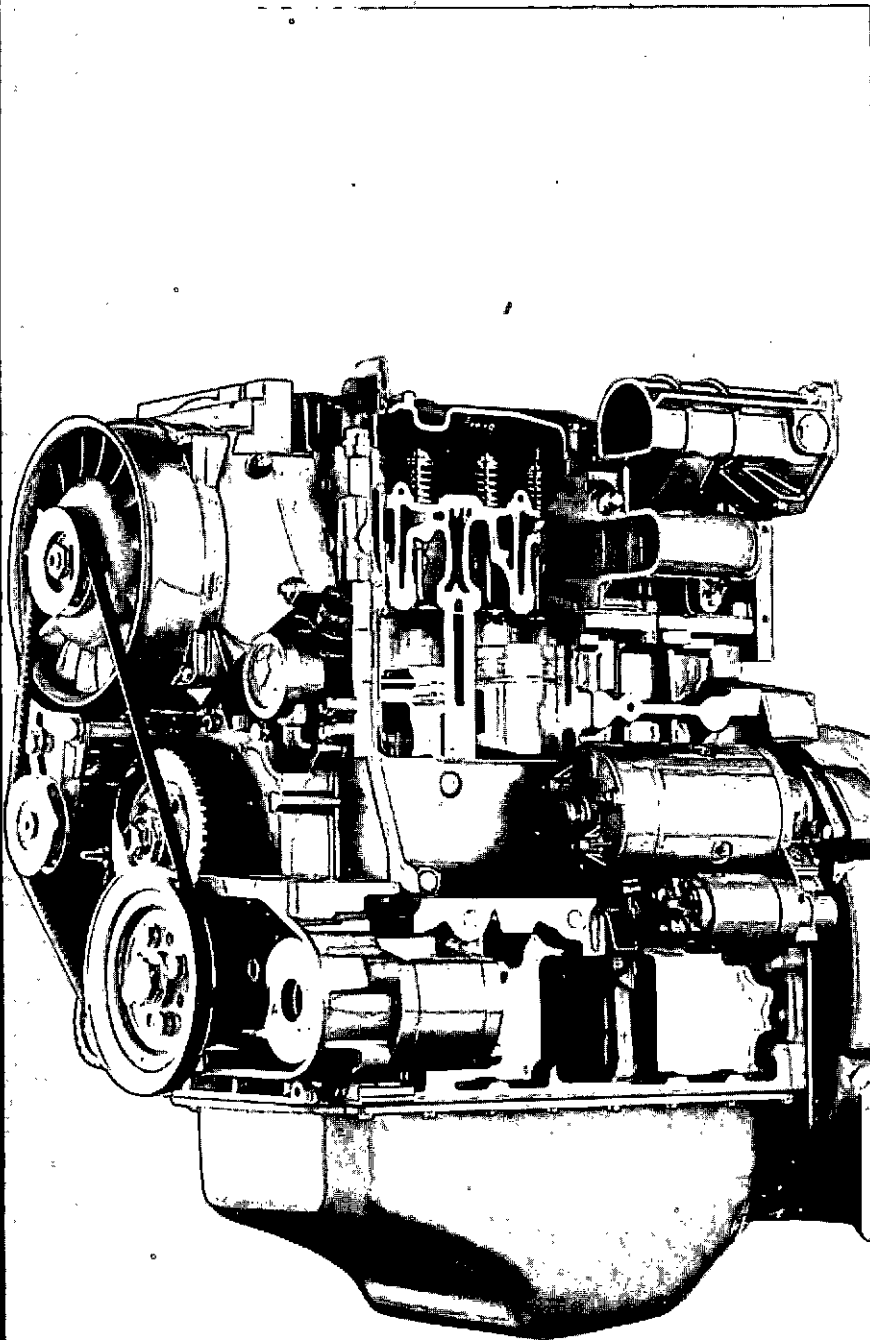




Workshop Manual B/FL 1011/T



Contents and lay-out: Department AZ-MD
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1st Edition, 10 / 1988

In view of the constant improvements to our engines, the specification data and other technical information included in this Workshop Manual are subject to change. No part of this Manual may be reproduced in any form or by any means without our written permission.

Werkstatthandbuch B/FL 1011/T
Workshop Manual B/FL 1011/T
Manuel d'Atelier B/FL 1011/T
Manual de Taller B/FL 1011/T



0291 1942

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FOREWORD

Reliable engine operation is dependent on properly executed repairs as well as adjustment work.

This Workshop Manual describes the appropriate operations for any repair and adjustment work on the engine and engine components. It is presumed that this work will be carried out by qualified personnel.

The Manual has been made up in a manner which ensures quick comprehension of the contents, i. e. graphic symbols have been placed beside the brief text passages, which visualize the working operation concerned.

Aspects of operation and maintenance are dealt with in the respective Engine Operation Manual.




























For spare parts orders the spare parts catalogue should be referred to.

This Workshop Manual is not regularly updated. Any engineering changes having been introduced in the meantime will be considered in the next issue. Therefore please refer to the information announced in our Technical Circulars when carrying out repairs.

General:

- Please read carefully and observe the instructions given in this Workshop Manual. This will avoid accidents and will help to ensure that your engine always functions properly and reliably.
- Make sure that this Workshop Manual is readily available for everybody carrying out repair or adjustments and that the instructions are well understood.
- Non-compliance with given instructions may result in functional trouble and engine damage as well as personal injury for which the manufacturer shall not accept any liability.
- The relevant regulations for prevention of accidents as well as other general and legal rules regarding safety and industrial medicine are to be complied with.
- A prerequisite for successful repair is that all required equipment, hand and special tools are available and in perfect condition.
- Optimal operation economy, reliability and durability of the engine can be ensured only when using genuine DEUTZ parts.
- Remember that such engine components as springs, clips, snap rings, etc. involve the risk of injury if not handled with care.
- Engine overhauls must be based on the relevant engine duty schedule - as defined by the equipment manufacturer. For conversions only such parts should be used which DEUTZ develops and supplies specifically for this purpose.

Key to Symbols

| | | | |
|---|--|--|---|
|  | Disassembly of assembly groups |  | Guard against personal injury Indication of hazard |
|  | Reassemble to form assembly group |  | Guard against material damage Damage to parts |
|  | Remove obstructing parts |  | Prop up - Support - Hold |
|  | Reinstall - Remount parts which had obstructed disassembly |  | Oil |
|  | Attention! Important notice! |  | Grease |
|  | Check - Adjust e. g. torque, dimensions, pressures, etc. |  | Mark before disassembly, observe marks when reassembling |
|  | Special tool |  | Balance Eliminate any imbalance |
|  | Note direction of installation |  | Filling - Topping up - Refilling e. g. oil, cooling water, etc. |
|  | Visual inspection |  | Drain off e. g. oil, cooling water, etc. |
|  | Possibly still serviceable Renew if necessary |  | Loosen - Release e. g. loosening a clamping device |
|  | Renew at each reassembly |  | Tighten - Clamp e. g. tightening a clamping device |
|  | Unlock - Lock e. g. split pin, locking plate, etc. |  | Vent |
|  | Lock - Adhere e. g. with liquid sealant |  | Machining process |
| | |  | See Technical Data (For inst. 67 as indication of the line) |

Specification Data

1

Inspection, tests, checking, adjusting

2

Repair of components

3

Disassembly and reassembly of complete engine

4

Turbocharger

5

Tools

6

Specification data

1


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Specification data

000 General engine data

1

|  | English | F2L 1011 | F3L 1011 | F4L 1011 | 8F4L 1011 T |
|---|--|---|----------|----------|-------------|
| 001 | Engine weight w/o starter w.generator ca. kg | 162 | 202 | 242 | 248 |
| 002 | Engine swept volume cm ³ | 1366 | 2049 | 2732 | |
| 003 | Bore mm | 91 | | | |
| 004 | Stroke mm | 105 | | | |
| 005 | Direction of rotation | When facing flywheel left counter-clockwise | | | |
| 006 | Rated speed max. rpm | 3000 / 3600 | | | 2500 |
| 007 | Minimum idle speed rpm | 900 | | | |
| 008 | Working cycle | Four-stroke diesel | | | |

000 General engine data


|  | English | F2L 1011 | F3L 1011 | F4L 1011 | BF4L 1011 T |
|---|--|------------------|-----------|---------------|-------------|
| 009 | Combustion system | Direkt injection | | | |
| 010 | Compression ration | 18,5 : 1 | | | 17 : 1 |
| 011 | Compression pressure bar | 25 - 30 | | | 22 - 27 |
| 012 | Firing order | 1 - 2 | 1 - 2 - 3 | 1 - 3 - 4 - 2 | |
| 020 | Dimensions of engine incl. standard flywheel | | | | |
| 021 | Max. length mm | 522 | 630 | 741 | |
| 022 | Max. width mm | 444 | | | 490 |
| 023 | Max. height mm | 691 | | 711 | |

1


Specification data

100 Fuel injection system

1

|  | English | F2L 1011 | F3L 1011 | F4L 1011 | BF4L 1011 T |
|---|--|---------------------------------------|----------|----------|-------------|
| 110 | Fuel injection pump | | | | |
| 111 | Make, model | OMAP | | | |
| 112 | Min. pres. that must be attained with abt. 5 rot. of crankshaft bar | 300 | | | |
| 113 | Pressure for testing tightness of relief valve bar | 150, drop to 140 in a minute permiss. | | | |
| 120 | Governor | | | | |
| 121 | Make, model | KHD | | | |
| | | | | | |
| | | | | | |


100 Fuel injection system

|  | English | F2L 1011 | F3L 1011 | F4L 1011 | BF4L 1011 T |
|---|---|---------------------|----------|----------|---|
| 130 | Injection nozzle | | | | |
| 131 | Make, model | OMAP | | | |
| 132 | Opening pres. (checking injector for re-use) bar | 245 ^{1) 8} | | | 245 ^{1) 8} 1) 205 ^{1) 8} |
| 133 | Opening pressure (new condition) bar | 250 ^{1) 8} | | | 250 ^{1) 8} 1) 210 ^{1) 8} |
| | | | | | |

1) Engines for Messrs Holder


Specification data

100 Fuel injection system

|  | English | F2L 1011 | F3L 1011 | F4L 1011 | 8F4L 1011 T |
|---|--|----------|---------------------------------------|----------|-------------|
| 140 | Commencement of fuel delivery | | | | |
| 141 | Static <u>w/o</u> advance / retard unit | | | | |
| 145 | Installation dimension of injection pump mm | | W 1800 57,3 W 1801 56,8 1) 57,0 | | 58,0 |
| | | | | | |

1) Engines for Messrs Holder


200-400 Cylinder unit

|  | English | F2L 1011 | F3L 1011 | F4L 1011 | BF4L 1011 T |
|---|--|----------|---------------------|----------|-------------|
| 200 | Cylinder head | | | | |
| 210 | Valve guide | | | | |
| 211 | Valve guide Outer dia. mm | | | | |
| 212 | Valve guide bore in cyl. head mm | | | | |
| 213 | Valve guide Inner dia. mm | | 8 ^{+0.025} | | |
| 220 | Valve seat insert | | | | |
| 221 | Valve seat insert Outer dia. Inlet mm | | 42,67 ±0.005 | | |
| 222 | Number of oversizes | | 1 | | |


1

Specification data

200-400 Cylinder unit

|  | English | F2L 1011 | F3L 1011 | F4L 1011 | BF4L 1011 T |
|---|--|---------------|----------|----------|-------------|
| 223 | Each oversize | 0,2 | | | |
| 224 | Valve seat Outer dia. Exhaust mm | 37,07 ± 0,005 | | | |
| 225 | Number of oversize | 1 | | | |
| 226 | Each oversize | 0,2 | | | |
| 227 | Valve seat insert bore Inlet mm | 42,6 + 0,03 | | | |
| 228 | Valve seat insert bore Exhaust mm | 37 + 0,03 | | | |
| 230 | Valve | | | | |
| 231 | Valve stem dia. Inlet mm | 7,98 - 0,015 | | | |


200-400 Cylinder unit

|  | English | F2L 1011 | F3L 1011 | F4L 1011 | BF4L 1011 T |
|---|---|------------------------|----------|----------|-------------|
| 232 | Valve stem dia Exhaust mm | 7,96 ^{-0,015} | | | |
| 233 | Valve stem clearance Inlet standard mm | 0,02 - 0,06 | | | |
| 234 | Valve stem clearance Inlet Wear limit mm | 0,12 | | | |
| 235 | Valve stem clearance Exhaust standard mm | 0,04 - 0,08 | | | |
| 236 | Valve stem clearance Exhaust Wear limit mm | 0,15 | | | |
| 237 | Valve head Ø Inlet mm | 40,1 ±0,1 | | | 40,5 ±0,1 |
| 238 | Valve head Ø Exhaust mm | 34,9 ±0,1 | | | |
| | | | | | |

1


Specification data

200-400 Cylinder unit

|  | English | F2L 1011 | F3L 1011 | F4L 1011 | BF4L 1011 T |
|---|--|----------|----------|----------|-------------|
| 239 | Valve seat width Inlet mm | 1,7 ±0,4 | | | 1,58 ±0,4 |
| 240 | Valve seat width Exhaust mm | 1,7 ±0,4 | | | |
| 241 | Seat angle Inlet deg. | 45 | | | 30 |
| 242 | Seat angle Exhaust deg. | 45 | | | |
| 243 | Marg. thickness Inlet standard mm | 1,25 | | | 1,87 |
| 244 | Marg. thickness Exhaust standard mm | 1,85 | | | |
| 245 | Marg. thickness Inlet Wear limit mm | 0,8 | | | 1,4 |
| 246 | Marg. thickness Exhaust Wear limit mm | 1,2 | | | |

200-400 Cylinder unit


1

|  | English | F2L 1011 | F3L 1011 | F4L 1011 | BF4L 1011 T |
|---|-------------------------------------|----------|----------|----------|-------------|
| 250 | Valve spring | | | | |
| 251 | Number per valve | | | 1 | |
| 252 | Windings total | | | 6,2 | |
| 253 | Length unloaded standard mm | | | 44,3 | |
| 254 | Length unloaded Fatigue limit mm | | | | |
| 260 | Standard Valve clearance | | | | |
| 261 | Inlet mm | | | 0,3 | |
| 262 | Exhaust mm | | | 0,5 | |

Specification data


200-400 Cylinder unit

1

|  | English | F2L 101.1 | F3L 101.1 | F4L 101.1 | BF4L 101.1 T |
|---|-----------------------------|-----------|-----------|-----------|--------------|
| 270 | Distances to be checked | | | | |
| 271 | Valve recess standard mm | 1 ± 0.13 | | | 0,8 ± 0.13 |
| 272 | Wear limit mm | 1,53 | | | 1,3 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

200-400 Cylinder unit


1

|  | English | F2L 1011 | F3L 1011 | F4L 1011 | BF4L 1011 T |
|---|-----------------------|----------|----------|----------|-------------|
| 280 | Cylinder head studs | | | | |
| 281 | Length standard mm | 185 ±0.8 | | | |
| 282 | Length limit mm | | | | |
| | | | | | |
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Specification data

200-400 Cylinder unit

1

|  | English | F2L 1011 | F3L 1011 | F4L 1011 | BF4L 1011 T |
|---|-----------------------|----------|----------|----------|-------------|
| 300 | Cylinder | | | | |
| 301 | Bore standard mm | 91 +0,02 | | | |
| 302 | Bore Wear limit mm | 0,1 | | | |
| 303 | Number of oversizes | | | | |
| 304 | Each oversize mm | | | | |
| | | | | | |
| | | | | | |
| | | | | | |


200-400 Cylinder unit

|  | English | F2L 1011 | F3L 1011 | F4L 1011 | BF4L 1011 T |
|---|---|--|----------|----------|--|
| 400 | Piston | | | | |
| 401 | Diameter standard mm | 90,93 | | | 90,92 |
| 402 | Number of oversizes | | | | |
| 403 | Each oversize mm | | | | |
| 404 | Distance between piston and cylinder head mm | | | | |
| 405 | Bore for piston pin mm | 26 $\begin{matrix} +0,01 \\ +0,004 \end{matrix}$ | | | 30 $\begin{matrix} +0,01 \\ +0,004 \end{matrix}$ |
| 406 | Piston pin diameter mm | 26 -0,005 | | | 30 -0,005 |
| | | | | | |

1


Specification data

200-400 Cylinder unit

|  | English | F2L 1011 | F3L 1011 | F4L 1011 | BF4L 1011 T |
|---|---------------------------|--|----------|----------|-------------|
| 410 | Piston ring groove height | | | | |
| 411 | 1st ring mm | <div style="display: flex; justify-content: space-around;"> 2,0 ^{+0,10} _{+0,08} </div> | | | |
| 412 | 2nd ring mm | <div style="display: flex; justify-content: space-around;"> 2,0 ^{+0,07} _{+0,05} 2,5 ^{+0,08} _{+0,06} </div> | | | |
| 413 | 3rd ring mm | <div style="display: flex; justify-content: space-around;"> 3,0 ^{+0,04} _{+0,02} 3,5 ^{+0,05} _{+0,03} </div> | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

200-400 Cylinder unit


1

|  | English | F2L 1011 | F3L 1011 | F4L 1011 | BF4L 1011 T |
|---|---|--------------|----------|----------|-------------|
| 420 | Piston rings | | | | |
| 421 | Axial clearance 1st ring standard mm | 0,09 - 0,12 | | | |
| 422 | Wear limit mm | 0,2 | | | |
| 423 | Axial clearance 2nd ring standard mm | 0,07 - 0,102 | | | |
| 424 | Wear limit mm | 0,16 | | | |
| 425 | Axial clearance 3rd ring standard mm | 0,04 - 0,075 | | | |
| 426 | Wear limit mm | 0,12 | | | |
| | | | | | |


Specification data

200-400 Cylinder unit

1

|  | English | F2L 1011 | F3L 1011 | F4L 1011 | BF4L 1011 T |
|---|---------------------------------------|------------|----------|----------|-------------|
| 429 | Gap 1st ring standard mm | 0,3 - 0,5 | | | 0,3 - 0,45 |
| 430 | Wear limit mm | 0,8 | | | |
| 431 | Gap 2nd ring standard mm | 0,8 - 1,05 | | | |
| 432 | Wear limit mm | 1,8 | | | |
| 433 | Gap 3rd ring standard mm | 0,45 - 0,7 | | | |
| 434 | Wear limit mm | 1,2 | | | |
| | | | | | |
| | | | | | |

500-700 Motion parts


|  | English | F2L 1011 | F3L 1011 | F4L 1011 | BF4L 1011 T |
|---|---------------------------------|----------|----------|--|-------------|
| 500 | Crankshaft | | | | |
| 510 | Crankpin | | | | |
| 511 | Pin width standard mm | | | 31 | |
| 512 | Pin diameter standard I mm | | | 55 ^{-0,01} _{-0,03} | |
| 513 | Pin diameter standard II mm | | | | |
| 514 | Each undersize mm | | | 0,25 | |
| 515 | Limit for undersize mm | | | 54,5 ^{-0,01} _{-0,03} | |
| 516 | Pin ovality Waer limit mm | | | 0,01 | |

1

Specification data


500-700 Motion parts

1

|  | English | F2L 1011 | F3L 1011 | F4L 1011 | BF4L 1011 T |
|---|---|----------------------|----------|----------|-----------------------|
| 573 | Each oversize mm | 0,4 | | | |
| 574 | Limit for oversize mm | 35,7 $-0,133$ | | | |
| 575 | Crankshaft axial clearance standard mm | 0,1 - 0,3 | | | |
| 576 | Wear limit mm | 0,4 | | | |
| 600 | Connecting rod | | | | |
| 601 | Centre distance from small eye bush to big eye bore mm | 173 $\pm 0,03$ | | | |
| 602 | Bore for piston pin bush mm | 29 $+0,02$ | | | 33 $+0,02$ |
| 603 | Piston pin bush Outer dia. mm | 29 $+0,1$ $+0,06$ | | | 33 $+0,11$ $+0,07$ |

500-700 Motion parts


1

|  | English | F2L 1011 | F3L 1011 | F4L 1011 | BF4L 1011 T |
|---|---|---|----------|----------|---|
| 604 | Piston pin bush (pressed in) Inner dia. mm | $26 \begin{matrix} +0,035 \\ +0,025 \end{matrix}$ | | | $30 \begin{matrix} +0,035 \\ +0,025 \end{matrix}$ |
| 605 | Piston pin clearance mm | 0,025 - 0,04 | | | |
| 606 | Wear limit mm | 0,08 | | | |
| 607 | Bore for big end bearing mm | 58,5 $+0,02$ | | | |
| 608 | Big end bearing shells Inner dia. standard I mm | 55,004 - 55,04 | | | |
| 609 | Big end bearing shells Inner dia. standard II mm | | | | |
| 610 | Each undersize mm | 0,25 | | | |
| 611 | Limit for undersize mm | 54,504 - 54,54 | | | |

Specification data


500-700 Motion parts

1

|  | English | F2L 1011 | F3L 1011 | F4L 1011 | BF4L 1011 T |
|---|--|----------------------|----------|----------|-------------|
| 612 | Big end bearing radial clearance standard mm | 0,024 - 0,078 | | | |
| 613 | Big end bearing radial clearance Wear limit mm | 0,12 | | | |
| 614 | Big end bearing width mm | 25,6 _{-0,3} | | | |
| 615 | Connecting rod width mm | 27 _{-0,06} | | | |
| 616 | Connecting rod axial clearance, standard mm | 0,2 - 0,56 | | | |
| 617 | Connecting rod axial clearance Wear limit mm | 0,8 | | | |
| | | | | | |
| | | | | | |

500-700 Motion parts


1

|  | English | F2L 1011 | F3L 1011 | F4L 1011 | BF4L 1011 T |
|---|--|--------------|----------|----------|-------------|
| 710 | Camshaft | | | | |
| 711 | Axial clearance, standard mm | 0,3 - 0,6 | | | |
| 712 | Axial clearance Wear limit mm | 0,8 | | | |
| 713 | Camshaft bearing Inner dia. standard mm | 51 ± 0,054 | | | |
| 714 | Radial clearance, standard mm | 0,05 - 0,124 | | | |
| 715 | Radial clearance Wear limit mm | 0,15 | | | |
| | | | | | |
| | | | | | |


Specification data

500-700 Motion parts

1

|  | English | F2L 1011 | F3L 1011 | F4L 1011 | BF4L 1011 T |
|---|---|----------|----------|----------|-------------|
| 716 | Cam lift Inlet mm | 6,6 | | | |
| 717 | Exhaust mm | 6,8 | | | |
| 720 | Valve timing with valve clearance adjusted mm | | | | |
| 721 | Inlet opens before TDC degrees | 45 | | | 47 |
| 722 | Inlet closed after BDC degrees | 65 | | | 63 |
| 723 | Exhaust opens before BDC degrees | 76 | | | 99° 30" |
| 724 | Exhaust closed after TDC degrees | 44 | | | 51° 30" |
| | | | | | |


800 Lubrication system

|  | English | F2L 1011 | F3L 1011 | F4L 1011 | BF4L 1011 T |
|---|--|----------|----------|----------|-------------|
| 800 | Lube oil pump | | | | |
| 810 | Lube oil pressure | | | | |
| 811 | Pressurestat bar | 6 | | | |
| 812 | Lube oil pressure at low idling Temperature approx. 120°C oil SAE20W/20 Min. bar | 1,1 | | | |
| 815 | By-pass valve on filter housing bar | | | | |
| 816 | Pump speed / Engine speed rpm | | | | |
| 817 | Delivery rate $\pm 10\%$ at 4 bar 60° C oil SAE 20 l/h | 60 | | 85 | 100 |
| | | | | | |

1

Specification data

Tightening Specifications


| 1 |  | English | Initial tightening Nm | Tightening angles | | | | Total | Remarks |
|-----|---|---|---|-------------------|--------|--------|--------|--------------|---------|
| | | | | 1. | 2. | 3. | 4. | | |
| 901 | | Main bearing bolts | 50 | 60 | 45 | - | - | 105° | |
| 904 | | Big end bolts | 30 | 60 | 60 | - | - | 120° | |
| 907 | | Flywheel bolts | 30 | 60 | 30 | - | - | 90° | |
| 909 | | Cylinder head studs | a) 1. Stufe 30 2. Stufe 80 3. Stufe 160 | 120 | - | - | - | 120° | |
| 910 | | Camshaft/Thrust bearing bolt M 8 x 35 8.8 | | | | | | 22 ± 2 Nm | |
| 911 | | Camshaft/Central bolt M14 x 1,5 x 110 10.9 M14 x 1,5 x 110 12.9 | 30 30 | 150 210 | - - | - - | - - | 150° 210° | |
| 912 | | Crankshaft/Central bolt | 130 | 210 | - | - | - | 210° | |
| 913 | | Rockerarm bolts M 8 x 45 Torx 8.8 | | | | | | 22 ± 2 Nm | |

a) 1st step

2nd step

3rd step

Tightening Specifications


|  | English | Initial tightening Nm | Tightening angles | | | | Total | Remarks |
|---|---|--------------------------|-------------------|----|----|----|-----------|---------|
| | | | 1. | 2. | 3. | 4. | | |
| 914 | Rocker arm setscrew nut | | | | | | 20 ± 2 Nm | |
| 915 | Cylinder head cover | | | | | | 9 ± 1 Nm | |
| 916 | Blower rotor nut M 17 Valeo M 16 Bosch | | | | | | 50 ± 5 Nm | |
| 917 | Blower carrier bolts M 8 x 50 Torx 8.8 | | | | | | 20 ± 2 Nm | |
| 918 | V-belt pulley bolts M 10 x 16 8.8 | | | | | | 42 ± 4 Nm | |
| 919 | Idler pulley/V-belt pulley bolt M 10 x 25 8.8 | | | | | | 45 ± 4 Nm | |
| 920 | Idler pulley for toothed belt bolt M 10 . 50 8.8 | | | | | | 45 ± 4 Nm | |
| 921 | Lube oil pump bolts M 8 x 35 Torx | | | | | | 22 ± 2 Nm | |

1


Specification data

Tightening Specifications

1

|  | English | Initial tightening Nm | Tightening angles | | | | Total | Remarks |
|---|--|--------------------------|-------------------|----|----|----|-------------|---------|
| | | | 1. | 2. | 3. | 4. | | |
| 922 | | | | | | | | |
| 923 | Oil filter bracket bolts M 6 x 25 8.8 M 6 x 35 8.8 | | | | | | 10 ± 1 Nm | |
| 924 | Oil intake housing bolts M 8 x 75 Torx | | | | | | 22 ± 2 Nm | |
| 925 | Fuel pump bolts M 8 x 20 Torx 8.8 | | | | | | 22 ± 2 Nm | |
| 926 | Injection pump nuts | | | | | | 22 ± 2 Nm | |
| 927 | Injector cap nut | | | | | | 45 ± 5 Nm | |
| 928 | Injector fastening bolt M 8 x 35 Torx 8.8 | | | | | | 20 ± 2 Nm | |
| 929 | Injection line | | | | | | 15 ± 1,5 Nm | |

Tightening Specifications


|  | English | Initial tightening Nm | Tightening angles | | | | Total | Remarks |
|---|---|--------------------------|-------------------|----|----|----|---|---------|
| | | | 1. | 2. | 3. | 4. | | |
| 946 | Adapter housing bolts M 12 x 35 10.9 M 12 x 75 10.9 | | | | | | 95 ± 10 Nm | |
| 961 | Crankcase screw plugs 1. M30 x 1,5 2. M20 x 1,5 3. M10 x 1 4. M6 x 12 5. M16 x 1,5 6. M30 x 1,5 | | | | | | 60 ± 6 Nm 35 ± 3,5 Nm 12 ± 1,5 Nm 5 ± 1 Nm 26 ± 3 Nm 60 ± 6 Nm | |
| 962 | Oil pressure control valve screw plugs | | | | | | 190 Nm | |
| 963 | Hydraulic pump bracket bolts BM10 x 90 Torx 10.9 | | | | | | 57 Nm | |
| 964 | Hydraulic pump bolts M10 x 100 10.9 M10 x 110 10.9 M10 x 210 10.9 | | | | | | 57 Nm | |
| 965 | Exhaust turbocharger nuts M8 | | | | | | 29 Nm | |
| 966 | Oil return line cap nut | | | | | | 60 ± 3 Nm | |

1

Specification data

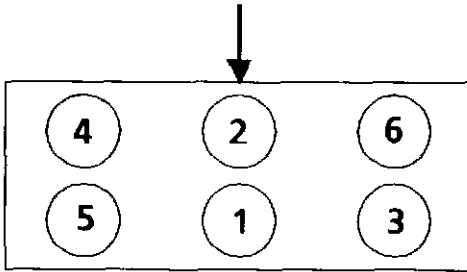
Tightening Specifications

1

|  | English | Initial tightening Nm | Tightening angles | | | | Total | Remarks |
|---|-------------------------------------|--------------------------|-------------------|----|----|----|------------|---------|
| | | | 1. | 2. | 3. | 4. | | |
| 967 | Piston cooling oil nozzles | | | | | | 4 Nm | |
| 968 | Air compressor nut BM18 x 1,5 | | | | | | 60 + 10 Nm | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
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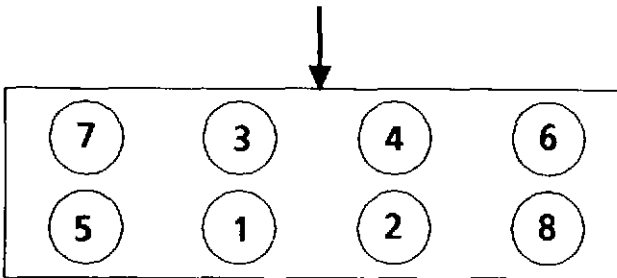
Tightening Cylinder Head Studs Order

Manifold side,



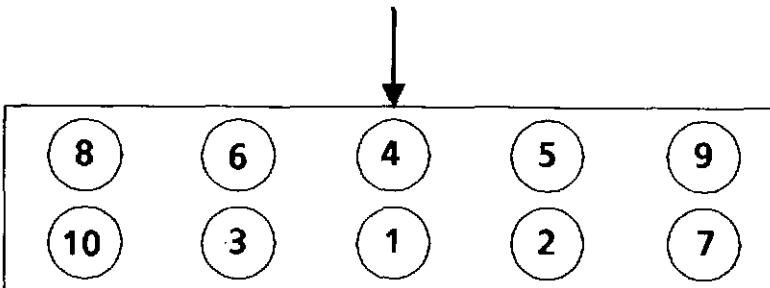
2-cylinders

Manifold side,



3-cylinders

Manifold side,



4-cylinders

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2. INSPECTIONS, TESTS, CHECKING, ADJUSTING

PAGE

| | |
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| Valve clearance | 2/1-2/3 |
| Compression pressure | 2/5-2/6 |
| Injector | 2/7-2/9 |
| Injection pump | 2/11-2/12 |

Valve clearance

The standard valve clearance can be adjusted: with engine cold or warm after cooling down for at least 0.5 h. Oil temperature $\leq 80^{\circ}\text{C}$.

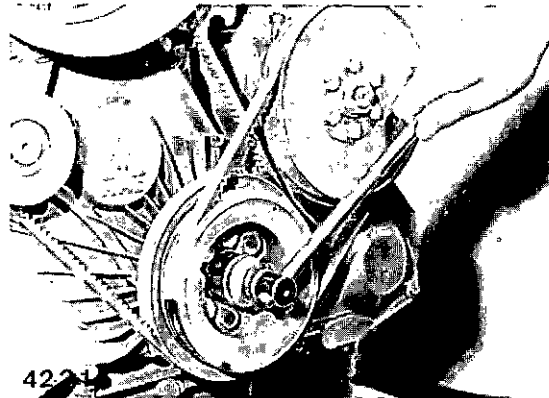
Note: The valve clearance is to be increased by 0.1 mm at every cylinder head gasket renewal. The standard valve clearance is to be adjusted after completion of 50 hours of operation.



