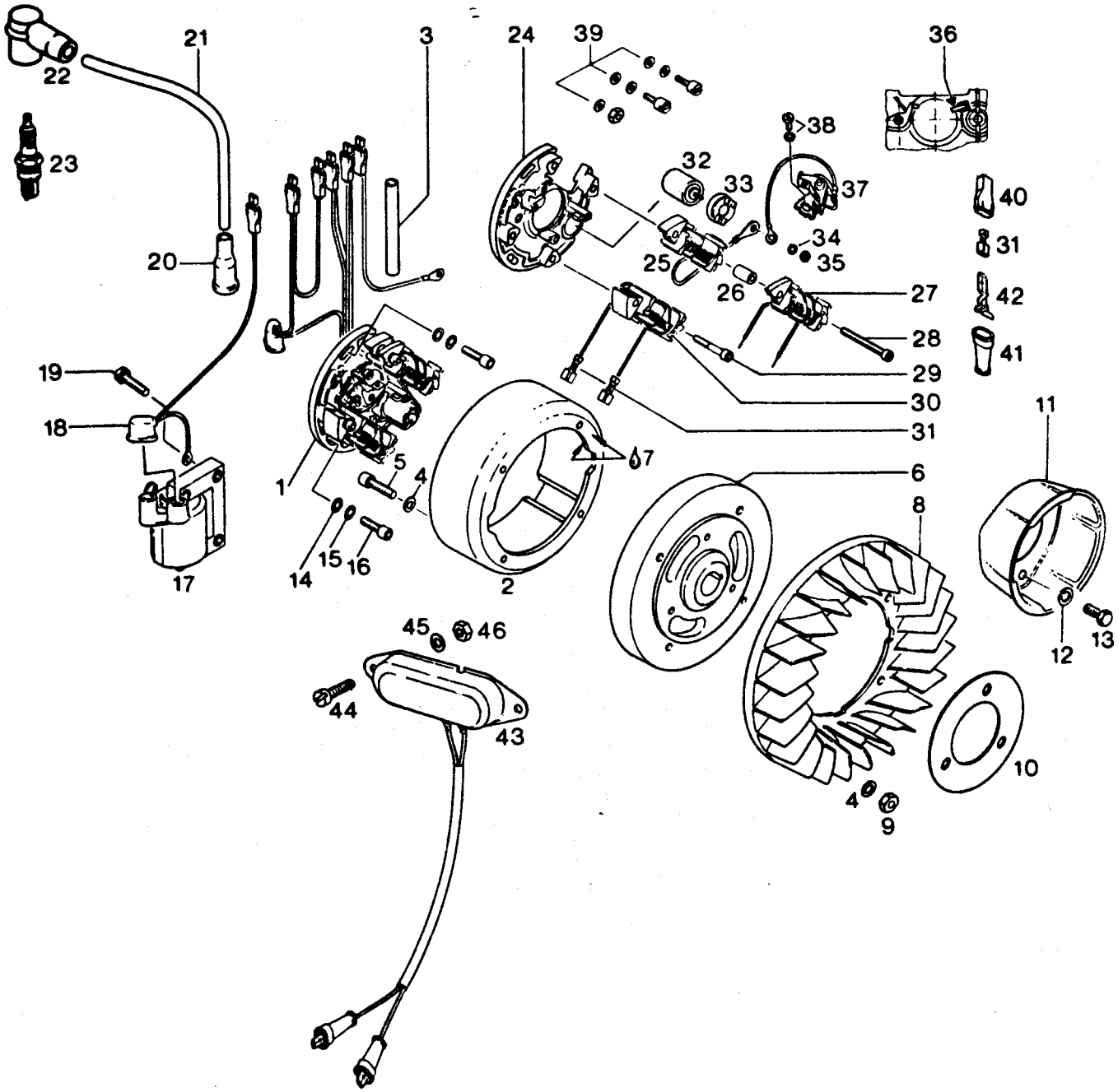
Magneto Generator 12V 75/23W with Soldering Connection



Ill. No.	Part No.	D e s c r i p t i o n	Qty
1,2,	292 701	magneto generator 12V 75/23W	1
1	992 585	armature plate assy.	1
2	983 864	magneto flywheel	1
3	960 182	protection hose 60 mm	1
4	945 761	lock washer A6	8
5	840 400	cyl. screw M6 x 22	4
6	866 415	magneto housing assy.	1
7	899 786	means of securing LOCTITE blue	as requ.
8	866 430	fan	1

