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5) Table of amendments

***Approval**

The technical content of this document is approved under the authority of

DOA Nr. EASA.21J.048.

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6) General note

We are pleased you decided to purchase a ROTAX aircraft engine.

This section describes the maintenance of all engines in the 912/914 Series.

◆ NOTE: The 912/914 Series includes the following engines:

- 912 A
- 912 F
- 912 S
- 912 UL
- 912 ULS
- 912 ULSFR
- 914 F
- 914 UL

Before carrying out maintenance work on the engine, please read the Maintenance Manual (Heavy Maintenance) carefully. See also the latest revision of the corresponding Maintenance Manual (Line Maintenance) for the respective engine type 912 Series or 914 Series.

If any passages of this Manual are not clearly understood or if you have any questions, please contact an authorized distributor or Service Center for ROTAX aircraft engines.

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7) Safety notice

Although the mere reading of such information does not eliminate the hazard, your understanding and application of the information will promote correct use.

The information and components/system descriptions contained in this Maintenance Manual are correct at the time of publication. BRP-Rotax maintains a policy of continuous improvement of its products, without, however, incurring any obligation to install them on its products previously manufactured.

BRP-Rotax reserves the right to discontinue or alter any specification, design, detail, model or equipment, at any time and without incurring obligation.

The illustrations in this Maintenance Manual show the typical construction. They may not correspond to every detail or the exact shape of the actual parts, but show parts which have the same or similar function.

Specifications are given in the SI metric system with the USA equivalent in parenthesis.

7.1) Repeating symbols

This Manual uses the following symbols to emphasize particular information. These indications are important and must be respected.

▲ **WARNING:**	**identifies an instruction which, if not followed, may cause serious injury including the possibility of death.**
■ **CAUTION:**	**Denotes an instruction which, if not followed, may severely damage the engine or other component.**
◆ **NOTE:**	**Indicates supplementary information which may be needed to fully complete or understand an instruction.**
|| ||	A revision bar outside of the page margin indicates a change to text or graphic.
(XXX)	In various illustrations, this symbol indicates the location of the serial number on a component.
4	In the illustrations concerned, this symbol indicates the position of the serial component number (e.g. on crankshafts, camshafts).
VT06	In the illustrations concerned, a fourdigit combination of letters and numbers indicates a control point which needs to be checked. See the corresponding dimension sheets for the correct value.

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8) Technical documentation

See also the corresponding Maintenance Manual (Line Maintenance) for the respective engine type 912 Series or 914 Series.

8.1) Filling in the dimension sheets

See Fig. 00-1

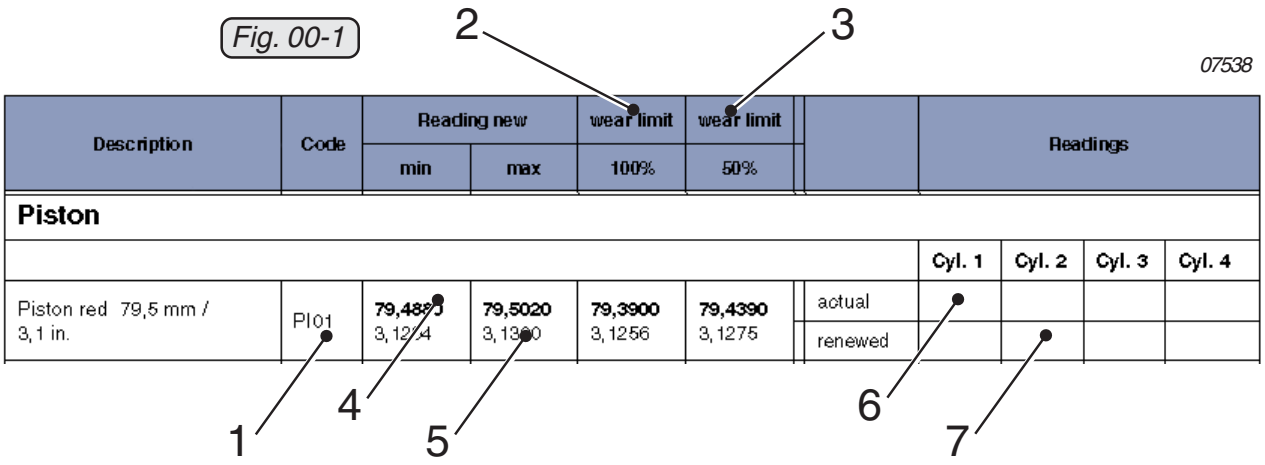
All measurements must be entered in the corresponding dimension sheets as shown.

Fig. 00-1 shows the correct procedure for filling in the dimension sheets attached after each section.

■ CAUTION: If the engine is overhauled / repaired before the end of the TBO, the 50% specified values (3) for wear limits do not apply and must be calculated separately in accordance with Section 9 “Classification of parts for maintenance”.

- Look up the desired control point code (1) in the illustration in the specified section.

Fig. 00-1



- The maximum limits for wear are divided into two columns, maximum wear 100% (2) and 50% wear (3).
- Field (4) gives the maximum permissible values in [mm], field (5) in [inches].
- The respective actual value must be entered in the corresponding box (6) in [mm] or [inches].
- The actual value for any part which has been replaced is entered in the corresponding field (7) in [mm] or [inches].

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Dimensional check of parts

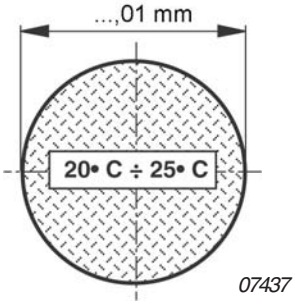
See Fig. 00-2

Take readings of all parts listed in the dimension sheets.

Enter the respective actual value in the dimension sheets attached directly after each section.

■ CAUTION: Where measurement values are taken in hundredths of a millimeter or more precisely, the temperature of the part must be 20 to 25 °C (68 to 77 °F).

Fig. 00-2



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8.2) List of abbreviations

The following table shows the abbreviations used for the control points.

Abbreviations for control points

Abbreviation	Description
AL	**al**ternator
CA	**ca**mshaft
CC	**c**rank**c**ase
CH	**c**ylinder **h**ead
CR	**c**on**r**od
CS	**c**rank**s**haft
CY	**cy**linder
EL	**el**ectric
ES	**e**lectric **s**tarter
EX	**ex**haust
GB	**g**ear**b**ox
GO	**go**vernor
OP	**o**il **p**ump
PI	**pi**ston
PP	**p**iston **p**in
ST	**st**ator
TC	**t**urbo **c**harger
VT	**v**alve **t**rain
WP	**w**ater **p**ump

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9) Classification of parts for maintenance/repair

See Figs. 00-3 and 00-4.

As for an overhaul, parts for maintenance/repair must be classified. They are classified either as **“parts usable”** or as **“parts to be replaced”**.

The classification is made on the basis of the following criteria:

– **Hours of operation** (decisive are the total operating hours of the part / engine or hours since the last overhaul)

– Determined (measured) **actual dimension** of the respective parts.

– See Figs. 00-3 and 00-4 for the classification of such parts.

Proceed as follows:

– Determine wear as a percentage of the wear tolerance

(see the dimension sheets attached directly after each section for the wear limit (100%) of the part in question).

– Determine the hours of operation for the part in question (see Log book etc.)

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For engines of Series 912:

Fig. *00-3*

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TSN [h] (Time Since New)		max. permissible wear for repair [%]	max. permissible wear for repair [%]
from	to	TBO 1500 - 912 Series	TBO 2000 - 912 Series
0	50	4	4
51	100	12	12
101	150	18	18
151	200	24	24
201	250	30	30
251	300	36	36
301	350	42	42
351	400	46	46
401	450	52	52
451	500	56	56
501	550	60	60
551	600	62	62
601	700	68	67
701	800	73	72
801	900	78	76
901	1000	82	80
1001	1100	87	83
1101	1200	90	87
1201	1300	93	90
1301	1400	96	92
1401	1500	100	94
1501	1600		96
1601	1700		98
1701	1800		98
1801	1900		99
1901	2000		100

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For engines of Series 914:

Fig. *00-4*

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TSN [h] (Time Since New)		max. permissible wear for repair [%]	max. permissible wear for repair [%]
from	to	TBO 1200 - 914 Series	TBO 2000 - 914 Series
0	50	6	4
51	100	14	12
101	150	24	18
151	200	30	24
201	250	36	30
251	300	44	36
301	350	50	42
351	400	54	46
401	450	60	52
451	500	64	56
501	550	68	60
551	600	72	62
601	700	76	67
701	800	82	72
801	900	87	76
901	1000	91	80
1001	1100	95	83
1101	1200	100	87
1201	1300		90
1301	1400		92
1401	1500		94
1501	1600		96
1601	1700		98
1701	1800		98
1801	1900		99
1901	2000		100

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9.1) Determination of actual wear [%]

See Figs. 00-5, 00-6 and 00-7.

Determine actual dimension **F** of the part in question.

For new dimension (max) **B** and wear limit **C,** see the corresponding section ´Wear limits“ (e. g. 74-00-00 sec. 4).

Fig. 00-5
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$$\text{Actual wear} = \frac{\{\text{Actual dimension (F)} - \text{New dimension max. (B)}\} \times 100}{\{\text{Wear limit (C)} - \text{New dimension max. (B)}\}} \ [\%]$$

Fig. 00-6
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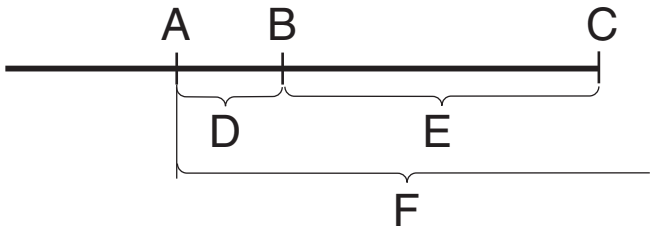

The **actual wear** in [%] is determined with the following formula:

Legend:

A New dimension (min)

B New dimension (max)

C Wear limit

D New dimension tolerance

E Wear tolerance

F Actual dimension

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■ CAUTION: New dimension (max) **B** is always the dimension which is closest to wear limit **C**.

Fig. 00-7

Actual wear [%] is **greater** than or **equal** to the **max. permissible wear** [%] calculated from the table	Parts must be replaced
Actual wear [%] is **smaller** than the **max. permissible wear** [%] calculated from the table	Parts can be used again

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Procedure for classification of "On Condition Parts" at maintenance/ repair:

◆ NOTE: A negative result means that the actual dimension **F** is within the new dimension tolerance **D**.

Example for engines of Series 914:

Hours of operation indicated 300 h.

The determined percentage of maximum permissible wear calculated is **46.6 %**.

New dimension (max) **B** = 28.03 mm (1.1035 in.)

Wear limit **C** = 28.10 mm (1.1062 in.)

Actual dimension **F** = 28.07 mm (1.1051 in.)

Actual wear 57.1 %

▲ WARNING: The part must be replaced (i.e. this part is excessively worn for only 300 hours of operation).

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NOTES

10) Maintenance

The following sections describe maintenance procedure for engines of the 912/914 Series above and beyond the maintenance and special checks, see corresponding Maintenance Manual (Line Maintenance) for the respective engine type, 912 Series or 914 Series, and the systems descriptions given hitherto. The description is subdivided into subsections and descriptions of the function of the various systems.

Some overlapping maintenance instructions are treated as generally valid information at the beginning of this chapter.

10.1) Trouble shooting

In the Operators Manual, possible problems as well as feasible remedies are listed. At the same time, brief reference is made to the necessary remedial action.

See the respective sections in the Operators Manual for the corresponding engine type in the 912/914 Series.

10.2) Tightening torques

In general, all screw connections on ROTAX engines must be tightened using a torque wrench.

If not specified otherwise for a component, tighten screw connections to the following torque:

M4 : 4 Nm (35 in.lb)

M5 : 6 Nm (55 in.lb)

M6 : 10 Nm (90 in.lb)

M8 : 24 Nm (17.7 ft.lb)

M10 : 35 Nm (25.8 ft.lb)

■ CAUTION: If not specified otherwise, the threads are not lubricated when fastened.

◆ NOTE: Adhere to the tightening torques specified see also indications in the Illustrated Parts Catalog.

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10.3) Consumable materials

▲ WARNING: Use only the specified or **technically equivalent** materials for all maintenance work.

The materials listed have undergone longterm testing and are suitable for all operating conditions indicated by the manufacturer.

▲ WARNING: When handling chemicals, comply with all the customary regulations and specifications of the producer, including the expiry date.

◆ NOTE: Consider the curing time of the sealing surface compound as stated by the manufacturers' instructions.

No.	part no.	description, application ..... Qty.
1	899785	**LOCTITE 221 (222) violet,** light duty screw locking agent ..... 10 ml
2	897651	**LOCTITE 243 blue,** medium duty screw locking agent ..... 10 ml
3	898441	**LOCTITE 2701,** heavy-duty screw locking agent ..... 5 ml
4	899789	**LOCTITE 603 green,** oil tolerant retaining compound, heavy-duty ..... 10 ml
5	897511	**LOCTITE 380 black,** grouting product, heavy-duty, fasthardening ..... 20 ml
6	n.a	**LOCTITE 518 red,** can be used instead LOCTITE 574 orange
7	297434	**LOCTITE Anti-Seize 8151,** for the prevention of fretting corrosion ..... 50 g
8	297433	**MOLYKOTE G-N,** lubricant ..... 100 g
9	897166	**MOLYKOTE 44 medium,** longterm lubricant for shaft seals ..... 100 g
10	897330	**Lithium-base grease,** to avoid leakage current ..... 250 g
11	897870	**K&N Filter oil 99 - 11312,** for optimum filter efficiency and moisture protection ..... 14.8 ml
12	297368	**SILASTIC 732** multipurpose onecomponent siliconbased sealing compound ..... 310 ml
13	899788	**LOCTITE 648 green,** high temperature screw locking agent ..... 5 ml

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14 899791 LOCTITE 5910
flange sealant provides flexibility and adhesion .....50 ml

15 n.a. LOCTITE 7063
for degreasing and cleaning surfaces.....as required

16 897186 SILICONE HEAT CONDUCTION COMPOUND ..... 150 g

Application of the heat conduction compound will reduce heat transfer resistance. The greaselike, temperature-resistant silicon compound fills cavities between components and cooling elements (e.g: spark plug - cylinder head), which otherwise do not contribute to heat conduction.

17 297710 PU-glue
for shock absorption .....310 ml

18 n.a. Multipurpose grease LZ

Generally usable, neutrally colored multipurpose grease, water resistant and highly adherent. Usable for temperatures from -35 °C to +120 °C (-31 °F to 248 °F) and can be subjected to high mechanical loads.

19 n.a. Preservation oil

This special oil has excellent penetrating capabilities and reaches even tiny gaps, it's highly effective additives protect against corrosion of metal surfaces.

20 n.a. Flexible web for surface finishing 3M Scotch-Brite Multi . Flex - very fine or ultra fine

Is sold by the meter and used for manual removal of smaller rust spots or oxidation, especially for optimum ground connections. It is particularly suitable for removing LOCTITE from surfaces or threads to make them metallic clean. Before re-applying LOCTITE, clean surfaces with nitrothinner or degreasing agent (CASTROL ZA 30 or OMV - SOFT SOL). When using solvents, observe the safety regulations for persons and the environment.

21 n.a. MS4 / DC4 Dow Corning # 4

Electrical insulating compound for protection of electrical connections.

d04774

22 898570 Screw securing paint

seals screws ..... 20 ml

23 n.a. Cleaning agent

▲ WARNING: Use only approved cleaning agents (e.g. varsol, etc.) for cleaning metal parts.

Do not use lyebased cold cleaners or degreasing agents. Do not clean coolant and oil hoses with aggressive solutions. Clean off residues of sealing compound with sealant remover.

Soak combustion chamber, piston and cylinder head with cleaning agent and remove combustion residues with a bronze brush. CASTROL “Clenvex 2000” has proved very effective. It is a solvent - cold cleaner, free of halogen, on the basis of selected fuel fractions and is biodegradable.

Never use caustic or corrosive cleaning agents.

24 n.a. Valve lapping paste

This paste, produced by various manufacturers, is a fine granulate lapping paste for manual lapping of valve seats and valves. The paste is usually available in 3 different granulate sizes. Use as per manufacturer’s instructions.

25 n.a. MICRONORM abrasive

This abrasive is suitable for local and gradual very fine treatment of steel parts with rust film (propeller shaft). The MICRONORM abrasive contains no harmful substances, is approved by the competent authorities and guarantees optimum cleaning. The granulates used are of sizes 40 to 60 μ . The achievable surface roughness is between 0.5 and 1 μ, which corresponds to ultrafine machining of surfaces.

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10.4) Auxiliary tools

– compression tester or 2 pressure gauges with calibrated orifice, adapter for dial gauge in spark plug thread

– valve spring mounting pliers

– step punch for valve guide

– adjustable reamer 6.5 to 7.5 mm (0.256 to 0.295 in.)

– valve seat machining device, valve lapping paste,

– gearbox support plate

– stud extraction tool

– scraper, very fine emery cloth, grinding tool, cover sheet, adhesive tape

– cleaning agent, approved cleaners, funnel, graphite marker.

– magnetic particle tester DEUTROFLUX, series UHW, or equivalent. See 72-00-00 sec. 5.1.1.

  These testers are suitable for complete combined magnetic particle crack inspection of all ferromagnetic materials. For this purpose **an A.C. field circulation** can be combined with a **shifted phase A.C. circulation** . The two magnetizing methods are independent from each other and can be applied separately.

  To achieve the direction changes of the magnetic field vector necessary for indication of cracks in any direction, the alternating currents serving as the current supply for the different methods of magnetizing are dephased by 120° to each other:

  a) current circulation for indication of longitudinal cracks

  b) field circulation for indication of transverse cracks

  c) auxiliary circulation for indication of axial and radial cracks on parts with bores right through by using an electric auxiliary conductor (copper bar).

  Measure tangential field intensity with field intensity tester Deutrometer 3870 or with an equivalent field intensity tester. The target value is 10 - 50 A/cm. If cracks are detected then the affected part must be replaced. Clean and demagnetize the part. The maximum remaining magnetism must not exceed 1.2 A/cm.

  The inner bore of the propeller shaft is excluded from magnetic particle crack inspection.

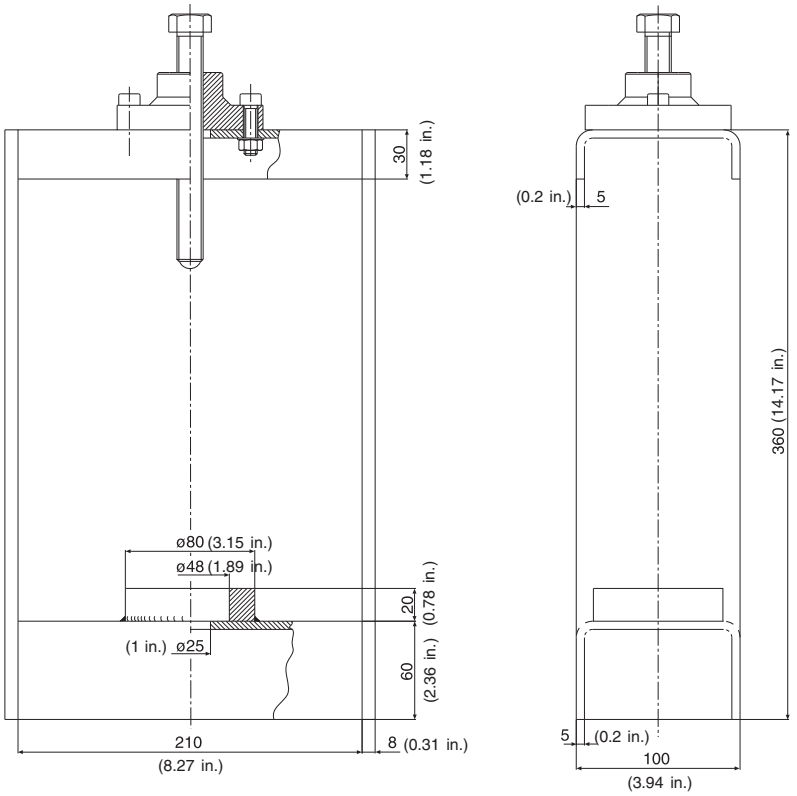
■ CAUTION: Observe the manufacturers instructions.

d04774

- Disassembly device for propeller gearbox.

  Fig. 00-8 shows one possible tensioning device for the disassembly of the propeller gearbox. The dimensions given are only intended for easier orientation and are not binding.

Fig. 00-8



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10.5) Measuring tools

Calliper rule, dial gauge indicator, micrometer, inner micrometer, inner fine measuring device, feeler gauge, spring scale up to 50 kp (500 N)(112.5 lbf).

Stroboscope:	BOSCH 0 684 100 308 or equivalent. Supply voltage 8 to 15 V. Flash triggering via inductive clampon pickup. Flashing frequency 4500 rpm.
Multimeter:	FLUKE series 70, series 80 or equivalent.
	Electronic, 3 1/2 digit indication.
	Current range 10 A.
	Direct voltage range 200 V minimum.
	Resistance range 200 Ω to 2 MΩ
	Acoustic continuity tester.
Oscilloscope:	TEKTRONIX 2225 or equivalent
	2 channels
	Analog
	Sensitivity 5 mV to 5V/div
	Frequency limit 50 MHz

■ CAUTION: When using these instruments, observe the manufacturer's instructions.

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10.6) Special tools and devices

See Figs. 00-9, 00-10 and 00-11.

The following tools and devices are also listed in the Illustrated Parts Catalog.

Fig. No.	Part No.	Description, application	Number
1	276282	spark plug wrench a/f 16	1
	276280	spark plug wrench a/f 18	1
2	977420	hand lever 8x130-10 for spark plug wrench	1
3	240880	thread bolt M8x50 for crankshaft locking	1
4	877890	Torx bit - T40 for magnetic plug	1
5	877110	guide sleeve for O-ring idle mixture screw and idle jet	1
6	876510	insertion jig for oil seal (12x30x7), water pump shaft	1
7	877258	insertion jig for rotary seal	1
8	877270	insertion jig assy. for oil seal 32x52x7 crankshaft magneto side	1
9	877802	circlip installation tool assy., for assembly of piston pin circlips	1
10	877650	insertion jig	1
11 - 12	877091	piston pin extractor assy. for assembly and disassembly of the piston pin	1
12	877155	extracting nut M6 assy., for piston pin extractor	1
13	276332	insertion jig assy. for pressing out needle sleeve 22x28x12 and ball bearing 15x32x8, vacuum pump	1
14	877276	insertion jig assy. for oil seal 22x32x7, vacuum pump	1
15	877360	guide sleeve for oil seal 32x52x7, crankshaft, magneto side	1

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Fig. No.	Part No.	Description, application	Number
16	877295	piston ring retainer assy. for water pump impeller	1
17	240381	hex. screw M6x12 for float level gauge	1
17-18	877730	float level gauge assy., for check of float lever	1
19	877320	press-in ring for ball bearing 35-72-17 propeller shaft, use together with pressin jig 876 518	1
20	877680	insertion jig with sleeve... for oil seal 6x11x3/4,5 of rev counter housing	1
21	841875	hex. screw M16x120 for puller	1
21- 22	877375	puller assy. for fly wheel hub	1
23	877417	protection mushroom for crankshaft, magneto side	1
24	877377	puller assy. narrow configuration, for fly wheel hub	1
25- 27	877765	crankcase splitting tool	Z
28	877387	valve spring mounting device assy.	1
29	877380	valve spring mounting device assy.. for removal of the valve springs	1
30	877790	adapter ring for removal of valve spring.	1
31	877570	tapping drill M18x1 for cleaning of fine thread when replacing the coolant fitting	1
32	876967	piston ring retainer 84 mm (3.31 in.)	1
32	876978	piston ring retainer 79.5 mm (3.13 in.)	1
33	877440	socket wrench A/F 41x20 L	1
33- 34	877445	socket wrench assy. 41x12.5 for hex. nut 41 a/f, crankshaft power take off side	1
34	877460	reducing socket wrench 3/4"-1/2"	1
35	877465	reduction socket 3/4"-1" 1" to 3/4", for socket wrench 46 a/f	1
36	877450	insert S 46x20 L for hex. nut 46 a/f, crankshaft magneto side	1

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Fig. No.	Part No.	Description, application	Number
37	877315	graduated straightedge assy. for checking the plain bearing projection	1
38	876950	precision dial gauge	1
39	877710	dial gauge adapter assy.,	1
40	877300	aligning plate	1
41	877262	cylinder aligning tool for alignment of the cylinder	1
42	877620	oil filter wrench 80-110 for oil filter removal	1
43	877245	trestle adapter assy., for fixation of engine Type 914	1
44	877670	cutting tool	1
45	874230	fuel pressure gauge	1
46	877240	trestle adapter assy., for fixation of engine Type 912	1
47	877930	trestle support assy.	1
48	877840	hose clamp pliers for spring band hose clip 28	1
49	976140	dial gauge adapter assy. for checking valve seating	1
50	976210	measuring tool measuring fixture for checking valve springs	1
51	976995	check weight check weight for checking valve springs	Z
52	242660	distance nut M8x33 locking device for vacuum pump drive sleeve	1
53	876470	ring spanner a/f 10/13	1
54	876518	insertion jig for oil seal 40x55x7, gear cover	1
55	877660	puller assy., for gearbox	1
56- 57	877615	extractor assy., for propeller shaft, roller bearing 25x52x15 and oil seal 30x52x7	1
57	877580	pull-in spindle M24x1.5	1
58	276155	handle lever 12x250	1

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Fig. No.	Part No.	Description, application	Number
59	842585	hex. nut M24x1.5 length 19	1
60	941180	stud M10x45/20 for roller bearing 25x52x15 and oil seal 30x52x7	1
61	877600	press-out mushroom for propeller shaft F3 and F4	1
62	877605	press-out mushroom for propeller shaft F2	1
63	877594	press-in insert for roller bearing 25x52x15 and oil seal 30x52x7, for F2	1
64	877590	press-in mushroom for roller bearing 25x52x15 and oil inlet flange, for F3	1
65	877560	pull-out plate for roller bearing 25x52x15, oil seal 30x52x7 and oil inlet cover	1
66	242091	hex. nut M10 for roller bearing 25x52x15, oil seal 30x52x7 and oil feed line cover	1
67	876885	mounting yoke to compress dog gear	1
68- 71	876489	puller assy., for ball bearing 15x32x8, needle sleeve 22x28x12, oil inlet flange and oil inlet cover	1
69	941730	hex. screw M6x80	1
70	827305	washer 6.2/18/2	1
71	242211	hex. nut M6	1
72	877597	press-in mushroom for ball bearing 15x32x8, vacuum pump and governor drive	1
73	877595	press-in mushroom for needle sleeve 22x28x12, vacuum pump and governor drive	1
n.d.	976380	mono hook circlip - puller for piston pin circlip	1
74	877690	check lever for removal of the rocker arms	1
75	877190	press-in device for pressing in the rev counter pinion	1
76	877500	pin release tool	1

d04774

Fig. 00-9

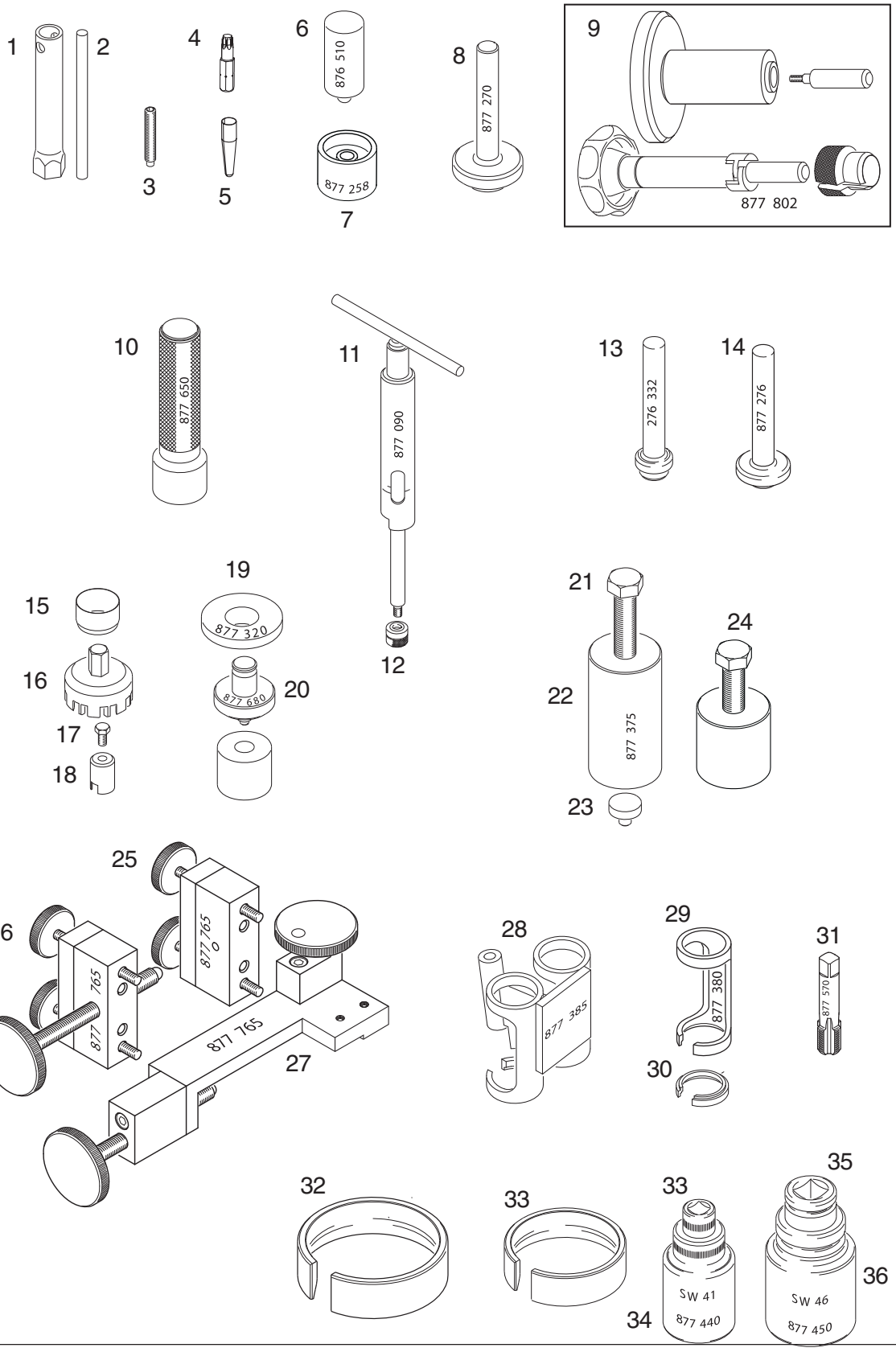
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Fig. 00-10

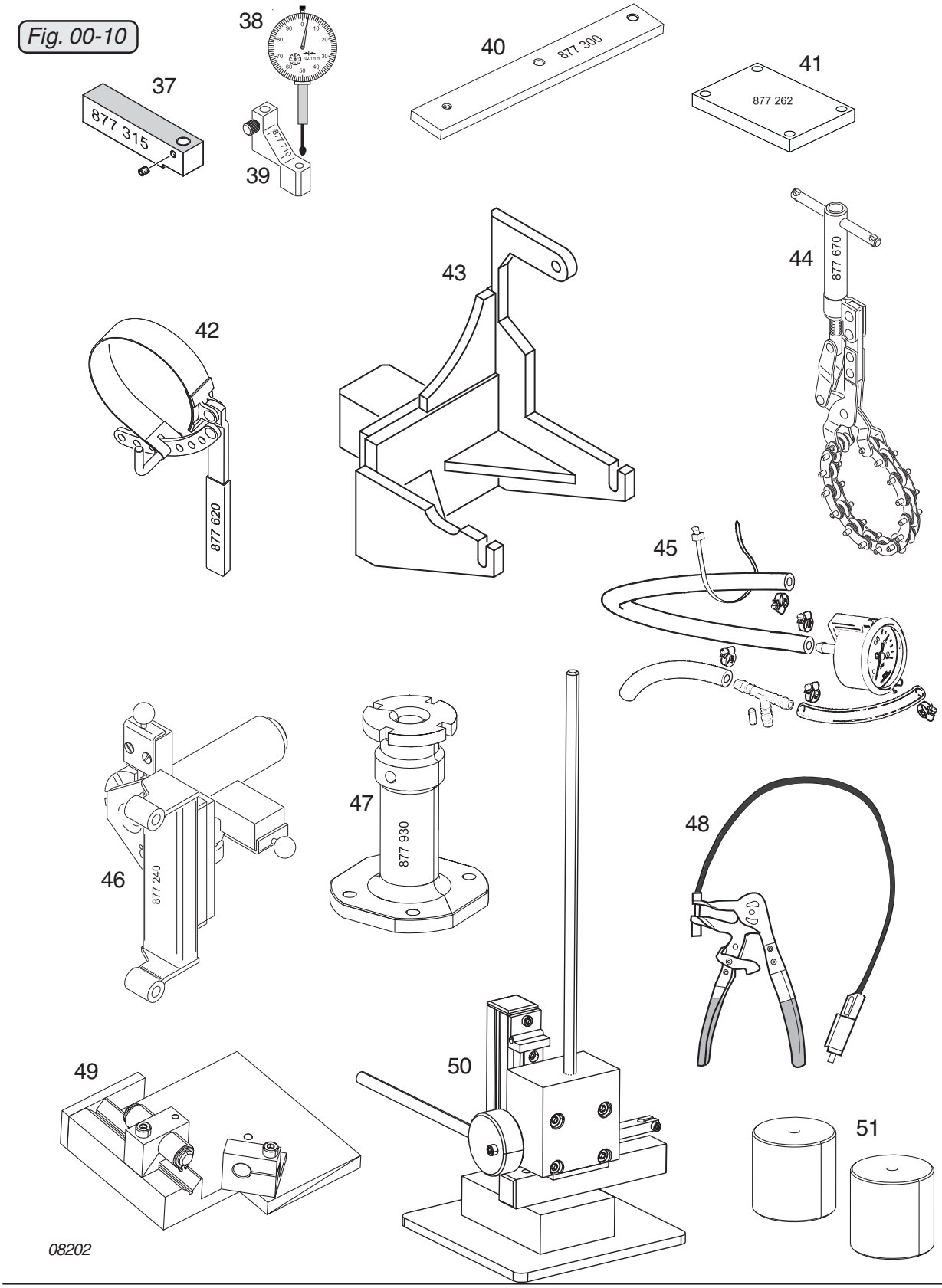

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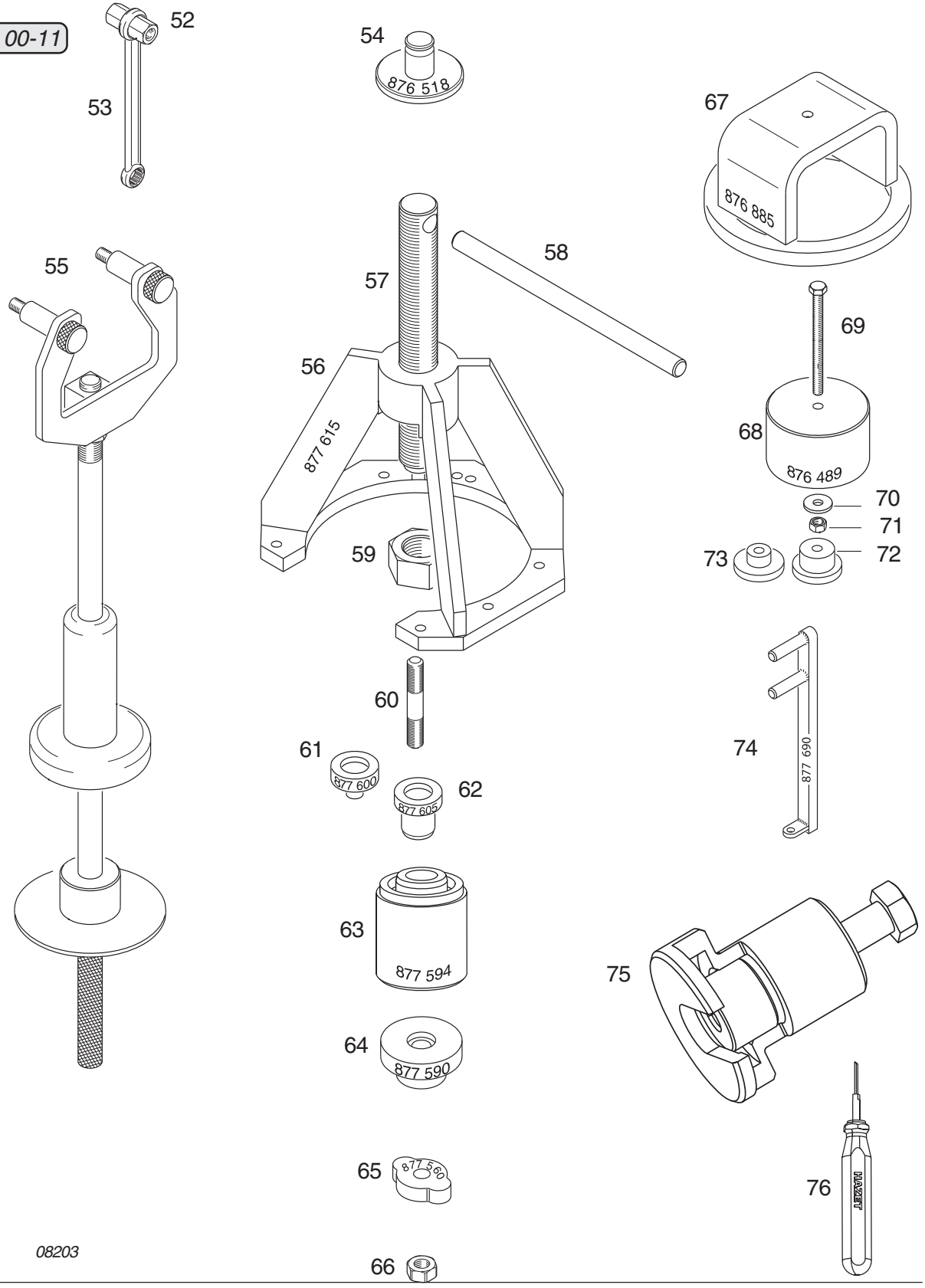
Fig. 00-11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876 885
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877 615
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876 489
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877 690
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877 600
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877 605
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877 594
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877 590
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877 581
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MAGNET
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08203
d04774

3) Technical data

■ CAUTION: The technical data relevant for engine operation are listed in detail in the respective Operators Manual and must be observed.

3.1) Operating limits

See latest version of valid Operators Manual for the engine in question 912 Series or 914 Series, ¨Operating instructions“.

3.2) Operating fluids / Capacity

See latest version of valid Operators Manual for the engine in question 912 Series or 914 Series, ¨Operating fluids“.

3.3) Weights

See latest version of valid Operators Manual for the engine in question 912 Series or 914 Series, ¨Technical data“.

3.4) Engine / Components

DESIGN:	4-cylinder horizontally opposed 4-stroke-engine
BORE:	79.5 mm (3.13 in.) [1) 3)] 84 mm (3.31 in.) [2)]
STROKE:	61.0mm (2.40in.)
DISPLACEMENT:	1211.2 cm³ [1) 3)] 1352 cm³ [2)]
CYLINDER:	Lightweight metal cylinder with Nikasil coated running surface
PISTON:	Lightweight cast metal piston with 3 piston rings
CYLINDER HEAD:	4 individual cylinder heads
COMPRESSION:	9 : 1 [1) 3)] 11.1 : 1 [2)]
INTAKE VALVE:	38 mm (1.49 in.), valve seat surface hardened
EXHAUST VALVE:	32 mm (1.26 in.) NIMONIC, armor welding at valve seat
VALVE CLEARANCE:	automatic compensation of clearance by hydraulic valve tappets
VALVE TRAIN:	OHV, hydraulic valve tappets, pushrods and rocker arms
CAMSHAFT:	steel, annealed, liquid nitriding
CONTROL TIME: (at 1 mm valve stroke):	[1) 3)] Io. 0° T.D.C. Oo. 48° before B.D.C. Ic. 48° after B.D.C. Oc. 0° T.D.C. [2)] Io. 2° before T.D.C. Oo. 48° before B.D.C. Ic. 48° after B.D.C. Oc. 2° after T.D.C.
CRANKSHAFT:	supported in 5 plain bearings, case hardened
COOLING:	liquid cooled cylinder heads, ram air cooled cylinders
LUBRICATION:	**1) Main oil pump circuit:** Dry sump forced lubrication system, trochoid pump driven by the camshaft, oil return by the blow-by gases **2) Suction pump circuit**:[3)] Extra trochoid pump driven by the camshaft returns oil from the lower oil sump of the turbocharger to the oil tank
OIL DELIVERY RATE:	**1) Main oil pump:** approx. 16 l/min. at 5500 rpm **2) Suction pump circuit:** [3)] approx. 4 l/min. at 5500 rpm

[1)] 912 A, F, UL
[2)] 912 S, ULS, ULSFR
[3)] 914 F, UL

d04775

IGNITION UNIT: ROTAX DCDI, interference suppressed

IGNITION POINT:

Differences between electronic module part no. 966726 and part no. 966727:		current 966726	new 966727
	fly wheel hub		
ignition point at start	966871 current 966872 new	4° Before T.D.C. 3° After T.D.C.	4° Before T.D.C. 3° After T.D.C.
time delay for ignition at start:		none	3 - 8 sec.
switching to advanced ignition:		from 650 to 1000 RPM depending on trigger gap	after the expiration of the time delay (3-8 sec.)
ignition timing in normal operation:		26° before T.D.C.	26° before T.D.C.

06301

FIRING ORDER: 1- 4 - 2 - 3

SPARK PLUGS: 12 mm (0.47 in.), DCPR7 [1)], DCPR8 [2)], X27EPR-U9 [3)]

ELECTRODE GAP: see Fig. 74-6 and dimension (SPO1) in 74-00-00

INTEGRATED ALTERNATOR: Permanent magnet-singlephase alternator (approx. 250 W AC)

RECTIFIER-REGULATOR: 12 V 20 A DC

EXTERNAL ALTERNATOR: (optional) 12 V 40 A DC with full-wave rectifier-regulator

CARBURETOR: 2x Bing-constant depression carburetors 32 mm, Type 64

FUEL PUMP: 2 electric fuel pumps [3)]
1 mechanically driven fuel pump [1) 2)]

STARTER: electric starter, 12 V/0.6 kW, optionally 0.9 kW

PROPELLER GEARBOX: integrated spur gear with torsional shock absorbing, overload clutch, on UL optionally without overload clutch

GEAR TRANSMISSION: 2.27 [1)], 2.43 [2) 3)]

d04775

[1)] 912 A, F, UL
[2)] 912 S, ULS, ULSFR
[3)] 914 F, UL

DIRECTION OF ROTATION:	counterclockwise, seen from the front in the direction of the propeller flange
OVERLOAD CLUTCH:	multi-disk clutch
VACUUM PUMP (optional):	drive via the gearbox
PROPELLER PITCH GOVERNOR (optional):	drive via the gearbox
TURBOCHARGER:	Exhaust gas turbine with wastegate, radial-flow compressor T25 [3)]
TURBOCHARGER CONTROL UNIT (TCU):	electronic, proportional plus integral plus derivative regulator with 2 external indicating lamps [3)]
CERTIFICATION:	912 A: in acc. with JAR 22 912 F: in acc. with FAR 33 912 S: in acc. with FAR 33 and JAR-E 914 F: in acc. with FAR 33 and JAR-E
CERTIFICATION	912 A: EASA.E.121 912 F: EASA.E.121, E00051 EN 912 S: EASA.E.121, E00051 EN 914 F: EASA.E.122, E00058 NE

d04775

5) Preservation and returning to service

5.1) Storage and preservation directives for a new engine

BRP-Rotax as the manufacturer of the engine warrants corrosion protection of aircraft engines of the 912 /914 Series for at least 12 months from date of delivery by BRP-Rotax.

This warranty confirmation is subject to the following conditions:

- The engine must be stored in the original packing as supplied by BRP-Rotax.
- The protective covers must not be removed.
- The engine must be stored in a suitable place (closed area, clean and dry).

If the engine is stored longer than 12 months, the following inspections must be carried out every 3 months:

- Remove one spark plug on each cylinder and turn crankshaft by hand 2 full turns. Refit spark plug.
- Visual inspection for rust formation (e.g. on propeller shaft). If rust formation is detected, the engine must be sent immediately to an authorized overhaul facility for inspection.

▲ WARNING: The engine must not be taken into operation.

◆ NOTE: The maximum possible storage period of the engine is limited to 24 months.

If this period is exceeded, the engine must be sent to an ROTAX authorized overhaul facility for inspection.

d02621

5.2) Preservation of an engine which has been in operation

Due to the special coating of the cylinder wall, the ROTAX aircraft engine normally needs no extra protection against corrosion.

■ **CAUTION:** Maximum storage period 12 months if the listed precautions are taken!

– Oil change see latest issue Maintenance Manual (Line Maintenance) for the respective engine type, 912 Series or 914 Series.

– On the ROTAX 912 Series: Run the engine to allow it to warm up, leave it running at increased idle speed, remove the air filters and inject approx. 30 cm^3 of preservation oil into the carburetors, shut down the engine.

– On the ROTAX 914 Series: Remove the top spark plugs from all four cylinders and spray preservation oil into the cylinders through the spark plug bores.

  Turn the crankshaft several times.

  Fit spark plugs and spark plug connectors.

– Drain carburetor float chambers.

– Apply engine oil to all linkages on carburetors.

– Close all openings on the cold engine, such as the exhaust pipe, venting tube and air filter intake against entry of dirt and humidity.

– Spray all external engine steel parts with preservation oil.

– In the event of longer out of service periods repeat the whole preservation procedure annually.

5.3) Returning the engine to service

– Remove all plugs and fasteners.

– Clean spark plugs with solvent and a plastic brush.

– If preservation including oil change took place not longer than a year ago, oil replacement will not be necessary.

– Complete 100 hour inspection if engine has been out of service for more than one year.

▲ WARNING: Work on the engine may only be carried out and approved by authorized persons. See the latest issue Maintenance Manual (Line Maintenance) for the respective engine type, 912 Series or 914 Series.

d04775

6) Maintenance

The following sections describe maintenance procedure for engines of the 912/914 Series above and beyond the maintenance and special checks, see latest issue Maintenance Manual (Line Maintenance) for the respective engine type, 912 Series or 914 Series, and the systems descriptions given hitherto. The description is divided into subsections and descriptions of the function of the various systems.

6.1) Engine suspension frame

6.1.1) Engine suspension frame disassembly

See Figs. 71-10 and 71-11.

▲ WARNING: Perform tasks only on the cold engine. **Danger of burns!**

◆ NOTE: Prior to detachment of the engine suspension frame (1), remove the water pump housing (2), as the coolant sockets, which protrude outwards, would hinder removal of the engine suspension frame. See 75-00-00 sec. 3.

After removal of the two allen screws M10x110 (3) and M10x35 (4) together with the lock washers, the engine suspension frame can be taken off.

◆ NOTE: On engines of the 914 Series, it will also be necessary to remove the muffler and the turbocharger. See 78-00-00 sec. 3.

d02621

6.1.2) Engine suspension frame inspection

See Fig. 71-11

– All components must be subjected to a visual inspection.

■ CAUTION: If the engine is fitted with engine suspension frame part no. 886567, inspection in accordance with SB-912-028 or SB-914-016,“Checking or replacement of engine suspension frame“, latest issue must be performed.

◆ NOTE: A detailed visual inspection of the engine suspension frame in the area of all welded joints between the circular pipe (1) and the struts (6).

◆ NOTE: If necessary, the engine may be flown to a repair facility as long as not more than 50% of the tube or the strut are severed. If they are completely severed, they must be replaced immediately.

6.1.3) Engine suspension frame assembly

See Figs. 71-10 and 71-11.

Screw the engine suspension frame (1) to the engine housing with the lock washers and the allen screw M10x110 (3) and M10x35 (4), tightening to 40 Nm (29.5 ft.lb) in each case.

◆ NOTE: Ensure that the engine suspension frame is attached free of stress. If necessary, fit the shims as needed (5).

◆ NOTE: The allen screws (4) must be of strength 10.9. See SI-25-1997,“Running modifications“, latest issue.