Cylinder head cover has been removed.

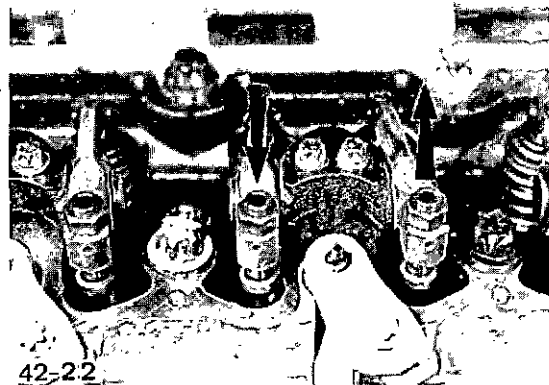
1. Turn engine until valves of cylinder No. 1 overlap.

See schematic for valve clearance adjustment.

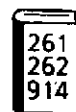


Note:

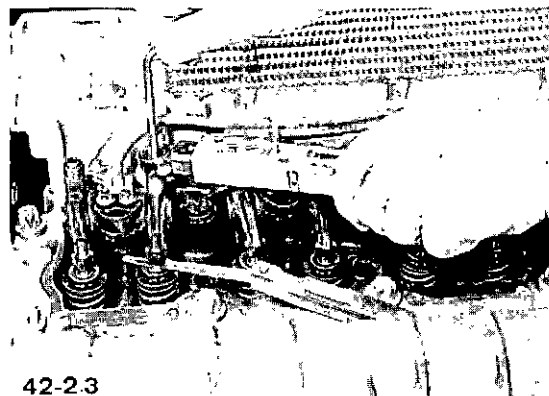
Valves overlapping means: exhaust valve about to close, inlet valve about to open. Both pushrods are now non-rotatable.



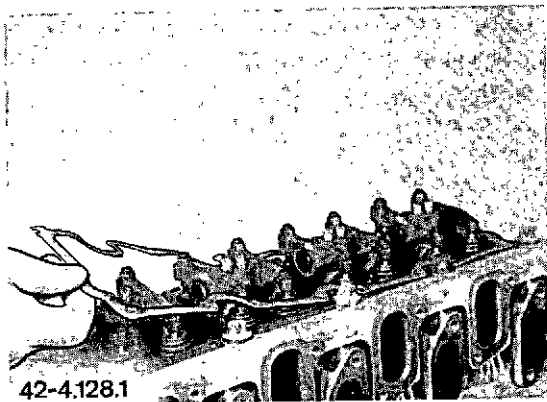
2. Adjust valve clearance on respective cylinder with feeler gauge.



Tighten locknut in accordance with specifications. Recheck the adjustment with feeler gauge.



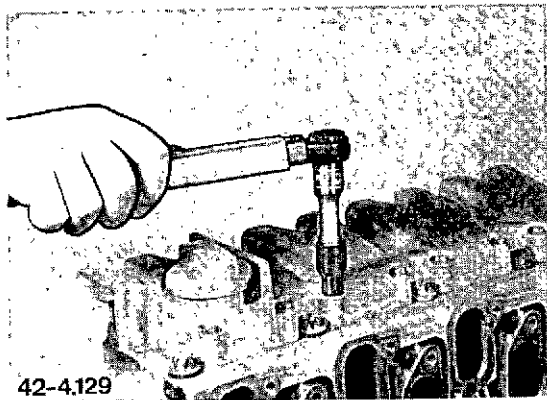
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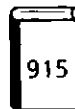
42-4.128.1



3. Put gasket in place.



42-4.129



4. Fit cylinder head cover. Tighten bolts in accordance with specifications.

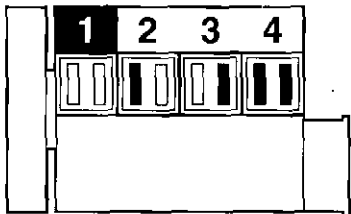
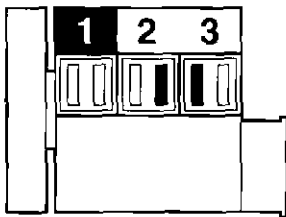
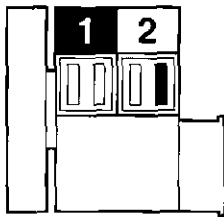
Schematic for valve clearance adjustment

Crankshaft position **1**

1

Turn engine until valves of cylinder No. 1 overlap.

Not ready for adjustment

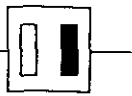
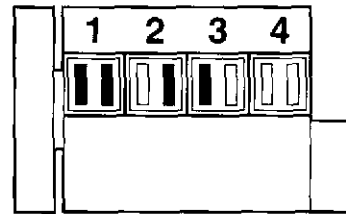
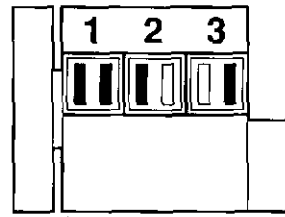
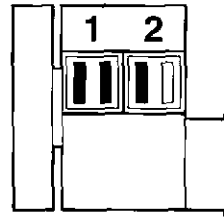


Crankshaft position **2:**

2:

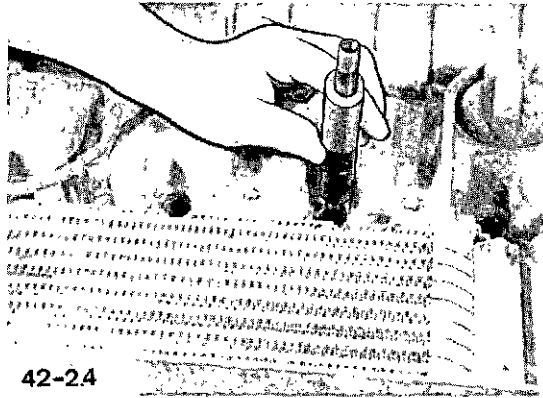
Turn engine further by one complete revolution (360°).

Ready for adjustment

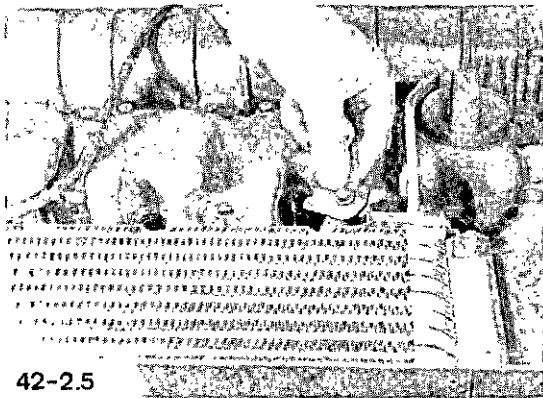


2

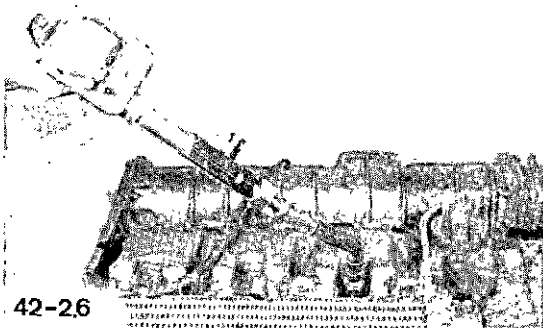
2



42-24



42-25



42-26



Compression pressure

Commercial tools required:
Compression tester 2461 Torx tools.

Special tool required:
Adapter 100090

Injectors have been removed
Valve clearance has been checked.

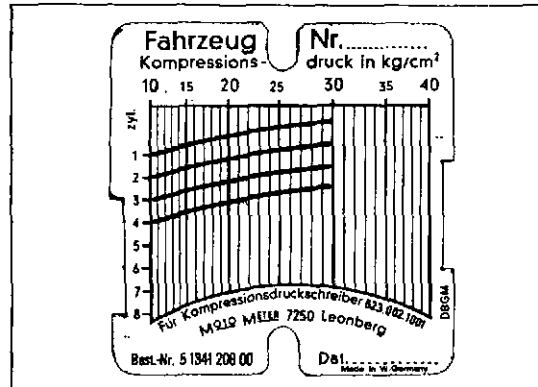
1. Insert adapter with new special sealing ring.

2. Fit clamping pad. Tighten bolt.

3. Connect compression tester.
Turn engine with starter.

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The measured compression pressure is dependent on the starting speed during the measuring process and also on the altitude of the engine site. Limiting values are therefore difficult to lay down exactly. It is recommended to use the compression pressure measurement only for comparison of compression pressures of all cylinders in one engine. If a difference in pressure exceeding 15 % is determined, the cylinder unit concerned should be dismantled to establish the cause.



2

Note:
For fitting injectors and injection lines see chapter 4.



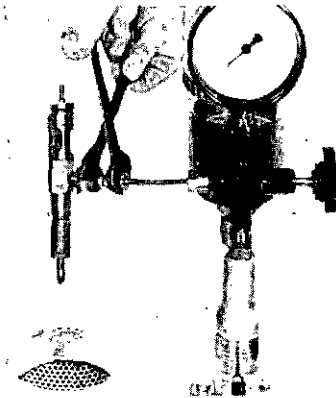
2

Injector



Note:

Utmost cleanliness must be observed when working on the injection equipment. For testing the injectors use only pure test oil to ISO 4113 or clean diesel fuel.



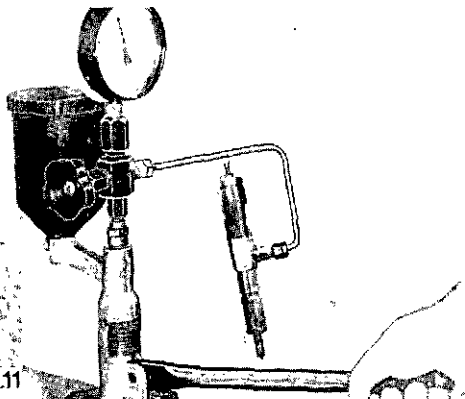
42-2.10



Caution

Beware of injection nozzle fuel jet. The fuel penetrates deeply into the skin tissue, possibly resulting in blood poisoning.

1. Connect injector to testing outfit.



42-2.11



2. Checking opening pressure
With pressure gauge switched on, slowly press down lever of testing outfit. The pressure at which the gauge pointer stops or suddenly drops, is the opening pressure.

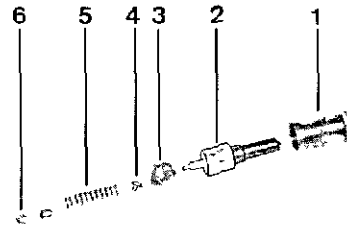


3. Adjusting the opening pressure on the injector.
Clamp injector between soft-metal cheeks in vise. Remove cap nut and all other parts.

42-2.12

Sequence of parts disassembly

1. Cap nut
2. Injection nozzle
3. Intermediate piece
4. Thrust pin
5. Compression spring
6. Shims



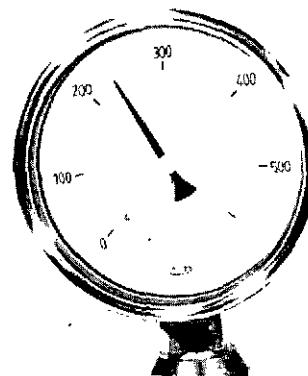
42-2.13

4. Adjust pressure by selecting appropriate shim. A thicker shim pack increases the opening pressure. Reassemble injector and recheck on testing outfit.



42-2.14

5. Checking for tightness
Dry nozzle and nozzle holder and blow out with compressed air. Slowly press down handlever of testing outfit until a pressure of about 20 bar below the previous opening pressure reading is attained.

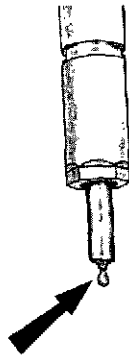


42-2.15

6. Nozzle is tight if there is no dripping within a period of 10 seconds.



42-2.16



7. In the case of a drip, the injector must be dismantled and cleaned to remedy the leak. If this does not cure the leak, the injector must be replaced.

Reworking is not admissible.

42-2.17

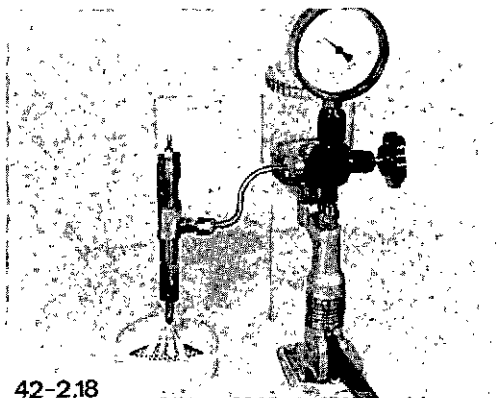
2

8. Buzzing and spray pattern test

Switch out testing outfit pressure gauge.

The buzzing test permits an audible check of the ease of movement of the nozzle needle in the nozzle body. New injectors emit a different buzzing sound as compared to used injectors. It *deteriorates due to wear in the needle seat zone*. If an injection nozzle does not buzz despite cleaning, it must be replaced by a new one.

A used injector should buzz clearly during rapid actuation of the handlever, while exhibiting a well atomized spray pattern. The spray pattern can differ noticeably from that of a new injector.



42-2.18

Injection pump

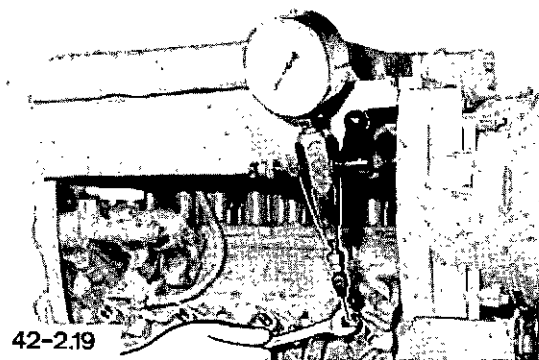
Commercial tools required:

Injection pump tester ... 3202
Crowfoot spanner a/flats 13

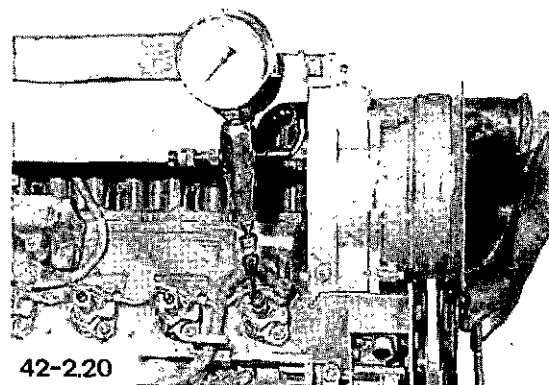
The injection pump is tested on the engine to make sure that the delivery valves and pump elements are free from leaks. For the test, it is essential that the fuel feed system is operating properly and that the fuel system is free from air.

Injection lines have been removed.

1. Connect injection pump tester to delivery valve holder.

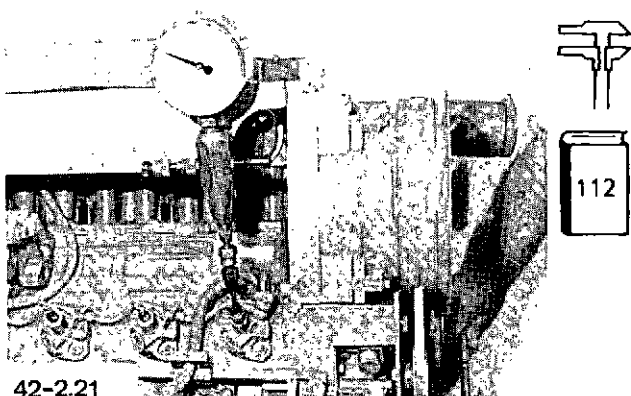


2. Turn crankshaft via V-belt pulley, while bleeding tester at the screw plug.



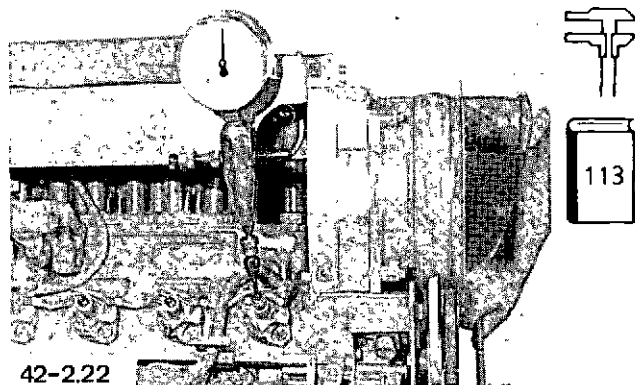
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2



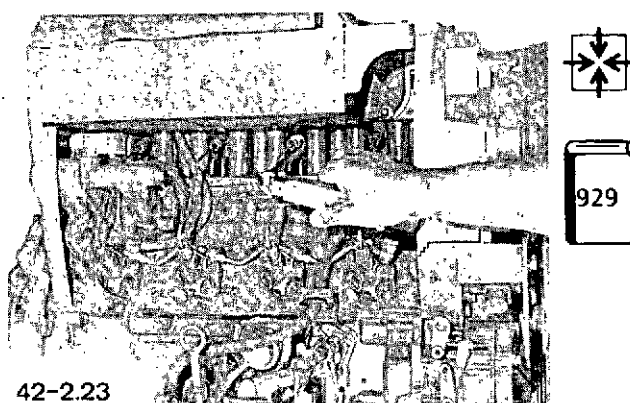
42-2.21

3. Turn crankshaft until a pressure of 150 bar is applied to the delivery valve. The indicated pressure should not drop more than 10 bar within one minute.



42-2.22

4. Turn crankshaft further until a pressure of 300 bar is generated. If this value is not attainable, remove injection pump.



42-2.23

5. Remove injection pump tester and reassemble engine.

Note:
Secure injection lines in accordance with specifications.

Repair of components

3

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| Injector | 3/51-3/53 |
| Hydraulic pump bracket | 3/55-3/59 |
| Crankcase with integrated cylinder liners | 3/61-3/69 |

Cylinder head

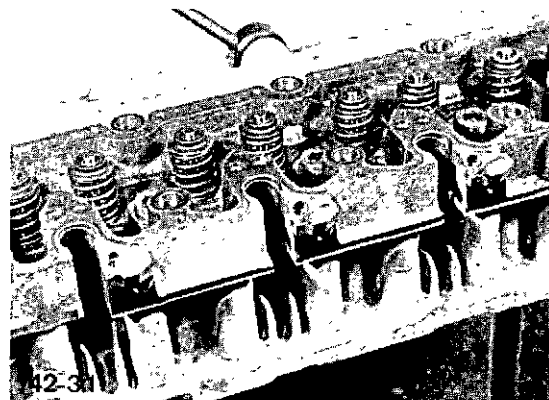
Commercial tools required:

- Magnetic measuring stand
- Valve spring assembly lever
- Valve reseating tool

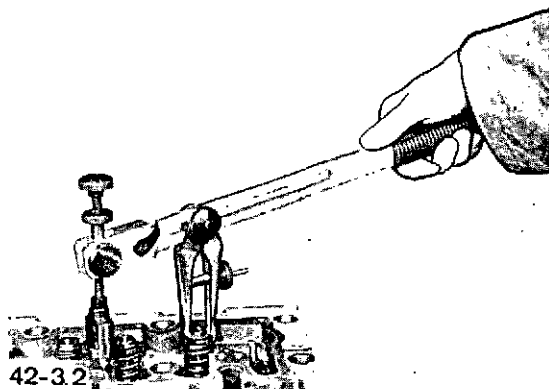
Special tools required:

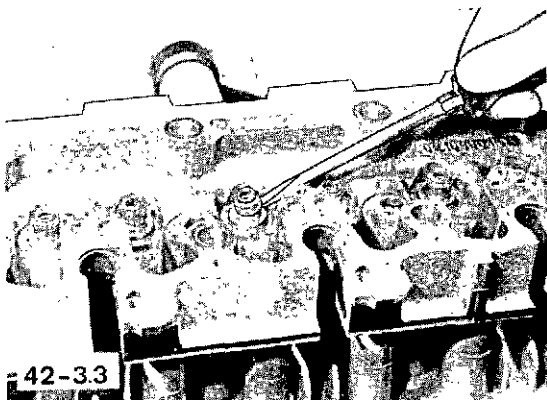
- Clamping stand 120900
- Clamping plate 120910
- Sleeve for fitting
valve stem seal 121410

1. Mount cylinder head on fixture.

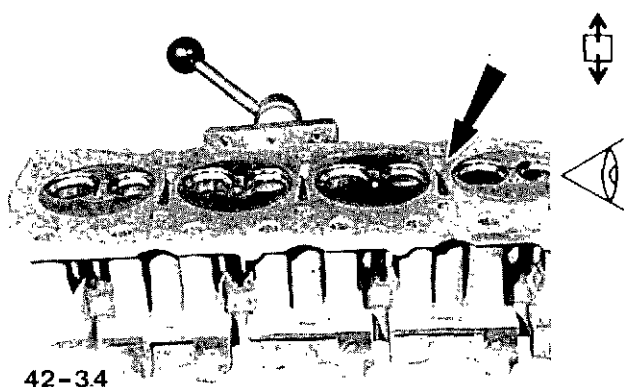


2. Remove valve collet, valve spring cap, valve springs and valves.

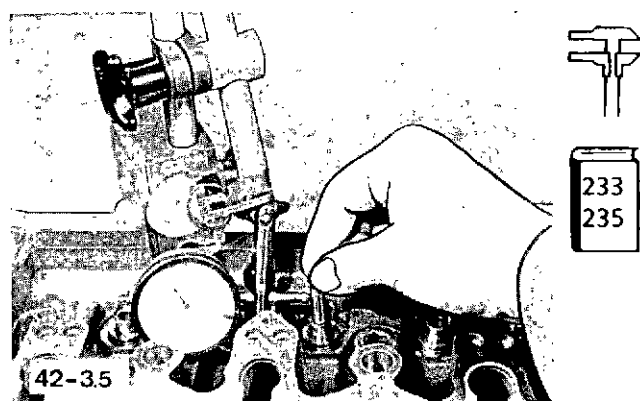




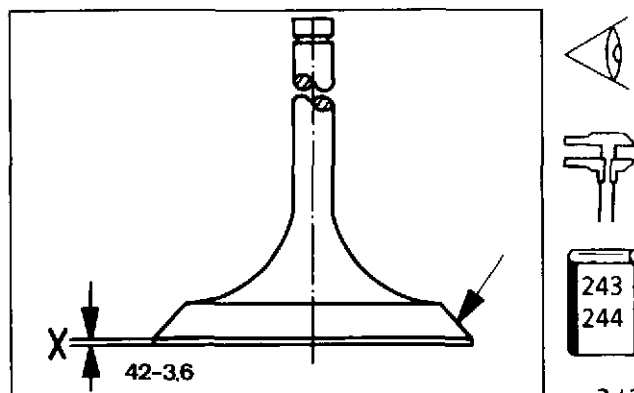
3. Remove valve stem seal.



4. Clean cylinder head and check for damage.



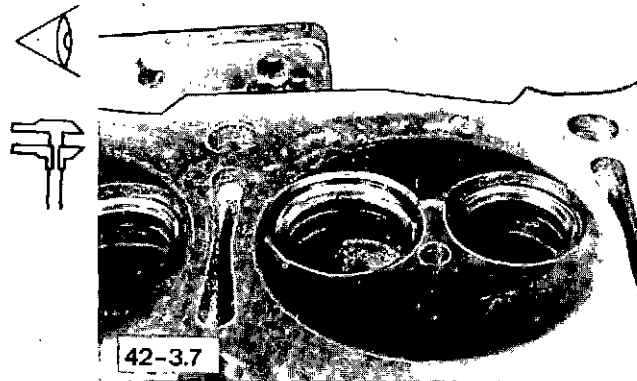
5. Gauge valve stem clearance.



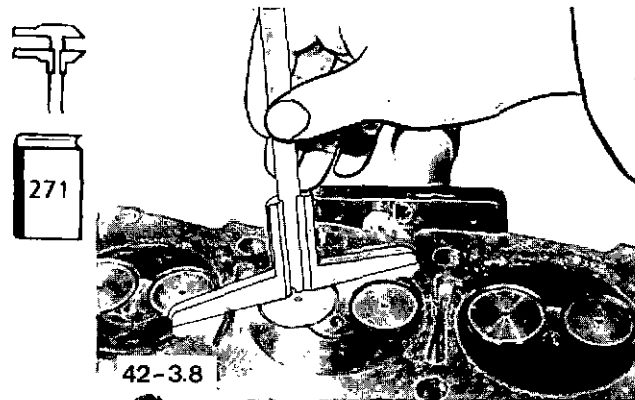
6. Carry out visual check on valves. Inspect for degree of wear.

3

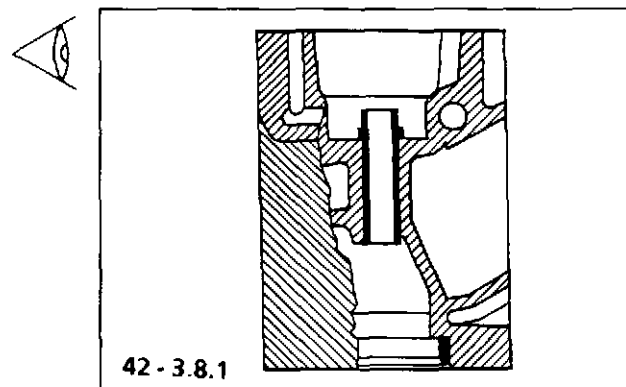
7. Carry out visual check on valve seat inserts. Inspect for degree of wear.



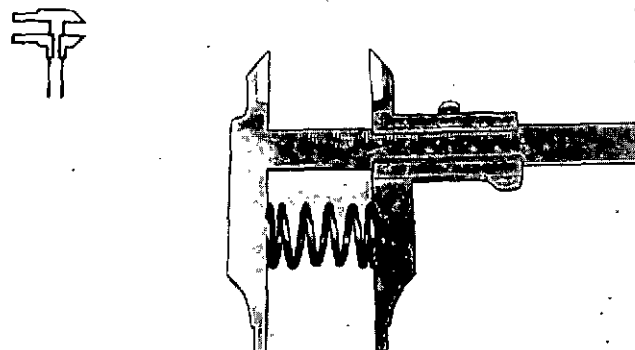
8. Gauge valve clearance between valve disc centre and cylinder head sealing surface.



8.1 If valve seat inserts or valve guides are worn out, it is possible to have the cylinder head repaired in our service centers.

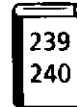
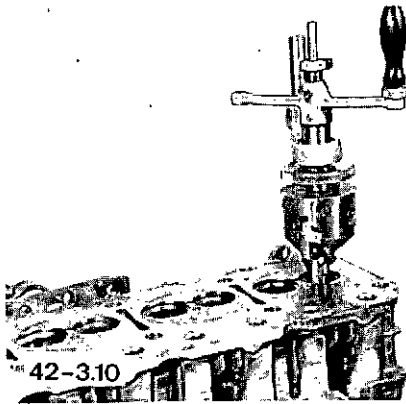


9. Gauge length of valve spring.



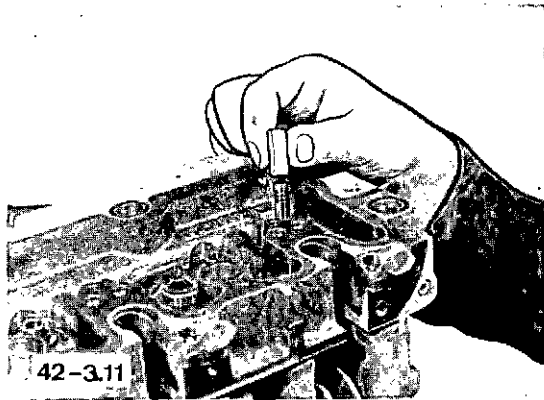
Repair of components

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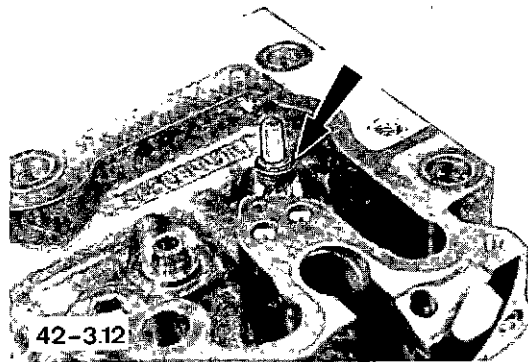
10. Correct seat width and relief using valve reseating tool.

Note:
Measure valve distance again after reworking valve seat inserts.

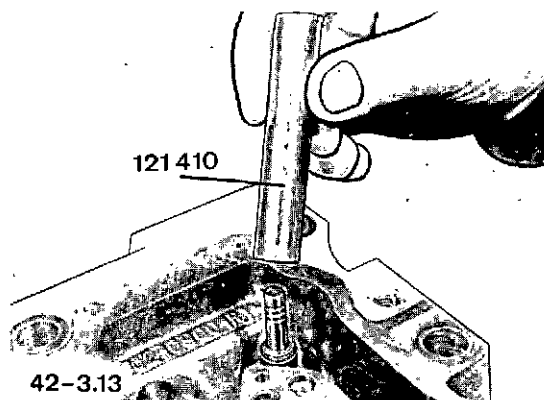


11. Insert and hold up valve. Push protective sleeve onto valve stem.

Note:
Before assembly of valve stem seal, valve splines must be covered by the protective sleeve or masking tape.

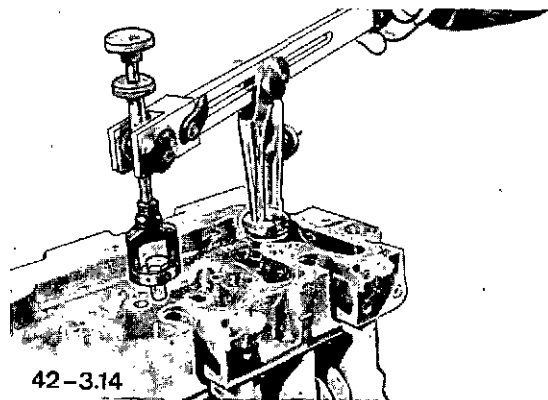


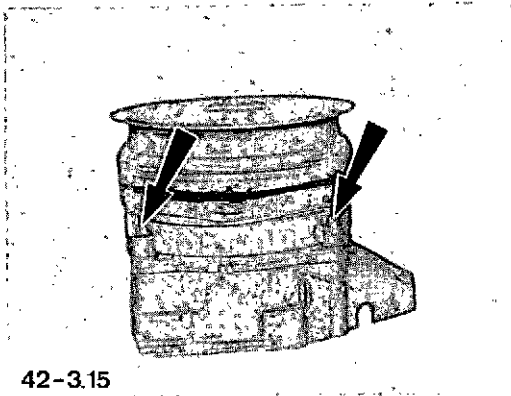
12. Push valve stem seal onto protective sleeve.