Ill. No.	Part No.	D e s c r i p t i o n	Qty
9	242 210	hex. nut M6	4
10	827 285	washer	1
11	852 310	starting pulley	1
12	945 751	lock washer A6	3
13	240 910	hex. screw M6 x 14	3
14	827 800	washer 5,5	3
15	945 750	lock washer A5	3
16	840 515	cyl. screw M5 x 18	3
17	984 555	ignition coil	1
18	864 272	mass cable assy.	1
19	841 550	Taptite-screw M5 x 22	3
20	960 550	protection cap	1
21	964 710	ignition cable 390 mm	1
22	865 200	spark plug protector	1
23	897 050	spark plug 14 NGK B8ES	1
24	865 910	armature plate	1
25	865 890	generator coil	1
26	847 240	distance sleeve 11 mm	2
27	865 900	lighting coil 23W	1
28	241 415	combined screw M5 x 32	2
29	640 095	locking screw M5 x 25	2
30	865 026	lichting coil 75W	1
31	864 011	Faston connector 6,3 x 0,8	6
32	965 910	condenser without cable	1
33	265 815	lubricating wick	1
34	983 347	contact breaker set	1
35	964 210	parts set	1
36	866 572	ignition damping box	1
37	960 719	protection cap	6
38	960 970	protection cap	4
39	866 300	Faston connector	6
40	240 791	cyl. screw M5 x 10	2
41	927 571	washer 5,3	2
42	842 030	locking nut M5	2

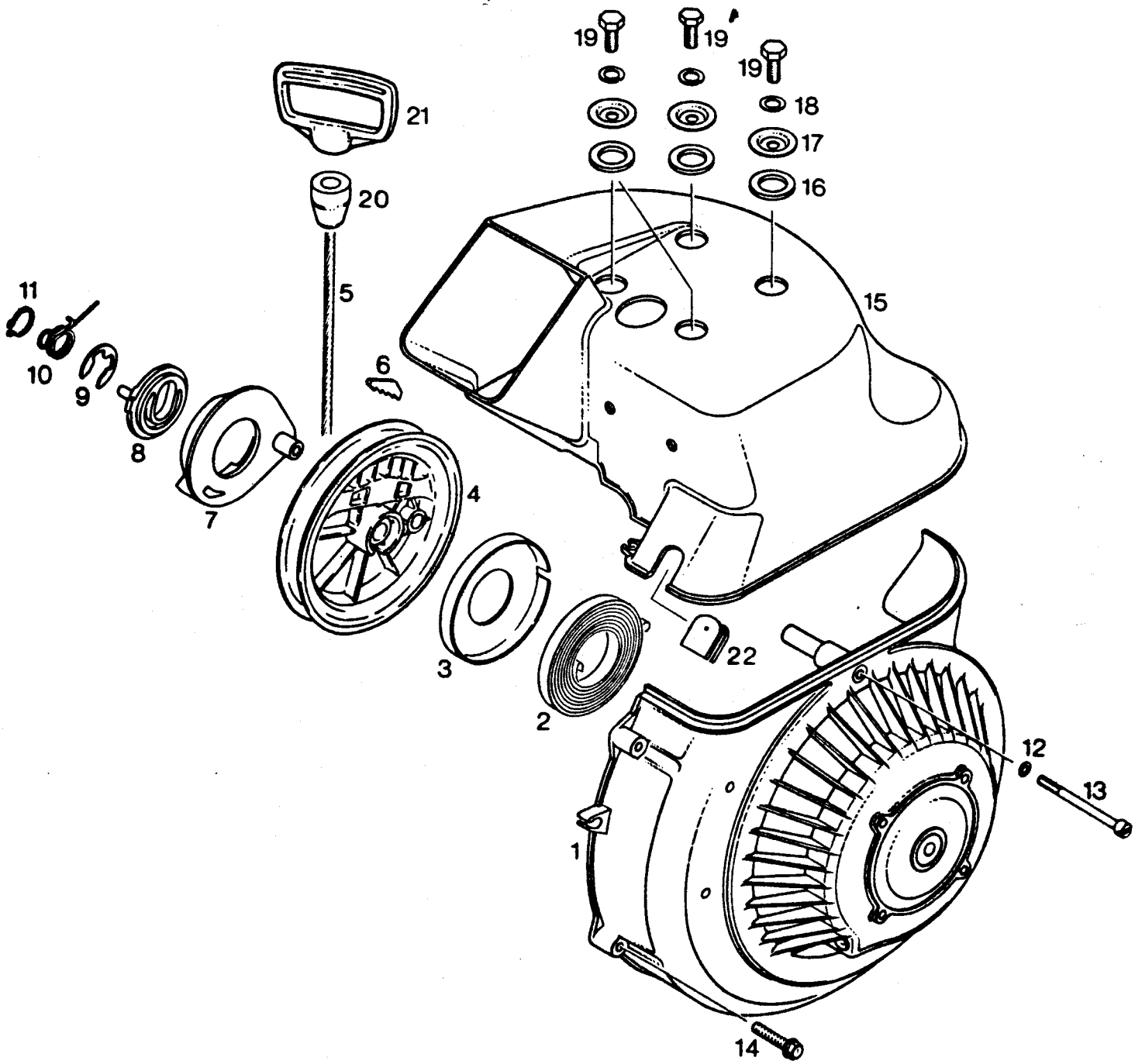
Magneto Generator 12V 75/23W with Threaded Connection