– On engines of the 914 Series, reattach the muffler and the turbocharger. See 78-00-00 sec. 3.5.

d04775

SECTION 72

ENGINE

1) Table of contents

SECTION 72
ENGINE

d04776

2.2) Hydraulic governor

See Fig. 72 -2

◆ NOTE: Not included in the range of delivery.

A hydraulic governor can be fitted on engines of the 912/914 Series configuration 3 to control a hydraulic constant speed propeller. Engines of the 912/914 Series configurations 2 and 4 can be retrofitted for this purpose.
i.e., the drive for the governor in the propeller gearbox and the crankcase, its connection cable and the oil feed line to the propeller shaft must be retrofitted.

– On configuration 912/914 - 2, the hollow propeller shaft must also be exchanged for the correct one.

– On configuration 912/914 - 4, the propeller shaft can remain. It is the same design as for configuration 912/914 - 3, with the exception that the inside bore is plugged. After removal of the plug cover the propeller shaft is suitable for use with a governor.

Gear ratio (i)	912 A/F/UL		912 S/ULS/ULSFR 914 Series	
crankshaft : propeller shaft	50 : 22	2.273*	51 : 21	2.429
propeller shaft : governor	22 : 29	0.759	22 : 29	0.759
Total	1.722		1.842	

* optional 2.429 possible

08218

Fig. 72-2

◆ NOTE: Installation of both the hydraulic governor and vacuum pump is not possible.

◆ NOTE: The gear ratio crankshaft to vacuum pump or propeller governor is 1.722 or 1.842, depending on engine type.

Direction of rotation of the governor ..... counterclockwise (CC), looking from the magneto side above onto the governor flange.

d02622

2.3) Vacuum pump

It is possible to install a vacuum pump for employment of an inertial navigation system. To do this, the drive kit for the vacuum pump must be retrofitted on propeller gearbox and crankcase.

◆ NOTE: Installation of both the vacuum pump and hydraulic governor is not possible.

Gear ratio: Vacuum pump and hydraulic governor are driven the same way and therefore have an equivalent gear ratio. See hydraulic governor.

2.4) Connections for instrumentation

■ CAUTION: Consult also the relevant section on connections for instrumentation in the Installation Manual.

2.4.1) Mechanical rev counter and hourmeter (optional)

These are driven from the camshaft via a bevel gear to the rev counter shaft. A flexible shaft allows connection of a combined instrument, rev counter or hourmeter. Subsequent installation of a flex. rev counter shaft is possible after removal of the rev counter cover on the ignition housing. On engines produced from the year 2007 onwards, it is also necessary to replace the ignition cover and press the worm gear into the camshaft using the tool with part no. 877190.

For connection of a rev counter, see 71-00-00 sec. 2.3 item no. 21 (on 912 Series) or item no. 32 (on 914 Series).

The total transmission ratio from crankshaft to rev counter shaft i = 4

◆ NOTE: As the mechanical hourmeter is directly coupled to the engine speed, the readings may deviate considerably from those given by electronic hourmeters (e.g. TCU, FlyDat). Maintenance and overhaul intervals are always dictated by the flight time.

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3) Maintenance

The following sections describe maintenance procedure for engines of the 912/914 Series above and beyond the maintenance and special checks, see latest issue Maintenance Manual (Line Maintenance) for the respective engine type, 912 Series or 914 Series, and the systems descriptions given hitherto. The description is divided into subsections and descriptions of the function of the various systems.

3.1) Vacuum pump removal and inspection

See Fig. 72-3.

■ CAUTION : Observe the vacuum pump manufacturers specifications for maintenance, inspection and repairs!

Unscrew the 4 hex. nuts (1) M6 and remove the lock washers. Remove the vacuum pump (2) from the crankcase (4) together with the gasket and the retaining flange (3).

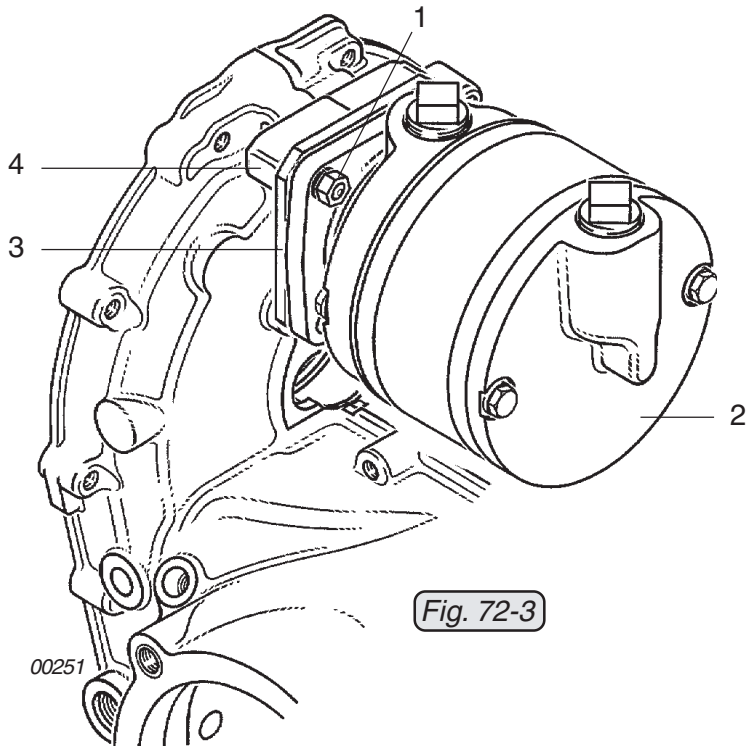

Fig. 72-3

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3.2) Governor removal and inspection

See Fig. 72-34 in 72-00-00.

■ CAUTION : Observe the governor manufacturers specifications for maintenance and repairs!

Unscrew the 3 allen screws (16) M8x40 and the 1 allen screw (17) M8x35 and remove together with the lock washers. Remove the governor with the gasket.

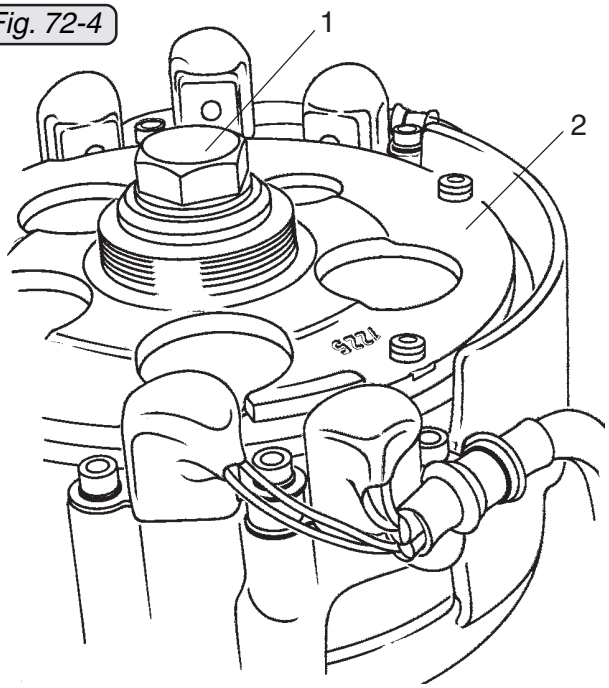
◆ NOTE: The screwing can be different depending on the type of governor. See SB-912-052 and/or SB-914-035, " Installation / Use of governor", latest issue.

3.3) Removal of the fly wheel hub

See Fig. 72-4

Remove hex. screw M16x1.5 (1). Place protection piece part no. 877410 on the crankshaft, screw puller part no. 877375 down fully and press off the fly wheel hub (2) with the hex. screw.

Fig. 72-4



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3.4) Ignition housing removal and inspection

See Figs. 72-5, 72-6, 72-7 and 72-8.

Cut the tie wraps and remove the cable clamp from the electronic module. Detach the plug connections of the two pickup cables and the plug connections of the charging cable. Detach both plug connectors of the alternator cable and the control wiring for the electronic rev counter. See 74-00-00 sec. 3.15.

Decide whether the stator may remain in the ignition housing. Otherwise remove the cable clamps and remove the stator.

Remove the woodruff key (1) from the crankshaft.

■ CAUTION: Cover the groove for the woodruff key (1) with a protective tape to avoid damage to the oil seal, see Fig. 72-3.

Remove the electric starter. See 80-00-00 sec. 3.1.

Remove the 7 allen screws M6 from the ignition cover on the bottom side of the ignition cover from the crankcase. A smart blow with a mallet will separate the ignition cover (3) from the crankcase so that it can be taken off.

Remove the O-ring (2).

◆ NOTE: The crankshaft bearings in the ignition housing are lubricated via the oil duct (4). The oil duct at the joining face between the crankcase and the ignition housing is sealed by the O-ring (2) 5x2.

◆ NOTE: The thrust washer of the intermediate starter gear may be stuck on the rear side of the ignition housing.

Fig. 72-5

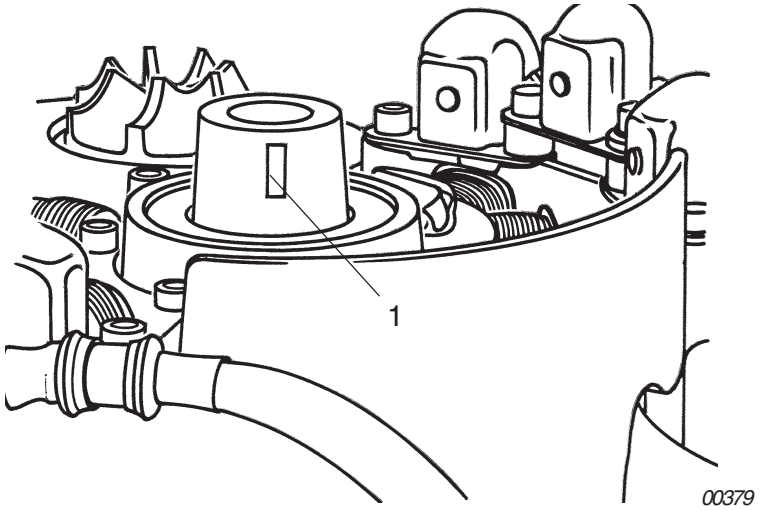

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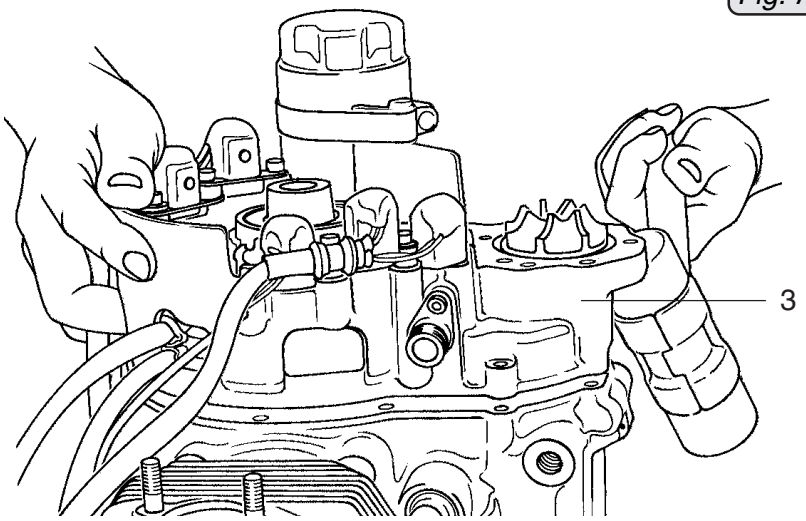
Fig. 72-6



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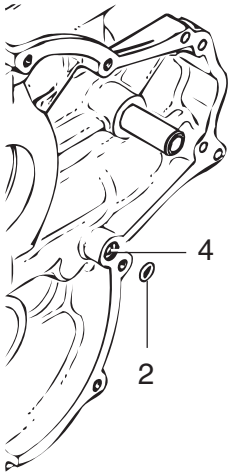

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Carry out a visual inspection of the sealing surfaces.
Clean oil duct (10) with compressed air and check for free passage. Measure the bearing bore Ø32 (1.26“) mm of the bearing bushing (11) (dimension (IH01)) for the crankshaft bearing (dimension (CS05)) and determine the clearance. See 72-00-00 sec. 4.

The bearing bushing (11) can not be replaced, as the internal bore and the lubricating bore (10) are machined after pressing in the bushing, if the bearing bushing (11) is worn, the complete ignition cover with pressed-in and machined bushing must be replaced.

Check the shaft seal (13) 32x52x7 for the crankshaft, if necessary, press new shaft seal into the block with an insertion jig, part no. 877270.

Check whether oil or water emerge from the outside of the leakage bore (14).

Check the rotary seal (15) for the water pump sealing. If liquid is leaking, replace the rotary seal and the shaft seal (16).

Carry out a visual inspection of the bearing (17) for the electric starter.

◆ NOTE: Fig. 72-8 item 18 is the drive shaft for the mechanical rev counter.

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Fig. 72-7

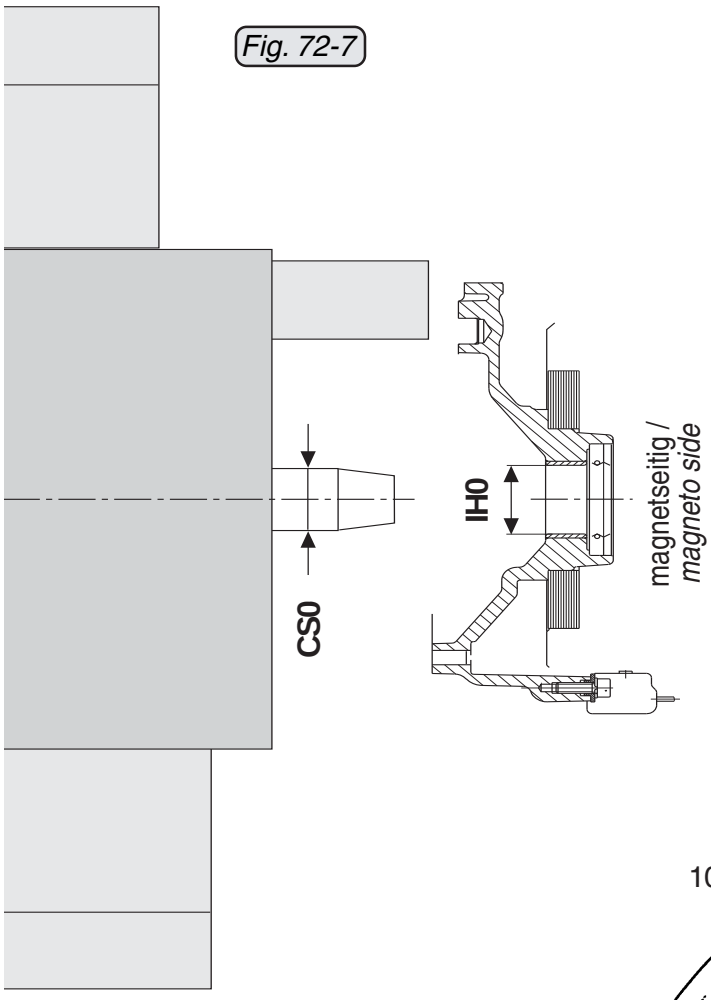

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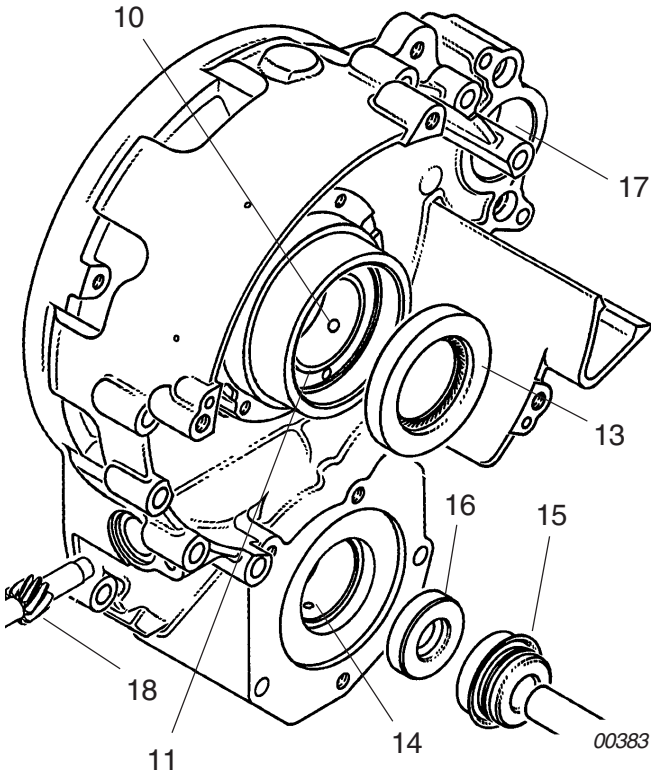
Fig. 72-8



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3.5) Ignition housing fitting

See Fig. 72-9.

Install the intermediate gear. See 72-00-00 sec. 3.7.

■ CAUTION: If the mounting sleeve, part no. 877360, is not used, the oil seal will be damaged by the sharp edge of the keyway in the crankshaft.

Place O-ring 5x2 into the crankcase and fit mounting sleeve, part no. 877360, for oil seal onto the crankshaft.

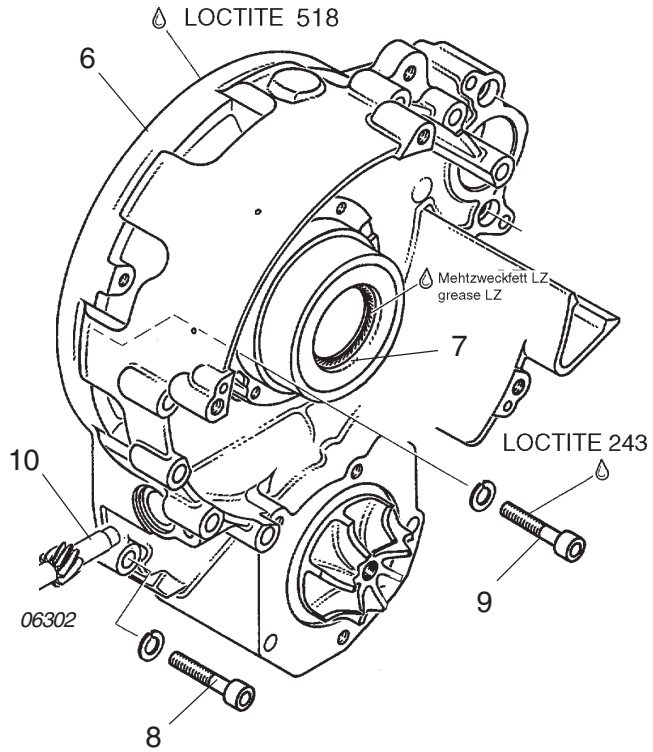
Apply LOCTITE 518 or 5910 surface sealing compound to the sealing surface (6) of the pre-assembled ignition cover, apply multi-purpose grease LZ or equivalent grease to the oil seal (7), fit it and turn the water pump shaft to engage it in the geartooth system. Tighten ignition cover with 7 allen screws M6x30 (8) and lock washers evenly to 10 Nm (90 in.lb.).

◆ NOTE: Allen screw (9) M6x30 extends into the oil compartment and must therefore be sealed with LOCTITE 243.

◆ NOTE: Fig. 72-9 item 10 is the drive shaft for the mechanical rev counter.

◆ NOTE: For fly wheel installation see 74-00-00 sec. 3.20.

Fig. 72-9



3.6.2) Sprag clutch dismantling

See Figs. 72-12 and 72-13.

Carry out a visual inspection to check whether oil sludge has been deposited in the sprag clutch housing (5) and in in the lock (16). For inspection/cleaning purposes, remove the circlip (14). Compress the circlip (19) in the sprag clutch (17) slightly with circlip pliers and twist the sprag unit out of the sprag clutch housing. Clean all parts thoroughly. The circumferential helical spring (15) must not be loose or distorted to a wavy form. Replace sprag clutch as required.

The cams (16) of the sprag clutch must move freely and the surface must be free of damage. Inspect the engaging surfaces of the sprag clutch in the sprag clutch housing.

If wear can be measured on the internal contact surfaces of the sprag clutch housing, the affected parts must be replaced. Check the tapered surface (18). Check the geartooth system (12), the engaging surface of the sprag clutch (11) on the free wheel gear and the bearing bushing (13).

Fig. 72-12

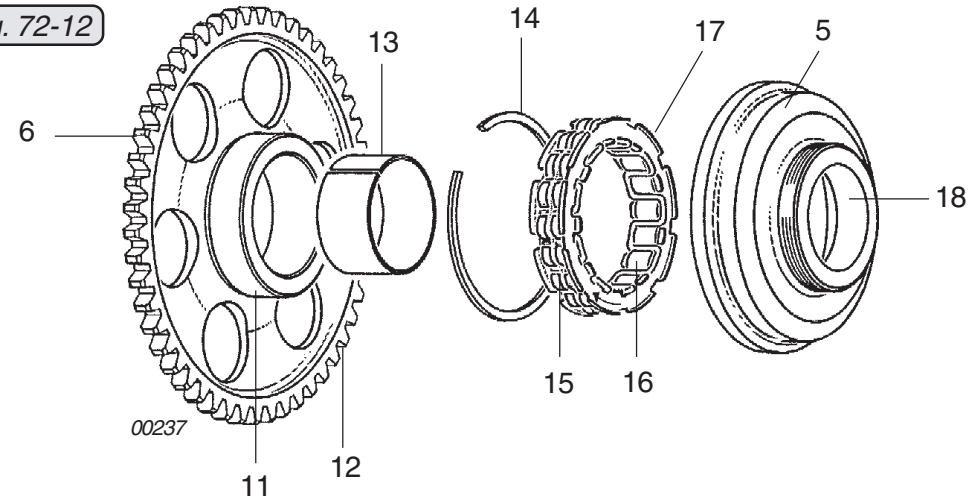
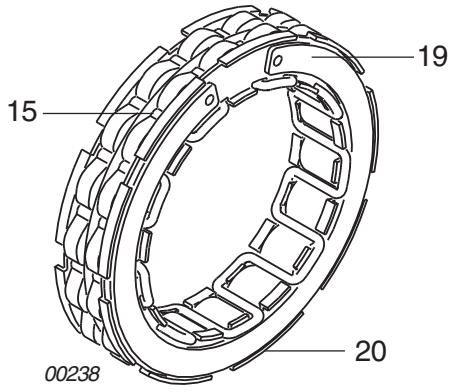


Fig. 72-13



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3.6.3) Sprag clutch installation

See Figs. 72-10, 72-11, 72-12, 72-13, 72-14 and 72-15.

Place the sprag clutch into the sprag clutch housing so that the circlip (19) is visible. To fit the circlip, compress it slightly using circlip pliers and ensure that clip remains in position and engages fully on the catches in the sprag unit (20).

■ CAUTION : The circlip must be fitted as shown in Fig. 72-15. Otherwise, it may not fit tightly.

Fit the circlip (14) with the sloping edge pointing towards the sprag clutch.

■ CAUTION : If there is a circlip 68 (14) part no. 845420 still fitted, it must be replaced with a circlip 70 part no. 845245.

◆ NOTE: Circlip 68 and circlip 70 can be distinguished by the different outside dimension before they are installed. See Fig. 72-15.

Lock the crankshaft. Degrease taper and threads of the crankshaft and taper of the sprag clutch housing.

■ CAUTION : Approx. 2 - 3 mm (0.079 - 0.12 in.) on the bottom side of the sprag clutch housing must be kept free of LOCTITE 221. If this instruction is not observed, the bearing bushing and the free wheel gear can adhere to the crankshaft, which would cause friction wear on the sprag clutch.

Coat taper of the sprag clutch housing thinly with LOCTITE 221 and fit on crankshaft. As you do so, turn the free wheel gear so that the sprag lobes (16) can be aligned.

◆ NOTE: When turned to the left, looking towards the magneto side of the engine, the free wheel gear (6) must engage in the crankshaft, and when turned to the right, it must move freely!

See Fig. 72-14.

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Secure degreased hex. nut M34x1.5 with LOCTITE 648 and tighten to 120 Nm (88.5 ft.lb).

◆ NOTE: Hex. nut has lefthanded thread!

■ CAUTION : Check axial clearance of free wheel gear, see Fig. 72-10 and dimension (ES10) in 72-00-00 sec. 4.

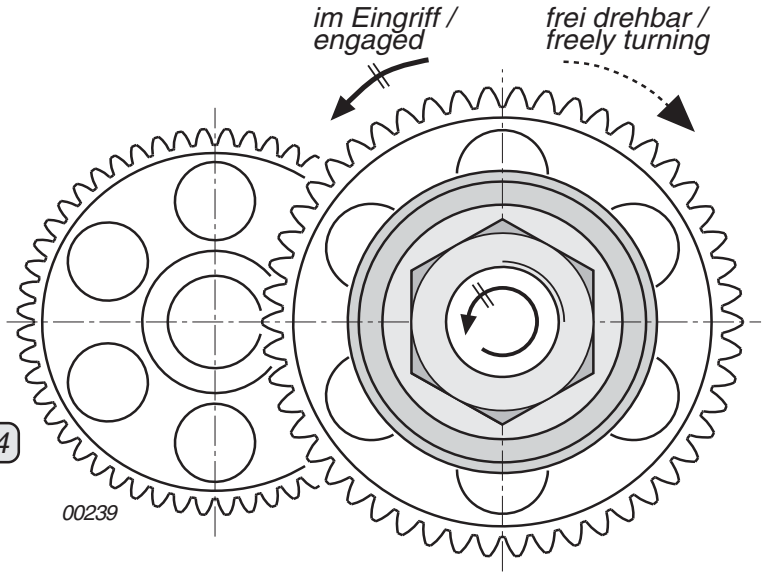
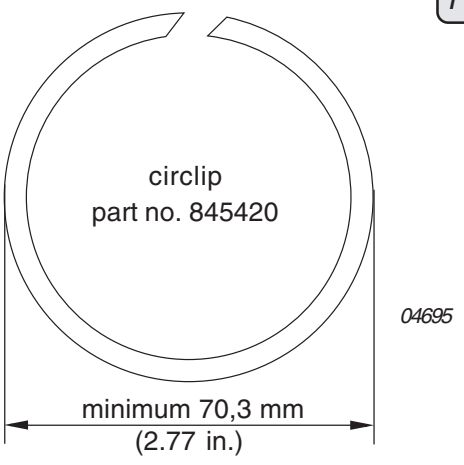
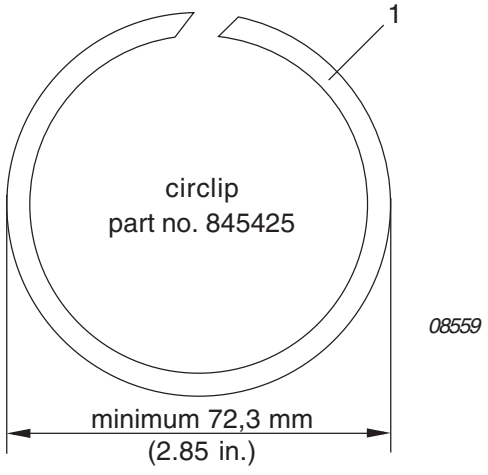


Fig. 72-14

Fig. 72-15





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3.7) Reduction gear for electric starter

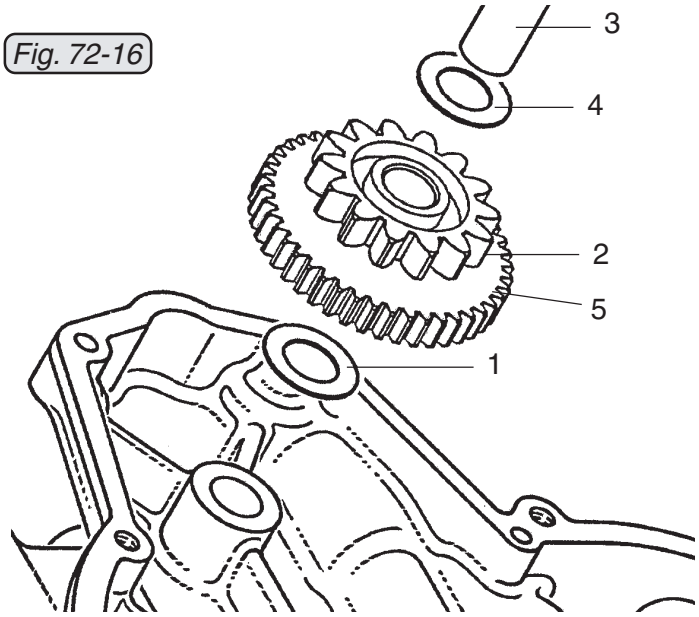
See Fig. 72-16.

Place thrust washer (1) 12.5/21.5/1 on the crankcase. Place intermediate gear (2) in position, oil intermediate gear shaft (3) and push into position. Place thrust washer (4) 12.5/21.5/1 on top.

Check the geartooth system of the intermediate gear (5). If the geartooth system is deformed, the intermediate gear must be replaced.

◆ NOTE: If the teeth of the intermediate gear are deformed, a noise will be produced when the engine is started.

Fig. 72-16



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3.8) Rev counter drive

See Figs. 72-17, 72-18 and 72-19.

The optional mechanical rev counter (1) is driven via the worm gear pressed into the camshaft.

◆ NOTE: On older engine versions without a mechanical rev counter, a cover plate is fitted in place of the rev counter housing. The engine can be retrofitted with a rev counter drive by installation of the drive shaft. See Fig. 72-18.

◆ NOTE: On new engine versions, the ignition cover must also be replaced and the worm gear (9) pressed into the camshaft using special tool, part no. 877190.

Remove allen screw M5x16 (2) and the lock washer, and pull the rev counter housing (3) along with the O-ring (4) and the rev counter shaft (5) out of the ignition housing (see 72-00-00 sec. 3.4).

Gear-tooth system (6) and square end (7) of the rev counter shaft must be inspected for damage. If there is oil leakage, replace the shaft seal (8) 6x11x3 and O-ring (4). Press new shaft seal fully home in the rev counter housing (3) using punch, part no. 877680.

Fig. 72-17

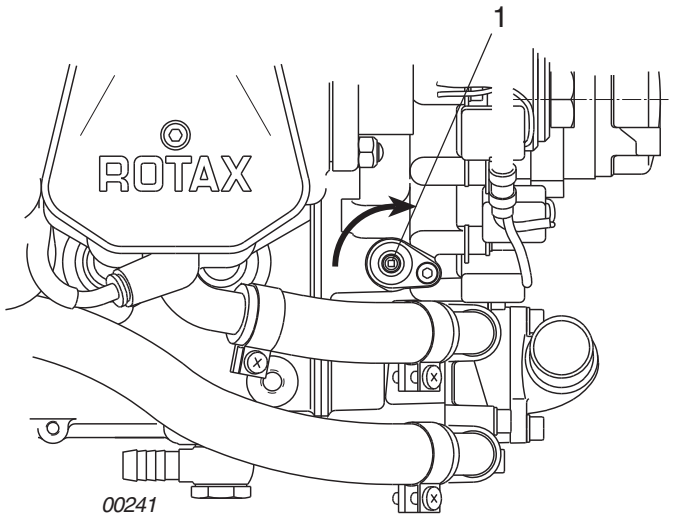


Fig. 72-19

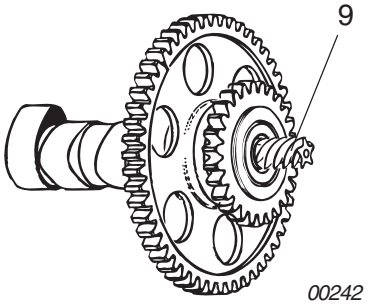
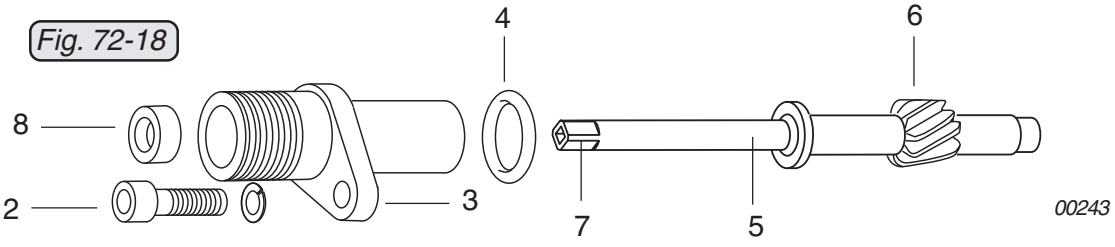


Fig. 72-18



d02622

3.9) Propeller gearbox

See Figs. 72-20, 72-20/1 and 72-21.

Before removing the gearbox, it is advisable to check the friction torque. See the corresponding Maintenance Manual (Line Maintenance) for the respective engine type, 912 Series or 914 Series.

■ CAUTION : When removing the gearbox, take care not to damage the bearing seat and the oil seal running surface of the propeller shaft.

Lock crankshaft. See chapter 12-00-00 of the maintenance manual (line maintenance) of the corresponding engine type (912 Series or 914 Series).

Remove 8 allen screws (1) M6 and 2 allen screws (2) M8 together with the lock washers crosswise from the gear cover (3). The gear cover is kept in position by 2 dowel pins. Screw puller (4), part no. 877660, into the two M8 mounting lugs (5) of the gear cover (3). Now the complete gearbox can be pulled off with the slide hammer puller (6) without damaging the ball bearing and the propeller shaft.

◆ NOTE: Alternatively the optimized special tool part no. 877540 can be used to remove the propeller gearbox. See Fig. 72-20/1.

Insert dowel pin 8x20 (7) into the right (8) and left (8) bore of the gearbox housing. Screw hex. screw M6 x 40 into the release mechanism. Center the release mechanism (10) and tighten with hex. screw M10x20 (11). Turn left and right hex. screws (9) evenly to press the gearbox housing off the crankcase.

▲ WARNING: Heated up components - Risk of scalds and burns. Wear safety gloves!

Use a hot air gun to heat up hex. nut M30x1.5 to about 100 to 120 °C (212 to 248 °F).

Release hex. nut M30x1.5 (12) with wrench 41 a/f, part no. 877445 and remove the drive gear with friction washer (13) from the crankshaft. If required, lever drive gear gently off with 2 screwdrivers.

◆ NOTE: Hex. nut has lefthanded thread!

Make sure that both dowel sleeves remain in the crankcase and not in the gearbox housing.

■ CAUTION : The gear set has a continuous 6-digit serial number which is shown on the front side of the drive gear (14) and on the dog gear. The gears are paired as a set and must not be exchanged individually.

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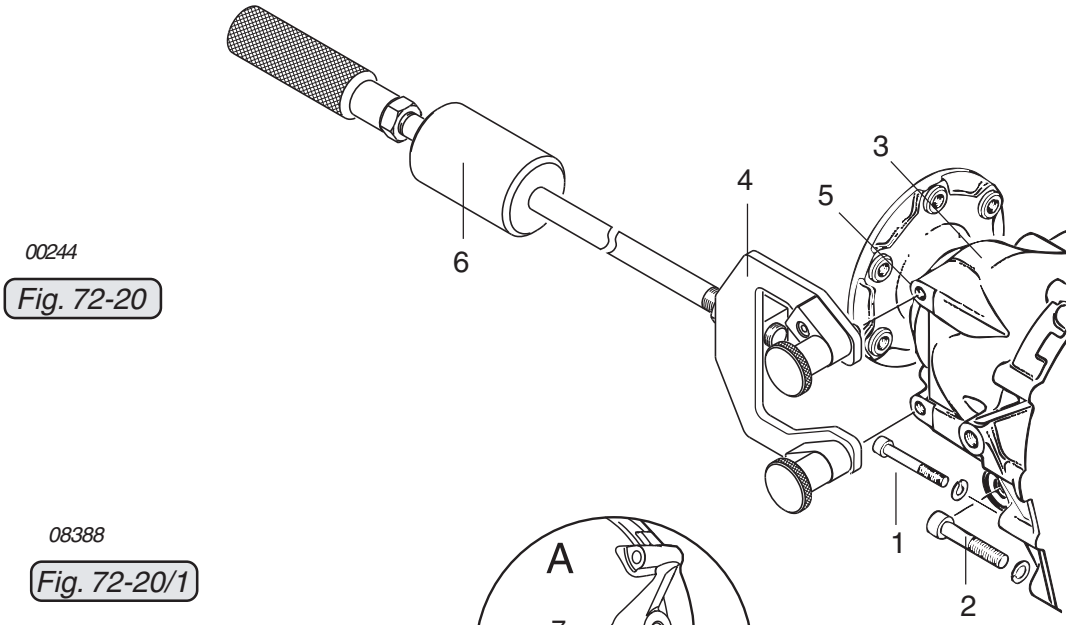

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Fig. 72-20

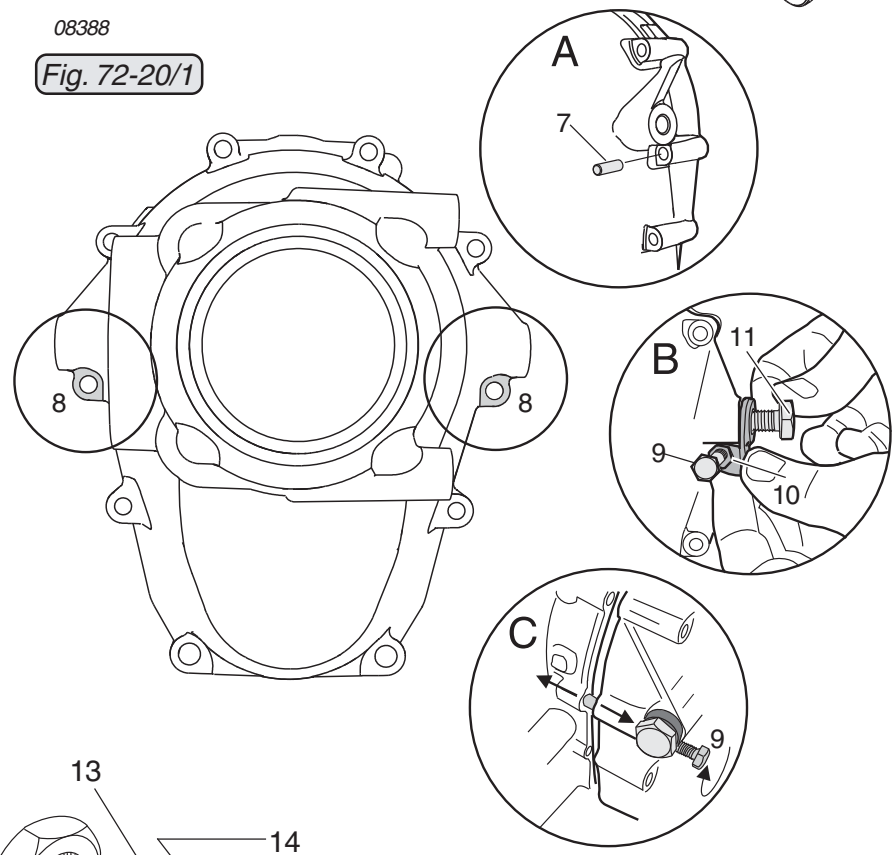

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Fig. 72-20/1

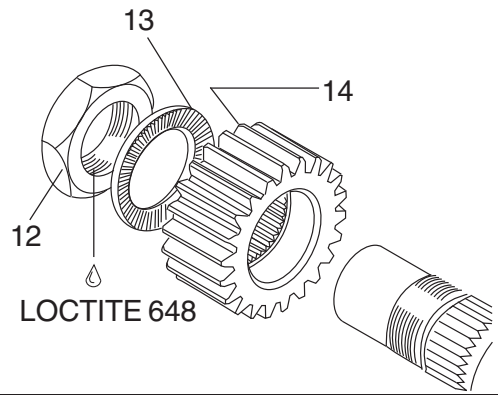

Fig. 72-21

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Propeller shock load - Inspection of crankshaft distortion on installed crankshaft

See Figs. 72-21/1 to 72-21/3

◆ NOTE: The inspection of the crankshaft only makes sense if the shaft runout of the crankshaft AS or MS is less than 0.080 mm (0.0031 inch)

(**A**) Carefully mount holder (1) for protractor (2) part no. 877520 onto the crankshaft .

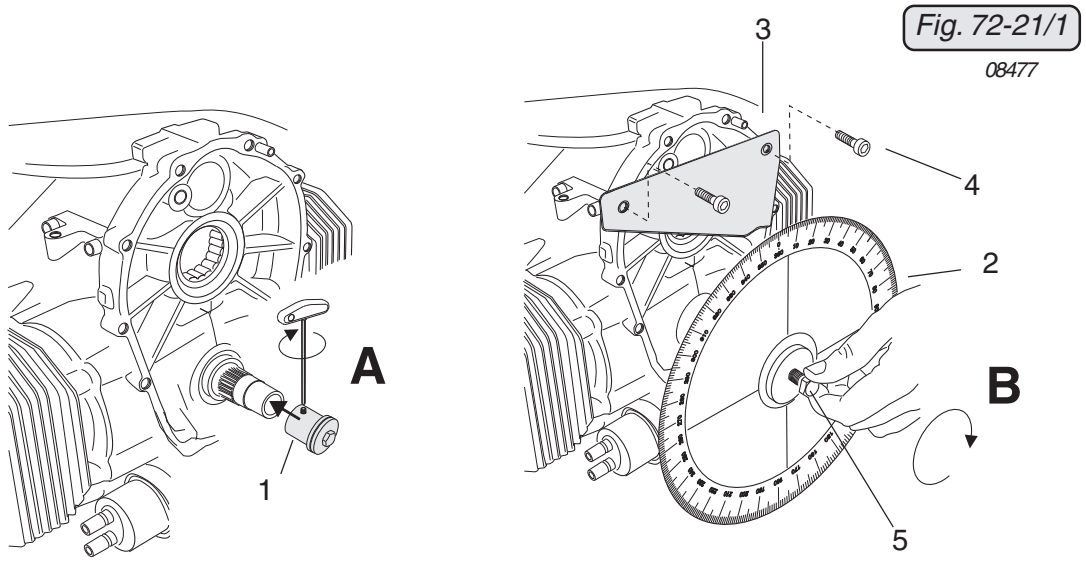

Fig. 72-21/1
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■ CAUTION: Do not damage the crankshaft.

(**B**) Install the metal sheet (3) with allen screw M6x20 (4) between drive sleeve and roller bearing.

◆ NOTE: Make sure that the upper spark plugs have been removed.

(**C**) Starting with cylinder 1 screw in piston stopper (7) completely.

◆ NOTE: On all 4 cylinders the piston stopper has to be installed in the upper spark plug thread.

◆ NOTE: Make sure that the piston stopper has been screwed in completely - so that it is bottomed out in with the spark plug hole.

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Fig. 72-21/2
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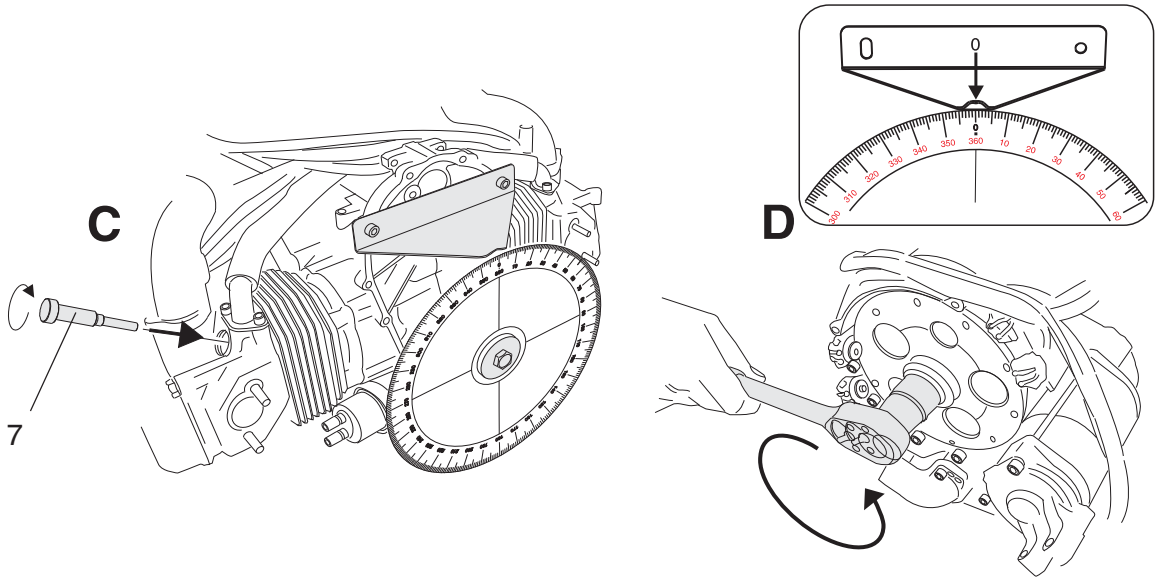

(**D**) Turn the crankshaft carefully in direction of engine rotation until the piston touches the piston stoppers.

◆ NOTE: Allways turn the crankshaft in direction of engine rotation, to move the piston towards the piston stopper.

◆ NOTE: The force applied should be strong enough to break-through possible accumulations on the piston's surface.

(**E**) Turn the protractor (2) on the holder (1) until the pointer of the metal sheet (3) points to 0° then tighten with screw (5).

◆ NOTE: From this point onwards until the measurement procedure has ended the protractor must not be turned on the metal sheet.

◆ NOTE: In this position the piston of cylinder 1 touches the piston stopper.

(**F**) For a smoother removal of the piston stopper turn the piston slightely away from the piston stopper.

(**G**) Now install the piston stopper at cylinder 2 and procede like at cylinder 1.

(**H**) Read the difference to 0° from the protractor.

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■ CAUTION: The value can be positive or negative.

(**I**) For smoother removal of the piston stopper turn the piston slightely away from the piston stopper.

(**J**) Repeat this procedure for cylinder 3. The piston will be stopped at 180°.

(K) Read the difference to 180° from the protractor.

■ CAUTION: The value can be positive or negative.

(**L**) Repeat this procedure for cylinder 4. The piston will be stopped at 180°.

(M) Read the difference to 180° from the protractor.

■ CAUTION: The value can be positive or negative.

■ CAUTION: If a value exceeds the GB20 limit, then the engine needs to be overhauled by a ROTAX-authorised service partner.

■ CAUTION: The deviation of the crank pin (as a whole) must not exceed the GB20 value. For GB20 see also Chapter 4 “wear limits”.

Example showing the results from meassuring a crankshaft, where the GB20 threshold is not exceeded:

Cylinder	deviation
1	0°
2	+ 2°
3	0°
4	+1°

Fig. 72-21/3

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Example showing the results from meassuring a crankshaft, where the GB20 threshold is exceeded:

Cylinder	deviation
1	0°
2	+ 2°
3	0°
4	-1°

Fig. 72-21/4

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3.9.1) Removal of roller bearing for - Series 2

See Fig. 72-22.

After the propeller gearbox is removed, the crankcase side propeller shaft bearing and oil seal can be replaced if necessary.

Remove the retaining ring (1) with the circlip pliers. Attach extractor (2) part no. 877615 with 8 allen screws M6x25 to the crankcase. Screw stud (3) M10x45/20, part no. 941180, into the pull-in spindle (4), part no. 877580 and fit hex. nut (5) M24x1.5 onto the pull-in spindle.

For better guidance, place the press-in insert (6), part no. 877592, into the roller bearing (7). Place the pull-in spindle (4) into the extractor (2) and through the crankcase.

On the rear side of the crankcase, push the pullout plate (8), part no. 877560, onto the stud and attach with the hex. nut M10 (9), part no. 242091.

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Keep pull-in spindle in position with the handle lever and turn the hex. nut clockwise until the roller bearing (7) with oil seal (10) is pulled out of the housing. Unscrew hex. nut, remove pullout plate with roller bearing and oil seal and withdraw spindle (11). Unscrew extractor from housing.

■ CAUTION : During this procedure, the oil seal (10) is destroyed and must be replaced.