13. Remove protective sleeve. Press in valve stem seal as far as it will go.

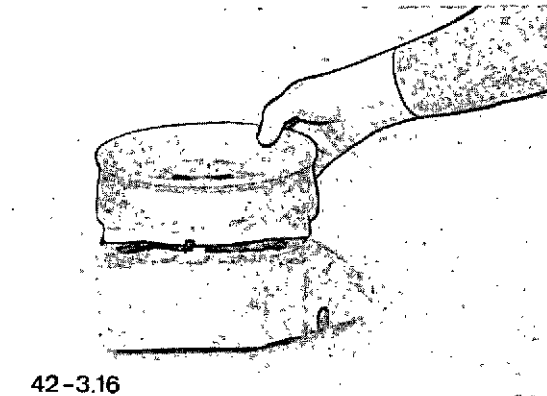
14. Assemble cylinder head complete with: valve springs, valve spring cap and valve collet.



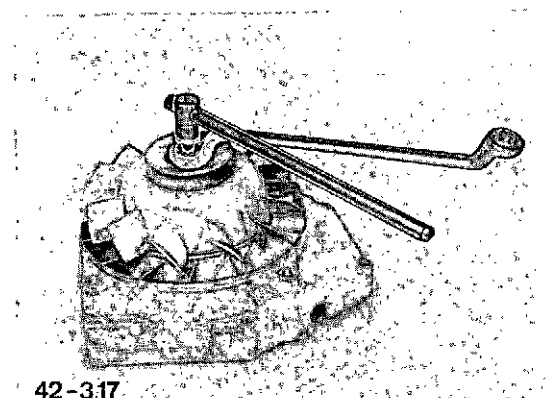


Blower

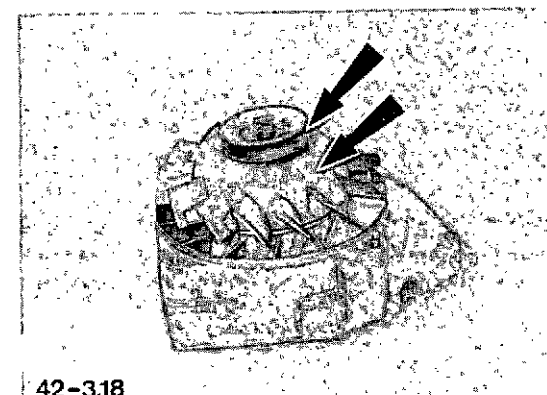
1. Remove complete air guide ring.



2. Remove blower housing inlet.



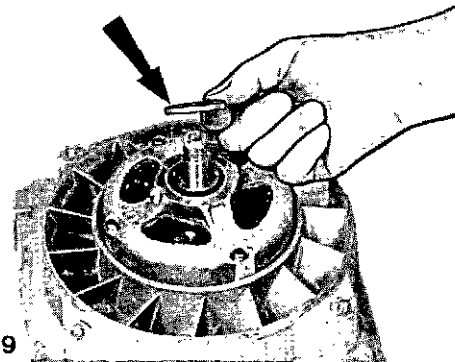
3. Undo fastening nut.



4. Lift off V-belt pulley and blower rotor.

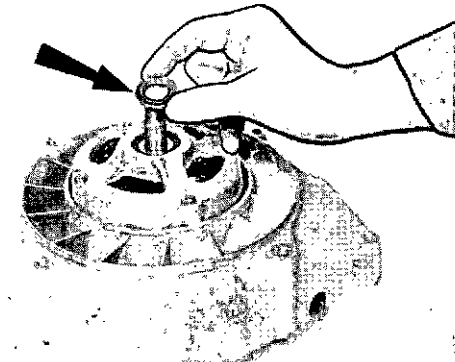
3

5. Remove spacer disc.



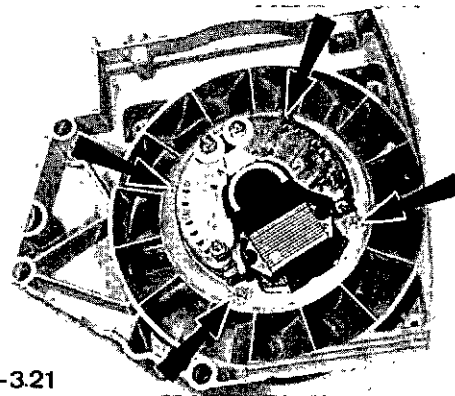
42-3.19

6. Remove guide plate.



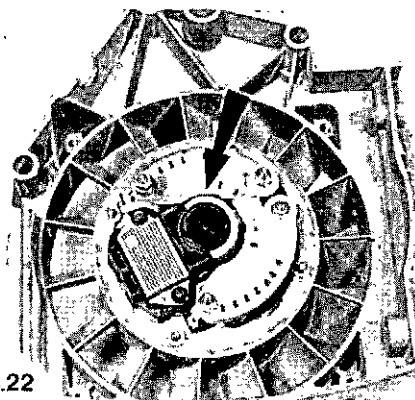
42-3.20

7. Undo fastening nuts.

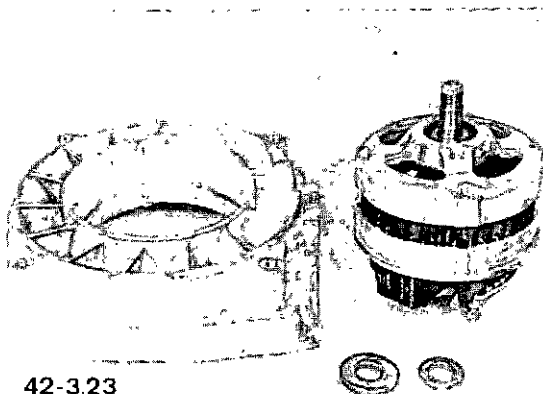


42-3.21

8. Press out alternator.



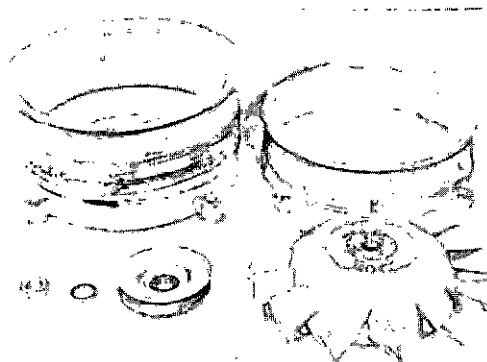
42-3.22



42-3.23



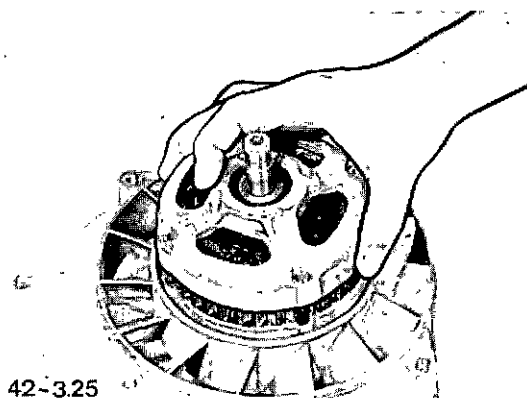
9. Inspect all parts, renew if necessary.



42-3.24



3

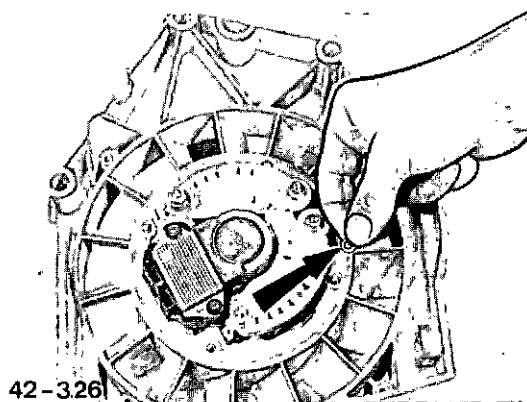


42-3.25



10. Install alternator in blower.

Note:
Watch direction of installation.



42-3.26

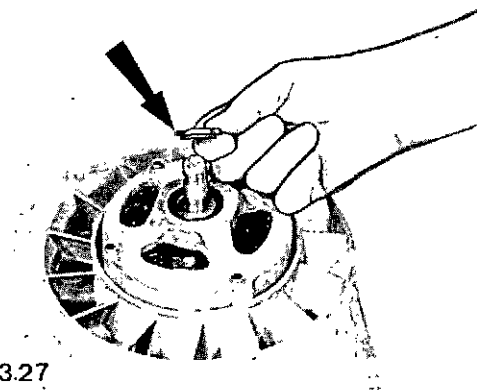


11. Position washers, tighten nuts in accordance with specifications.

12. Place guide plate in position.

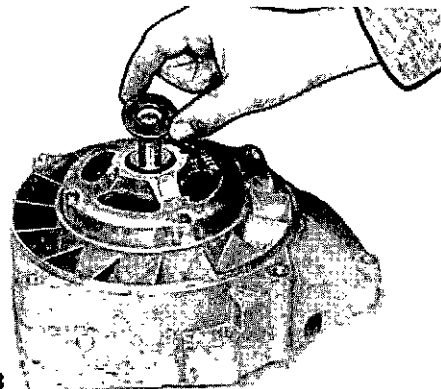
Note:

Recessed side must face towards alternator.



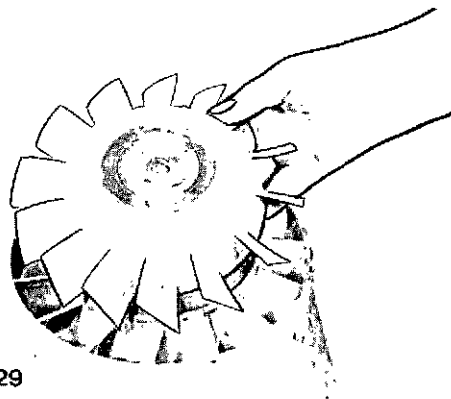
42-3.27

13. Place spacer disc in position.



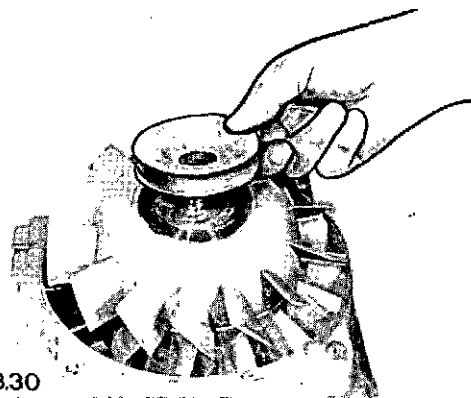
42-3.28

14. Fit blower rotor.



42-3.29

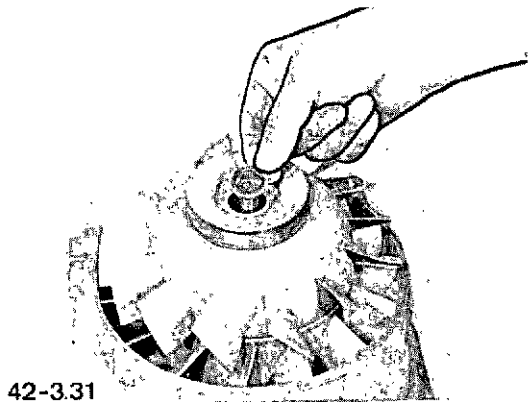
15. Place V-belt pulley in position.



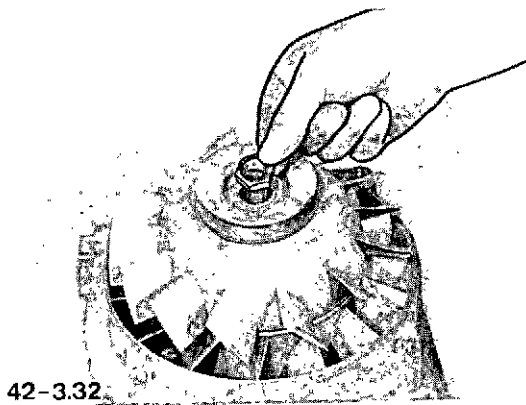
42-3.30

Repair of components

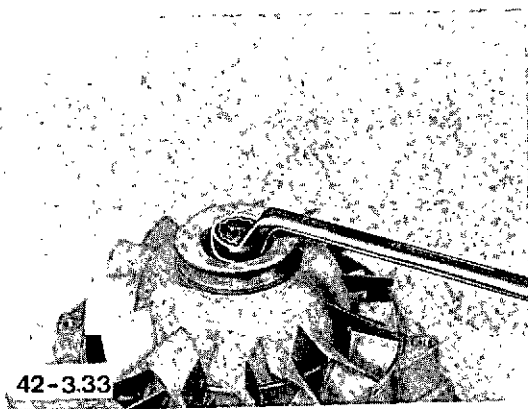
Werkstatthandbuch B/FL 1011/T



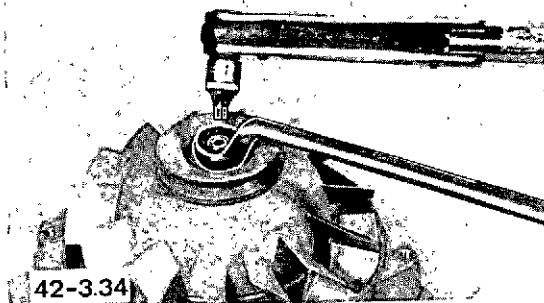
16. Position washer in place.



17. Screw on fastening nut.

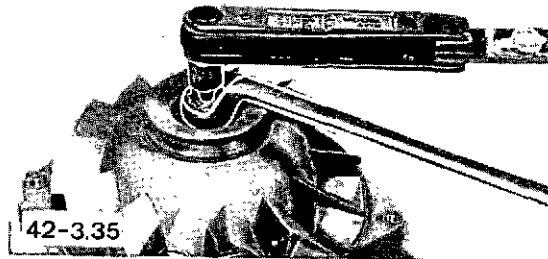
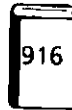


18. Fix box spanner.

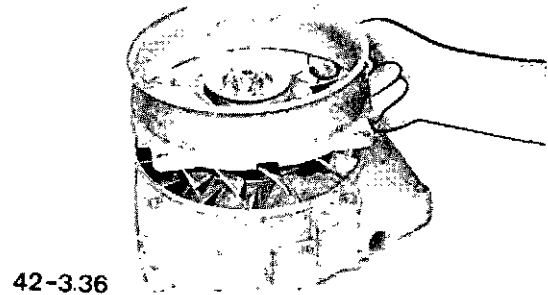


19. Insert torque spanner with hex. socket.

20. Lock down fastening nut in accordance with specifications.

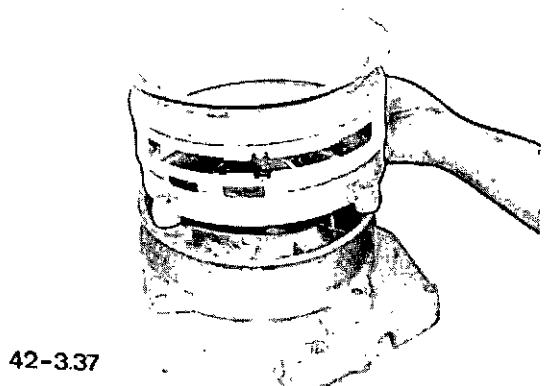


21. Fit blower housing inlet.

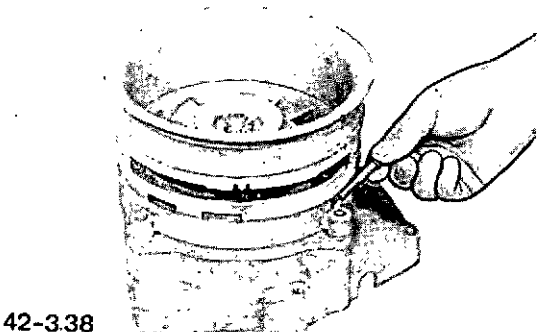


22. Fit air guide ring.

Note:
Watch direction of installation.

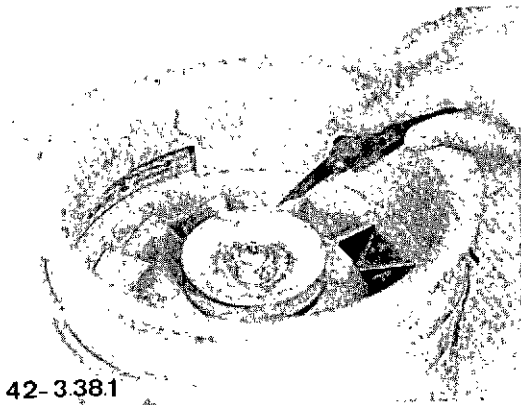


23. Insert and lock down fastening bolts.



Repair of components

Werkstatthandbuch B/FL 1011/T

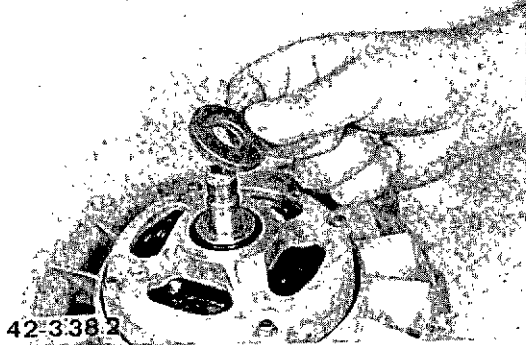


23.1 Measure gap between blower rotor and blower housing inlet.

Min. = 0.2 mm

Max. = 0.8 mm

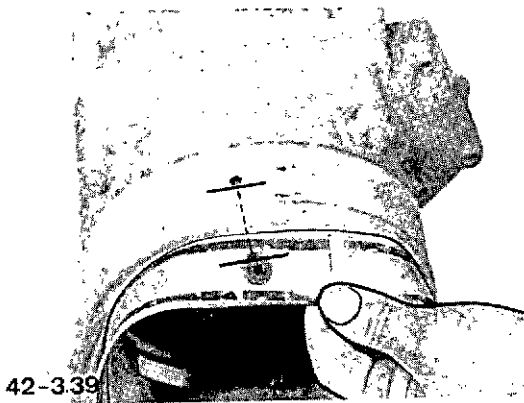
3



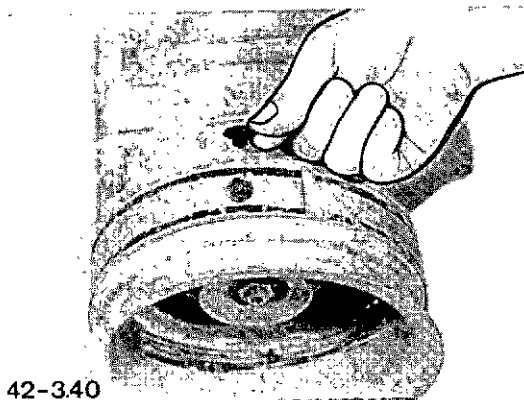
23.2 For correction use appropriate spacer discs.

Note:

Spacer discs are available from 4.0 to 7.5 mm.



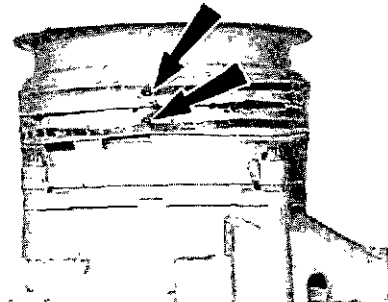
24. Fit sealing ring and make sure that bores are in line.



25. Press fastening knob through sealing ring into air guide ring.

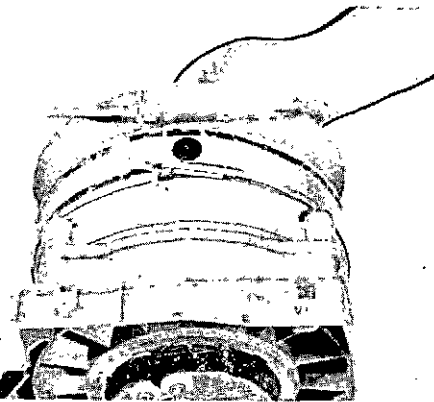
Werkstatthandbuch B/FL 1011/T

26. Press sealing ring into metal lugs.



42-3.41

27. Fit hose clips and secure.



42-3.42

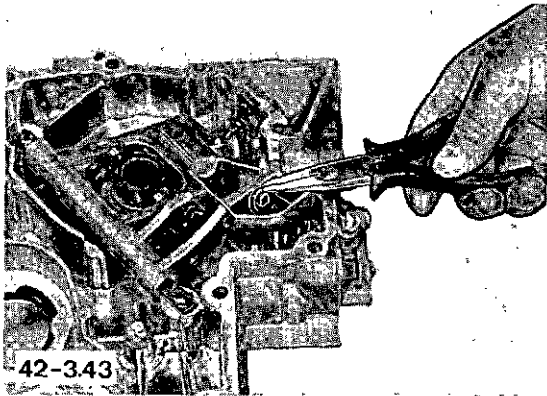
Front cover

Special tools required

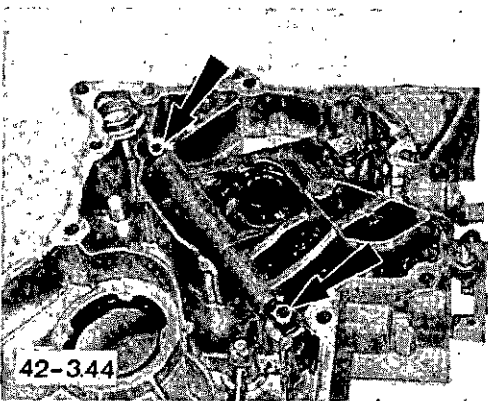
Assembly tool 142850

Assembly tool 142050

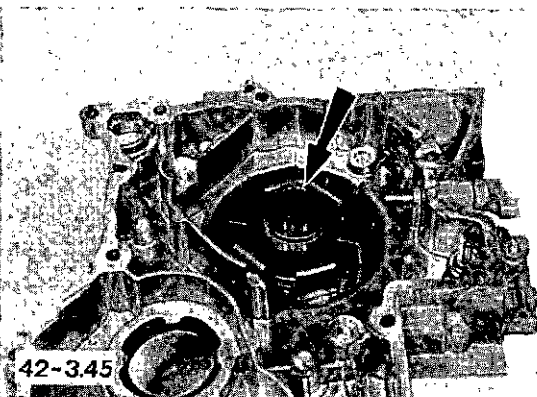
3



1. Detach governor spring.



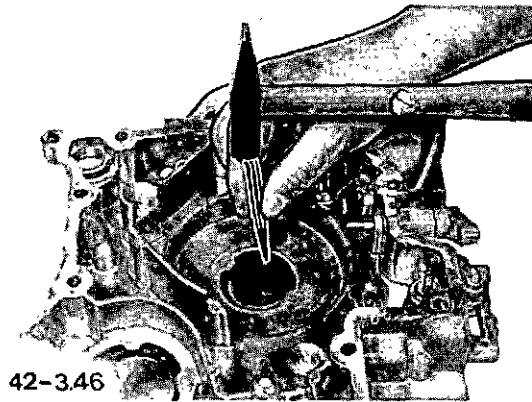
2. Unscrew fastening bolts of governor shaft.



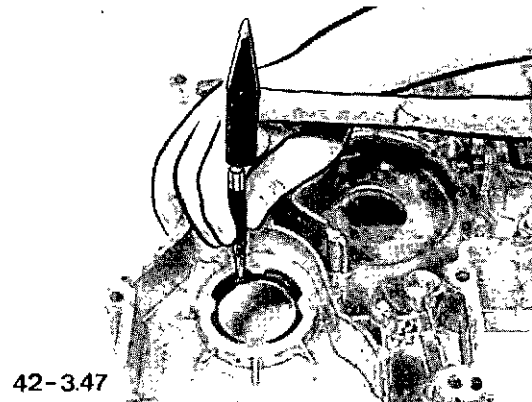
3. Remove centrifugal governor.

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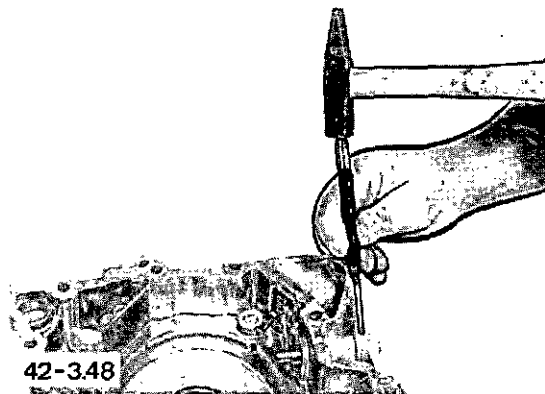
4. Drive out camshaft seal.



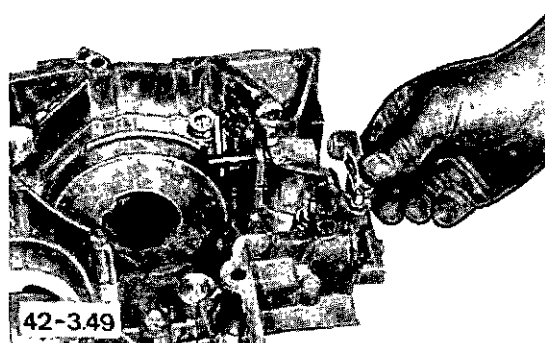
5. Drive out crankshaft seal.



6. Drive out dowel sleeve.

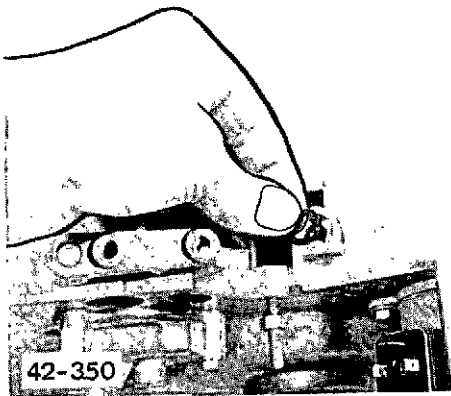


7. Remove shutdown lever together with spacer bushes.

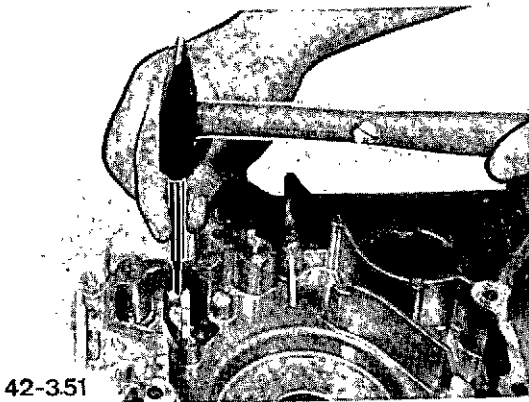


Repair of components

Werkstatthandbuch B/FL 1011/T

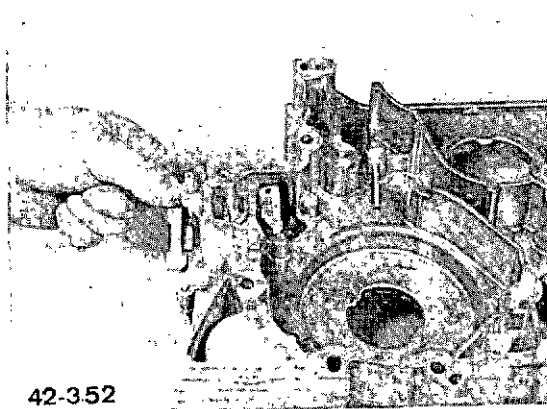


8. Remove O-seal.

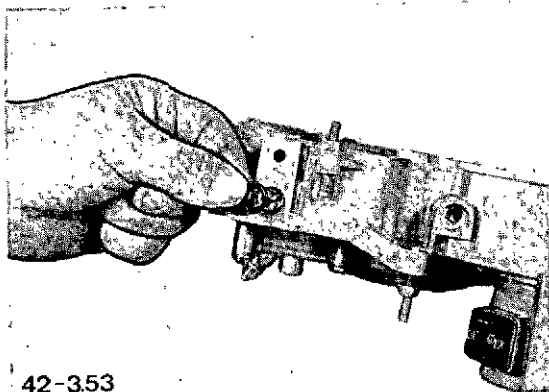


9. Drive out dowel sleeve.

3



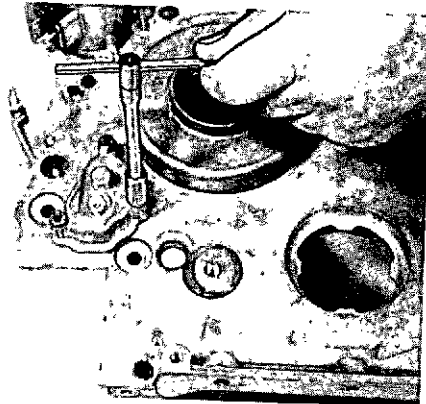
10. Remove speed control lever together with spacer bush.



11. Remove O-seal.

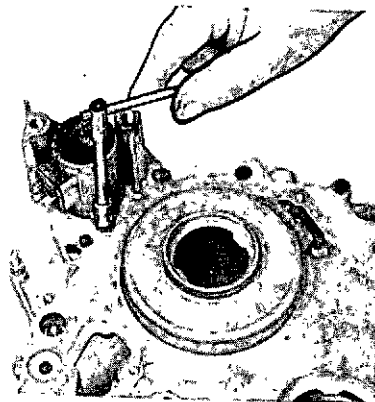
42-353

12. Remove cover for idle adjusting screw.



42-354

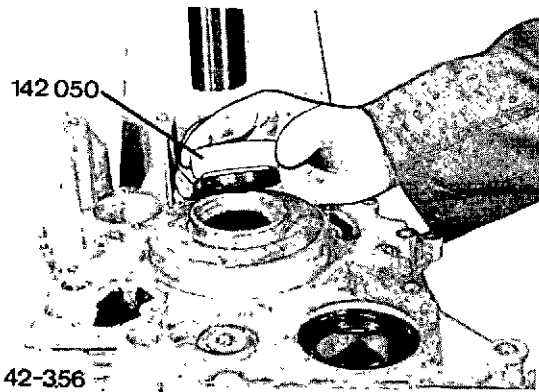
13. Remove engine shutdown lever.



42-355

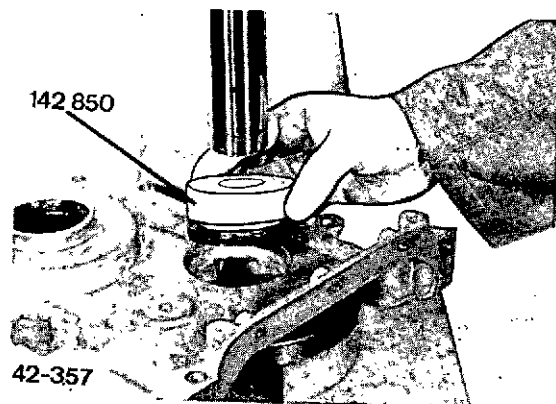
Inspect front cover and renew if necessary.