Ill. No.	Part No.	D e s c r i p t i o n	Qty
1,2,	292 701	magneto generator 12V 75/23W	1
1	992 585	armature plate assy.	1
2	983 864	magneto flywheel assy.	1
3	960 182	protection hose 60 mm	1
4	945 761	lock washer A6	8
5	840 400	cyl. screw M6 x 22	4
6	866 415	magneto housing assy.	1
7	899 786	means of securing LOCTITE® blue	as requ.
8	866 430	fan	1

Ill. No.	Part No.	D e s c r i p t i o n	Qty
9	242 210	hex. nut M6	
10	827 285	washer	1
11	852 310	starting pulley	1
12	945 751	lock washer A6	3
13	240 910	hex. screw M6 x 14	3
14	827 800	washer 5,5	3
15	945 750	lock washer A5	3
16	840 515	cyl. screw M5 x 18	3
17	984 555	ignition coil	1
18	864 272	mass cable assy.	1
19	841 550	Taptite-screw M5 x 22	3
20	960 550	protection cap	1
21	964 710	ignition cable 390 mm	1
22	865 200	spark plug protector	1
23	897 050	spark plug 14 NGK B8ES	1
24	865 910	armature plate	1
25	865 890	generator coil	1
26	847 240	distance sleeve 11 mm	2
27	865 900	lighting coil 23W	1
28	241 415	combined screw M5 x 32	2
29	640 095	locking screw M5 x 25	2
30	865 026	lighting coil 75W	1
31	864 011	Faston connector	6
32 - 35	964 217	condenser set	1
32	265 525	condenser	1
33	860 130	condenser cap	1
34	245 090	lock washer A3	1
35	942 171	hex. nut M3	1
36	265 815	lubricating wick	1
37	983 343	contact breaker set	1
38	241 215	combined screw M4 x 10	1
39	964 210	parts set	1
40	960 719	protection cap	6
41	960 970	protection cap	4
42	866 300	Faston connector	4
43	866 572	ignition damping box	1
44	240 791	cyl. screw M5 x 10	2
45	927 571	washer 5,3	2
46	842 030	locking nut M5	2