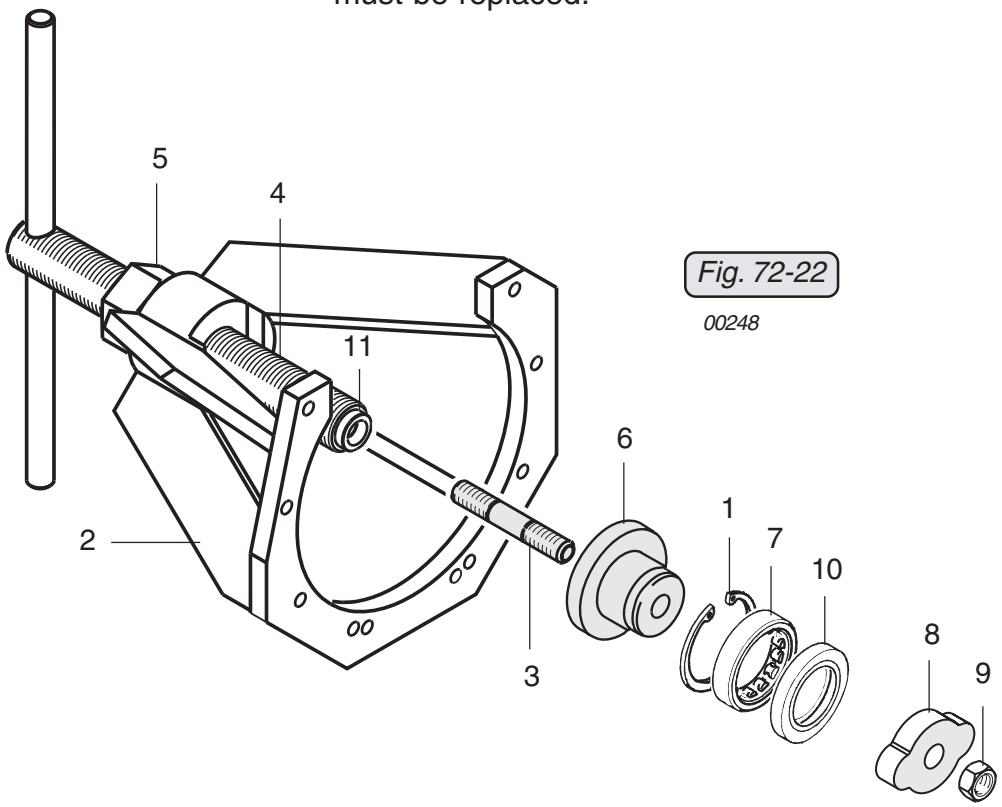

Fig. 72-22

00248

3.9.2) Removal of roller bearing for - Series 3

See Fig. 72-23.

After the propeller gearbox is removed, the crankcase side propeller shaft bearing and oil inlet flange can be replaced if necessary.

Before disassembly, the governor flange must be removed. On configuration 912 Series 3 with hydraulic governor, the procedure for pressing out varies from that for Series 2 and 4. On Series 3, the roller bearing is pressed out together with the oil inlet flange.

Remove the retaining ring (1) with circlip pliers. Fit puller cap (2), part no. 876489, and push hex. screw (3) through the cap, roller bearing (4) and oil inlet flange (5). Fit washer (6) and nut (7) on the back end. By turning the hex. screw clockwise, the roller bearing is pulled out together with the oil inlet flange. Take out O-ring (8) and both O-rings (9).

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3.9.3) Removal of roller bearing for - Series 4

See Fig. 72-24.

After the propeller gearbox is removed, the crankcase side propeller shaft bearing can be replaced if necessary.

For the extracting procedure it is necessary to drill a bore (2) of at least 6.2 mm dia., (1/4") into the center of the oil inlet cover (1).

■ CAUTION : The oil inlet cover is thus rendered useless and must be replaced before installation!

■ CAUTION : Grease the grooves of the drill slightly to ensure that the majority of the metal chips adhere to the drill. Remove metal chips carefully after drilling.

The roller bearing is pulled out together with the oil inlet cover. Remove the retaining ring (3) with circlip pliers. On the gearbox side, fit puller cap (4), part no. 876489, and push hex. screw (5) through the cap, roller bearing (6) and the hole drilled in the oil inlet cover (1). Fit the pullout plate (7) with the nut (9) and washer (8) on the back end. By turning the hex. screw clockwise, the roller bearing is pulled out together with the oil inlet cover. Remove the O-ring (10).

Fig. 72-24
00250

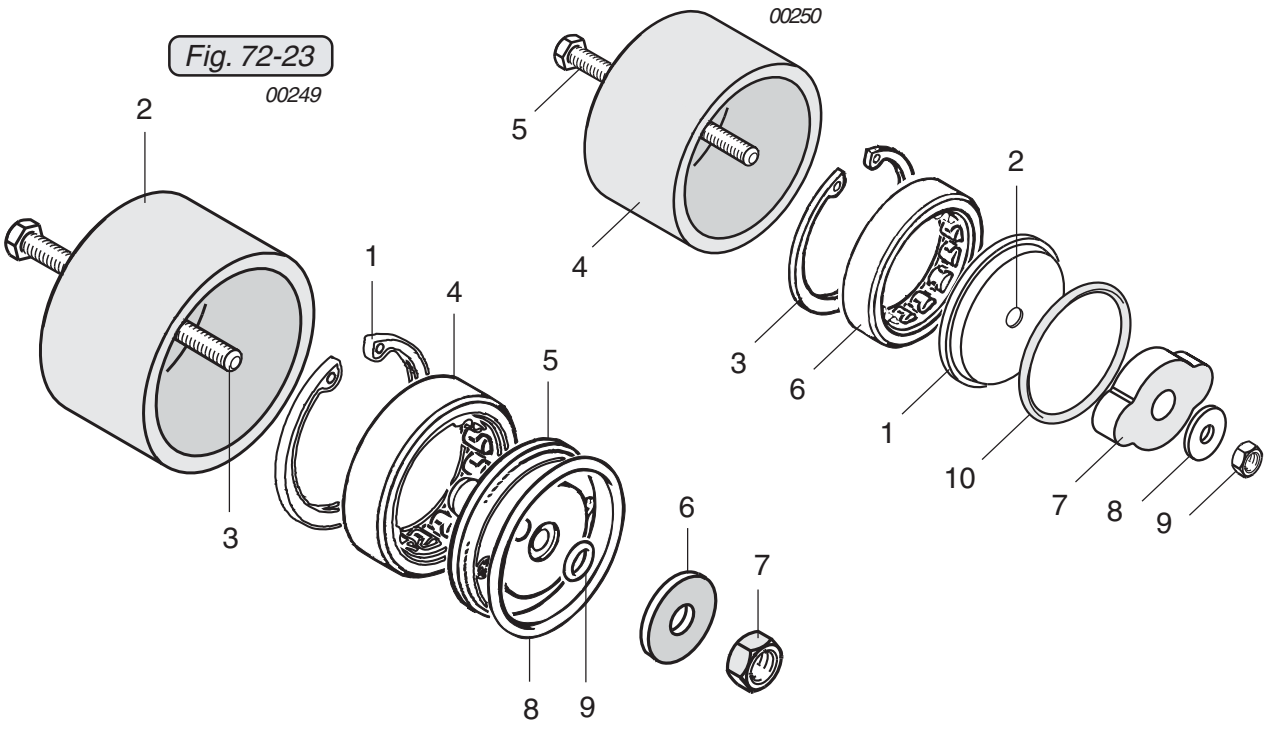

Fig. 72-23
00249

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3.9.4) Propeller gearbox disassembly

See Figs. 72-25, 72-26 and 72-27.

■ CAUTION : Only push the dog gear down until it is possible to remove the two ring halves, otherwise the gearbox housing could be destroyed. The gear cover should be rotated back and forth during this step!

Place the complete gearbox in a suitable fixture (1) and press down the gear wheel with the mounting yoke (2), part no. 876885, until the ring halves (3) can be removed, see 00-00-00 section 10.4

Now relieve the pressure on the gear by turning spindle (4) back and remove the mounting yoke and the gearbox from the fixture. Remove the drive gear (5), the thrust washer and the dog gear. Force bearing bushing (6) apart with circlip pliers and withdraw from the propeller shaft.

■ CAUTION: Do not overstress bearing bushing (6), as otherwise it will become unusable.

Remove the complete overload clutch (7) or dog hub (13), disc springs (8) 80x35x3, step collar (9), 6 mm (0.236 in.) distance sleeve (17), compensating shim (10), eccenter (11) (for fuel pump on the ROTAX 912 Series, of no significance on the 914 Series) and 8 mm (0.31in.) distance sleeve (12).

■ CAUTION: The overload clutch is fitted **in serial production on** all certified aircraft engines and on all noncertified aircraft engines of configuration 3. All other engine versions are equipped with a dog hub, but available with an optional overload clutch or can be retrofitted to accommodate one.

Fig. 72-25

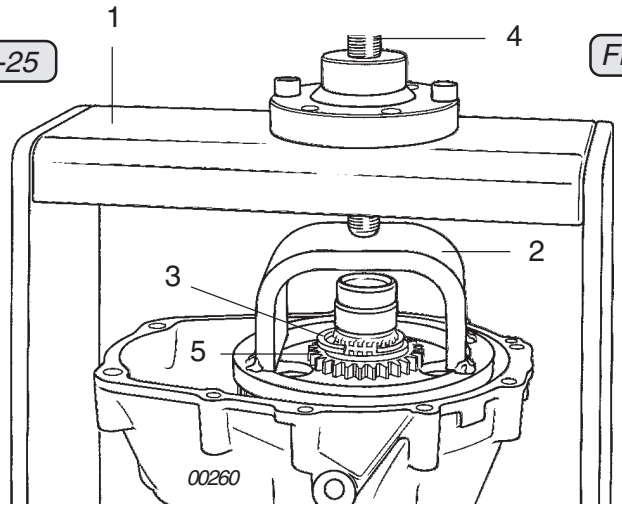


Fig. 72-26

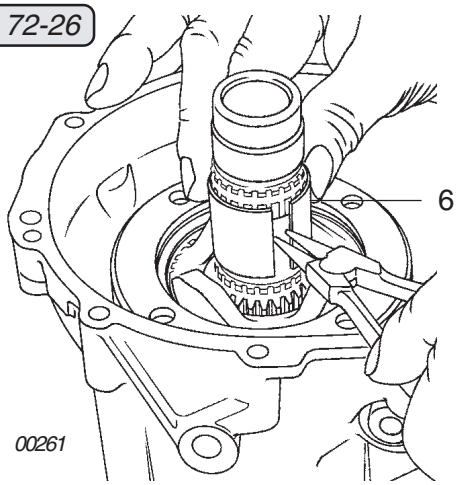
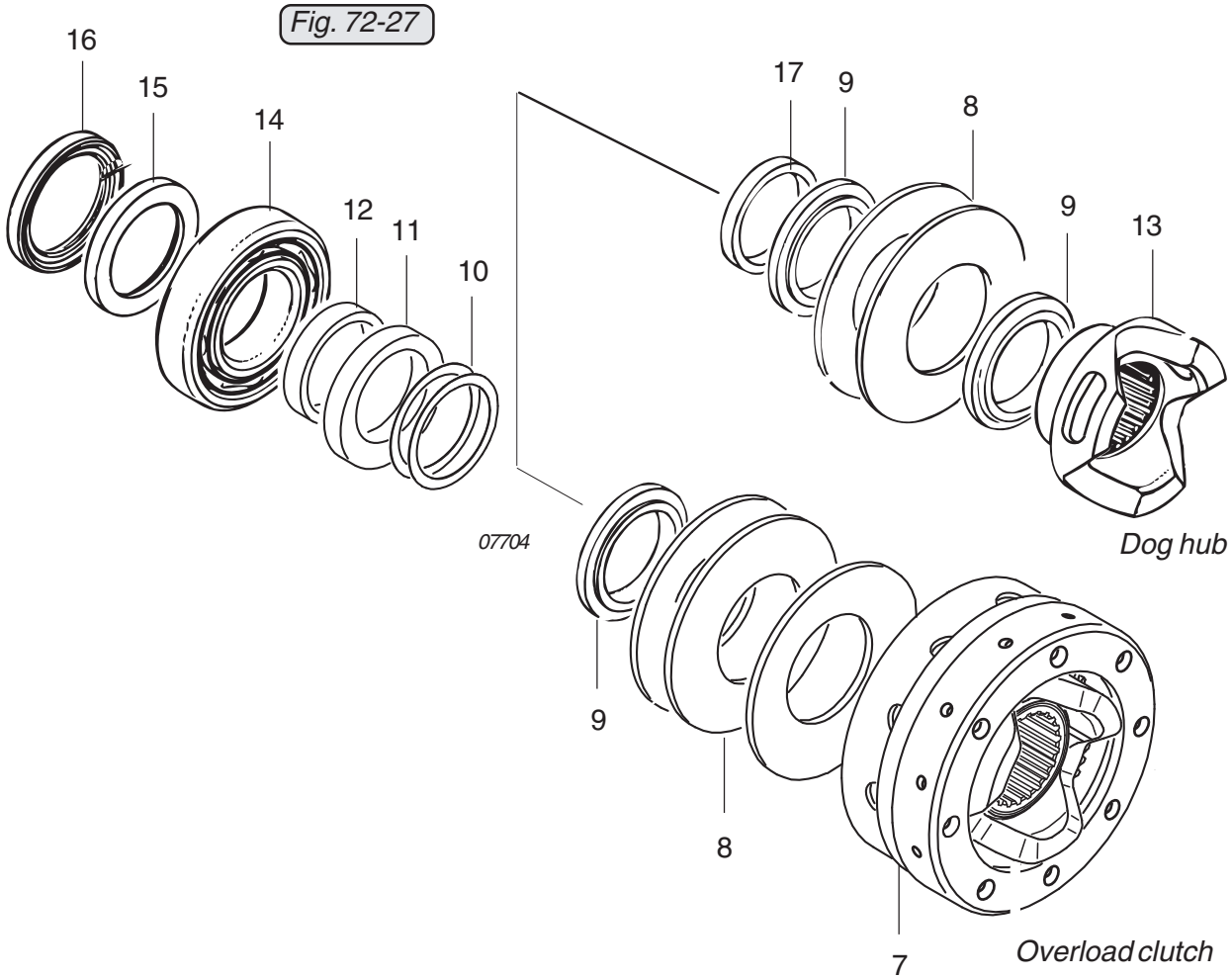


Fig. 72-27



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3.9.5) Propeller shaft removal

See Figs. 72-28 and 72-29.

Place gearbox housing on a suitable surface and press out the propeller shaft with a hand press. Alternatively, the extractor (1), part no. 877615, can be used to press out the propeller shaft.

Fit the extractor onto the gearbox housing (3) with 6 x M6 screws (2) and place press-out insert (4), part no. 877605 (for engine configuration 2), or press-out insert (5), part no. 877600, (for configurations 3 and 4) on the end (6) of the propeller shaft (7).

Insert pull-in spindle (8) into the support (9) of the extractor (1) and screw hex. nut (10) M24x1.5 onto the spindle (8) from the inside. Keep nut in position with a wrench. By turning the spindle clockwise, the propeller shaft is pressed out of the gearbox housing.

■ CAUTION : The protection piece (press-out insert (4) - part no. 877605 or press-out insert - part no. 877600) must be used without fail, as otherwise the machined inner diameter of propeller shaft would be damaged. If the propeller shaft is removed, the ball bearing (11) must be replaced!

To remove the ball bearing (11), unscrew the 4 hex. screws (12) M7x16 with the washers (13) from the gearbox housing (3).

■ CAUTION : During this procedure, the shaft seal (14) will be damaged and must be replaced.

Heat the gearbox housing to 80 to 100 °C (176 to 212 °F) and knock the ball bearing (11) out, together with the oil seal (14) and the radius ring (15), using a suitable punch and from the outside towards the inside.

d04776

Fig. 72-28

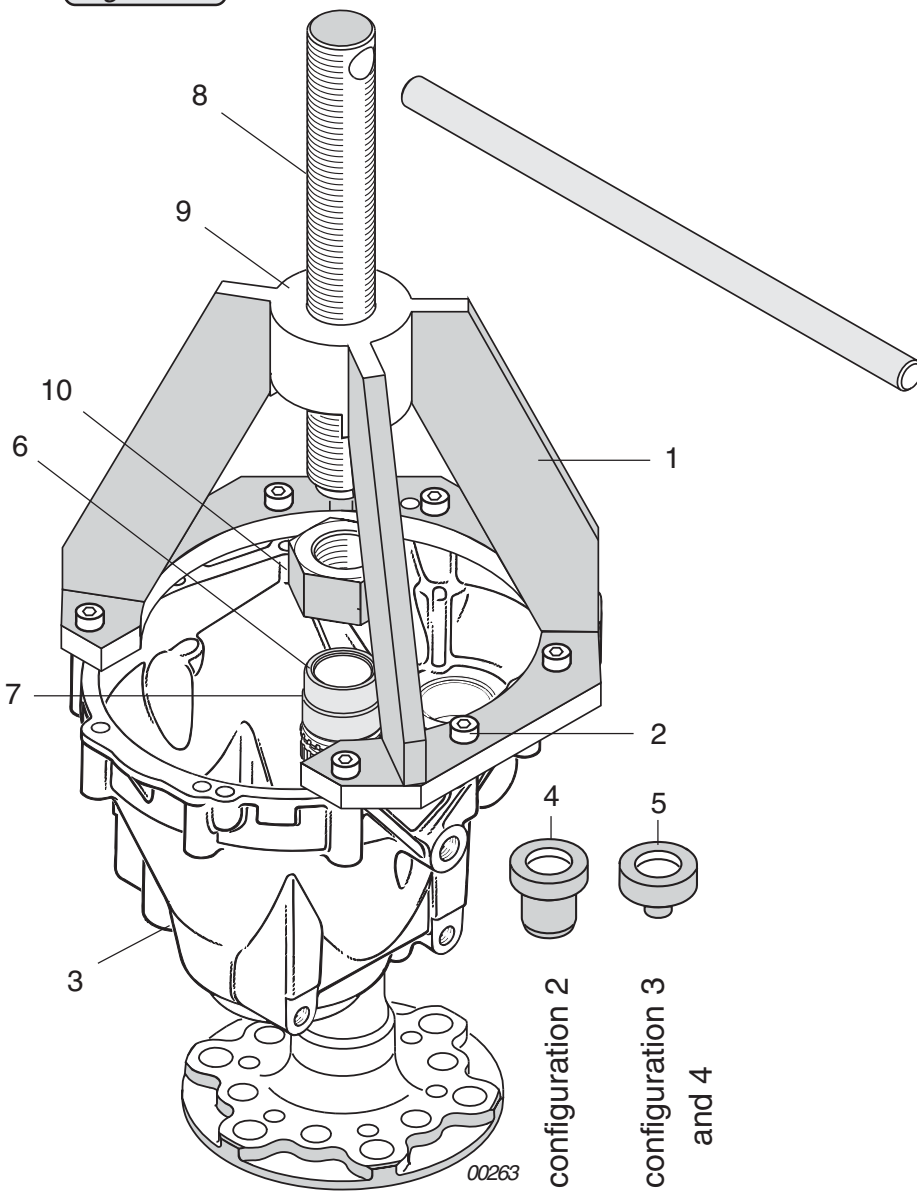
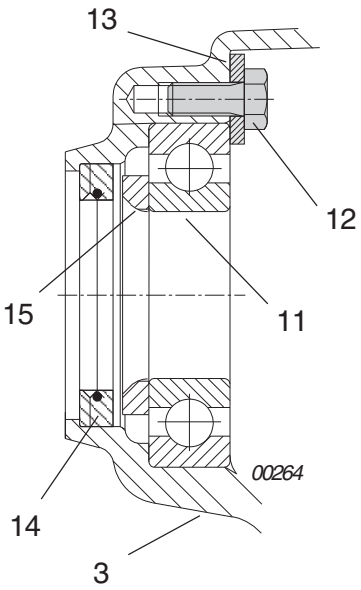


Fig. 72-29



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3.9.6) Vacuum pump drive removal

See Fig. 72-30.

The vacuum pump is driven via the drive gear (1) fitted on the propeller shaft.

Check the ball bearing (2) and the needle sleeve (3). Check the gear-tooth system of drive gear (1), the vacuum pump gear (4), the drive sleeve (5) and the drive shaft of the vacuum pump.

If the ball bearing or needle sleeve are to be replaced, remove the vacuum pump as follows:

Lock the drive sleeve (5) with the holder, part no. 242660, remove the allen screw (6) M8x14 and remove the vacuum pump gear (4) with the drive sleeve (5).

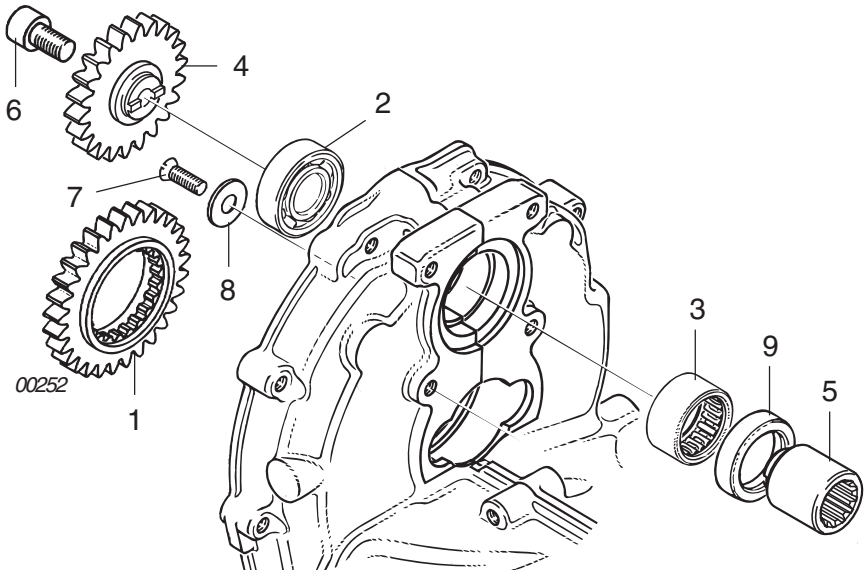
Remove the countersunk screw (7) M5x12 with the washer (8) for ball bearing fixation.

Lift out the oil seal (9) and press out the needle sleeve and ball bearing with a suitable step punch towards the propeller flange. Clean and inspect bearing seat.

◆ NOTE: During this procedure, the needle sleeve (3), the oil seal (9) and the ball bearing (2) are damaged and must be replaced.

■ CAUTION : The attachment screw (6) M8 of the vacuum pump gear for hydraulic governor drive is **16 mm long** (0.63 in.) and with a low profile screw head. For vacuum pump drive, however, it is only **14 mm long** (0.55 in.) with standard screw head.

Fig. 72-30



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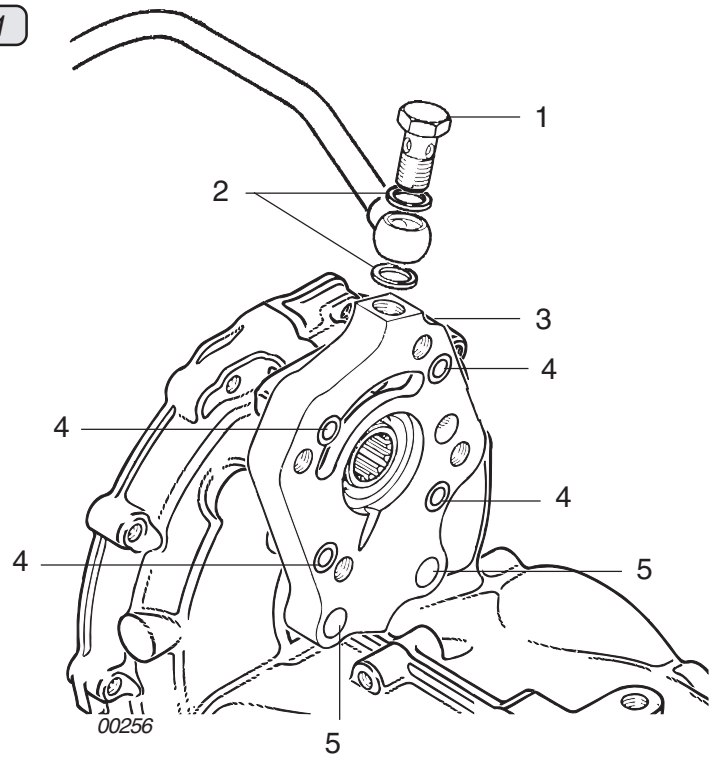
3.9.7) Propeller governor drive removal

See Figs. 72-31 and 72-32.

Remove banjo bolts (1) M10x1 and both sealing rings (2) from the governor flange (3) and the oil pump housing and remove the oil line. Remove the 4 allen screws (4) M6x20 and 2 allen screws (5) M6x16 for oil inlet flange fixation. Remove governor flange with O-ring and distance sleeve (item 9 of fig. 72-34) behind.

Fig. 72-31



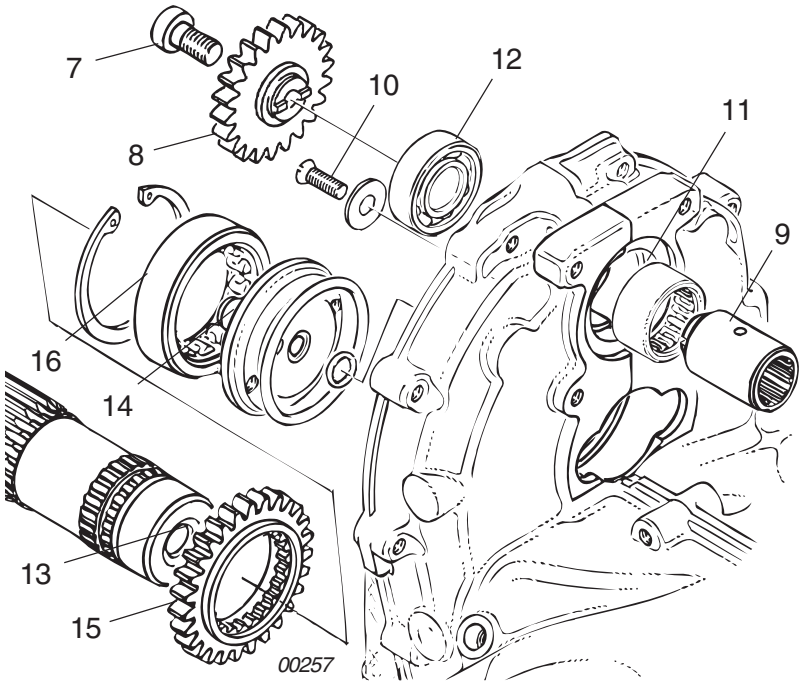
After removal of propeller gearbox the drive can be disassembled. Fix the drive sleeve (9) with holder, part no. 242660. Unscrew allen screw M8x16 (7) and remove the governor gear (8) with the drive sleeve (9). Remove the countersunk screw (10) M5x12 with the washer for ball bearing fixation.

Press out the needle sleeve (11) and the ball bearing (12) with a suitable step punch towards the gearbox.

◆ NOTE: Needle sleeve and ball bearing will be damaged by this procedure and must be replaced.

d04776

Fig. 72-32



Measure the inner diameter (13) of the propeller shaft and the bearing neck (14) of the oil inlet flange (GB05 and GB06). Any wear will probably appear as a flat area on the journal. Check the gear-tooth system of the drive gear (15) and the vacuum pump gear (8). Carry out a visual inspection of the ball bearing (12) and the cylindrical roller bearing (16).

■ CAUTION : The attachment screw (7) M8 of the vacuum pump gear for hydraulic governor drive is **16 mm** long (0.63 in.) and with a low profile screw head. For vacuum pump drive, however, it is only **14 mm** long (0.55 in.) with standard screw head.

Clean parts carefully and remove sealant residues. Check the sealing surface and all oil bores in the governor flange (3) for free passage. Carry out a visual inspection of the needle sleeve (11) and the gear-tooth system and bearing surface of the drive sleeve (9). Ensure that the connecting face for the oil pressure line is clean.

The governor must be sent to the manufacturer if any repair work becomes necessary.

d04776

3.9.8) Propeller governor drive installation

See Figs. 72-32, 72-33 and 72-34.

■ CAUTION : The oil inlet flange must be properly aligned and the O-ring must not be squeezed.

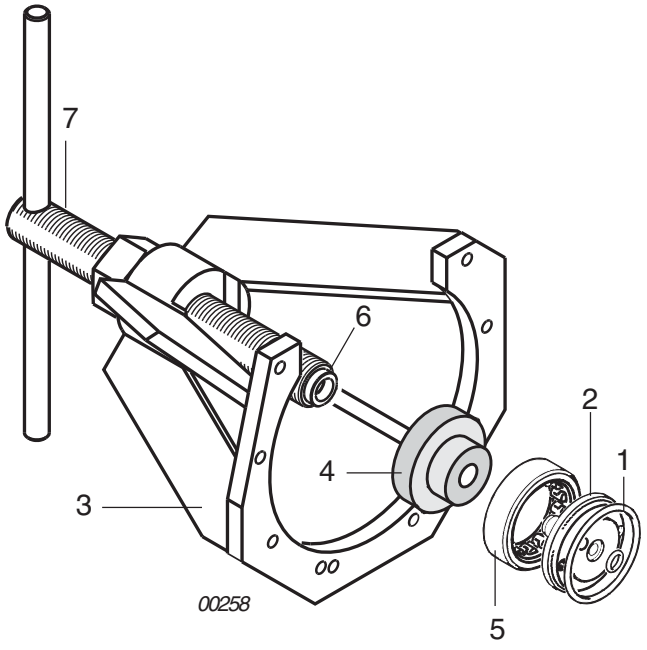
Install needle sleeve and ball bearing as described in 72-00-00 sec. 3.9.9. Grease new O-ring (1) and insert it together with the oil inlet flange (2) into the crankcase. Take care that both M6 threads are horizontal and the oil gallery is in a position to let the oil pass. For better positioning, temporarily attach governor flange with 2 allen screws M6x20 (12) and oil inlet flange with 2 allen screws M6x16 (13). Do not torque screw, only tighten enough to keep flange aligned.

Screw extractor (3), part no. 877615, onto the crankcase, place press-in insert (4), part no. 877590, into roller bearing (5), place on the centering (6) and press it fully home into the crankcase with the spindle (7). Fit circlip in groove with its sharp edge towards the outside.

Align drive gear lip (8) Fig. 72-32 into drive sleeve notch (9) Fig. 72-32 with holder, part no. 242660. Apply LOCTITE 2701 to the allen screw M8x16 and tighten.

Fit the governor flange (8) again. Fit distance sleeve (9) and new O-ring (10) 32x4 into the crankcase. Place one O-ring (11) 7x2 into the oil inlet flange and one into the governor flange and keep them in position with some grease. Fit the governor flange and attach it to the crankcase with 4 allen screws (12) M6x20 and to the oil inlet flange with 2 allen screws (13) M6x16.

Fig. 72-33



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■ CAUTION : Longer screws will damage the oil inlet flange.

◆ NOTE: Tightening torque 10 Nm (90 in.lb). The allen screws (12) and (13) are secured with LOCTITE 221.

Fit the governor (14) and the new gasket (15). Take care that the gear-tooth system engages.

Depending on governor type different screws and nuts are needed. See SB-912-052 and SB-914-035, “Installation / Use of governors“, latest issue.

Fit the pressure oil line (18) to the governor flange and the oil pump housing and secure with a clamp. The screw plugs (19) and (20) normally remain closed. A pressure gauge for governor pressure inspection can be connected at position (19) if necessary. The maximum governor pressure is between 21.5 bar (312 p.s.i) and 24.5 bar (355 p.s.i), depending on governor type. The governor starts regulating at 3400 to 4150 rpm.

Malfunction of the propeller governing may be caused by the following:

— incorrect adjustment of governor actuation

— malfunction of propeller governor

— insufficient oil pressure, oil pressure fluctuations

— propeller pitch control.

d02622

3.9.10) Gearbox components inspection

See Figs. 72-37, 72-38, 72-39, 72-40, 72-41 and 72-42.

Clean disassembled gearbox with suitable cleaning agents and check the following parts:

— Check that the bearing bushing (1) for crankshaft support bearing in the gear cover fits tightly and measure dimension (GB01). See 72-00-00 sec. 4.

— Measure both bearing seats (2) and (3) on the propeller shaft. See dimension (GB02) and dimension (GB03). Check oil seal running surface (4) and (5). Roll propeller shaft and check for run out. Check the run out of the propeller flange, see dimension (GB04). See 72-00-00 sec. 4.

Fig. 72-37

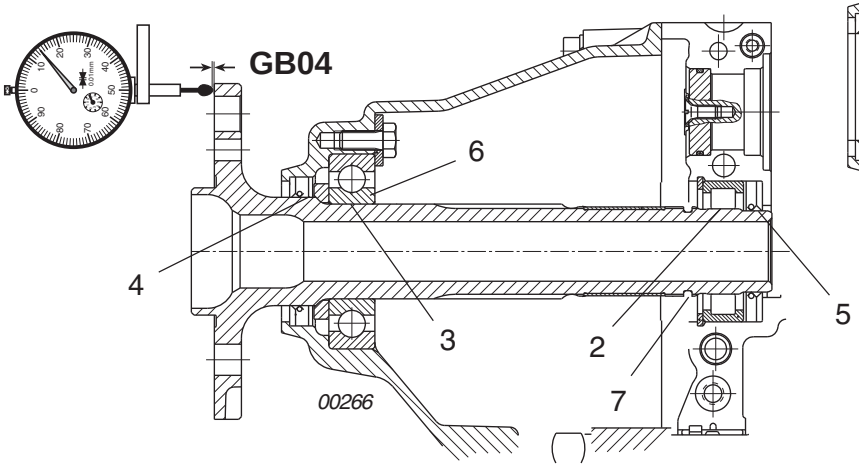
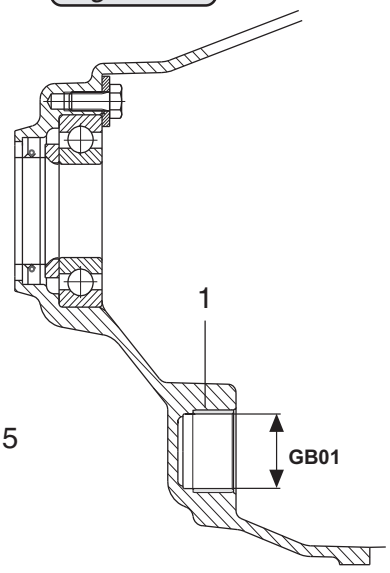


Fig. 72-38



■ CAUTION: The entire propeller shaft with attachment bores must be free of corrosion, and there must be no fretting corrosion at bearing points ((2) and (3)).

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Treatment of corrosion damage and surface damage to the propeller flange

The flange of the propeller shaft is subject to corrosion. After wrapping the propeller shaft (2) in plastic tape or covering it with plastic tubing, the propeller flange can be treated with an abrasive.

■ CAUTION: Before applying the protective coating, carefully cover the flange face (3), the attachment bores and the propeller shaft in this area (2).

To prevent corrosion damage, the back of the propeller flange should be coated with a corrosioninhibiting agent.

Where there is greater corrosion damage and the material has been affected, the propeller shaft must be replaced.

When carrying out any of these steps, the manufacturers instructions must be observed.

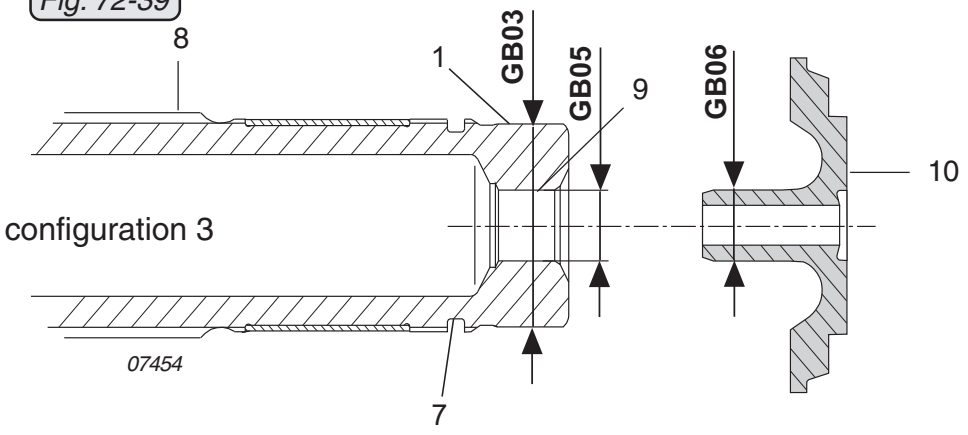
— The ball bearing (6) must be an interference fit on its outer race in the gearbox housing and on its inner race on the propeller shaft. Check groove (7) for the retaining rings and the gear-tooth system (8) for wear or damage.

On configuration 3, the inner diameter (9) of the propeller shaft must be checked in the area of the oil inlet flange (10), dimension (GB05/GB06). See 72-00-00 sec. 4.

◆ NOTE: The dimension GB05 or GB06 by itself is not as important as the radial clearance between GB05/GB06.

Inspect the propeller shaft for cracks. See 00-00-00 sec.10.4. Register the results of the magnetic particle inspection in the respective form sheet. See 72-00-00 sec. 5.

Fig. 72-39



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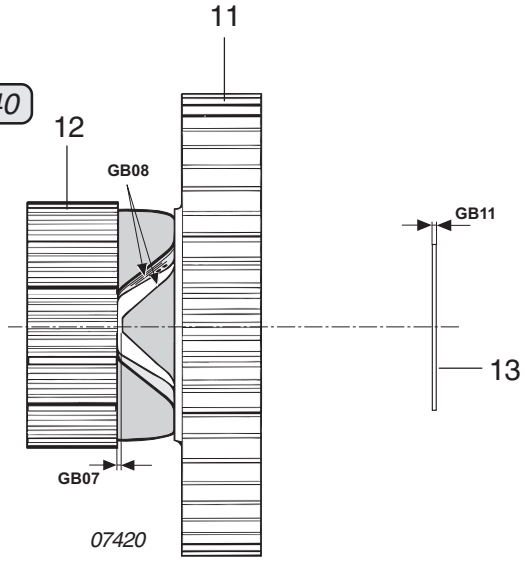
— Carry out a visual inspection of the dog gear (11) and the dog hub (12) to establish whether pitting is visible on the gear-tooth system and/or the sliding ramps (GB08) of the dogs. Ensure that the ramp tops of the dog gear are clearing the ramp valleys of the dog hub. Check the gap between the ramp top and the ramp valley, see dimension (GB07). See 72-00-00 sec. 4. Light to medium traces of wear and pitting on the dogs are permissible.

Fig. 72-40



— Check the gear-tooth system (14) of the gear set.

— Check the eccenter for the fuel pump and the fuel pump tappet for wear, see 72-00-00 sec. 3.9.4 and 73-00-00 sec. 3.4.8

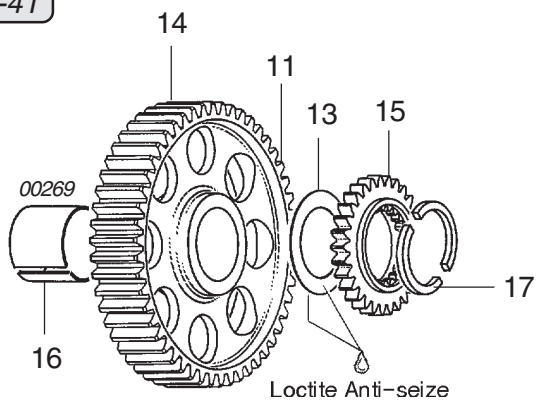
— Check the step collar for wear in the area of the disc spring support, see 72-00-00 sec. 3.9.4.

— Measure the thickness of the plastic thrust washer (13) between the dog gear (11) and the drive gear (15), see dimension (GB11). See 72-00-00 sec. 4.

— Check the hardened steel dog gear bush (16) for wear.

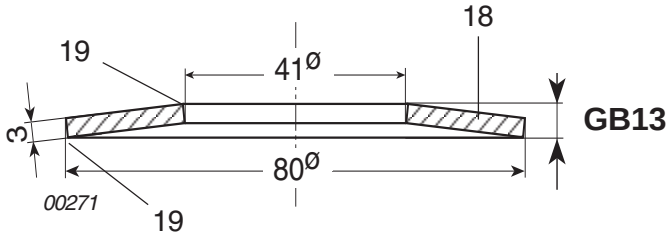
d02622

Fig. 72-41



— If there is visible wear to the disc springs (18) in the contact area (19), they must be replaced. Check dimension (GB13) of the uncompressed disc spring.
See 72-00-00 sec. 4.

Fig. 72-42



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3.9.14) Disc spring pre-tension adjustment (with overload clutch)

See Figs. 72-53 and 72-25 (see Section 72-00-00 / 3.9.4).

When the propeller shaft assembly is uncompressed, the contact surface (24) for the ring halves must lie in the groove of the propeller shaft 1 mm (0.039 in.) over the upper edge (25). The difference must be compensated for by placing shims (26) between eccenter (14) and step collar (15).

◆ NOTE: To facilitate adjustment, they can first be pushed apart until the top edge (25) of the contact surface (24) for the ring halves slips into the groove in the propeller shaft and a 1 mm (0.039 in.) compensating shim (26) can be inserted between step collar (15) and eccenter (14).

◆ NOTE: To check the friction torque of the dog hub in free rotation, see the corresponding Maintenance Manual (Line Maintenance) for the respective engine type, 912 Series or 914 Series.

3.9.15) Disc spring pre-tension adjustment (with dog hub)

See Fig. 72-53

Completely compress disk springs utilizing mounting yoke part no. 876885. The lower edge of the groove (25) in the propeller shaft must align with the top edge of the retaining ring (24) (distance must not be more than 0.2 mm (0.008 in)). Set distance by shims to max. 0.2 mm (0.008 in).

After completing the adjustment of the disk spring travel, depress dog gear (2) with mounting yoke, part no. 876885, until both ring halves can be inserted.

■ CAUTION : Always use new ring halves.

Insert ring halves and release pressure, see 72-00-00 sec. 3.9.4.

■ CAUTION : If the spacing is insufficient, never overpress the springs, as this will cause the dog gear to collide with the gear cover.

■ CAUTION : The ring halves must be completely inserted in the groove on propeller shaft!

Check that the ring halves are positioned correctly.

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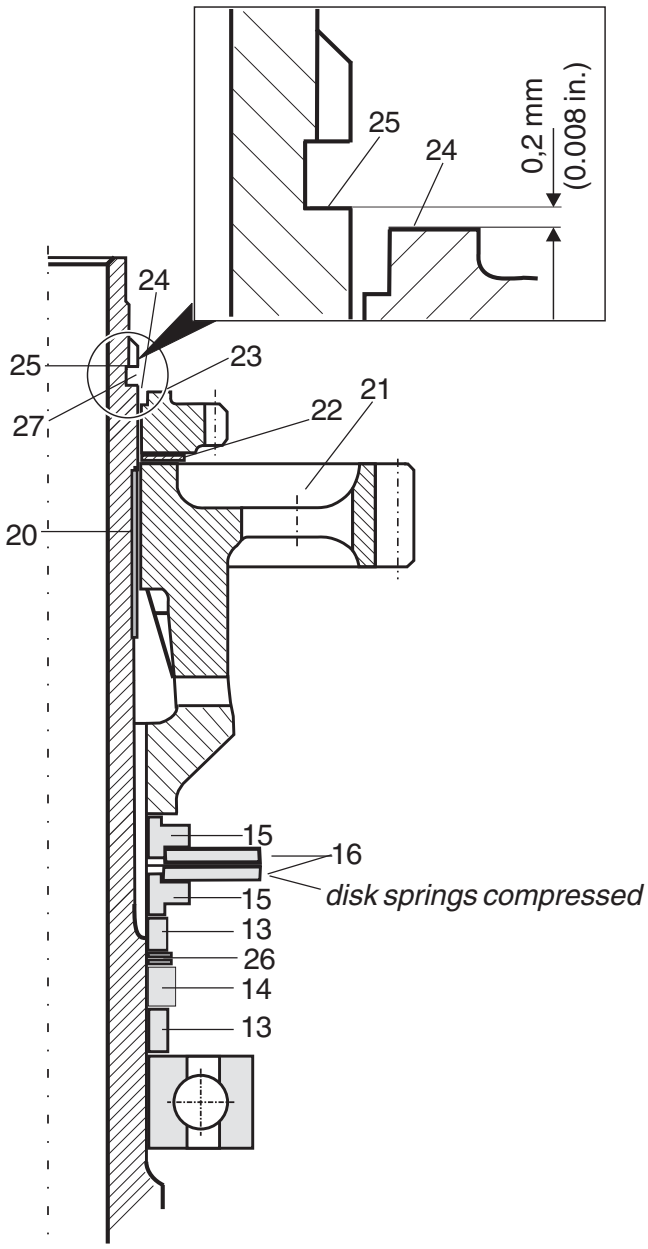
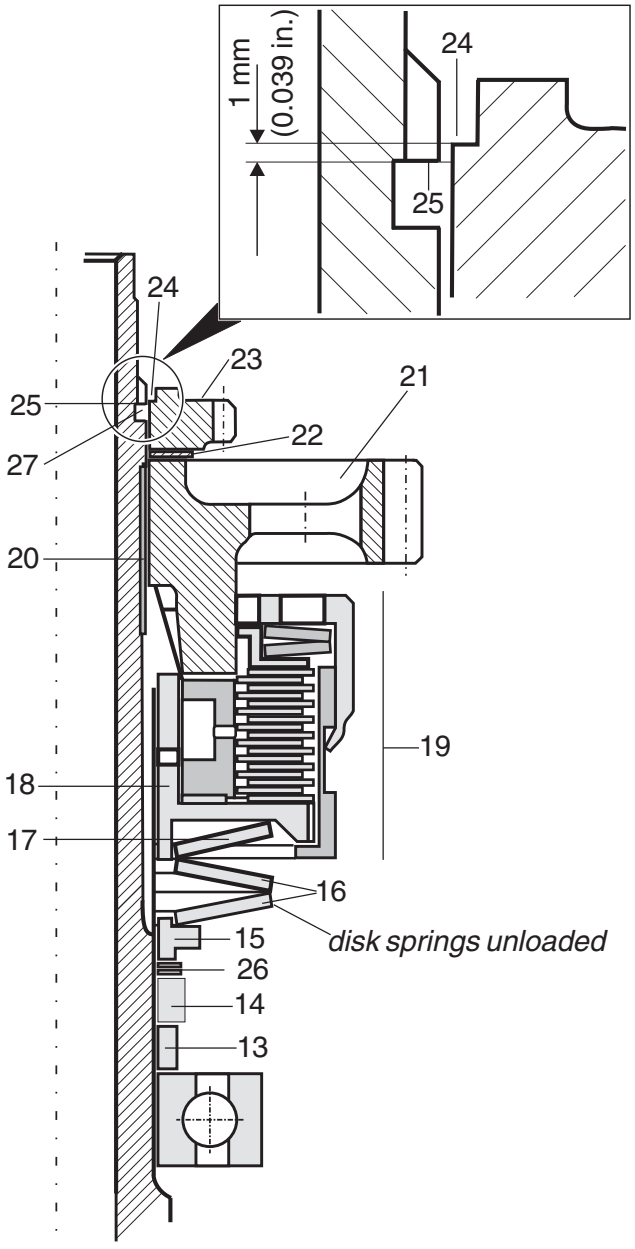
Fig. 72-53

Version with dog hub



Version with overload clutch



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3.9.16) Propeller gearbox — installation

See Figs. 72-54, 72-55 and 72-56.

Carry out a visual inspection of the crankshaft (1) on the power take off side. Slide drive gear (2) onto the crankshaft (3).

◆ NOTE: Due to the restricted tolerances it can occur that it is difficult to slide the drive gear onto the crankshaft. In such a case try to slide on the drive gear in a different position. Don't use tools - don't press or strike the drivegear onto the crankshaft.

■ CAUTION : Before installing, clean hex. screw (4) with LOCTITE 7063. Make sure to have an appropriate installation position of the friction washer (5).

Apply LOCTITE 648 to hex. nut (4) M30x1.5 and screw the nut onto the crankshaft together with the friction washer (5) VS30. Tightening torque 200 Nm (147.5 ft.lb). Then measure the run out (CS24).

See 72-00-00 sec. 4.