14. Press in camshaft seal.

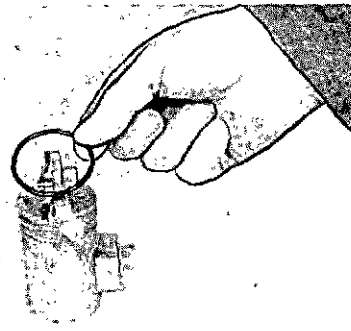


42-356

15. Press in crankshaft seal.



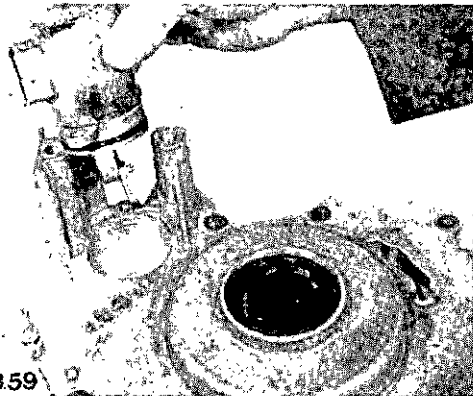
42-357



42-358



16. Place O-seal in position and apply some grease.

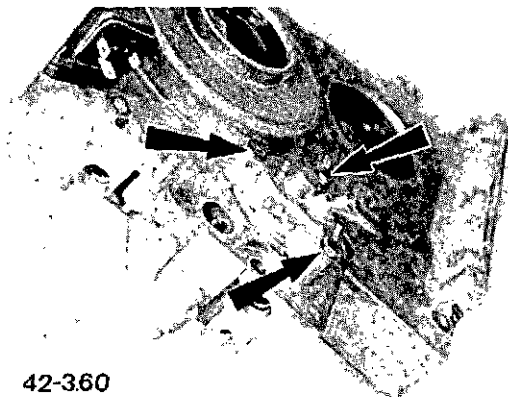


42-359



17. Refit engine shutdown lever and secure.

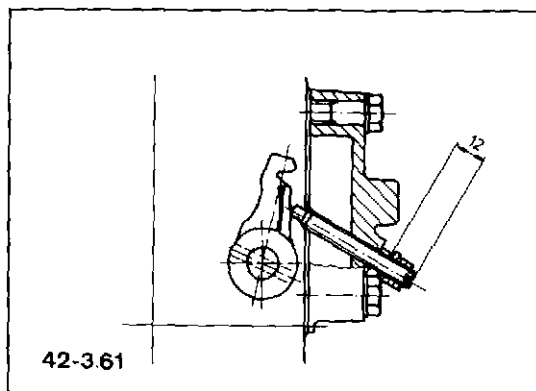
Note:
Watch direction of installation.



42-360



18. Refit cover for idle adjusting screw together with gasket and secure.



42-361

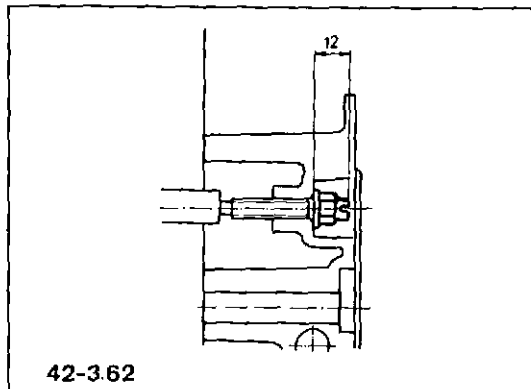


19. Adjust clearance of max. speed setscrew and tighten with sealing nut.

Distance 12 mm

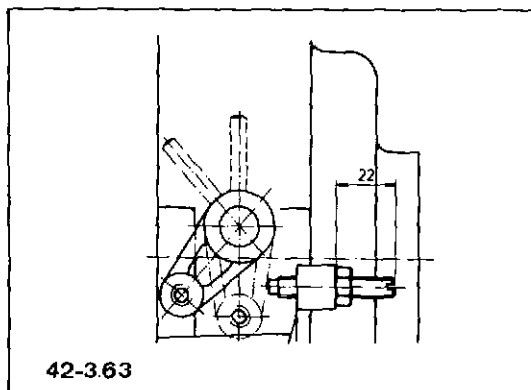
20. Adjust clearance of full-load setscrew and tighten with sealing nut.

Distance 12 mm



21. Adjust clearance of engine shutdown stop screw and tighten.

Distance 22 mm



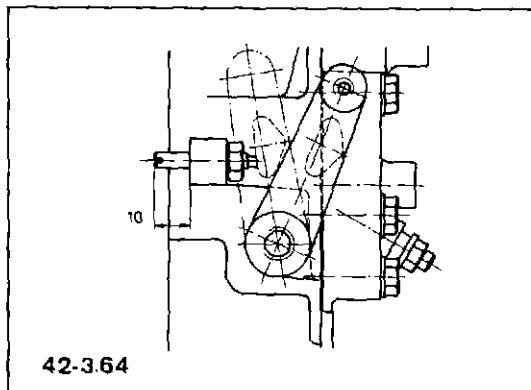
22. Adjust clearance of min. speed setscrew and tighten.

Distance 10 mm

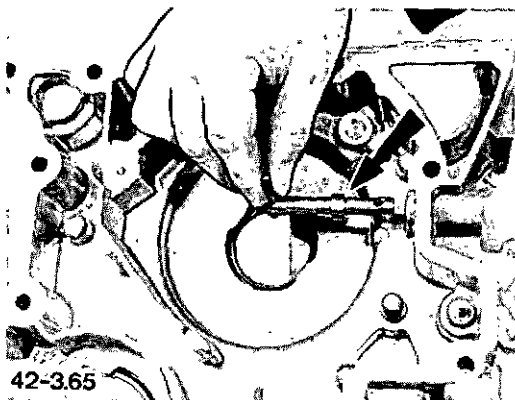


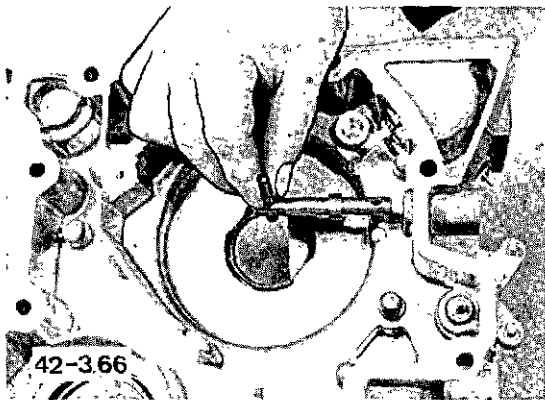
Note:

It is necessary to carry out a test run for setting engine power and speed.

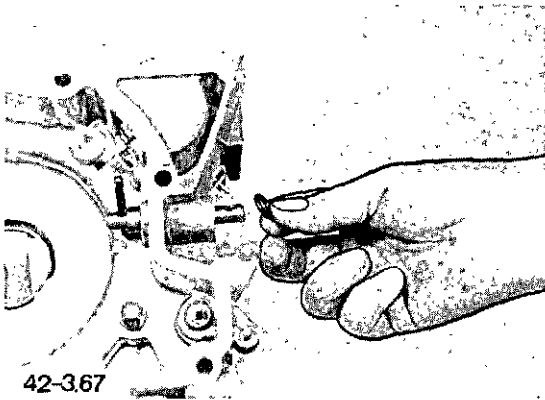


23. Slide spacer bush over shutdown shaft.





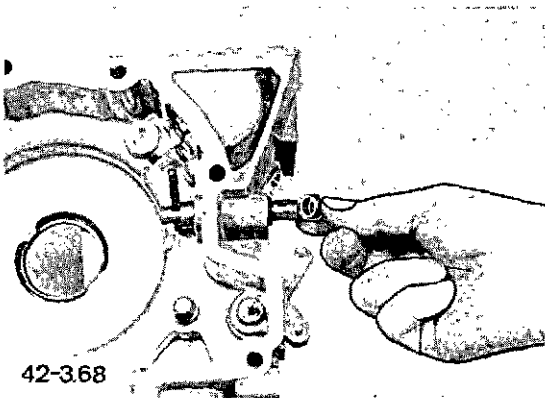
24. Fit shutdown shaft.



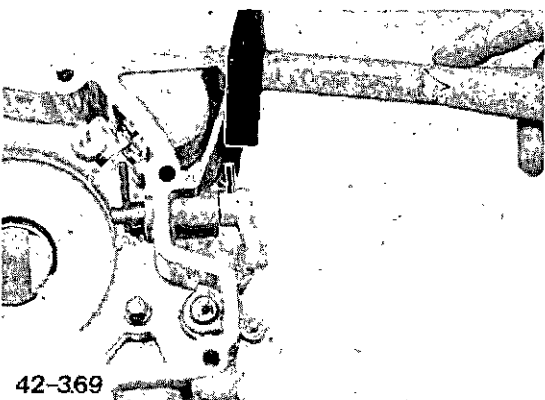
25. Slide greased O-seal over shaft.



3

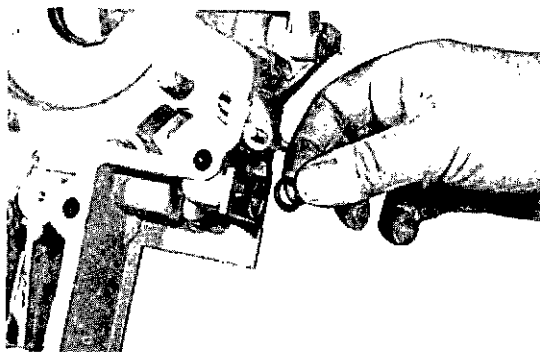


26. Slide over spacer bush.



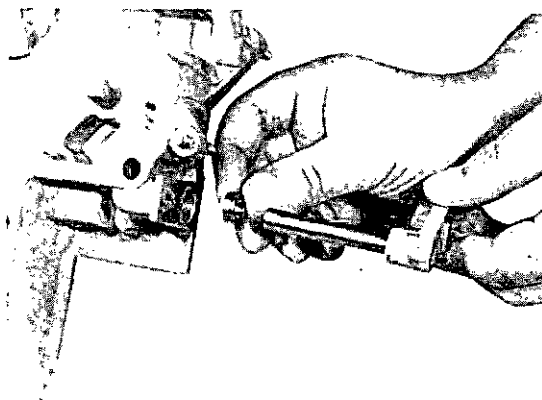
27. Fit shutdown lever with dowel sleeve.

28. Fit greased O-seal.

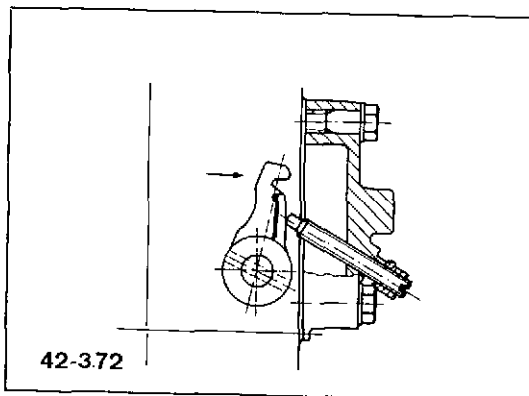


42-370

29. Fit spacer bush on drive shaft and press in.

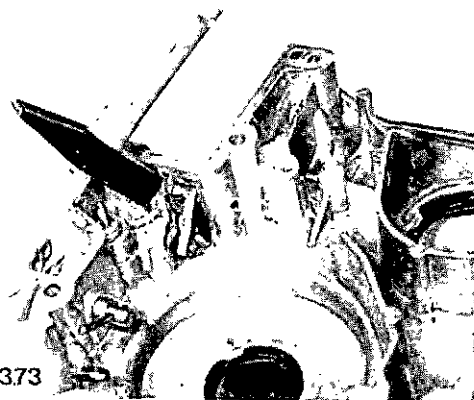


Note:
Watch direction of installation of speed control lever.



42-372

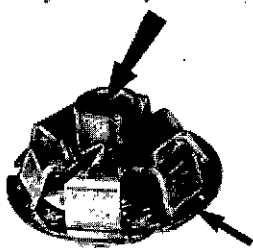
30. Fit speed control lever with dowel sleeve.



42-373

Repair of components

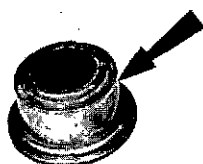
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42-374



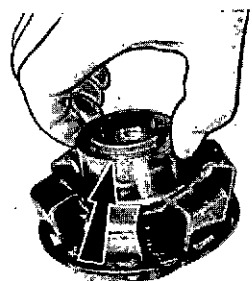
31. Inspect centrifugal governor for wear.



42-375



32. Inspect governor plate.



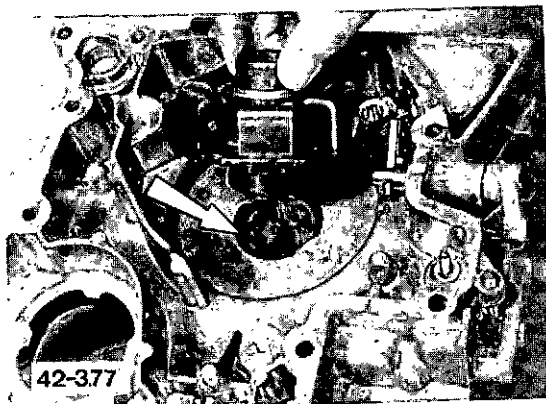
42-376



33. Fit governor plate together with centrifugal governor.



Note:
Watch direction of installation.



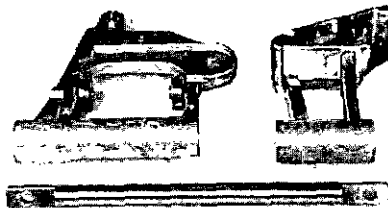
34. Install centrifugal governor in front cover.



Note:
Be careful not to damage sealing lip of shaft seal.

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35. Inspect governor lever, shaft, and governor lever stop.



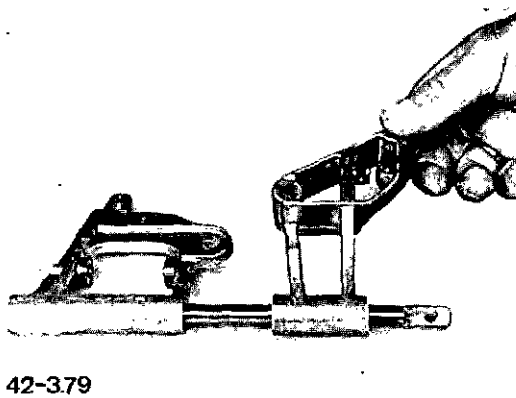
42-378

36. Fit governor lever together with governor lever stop and shaft.



Note:

Watch direction of installation.



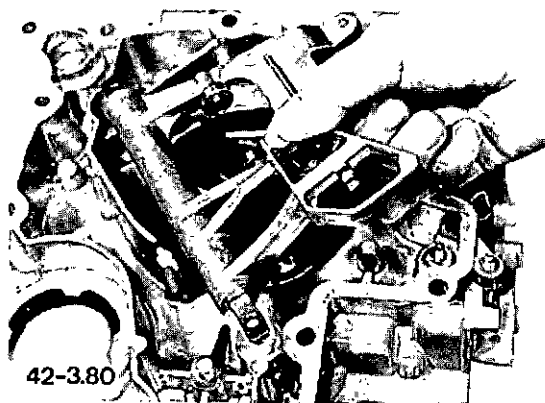
42-379

37. Install complete governor lever shaft in front cover and secure.



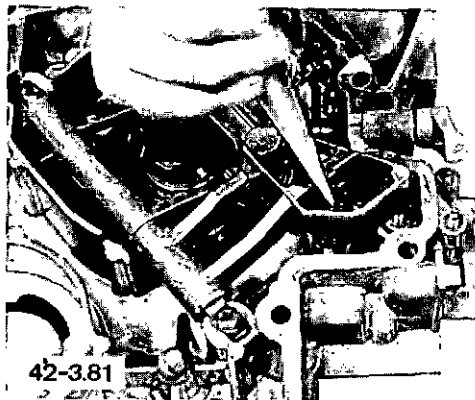
Note:

Check governor lever for free movement.



42-380

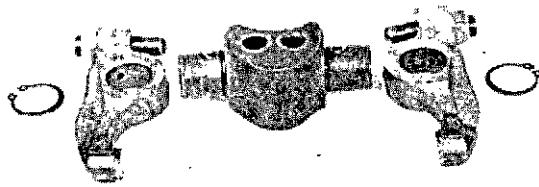
38. Hook up governor spring.



42-381

Rocker arm bracket

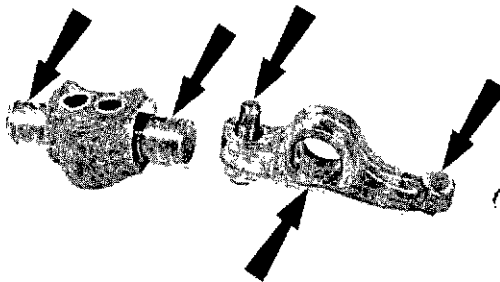
1. Dismantle rocker arm bracket.



42-3.82



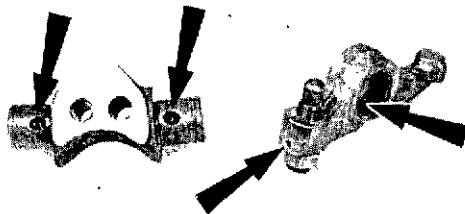
2. Check journals, adjusting screw, rocker arm contact face and bore for wear.



42-3.83



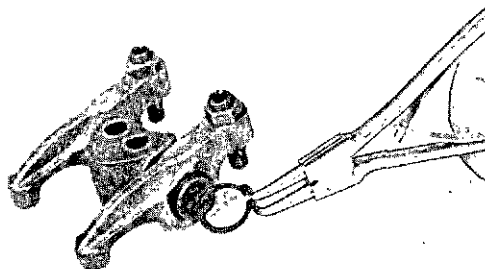
3. Check oil duct for free passage.



42-3.84



4. Reassemble rocker arm bracket. Fit circlips.

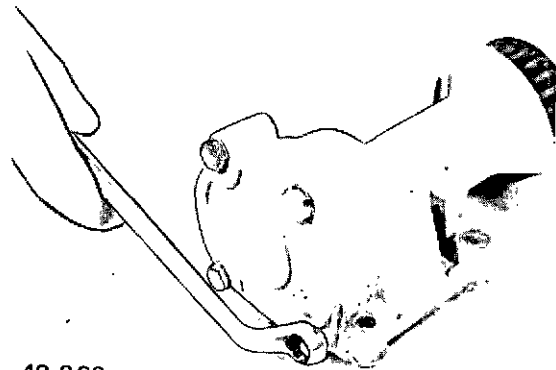


42-3.85



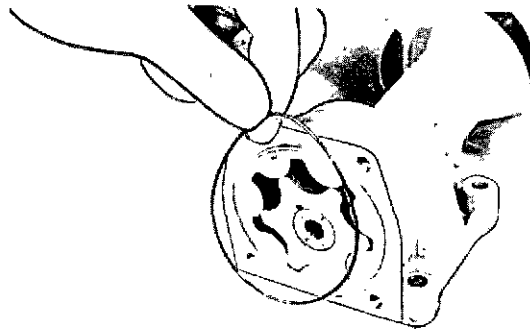
Lube oil pump

1. Remove cover.



42-3.86

2. Refit cover with new O-seal.

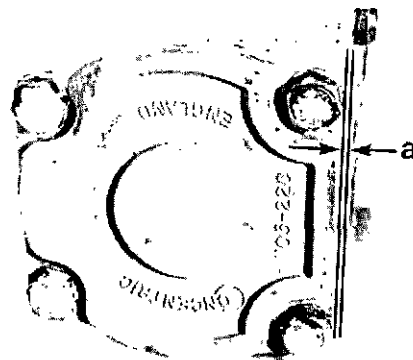


42-3.87

Note:

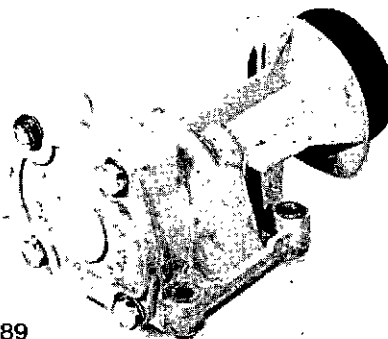
When fitting cover clearance „a“ must be observed.

„a“ = min. 0.5 mm.



42-3.88

4. Renew lube oil pump if damaged.

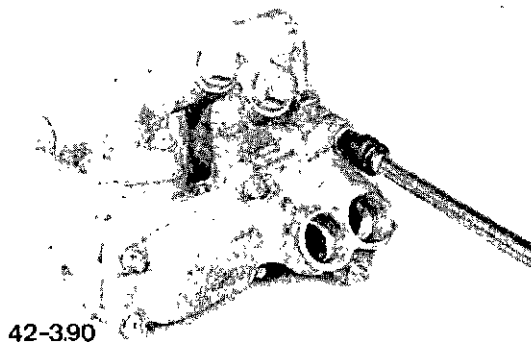


42-3.89

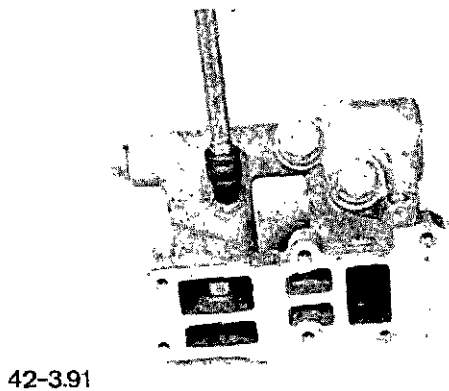
Thermostat housing

Commercial tools required:
Screw driver with socket

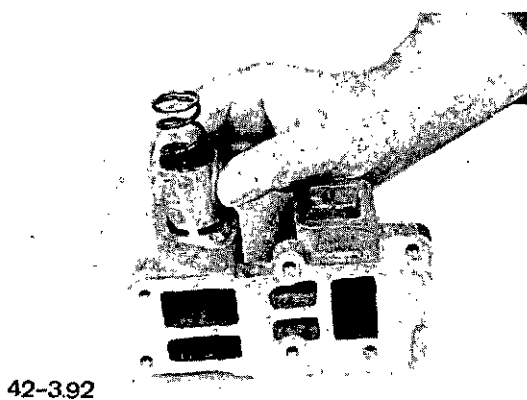
3



1. Lift off cover. Remove steel gasket.



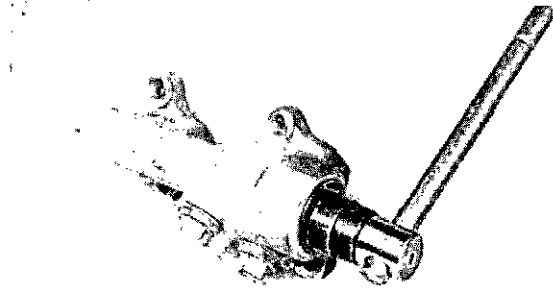
2. Remove valve plunger housing.



3. Take out thermostat together with spring.

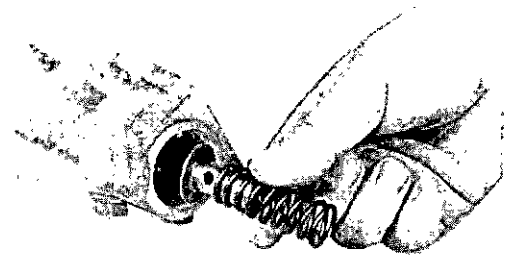
4. Remove screw plug for valve plunger.

Note: Heat up screw plug.



42-3.93

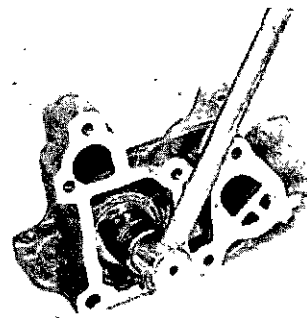
5. Remove valve plunger together with compression spring.



42-3.94

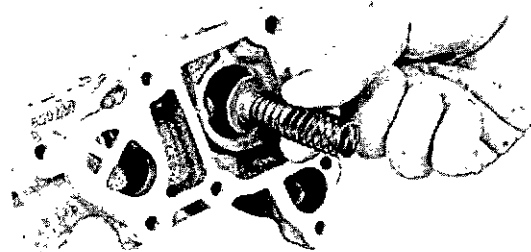
6. Remove screw plug for valve plunger.

Note:
Heat up screw plug 150° C.

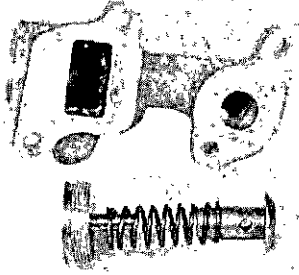


42-3.95

7. Remove valve plunger together with compression spring.

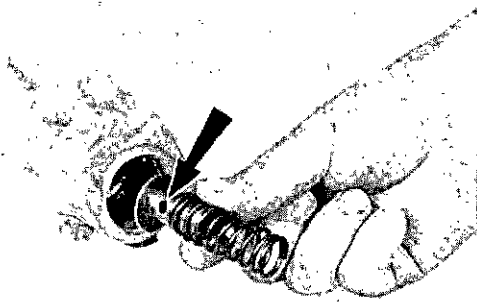


42-3.96



42-3.97

8. Inspect individual component parts.



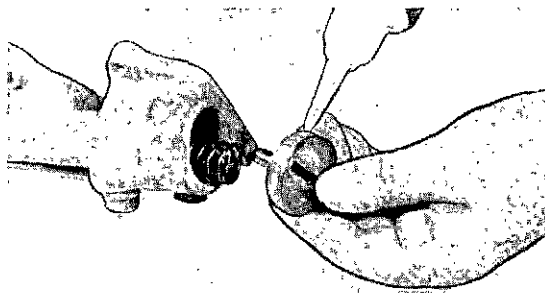
9. Refit valve plunger together with compression spring.

Note:
Watch bypass bore.



3

42-3.98



10. Spread thread of screw plug with sealing compound Loctite 648.



42-3.99

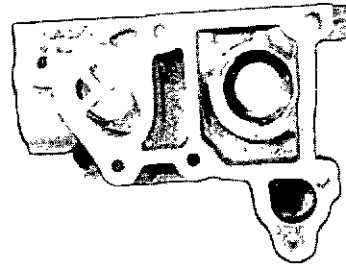


11. Tighten screw plug in accordance with specifications.



42-3.100

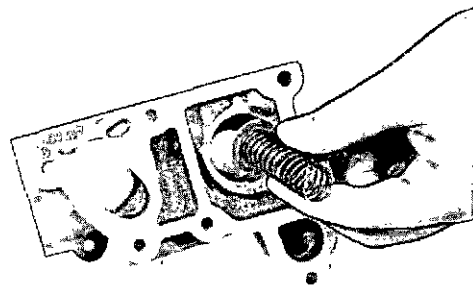
12. Inspect individual component parts.



42-3.101

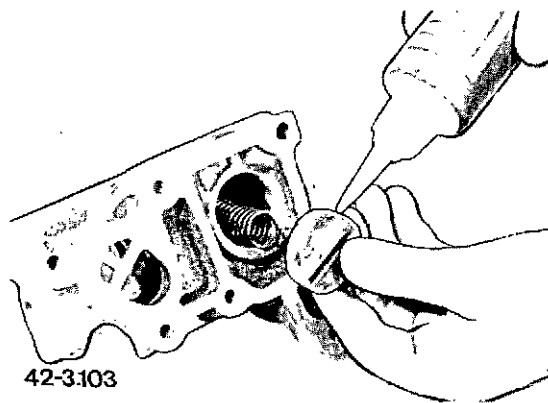


13. Refit valve plunger together with compression spring.



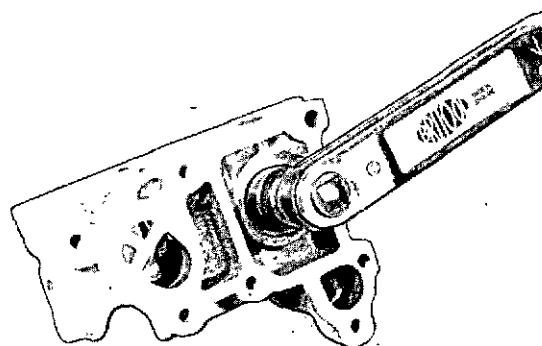
42-3.102

14. Spread thread of screw plug with Loctite 648.

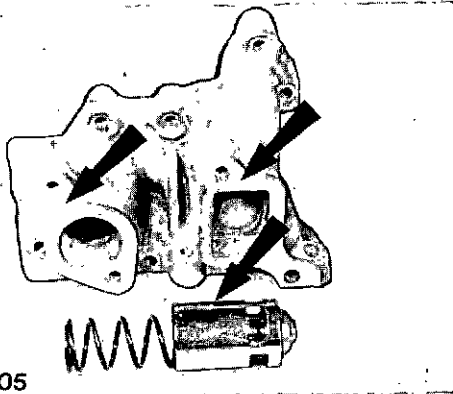


42-3.103

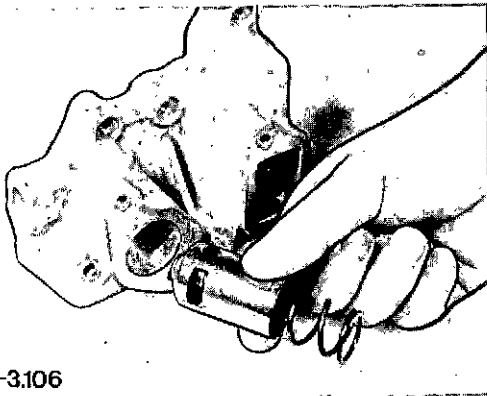
15. Tighten screw plug in accordance with specifications.



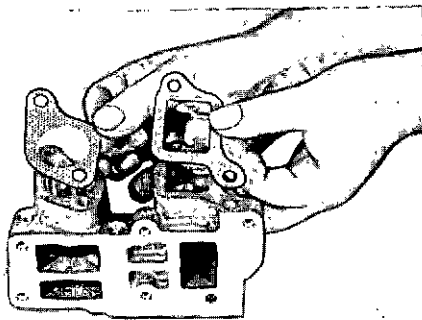
42-3.104



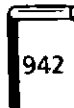
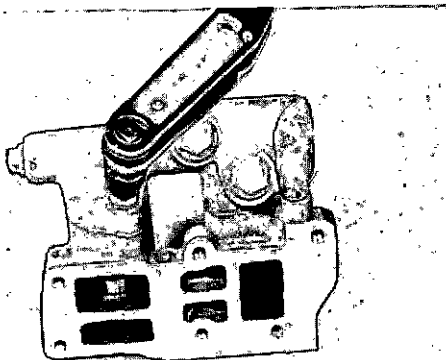
16. Inspect individual component parts.



17. Refit thermostat together with compression spring.



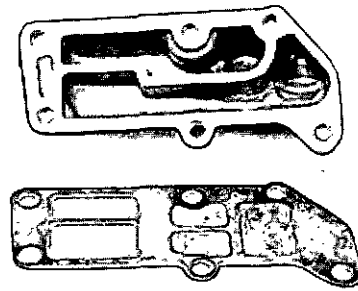
18. Position new gaskets.



19. Refit valve plunger housing and tighten bolts in accordance with specifications.

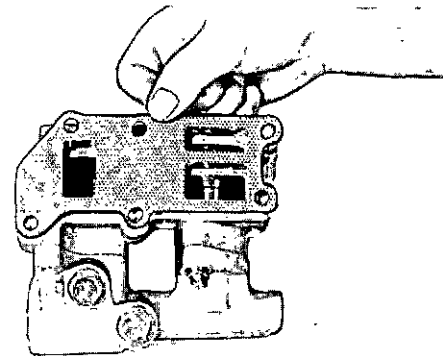
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20. Inspect individual component parts.