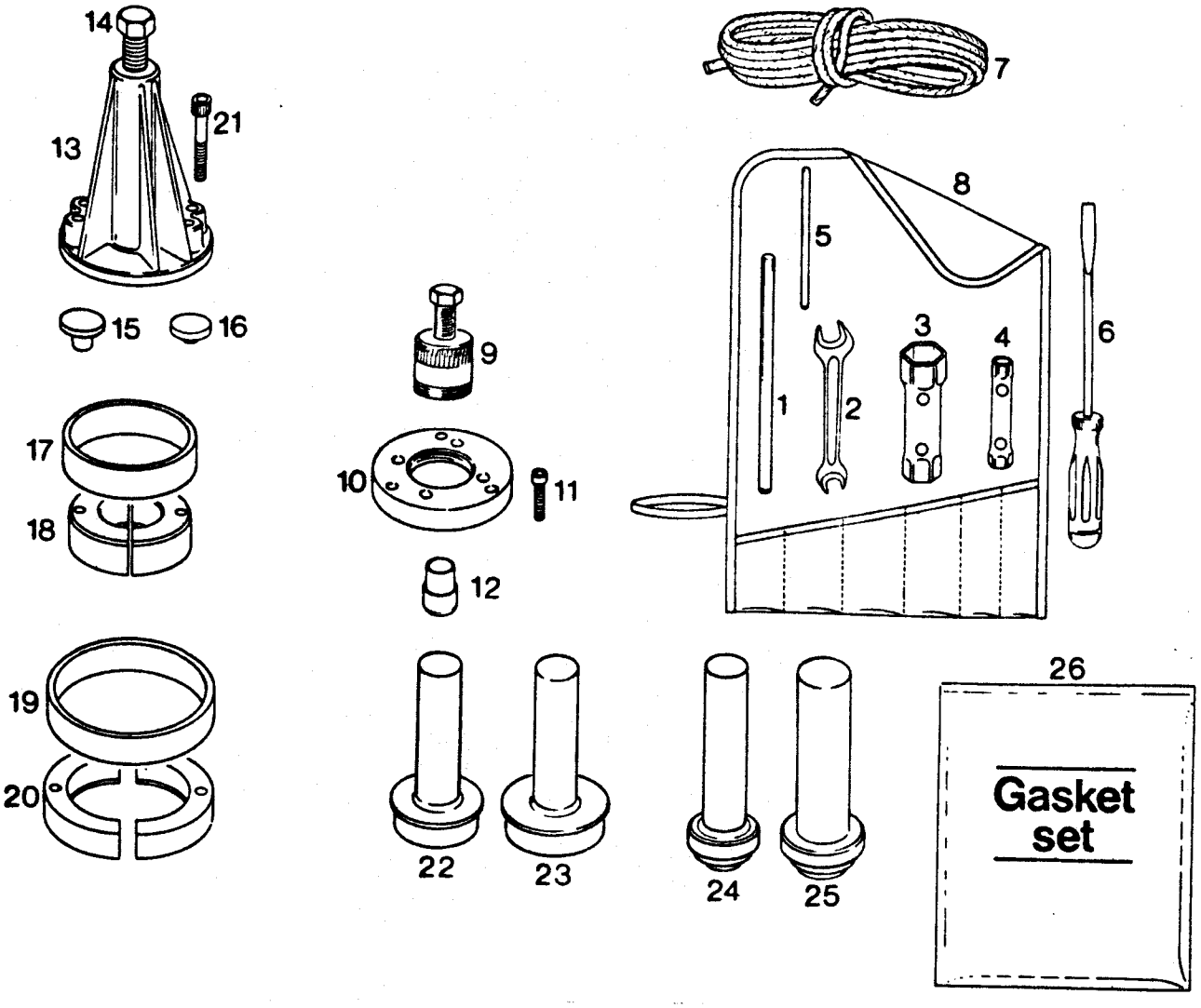
Fan Cowl w. Rewind Starter, Cylinder Cowl



Ill. No.	Part No.	D e s c r i p t i o n	Qty
1 - 11	994 882	fan cowl w. rewind starter	1
1	910 016	fan cowl assy.	1
2,3,	984 454	spring cartridge assy.	1
2	938 001	rewind spring	1
3	827 350	spring guide	1
4	852 282	rope sheave	1
5	852 097	starter rope 2200 mm	1
6	852 070	key clamp	1

Ill. No.	Part No.	D e s c r i p t i o n	Qty
7	852 290	pawl	1
8	852 300	pawl lock	1
9	845 300	locking washer 15	1
10	938 985	loop spring	1
11	945 770	locking ring 17 x 1	1
12	945 751	lock washer A6	1
13	241 571	cyl. screw M6 x 73	1
14	941 505	Taptite-screw M6 x 30	5
15	910 022	cylinder cowl	1
16	960 860	rubber washer	4
17	827 140	cowl cover	4
18	945 752	lock washer A8	4
19	940 581	hex. screw M8 x 16	4
20	960 415	rubber buffer	1
21	852 175	starter grip	1
22	960 587	cable grommet	1

Tools, Gasket Set



Ill. No.	Part No.	Description	Qty
1 - 8	876 631	tool bag assy.	1
1	977 420	bolt, socket wrench 8 x 130	1
2	276 065	fork wrench 10/13 mm	1
3	876 210	socket wrench 21/26 mm	1
4	876 225	socket wrench 10/13 mm	1
5	876 640	crankshaft fixation bolt	1
6	876 200	screw driver	1
7	852 091	starter rope 2110 mm	1
8	876 195	tool bag, black	1
9	876 065	puller assy. for magneto housing M42 x 1,5	1
10	876 655	puller ring	1
11	840 860	cyl. screw M6 x 25	3
12	976 890	protection cap 18 assy.	1

Ill. No.	Part No.	D e s c r i p t i o n	Qty
13	876 296	puller assy.	1
14	940 755	hex. screw M16 x 1,5 x 145	1
15	876 550	protection mushroom for crankshaft, p.t.o. side	1
16	876 555	protection mushroom for crankshaft, magneto side (only for crankshaft with square insert)	1
17	977 480	ring for puller	1
18	276 020	ring half for ball bearing	2
19	977 490	ring for puller	1
20	977 470	ring half for ball bearing	2
21	840 680	cyl. screw M8 x 40	2
22	276 930	plastic ring insertion jig, magneto side	1
23	276 940	plastic ring insertion jig, p.t.o. side	1
24	277 875	stamp to mount oil seal	1
25	876 660	stamp to mount oil seal	1
26	992 067	gasket set assy.	1