Fig. 72-54

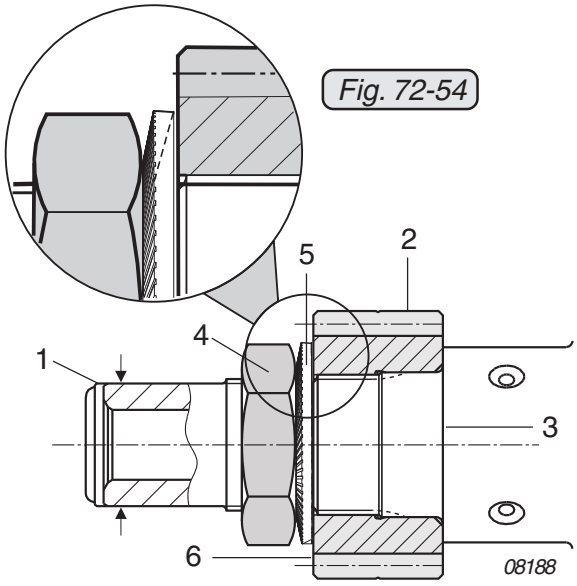
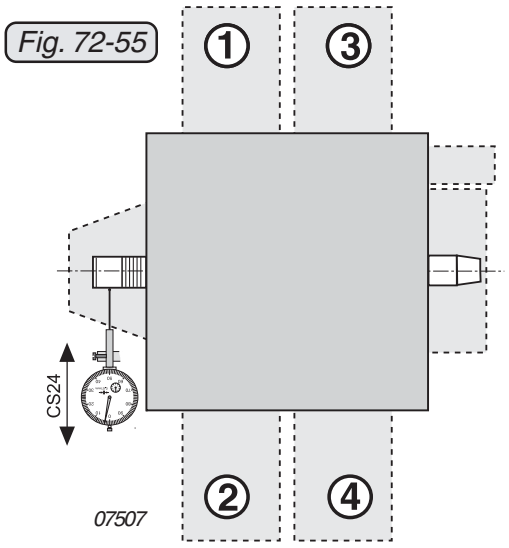


Fig. 72-55



◆ NOTE: If there is slight radial run out, reinstall nut (4) and measure again.

■ CAUTION : Dog gear and drive gear are paired and are marked with a consecutive serial number (6). Use only parts with the same serial number!

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Clean sealing surface of gearbox housing and crankcase. Oil which drains onto the sealing surface will eventually create a leak. Insert both dowel pins 6x20 into crankcase. Grease oil seal for propeller shaft in crankcase. Lubricate bearing bore for propeller shaft.

◆ NOTE: Engines of the 912/914 Series configuration 3 and configuration 4 have no oil seal.

Keep the rollers of the roller bearing in position with grease to facilitate assembly of propeller shaft.

Position gearbox housing with completely pre-assembled gear unit, previously coated with a thin layer of sealing compound LOCTITE 5910. Turn propeller shaft slightly to allow the dog gear to engage. By gently tapping on the gearbox housing (not on the propeller shaft) with a plastic mallet, the gearbox is fitted on the crankcase.

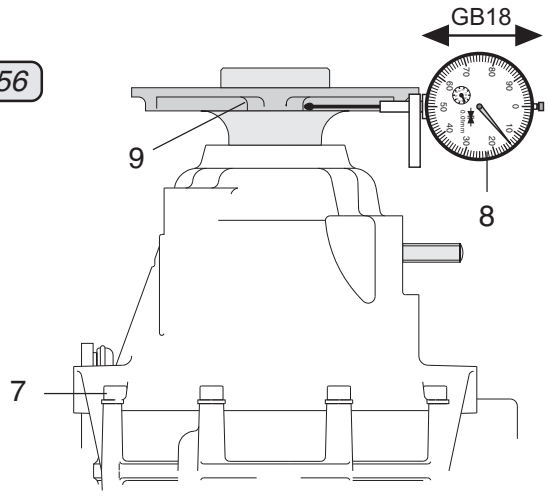
◆ NOTE: If there is resistance with a gap of approx. 10 mm (0.4 in.), the alignment of the rollers may need readjusting. Fix the rollers in position again with grease, press them outwards and / or turn the vacuum pump /governor gear slightly to allow engagement.

■ CAUTION : If excessive force is applied at assembly, the roller bearing or the vacuum pump drive can be damaged.

If the sealing surface becomes oily during the assembly process, clean it and reapply surface sealing compound LOCTITE 5910 or 574.

Tighten gearbox evenly with 2 allen screws M8x45 and 8 allen screws (7) M6x45 and lock washers in a crosswise pattern.

Fig. 72-56



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Check the radial gear backlash at the propeller flange (9) with the dial gauge (8), dimension (GB18). See 72-00-00 sec. 4.

Check the friction torque. See the relevant Manual (Line Maintenance) 12.00.00 chapter 7 of the corresponding engine type 912 Series and 914 Series.

Remove crankshaft locking screw and fit crankshaft plug screw M8 x 20 with new Cu gasket ring and tighten to 15 Nm (133 in.lb). For verification turn crankshaft with spanner 24 a/f on hex. screw on magneto side.

3.10) Cylinder head — removal

See Figs. 72-57 and 72-58.

If components of several cylinders are disassembled, they must be marked to ensure correct coordination at refitting.

Remove allen screw M6x25 (1) and washer from valve cover (2) and lift off valve cover and large and small O-ring. Remove crosswise 2 flanged nuts (3) with washers (4) and two collar cap nuts M8. The collar cap nut is inside the valve cover and has a sealing edge.

◆ NOTE: There is no washer required under the collar cap nut.

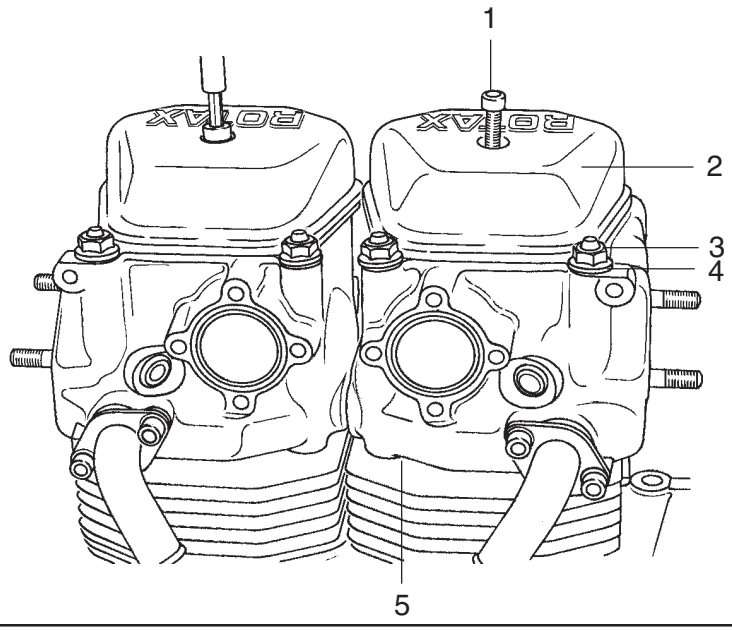
On newer engine versions, no washers (4) are fitted. They can be left out during assembly on all engine versions.

■ CAUTION: Do not damage the sealing surface!

Using both hands, carefully pull the complete cylinder head off the cylinder (5).

Fig. 72-57

00277



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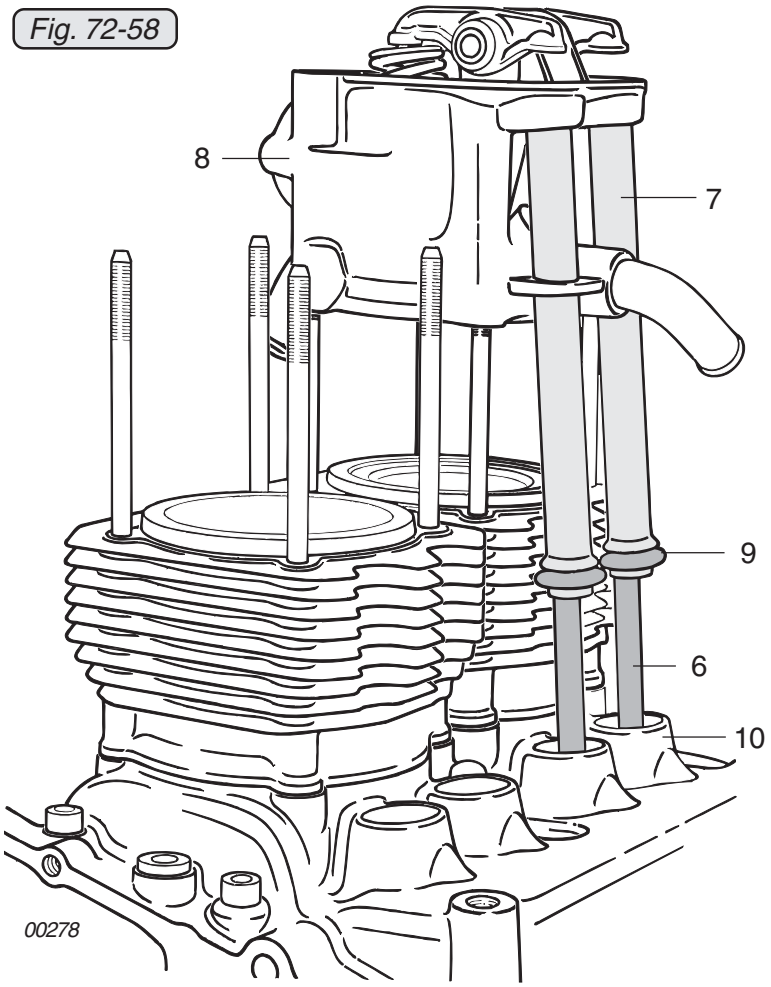
Keep both push rods (6) in position in the oil return tubes (7), seal oil bore of push rods with finger and remove cylinder head (8). The oil return tubes remain with the cylinder head. Remove O-rings (9) 16x15 from the oil return tubes or from the crankcase (10).

Store cylinder head in such a way that the sealing surface and oil return tubes are not damaged. Lift out oil filled push rods, stop oil from dripping by sealing with finger. Coordinate push rods with cylinder heads to prevent any mix-up.

Mark the installation position of the push-rod with a suitable pen (e.g. touchup pen) (e.g. ¨IV1“ for intake valve cylinder 1). If the parts are refitted in exactly the same position and assignment as before, the push-rods can be used again. This is because the parts have become broken in to each other in the course of operation before disassembly.

Fig. 72-58



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3.11) Cylinder head - disassembly

See Fig. 72-59.

If the rocker arms are to be dismantled without removing the cylinder head, turn the crankshaft to set the piston of the respective cylinder to ignition T.D.C. so that only little pressure remains on the rocker arm. Depress rocker arm with check lever part no. 877690 towards the hydraulic valve tappet. Now the rocker arm is completely released and the rocker arm shaft can be removed.

◆ NOTE: Never use force to press out the rocker arm shaft. The hexagon of the collar cap nut may be in an unfavorable position and prevent removal of the rocker arm shaft. In this case, loosen the nut.

Withdraw rocker arm shaft and remove both rocker arms.

◆ NOTE: Newer engine versions have plastic bushings as bearings. These plastic bushings must be laid aside in an ordered manner to prevent any mixup.

Compress the valve springs using valve spring mounting device (1), part no. 877380, valve spring mounting pliers (2) or similar tool and lift out valve cotters. Release valve spring. Remove valve spring retainer and both springs and withdraw valve.

◆ NOTE: Prior to removal of valves, clear burrs which may be present on valve stems to prevent damage to valve stem seal and valve guide. Mark valves coordinately.

Repeat procedure for the second valve. Clean cylinder head.

Check oil return tubes for leaks (visual inspection). If there is leakage in area (3), the respective oil return tubes must be replaced. For this procedure, heat the return tubes with a hot air gun to max. 120 °C (248 °F). Extract the oil return tubes and remove any glue residues from the bore. Apply LOCTITE 648 on the new oil return tubes in the area of the two grooves and twist and push tube into position in the preheated cylinder head. After that heat the cylinder head 10 to 15 minutes to 100 °C (212 °F) so that the LOCTITE hardens.

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When replacing the coolant elbow, mark its position, heat the area with a hot air gun to max. 120 °C (248 °F) and unscrew the fitting. Remove residues of LOCTITE means and check threads. Apply LOCTITE 648 to the thread on the cylinder head and to the new coolant fitting and screw the fitting into the cold cylinder head. Leave cylinder head to harden for approx. 10 minutes at 100 °C (212 °F).

If there are oil carbon residues on the sealing face with the cylinder, remove them carefully. Check that the sealing face is level.

In the case of slight wear, valve and valve seat may be seal-lapped, using emery paste.

Clean cylinder head and individual components with suitable cleaning agents. See 00-00-00 sec. 10.3.

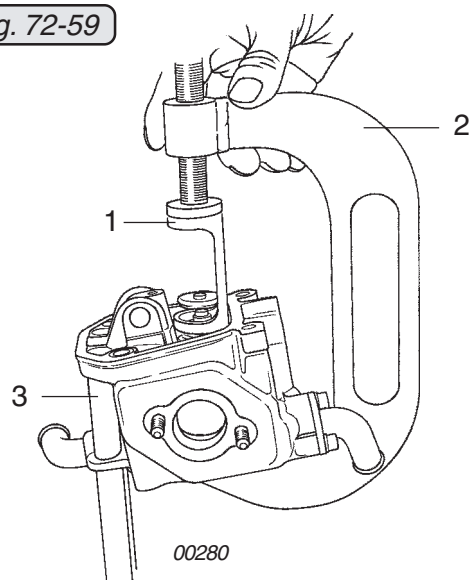
Check cylinder head sealing surface and if necessary, blue it and the cylinder. The flat surface of the cylinder and the cylinder head may only be slightly machined.

◆ NOTE: In the event of more serious leakage, cylinder and cylinder head can be reworked as described in the Overhaul Manual by a ROTAX authorized overhaul facility.

If the engine has been "run hot", the hardness of the cylinder head and the cylinder material must be checked.

See 72-00-00 sec. 5 and the corresponding Maintenance Manual (Line Maintenance) for the respective engine type 912 or 914 Series.

Fig. 72-59



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3.11.1) Cylinder head and exhaust manifold studs

See Figs. 72-60, 72-61 and 72-62.

Studs M8 x 20/23 (1) are for attaching the exhaust manifold. Check for tight fit and any damage.

When replacing a stud, it is fitted so that the longer thread (23 mm (0.91 in.)) is screwed into the cylinder head. Secure studs with LOCTITE 648.

Tightening torque 8 Nm (70 in.lb).

■ CAUTION: If the engine has been overheated, the hardness of the cylinder head must be checked. See the corresponding Maintenance Manual (Line Maintenance) for the respective engine type, 912 Series or 914 Series. Hardness is tested at control point CH08 as shown in Fig. 72-61.

Procedure for hardness test:

CH08: HB2.5/62.5 DIN EN ISO 6506-2

■ CAUTION: The results of the hardness test must be entered in 72-00-00 sec. 5.

Fig. 72-60

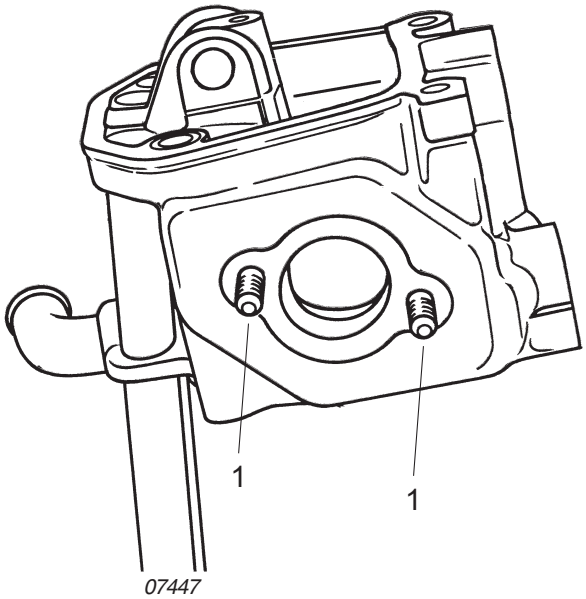
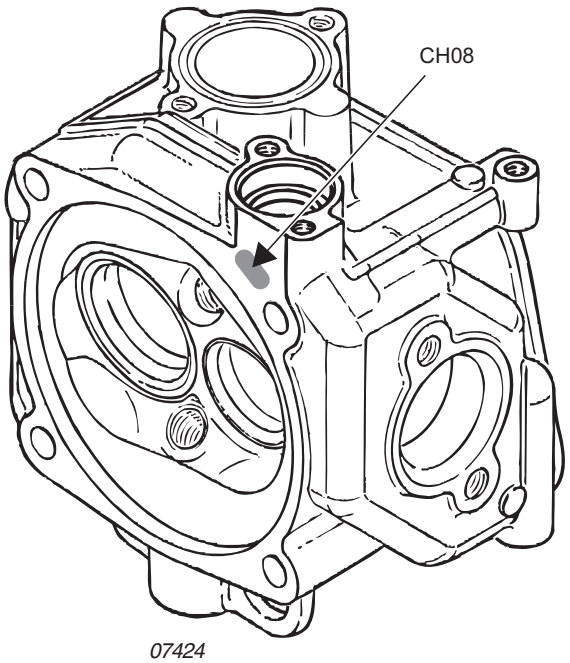


Fig. 72-61



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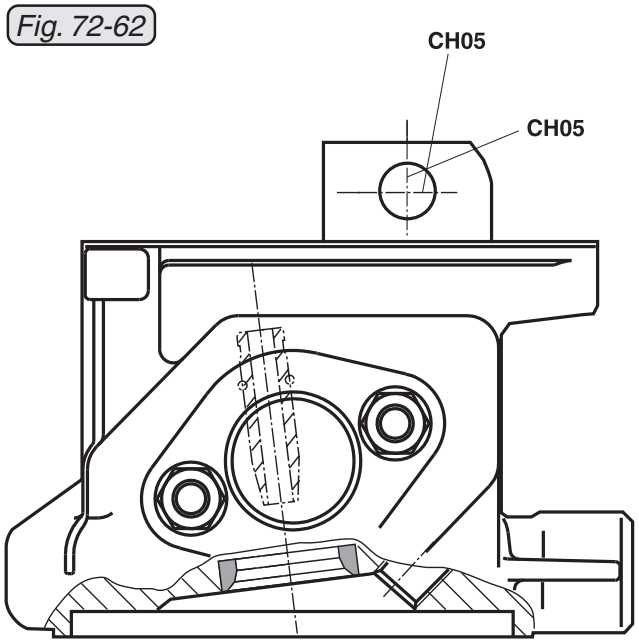
◆ NOTE: If the rocker arm shaft bearing (CH05) is worn, it can be reworked up to a certain limit. The cylinder head must be sent to a ROTAX authorized overhaul facility for this purpose.

Fig. 72-62



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3.11.4) Valve seats

See Fig. 72-66.

Carry out a visual inspection of the valve faces for damage and wear.

Apply engineers blue evenly to the valve faces and fit the valves into the respective valve guides. Turn the valve under gentle pressure to produce a clear imprint of the sealing surface on the valve seat ring.

Ensure that the sealing surface of the valve seats (1) is clean and if necessary, regrind with valve lapping paste.

■ CAUTION: The annular imprint on the valve face must be a continuous, unbroken ring.
The width of the imprint corresponds to the width of the valve seat CH02.

■ CAUTION: If burned spots or deformation are detected, send the cylinder head to a ROTAX authorized overhaul facility for overhaul or repair.

See 72-00-00 sec. 4.

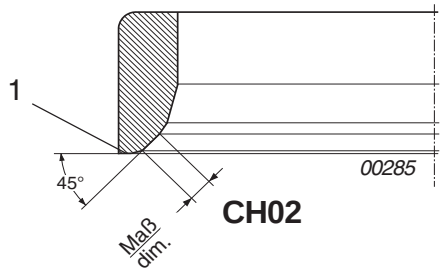

Fig. 72-66

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3.11.5) Valves

See Figs. 72-67, 72-68, 72-69 and 72-70.

Intake valves are checked as follows:

Carry out a visual inspection of the valves for damage and wear.

Clean valves, measure valve stem diameter and check valve disk for wear.

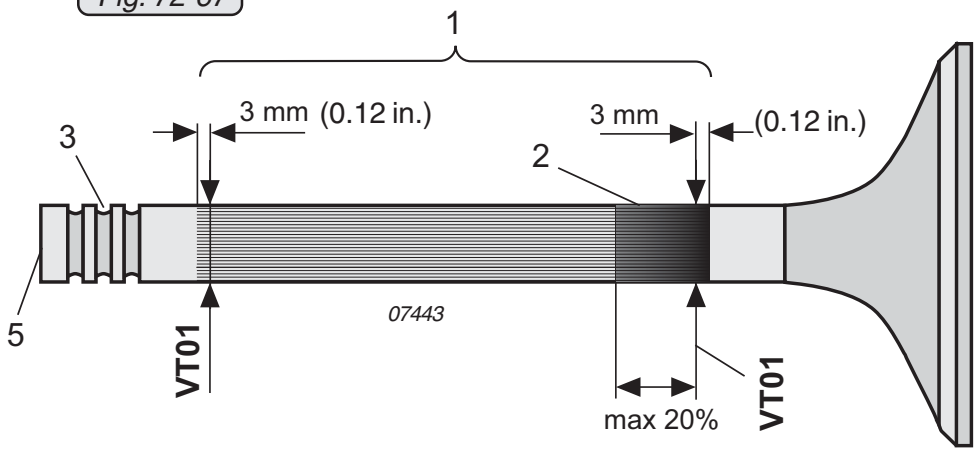
The valve stem diameter VT01 is measured at the edge of the moving path (1) of the valve stem. See Fig. 72-67.

See 72-00-00 sec. 4.

Check valve front surface (5) for pitting.

Check valve stem for possible deposits. Heavy oil carbon residues (2) on the valve stem indicate increased wear on the valve guide.

Fig. 72-67



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3.11.7) Washers

See Figs. 72-73, 72-74 and 72-75.

Carry out a visual inspection of the washers for damage and wear.

The wear must be measured radially with a dial gauge, starting from the reference area (on the inner part of the valve spring support) in measuring range radius (1) and working towards the outside. Dimension t=max. 0.04 mm (0.0016 in.). see Fig. 72-75. Pounding (wear) of more than 0.04 mm (0.0016 in.) is not permissible. If the dimension exceeds this limit, the valve, the valve spring support, the valve spring retainer, the valve cotters and the hydraulic valve tappet or any other damaged components must be replaced on the affected valve.

◆ NOTE: The valve spring support can indicate a malfunction of the valve train as a result of badly or insufficiently vented hydraulic valve tappets. Under normal conditions, no measurable wear will be seen, even after longer periods of operation. If a visual inspection reveals pounding wear on the contact surface, the current wear must be tested using a dial gauge.

See SI-912-018 / SI-914-020, “Purging of lubrication system”, latest issue.

Fig. 72-73

„magnified image“

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Fig. 72-74

„magnified image“

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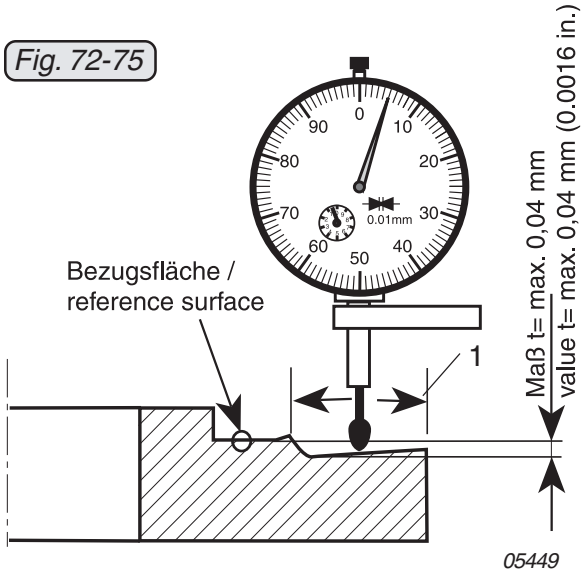
Fig. 72-75



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3.11.8) Rocker arm and rocker arm shaft

See Figs. 72-76 and 72-77.

The rocker arm bearing (1) is lubricated via the hollow pushrod (2) to the ball joint (female) (3). The oil flows through the oil ducts (4) in the rocker arm to lubricate the rocker arm bearing. The oil exit and thus the splash oil lubrication of the complete valve mechanism is via bore (5) The rocker arms for the inlet and outlet are different.

Check surface of rocker arm shaft and inner diameter of the rocker arm bearing bush (6) for signs of friction. Carry out a visual inspection of the valve stem contact area (7) and ball joint (female) (3) of the rocker arm. Excessive signs of wear indicate lack of oil. Slight reworking of contact area (7) for the valve stem is permissible. Check oil bores (4) in the rocker arm for free passage.

◆ NOTE: Oversize rocker arm shafts and rocker arm bushings are available for repairing the rocker arm bearing in the cylinder head.

The bronze colored fitted bearing bushing (6) cannot be replaced. If necessary, replace the whole rocker arm.

Fig. 72-76

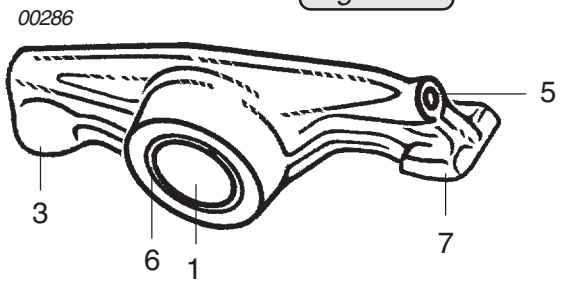
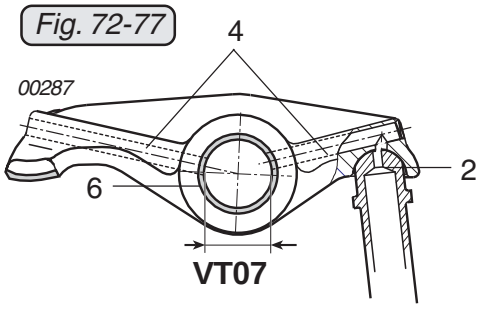


Fig. 72-77



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3.13.2) Checking the piston ring

See Figs. 72-88 and 72-89.

Check the end clearance of the cleaned piston rings.

To determine the end clearance (4), remove the piston rings from the piston using piston ring pliers, clean them and insert into the cylinder. Use a piston as pusher to align piston squarely in cylinder and approx. 10 mm (0.395 in.) from the top edge. The end clearance is measured using the feeler gauge (4), see dimension (PI07).

See 72-00-00 / 4.

By closely inspecting the ring surface (5), the portion of surface contact can be seen and indicates the wear. Install piston rings using piston ring pliers with the marking (6) "TOP" or the dot mark pointing upwards towards the piston crown.

Fig. 72-88

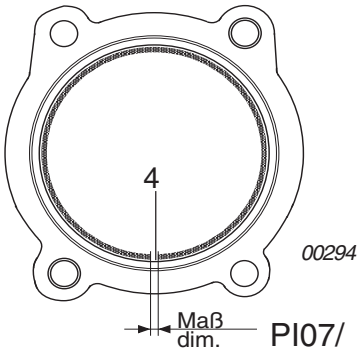
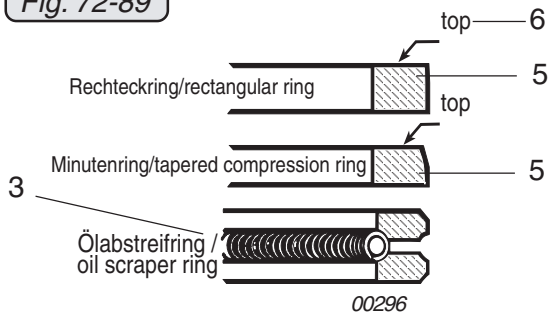


Fig. 72-89



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3.13.3) Piston pin

See Fig. 72-90

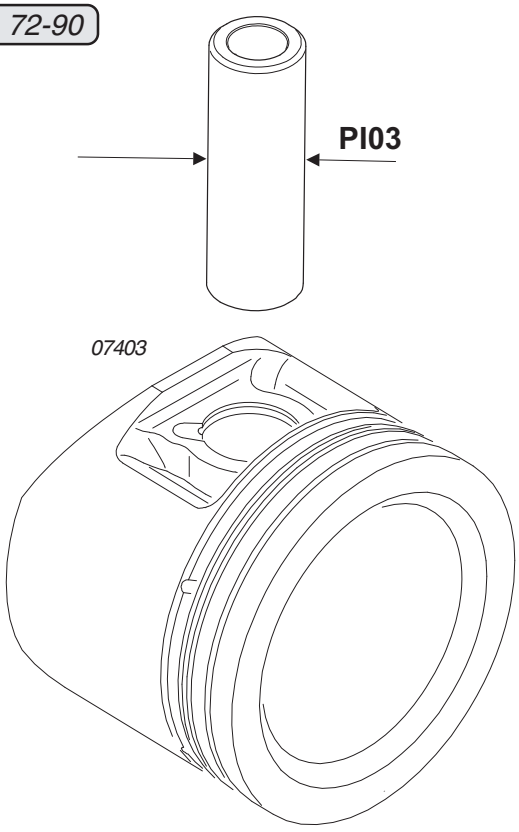
Measure piston pin and check for traces of seizure in area of con-rod seat. In case of distinct traces of seizure, replace piston pin even if dimensions are correct.

Measure dimension PI03.

See 72-00-00 sec. 4.

◆ NOTE: The circlips for axial piston pin retention must be used only once and must therefore be replaced.

Fig. 72-90



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3.13.4) Cylinders inspection

See Figs. 72-91, 72-92 and 72-93.

The running surface of the cylinder is "NICKEL-SILICON"coated. All 4 cylinders are identical. Clean the cooling fins (1) of the cylinder. Remove oil carbon deposits from the top end (2) of the cylinder bore. Clean sealing surfaces on top (3) and bottom sides (4) and inspect cylinder.

Measure cylinder as shown in the following diagrams and enter the readings (CY01/CY02/CY03) in the corresponding form sheet. See 72-00-00 sec. 4.
Measure the installation clearance, see 72-00-00 sec. 3.13.1. If the wear limit for the cylinder has been reached, the cylinder and/or the piston must be replaced.

◆ NOTE: Slight oil carbon residues on the cylinder sealing surface (3) indicate leakage. True up the cylinder along with the cylinder head.

◆ NOTE: If porosity is found in the cylinder wall the pores must not exceed a diameter of 0.4 mm (0.015 in.), the distance between pores must be at least 8 mm (0.31 in.).

■ CAUTION : If the engine has been overheated, the hardness of the cylinder must be checked. The hardness is measured at control point CY04. See Fig. 72-93. See 72-00-00 sec. 5.1.

d04776

Fig. 72-91

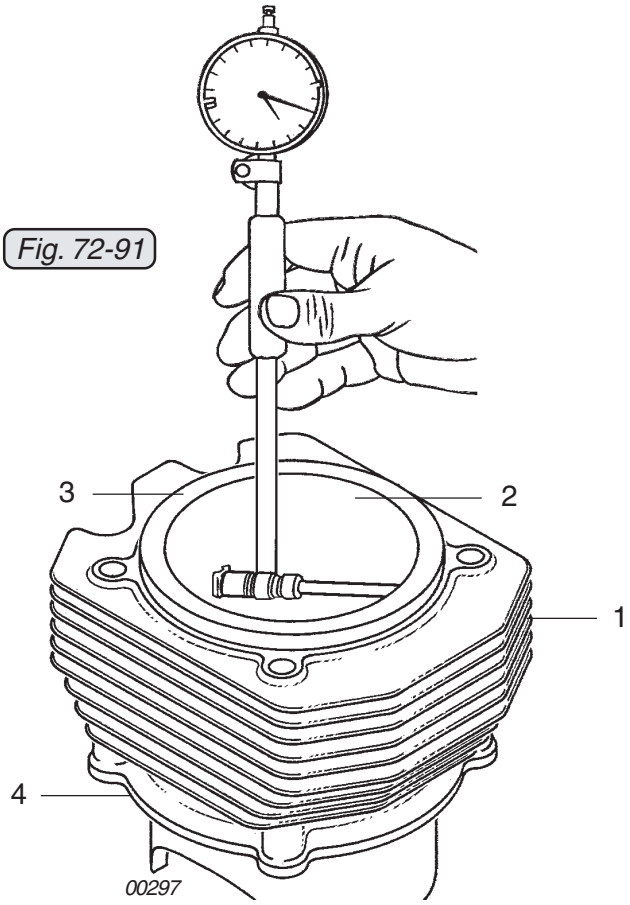


Fig. 72-92

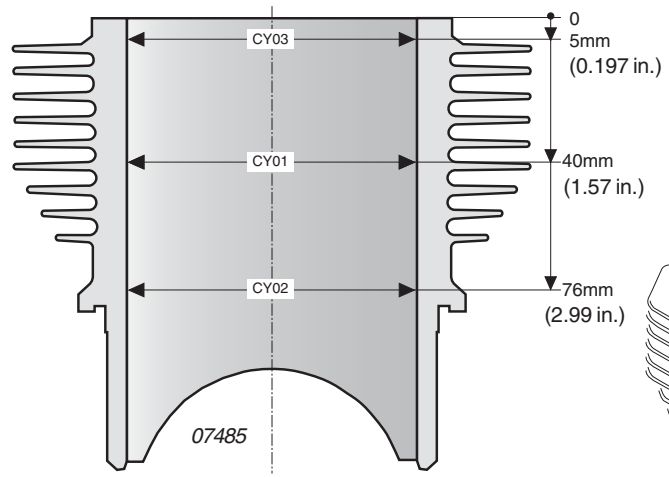
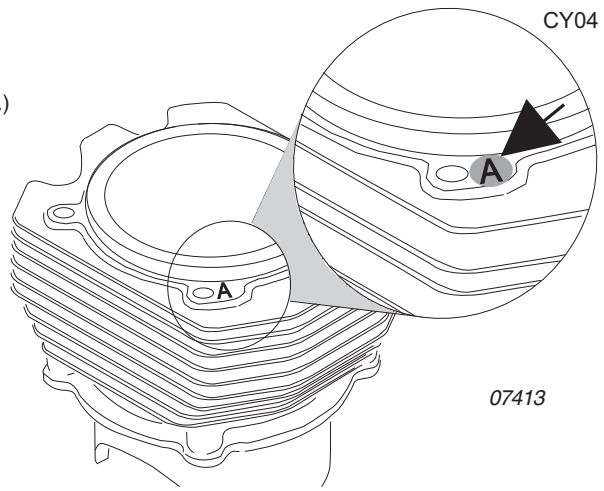


Fig. 72-93



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3.14) Hydraulic valve tappets

See Figs. 72-94, 72-95, 72-96 and 72-97.

Pull hydraulic valve tappets (1) out of the housing using the mono hook circlip puller (2), part no. 976380.

■ CAUTION : Never insert the puller into the retainer (3), but always into the groove in the hydraulic valve tappet. Inserting it into the retainer could cause the hydraulic valve tappet to fall apart. See Fig 72-94.

Lay hydraulic valve tappets aside, arranging them in a manner that ensures they will be refitted in their original place.

Carry out a visual inspection of the hydraulic valve tappets for damage and wear.

◆ NOTE: The hydraulic valve tappets rotate during engine operation, so the camshaft lobes (4) should be worn evenly.

Failure of a hydraulic valve tappet to rotate will result in uneven wear (2) on the contact surface (1). If there are irregular bright areas, fretting/pitting, the tappet must be replaced. See Fig. 72-97.

■ CAUTION: The cams of the camshaft can be visually inspected for damage after removing the hydraulic valves.

In the event of damage of the camshaft, the assy. engine block must be sent to a ROTAX authorized overhaul facility.

■ CAUTION : Taking apart hydraulic valve tappets is not allowed and not necessary.

■ CAUTION : In the event of malfunctions such as operation with un-purged hydraulic valve tappets, the components in the tappet (plate) are worn down.

■ CAUTION : If it is necessary to replace a hydraulic valve tappet, make sure that a tappet with a polished cam running surface (ROTAX part no. 881831) is used.

Depending on storage conditions, new hydraulic valve tappets are partially emptied and pump full of oil during engine startup. Oil enters the hydraulic valve tappet through the bore (5). The retaining ring (3) keeps the piston (6) in position when the hydraulic valve tappet is removed. See Fig. 72-95 and 72-96.

◆ NOTE: When putting into operation, observe SI-912-018 / SI-914-020 "Purging of lubrication system“, latest issue.

See 72-00-00 sec. 4.

d04776

Fig. 72-94

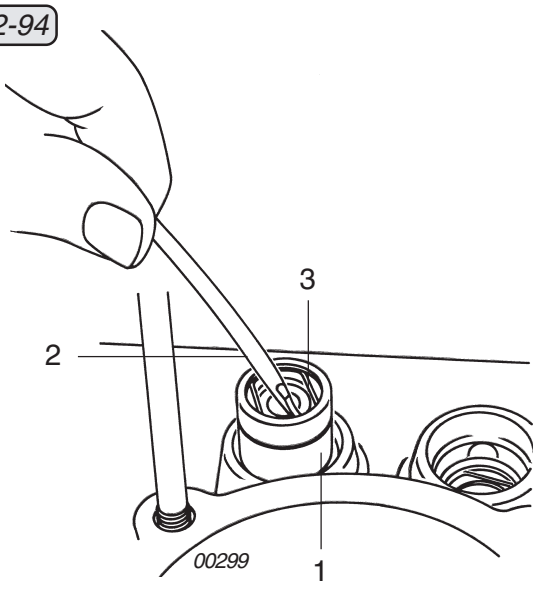


Fig. 72-95

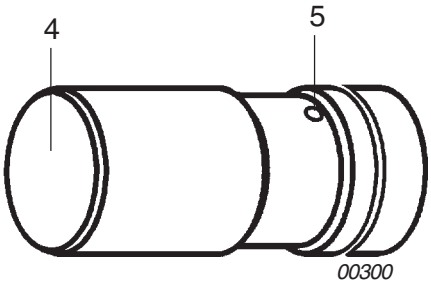


Fig. 72-96

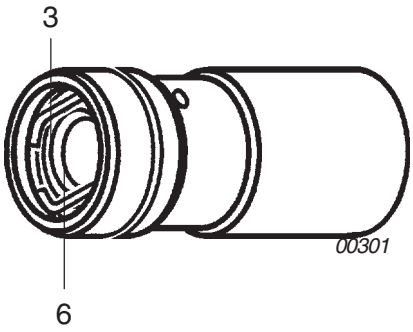
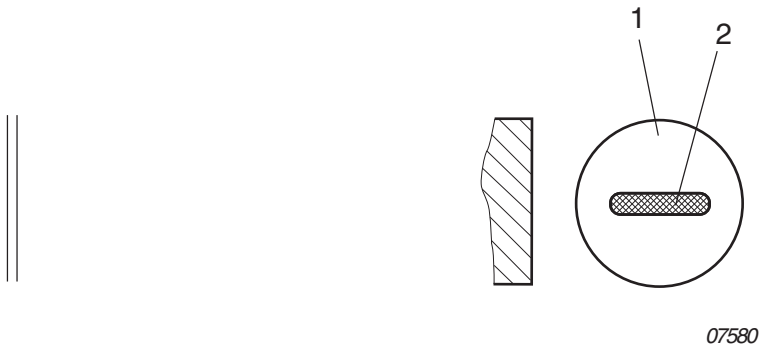


Fig. 72-97



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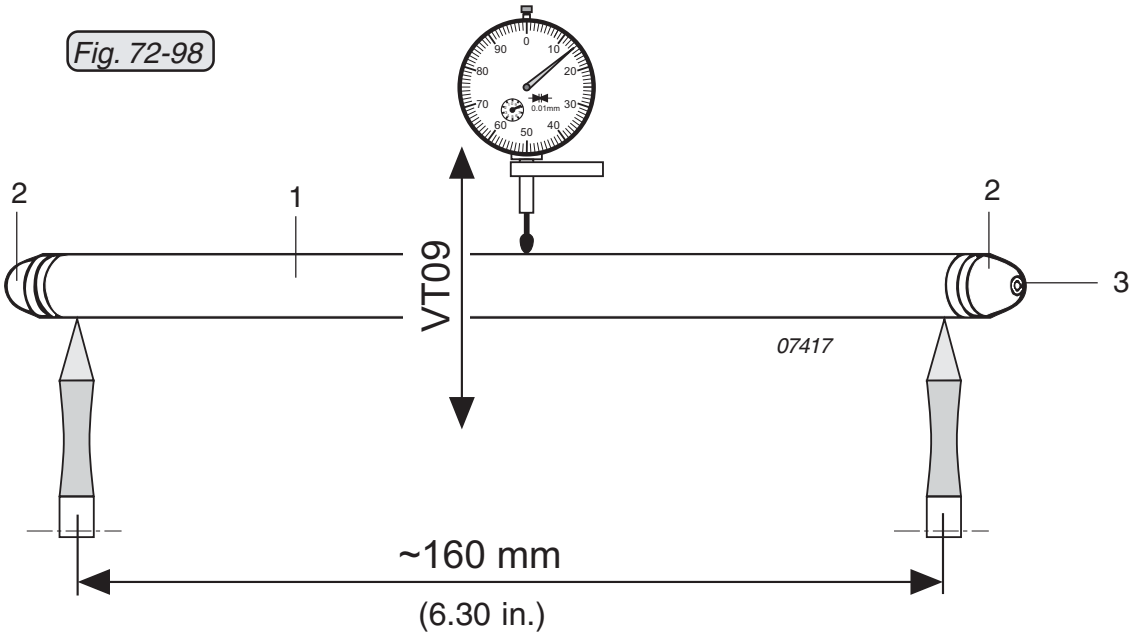
3.15) Pushrods

See Fig. 72-98.

Clean push-rods (1) and carry out a visual inspection. Make sure that the two ball heads (2) pressed into the rod fit tightly. Excessive engine speed may have caused bending of the pushrods. Roll push-rods and check for run out, dimension (VT09). Lube oil from the hydraulic valve tappet passes to the rocker arm through the bore (3).

See 72-00-00 sec. 4.

Fig. 72-98



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3.16) Piston and cylinder assembly fitting

3.16.1) Hydraulic valve tappets fitting

Lubricate bearing bore for hydraulic valve tappets in crankcase. Apply LOCTITE Anti-Seize to the contact surfaces of the hydraulic valve tappets, lubricate their circumference and insert them into the crankcase according to the recorded position . The hydraulic valve tappet must be able to turn in the crankcase without resistance.

3.16.2) Pistons fitting

See Figs. 72-99, 72-100, 72-101, 72-102, 72-103 72-104 and 72-105.

The piston pin center is offset from the piston center. During installation of the piston, the arrow (1) on the piston crown must point toward the propeller shaft. This means that on cylinders **1** and **3**, the offset (narrower side (2)) faces downwards, while on cylinders **2** and **4**, the offset (narrower side (3)) faces upwards.

Install the piston as shown on Fig. adjacent the offset of the piston pin bore is 1 mm (0.039 in.).

If the arrow (1) on the piston crown is no longer visible, the piston must be measured to determine the correct pin offset. See fig. 72-99/72-100.

Fig. 72-99

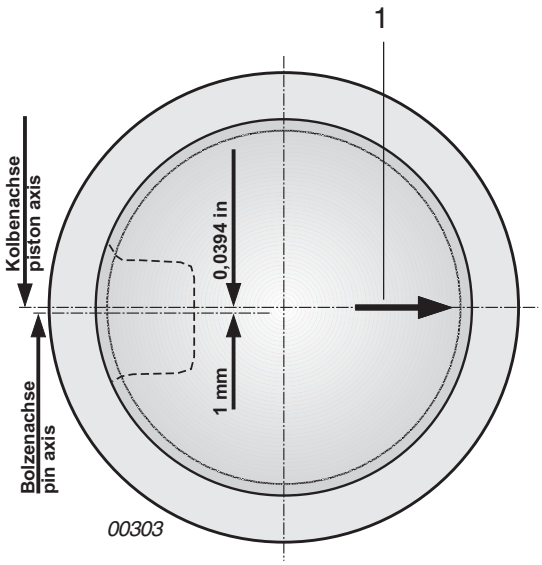

Fig. 72-100

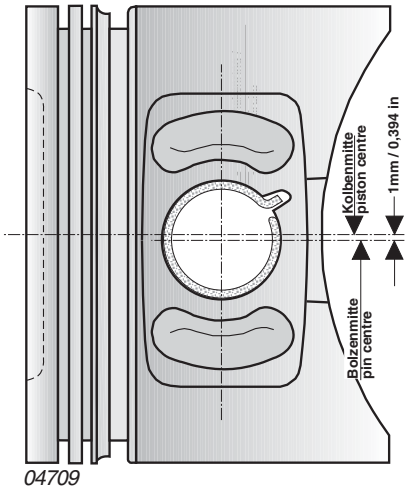

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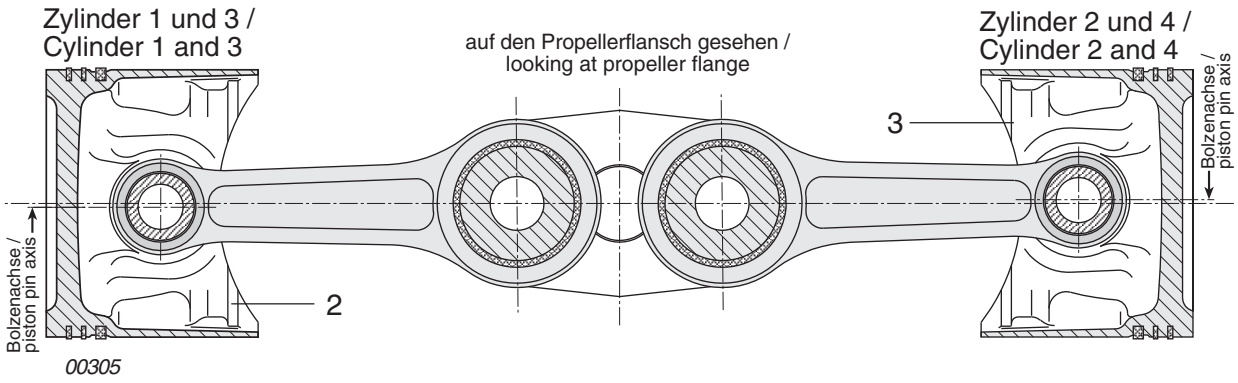
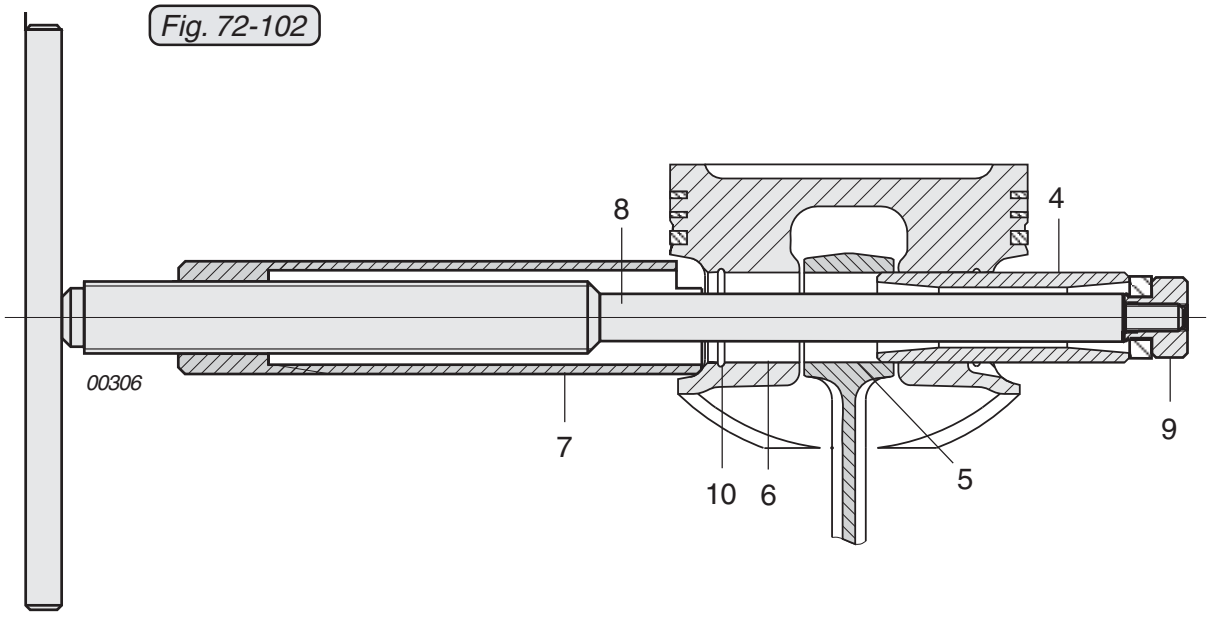
Fig. 72-101



Oil the entire length of the piston pin (4). The connecting rod eye (5) and the piston pin bore (6) are also oiled. Insert piston pin with guide punch, part no. 877802 (slide fit).