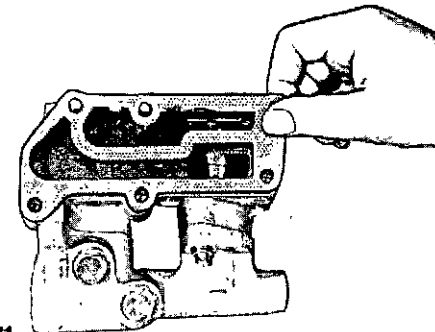
42-3.109

21. Position new gasket.



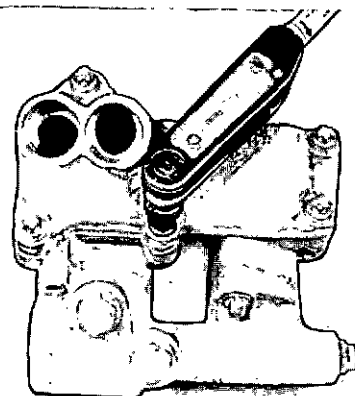
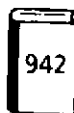
42-3.110

22. Position steel gasket and an additional, new gasket.



42-3.111

23. Fit cover. Tighten bolts in accordance with specifications.



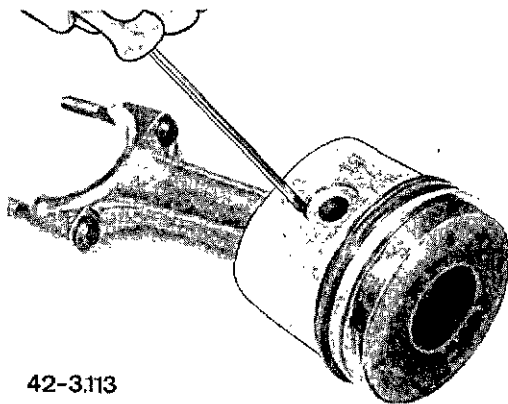
42-3.112

Piston and connecting rod

Special tools required:

- Piston ring pliers 130300
- Assembly device for small end bush 131340

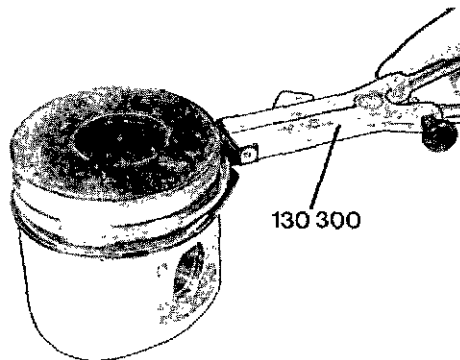
3



1. Remove circlip. Take out piston pin.



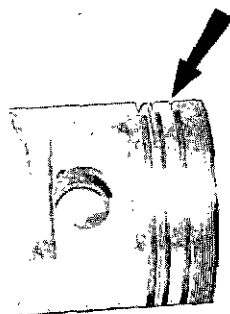
42-3.113



2. Adjust piston ring pliers to piston diameter. Remove piston rings.



42-3.114



3. Clean and inspect piston and ring grooves.

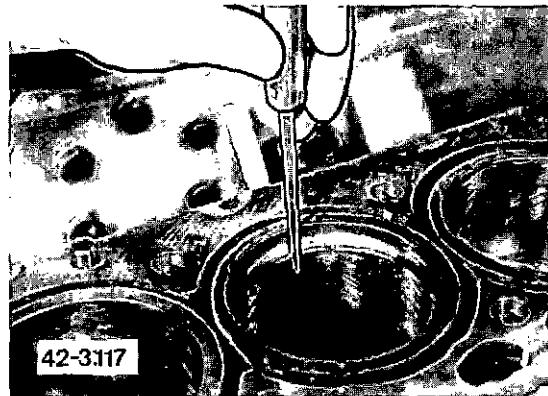
42-3.115

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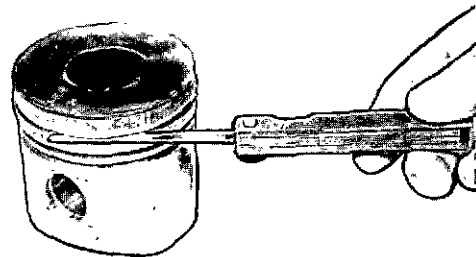
4. Measure ring gap with feeler gauge.

Note:

Gauge with new piston rings fitted.

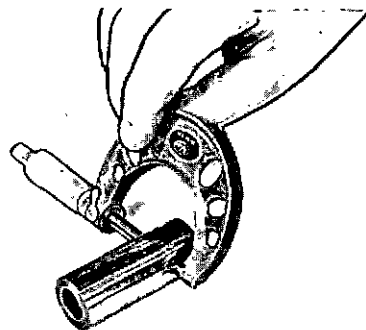


5. Measure ring grooves with feeler gauge.



42-3.116

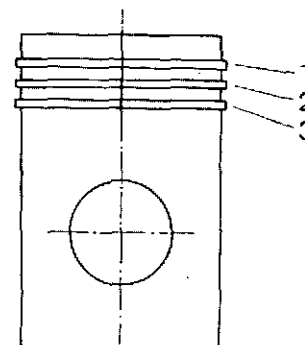
6. Check piston pin for wear.



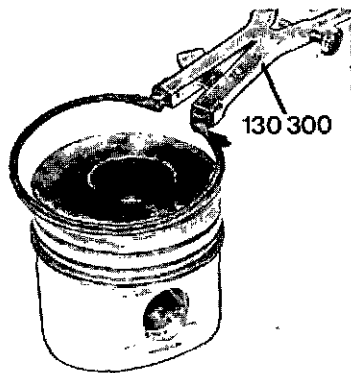
42-3.118

7. Order and position of piston rings:

1. Rectangular ring
On BF-engines: keystone ring
2. Tapered compression ring
(top facing comb.chamber)
3. Bevelled-edge slotted oil control ring



42-3.119



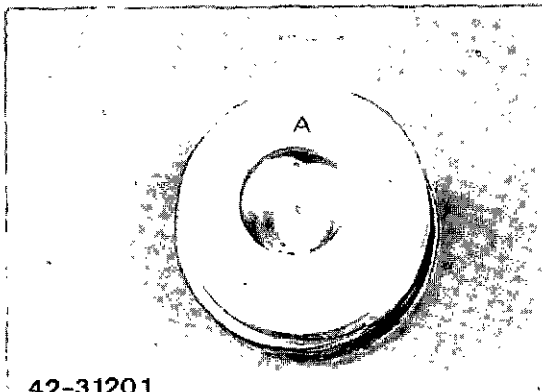
42-3.120



7.1. Fit piston rings.

Note:

Spring gap of bevelled edge ring to be offset by 180° relative to ring gap.



42-3.120.1



Note:

Standard pistons are installed with the following compression heights

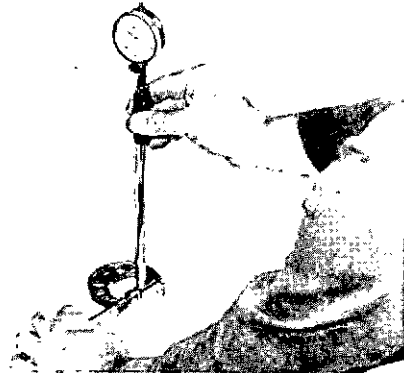
hKH1 piston A = 55.17 mm
hKH2 piston B = 55.27 mm
hKH3 piston C = 55.37 mm.

The identification numbers of 3 piston variants are stamped on the piston crown. When exchanging a piston, make sure that a piston with same compression height is installed.

When renewing the crankshaft or crankcase, the distance between "top edge of crankpin TDC and cylinder head gasket seating surface" has to be gauged again in order to determine the piston compression height. See Section 4.

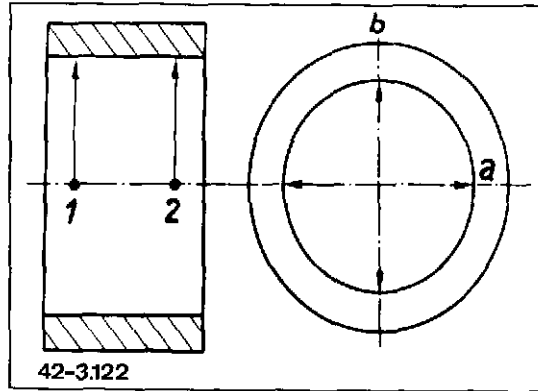
Connecting rod

8. Set internal dial gauge.



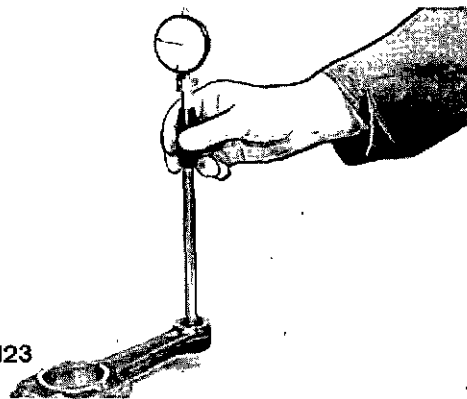
42-3.121

9. Gauge small end bush at points 1 and 2 in planes „a“ and „b“.



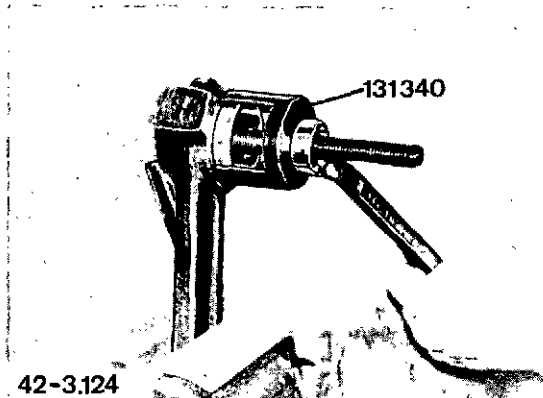
42-3.122

10. Gauge



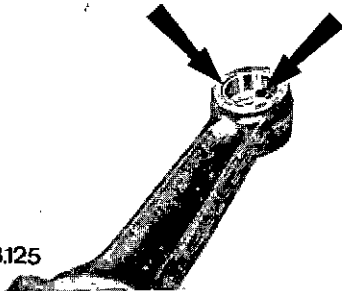
42-3.123

11. Replace small end bush as necessary.



42-3.124

42-3125

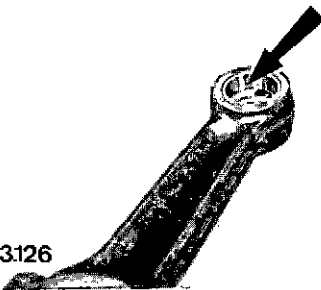


12. Lube oil bores of small end bush and connecting rod must be in line.

Note:
Press in small end bush flush.

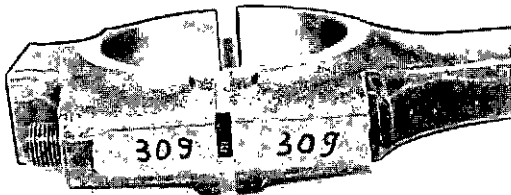
3

42-3126



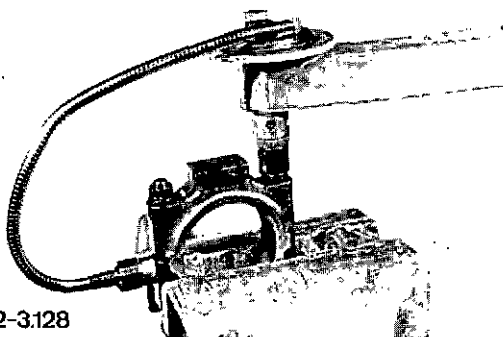
13. After pressing in, precision-bore small end bush on a fine boring mill.

42-3127



14. Make sure that cap mates with connecting rod.

42-3128

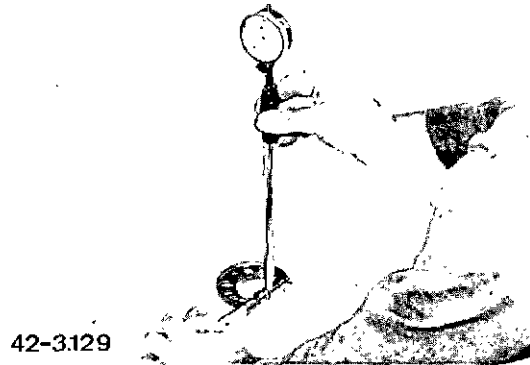


15. Mount bearing cap. Tighten nuts with **12-point socket spanner** in accordance with specifications.

Note:
Clamp connecting rod in vise at big end.

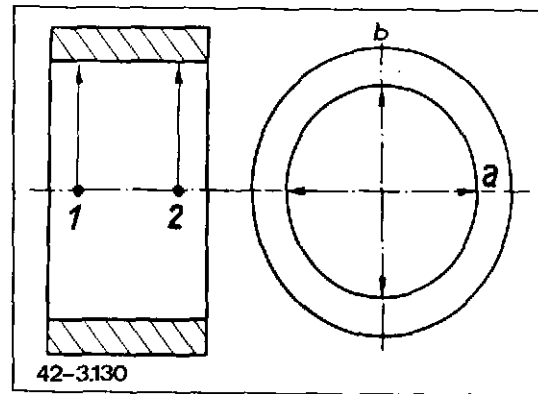
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16. Set internal dial gauge.



42-3129

17. Diagram for gauging big end bearing bore at points 1 and 2 in planes „a“ and „b“.

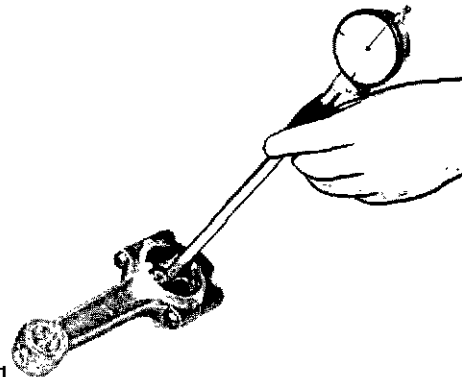


42-3130

18. If the gauge readings conform to the specified values, the necessary preload will be obtained after fitting the bearing shells.

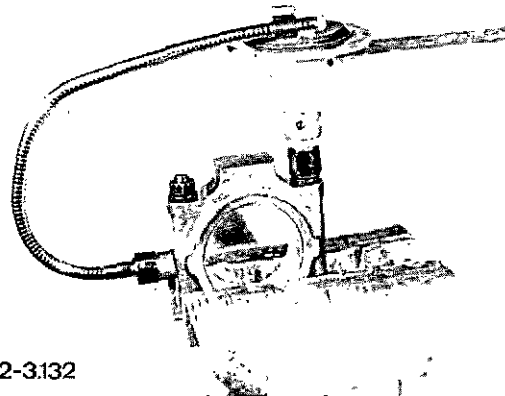
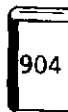
Note:

If the measured values deviate only slightly, additional measurements are to be carried out with new bearing shells fitted.

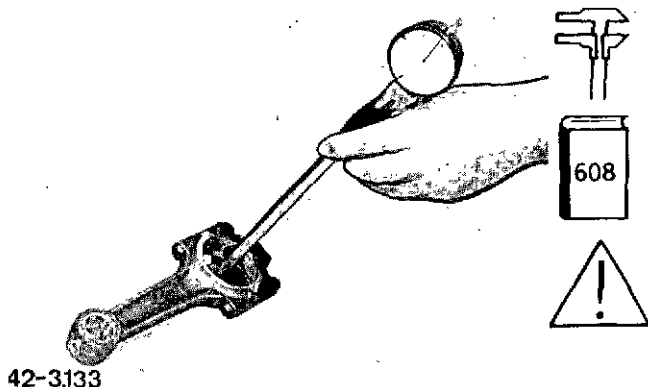


42-3131

19. Remove bearing cap and fit new bearing shells. Refit bearing cap. Tighten nuts in accordance with specifications.

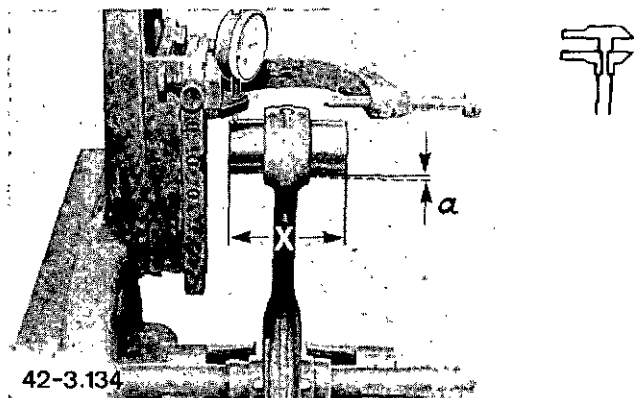


42-3132



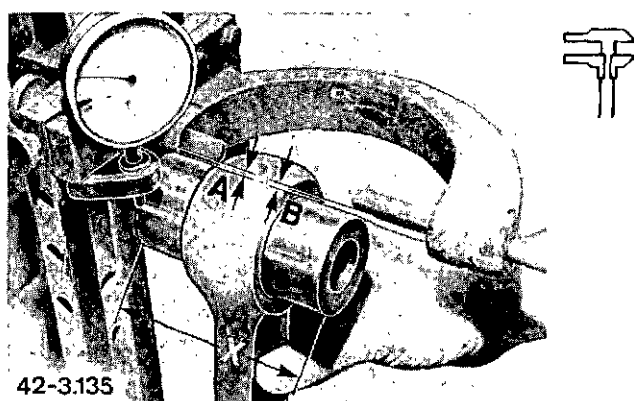
20. Adjust internal dial gauge. Gauge bearing shells at points 1 and 2 in planes „a“ and „b“.

Note:
If the readings do not exceed bearing tolerances by more than **0.015 mm** the rod can be kept in use. If the limit value is exceeded, replace connecting rod.



21. Check connecting rod without bearing shells on connecting rod tester.

21.1 Parallelism check: Permissible tolerance $a = 0.10 \text{ mm}$ over a distance $x = 100 \text{ mm}$.



21.2 Squareness check:

Permissible tolerance „A“ relative to „B“ = 0.08 mm .

Assembling connecting rod with piston

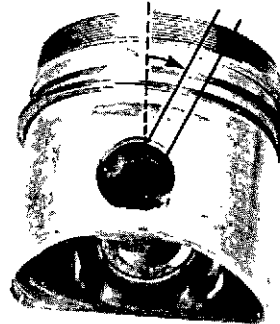
22. Fit circlip.



42-3.136

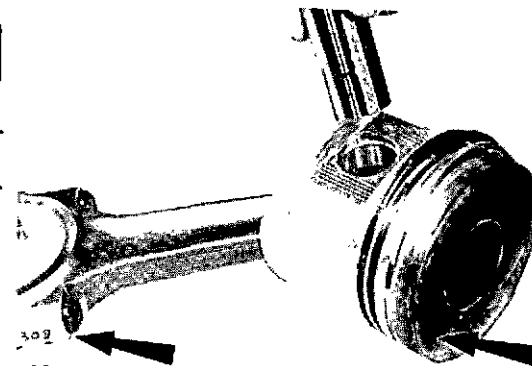
Note:

Ring gaps of circlips must face towards piston crown.



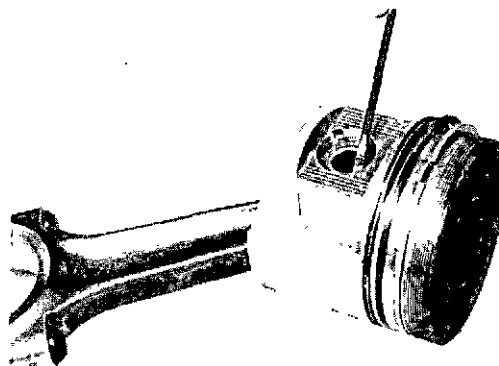
42-3.137

23. Install piston together with connecting rod. Flywheel symbol on the piston must point to the left and identification number on connecting rod must be visible.

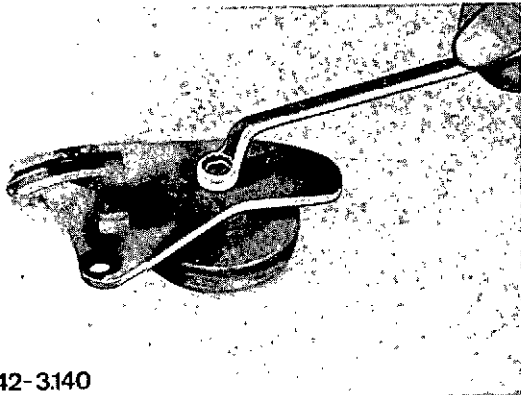


42-3.138

24. Fit second circlip and bring into correct position.

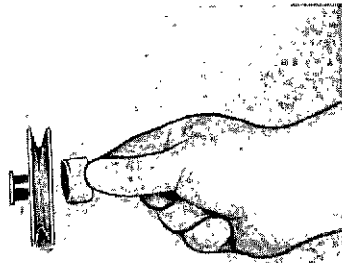


42-3.139

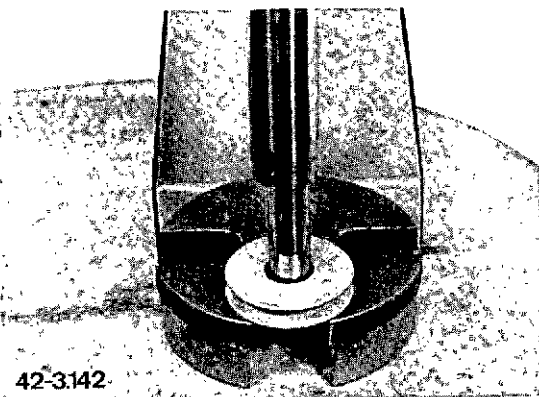


V-belt idler pulley

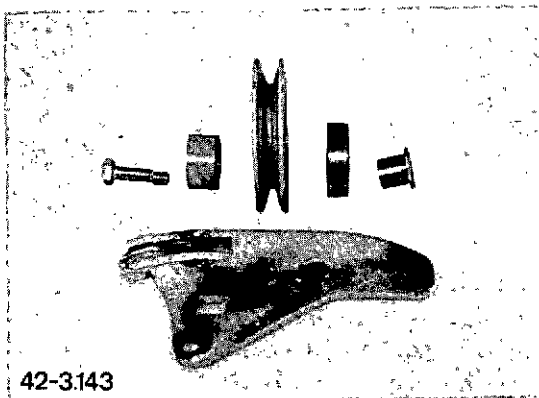
1. Remove clamping plate.



2. Remove spacer bush and flanged bush.



3. Press out ball bearing.

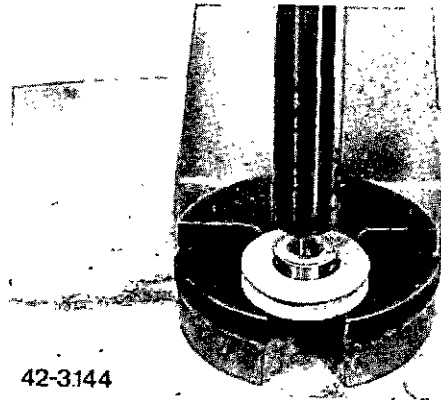


4. Inspect individual component parts.



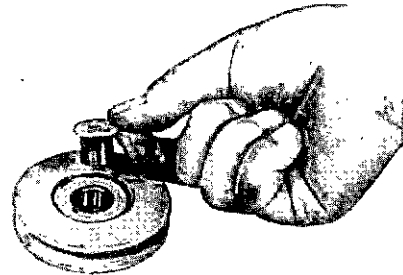
Note:
Replace ball bearing as necessary.

5. Press in ball bearing as far as it will go.



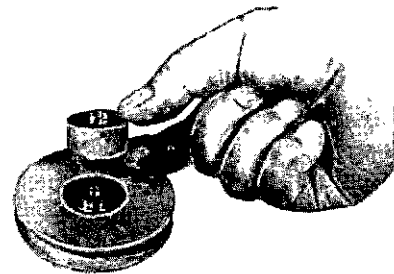
42-3:144

6. Refit flanged bush.



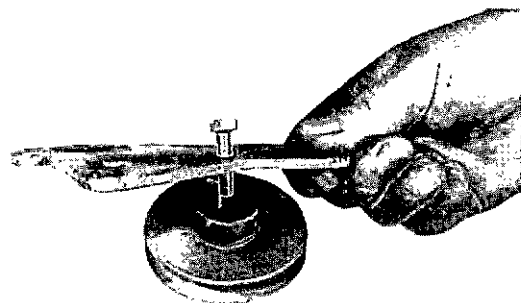
42-3:145

7. Refit spacer bush.

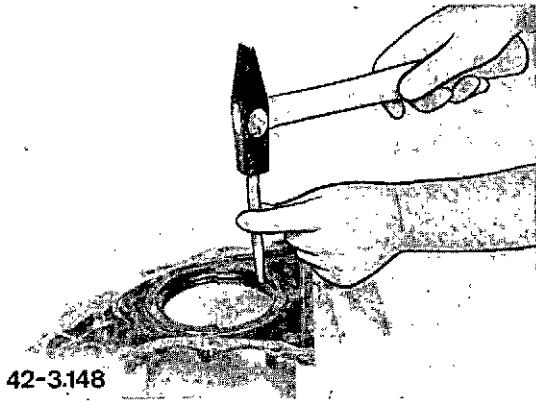


42-3:146

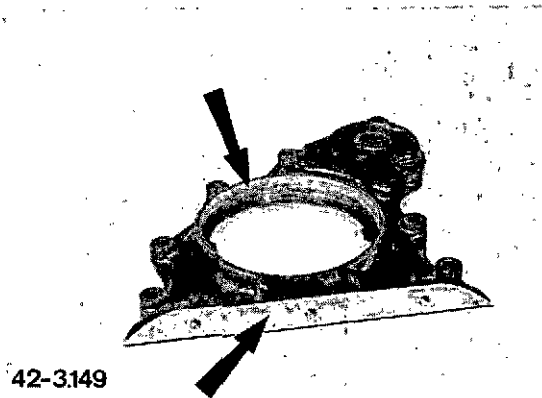
8. Refit clamping plate.



42-3:147



42-3.148



42-3.149



Rear cover

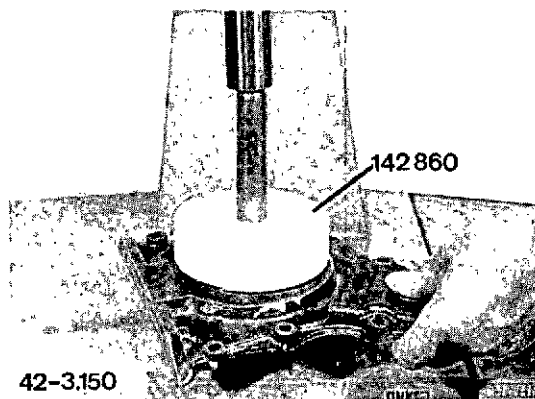
Special tools required:

Assembly tool 142860

1. Drive out shaft seal.

2. Inspect cover and replace as necessary.

3



42-3.150

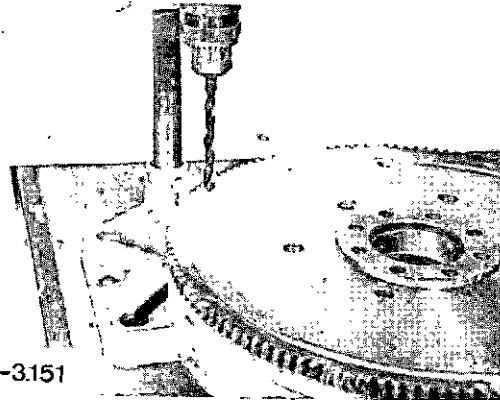
142860



3. Fit shaft seal with assembly tool.

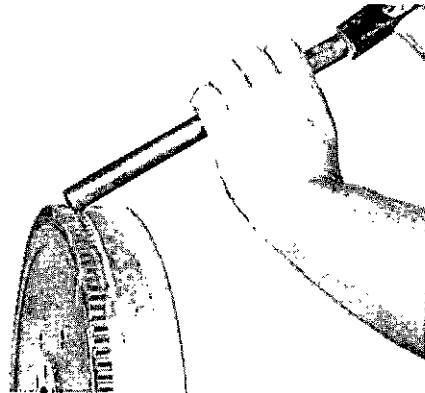
Starter ring gear/flywheel

1. Drill ring gear apart.



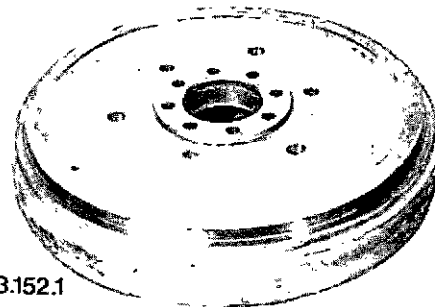
42-3.151

2. Remove ring gear.



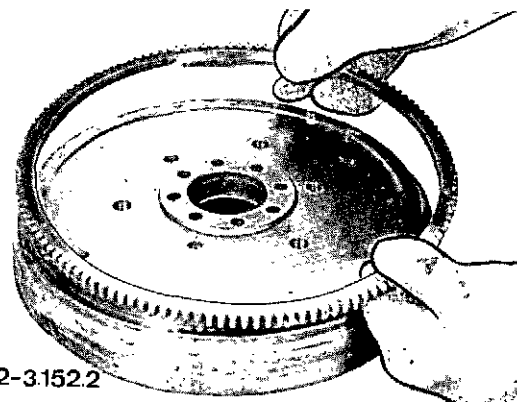
42-3.152

3. Clean flywheel and inspect at supporting flange.



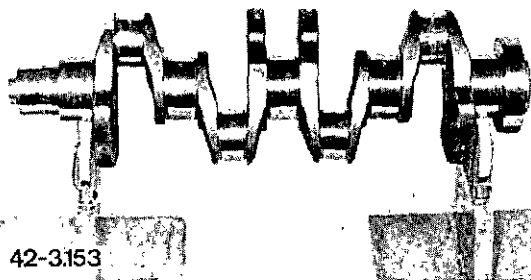
42-3.152.1

4. Heat ring gear to max. 220° C. Place ring gear in position and bring to stop at flange.

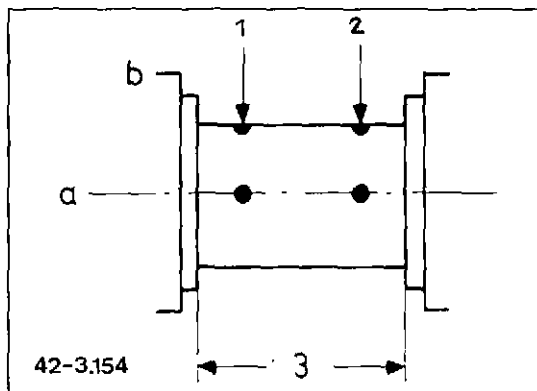


42-3.152.2

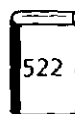
Crankshaft



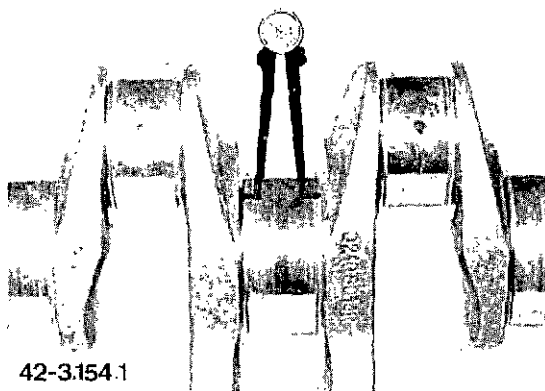
1. Chuck crankshaft up on prism stand.