If this is not possible, the piston pin can be pulled in with the piston pin tool (7), part no. 877091. Insert piston pin into one side of the piston bore, insert spindle of installation tool (8) and fit nut (9). Turning the spindle clockwise draws the piston pin in completely, up to the retaining groove (10).

Fig. 72-102



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■ CAUTION: Always use new mono hook circlips! Used retaining rings or retaining rings which have already been fitted have too little tangential tension, can twist and thus wear the groove in the piston.

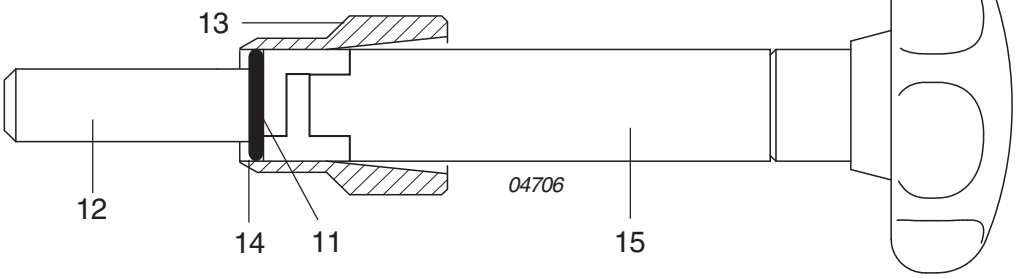
Fit piston pin circlip with installation tool, part no. 877802. To do so, press the mono hook circlip (11) into the groove (14) of the mounting sleeve (13) and push guide punch (12) into the mounting sleeve. Slide mounting sleeve onto the installation tool.

■ CAUTION : The position of the mono hook circlips is dictated by the recess on the piston. When assembled, the open side of the mono hook circlip must be positioned opposite the piston crown. See Fig. 72-100.

Push installation tool (15) into the positioning gauge and press the ring towards the front as far as the stop. Now position the complete installation tool (15) on the piston. Support piston with hand and exert strong pressure on the installation tool to push the mono hook circlip (11) into the groove (16) of the piston. Apply same procedure on the opposite side of the piston.

◆ NOTE: Old style pistons (17) are made for hookless circlips, the mono hook circlip must be reworked as described in SI-21-1997 “Introduction of the mono hook circlip“, latest issue. See Fig. 72-105.

Fig. 72-103



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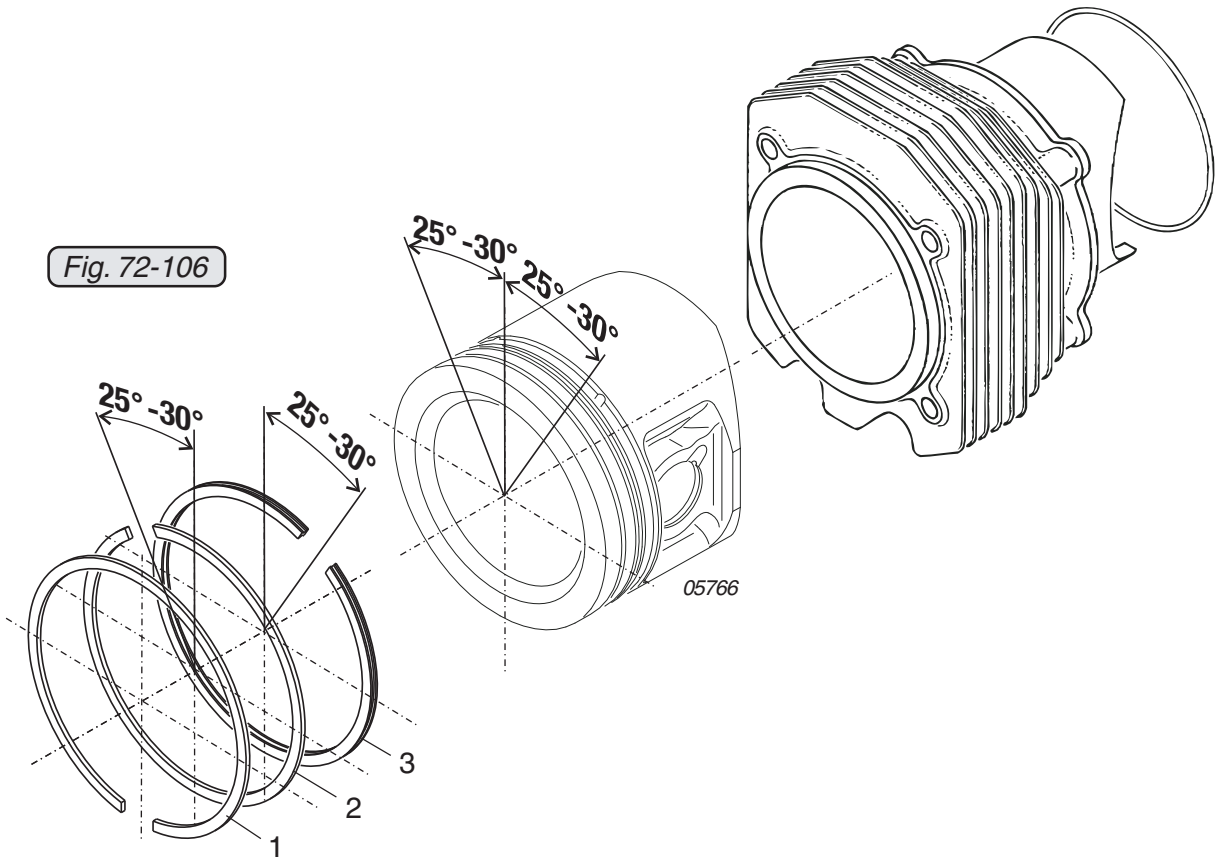

Fig. 72-106

d02622

3.16.4) Cylinder head fitting

See Figs. 72-107, 72-108, 72-109 and 72-110.

Install respective pushrods (1) in both oil return tubes on the pre-assembled cylinder head and place pre-oiled O-ring (2) 16x5 on oil return tube (3).

Fit cylinder head until the O-rings (2) on both oil return tubes rest in the crankcase (4). Now lift cylinder (5) until the centering (6) of the cylinder engages in the cylinder head recess.

◆ NOTE: This is a safety measure to prevent jamming of cylinder head resulting in leakage.

◆ NOTE: On engines of older design, washers (12) are fitted on the hex. nuts M8. Recent findings show that it is no longer necessary to fit these washers. These washers are therefore not necessary when fitting a new cylinder head.

■ CAUTION : Lightly grease the flat surfaces of the collar cap nuts (11) to ensure a constant tightening torque.

Fit cylinder head and cylinder together on crankcase. First, slightly tighten the cylinder head with 2 collar cap nuts M8 and 2 hex. nuts M8 crosswise. Ensure that the O-rings (2) are squeezed evenly into the crankcase.

Repeat this procedure on the other cylinder heads.

Attach cylinder aligning tool (8), part no. 877262, to the intake flange of the cylinder heads (10) with 4 allen screws (9) M6x25. Align cylinder heads, thus warranting a flat support for intake manifold. Screw on collar cap nut and flanged nut (11) with washer (12) and tighten cylinder heads in the order shown in Fig.72-108. Tighten to 10 Nm (90 in.lb) and then in addition tighten further by applying a 180° rotation. Remove 4 allen screws (9) and cylinder aligning tool.

◆ NOTE: If cylinder stud heads are damaged or if the cylinder baffle clearance is too tight then the cylinder head studs have to be replaced.

Lubricate all moving parts in rocker arm compartment. Place O-ring (13) 105x2.5 and O-ring (14) 6.4x1.8 in the valve cover (15).

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Fit valve cover and tighten with allen screw (16) M6x30 and washer (17) to a tightening torque of 10 Nm (90 in.lb).

■ CAUTION : On the outer contour, there must be a gap of at least 0.2 mm (0.008 in.) between the valve covers. The valve covers must not touch each other.

■ CAUTION : Never change the length of the valve cover screw! Check whether threads are damaged. If this screw is loose or if the valve cover is leaking, the oil return to the oil tank by "blow-by gas" will not work at all or only insufficiently.

Screw in spark plugs and tighten to 20 Nm (180 in.lb). Fit spark plug connectors on spark plugs according to the coding sleeves, see 74-00-00 sec. 3.4.

◆ NOTE: Proceed as per Wiring Diagram. See 74-00-00 sec. 3.13.

Fig. 72-107

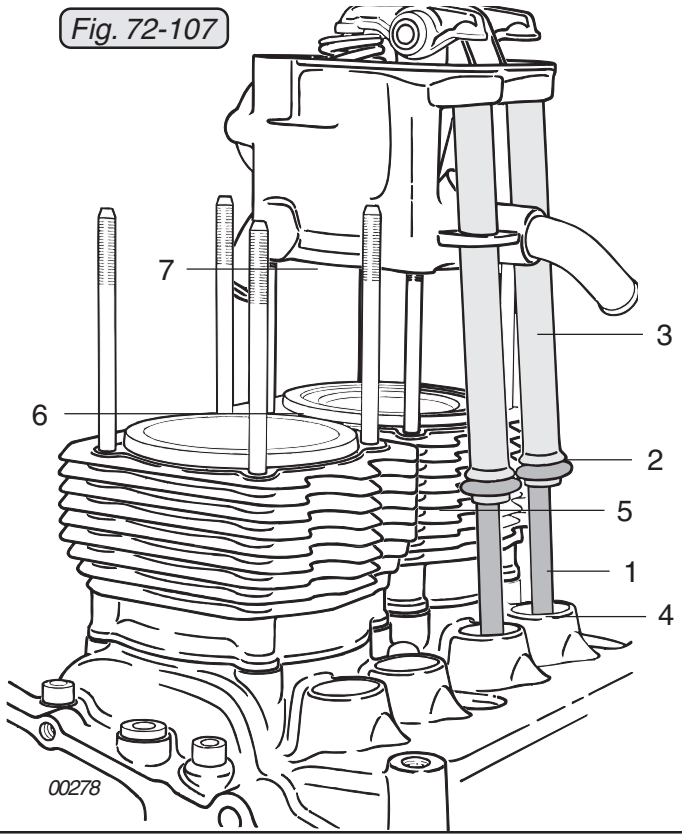

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Fig. 72-108

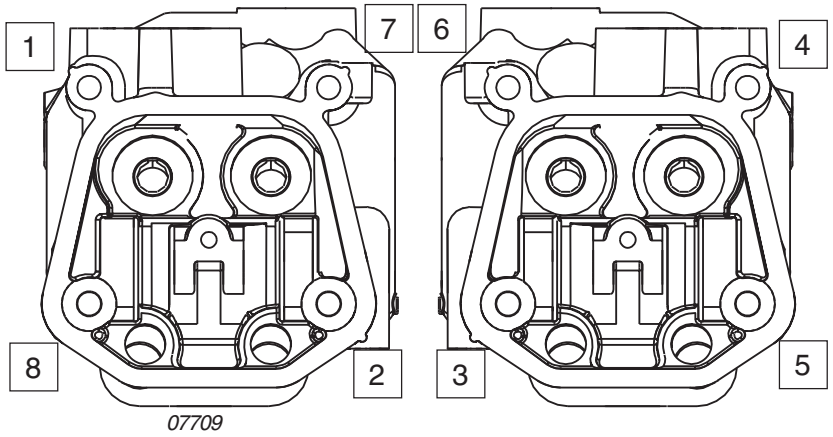


Fig. 72-109

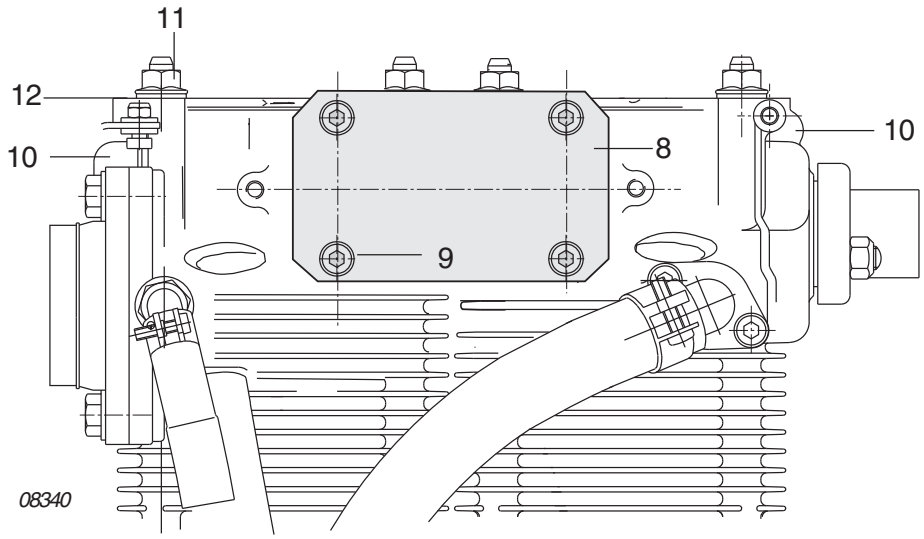
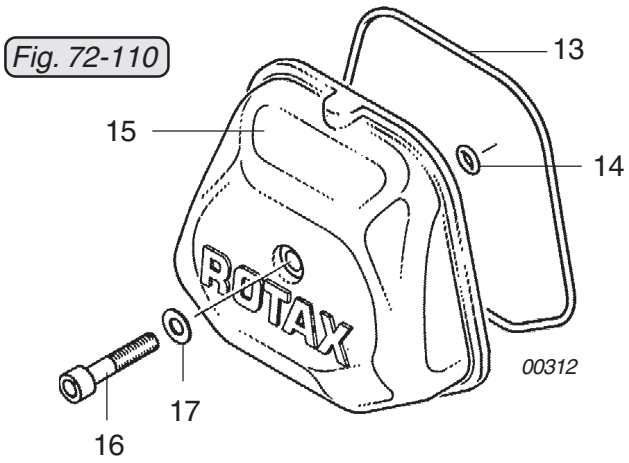


Fig. 72-110



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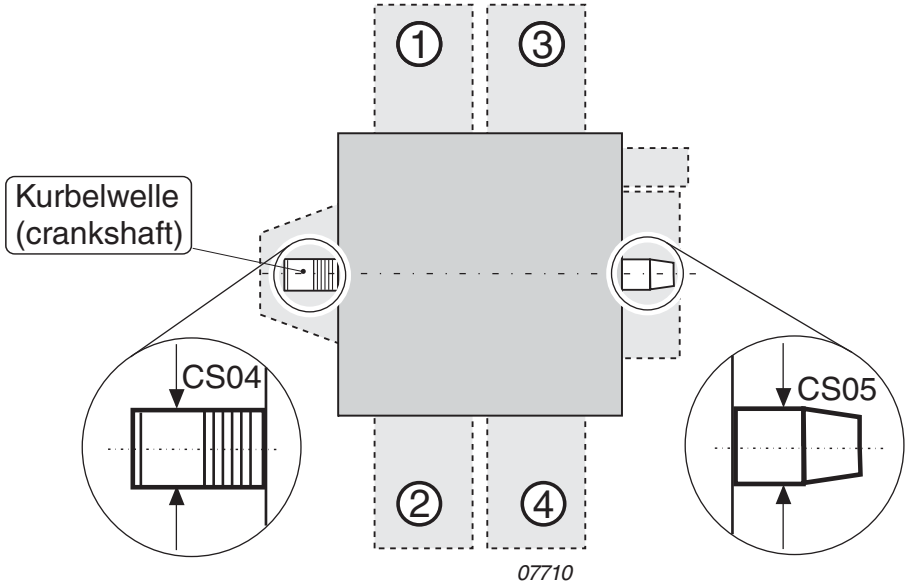
4) Wear limits



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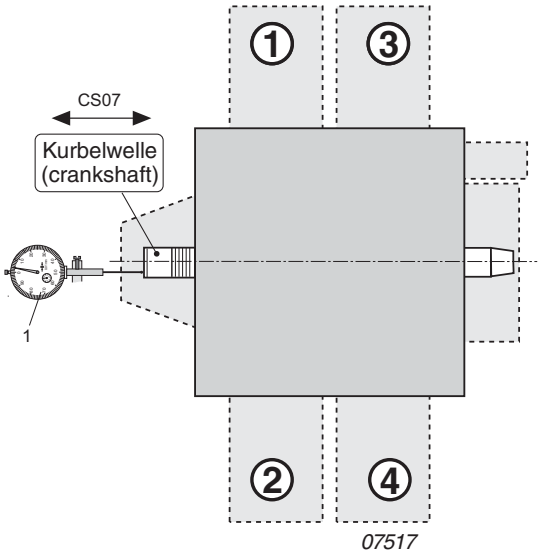

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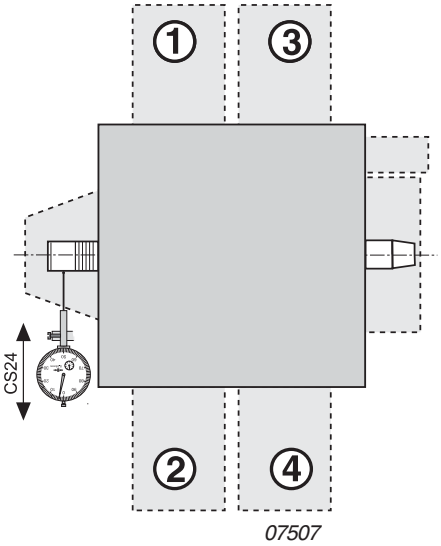


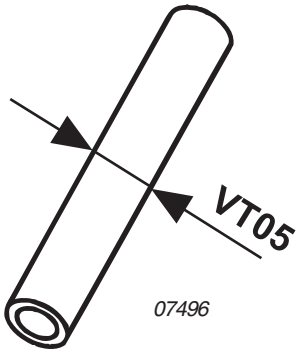
07507

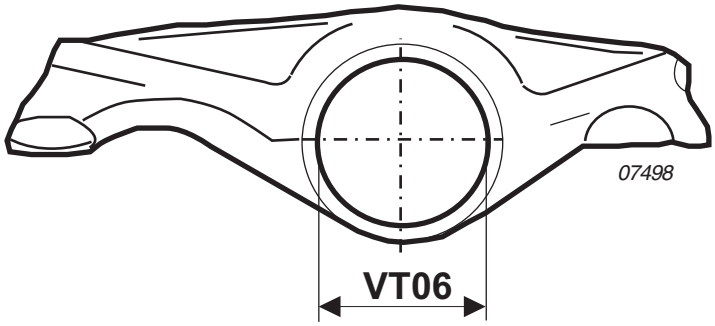
d02622

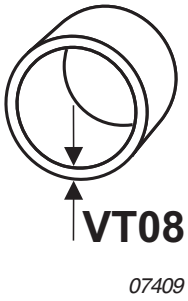
Description	Code	Reading new		wear limit	wear limit		Readings
		min	max	100%	50%		
Crankshaft							
Journal at power take off end (S1)	CS04	27,99 1,1020	28,00 1,1024	27,95 1,1004	27,97 1,1012	**actual** **renewed**	
Journal at magneto side (S2)	CS05	31,99 1,2594	32,00 1,2598	31,95 1,2579	31,97 1,2587	**actual** **renewed**	
Crankshaft axial clearance	CS07	0,08 0,0031	0,32 0,0126	0,50 0,0197	0,41 0,0161	**actual** **renewed**	
Crankshaft out of round assembled in crankcase, drive gear mounted	CS24	0,000 0,0000	0,060 0,0024	0,080 0,0031		**actual** **renewed**	
Crankshaft distortion	GB20			2°		**actual** **renewed**	

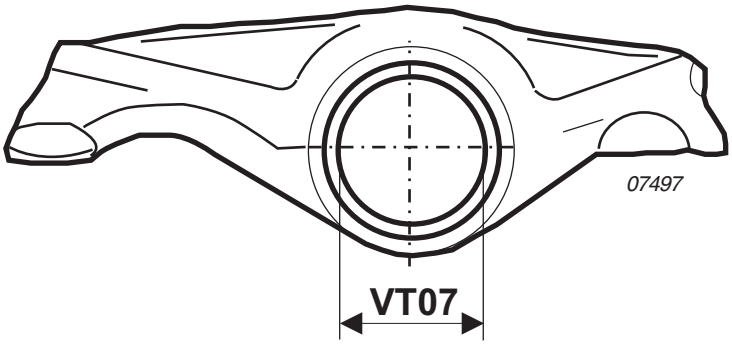
08748

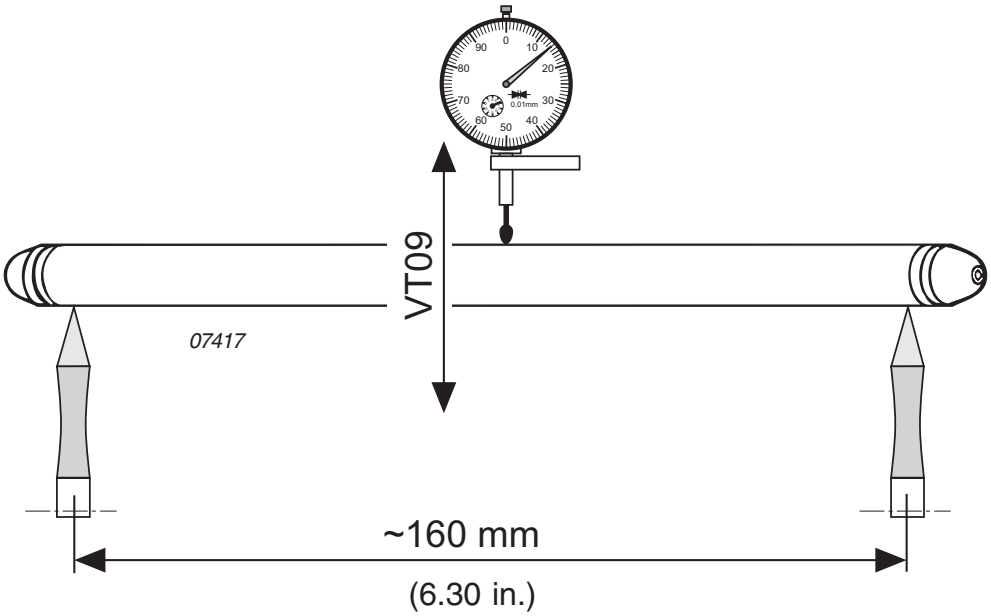
d04776


VT05
07496


07498
VT06


VT08
07409


07497
VT07


VT09
07417
~160 mm
(6.30 in.)

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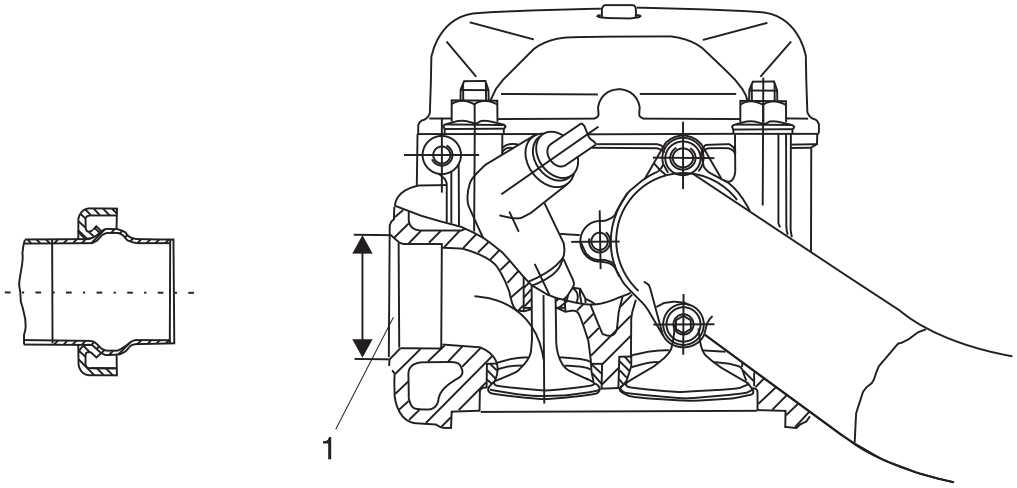
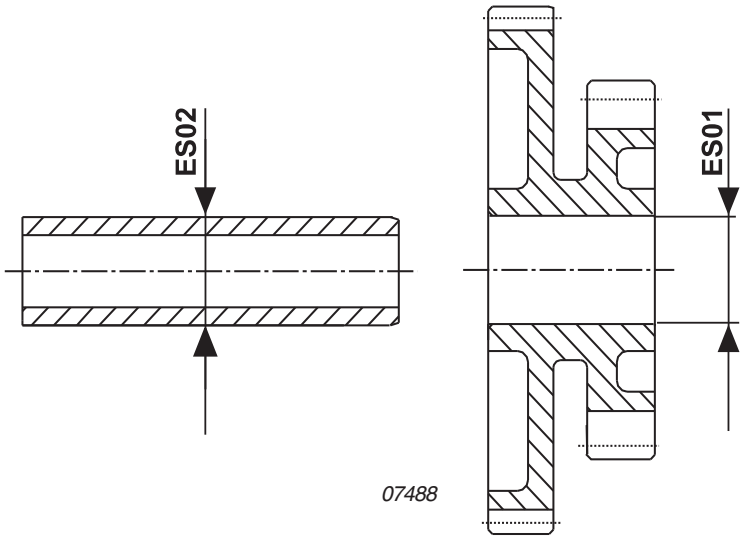


08207



07488

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Description	Code	Reading new min	Reading new max	wear limit 100%	wear limit 50%		Readings 07222 Cyl. 1	Cyl. 2	Cyl. 3	Cyl. 4
Cylinder										
Cylinder-bore A 79,5 mm / 3,1 in. (D1)	CY01	**79,500** 3,1299	**79,512** 3,1304	**79,580** 3,1331	**79,546** 3,1317	**actual**				
						renewed				
(D2)	CY02	**CY01 +0,015** CY01 +0,0006		**CY01 +0,015/-0,008** CY01 +0,0006/ -0,0003		**actual**				
						renewed				
(D3)	CY03	**CY01 +/- 0,008** CY01 +/- 0,0003		**CY01 +0,020/-0,008** CY01 +0,0008/ -0,0003		**actual**				
						renewed				
Cylinder-bore B 79,5 mm / 3,1 in. (D1)	CY01	**79,512** 3,1304	**79,524** 3,1316	**79,590** 3,1335	**79,566** 3,1325	**actual**				
						renewed				
(D2)	CY02	**CY01 +0,015** CY01 +0,0006		**CY01 +0,015/-0,008** CY01+0,0006/ -0,0003		**actual**				
						renewed				
(D3)	CY03	**CY01 +/- 0,008** CY01 +/- 0,0003		**CY01 +0,020/-0,008** CY01 +0,0008/ -0,0003		**actual**				
						renewed				
Cylinder-bore A 84mm / 3,3 in. (D1)	CY01	**84,000** 3,3071	**84,012** 3,3075	**84,080** 3,3102	**84,046** 3,3089	**actual**				
						renewed				
(D2)	CY02	**CY01 +0,015** CY01 +0,0006		**CY01 +0,015/-0,008** CY01 +0,0006/ -0,0003		**actual**				
						renewed				
(D3)	CY03	**CY01 +/- 0,008** CY01 +/- 0,0003		**CY01 +0,020/-0,008** CY01 +0,0008/ -0,0003		**actual**				
						renewed				
Cylinder-bore B 84mm / 3,3 in. (D1)	CY01	**84,012** 3,3075	**84,024** 3,3080	**84,090** 3,3106	**84,057** 3,3093	**actual**				
						renewed				
(D2)	CY02	**CY01 +0,015** CY01 +0,0006		**CY01 +0,015/-0,008** CY01 +0,0006/ -0,0003		**actual**				
						renewed				
(D3)	CY03	**CY01 +/- 0,008** CY01 +/- 0,0003		**CY01 +0,020/-0,008** CY01 +0,0008/ -0,0003		**actual**				
						renewed				
Cylinder-ovality		**0,0000** 0,0000	**0,007** 0,0003	**0,050** 0,0020	**0,029** 0,0011	**actual**				
						renewed				
Cylinder-taper		**0,000** 0,0000	**0,030** 0,0012	**0,060** 0,0024	**0,045** 0,0018	**actual**				
						renewed				
Rework of sealing surface Cylinder/Cylinder head		**0,00** 0,0000	**0,00** 0,0000	**0,30** 0,0118		**actual**				
						renewed				

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Description		Code	Reading new min	Reading new max	wear limit 100%	wear limit 50%		Readings 09475 Cyl. 1	Cyl. 2	Cyl. 3	Cyl. 4
Cylinder head											
Valve guide bore inner diameter	Int. V.	CH01	7,006 0,2758	7,018 0,2763	7,150 0,2815	7,084 0,2789	actual				
							renewed				
	Exh. V.	CH01	7,006 0,2758	7,018 0,2763	7,150 0,2815	7,084 0,2789	actual				
							renewed				
Valve seat width	Int. V.	CH02	1,40 0,0551	1,90 0,0748	2,40 0,0945	2,15 0,0846	actual				
							renewed				
	Exh. V.	CH02	1,50 0,0591	2,00 0,0787	2,50 0,0984	2,25 0,0886	actual				
							renewed				
Valve stem diameter	Int. V.	VT01	6,965 0,2742	6,980 0,2748	6,940 0,2732	6,953 0,2737	actual				
							renewed				
	Exh. V.	VT01	6,965 0,2742	6,980 0,2748	6,940 0,2732	6,953 0,2737	actual				
							renewed				
Valve stem clearance	Int. V.	CH01/ VT01	0,026 0,0010	0,053 0,0021	0,150 0,0059	0,102 0,0040	actual				
							renewed				
	Exh. V.	CH01/ VT01	0,026 0,0010	0,053 0,0021	0,150 0,0059	0,102 0,0040	actual				
							renewed				
Out of round of valve head	Int. V.	VT02	0,00 0,0000	0,03 0,0012	0,04 0,0016	0,035 0,0014	actual				
							renewed				
	Exh. V.	VT02	0,00 0,0000	0,03 0,0012	0,04 0,0016	0,035 0,0014	actual				
							renewed				

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Description	Code	Reading new		wear limit	wear limit		Readings 07581			
		min	max	100%	50%					
Cylinder head										
							Cyl. 1	Cyl. 2	Cyl. 3	Cyl. 4
Push rod deflection Int. V	VT09	**0,000** 0,0000	**0,100** 0,0039	**0,200** 0,0079	**0,150** 0,0059	actual				
						renewed				
Push rod deflection Exh. V	VT09	**0,000** 0,0000	**0,100** 0,0039	**0,200** 0,0079	**0,150** 0,0059	actual				
						renewed				
Intermediate gear of electric starter										
Idle gear bore ⌀	ES01	**12,000** 0,4724	**12,018** 0,4731	**12,040** 0,4740	**12,029** 0,4736	actual				
						renewed				
Idle gear bore ⌀	ES02	**11,973** 0,4714	**11,984** 0,4718	**11,960** 0,4709	**11,967** 0,4711	actual				
						renewed				
Radial clearance	ES01/ ES02	**0,016** 0,0006	**0,045** 0,0018	**0,100** 0,0039	**0,073** 0,0029	actual				
						renewed				

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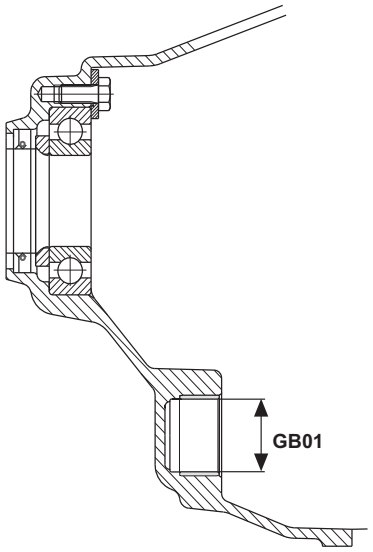

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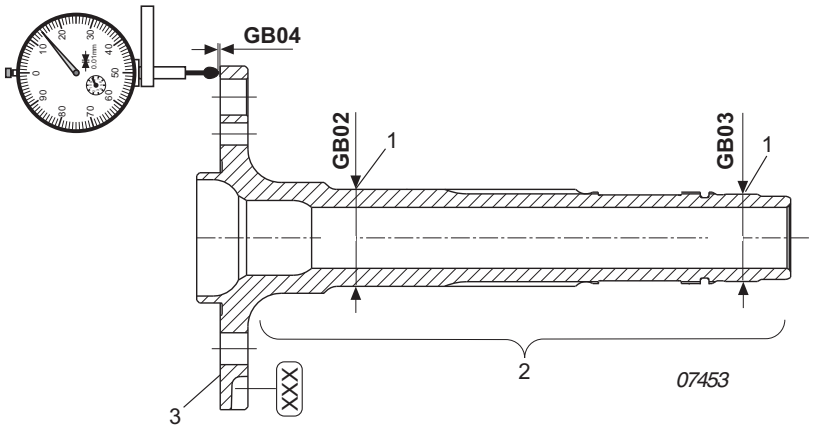

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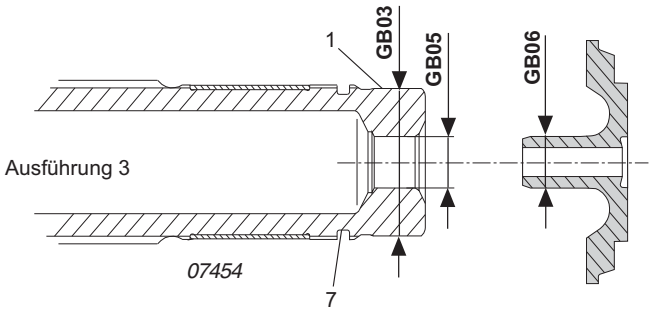

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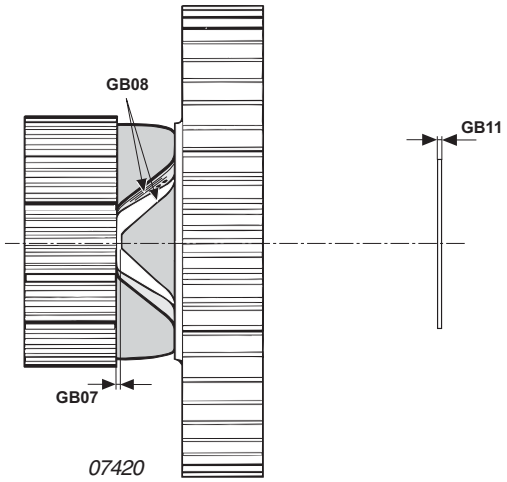

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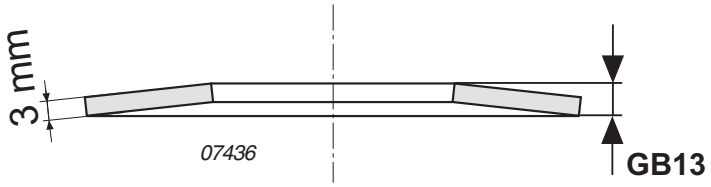

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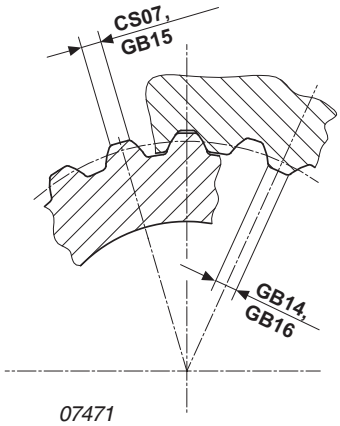

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SECTION 73

FUEL SYSTEM

1) Table of contents

SECTION 73
FUEL SYSTEM

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2.2) Fuel system (on 914 Series)

See Fig. 73-2.

The fuel system comprises the following items:

- fuel tank
- coarse filter
- fine filter / water trap
- fire cock
- 2 electric fuel pumps
- 2 check valves
- and the required fuel piping and connections

The fuel flows from the tank via a combination of filter and water trap (1) to the two electric fuel pumps ((2) and (3)), connected in series, passes on to the fuel pressure regulator (5) and further on to the individual carburetors.

A separate check valve (4) is installed parallel to each fuel pump.

◆ NOTE: The arrangement of the two fuel pumps connected in series yields better reserves against vapor lock at high altitudes and temperatures.

The two check valves in the system are necessary to ensure trouble free operation of the fuel system with one pump only.

The surplus fuel passes from the fuel pressure regulator back to the tank via the return line (7).

◆ NOTE: The fuel pressure regulator serves to maintain the fuel pressure at always approx. 0.25 bar (3.6 p.s.i.) above the changing boost pressure in the airbox, thus ensuring proper operation of the carburetors.

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Fig. 73-2a

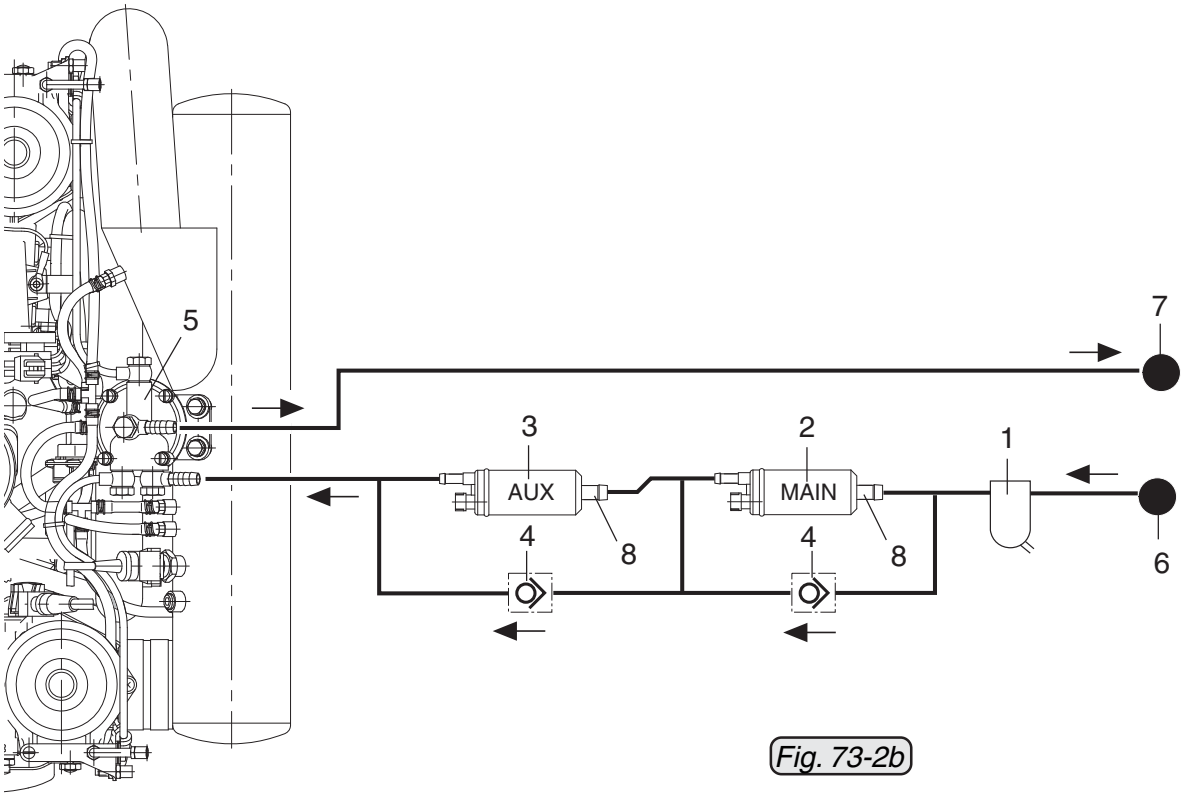

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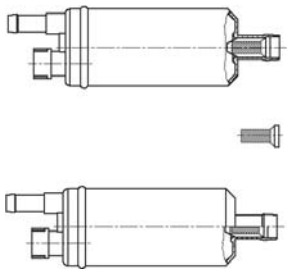
Fig. 73-2b



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Legend:

(1) fine filter / water trap
(2) main fuel pump (MAIN)
(3) auxiliary fuel pump (AUX)
(4) check valve
(5) fuel pressure regulator
(6) inlet from the tank
(7) return line to tank
(8) fuel filter

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2.3) Fuel filter

A **fine filter** in the fuel supply line between tank and inlet to the two fuel pumps must have been installed by the aircraft manufacturer.

◆ NOTE: At the suction side the fuel pumps are equipped with a filter.

2.4) Fuel pump (on 912 Series)

The engines of the 912 Series are equipped with a mechanical fuel pump. It is driven via an eccenter in the propeller gearbox.

2.5) Fuel pump (on 914 Series)

To warrant safe and adequate operation of the fuel system, two independent selfpriming vane pumps are used. The voltage supply to the two pumps must be established completely independently.

◆ NOTE: Voltage supply to main pump (MAIN) directly from internal alternator and supply to the supplementary pump (AUX) from bus bar or battery.

For engine operation, the rate of delivery of one pump alone is entirely sufficient.

■ CAUTION: Use only genuine ROTAX fuel pumps, as the pump must meet certain requirements.

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2.6) Fuel pressure regulator (only on 914 Series)

See Figs. 73-3 and 73-4.

The fuel pressure regulator (1) is mounted on the airbox.

Fuel pressure control is essential for flawless engine operation because it keeps the fuel pressure permanently at approx. 0.25 bar (3.6 p.s.i.) above the varying boost pressure in the airbox.

Design and function of the fuel pressure regulator:

The diaphragm (2) divides the pressure regulator into the top fuel chamber (3) and the air chamber (4). The force of the pressure spring, which is set by the adjusting screw (5) establishes an equilibrium of forces on the diaphragm at a fuel pressure 0.25 bar (3.6 p.s.i.) above the actual airbox pressure on the other side.

■ CAUTION: All fuel pressure regulators are calibrated by the engine manufacturer and need no further adjustment or maintenance.

◆ NOTE: The arrows cast into the top side of the fuel pressure regulator are of no significance for the usage, as inlet (6) and outlet (7) are directly connected via the chamber.

◆ NOTE: Ensure that the cap nut (8) is securely tightened, as otherwise the fuel pressure may drop.

Fig. 73-3

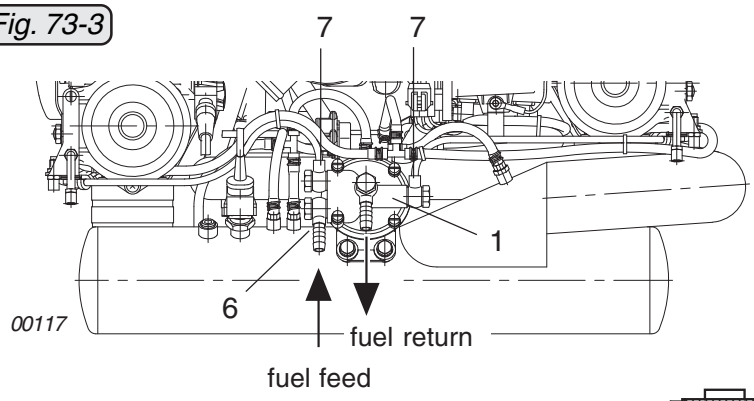
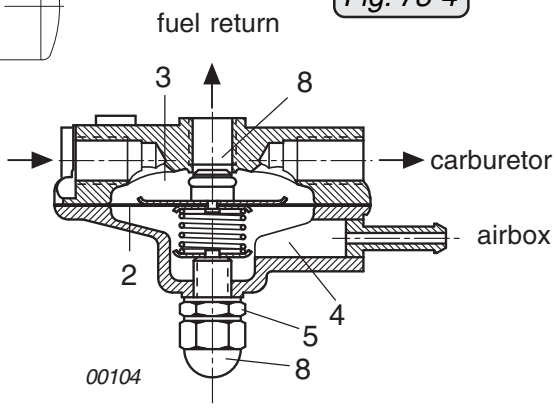


Fig. 73-4



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2.9) Handling of fuel

Use only clean gasoline of a registered brand.

Unleaded fuels contain alcohol. Alcohol binds up to 50 % of its own volume in water. Water enters the system mainly in the form of condensation. For this reason, avoid extreme differences in temperature, long period storage, direct sun and plastic containers. When handling fuel, observe the directives without fail.

When refuelling, observe the relevant regulations of the competent aviation authorities.

▲ WARNING: Before refueling, switch off ignition and remove ignition key!

▲ WARNING: Filter fuel (using filter funnel) when filling the tank. Use only clean, non-translucent safety approved fuel containers.

▲ WARNING: Only handle fuel in well ventilated places. Never fill fuel in enclosed spaces. Gasoline is highly inflammable and explosive. Do not smoke, do not allow open flames or sparks in the vicinity. Do not fill the tank to the brim, allow for expansion of the fuel. Never refuel while engine is running.

For further information, see SI-912-016 and SI-914-019 “Operating fluids“, latest issue.

2.10) Connections for instrumentation

■ CAUTION: Also consult the instructions regarding the connection for instrumentation in the Installation Manual.

2.10.1) Airbox air temperature display (only on 914 Series)

A connection is provided in the airbox for measurement of the air temperature . On the standard engines, this connection is closed by a plug screw.

2.10.2) Boost pressure display

A connection is provided for an absolute pressure gauge in the compensation tube for the indication of the boost pressure.

■ CAUTION: If no manifold pressure gauge is installed make sure that the connector is sealed so that no external air can be drawn in.

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◆ NOTE: On newer engines the manifold pressure fitting is plugged with a M 3.5 screw. Remove this screw before attaching a manifold pressure hose. See therefore SI-912-020 and SI-914-022 “running modifications” respectively.

2.11) Carb heat system and winter operation

The risks of carburetor icing are commonly known. The icing of air humidity in the carburetor may be avoided by preheating the air.

◆ NOTE: An airbox with a carburetor preheating flap is available for engines of the 912 Series.

◆ NOTE: Engines of the 914 Series normally do not require any preheating device as the intake air is preheated by the turbocharger.

◆ WARNING: Carburetor icing is a common cause of engine faults.

Because of the heating up of intake air due to the boost process, preheating of the intake air might not be necessary. But the option of a change over for air intake from the engine compartment is recommended as, for instance, the filter could be blocked by icing.

Preheating of the intake air will result in loss of engine performance because of the reduction in air density.

A further measure to reduce the risk of carburetor icing is to keep the water content of the fuel low by proper handling. Also, install a generously dimensioned water trap in the fuel system of the aircraft to prevent the formation of ice in the fuel lines, filters etc.

3) Maintenance

The following sections describe maintenance procedure for engines of the 912/914 Series above and beyond the maintenance and special checks, see corresponding Maintenance Manual (Line Maintenance) for the respective engine type, 912 Series or 914 Series, and the systems descriptions given hitherto. The description is divided into subsections and descriptions of the function of the various systems.

3.1) Disassembling fuel pump, carburetors, carburetor sockets, fuel lines and drip tray (on the 912 Series)

See Fig. 73-9, 73-9/1 and 73-9/2.

■ CAUTION: When disassembling the fuel lines support them so that tension or additional strain is avoided.

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■ CAUTION: Replace the insulating flange each time when the fuel pump is removed.

To remove the fuel pump (1) remove feed line (2) and hex nuts (3), then remove the fuel pump together with the insulating flange (4).

◆ NOTE: See SI-912-020 “Running modification”, latest issue.

The carburetors must be removed for inspection or maintenance.

◆ NOTE: Models produced from the year 2007 onwards have a flexible fuel line (5). See Fig. 73-9/3.

◆ NOTE: Usually it is not necessary to remove the clamp block (6). However, if it should become necessary to remove it, ensure that it is refitted in the same position.

Rigid fuel line

The fuel line (7) is supported by a cable clamp (8) on the carburetors. These clamps are attached with allen screws M5x12 (9) and lock nuts (10), which must be removed. Unscrew the collar nut (11) from the carburetor. Unscrew the banjo bolts (12) from the clamp block (6).

◆ NOTE: Airboxes of older build have drainage conncectors in vertical alignment.

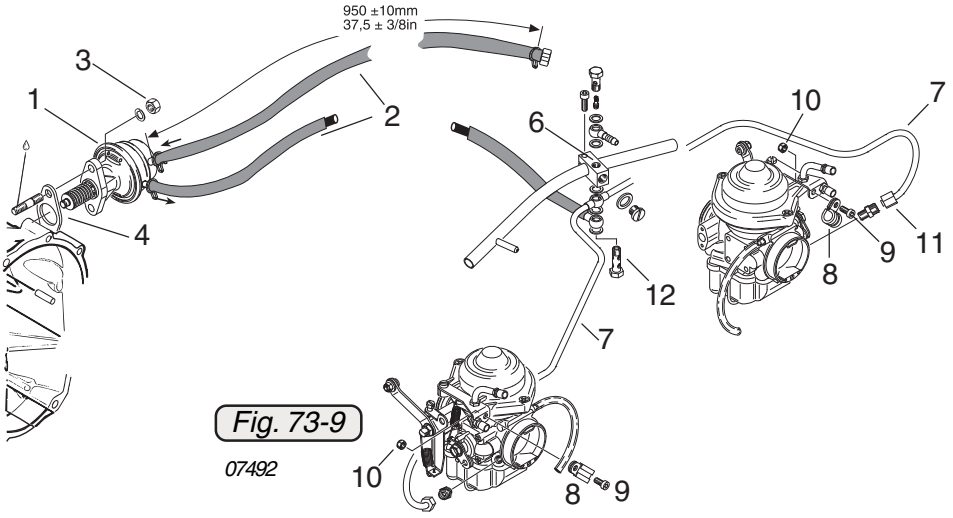

Fig. 73-9

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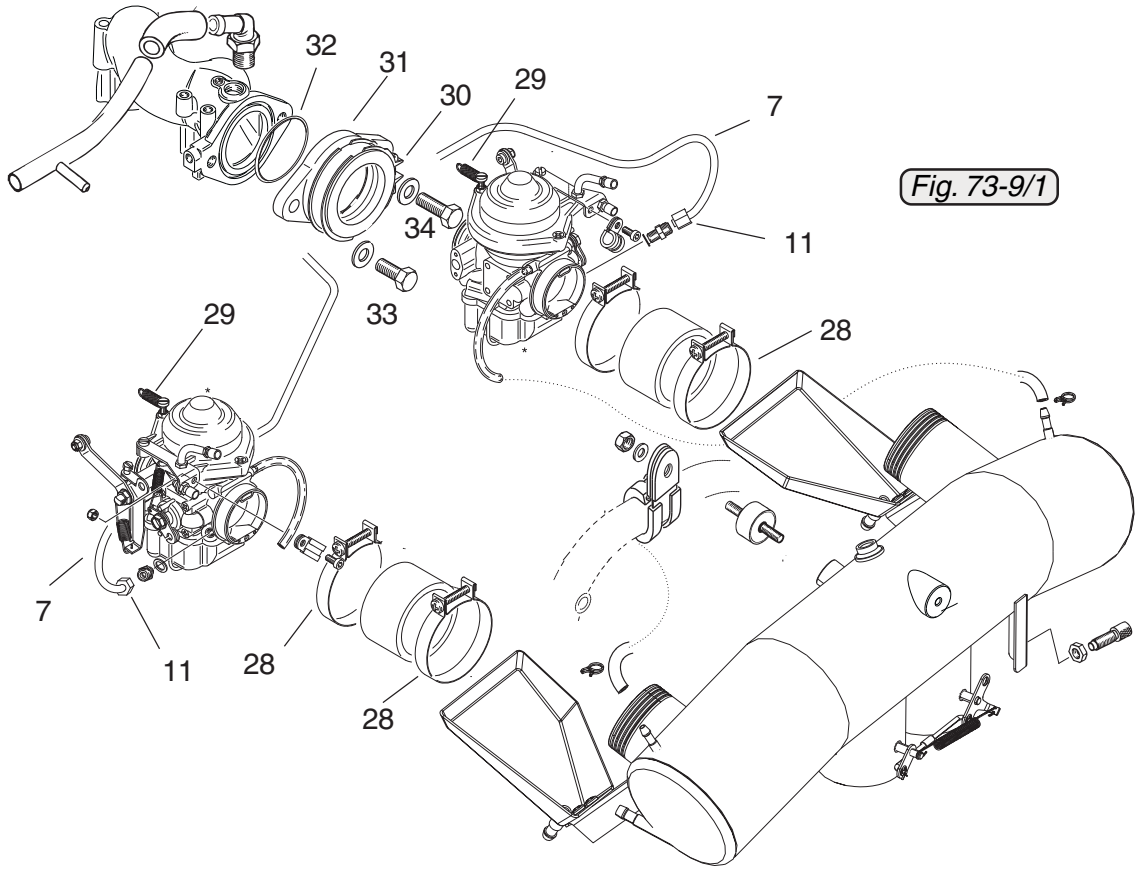

Fig. 73-9/1

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Flexible fuel line

See Fig. 73-9/2

Each fuel line (5) is supported by a cable clamp (13) on the intake manifold. Each of these clamps is attached with an allen nut M8 (14), which must be removed.

Further the fuel line is attached with 2 cable straps (15) to the compensation tube (16).

At the carburetors the ring hose nipple of the fuel line is installed with a distance sleeve (17) and sealing rings (18). After unscrewing the banjo bolt (19) take off the fuel lines.

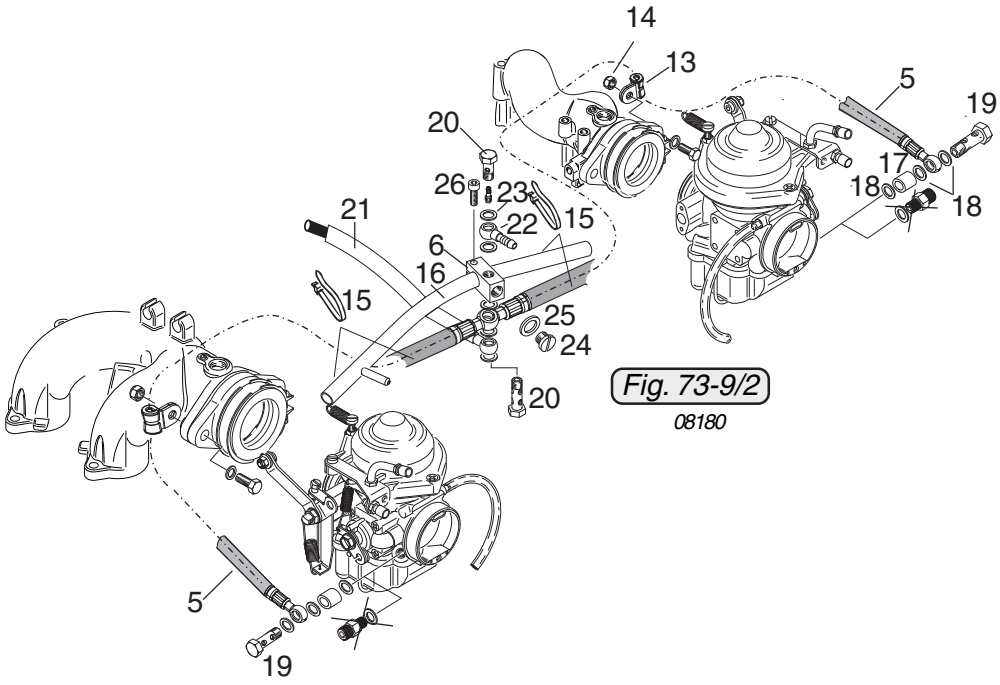

Fig. 73-9/2
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All fuel lines lead to the fuel manifold. Unscrew the banjo bolts (20). Remove the fuel line (21) (hose line).

Now the fuel lines (5 or 7), the ring hose nipple (22) (connection for return line and pressure gauge) and 5 sealing rings (23) can be removed.

Unscrew allen screw M10x1x8 (24) with the sealing ring (25).

Carry out a visual inspection of all fuel lines for damage and wear. Pay particular attention to the formation of any cracks in the area of the connections.

Check the lines for free passage with compressed air and inspect the lines for scuffing marks.

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Carry out a visual inspection of the clamp block (6) of the fuel manifold, the two banjo bolts (20) and the ring hose nipple (22).

◆ NOTE: It is not normally necessary to remove the clamp block (6). However, if it should become necessary to remove it, it must be reattached with an allen screw M5x16 (26) (tightening torque 6 Nm (53 in.lb). Ensure that it is refitted in the same position.

Inspect banjo bolts (20) for hairline cracks, deformation or tears in the area of the hole (27). If the hole is visibly ovalshaped, the banjo bolt has been overstretched and must be replaced. See Fig. 73-9/2.

■ CAUTION : In the event of leaks, the max. permissible torque must never be exceeded.

If the engine is equipped with a ROTAX Original Airbox, the screw hose clamps (28) must be released before the carburetors can be removed. See Fig.73-9/1. Remove the tension spring (29) for carburetor suspension.

Losen the clamp (30) on the carburetor socket (31) and remove the carburetor with twisty motions. Close off the intake openings of the carburetor sockets with appropriate covers.

Remove the hex. screws (31) M8x25, M8x30 (33) and washers to disassemble the carburetor sockets (12). Then the carburetor socket (31) and the O-Ring (32) can be taken off.

◆ NOTE: See SB-912-030, "Cracks, wear and distortion on the carburetor flange", latest issue.

Fig. 73-9/3

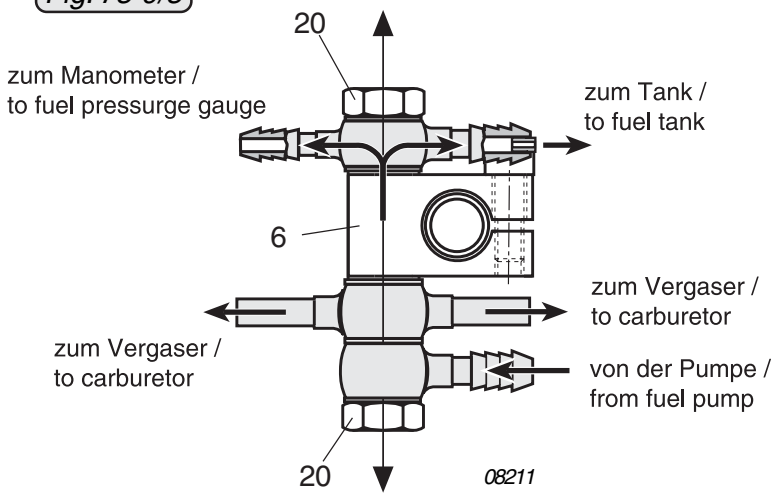
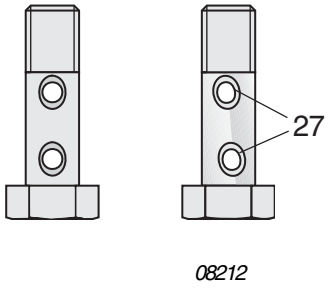


Fig. 73-9/4



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3.3) BING-constant depression carburetor inspection

3.3.1) General note

See Figs. 73-12, 73-13 and 73-14.

■ CAUTION: No modification may be made to the carburetor main jet. The determination of the main jet is carried out by the manufacturer on a test bed at 300 m (1000 ft) above Mean Sea Level.

Only aeronautical personnel or authorized testers acting on our instructions may carry out modifications to BRP-Rotax specifications.

■ CAUTION: To avoid contamination in the fuel system, proceed with great care and cleanliness. It is essential to store carburetors and dismantled parts on clean surfaces.

◆ NOTE: See SI-912-012 or SI-914-014, ”Routine modification of the Bing constant depression carburetor”, latest issue.

The fuel supply must be closed off before the carburetors are removed for closer inspection. Collect any fuel spilt during disassembly and dispose of it in an ecological manner.

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3.3.2) Float needle valve leakage test

See Fig. 73-12.

This check is carried out to ensure that the float valve seat is not leaking. If the pressure is not maintained, pay particular attention during disassembly to the float valve with the viton tip and the carburetor housing.

Turn the carburetor upside down, as the float needle valve is only closed in this position.

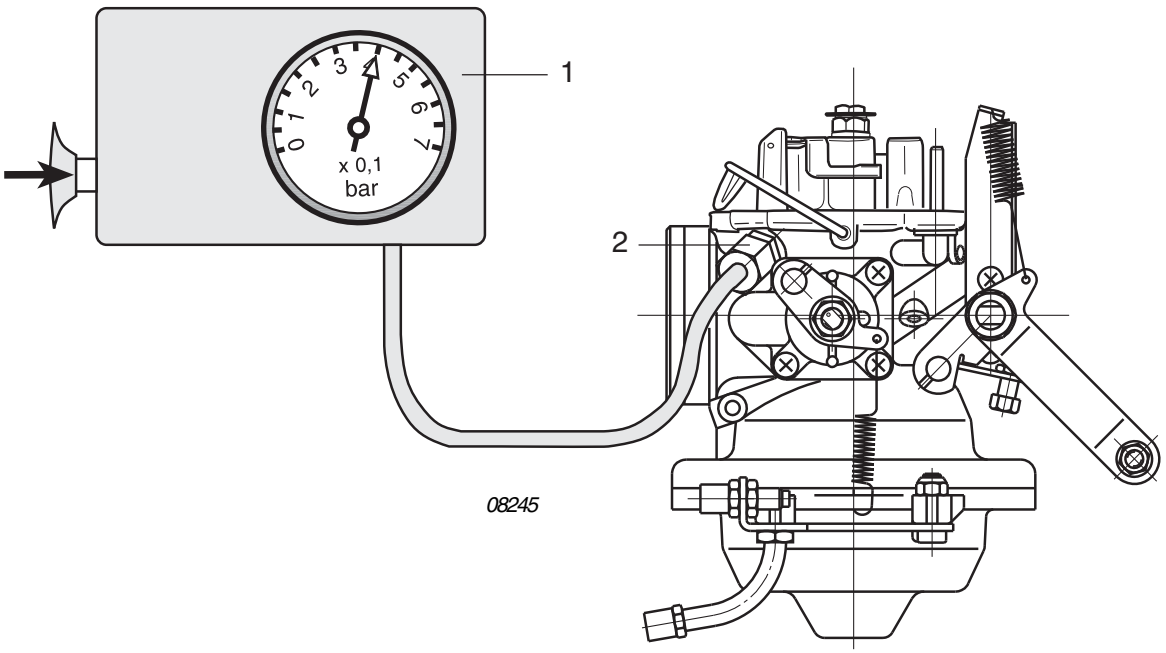
Connect pump (1) to the fuel supply line (2) and apply approx. 0.4 bar (5.8 p.s.i.) of pressure.

The pressure must be maintained for about 5 seconds.

■ CAUTION: If pressure drops, this indicates leakage which may cause fuel overflow and in consequence engine damage due to hydraulic shock.

Replacement of the float valve seat is not permissible.

Fig. 73-12



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3.3.5) Diaphragm

See Figs. 73-15 and 73-16.

The plunger (carburetor piston) (8) is attached to the diaphragm (6). Depending on the pressure prevailing, the plunger is moved up or down. For inspection, remove the two counter sunk screws (1) M5x12, take off the chamber top (2) and remove the plunger spring (3). Check that the cover plate (4) on the chamber top is tightly seated. Wash chamber top with cleaning agent and blowclean the inside venting bore with compressed air Then carry out a visual inspection.

Pull carburetor piston out of the carburetor housing and remove the 4 allen screws (5) M4x12. The diaphragm (6) is held by the retaining ring (7) on the carburetor piston (8). The position of the carburetor piston is controlled via the diaphragm. There are 2 indexing tabs on the diaphragm (5). Tab (9) fits exactly into the recess in the slider piston and nose (10) must engage in the recess in the carburetor housing.

Check diaphragm for cracks or brittleness, replace if necessary.

3.3.6) Needle

See Fig. 73-16.

The needle (12) controls the fuel consumption at part load. It can be regulated by selecting a needle position between 1 and 4.

Unscrew the retaining screw (11), check needle (12) with shaft securing (13) and O-Ring (20) for signs of wear.

Pay especial attention to the grooves and the taper of the needle. If there is visible wear, the needle must be replaced and a new one refitted in the same position. The needle jet must be replaced along with the needle as it will also be worn.

◆ NOTE: The needle must move freely when fitted.

Carry out a visual inspection of the outer diameter of the carburetor piston (8) and the two inside compensation bores.

◆ NOTE: The needle is damped by the O-ring (38). See Figs. 73-13 and 73-14.

The set up of the needle position (Fig. 73-15/1) and the determination of the main jet should to be carried out in accordance with the table of Fig. 73-15/2. The settings have to be recorded in appendix chapter 8.2 “carburetor jetting and jet needle position”.

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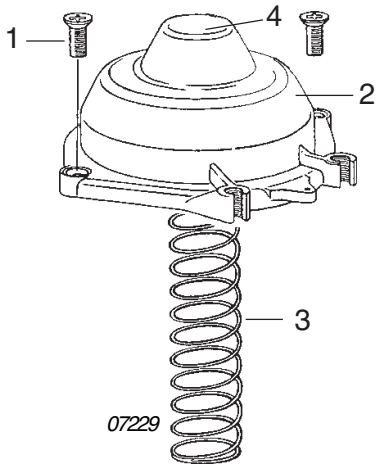

Fig. 73-15

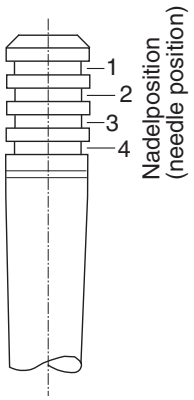

Fig. 73-15/1

Carburetor calibration		
912 A/F/UL	**Target**	
	Carburetor 1/3	Carburetor 2/4
Needle	2,72	2,72
Idle jet	35	35
Main jet [4]	155 or 158	155 or 158
Start jet [1]	85	85
Needle position [3]	3	3
912 S/ULS/ULSFR	**Target**	
	Carburetor 1/3	Carburetor 2/4
Needle	2,70	2,70
Idle jet	35	35
Main jet	155	155
Start jet [1]	85	85
Needle position [3]	3	3
914 F/UL	**Target**	
	Carburetor 1/3	Carburetor 2/4
Needle	2,72	2,72
Idle jet	35	35
Main jet [2]	156 or 160	158 or 164
Start jet [1]	85	85
Needle position [3]	1 or 2	2

Fig. 73-15/2

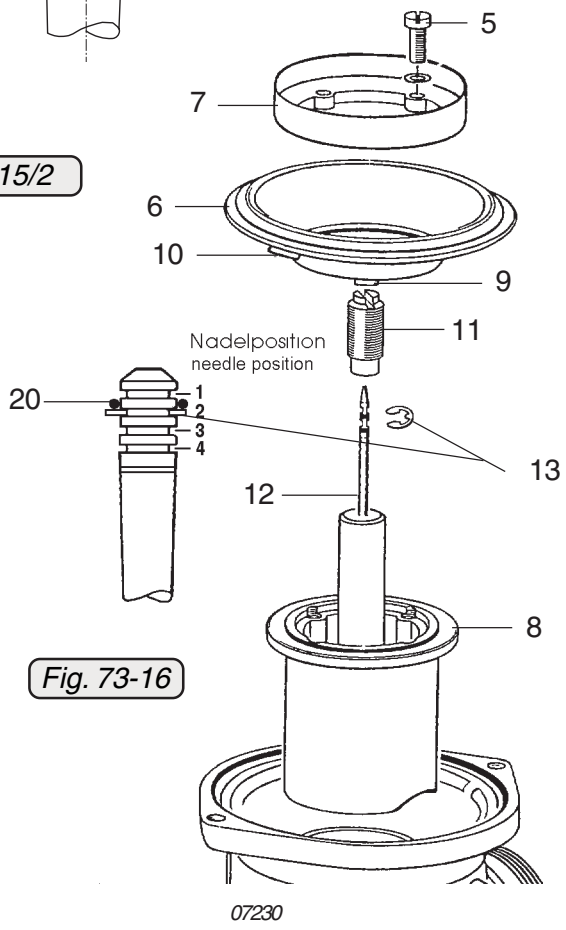

Fig. 73-16

1) See SI-03-1998, latest version.

2) Depending on the airbox version. See SI-914-013 and SI-914-015, latest version.

3) Depending on CO measurement value and specific fuel consumption. See SI-914-013 and SI-914-015, latest version.

4) On configuration with air filter. See SB-912-044, latest version.

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3.3.7) Float chamber, floats

See Figs. 73-17, 73-18, 73-19 and 73-20.

On the 912 Series: Release the spring clip (39). See Fig. 73-13.

On the 914 Series: Remove the safety wiring and the end screw (1) with the sealing ring (2) 16x22x1. Tightening torque 5.5 Nm (48.7 in.lb)

Remove and clean the float housing (11) with the seal (12).

Check both floats (9) for free movement on the guide pin (3). When the float is at its lowest position, it still must have radial clearance and must not stick on the float chamber wall (10).

■ CAUTION: A stuck float causes the carburetor to flood.

Check the wear on the guide sleeves (5) inserted in the float. Check the pins (6) for the float support (7) for wear caused by excessive vibration. If there is noticeable wear, replace both floats and if necessary also the float brackets (8).

Fig. 73-17

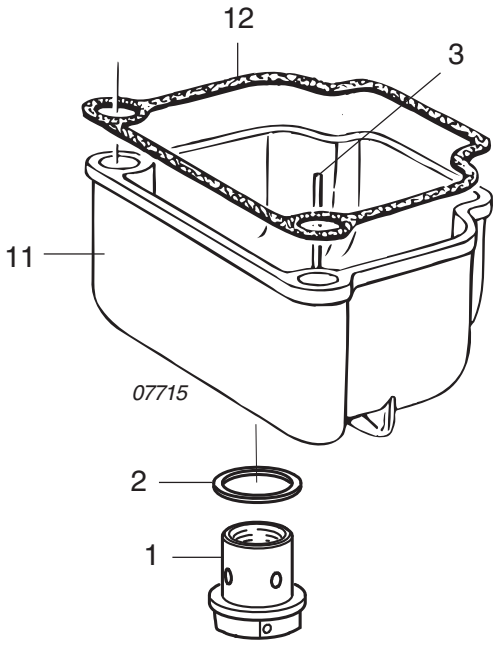
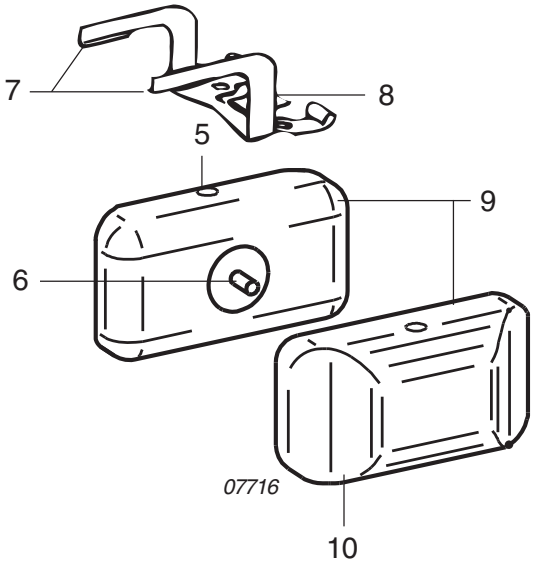


Fig. 73-18



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3.3.8) Float brackets

See Figs. 73-18, 73-19 and 73-20.

Check that the float suspension brackets (8) are parallel. To do so, remove main jet and attach the gauge (13) to the mixing tube with a hex. screw (14). When the needle valve is closed, the two arms (15) of the float bracket must be evenly spaced.

Spacing:

On the 912 Series: 0.4 to 0.5 mm (.016 to .02 in.) (measure withouth washer (20))

On the 914 Series: 5.4 to 5.5 mm (.21 to .22 in.)

Always replace float brackets together with the float needle valve.

If there is a noticeable fault, the float bracket can be bent for correction or be replaced. After the check, remove the gauge and refit the main jet.

Fig. 73-19

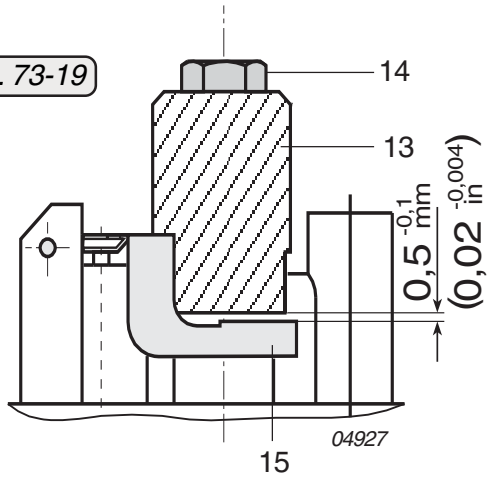
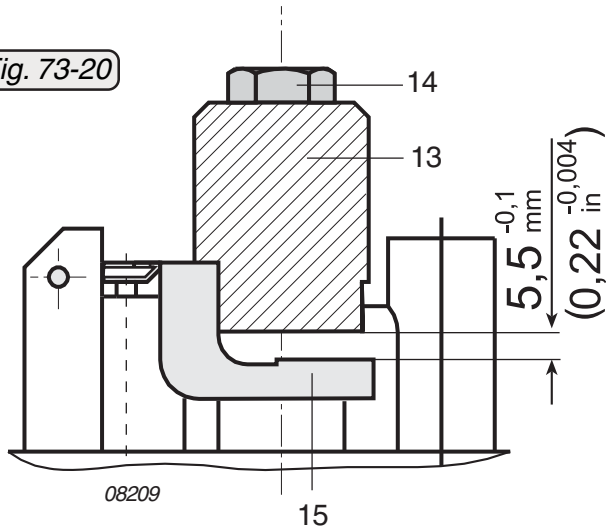


Fig. 73-20



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3.4.6) Fuel pump (on 914 Series)

See Fig. 73-36/1 and 73-36/2.

Check the filter in the pumps, see Line Maintenance 12-00-00 sec. 2.10.

If the installation specific fine filter shows a lot of dirt then the filter (4) of the fuel pump also have to be inspected.

Cleaning of the fuel pump integrated filter

■ CAUTION: Don't damage intake connection or filter.

- Use a forceps to carefully pull out pre-filter from the intake connection.

■ CAUTION: Always follow the safety regulations when handling fuel.

- Use fuel to clean pre-filter.

■ CAUTION: Make sure that no material gets into the fuel pump.

- Carefully accommodate the clean filter in the intake connetion.

Perform visual check on fuel pump.

■ CAUTION : It is not possible to disassemble the fuel pump, there are no spare parts available. If necessary the fuel pump has to be replaced.

In the event of a malfunction in the fuel system, the pump performance and/or the current input of the fuel pump can be checked.

With a pressure difference of approx. 250 hPa (3,63 PSI), the fuel pump is pumping at approx. 100 l/h.

The current input at this quantity is approx. 2 A.

◆ NOTE: These figures are reference values.

Fig. 73-36/1

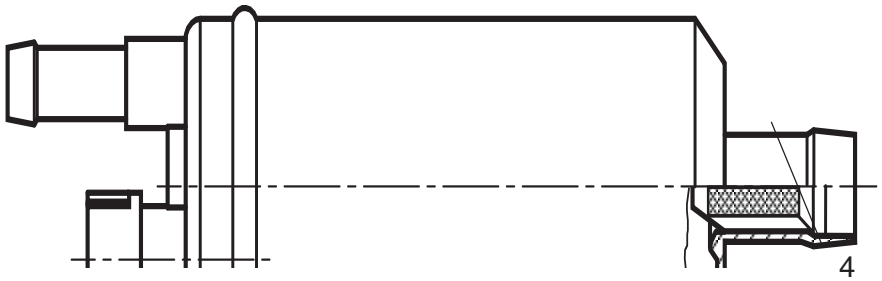

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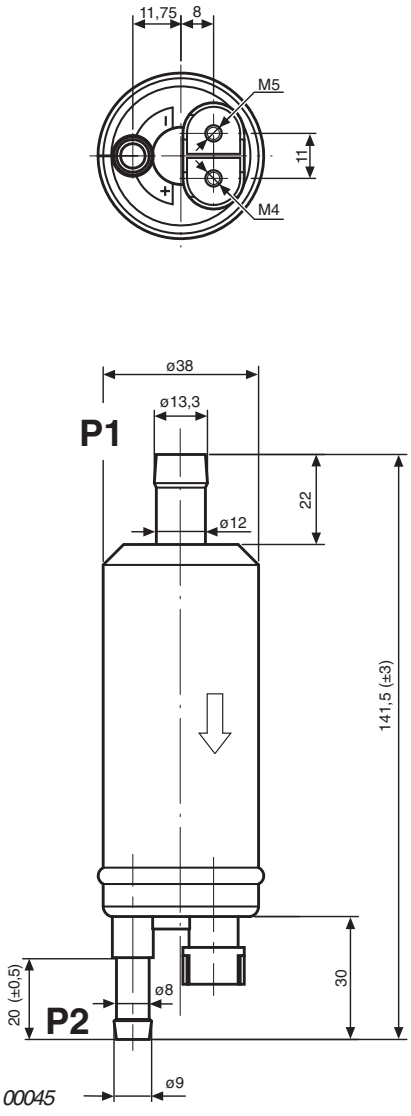
Fig. 73-36/2



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3.5) Assembly of carburetor sockets, carburetor and fuel lines

3.5.1) Fuel pump

See Fig. 73-39

■ CAUTION: It is necessary to use a new insulating flange. Do not reuse the old insulating flange.

◆ NOTE: Don't use sealing compound on the sealing surface of the gearbox housing or on the fuel pump flange.

Install fuel pump with new insulating flange (1). Secure and tighten hex. nuts M8 (2) together with washer and tighten evenly (Use LOCTITE 243). Tightening torque 15 Nm (11.1 ft.lb).

◆ NOTE: Always use LOCTITE 243 as a fastener when a fuel pump is (re-) mounted or when an insulating flange is affected.

Attach fuel lines again.

3.5.2) Carburetors and carburetor sockets

See Figs. 73-39/1, 73-40 and 76-41.

Attach carburetor socket (4) and new O-ring (5) with hex. screws (6) M8x25 and M8x30 (7) with washers.

◆ NOTE: On intake manifolds without an O-ring groove, a gasket (8) (see Illustrated Parts Catalog) must be fitted.

The screws are locked with LOCTITE 221. Tightening torque 15 Nm (133 in.lb).

Fit carburetor into carburetor socket, which should be **free of grease and oil**, align and fix with hose clamp (9). Tightening torque 2.5 Nm (22 in.lb).

◆ NOTE: If hose clamp (9) does not have a spacer leave a 7-8 mm (0.27 - 0.31 in.) gap. Do not overtighten as this will damage the socket.

Check distance of 5 to 6 mm (0.2 in. to 0.24 in.) on allen screw (10) as this is important to allow free movement of the tension spring (11).

Engage tension spring in the bracket (12) using a suitable tool.

■ CAUTION: To ensure efficient carburetor suspension, a distance of 40 mm (1.57 in.) between allen screw and engagement latch must be respected.

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Fig. 73-39

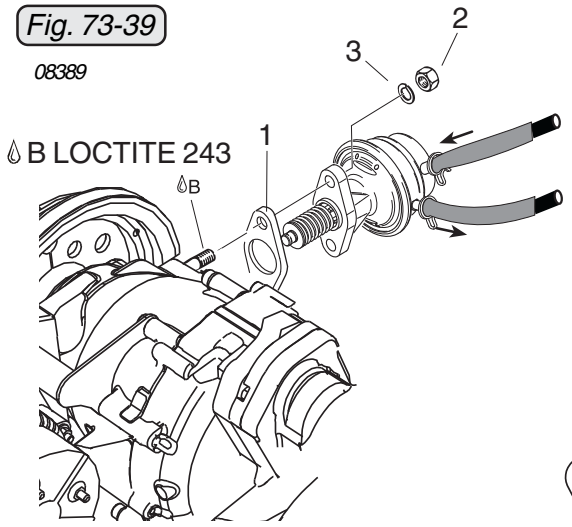


Fig. 73-39/1

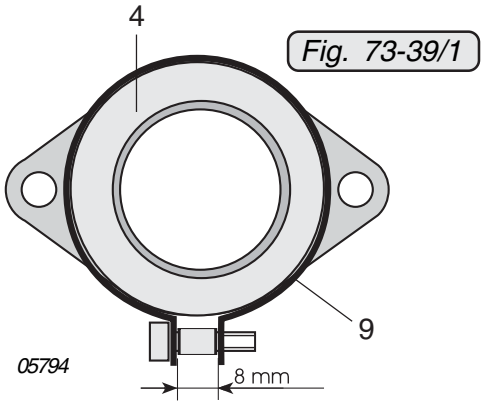


Fig. 73-40

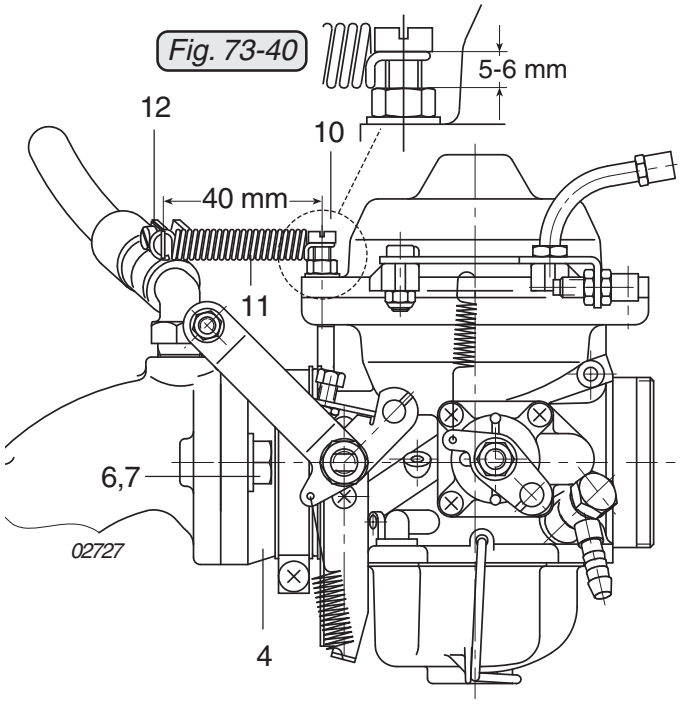
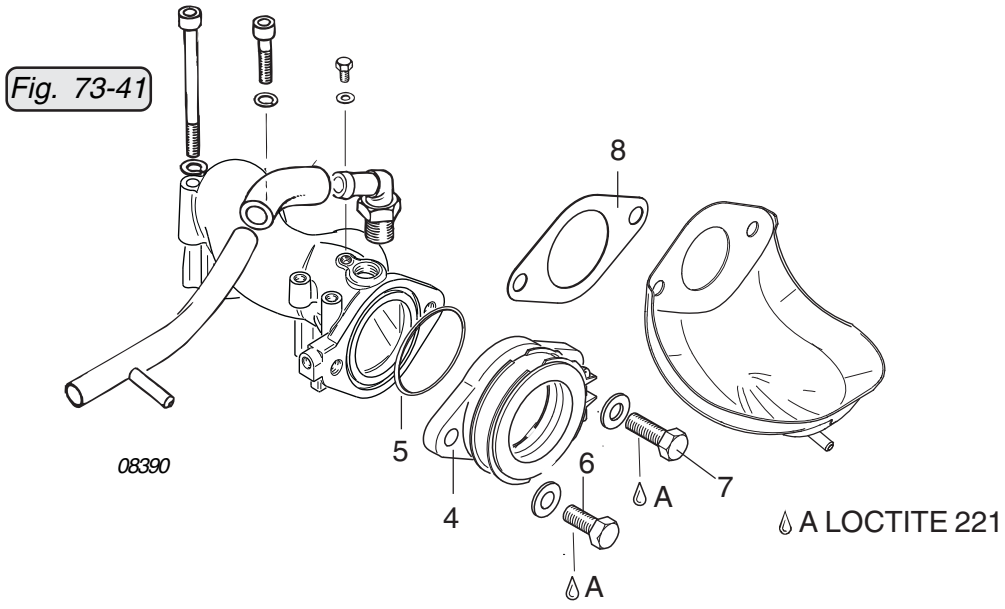


Fig. 73-41



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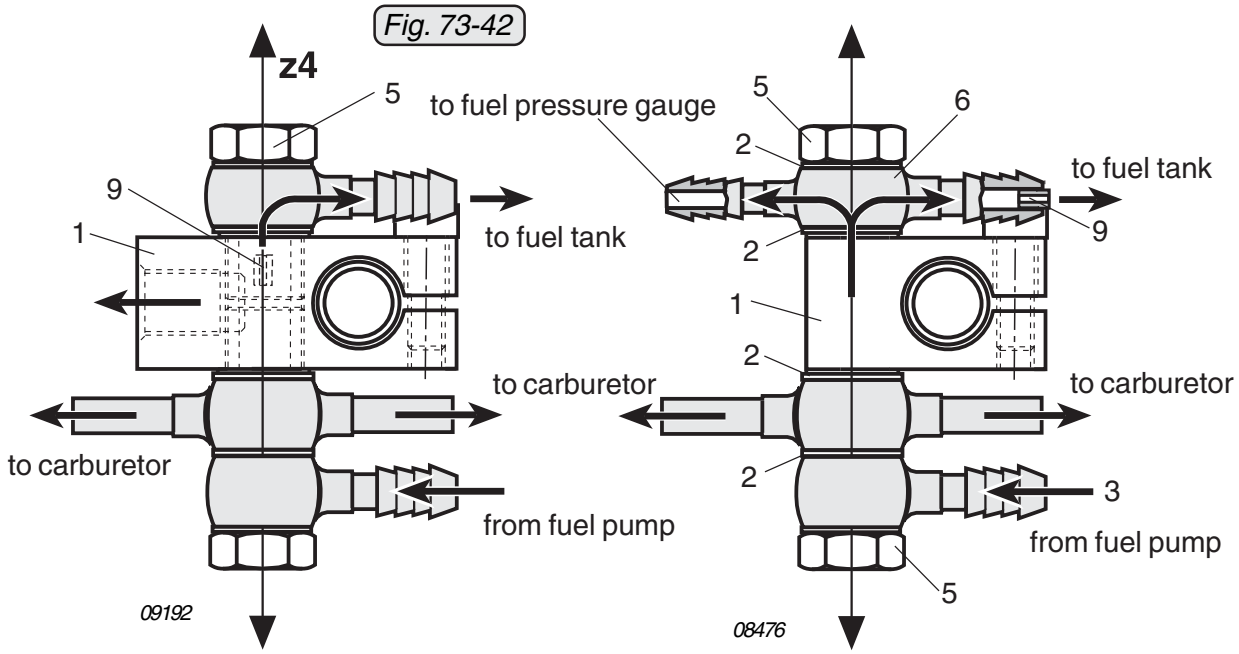
3.5.3) Assembly of the fuel lines (on 912 Series)

See Figs. 73-42, 73-43, 73-44

■ CAUTION: To prevent locked up stresses, all components should first be screwed on loosely and then tightened to the prescribed tightening torque.

If the clamp block (1) has been removed, it must now be reattached with an allen screw M5x16 and a tightening torque of 6 Nm (53 in.lb).

Fig. 73-42



◆ NOTE: For easier assembly of the fuel line, observe the original position of the clamp block.

The lines from the fuel pump (3) and the lines to the carburetors are attached to the **bottom side** of the clamp block, each between a sealing ring (2) and the banjo bolt (5) (tightening torque 10 Nm (90 in.lb)).

The ring hose nipple (6) is attached to the **top side** of the clamp block between a sealing ring (2) and the banjo bolt (5) (tightening torque 10 Nm (90 in.lb)).

– connection for return line to the tank (Ø outside 7mm (0.28 in.))
  slip-on length: max. 17 mm (0.67 in.)
– connection to the pressure gauge (Ø outside 6 mm (0.24 in.))
  slip-on length: max. 17 mm (0.67 in.)

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The double hose nipple (6) is optional.

◆ NOTE: The double hose nipple (6) contains an integrated restrictor (9) (0.35 mm (.0138 in.)) which plays a decisive role in ensuring correct functioning of the fuel system.

◆ NOTE: If no pressure gauge is connected, a single ring hose nipple is fitted. The restrictor (9) is then in the top banjo bolt (5). For recognition the banjo bolt is either marked with yellow color or with the label “FUEL”.

■ CAUTION: Do not get the connections mixed up.

Unscrew allen screw M10x1x8 (11) with the sealing ring (10). Tightening torque 15 Nm (133 in.lb) - screw secured with LOCTITE 221. See Fig. 73-44.

◆ NOTE: When converting to a double hose nipple for measurement of the fuel pressure, the jet must be removed from the banjo bolt (5).

Screw the fuel lines to the carburetors.

Rigid line

◆ NOTE: Do not tighten the clamp block until all lines have been connected.

▲ WARNING: The lines must be fitted without tension and with all the standard in serial supports to prevent breaks caused by vibration during operation.

■ CAUTION: When assembling the fuel lines, ensure that they are adequately supported to prevent strain on the connections. See Fig. 73-43.

◆ NOTE: An optional double hose nipple (6) is available for measurement of the fuel pressure.

Assembly at the carburetor should be carried out analogously the disassembly. See sec. 3.4.4.

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SECTION 74

IGNITION SYSTEM

1) Table of contents

SECTION 74
IGNITION SYSTEM

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Fig. 74-2

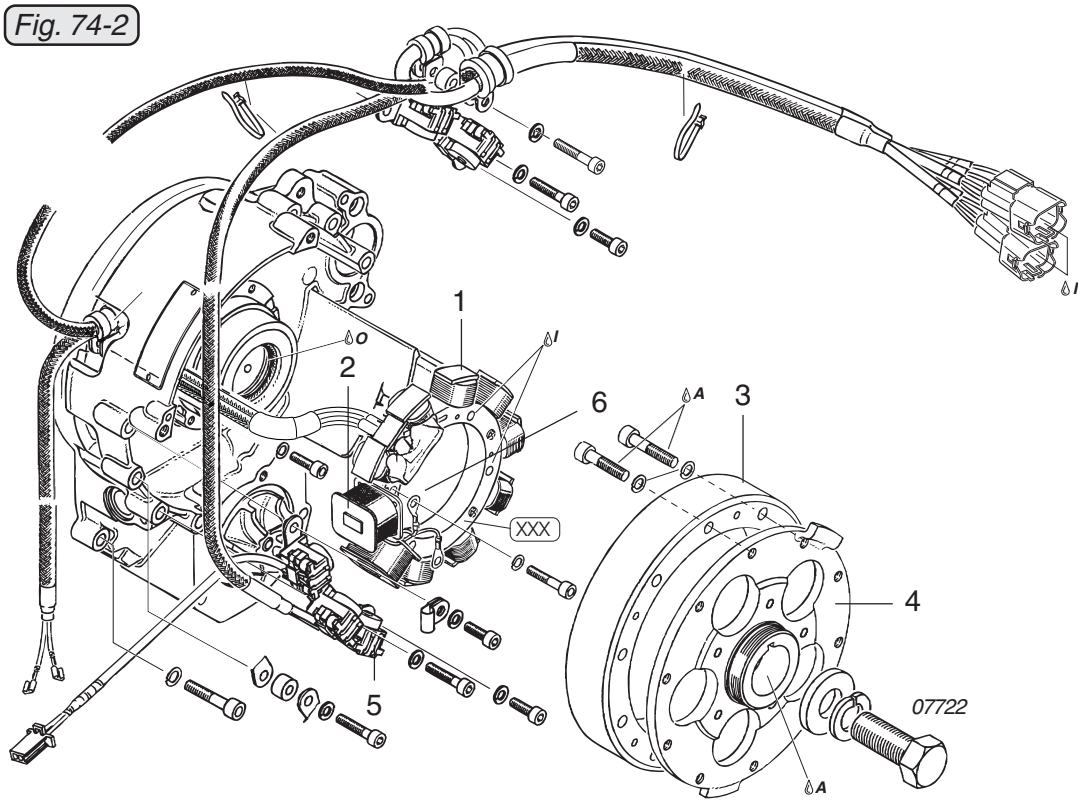
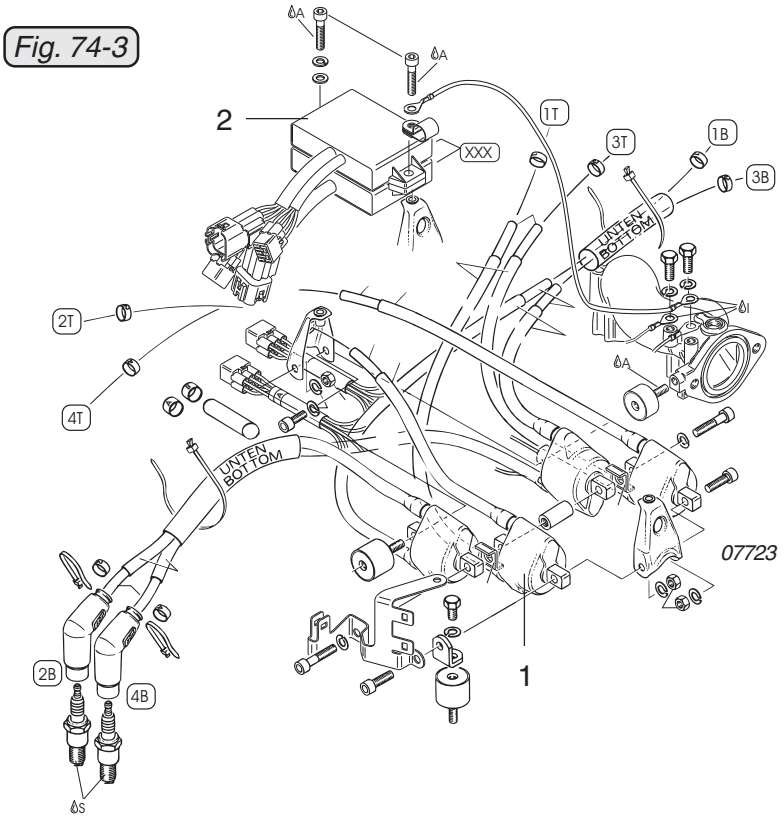


Fig. 74-3



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2.1.1) Ignition

See Fig. 74-4.

As already stated, the engine is equipped with dual ignition of a breakerless capacitor discharge design (DCDI). That means that the ignition unit comprises two independently working ignition circuits (separate trigger coil, electronic module, charging coils etc.).

◆ NOTE: The ignition unit cannot be disassembled and needs no adjustment.

Each ignition circuit consists of two ignition branches. Ignition occurs on cylinder 1 and 2 simultaneously every 360° as well as on cylinder 3 and 4 but 180° offset.

◆ NOTE: Due to engine design, ignition occurs also at "the TDC of the exhaust stroke", but this has no effect on engine operation.

The engine is furnished with an automatic ignition timing controlled by the edge of trigger cams on the fly wheel hub and the electronic modules.

◆ NOTE: For easy engine start, the ignition timing at start is 4° B.T.D.C. for ignition circuit A and B.

As soon as the engine runs, the ignition point will change over automatically to operation ignition.

On the 912 Series:

Differences between electronic module part no. 966726 and part no. 966727:		current 966726	new 966727
	fly wheel hub		
ignition point at start	966871 current 966872 new	4° Before T.D.C. 3° After T.D.C.	4° Before T.D.C. 3° After T.D.C.
time delay for ignition at start:		none	3 - 8 sec.
switching to advanced ignition:		from 650 to 1000 RPM depending on trigger gap	after the expiration of the time delay (3-8 sec.)
ignition timing in normal operation:		26° before T.D.C.	26° before T.D.C.

On the 914 Series: ignition circuit A 26°

ignition circuit B 22°

The transition from start ignition timing to the timing for operation takes place between 650 and 1000 rpm.

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3.8) Dual ignition coil

See Figs. 74-13 and 74-14.

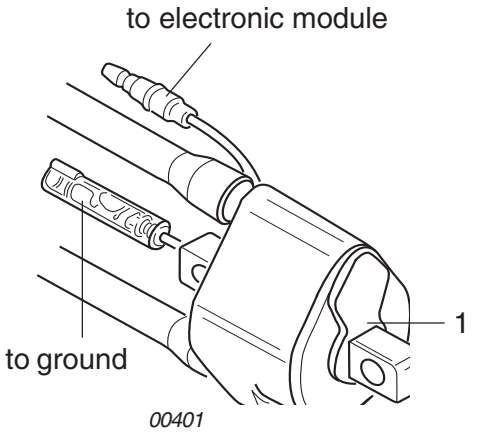
If the failure of a single resistance spark plug or 2 resistance spark plugs is noticed, check the connections and the resistance values of the respective dual ignition coil, see 74-00-00 sec. 3.12

The iron core (1) must not be loose. If required, replace the dual ignition coil. In this case, the following dismantling work must be performed, see 74-00-00 sec. 3.15 and 3.16. See SI-912-013 and SI-914-016,“Standardization of the ignition unit“, latest issue.

Measure the resistance with a multimeter.
See 74-00-00 sec. 3.12 and 74-00-00 sec. 5.