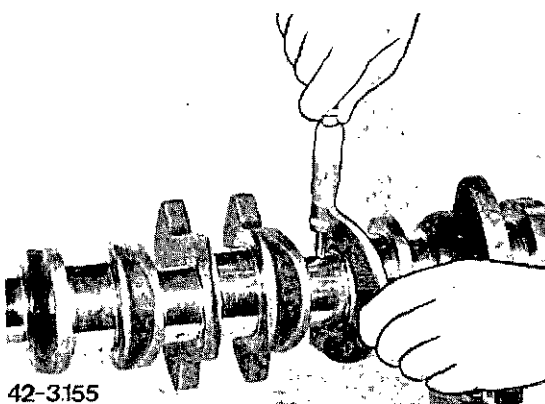
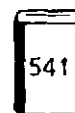
2. Diagram for gauging main bearing journals at points „1“ and „2“ in planes „a“ and „b“.



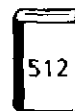
3



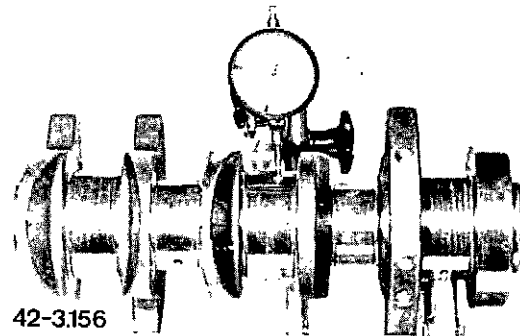
3. Gauge width of thrust bearing journal.



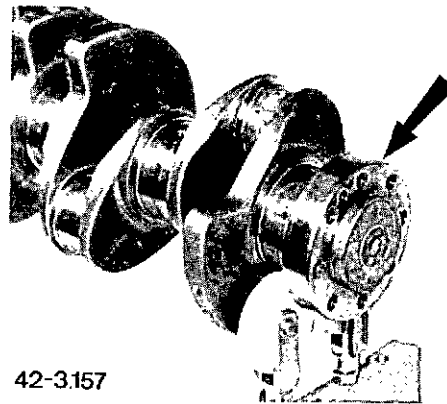
4. Gauge crankpin.



5. Check crankshaft for true running.



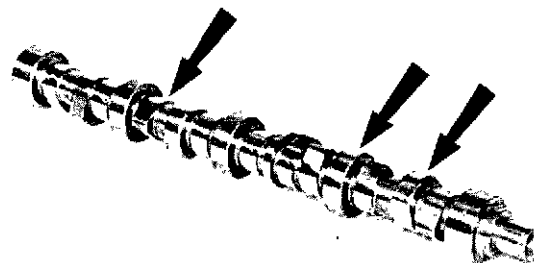
6. Inspect running surfaces of shaft seals.



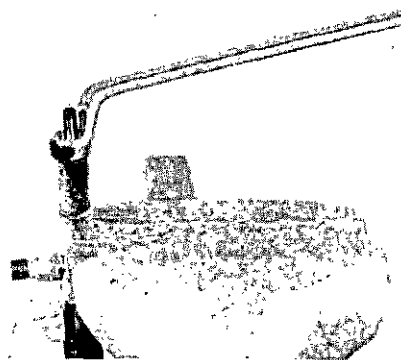
3

Camshaft

1. Check cams and bearing journals for wear.



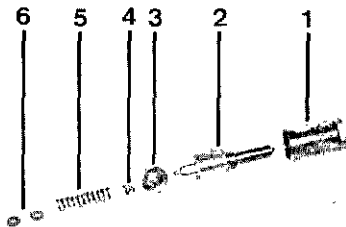
42-3.158



42-3.159

Injector

1. Undo cap nut.



42-3.160

2. Sequence of parts reassembly

1. Cap nut
2. Injection nozzle
3. Intermediate pieces
4. Thrust pin
5. Compression spring
6. Shims

Wash all parts in clean diesel fuel and blow out with compressed air.



42-3.161

3. Nozzle needle and nozzle body are lapped together and may neither be confused nor exchanged individually. Do not touch nozzle needle with your fingers. When nozzle body is held in upright position, nozzle needle should by its own weight slide down slowly and smoothly on its seating.

Note:

If nozzle needle does not slide down smoothly, wash injection nozzle again in diesel fuel. Renew, if necessary. New injection nozzle must likewise be washed in clean diesel fuel.



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4. Check seating faces of intermediate piece for wear. Make sure that centering pins are fitted.



42-3.162

5. Insert shims.



Note:

The ejecting pressure is dependent on the shims.



42-3.163

6. Insert compression spring.



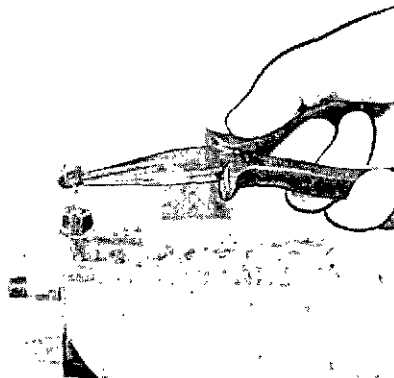
42-3.164

7. Insert thrust pin with centering collar facing towards the spring.



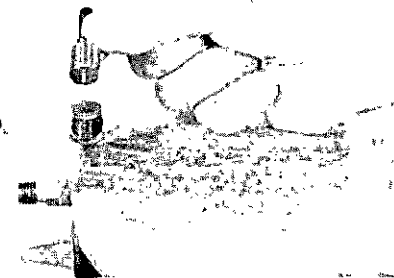
42-3.165

42-3.166



8. Insert intermediate piece with centering pins fitting into the bores in the nozzle holder.

42-3.167



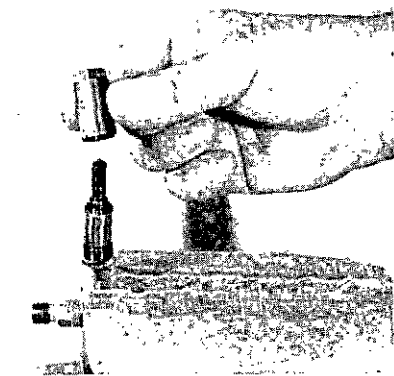
9. Fit injection nozzle with center bores mating with the centering pins of the intermediate piece.

Note:

Take care that nozzle needle does not fall out of nozzle body.

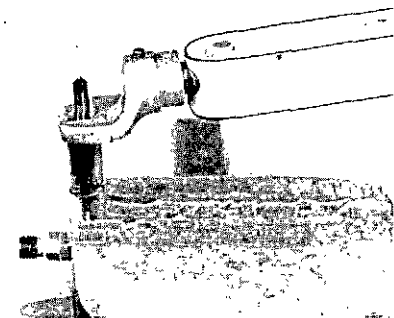


42-3.168



10. Screw on cap nut.

42-3.169



11. Tighten cap nut in accordance with specifications.

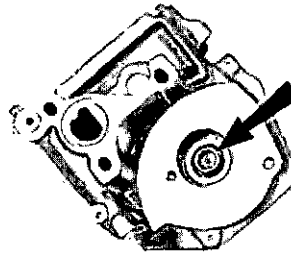
For testing and adjusting injector see chapter 2.



Hydraulic pump bracket

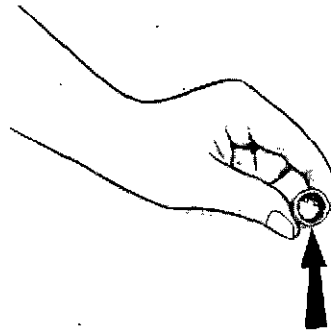


1. Remove coupling sleeve.



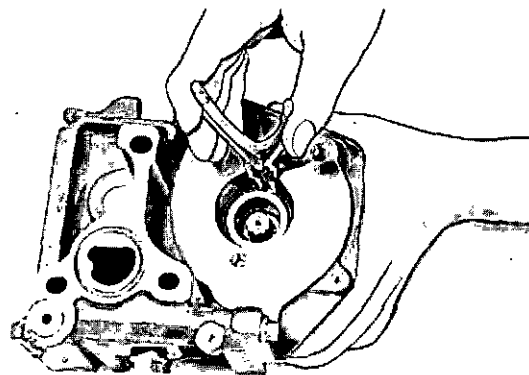
42-3.170

2. Remove circlip.



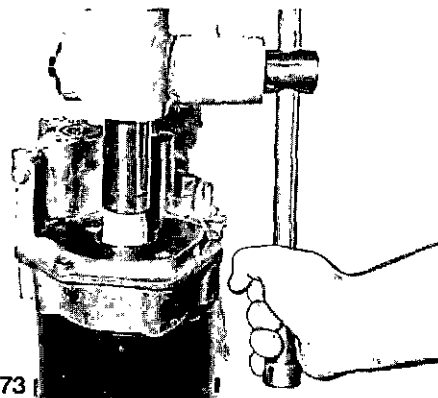
42-3.171

3. Remove circlip.

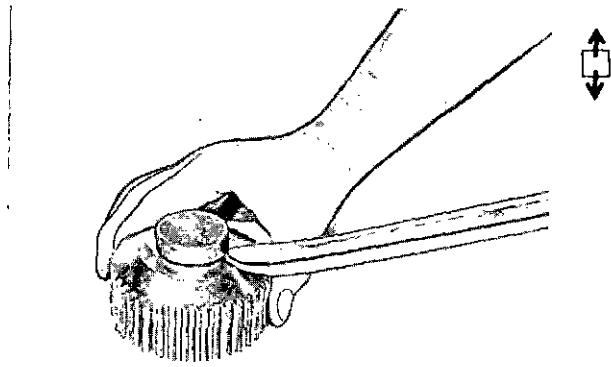


42-3.172

4. Push out hydraulic pump gear.

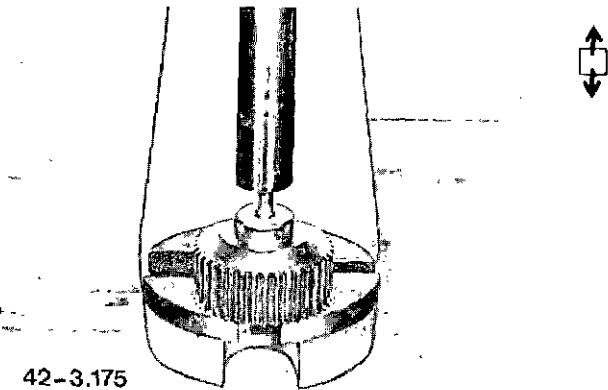


42-3.173



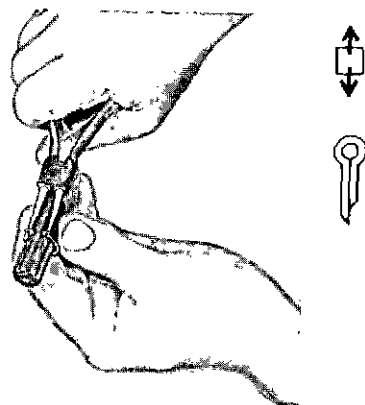
42-3.174

5. Lever up the cover.



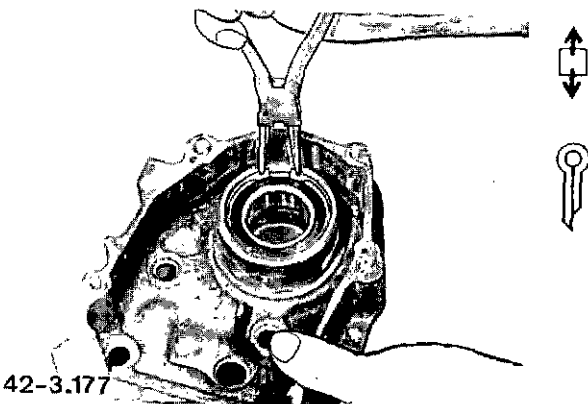
42-3.175

6. Push out serrated shaft.



42-3.176

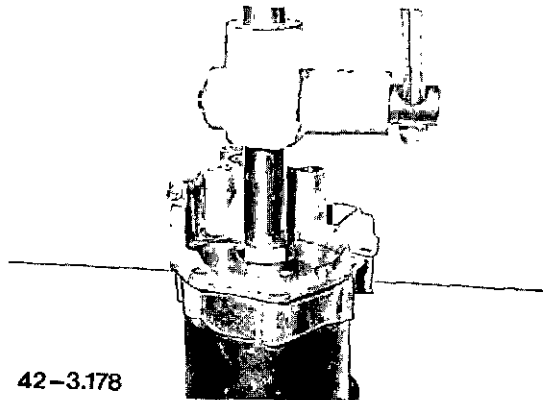
7. Remove circlip.



42-3.177

8. Remove circlip.

9. Push out ball bearing.

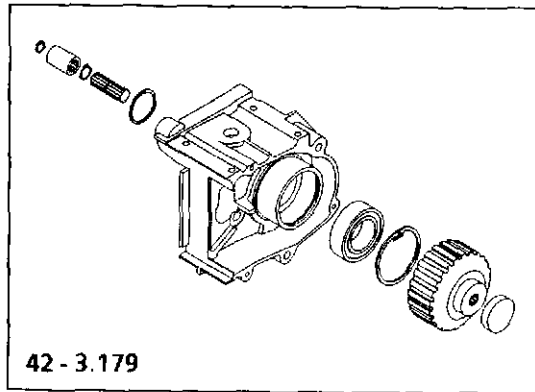


42-3.178

10. Inspect component parts.

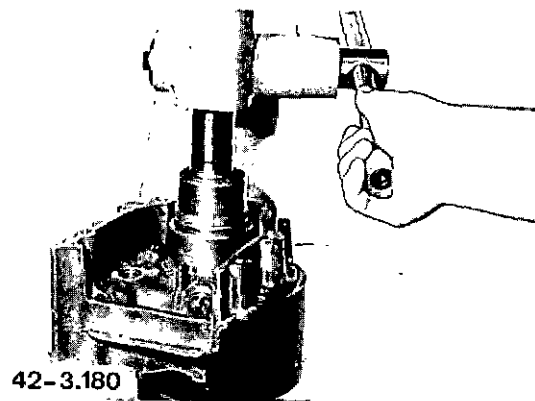
Note:

Renew component parts, if necessary.



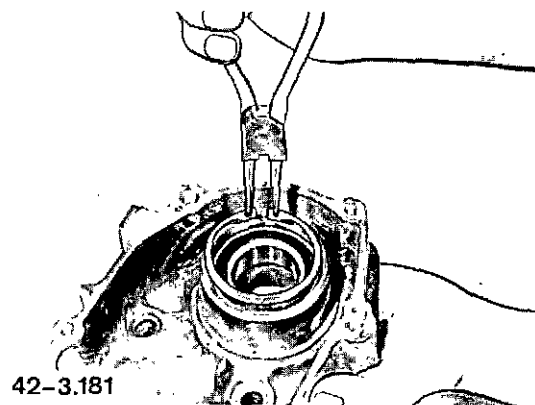
42-3.179

11. Push in ball bearing.

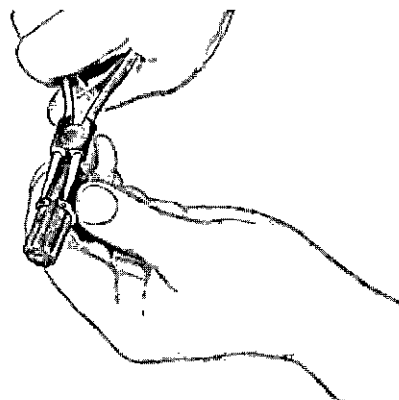


42-3.180

12. Insert circlip.



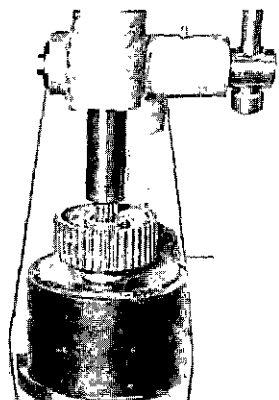
42-3.181



42-3.182



13. Insert circlip in groove on toothed shaft.



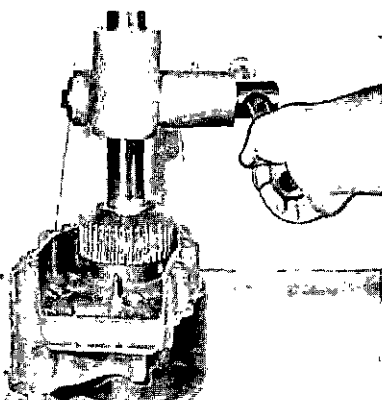
42-3.183



14. Push in serrated shaft with graphite grease.

Note:
Observe circlip.

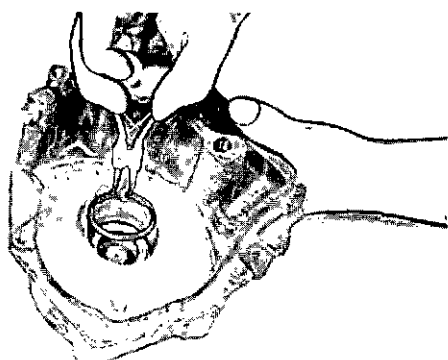
3



42-3.184



15. Push in hydraulic pump gear.

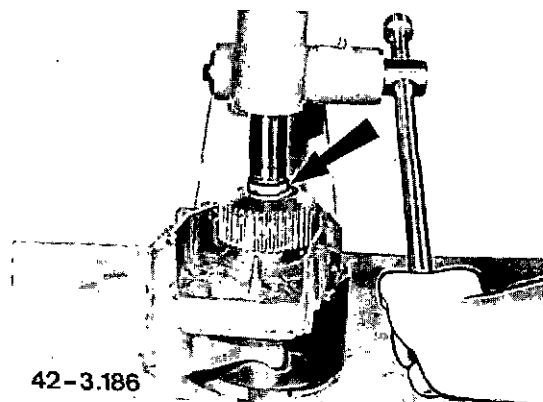


42-3.185



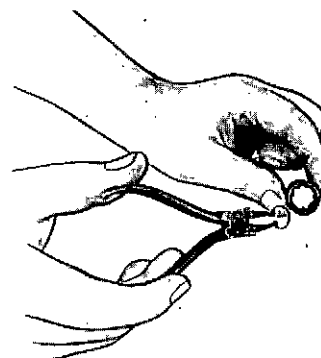
16. Insert circlip.

17. Press cover down.



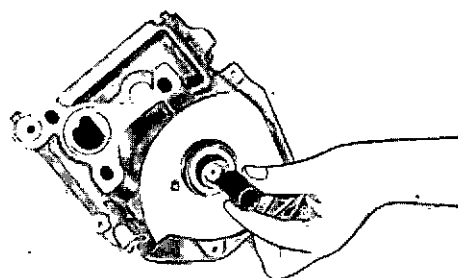
42-3.186

18. Insert circlip.



42-3.187

19. Insert coupling sleeve with graphite grease.



42-3.188

Crankcase with integrated cylinder liners

Commercial tools required:

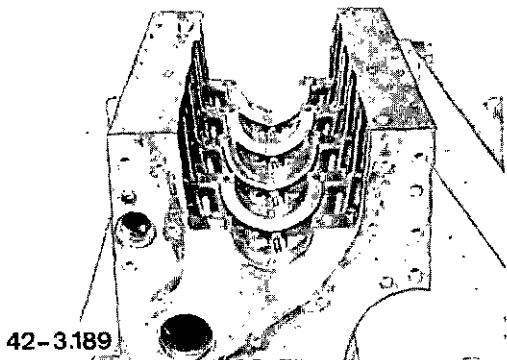
- Screwdriver socket 740c
- Internal dial gauge

Special tools required:

- Assembly tool for camshaft sleeve..... 143720
- Assembly tool for control rod sleeve 110100

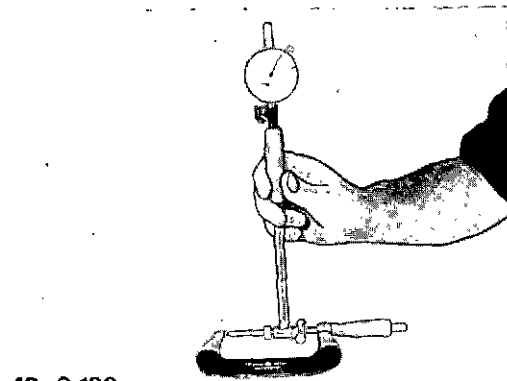
1. Clean crankcase and inspect for damage.

3



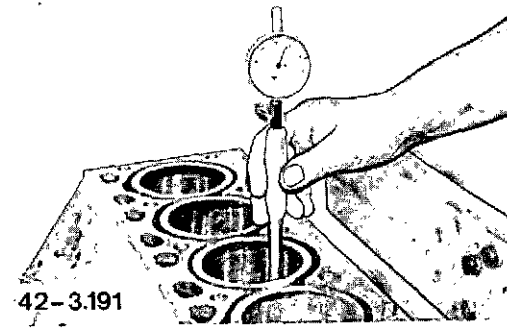
42-3.189

2. Set internal dial gauge.



42-3.190

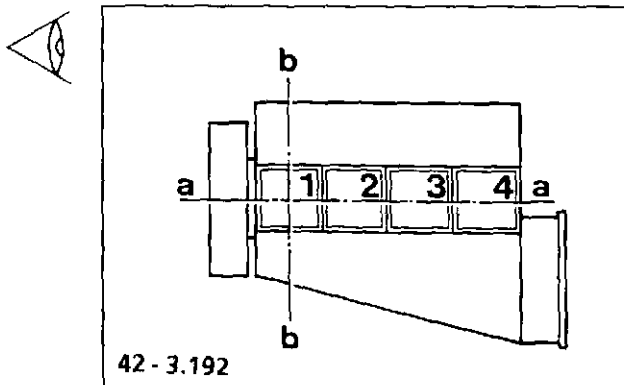
3. Gauge cylinders -



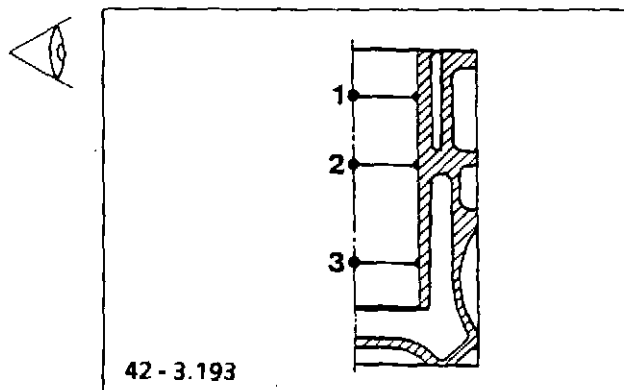
42-3.191

Werkstatthandbuch B/FL 1011/T

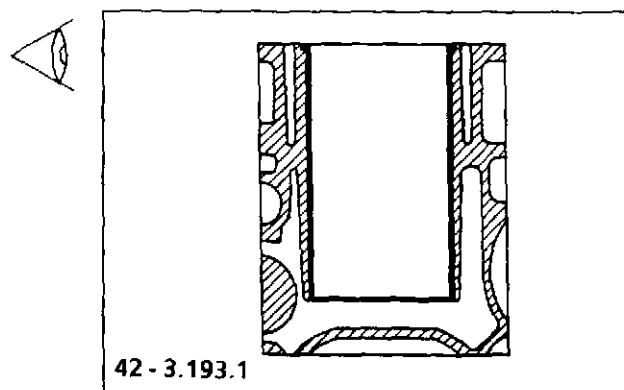
3.1 - in the engine's longitudinal axis "a" and transverse axis "b"



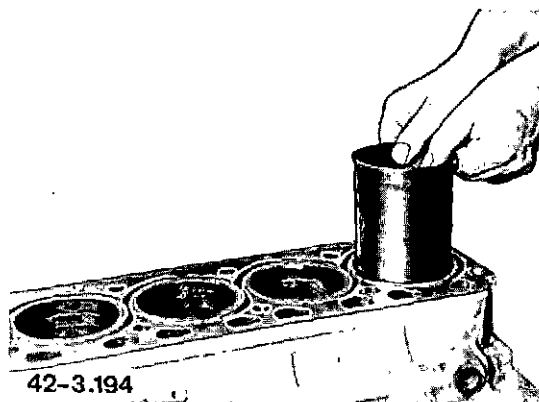
3.2 - and in planes 1-3.



4. If the cylinder working surfaces are worn out, it is possible to obtain a rebored crankcase with new, finish-machined ("slip-fit") liners from our service centers.

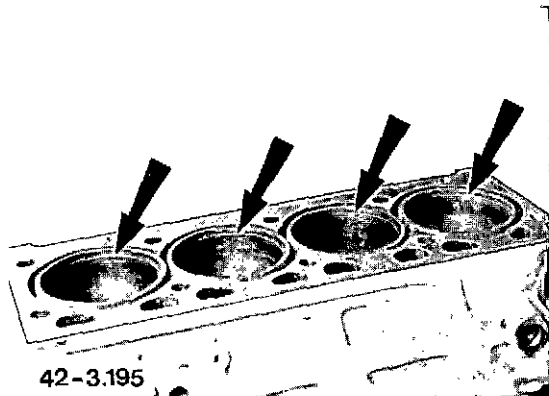


5. If the crankcase features slip-fit liners, - pull them out.

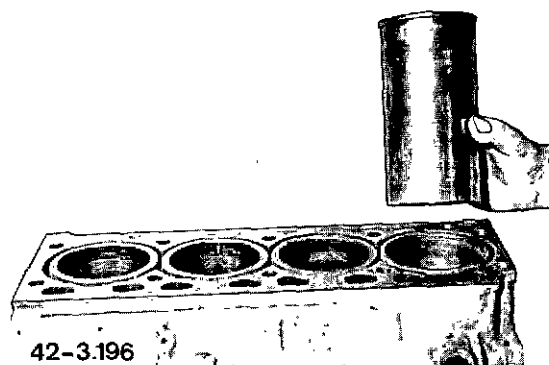


Repair of components

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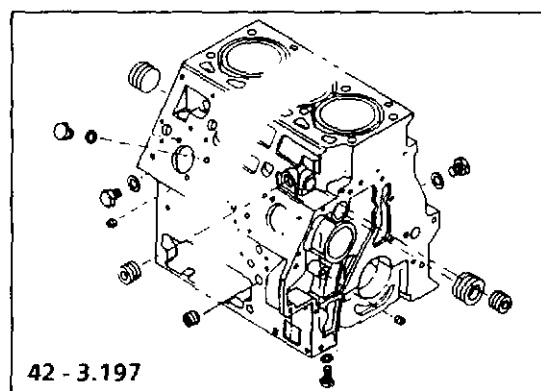
6. Inspect receiving bores and collar seating surface.



7. Push in new slip-fit liners as far as stop.



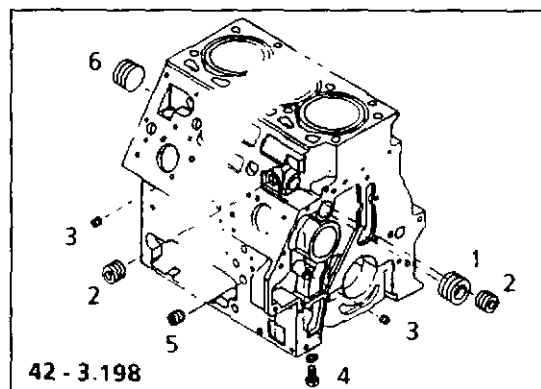
Note:
Use only with new standard pistons.



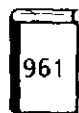
If the measured data correspond to the values specified for the liners, the crankcase is to be reconditioned, as required.



8. Remove screw plugs. Check oil ducts for free passage.



9. Tighten screw plugs in accordance with specifications.

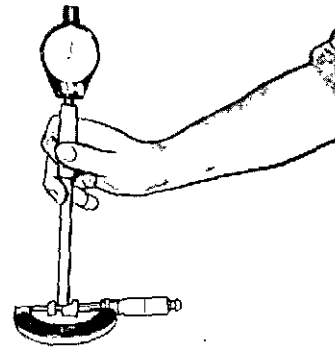


Note:
Apply locking compound DW71 to items 2-6.



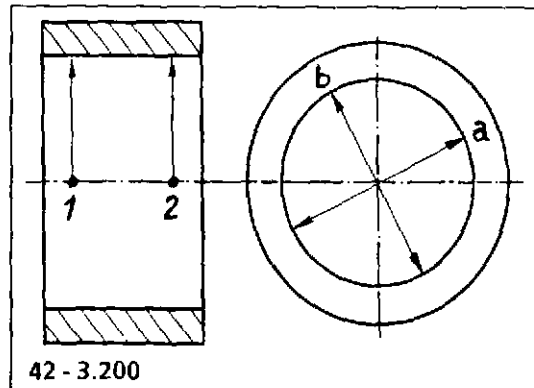
Camshaft bearing bushes

10. Set internal dial gauge.



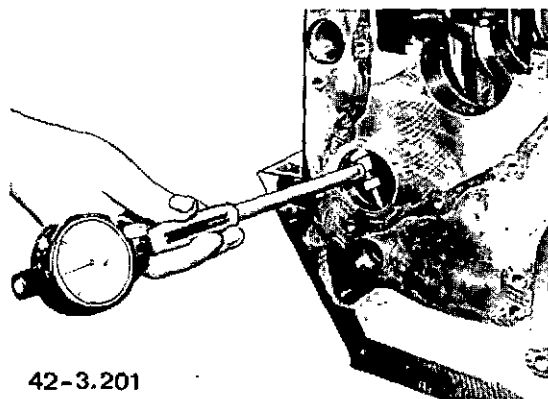
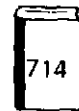
42-3.199

11. Schematic for gauging the bearing bushes at points 1 and 2 in planes "a" and "b".



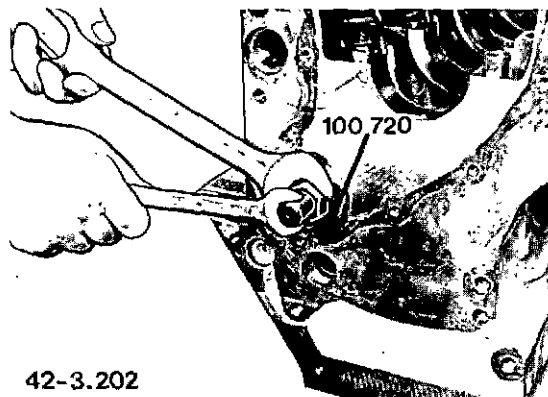
42-3.200

12. Gauge bearing bushes, renew if necessary.



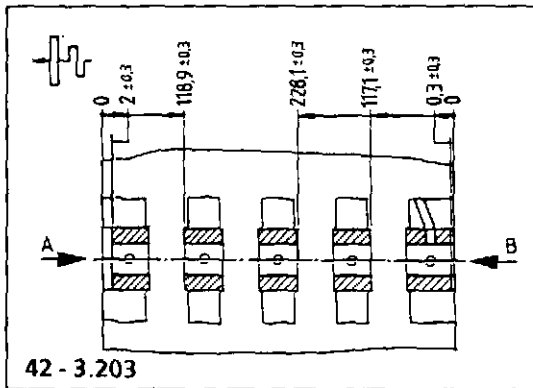
42-3.201

13. Remove bearing bushes.



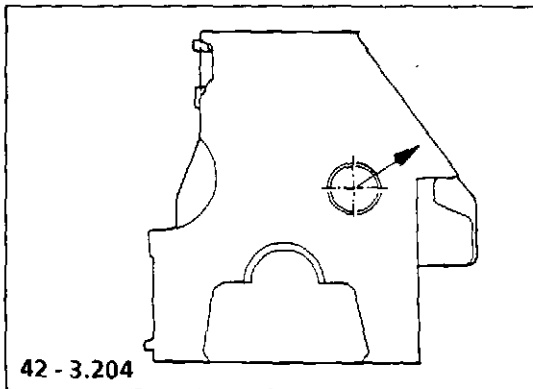
42-3.202

Werkstatthandbuch B/FL 1011/T

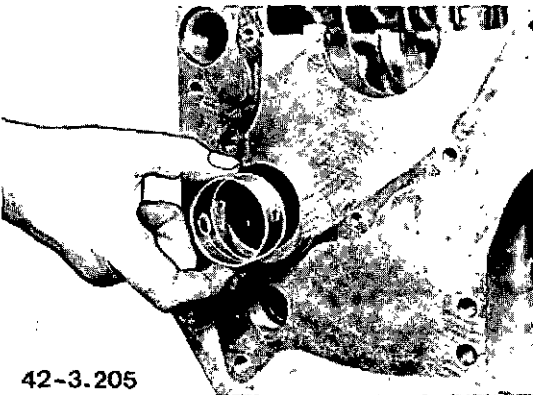


14. Schematic: Installation dimensions of bearing bushes.,

| | A | B |
|--------|--------------------|--------------------------------|
| 2 Zyl. | 2,0 mm | 0,3 mm 117,1 mm |
| 3 Zyl. | 2,0 mm 118,9 mm | 0,3 mm 117,1 mm |
| 4 Zyl. | 2,0 mm 118,9 mm | 0,3 mm 117,1 mm 228,1 mm |

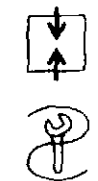
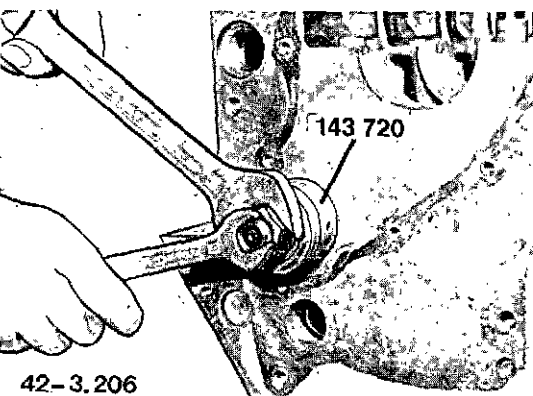


15. Schematic: Direction of installation of joint in the bearing bush.



16. Position new bearing bush.

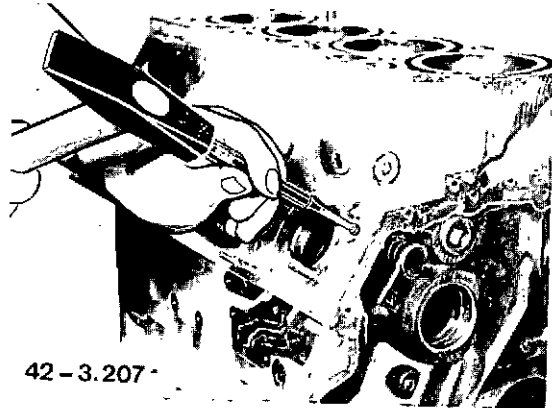
Note:
Lube oil bores must be lined up.