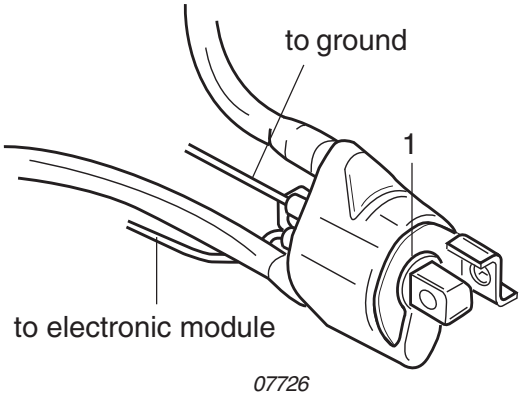
Older engine models

Fig. 74-13



New engine models

Fig. 74-14



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3.9) Cut-in speed of ignition

See Fig. 74-15

Ignition must cut-in between 150 rpm. and max. 220 rpm. of crankshaft speed. To be checked with stroboscope and inductive pliers (see 00-00-00 sec. 10.5).

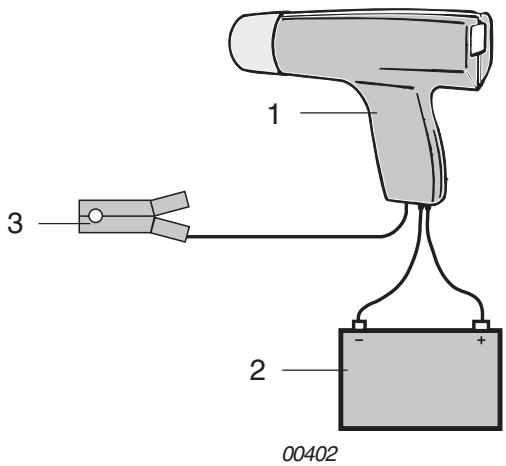
For this procedure, connect stroboscope (1) to battery (2) and clamp inductive pliers (3) to the ignition cable of cylinder 1 (top) or cylinder 2 (top). These two spark plugs are actuated by the trigger coil A1/2.

Start engine, aim stroboscope towards trigger coil A1/2 and observe flashing light.

This procedure should be performed on all ignition cables.

◆ NOTE: A precise inspection is only possible on an ignition test bed.

Fig. 74-15



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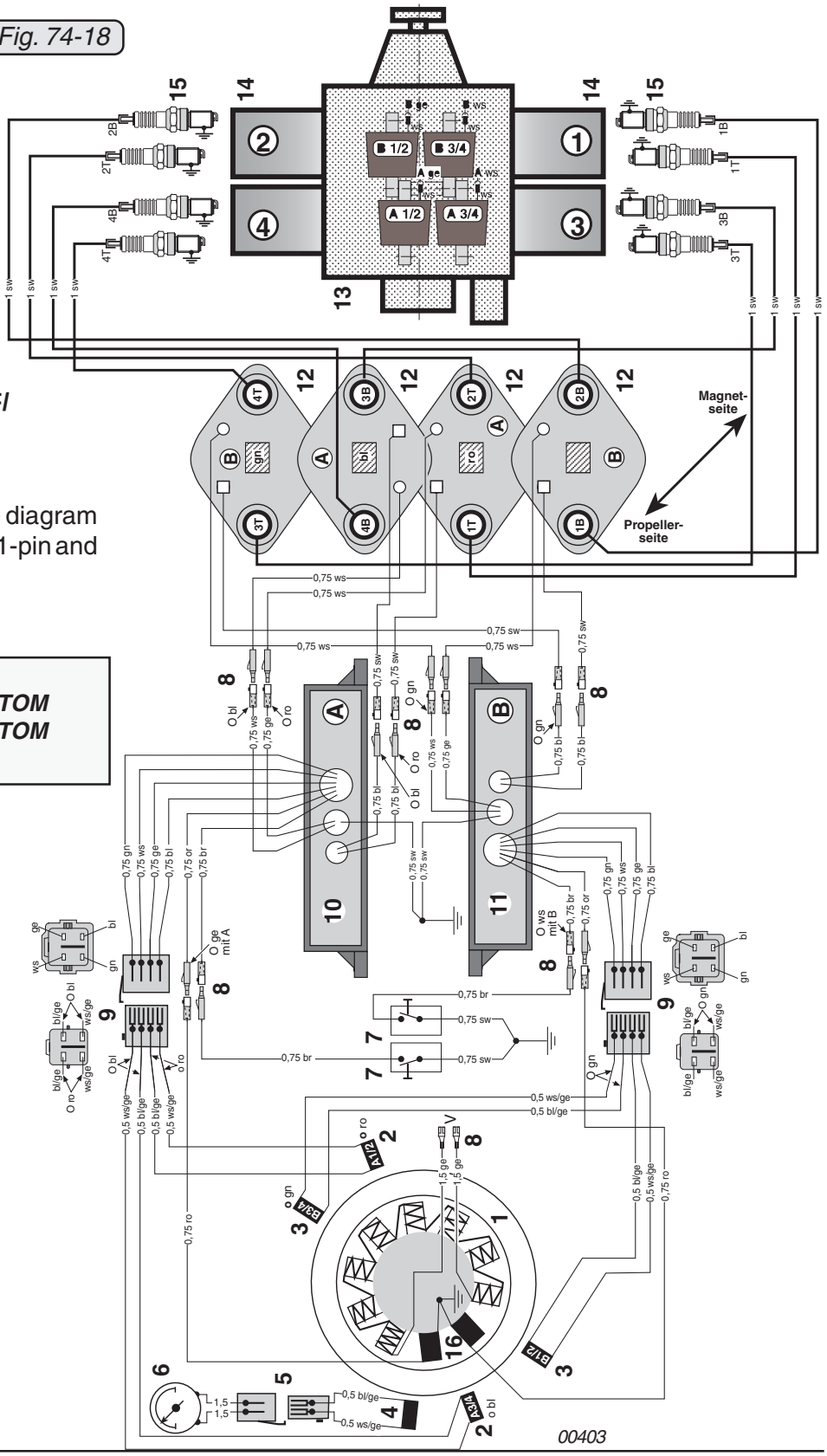
T =	*top = oben*
B =	*bottom = unten*

Fig. 74-18



Engine version 912 A/F/ UL older model

◆NOTE:

Fig. 74-18 shows the wiring diagram for electronic modules with 1-pin and 4-pin plugs.

ignition circuit A: 1 - 2 TOP
3 - 4 BOTTOM
ignition circuit B: 1 - 2 BOTTOM
3 - 4 TOP

bl	*blue*
br	*brown*
ge	*yellow*
gn	*green*
ro	*red*
rs	*pink*
sw	*black*
ws	*white*
or	*orange*

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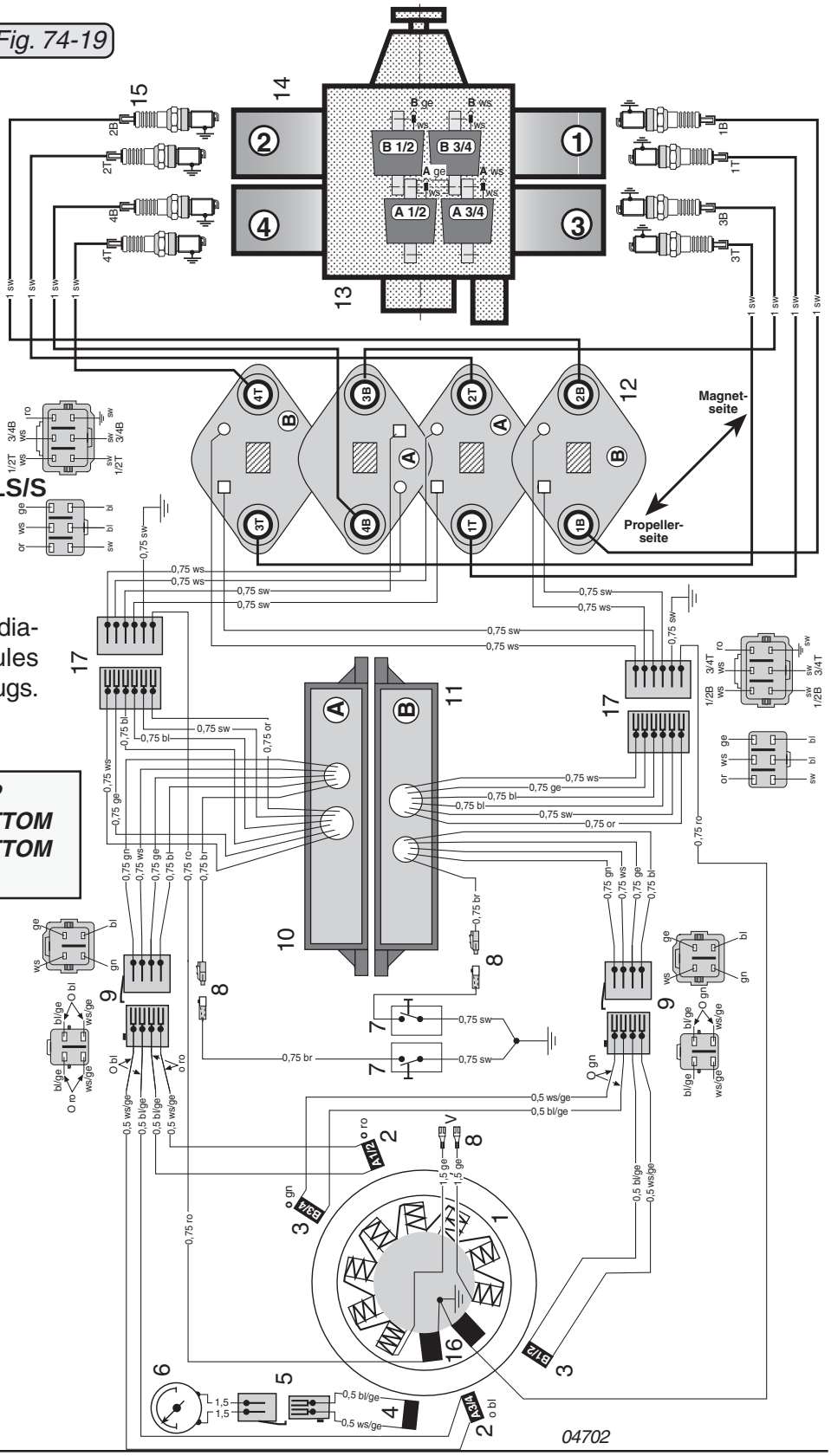
Legend to wiring diagram (Fig. 74-19)

1	ignition magneto generator
2	trigger coil for ignition circuit ”A”
3	trigger coil for ignition circuit ”B”
4	trigger coil for rev counter
5	plug receptacle 2-pin
6	electronic rev counter
7	grounding switch for ignition circuit ”A” and ”B”
8	plug receptacle 1-pin
9	plug receptacle 4-pin
10	electronic module for ignition circuit ”A”
11	electronic module for ignition circuit ”B”
12	double ignition coil
13	engine
14	cylinder 1 - 4
15	spark plugs
16	charging coils
V	consumer connection
o	color code

d02624

T =	*top = oben*
B =	*bottom = unten*

Fig. 74-19



Engine version 912 ULS/S older model

◆NOTE:

Fig. 74-19 shows the wiring diagram for electronic modules with 1-pin, 4-pin and 6-pin plugs.

ignition circuit A: 1 - 2 TOP
3 - 4 BOTTOM
ignition circuit B: 1 - 2 BOTTOM
3 - 4 TOP

bl	*blue*
br	*brown*
ge	*yellow*
gn	*green*
ro	*red*
rs	*pink*
sw	*black*
ws	*white*
or	*orange*

d04778

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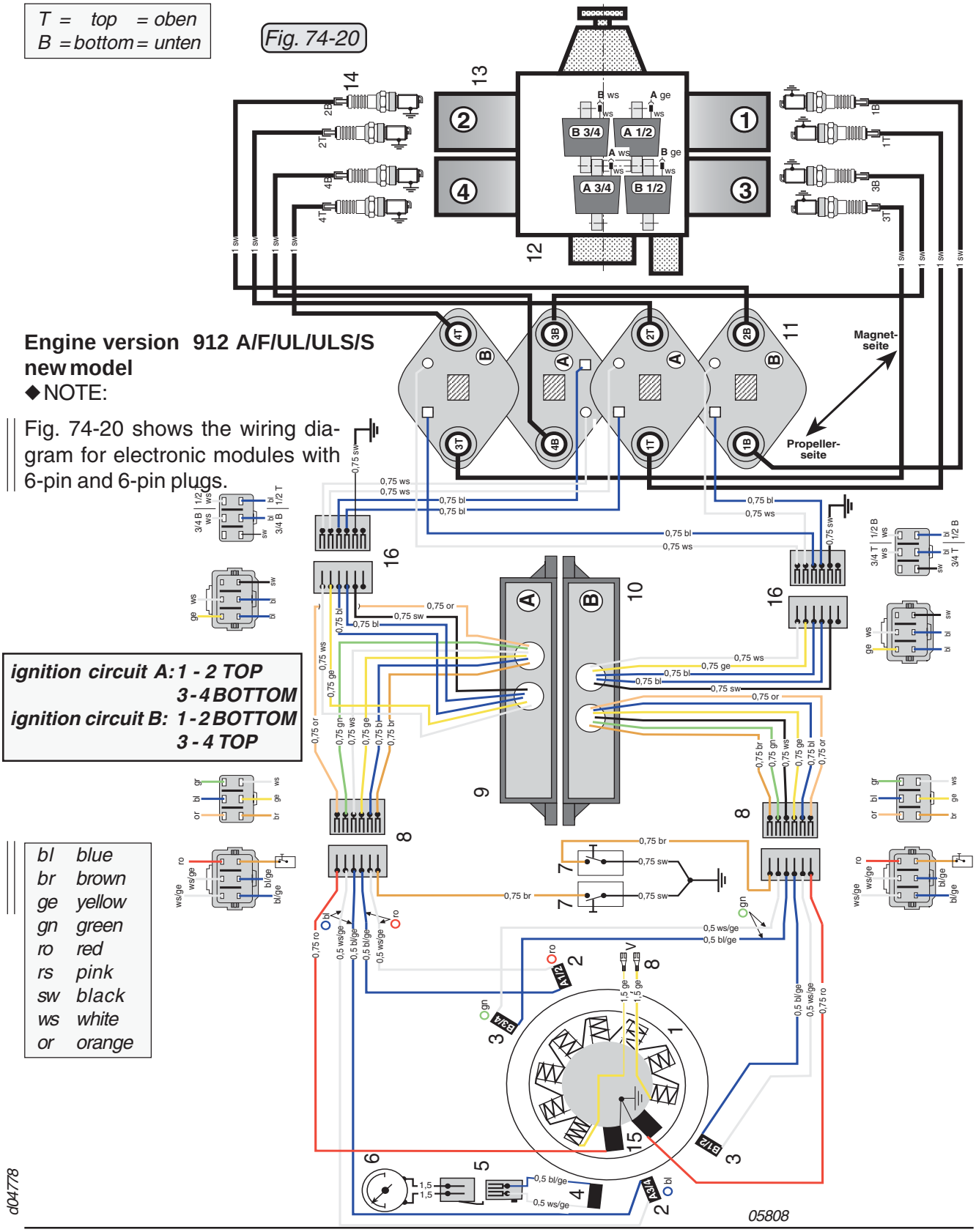
Legend to wiring diagram (Fig. 74-20)

1	ignition magneto generator
2	trigger coil for ignition circuit ”A”
3	trigger coil for ignition circuit ”B”
4	trigger coil for rev counter
5	plug receptacle 2-pin
6	electronic rev counter
7	grounding switch for ignition circuit ”A” and ”B”
8	plug receptacle 1-pin
9	plug receptacle 4-pin
10	electronic module for ignition circuit ”A”
11	electronic module for ignition circuit ”B”
12	double ignition coil
13	engine
14	cylinder 1 - 4
15	spark plugs
16	charging coils
V	consumer connection
o	color code

d02624

T =	top = oben
B =	bottom = unten

Fig. 74-20



Engine version 912 A/F/UL/ULS/S new model

◆NOTE:

Fig. 74-20 shows the wiring diagram for electronic modules with 6-pin and 6-pin plugs.

3.13.2 Engine internal (on the 914 Series)

See Figs. 74-21 and 74-22.

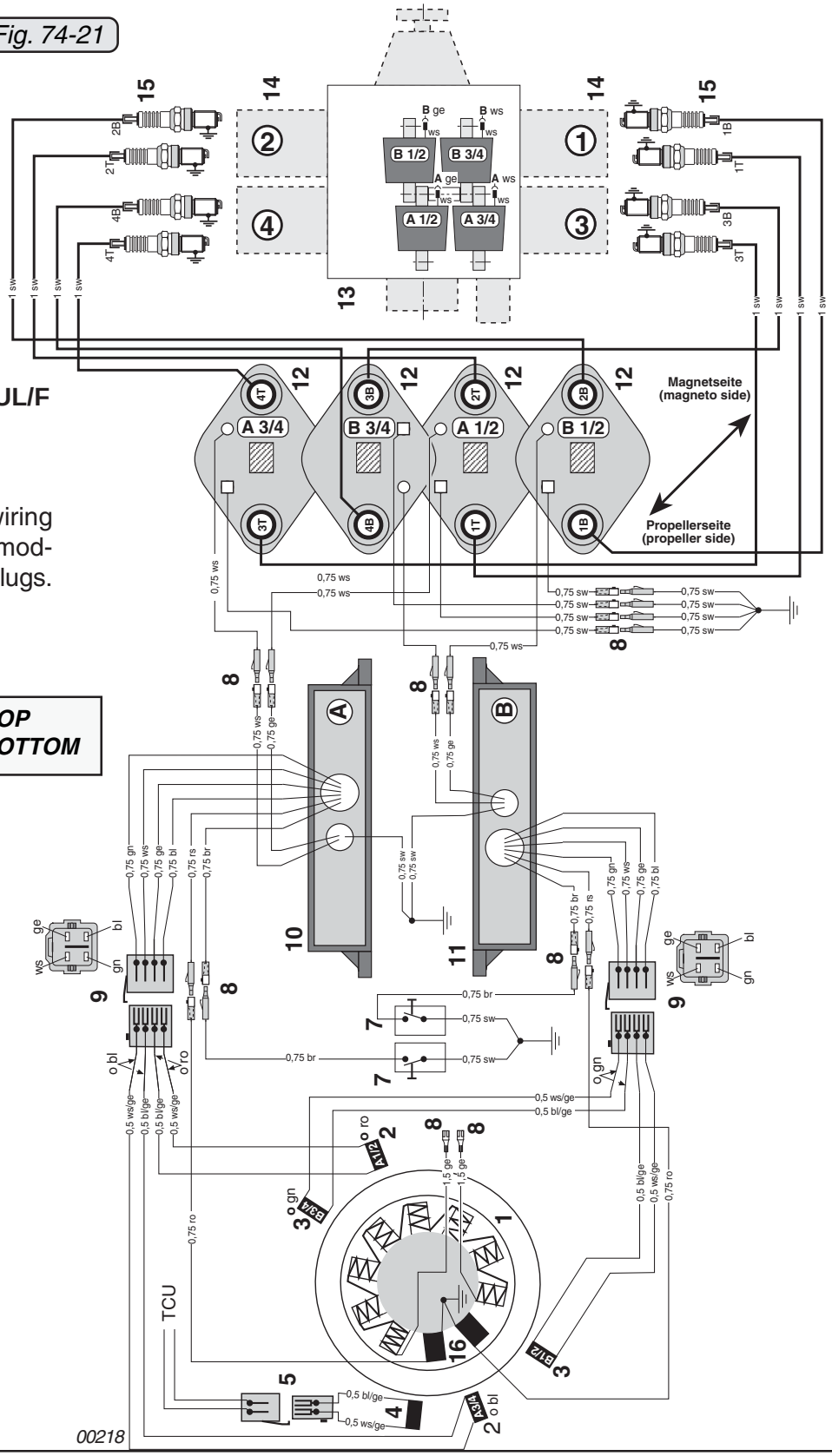
Legend to wiring diagram (Fig. 74-21)

1	ignition magneto generator
2	trigger coil for ignition circuit ”A”
3	trigger coil for ignition circuit ”B”
4	trigger coil for rev counter
5	plug receptacle 2-pin
6	electronic rev counter
7	grounding switch for ignition circuit ”A” and ”B”
8	plug receptacle 1-pin
9	plug receptacle 4-pin
10	electronic module for ignition circuit ”A”
11	electronic module for ignition circuit ”B”
12	double ignition coil
13	engine
14	cylinder 1 - 4
15	spark plugs
16	charging coils
V	consumer connection
o	color code

d02624

T = top = oben
B = bottom = unten

Fig. 74-21



Engine version 914 UL/F older model

◆NOTE:

Fig. 74-21 shows the wiring diagram for electronic modules with 1-pin and 4-pin plugs.

ignition circuit A: 1 - 4 TOP
ignition circuit B: 1 - 4 BOTTOM

bl	*blue*
br	*brown*
ge	*yellow*
gn	*green*
ro	*red*
rs	*pink*
sw	*black*
ws	*white*

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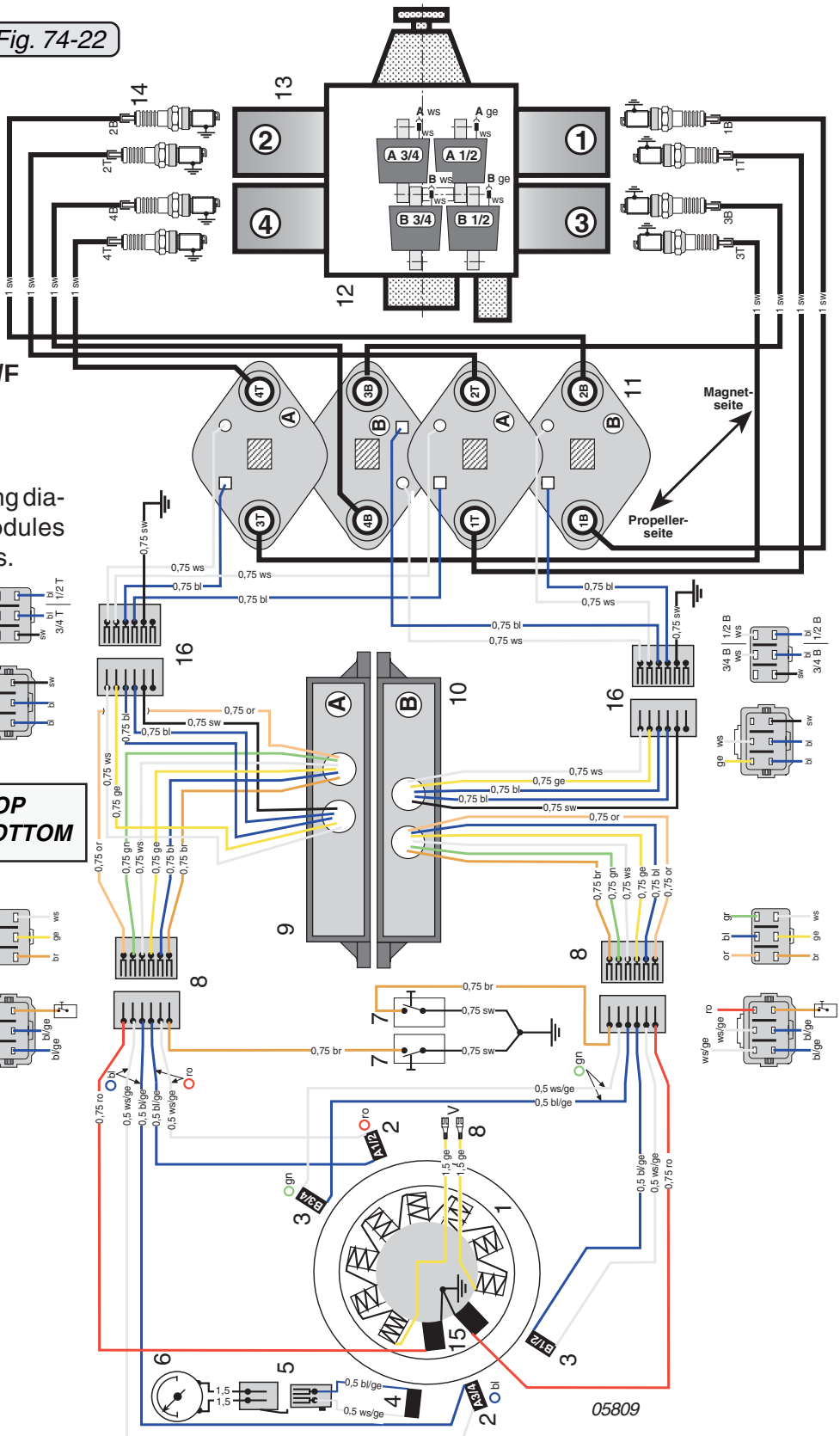
Legend to wiring diagram (Fig. 74-22)

1	ignition magneto generator
2	trigger coil for ignition circuit ”A”
3	trigger coil for ignition circuit ”B”
4	trigger coil for rev counter
5	plug receptacle 2-pin
6	electronic rev counter
7	grounding switch for ignition circuit ”A” and ”B”
8	plug receptacle 1-pin
9	plug receptacle 4-pin
10	electronic module for ignition circuit ”A”
11	electronic module for ignition circuit ”B”
12	double ignition coil
13	engine
14	cylinder 1 - 4
15	spark plugs
16	charging coils
V	consumer connection
o	color code

d02624

T =	top = oben
B =	bottom = unten

Fig. 74-22



Engine version 914 UL/F new model

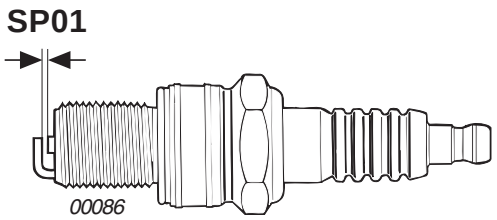
◆NOTE:

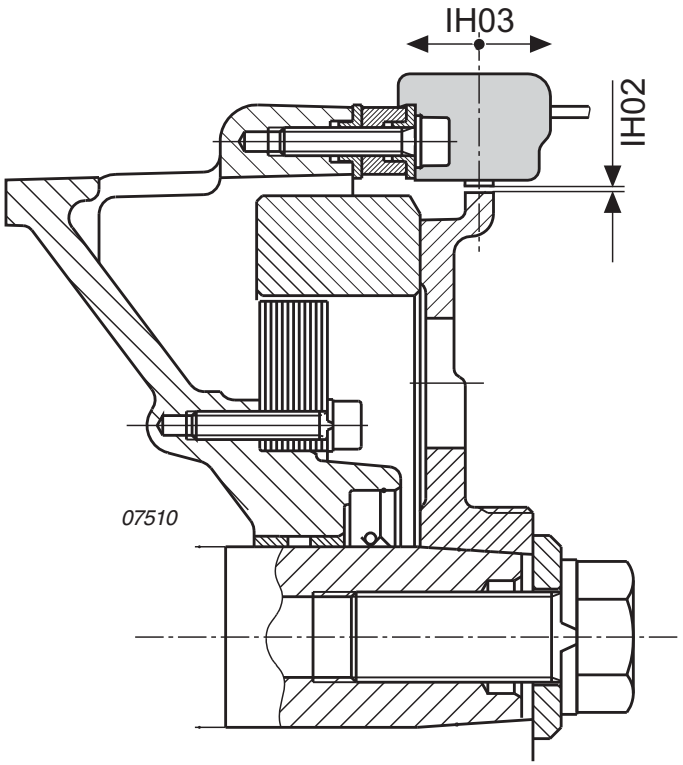
Fig. 74-22 shows the wiring diagram for electronic modules with 6-pin and 6-pin plugs.

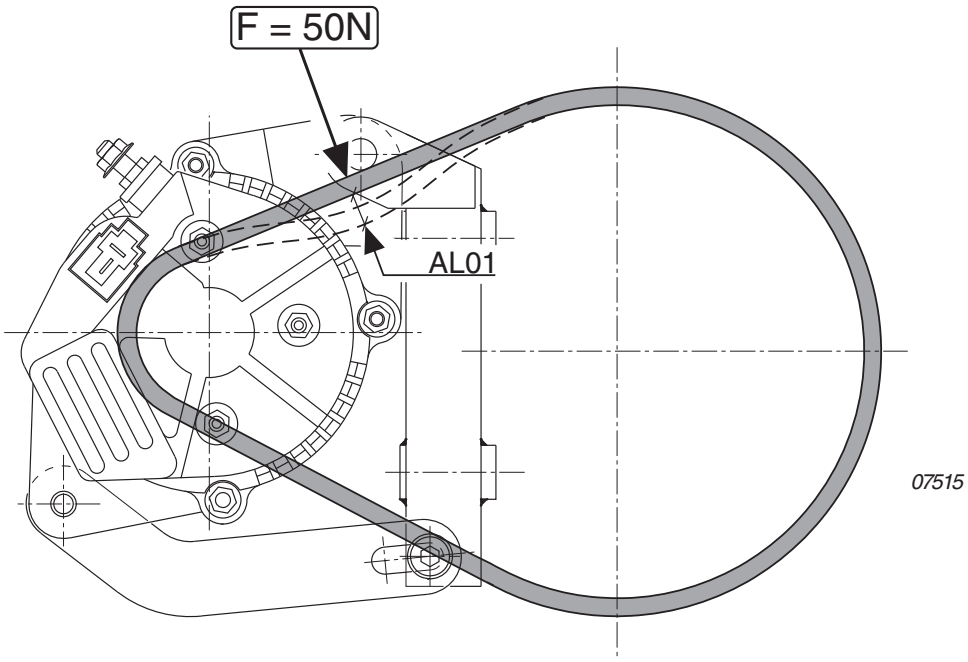
3.13.3 Engine external (on the 914 Series)

See latest Installation Manual for engines of the 914 Series and 76-00-00 sec. 3.1.2.3.

4) Wear limits







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08668

Description	Code	Reading new min	Reading new max	wear limit 100%	wear limit 50%		Readings			
Spark plug										
electrode gap 912	SP01	**0,6** **0**,022	**0,7** 0,028	**0,9** **0**,035		actual				
						renewed				
electrode gap 914	SP01	**0,7** **0**,027	**0,8** 0,031	**0,9** **0**,035		actual				
						renewed				
Ignition housing										
							A 1/2	A 3/4	B 1/2	B 3/4
trigger coil gap “old type”	IH02	**0,4** **0**,016	**0,5** **0**,020			actual				
						renewed				
trigger coil gap (with clamps)	IH02	**0,3** 0,012	**0,4** 0,016			**actual**				
						renewed				
trigger coil axial off-set	IH03	**0,0** 0,000	**0,2** 0,008			**actual**				
						renewed				
External alternator										
Deflection of V-belt at a force of 50 N	AL01		**6,0** **0**,236			actual				
						renewed				

08487

Description	Code	Reading new min	Reading new max	wear limit 100%	wear limit 50%		Readings
External alternator							
Length of coal brush	AI02	30 1,181		23 0,905	26,5 1,1043	actual	
						renewed	

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3.9) Ignition housing assembly

See 72-00-00 sec. 3.5.

3.10) Water pump housing — reassembly

See Fig. 75-11.

Position gasket (1), attach water pump housing (2) to the ignition housing with 2 allen screws (3) M6x90 and 3 allen screws (4) M6x35 together with lock washers, torque to 10 Nm (90 in.lb).

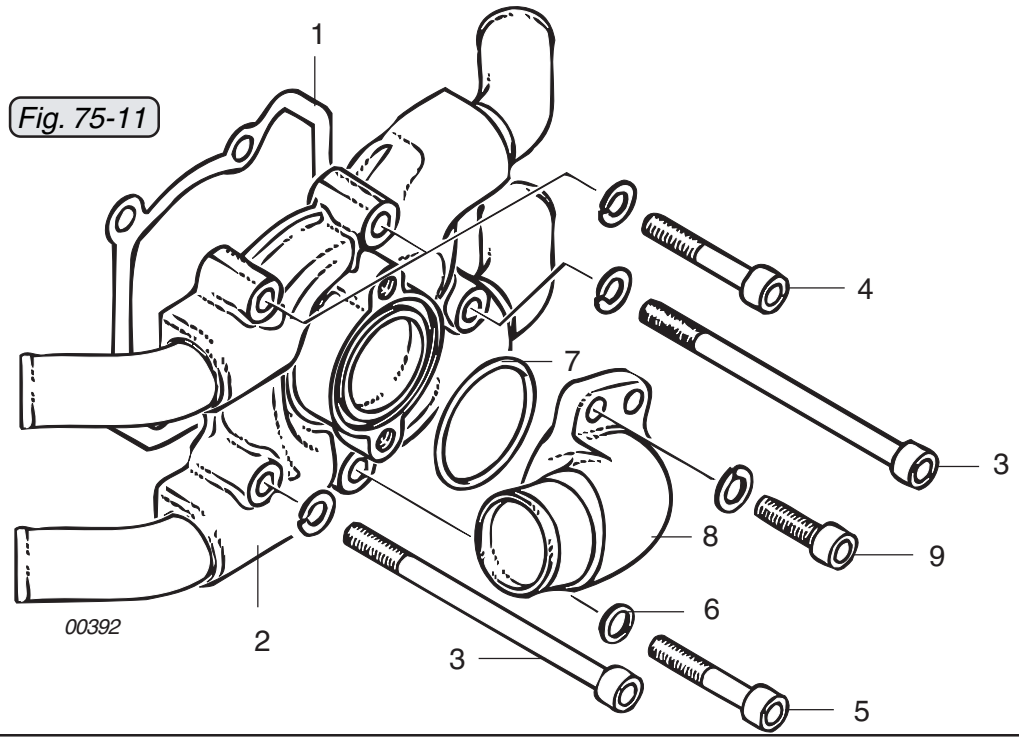
■ CAUTION : The bottom allen screw (5) M6x35 protrudes into the water chamber, so it is of stainless steel and fitted with a sealing ring (6).

Carry out a visual inspection to see whether the impeller scuffs in the pump housing. This can be recognized by scuffing traces in the pump housing or on the impeller. If necessary, the axial position of the water pump impeller can be corrected to achieve an optimum gap, see 75-00-00 sec. 3.8.

Insert O-ring (7) into water pump housing, fit the water inlet elbow (8) in the position marked before disassembly with 2 allen screws (9) M6x20 with lock washers. Tightening torque 10 Nm (90 in.lb).

◆ NOTE: The water inlet elbow is symmetrical and can, if required, be fitted in other positions.

Fig. 75-11



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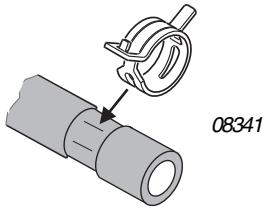
3.11) Coolant hoses fitting

See Fig. 75-13

■ CAUTION: The spring band hose clamps must be installed in the drawn origin position. (See sketch)



Fit all coolant hoses (1) coming from the expansion tank to the coolant exit on the cylinder heads (3) with spring band hose clamps (4). Also fit the coolant hoses between the water pump (6) and the coolant entry (7) into the cylinder heads with spring band hose clamps.

◆ NOTE: Position spring band hose clamps so that they cannot damage neighboring coolant hoses.

Use tool part no. 877840 (spring clamp pliers) or equivalent to mount the spring type hose clips.

On old engine designs the spring type of hose clips are not installed.

■ CAUTION: It is necessary to look out for a proper overlapping of the coolant hose and of the connecting tube.

Check the clips and hoses for tight fit and leaks. The spring type hose clips have to be mounted in such a way, so that chafing can not occur. If a governor is used then for the water tube at cylinder 1 a protection hose (8) has to be installed and secured with LOCTITE 480 or an equivalent adhesive.

3.12) Spring band hose clamps

Carry out visual inspection. Position the clamps so as to avoid contact and friction with neighboring parts.

Use a suitable tool for assembly. See 00-00-00 sec. 10.6.

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3.13) Radiator (optional 912/ 914 Series)

Clean radiator elements and check for damage, straighten fins if necessary. In particular, check the hose connections and the support plates. Check for tightness if leaks are suspected.

3.14) Cooling air duct (optional 912/ 914 Series)

The cylinders are ram-air cooled. The cooling air is pushed during flight and by the propeller into the engine compartment and is distributed evenly by the cooling air duct to the individual cylinders. Carry out visual inspection for damage, cracks, chafing marks, burnt spots etc. In the event of noticeable damage, replace the cooling air duct.

3.15) Expansion tank

See Fig. 75-12

See latest valid Maintenance Manual “Line Maintenance“ of the corresponding engine type. On newer engines the expansion tank is in a different position. See therefore the latest issue of the Service Information “Running modification” SI-912-020 and SI-914-022 respectively.

◆ NOTE: On engines with the old expansion tank, the old hose locations and the old coolant hoses don’t have to be upgraded and can be continued to be used.

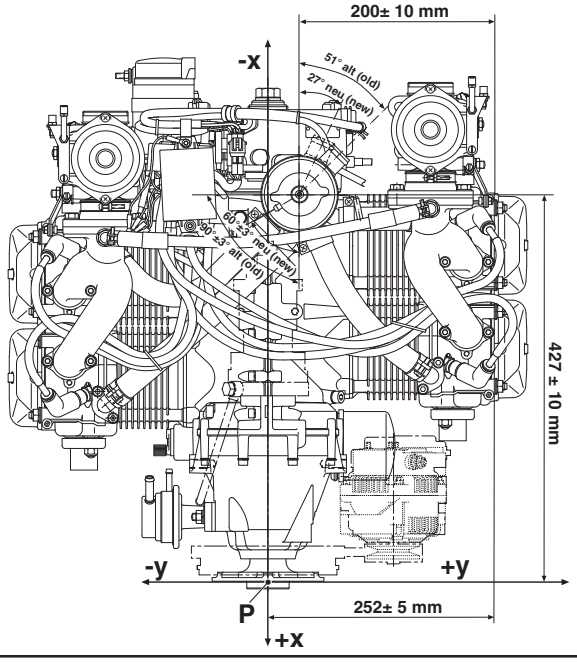

Fig. 75-12

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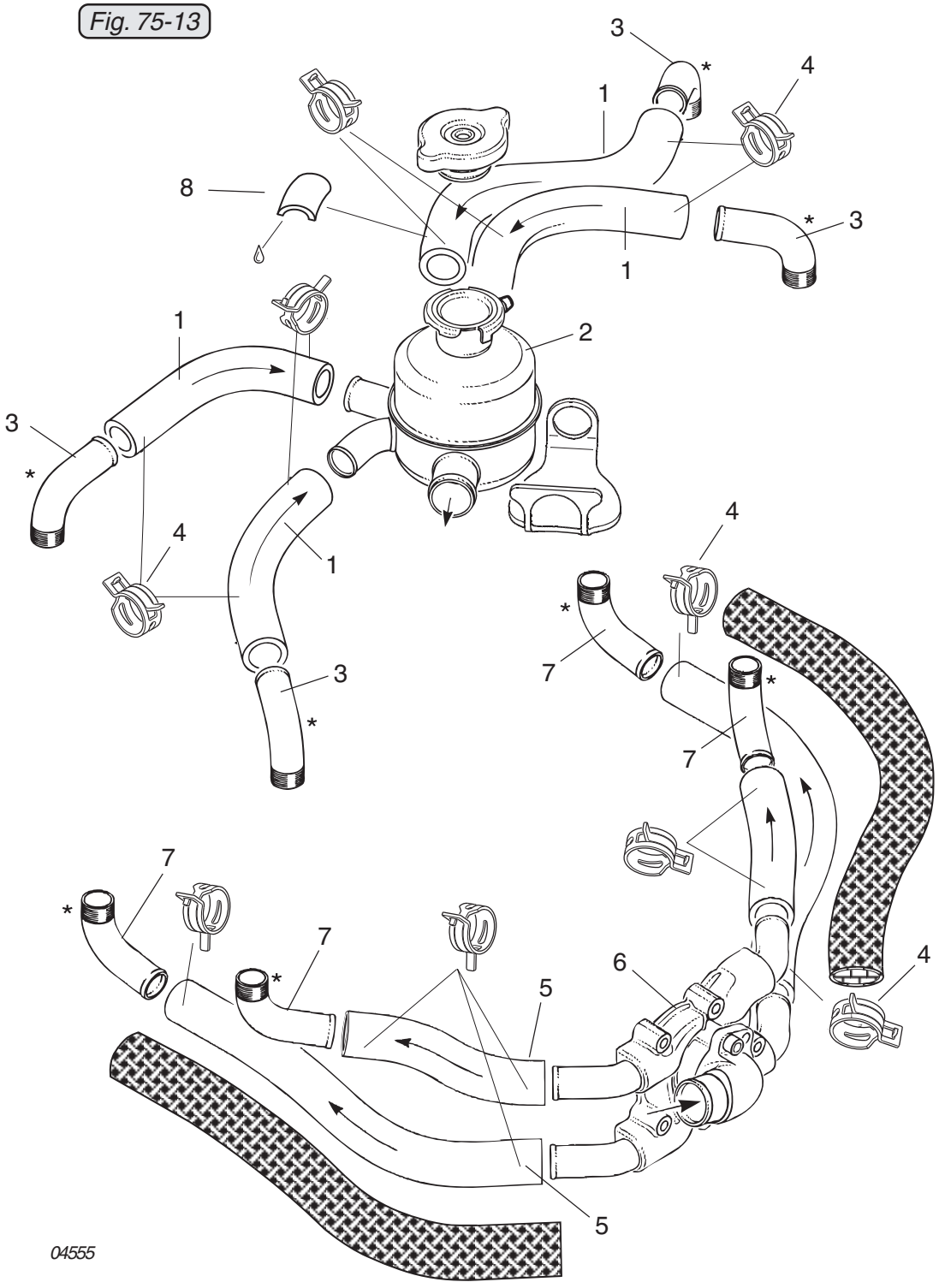
Fig. 75-13



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: LOCTITE 480

In the case of repair/overhaul it has to be considered that the old expansion tank part no. 922398 does not offer the space to install the spring hose type clamps this is due to limited space between the tube (cylinder 1 and cylinder 3).

Due to different positions for the supply/drain hoses leading to and from the expansion tank, it is necessary to have different hose lengths. Take care of the proper length of the hose and of its overlapping length with the connectors.

3.16) Overflow bottle

See latest Maintenance Manual “Line Maintenance” for the respective engine type.

■ CAUTION: Check whether the overflow bottle has been modified in accordance with SB-912-039 and SB-914-025, “Modifications of the overflow bottle”, latest issue.

3.17) Temperature measurement system

◆ NOTE: There are several temperature control points on ROTAX engines of the 912/914 Series. Refer to wiring diagram in Operators Manual.

3.17.1) Cylinder head temperature sensor

See Figs. 75-14 and 75-15.

In serial production, the two temperature sensors (1) are screwed into position on the bottom side of the cylinder heads of cylinders 2 and 3.

Fig. 75-14

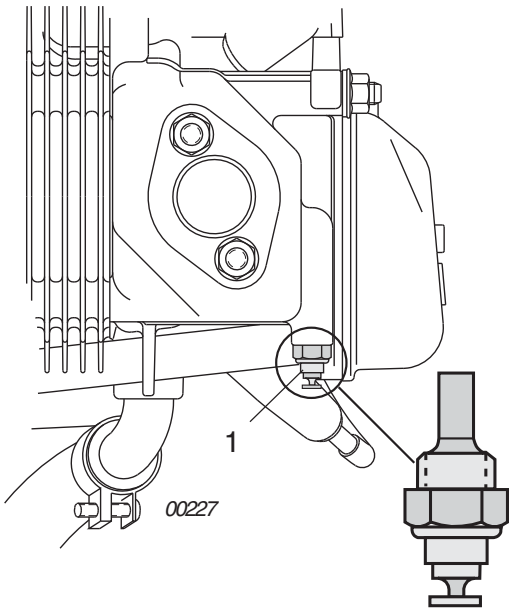

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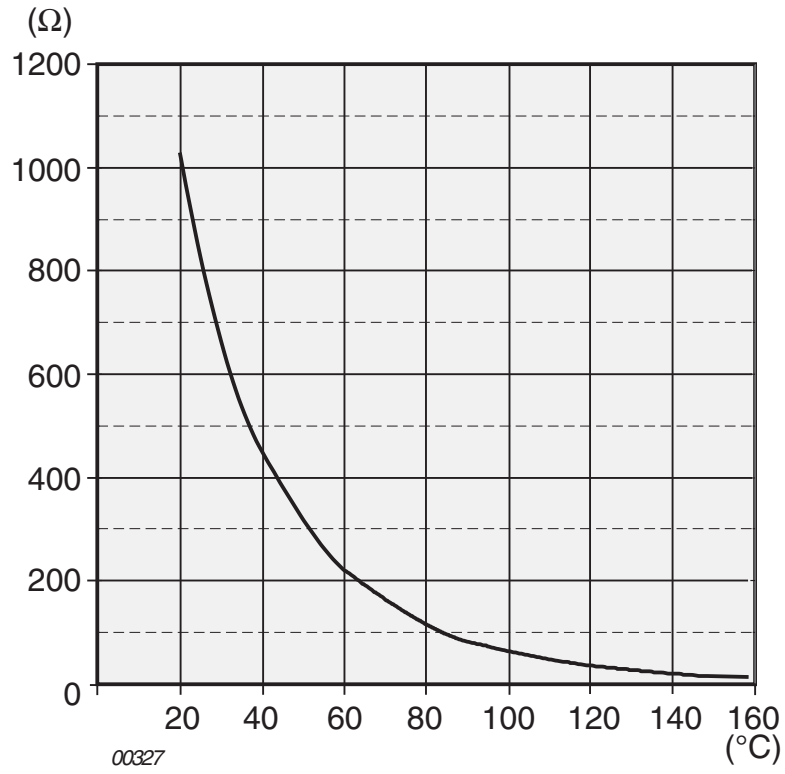
Fig. 75-15



◆ NOTE: Grounding connection of the temp. sensor directly via the cylinder head.

For sensor resistance, see following graph of sensor resistance overtemperature.

deviation: max ± 10%

On assembly, tighten the temperature sensor to 10 Nm (90 in. lb). Secure screws with LOCTITE 221.

d04779

4) Form Sheets

Fig. 76-53

d04780

Prüfprotokoll für Turboladerregler / Inspection protocol for turbo charger control unit

Motor / Engine type:	____________	TSN: ______	
Motor / Engine serial no.:	____________	TSO: ______	
TCU Serien-Nr. / TCU serial no.	____________	TSN: ______ / TSO: ______	
TCU Teile Nr. / TCU part no.:	____________		
TCU Programmversion / TCU Program-Version:	☐ TLR 4.3	☐ TLR 4.5	☐ TLR 4.6
Sichtkontrolle: / Visual check:	____________		
Prüfdongle, Serien-Nr.: / Check dongle, serialno.:	____________		
Prüfung mit: / Check with:	ROTAX Testkoffer / ROTAX testcase ☐	am Motor / on engine ☐	
Vergaser 2/4, Serien-Nr.: / carburetor 2/4, serial no.:	____________		

Lampenkontrolle / lamp control

Lampen leuchten beim Einschalten: / lamps flash during switch on:	gelbe Lampe / yellow lamp ☐	rote Lampe / red lamp ☐

Anreicherungsventilkontrolle / solenoid control

Solenoid schaltet bei : / solenoid operates at :	☐ 1250 mbar(966 470) / ☐ 1260 mbar(966 473 / 966 741)	Airboxdruck / Airbox pressure

Bemerkungen / Remarks : ________________________________

____

____

____

____

Unterschrift Prüfer / Signature Tester : ______________ Datum / Date: ________

Over Boost-Kontrolle /over-boost-control

rote Lampe leuchtet bei : / red lamp flashes at :	O.K. ☐ Airboxdruck >1550 mbar / airbox pressure >1550mbar

Plausibiltäts-Kontrolle / plausibility-control (MONITOR-Oberfläche / MONITOR-menu)

LOAD [1)] (idle) :	0È % (Sollwert/target value)	________ %
LOAD [1)] (full) :	115 %(Sollwert/target value)	________ %
ambient pressure[2)]:		________ mbar
airbox pressure[2)]:		________ mbar
airbox temperature[3)]:		________ °C
servoposition (idle)[4)]:	100 %±3 (Sollwert/target value)	________ %

1) lineare Kennlinienverlauf / Linear values of load
2) +/- 10 mbar Differenz der beiden Werte (vgl. Tagesdruck) / +/- 10 mbar difference between the two values (compare actual pressure of the day) Mit neuem Umgebungsdrucksensor / With new ambient pressure sensor +60 mbar (+/- 10 mbar) Differenz der beiden Werte (vgl. Tagesdruck) / +60 mbar (+/- 10 mbar) difference between the two values
3) die Temperatur sollte in etwa der Umgebungstemperatur entsprechen / temperature should be equal to ambient temperature
4) Servoposition bei IDLE = 100% Servoposition = Waste-Gate geschlossen / Servoposition at IDLE = 100% servoposition = Waste-Gate closed

Kalibrier-Kontrolle / calibration-control

	966470 ☐ / 966471 ☐	966473 ☐ / 966741 ☐
Servo OFFSET	10 ☐	60 ☐
Servo RANGE	1003 ☐	900 ☐
Throttle OFFSET	60 ☐	60 ☐
Throttle RANGE	710 ☐	710 ☐
Airbox pressure sensor calibration parameter A	12219 ☐	12219 ☐
Airbox pressure sensor calibration parameter B	250 ☐	250 ☐
Ambient pressure sensor calibration parameter A	6720 ☐	6720 ☐
Ambient pressure sensor calibration parameter B	-37 ☐	-37 ☐
	TLR 4.3	TLR 4.5 / TLR 4.6

06750

NOTES

SECTION 78

EXHAUST SYSTEM AND TURBOCHARGER

1) Table of contents

SECTION 78
EXHAUST SYSTEM AND TURBOCHARGER

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NOTES

2.) Systems description

2.1) Exhaust system (on the 912 Series)

On ROTAX engines of the 912 Series, the exhaust system is not included in the ROTAX range of delivery. The engine is supplied only with the 4 exhaust sockets on the cylinder head.