17. Install bearing bush.

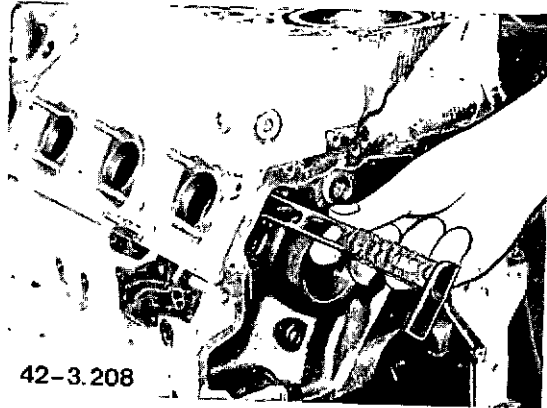
Control rod and guide sleeves.

18. Drive out cylindrical pin.



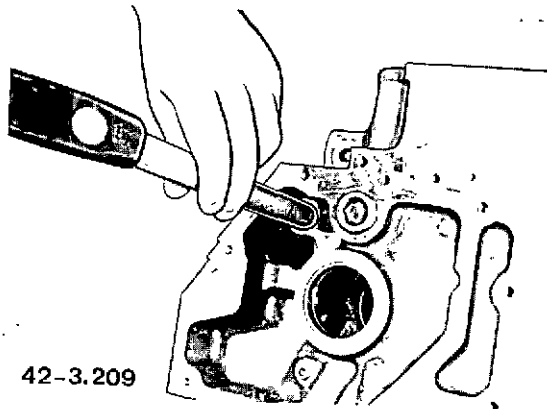
42-3.207

19. Remove control rod together with spring.



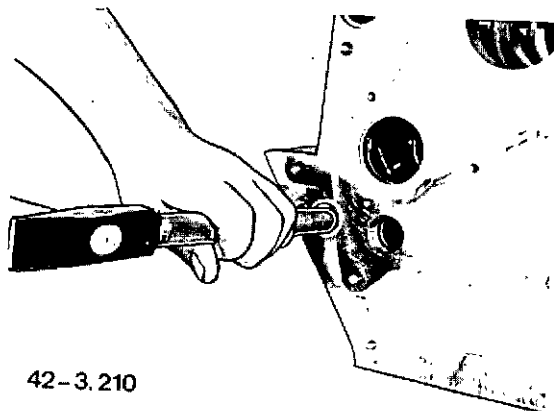
42-3.208

20. Drive out guide sleeve at front end.

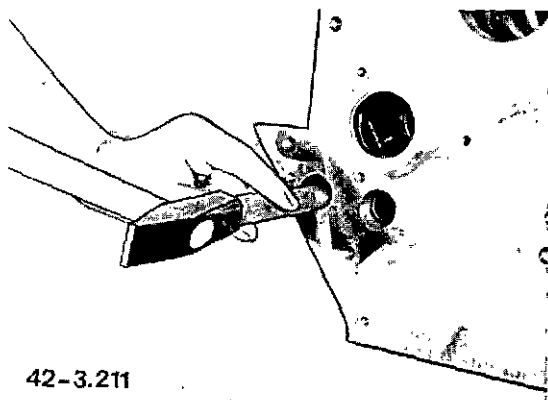


42-3.209

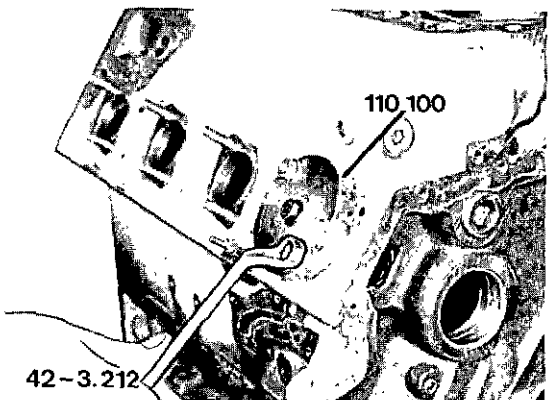
21. Drive out cover.



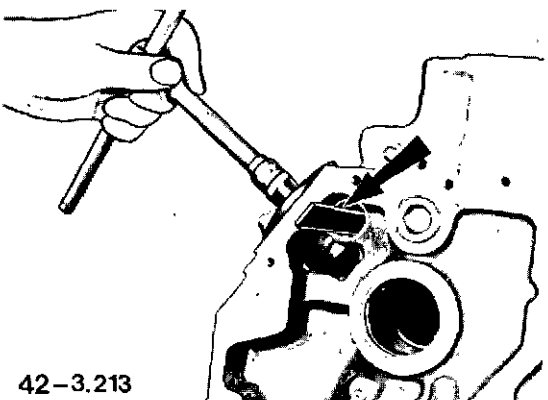
42-3.210



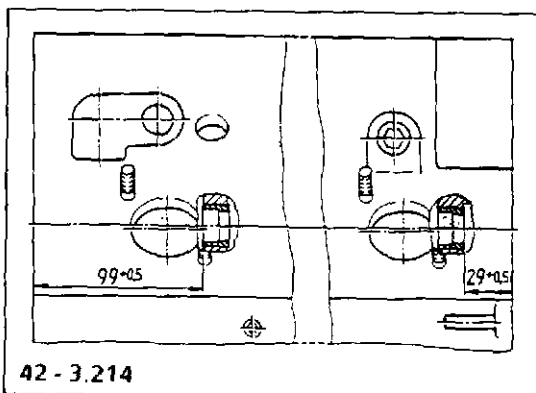
22. Drive out guide sleeve at flywheel end.



23. Position assembly tool and screw on.



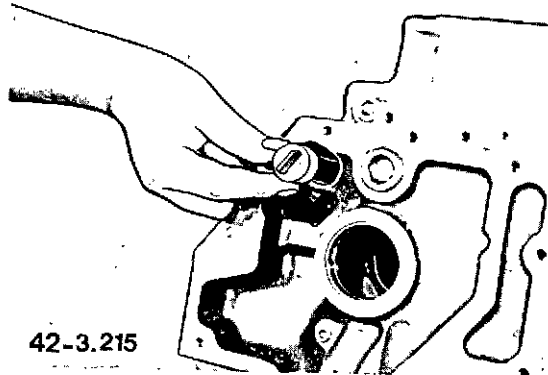
24. Insert guide bar and tighten.



25. Installation schematic: Guide sleeves.



26. Slide guide sleeve over guide bar and drive in, using self-made assembly tube.

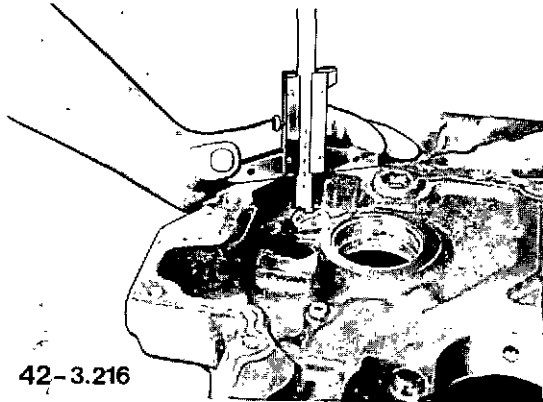


42-3.215

27. Measure distance of guide bar. See schematic.

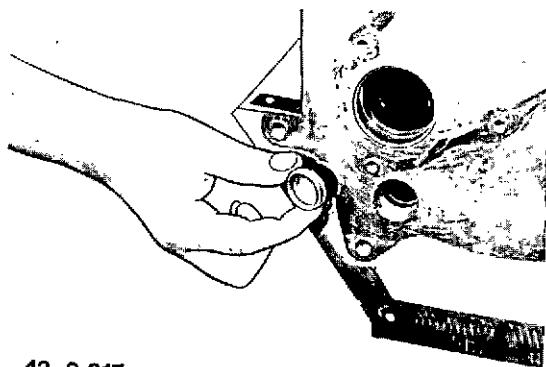
Note:

Installation of guide sleeve at flywheel end: see points 23-27.



42-3.216

28. Apply locking compound DW 71 to new cover and drive in flush.



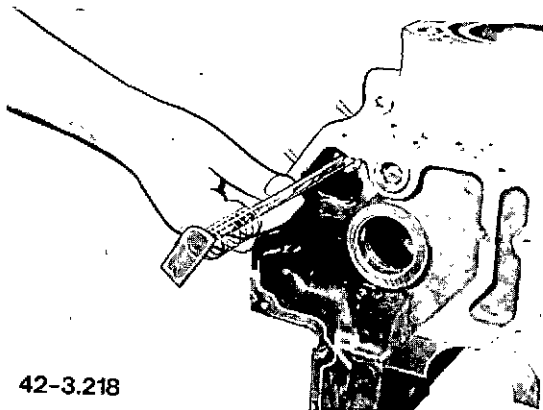
42-3.217

29. Insert control rod with starter spring into guide sleeve.

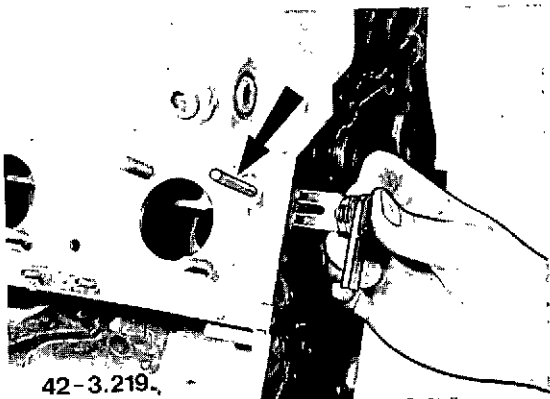


Note:

Check for free movement.



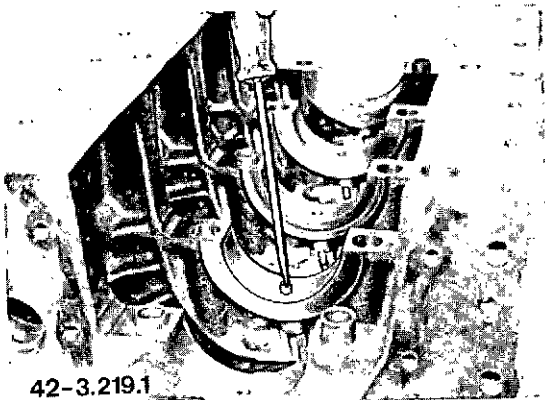
42-3.218



42-3.219.



30. Compress starter spring. Drive in cylindrical pin into recess for control rod limitation. Check that it is flush with surface.



42-3.219.1



Piston cooling oil nozzles

31. Renew piston cooling oil nozzles.

Note:
Before installing new piston cooling oil nozzles, check that the bore in the crankcase is clean and free of oil.

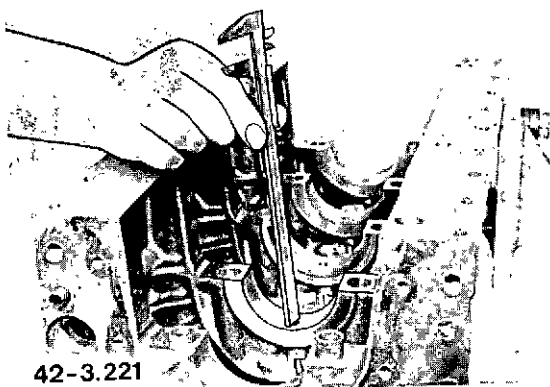
3



32. Fit new piston cooling oil nozzles in place and tighten in accordance with specifications.

Note:
BF-engines have 2 piston cooling oil nozzles per cylinder.

42-3.220



42-3.221



33. **Old version:**
Install piston cooling oil nozzle. Specified tap depth: $15,5^{+2}$ mm

Disassembly and reassembly of complete engine

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| Removal and refitment of exhaust turbocharger | 4/73-4/75 |

Disassembly and reassembly of complete engine

Dismantling engine

Commercial tools required:

Torx tools
Hose clip pliers
Spec. two-pin spanner
Bent spanner for starter
Multipower tool STW392
Socket a/flats 32 601MP

Special tools required:

Engine assembly stand ... 6067
Angled clamping plate.....
..... 6067/115
Dolly 143420
Shim..... 143430
Puller..... 143100
Dolly for camshaft 144130

The repair procedure outlined in this chapter refers to the standard specification, i.e. components for customizing the engine are not shown.

1. Clamp engine in swivel-type engine assembly stand.

Drain oil / residual oil.

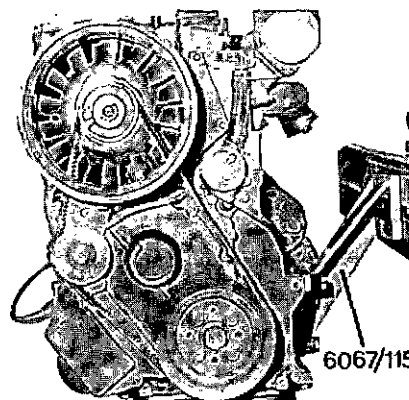
Note:

Starter to be removed before with 2- and 3cylinder engines.



42-4.1

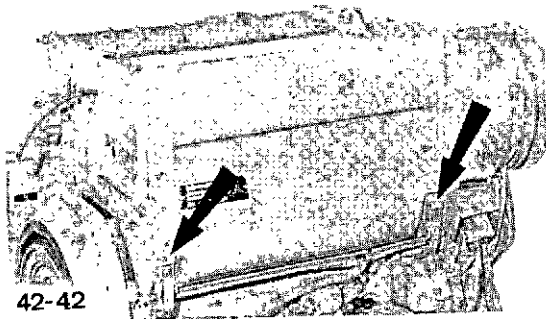
4 / 1



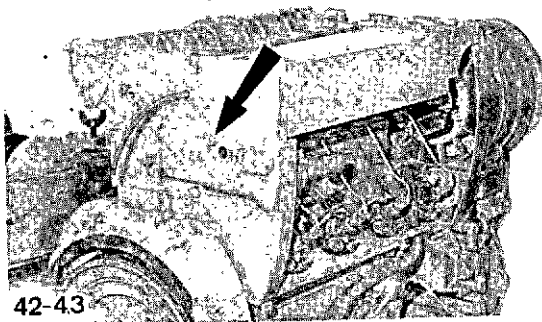
Disassembly and reassembly of complete engine

Werkstatthandbuch B/FL 1011/T

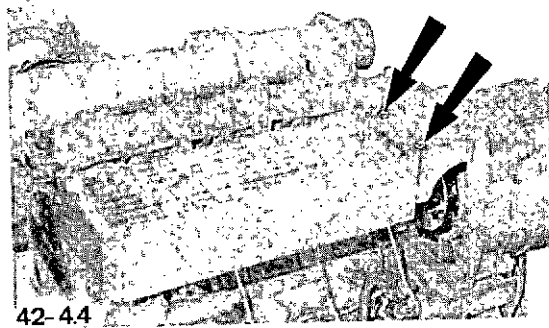
2. Remove hood.



3. Remove stay plate.

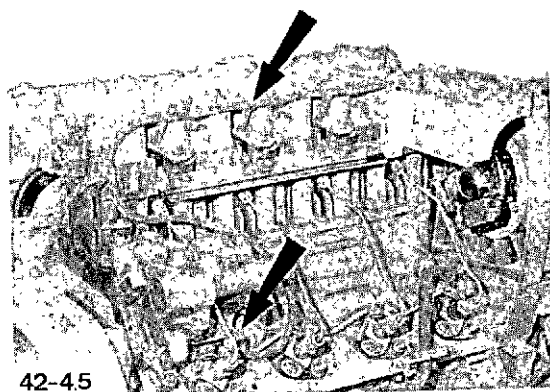


4. Remove oil cooler.

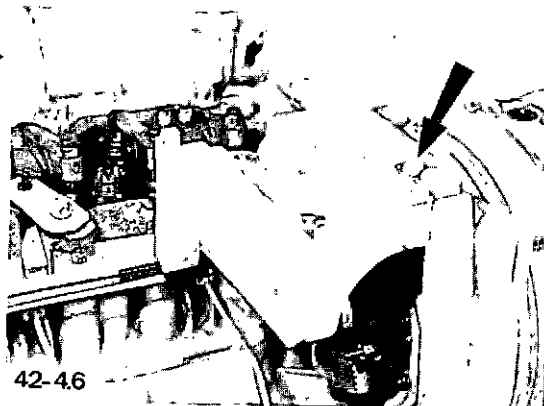


Note:
Catch any escaping oil.

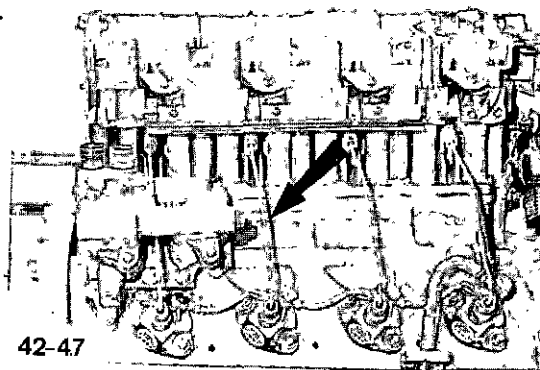
5. Remove leakage fuel pipe.



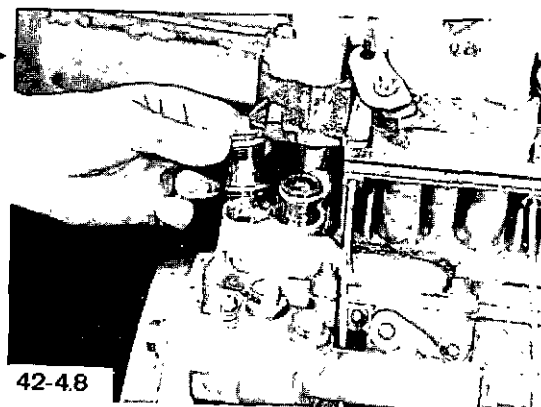
6. Remove cooling air ducting.



7. Remove injection lines.



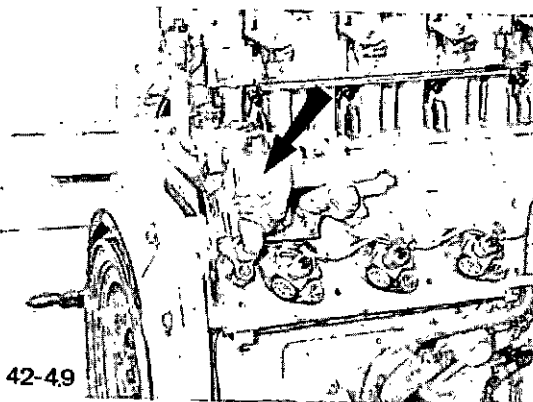
8. Take adapters out of thermostat housing.



9. Remove thermostat housing.

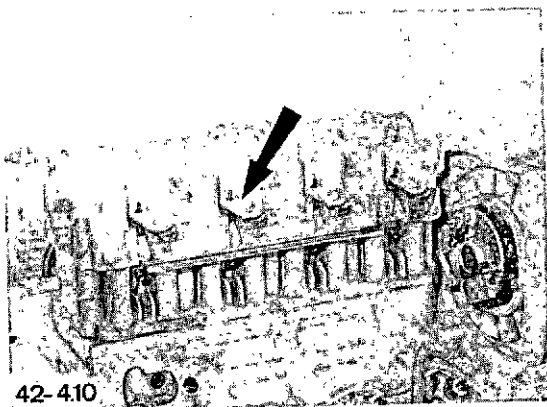


Note:
Catch any escaping oil.

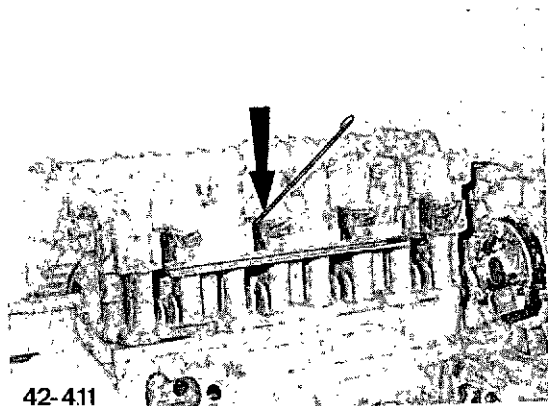


Disassembly and reassembly of complete engine

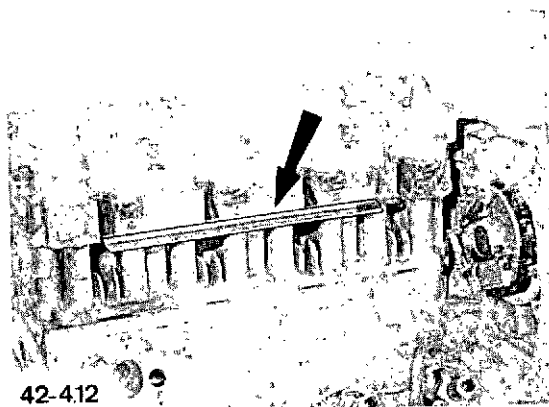
Werkstatthandbuch B/FL 1011/T



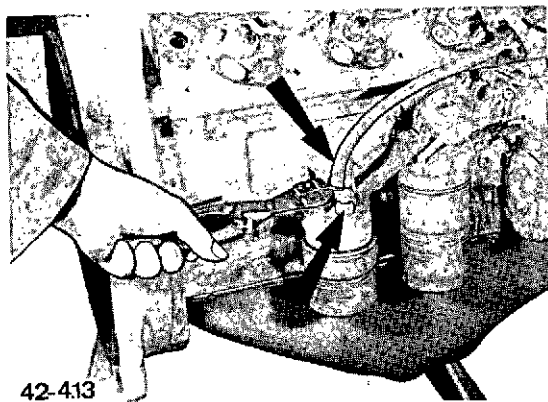
10. Take off clamping pads.
Remove injectors.



11. Remove sealing ring with
auxiliary tool.

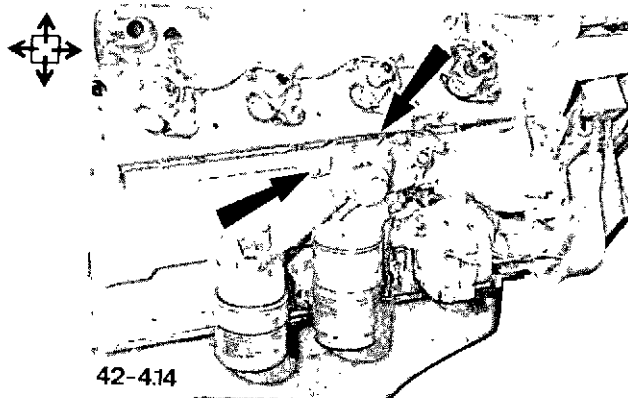


12. Lift off cover strip.

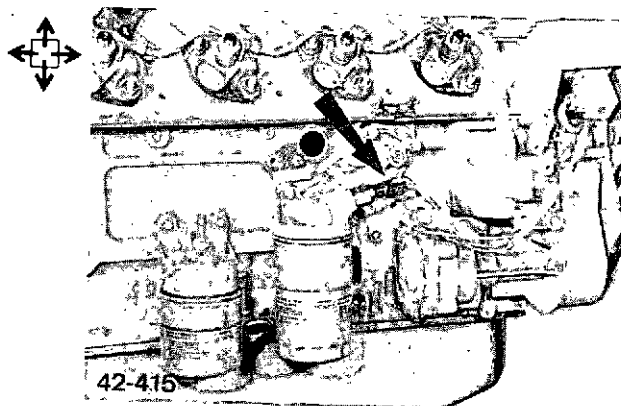


13. Remove fuel lines.

14. Remove fuel feed pump.

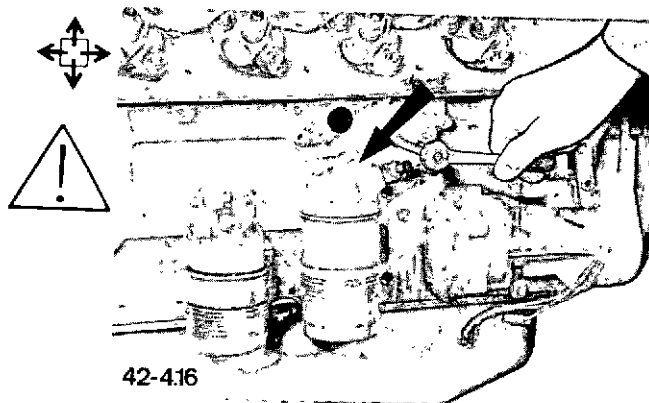


15. Pull off cable plug connection.



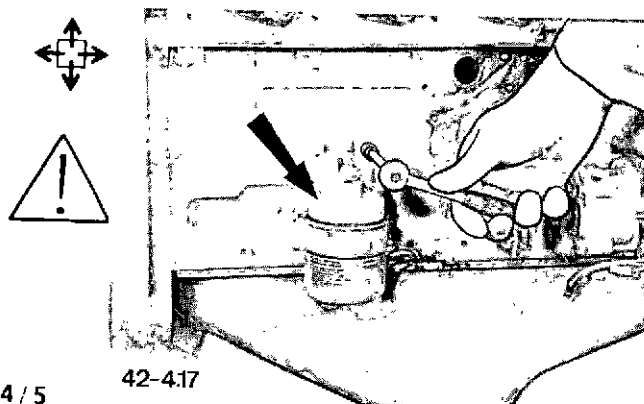
16. Remove oil filter housing together with oil filter.

Note:
Catch any escaping oil.



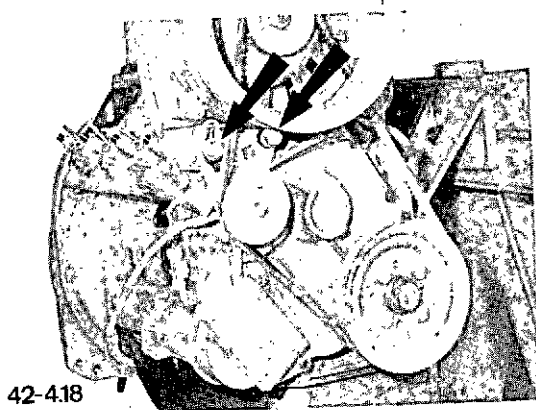
17. Remove fuel filter housing together with fuel filter.

Note:
Catch any escaping fuel.