The exhaust system must be configured or manufactured by the aircraft or fuselage manufacturer.

For disassembly, inspection and assembly of the exhaust system, observe the aircraft manufacturers instructions.

The exhaust muffler part no. 973670 especially designed for the ROTAX engines 912 S / ULS can be used also on the ROTAX engines 912 UL / A / F. Engine performance and specific fuel consumption remain unchanged or are slightly better when using this muffler part no. 973670.

The main advantage is the weight reduction. The weight is 2,2 kg, making this muffler 0,3 kg lighter than the muffler part no. 978482.

By optimizing the design of the muffler part no. 973670 the noise emission may seem subjectively higher compared with muffler part no. 978482. The exact measuring of the actual noise emission can be conducted only when the muffler is installed in the aircraft.

2.2) Exhaust system (on the 914 Series)

The exhaust system on ROTAX engines of the 914 Series collects all gases which accumulate in the combustion chamber of the cylinders and routes them via exhaust bends and exhaust manifold to the exhaust turbocharger. There, the combustion gases drive the exhaust gas turbine to achieve a power increase. See 78-00-00 sec. 2.3. From the exhaust turbocharger, the combustion gases are routed to the muffler, which is fitted for noise reduction.

The exhaust system is made of stainless steel. The exhaust bend is connected to the exhaust manifold by means of slide sleeves to ensure that expansion due to heat can be compensated for.

The exhaust bends are sealed to the cylinder head by the ridge on the exhaust bends. The muffler is supported via the exhaust bracket on the engine suspension frame.

Owing to continuous further development, the exhaust bends were slightly re-worked. The couplings were optimized for their position.
Position of the EGT connections to the exhaust bends for cylinders 3 and 4 were routed such that installation of the new drip trays is possible.

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◆ NOTE: If replacement of any single old part number is necessary, you must replace it with the same old part number. If the old part number is not available, the entire assembly including all 4 pipes and manifold must be replaced with new part numbers. New style pipes and manifold are not interchangeable with old style.

2.3) Turbocharger (only on the 914 Series)

ROTAX engines of the 914 Series are equipped with an exhaust turbocharger which makes use of the energy in the exhaust gas for precompression of the intake air.

The boost pressure in the airbox is controlled by means of an electronically controlled flap (wastegate) on the exhaust gas turbine.

The wastegate is actuated by an electric servo motor via a bowden cable.

2.3.1) Exhaust turbocharger

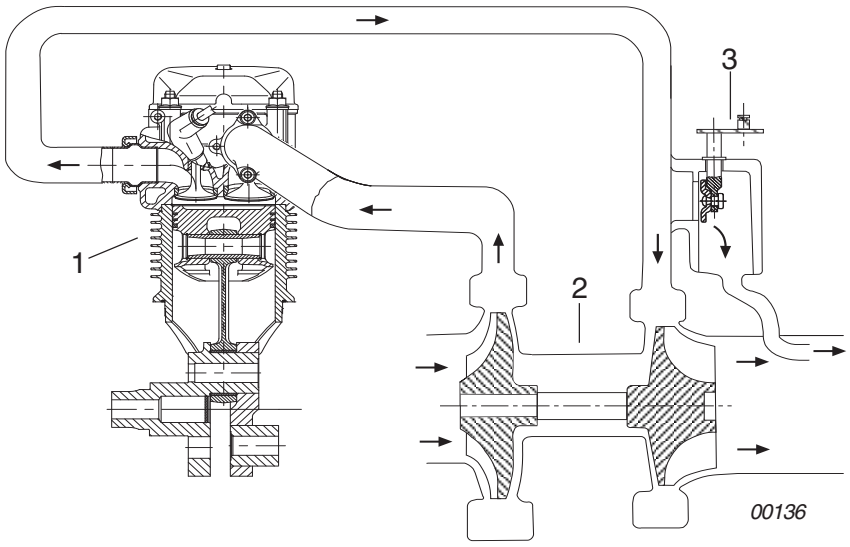
See Fig. 78-1

The exhaust turbocharger is basically an arrangement of two turbo machines, a turbine and a blower, on a common shaft.

The turbine transforms the energy of the hot exhaust gases and drives a blower which aspirates ambient air and transfers it precompressed via the carburetors into the cylinders.

The sole operational connection between engine and turbo is the air and exhaust stream. The speed of the turbo depends mainly on the pressure ratio at the turbine impeller but not directly on engine speed.

Fig. 78-1



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◆ NOTE: Fig. 78 -1 shows a schematic arrangement of a boost pressure control with the wastegate in the exhaust stream

(1) engine
(2) exhaust turbocharger
(3) boost pressure regulating valve (wastegate)

Because of the large speed range of the engine and the varying power requirement, control of the exhaust turbocharger is necessary to achieve the respective nominal pressure in the airbox.

The waste gate directs part of the engine exhaust gases so that they bypass the turbine and flow directly into the exhaust (by-pass).

◆ NOTE: With the wastegate completely open, the engine performance can reach up to approx. 70 kW since not all of the exhaust gases bypass the turbine.

2.4) Connections for instrumentation

■ CAUTION: Consult also the relevant sections on connections for instrumentation in the latest Installation Manual.

2.4.1) Exhaust gas temperature display (optional)

The exhaust gas temperature is monitored by means of 4 sensors on the exhaust manifold. The temperature display device is connected via NiCrNi control lines.

On 912 Series: The manufacturer of the exhaust system must attach or provide the connections M8x1 for installation of the metalsheathed thermocouples, part no. 966370, in the exhaust bends.

On 914 Series: The connection thread M8x1 for attachment of the metalsheathed thermocouples, part no. 966370, are already provided in the exhaust bends.

d04781

NOTES

After completion of installation as described, all the screw connections on the turbocharger bracket, exhaust manifold, exhaust bends and the tension clamp must be tightened to the specified torques. See Fig. 78-3

Tightening torque:

Allen screws	(8) M10x50	turbocharger bracket	40 Nm/ 30 ft.lb
Allen screws	(27) M10x50	exhaust bracket	40 Nm/ 30 ft.lb
hex. screw	(6) M10	tension clamp	20 Nm / 177 in.lb
hex. nuts	(1) M8	exhaust bend flange	12 Nm / 106 in.lb

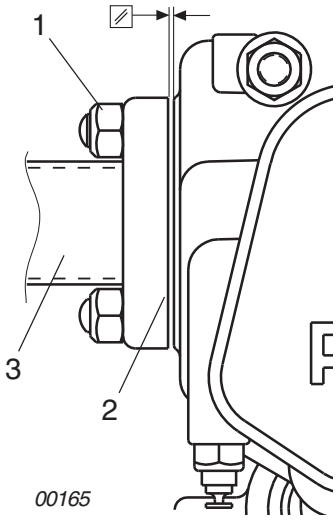
When tightening the exhaust bend flanges, ensure equal distance between flange and cylinder head from top to bottom. The flanges (2) of the exhaust bends (3) must not touch the cylinder heads. See Fig. 78-12

■ CAUTION: If the exhaust flange is deformed, it must be replaced.

After each disassembly, the lock nuts (1) must be replaced with new lock nuts M8.

■ CAUTION: In the high temperature zone of the turbocharger and exhaust system, use exclusively high grade, stainless steel screws.

Fig. 78-12



d04781

3.6) Bowden cable, rope sheave and spring for wastegate control (on the 914 Series)

See Fig. 78-13

3.6.1) Disassembly

Remove tension spring (1) with a suitable tool and cut wire (2) of the Bowden cable.

Loosen set screw of nipple (3) and pull Bowden cable out of the cable retainer (4).

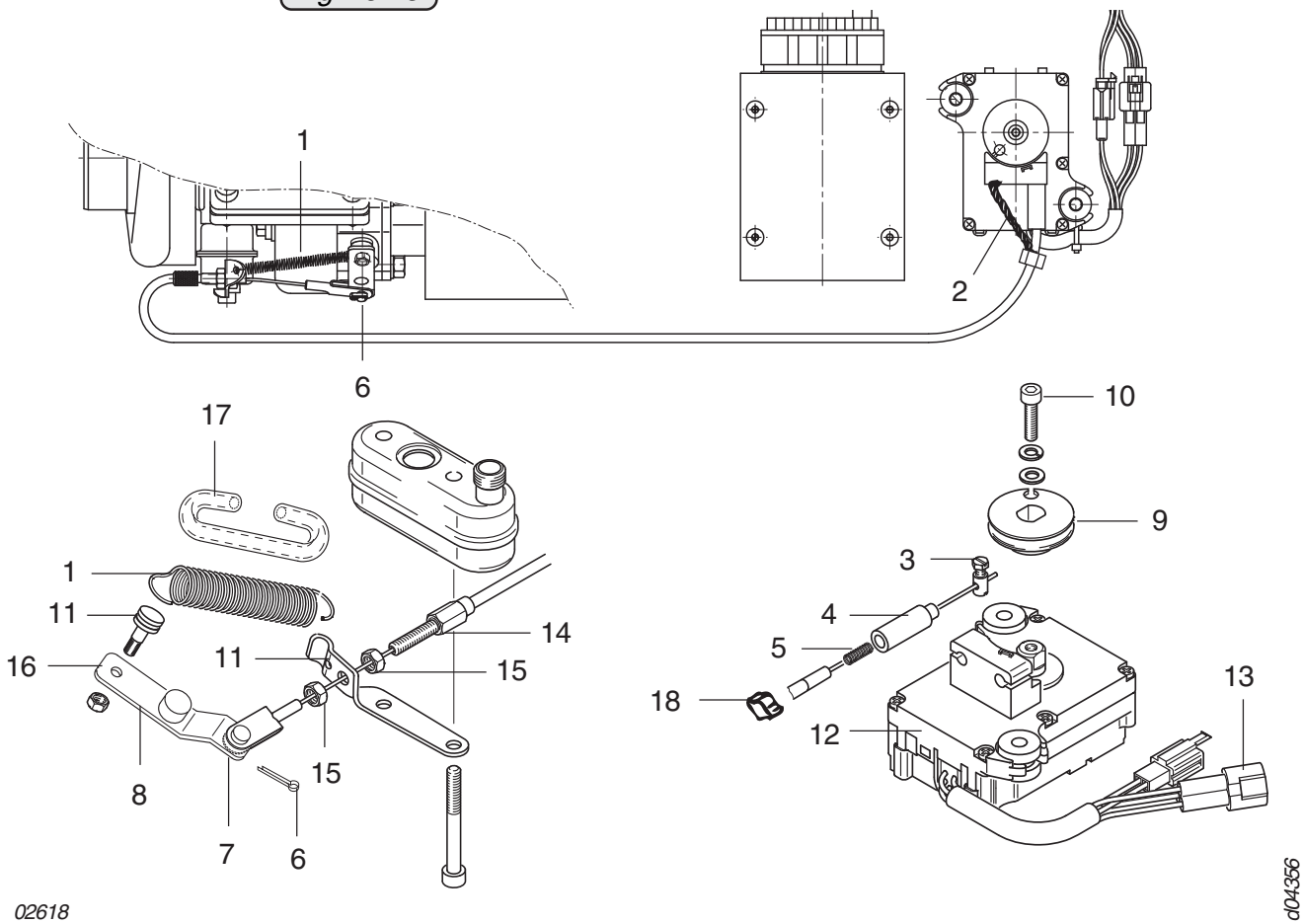
Do not lose the **pressure spring** (5) 5.5/1.2/16.9. Remove spring and store in a safe place.

Remove cotter pin (6) and pin (7) from wastegate lever (8).

Now the Bowden cable can be pulled out from the conduit.

If required, remove rope sheave (9) after removal of the allen screw (10) M5 x 20 along with lock washer and washer.

Fig. 78-13



4.) Wear limits

08473

Description	Code	Reading new		wear limit	wear limit		Readings
		min	max	100%	50%		
Turbocharger							
Axial clearance	TC01			0,025 0,0010 to 0,084 0,0033	0,040 0,0016 to 0,070 0,0028	**actual**	
						renewed	
Radial clearance	TC02			0,056 0,0022 to 0,127 0,0050	0,074 0,0029 to 0,109 0,0043	**actual**	
						renewed	
Rework turbine housing flange	TC03			0,5 0,0020		**actual**	
						renewed	

d04781

NOTES

d04356

2.2) Main oil pump (Engine lubrication circuit)

See Fig. 79-3

The trochoid oil pump sucks the engine oil out of the oil tank (1) via line (2). The oil passes through the oil cooler (3) fitted on the suction side via the oil line (4) to the oil pump rotor (5) **(main oil pump)**, which is driven by the oil pump shaft (6).

The pump forces the oil through the filter mat from the outside to the inside of the oil filter (7). The oil pressure from 1.5 to 5 bar (22 to 72 p.s.i.) is controlled by the pressure relief valve (8). The surplus oil returns to the oil pump rotor via the channel (9).

If the filter mat in the oil filter is completely clogged up, the pressure relief valve (10) will open and lube oil will flow unfiltered to the individual lubrication points. Prevent this situation by all means, using lube oil and filter as specified and carrying out punctual replacement of oil filter.

The oil will then be pumped through the oil duct (11) in the left side of the housing. The 4 hydraulic valve tappets (12) for cylinders 2 and 4 are supplied with oil via this channel. Oil flows to the rocker arm bearing via the hollow push-rod (13) and the oil duct (14). The oil emerging from bore (15) lubricates the valve mechanism and flows through the oil return line (16), into the channel (17) and back to the crankcase.

Forced oil supply from oil duct (11) is also supplied to camshaft bearing (18) CC23, main bearing (19) CC13, the conrod bearing (20) of cylinder 4 and the bronze bush (21) of the backing bearing IH01 in the ignition housing.

In the crankcase sealing surface (22), the oil enters the right crankcase half. As a result, the camshaft bearing (24) CC22, the middle main bearing (25) CC12 and the two conrod bearings (26) and (27) of cylinders 3 and 2 are lubricated via the oil duct (23). This oil duct supplies the hydraulic valve tappets and the valve mechanism of cylinders 1 and 3.

The forced oil supply then reaches the camshaft bearing (28) CC21, the main bearing (29) CC11, the conrod bearing (30) of cylinder 1 and the backing bearing (31) GB01 in the gearbox housing. The electrical connection of the oil pressure gauge is at the oil pressure sensor (32) .

d02628

On the ROTAX 912/914 Series, which is equipped with a hydraulic governor, the governor (35) is supplied with the required forced oil via oil line (33). From the governor flange (34), the oil flows to the gear pump in the governor, which raises the pressure to approx. 23 bar (330 p.s.i.). According to the lever position of the governor, oil is pumped via oil duct (36) and through oil inlet flange (37) and into the hollow propeller shaft (38) to the variable pitch propeller or drained into the crankcase through channel (39), thus changing pitch accordingly. The surplus oil returns back to the crankcase via the duct.

The engine oil emerging from all lubrication points flows to the bottom of the crankcase (40) and is pressed back into the oil tank by the crankcase gases (blow-by – gases) via the ring hose nipple (41) and the oil return line (42). The tangential feed of the returned oil effects separation of oil from air via the screen (43). As a result, the intake system (2) is supplied with oil which is to a large extent free of air.

The oil tank is vented via the connection (44) into a suitable container or to the outside.

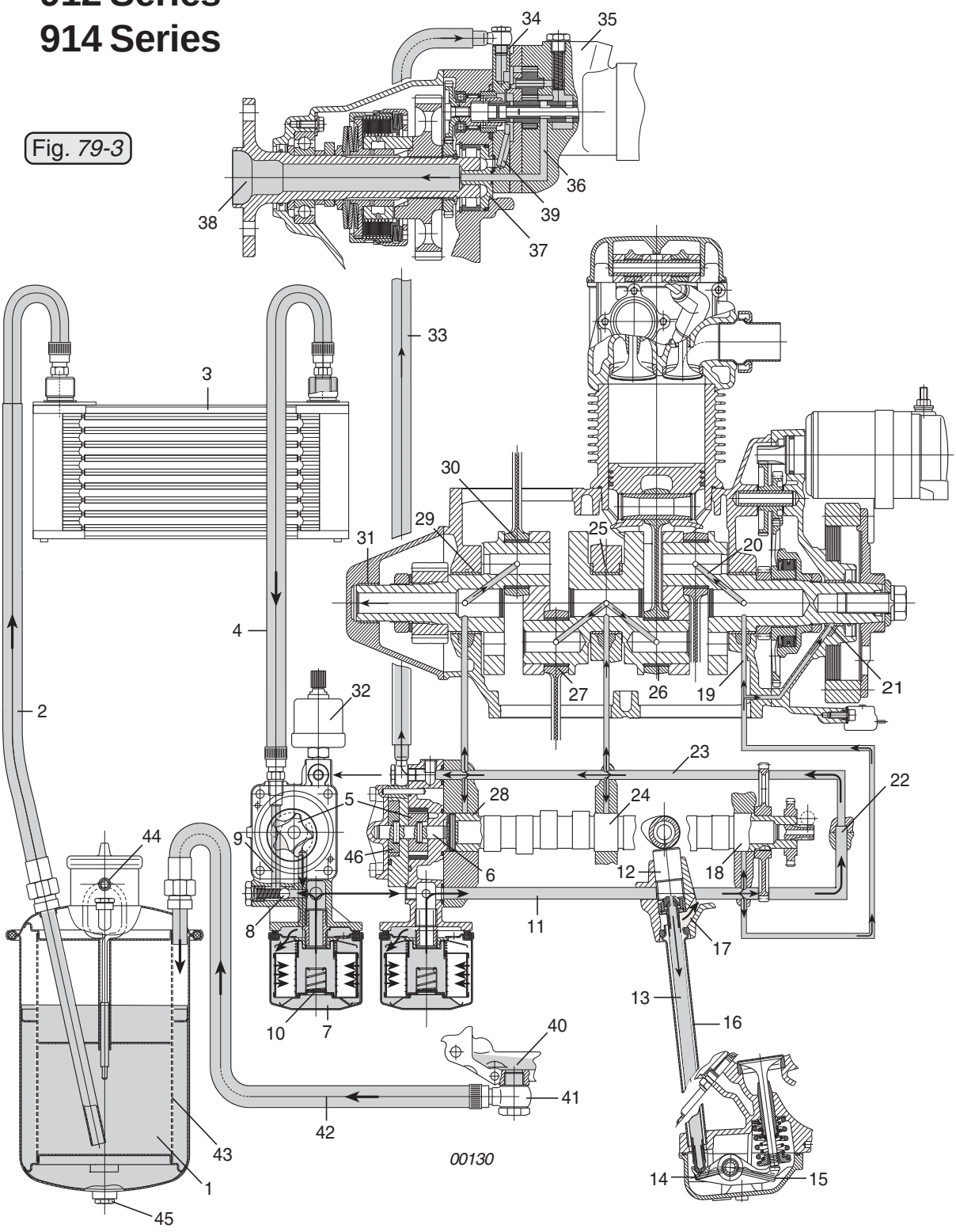
For oil change, the oil is drained by removing drain plug (45).

◆ NOTE: Only on 914 Series: Oil pump rotor (46) of the **suction oil pump.**

d04782

912 Series
914 Series

Fig. *79-3*



d02628

2.3) Suction pump (turbocharger oil circuit, only on 914 Series)

See Fig. 79-4

The suction pump (11) is of the same design as the main oil pump (12) and sits on the extended common pump shaft (15).

The lubrication of the turbocharger shaft, which is supported on plain bearings, is via a separate oil line (2) from the main oil pump.

The choke valve (3) on the entry into the turbocharger housing prevents flooding of the turbocharger (1) with engine oil by gravity after engine stop.

Operation of the pressure valve:

Oil pressure (min. 0.8 bar (11.6 p.s.i.)) keeps the ball valve open against the low spring pressure and the oil flows almost unhindered to the bearing bore. Without oil pressure the valve closes and stops the oil flow.

■ CAUTION: Oil loss combined with heavy smoke emission at engine start is a strong indication of a defective check valve.

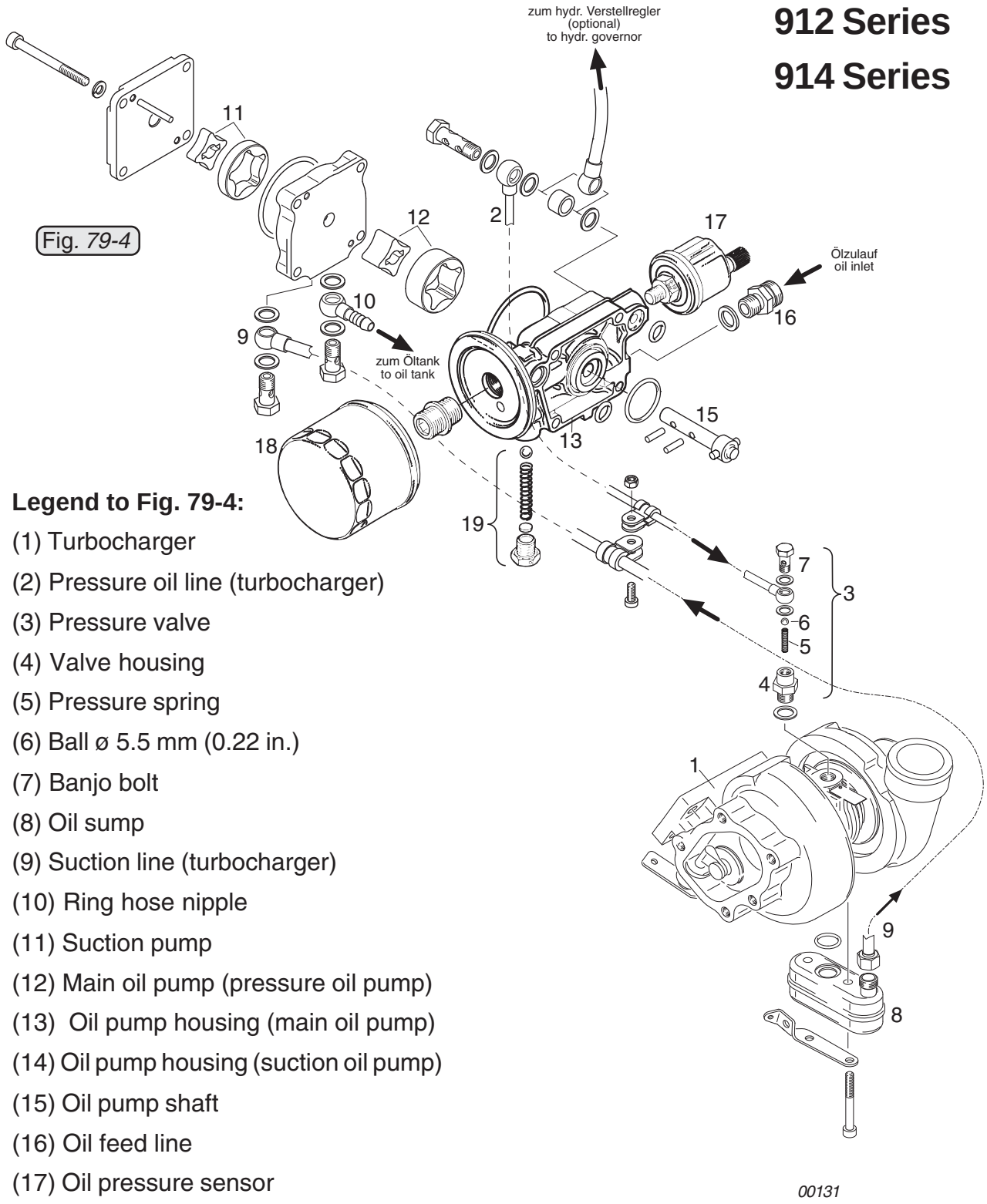
The oil emerging from the bearing bore collects in the oil sump (8). From there, it is sucked off by the suction pump (11) via a separate line (9) and pumped back to the oil tank via the ring hose nipple (10).

◆ NOTE: The suction pump is also a trochoid pump and, like the main oil pump (12), is driven by the common oil pump shaft.

d04782

912 Series
914 Series

Fig. *79-4*



Legend to Fig. 79-4:

(1) Turbocharger
(2) Pressure oil line (turbocharger)
(3) Pressure valve
(4) Valve housing
(5) Pressure spring
(6) Ball ø 5.5 mm (0.22 in.)
(7) Banjo bolt
(8) Oil sump
(9) Suction line (turbocharger)
(10) Ring hose nipple
(11) Suction pump
(12) Main oil pump (pressure oil pump)
(13) Oil pump housing (main oil pump)
(14) Oil pump housing (suction oil pump)
(15) Oil pump shaft
(16) Oil feed line
(17) Oil pressure sensor
(18) Oil filter
(19) Pressure relief valve

d02628

2.4) Magnetic plug

See the corresponding Maintenance Manual (Line Maintenance) for the respective engine type, 912 Series or 914 Series.

◆ NOTE: It is possible to repair the thread of the magnet plug of the crankcase with a helicoil. See section 8.7 of the overhaul manual.

2.5) Drain plug

See the corresponding Maintenance Manual (Line Maintenance) for the respective engine type, 912 Series or 914 Series.

2.6) Connections for instrumentation

■ CAUTION: Consult also the relevant section in the Installation Manual.

2.6.1) Oil pressure indication

Via an electric resistance pick-up attached on oil pump housing with connection to indicating instrument.

2.6.2) Oil temperature indication

The sensor for the oil temperature is fitted in the oil pump housing. The sensor is a thermo switch with changing internal resistance according to oil temperature.

d04782

3.1.5) Oil pump assembly (on 914 Series)

See Fig. 79-6

Lubricate bearing bore for pump shaft in oil pump housing with engine oil and install pump shaft (30).

Push needle pin (26) 4x15.8 into the pump shaft, insert oil pump piston with rotor (24) in main oil pump and turn pump shaft to check it.

Insert O-ring (25) 57-3 and push on oil pump housing (27), push second needle pin (26) 4x15.8 into the pump shaft, insert suction inner and outer rotor (28) of the suction pump. Rotate the pump shaft again to check it.

◆ NOTE: Apply LOCTITE 515 to the crankcase in the area of the crack between the two crankcase halves.

Push both needle pins (23) 4x29.8 through the two pump housings and insert O-ring (29) 46-3. Fit the 2 outer O-rings (13) 11-2.7 and O-ring (14) 30-2.5 in the oil pump housing and fit it to the crankcase.

◆ NOTE: Turn oil pump shaft until the drive pin (31) engages in the camshaft. Tighten oil pump cover (22) crosswise and by hand evenly with allen screws (12) M6x65 and lock washers. After this tighten allen screws (12) crosswise. Tightening torque with oiled thread 15 Nm (133 in.lb).

Fit ball 8.5 mm (0.33 in.) (21), pressure spring (20) 39.5 mm (1.55 in.) long and screw plug (18) M12x1. Tighten oiled thread with a torque of 15 Nm (133 in.lb).

■ CAUTION: The adjusting shim (19) is not supplied as standard equipment. It is only fitted if a test run reveals that the oil pressure is too low.

If the oil filter nipple (15) has been removed, retighten it to 60 Nm (44.3 ft.lb). Slightly lubricate the rubber seal for oil filter (11) with engine oil. Screw on oil filter by hand until it touches the oil filter housing. Then tighten oil filter by an extra 3/4 turn.

◆ NOTE: Depending on the model a hose nipple or a screw socket for either a metric connection or a UNF thread is installed.

d04782

Tighten the ring hose nipple with 15 Nm (133 in.lb). In the case of a model with a screw socket tighten with 25 Nm (18.5 ft.lb). Tighten oil temperature sensor (16) with LOCTITE 243 and a torque of 7 Nm (62 in.lb).

Also fit oil pressure sensor (17) secured with LOCTITE 243. Tightening torque 15 Nm (133 in.lb). Grease the threads of the banjo bolts (6) and (2) and tighten with 12 Nm (106 in.lb).

3.2) Pressure check valve (only on 914 Series)

See Fig. 79-14.

Remove banjo bolt (1) M8 with sealing rings (2) 8x13.

◆ NOTE: The valve housing (3) is only removed in the event of damage or for cleaning.

Remove ball (4) 5.5 and pressure spring (5), 22 mm long, from the valve housing.

◆ NOTE: The banjo bolt together with the ball and spring serve as a pressure check valve. For further information, see 79-00-00 sec. 2.3. At present it is possible to control the pressure check valvue by testing for an opening pressure (via oil) of 0.4 bar (+/- 0.05)

Clean all components and inspect them visually.

Also check thread and flange surface of turbocharger housing.

If there is leakage at the valve seat (6), it can be reworked with valve lapping paste or other suitable method. If necessary, replace banjo bolt.

Reassembly in reverse order.

Screw valve housing (3) with sealing ring (7) 12x18 into turbocharger housing and tighten to 25 Nm (18.5 ft.lb).

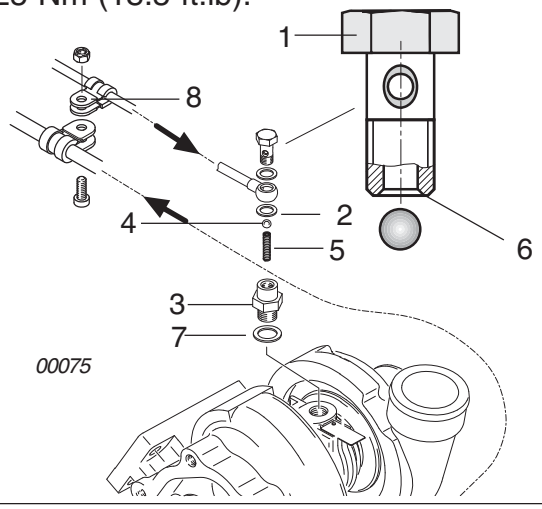


Fig. 79-14

d04782

■ CAUTION: If the ball (4) installed under the pressure spring (5), the oil circuit is interrupted and the turbocharger will be destroyed.

Insert pressure spring (5) and ball (4).

The pressure oil line (8) is attached with the banjo bolt (1) and sealing rings (2) on both sides. Tightening torque 10 Nm (90 in.lb).

◆ NOTE: For recognition the banjo bolt is either marked with a blue color or reads the label “OIL”.

3.3) Oil sump (only on 914 Series)

See Fig. 79-15

◆ NOTE: The oil sump (1) is only removed in the event of damage or for cleaning.

Remove tension spring from wastegate flap with a suitable tool.

Release collar nut (2) of the turbo oil suction line (3). Remove the 2 allen screws (4) M6x55 and take off cable support (5), oil sump (1) and O-ring (6) 9x2.3.

Clean all components and check them visually. Also check thread and flange surface of turbo charger housing. In the event of damage, replace oil sump.

Reassembly in reverse order.

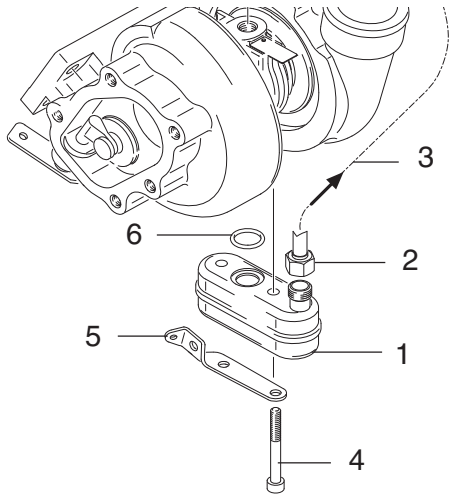
The oil sump (1) is attached with the O-ring (6), cable support (5) and 2 allen screws (4) M6x55.

Tighten collar nut (2) of the turbo oil suction line to 20 Nm (180 in.lb).

Secure the allen screws (4) with wire.

Fig. 79-15

00075



d04782

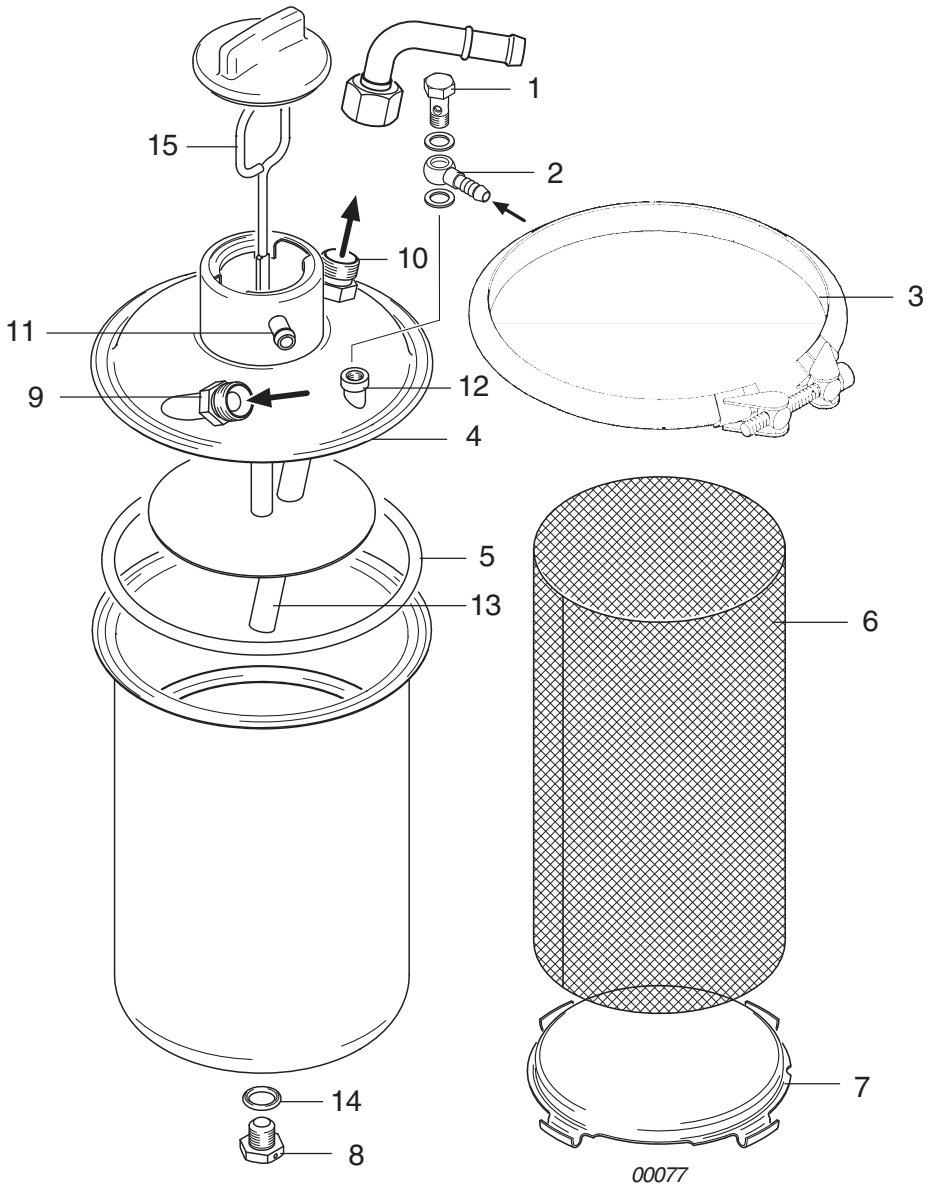
3.4) Oil tank

See Fig. 79-19

Detach oil lines. Remove banjo bolt (1) M10 and remove ring hose nipple (2) with sealing rings 10x14.

See latest Maintenance Manual "Line Maintenance“ for the respective engine type.

Fig. 79-16



3.9.2) Oil pressure sensor

See Figs. 79-19, 79-20 and 79-21.

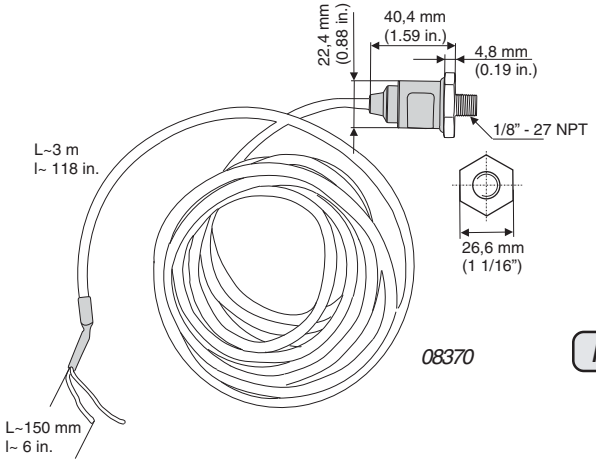
The sensor (2) for measurement of the oil pressure is screwed into the oil pump housing.

The range of the sensor is from 0 to 10 bar (0 to 145 p.s.i) This range (3) is indicated on the wrench flats of the sensor.

■ CAUTION: For this reason, the pressure range of the display instrument must be adjusted to the pressure range of the sensor. If this is not done, an incorrect oil pressure will be displayed.

Due to further develepment a new oil pressure sensor has been introduced. See therefore the latest issue of Service Instruction „Running Modifications“ SI-912-020 and SI-914-022 respectively.

New Version



Old Version

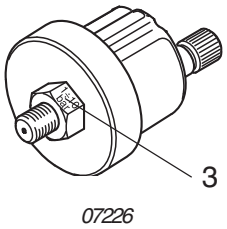


Fig. 79-20

Tightening torque: 10 Nm (90 in.lb)

The operating pressure must remain within the specified limits. If this is not the case, check

- the lubrication system (see corresponding Maintenance Manual (Line Maintenance) for the respective engine type, 912 Series or 914 Series.)
- oil pressure sensor
- indicating instrument
- wiring connections
- sensor cable

◆ NOTE: Grounding connection of the sensor is direct via the oil pump housing.

d04782

For sensor resistance see following graph showing sensor resistance over pressure. Compare pressure gauge with a calibrated instrument.

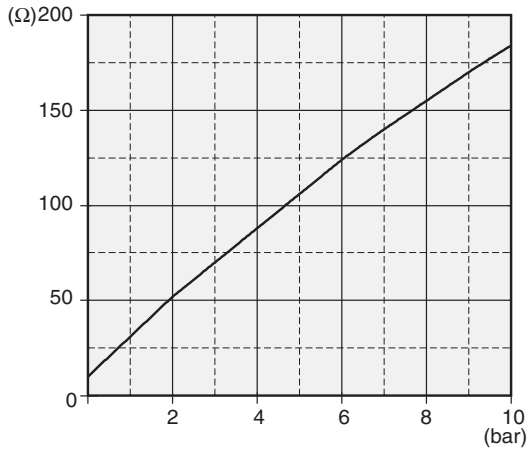
■ CAUTION: The graph resistance over pressure has been determined, and is effective at the following conditions only.

ambient temperature:	20 °C (68 °F)
voltage:	12 V
deviation:	max ± 5%

After removal of oil pressure sensor, clean the thread. Apply LOCTITE 243 to thread of sensor and tighten to 15 Nm (133 in.lb).

Fit sensor. See 79-00-00 sec. 3.1.5..

Fig. 79-21



00229

d02628

3.4) Electric starter — reassembly

See Figs. 80-3, 80-4, 80-5, 80-6 and 80-7.

◆ NOTE: The following work steps apply to both starter models (HD and standard starter).

Determine the required number of compensating shims (6) for the axial clearance, see dimension (ES08) of the rotor (5).

See 80-00-00 sec. 4.

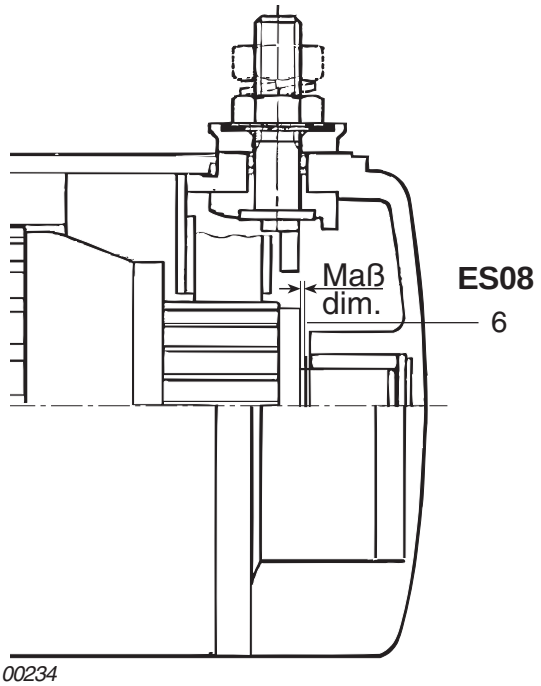
Grease oil seal (20), the ball bearing (10) and the bearing bushing (13). Insert rotor (5) into the bearing flange (1), fit new O-ring 62x1.5 (18) and put starter housing (2) over rotor.

Fit the brush holder (4) with the carbon brushes (14) onto the rotor. Push compensating shims (6) onto the rotor shaft, insert the positive-pole carbon brush (23) into the rotor bearing and then fit the complete rotor bearing (3) with new O-ring 62x1.5 onto the starter housing.

◆ NOTE: Ensure correct positioning and engagement of the positioning noses.

The HD starter is screwed together with the allen screws (24) M5x180, tightened to a torque of 6 Nm (53 in.lb).

Fig. 80-7



d04798

3.5) Electric starter — installation

3.5.1) Standard starter

See Fig. 80-1

Lightly grease the centering bore (9) in the ignition housing (8). Push complete electric starter (6) with new O-rings (5) 4.7x1.4 and distance sleeves (4) into the ignition housing (8).

◆ NOTE: Take care that the electric starter is not pushed apart as you do so.

Attach electric starter with lock washer (2) A5 and hex. nut (1) M5 to the crankcase, fix to ignition housing with a tension clamp (7). Tighten combined nut of the plus terminal connection to a tightening torque of 4 Nm (35 in.lb).

3.5.2) HD starter

See Fig. 80-2

Lightly grease the centering bore (9) in the ignition housing (6). Push complete electric starter (4) into the ignition housing (6). Tighten evenly with washer (3), spring (2) and hex. nut (1) M8 to a torque of 6 Nm (53 in.lb) and then attach to the ignition housing with the tension clamp (5).

■ CAUTION: The allen screw (7) M5x180 is only for "internal“ attachment of the starter components. During assembly on the ignition housing, the allen screw (7) must not be turned, as the position of the rotor bearing (8) could be changed. The marks on the rotor bearing and on the starter housing must correspond.

d02629

4) Wear limits

◆ NOTE: The wear limits apply to both configurations of the electric starter, standard and HD.

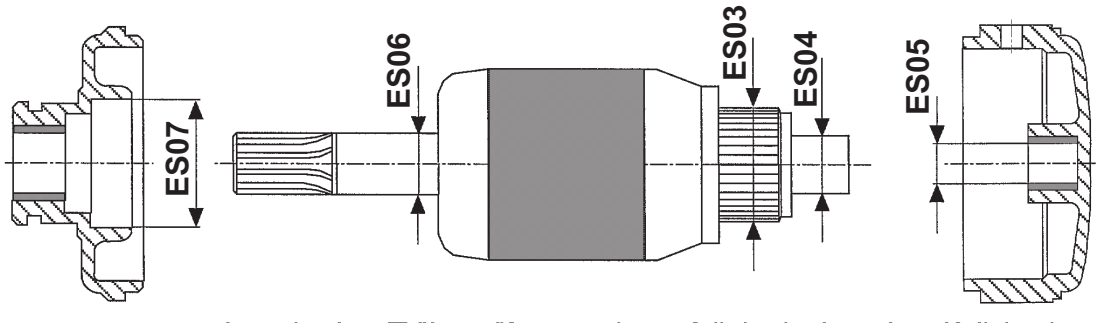


Fig. 80-8 07449

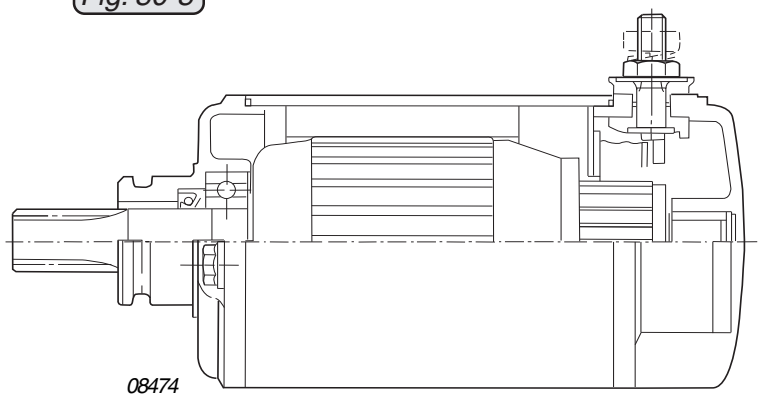


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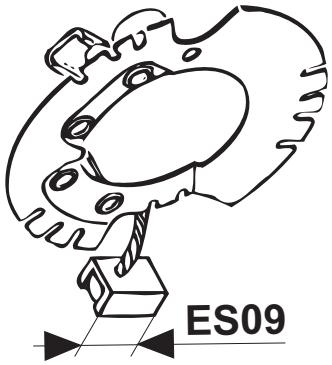
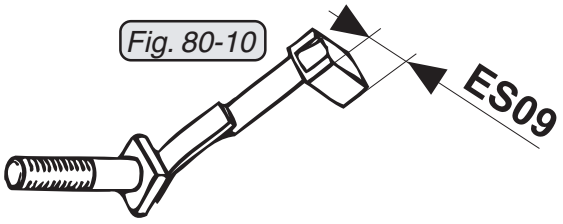
Fig. 80-9

standard configuration



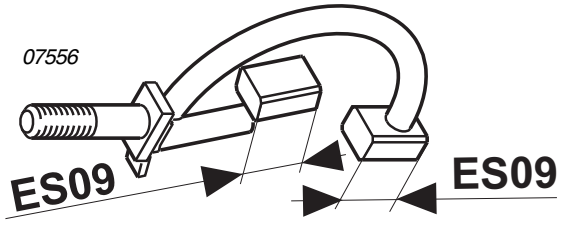
07555

Fig. 80-10



HD configuration

Fig. 80-11 07556



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08585

Description	Code	Reading new min	Reading new max	wear limit 100%	wear limit 50%		Readings
Electric starter							
Commutator	ES03	28,0 1,102		27,5 1,083		actual	
						renewed	
Armature shaft	ES04	9,79 0,3854		9,75 0,3838		actual	
						renewed	
Armature bushing	ES05	9,82 0,3866		9,86 0,3882		actual	
						renewed	
Bearing seat on shield	ES07	32,000 1,2598		32,069 1,2626		actual	
						renewed	
Axial clearance	ES08	0,1 0,004	0,4 0,016			actual	
						renewed	
Length of plus brush	ES09	12,0 0,472		8,5 3,347		actual	
						renewed	
Length of minus brush	ES09	12,0 0,472		8,5 3,347		actual	
						renewed	
Radial clearance armature shaft/ armature bushing	ES05/ ES04	0,0000 0,0000	0,03 0,012	0,11 0,0043	0,07 0,0028	actual	
						renewed	
Radial clearance bearing seat on shield/roller bearing outer diameter		0,00 0,0000		0,06 0,0024	0,03 0,0012	actual	
						renewed	
Press fit bearing seat on armature shaft/ roller bearing inner diameter		0,020 0,0008		0,000 0,0000		actual	
						renewed	

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