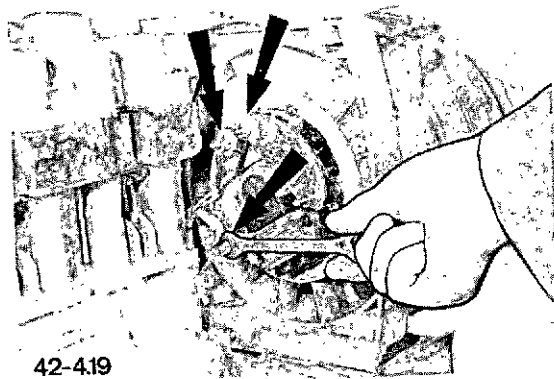
Disassembly and reassembly of complete engine

Werkstatthandbuch B/FL 1011/T



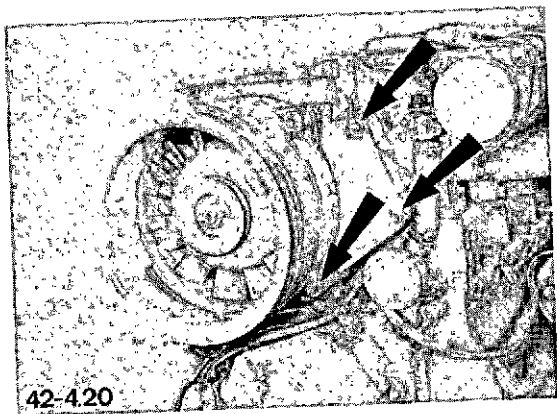
42-4.18

18. Remove idler pulley. Take off V-belt.



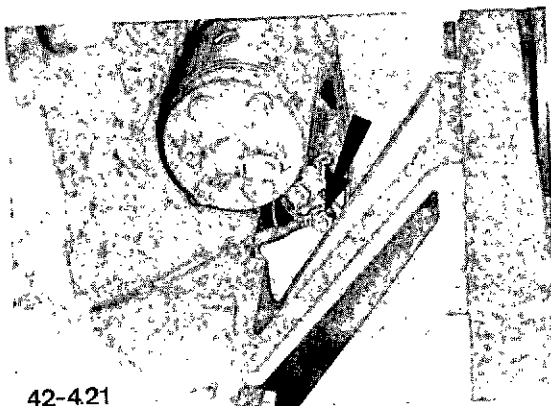
42-4.19

19. Mark cables and remove.



42-4.20

20. Remove blower together with alternator.



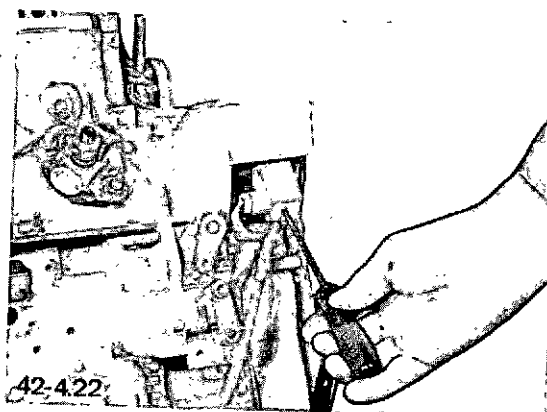
42-4.21

21. Remove cables from starter.

Disassembly and reassembly of complete engine

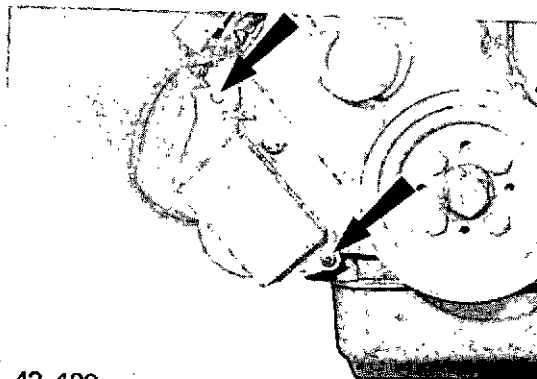
Werkstatthandbuch B/FL 1011/T

22. Remove cable plug connection.



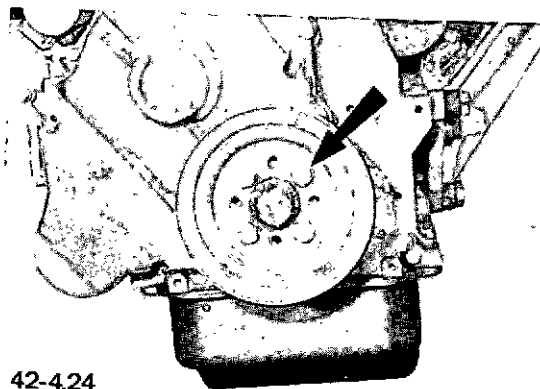
42-422

23. Take off cable terminal box.
Remove wiring harness.



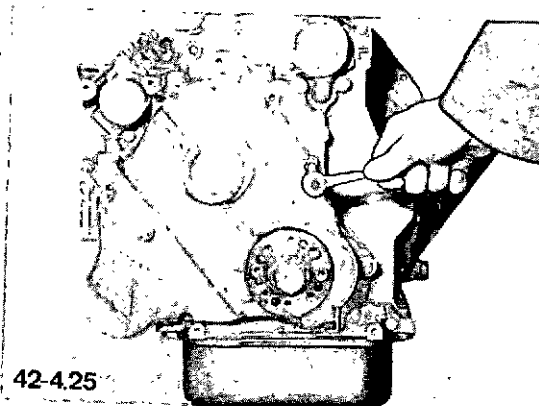
42-423

24. Remove V-belt pulley.



42-424

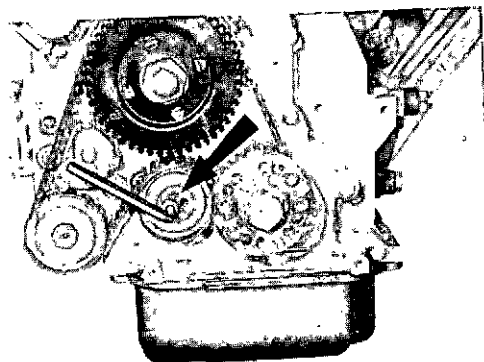
25. Removed toothed belt guard.



42-425

Disassembly and reassembly of complete engine

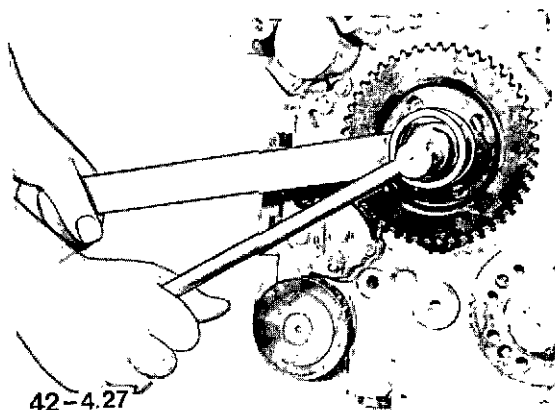
Werkstatthandbuch B/FL 1011/T



42-4.26



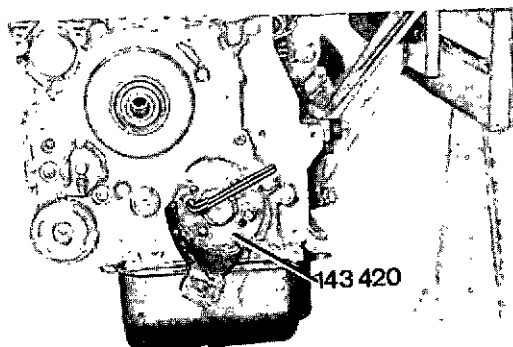
26. Remove idler pulley. Take off toothed belt.



42-4.27



27. Remove camshaft gear.



42-4.28



28. Fit dolly for crankshaft gear.

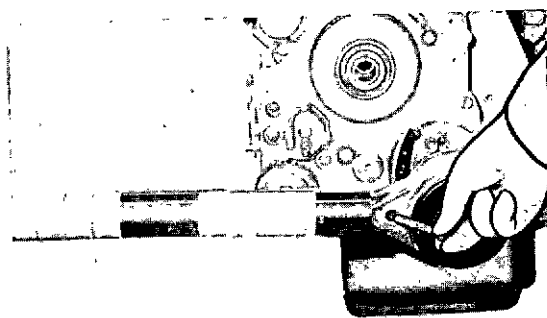


Note:

In the case of new version, fit dolly with shim No. 143430.



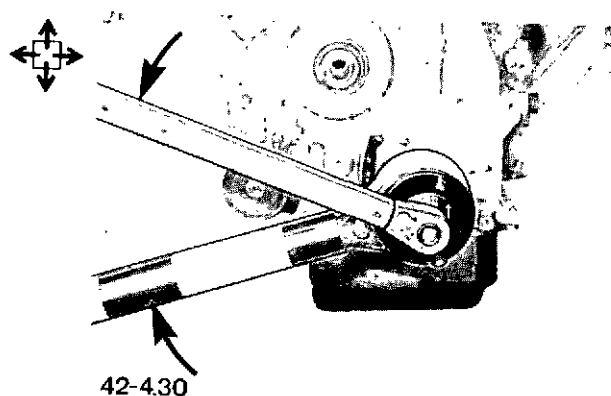
29. Fit multipower tool and screw on.



42-4.29

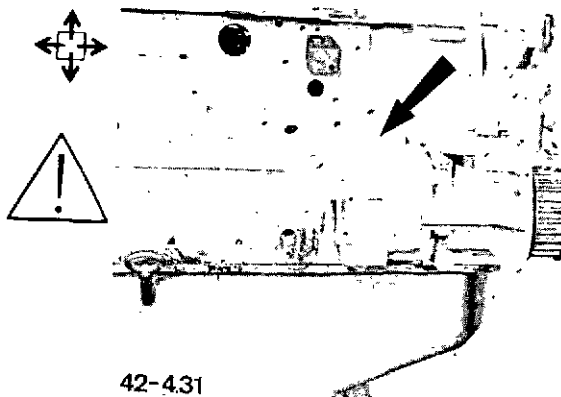


30. Retain multipower tool and loosen central screw union. Remove crankshaft gear and connecting flange.

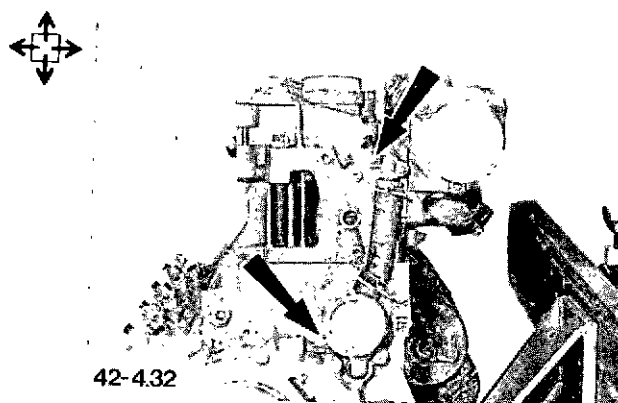


31. Remove lube oil pump.

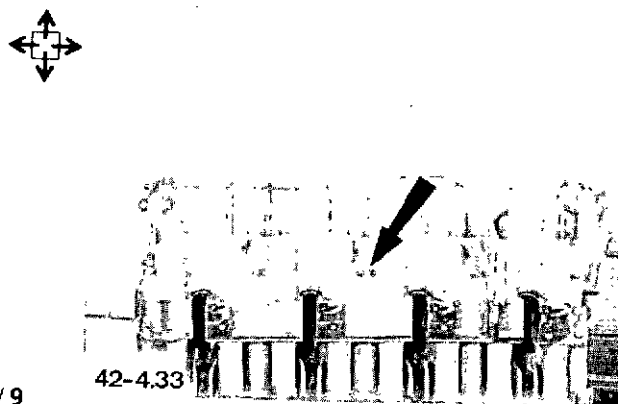
Note:
Catch any escaping oil.



32. Remove complete crankcase breather.

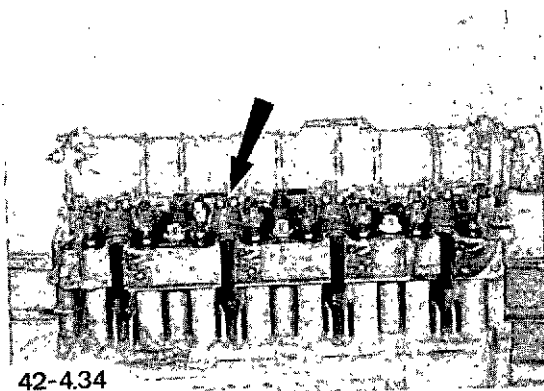


33. Lift off valve cover.



Disassembly and reassembly of complete engine

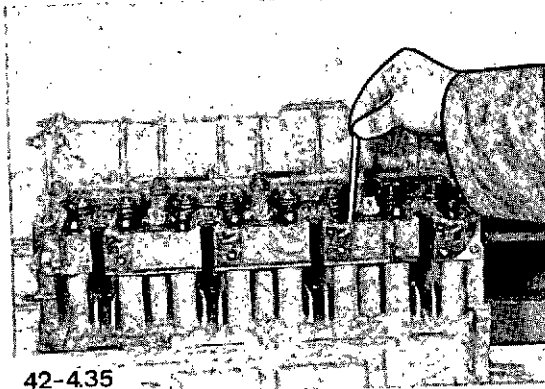
Werkstatthandbuch B/FL 1011/T



42-4.34



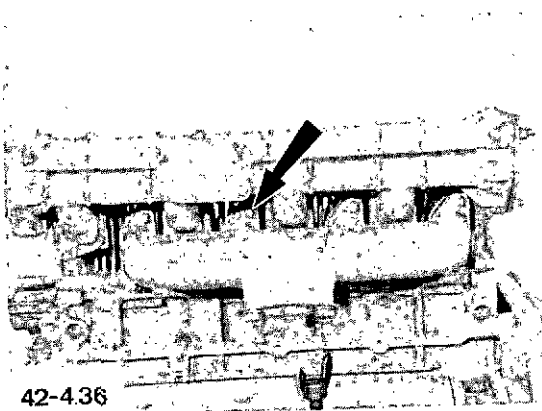
34. Remove rocker arm brackets.



42-4.35



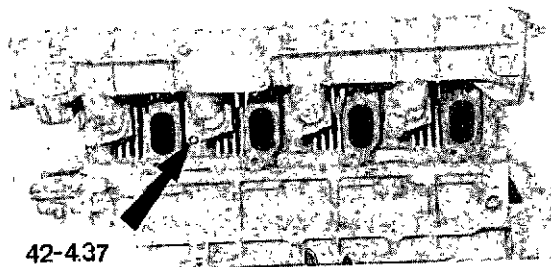
35. Take out pushrods.



42-4.36



36. Remove exhaust manifold.

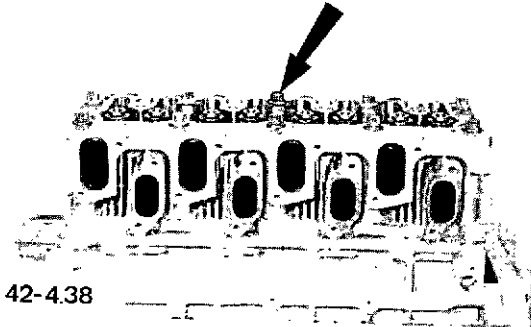


42-4.37

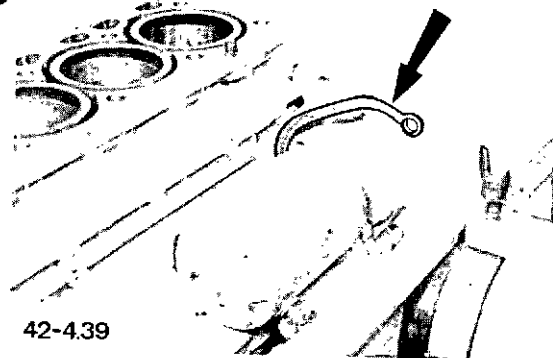


37. Remove air intake manifold.

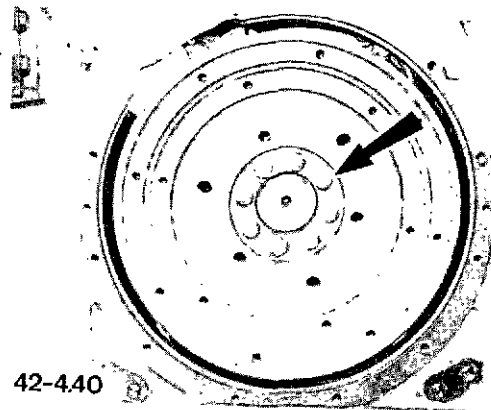
38. Lift off cylinder head.



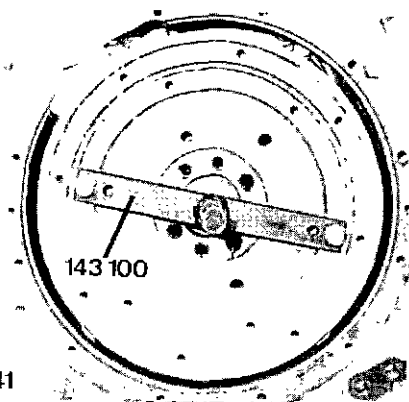
39. Remove starter.



40. Loosen flywheel bolts and remove.

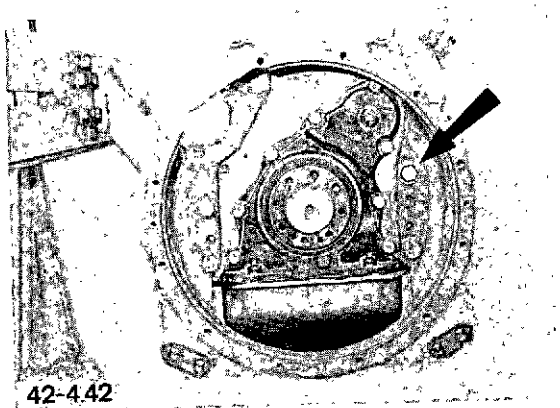


41. Fit flywheel puller. Pull off flywheel.

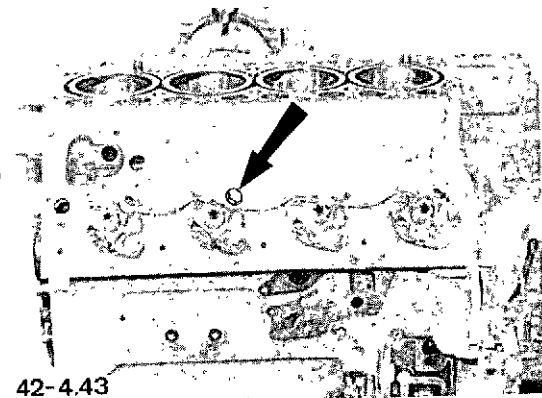


Disassembly and reassembly of complete engine

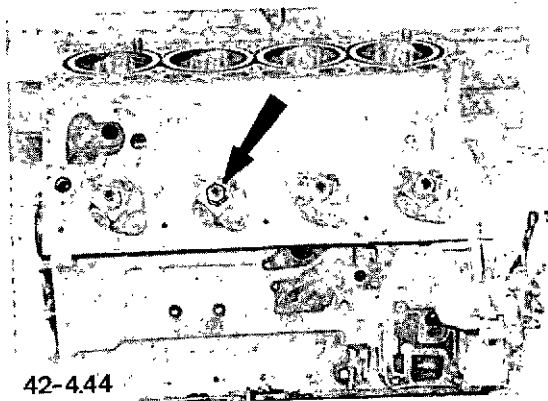
Werkstatthandbuch B/FL 1011/T



42. Remove adapter housing.

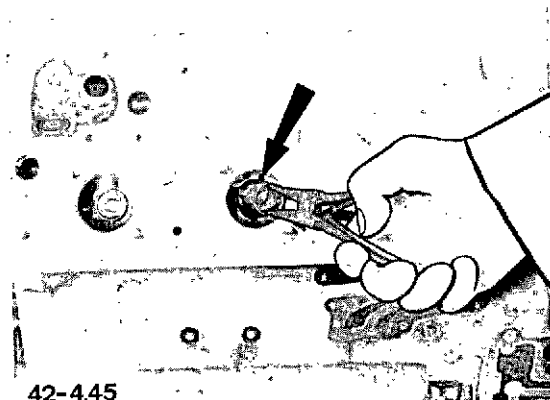


43. Remove leakage fuel line.



44. Remove injection pumps.

4

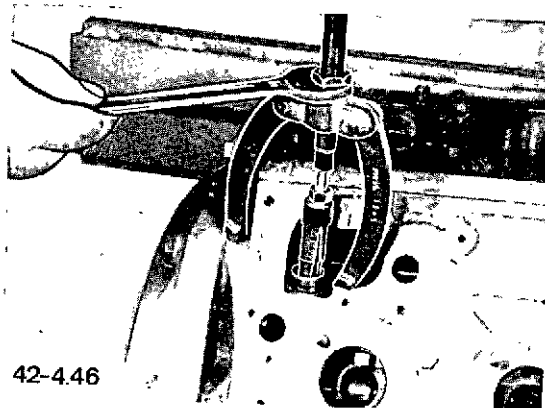


45. Take out roller tappets for injection pump (with circlip pliers).

Disassembly and reassembly of complete engine

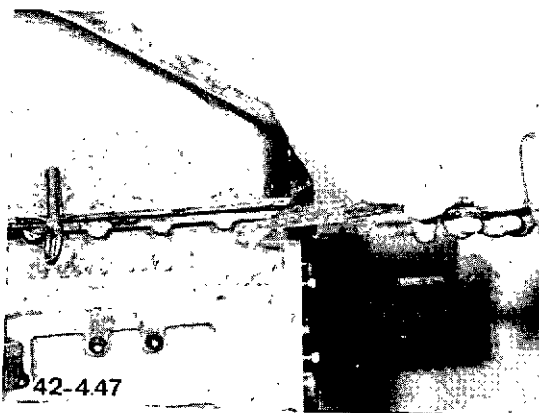
Werkstatthandbuch B/FL 1011/T

46. Remove connecting pipe.



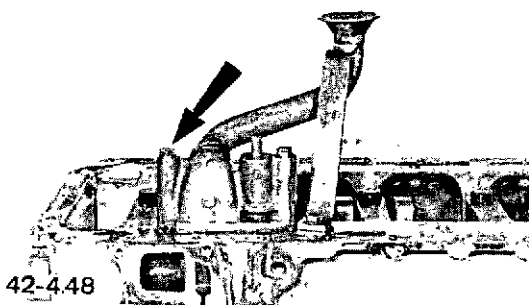
42-4.46

47. Turn engine through 180°.
Take off oil pan.



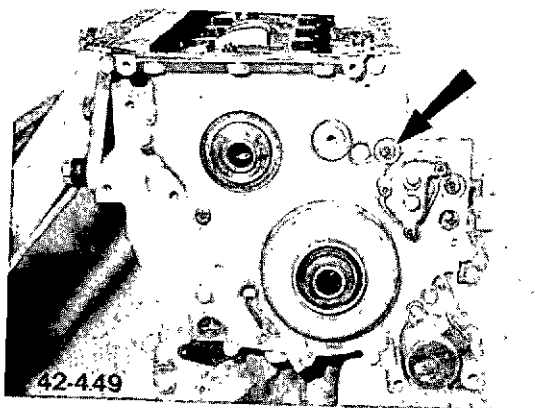
42-4.47

48. Remove complete oil suction pipe.



42-4.48

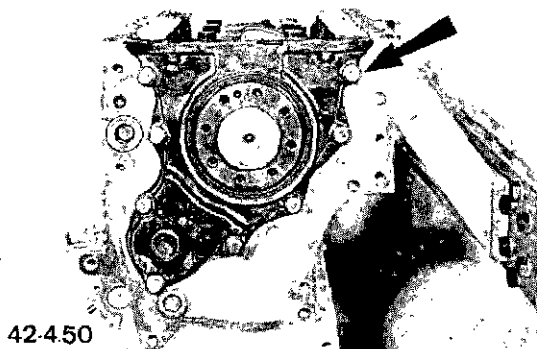
49. Remove complete front cover.



42-4.49

Disassembly and reassembly of complete engine

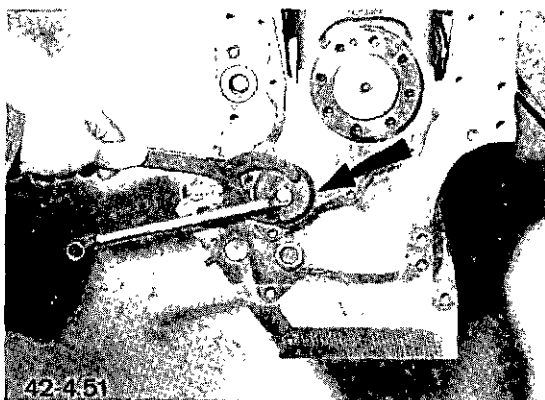
Werkstatthandbuch B/FL 1011/T



42-4.50



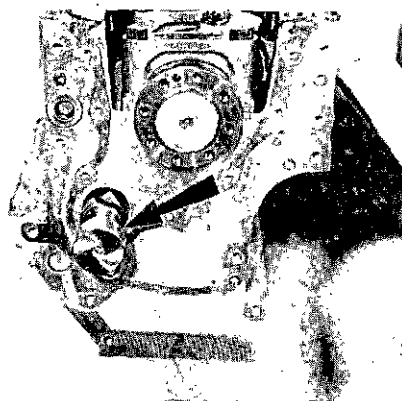
50. Remove rear cover.



42-4.51



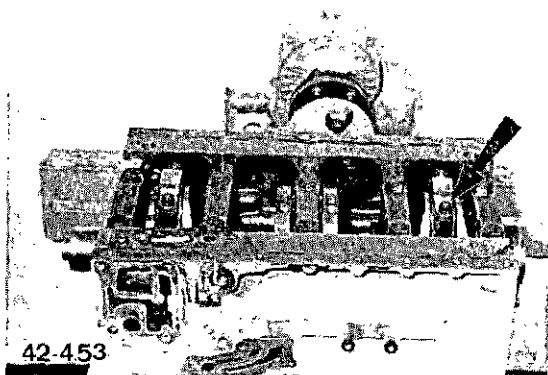
51. Take off thrust washers for camshaft.



42-4.52



52. Remove camshaft.

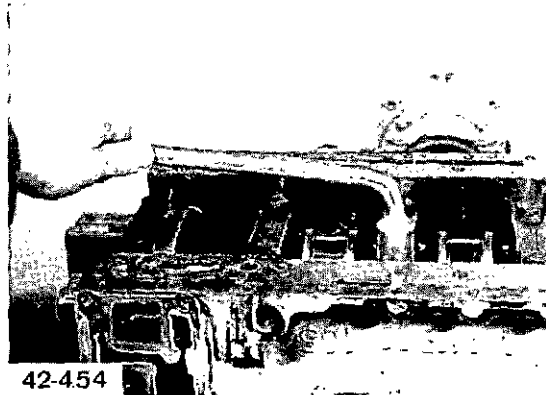


42-4.53

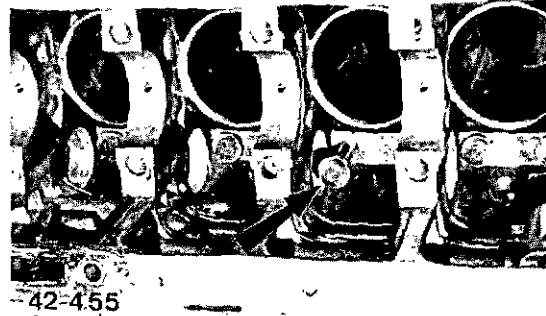


53. Remove piston complete with connecting rod.

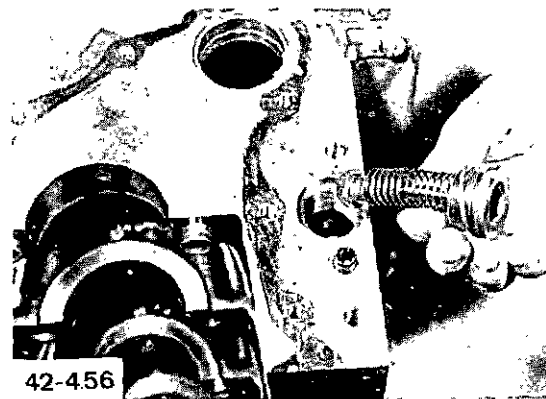
54. Remove main bearing caps.
Lift out crankshaft.



55. Take out tappets.



56. Remove oil pressure control valve.



Reassembling engine

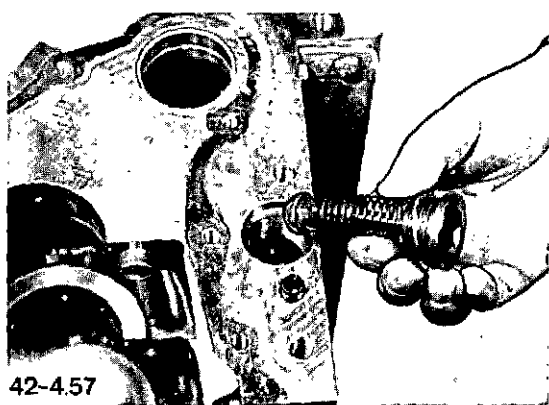
Commercial tools required:

- Torx tools
- Hose clip pliers
- Spec. two-pin spanner
- Bent spanner for starter
- Multipower tool STW392
- Socket a/flats 32 601MP
- Depth gauge TM2

Special tools required:

| | |
|---|--------|
| Dolly..... | 143420 |
| Shim..... | 143430 |
| Piston ring compressor.. | 130510 |
| Adjusting pin..... | 100700 |
| Adjusting pin..... | 100710 |
| Device for measuring toothed belt tension | 100720 |
| Dolly for camshaft..... | 144130 |
| Centering pin for injection pump | 100730 |
| Tensioning device for toothed bel..... | 144600 |

4

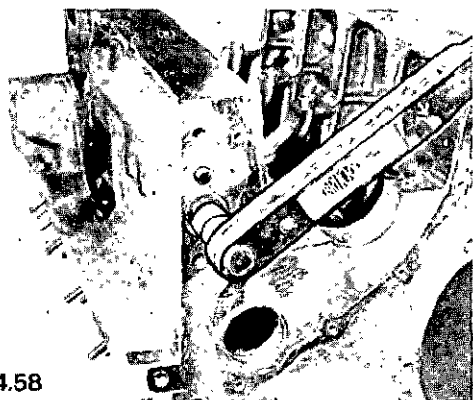


42-4.57

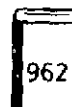


Oil pressure control valve

1 . Fit oil pressure control valve.



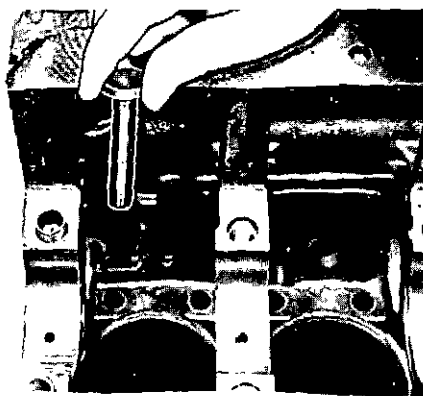
42-4.58



2. Fit screw plug in place together with new Cu sealing ring and tighten in accordance with specifications.

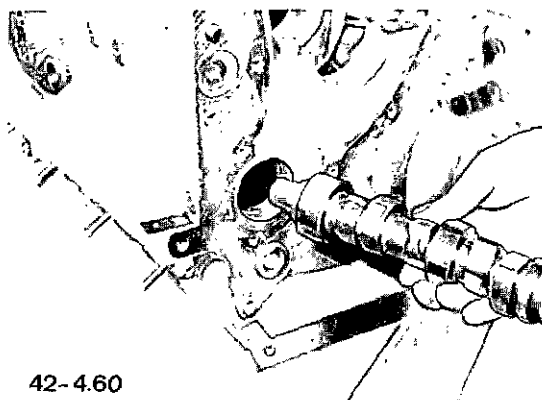
Tappets/camshaft

3. Insert tappets.



42-4.59

4. Introduce camshaft.

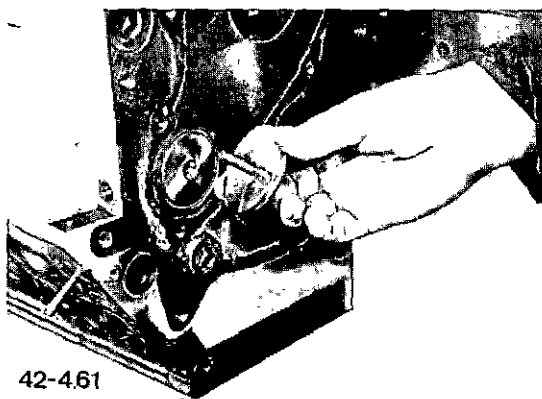


42-4.60

5. Insert thrust washer.

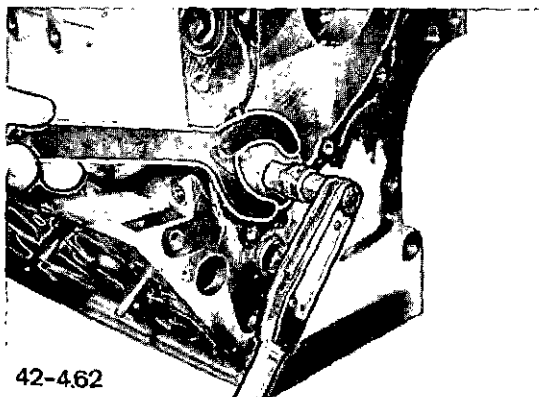
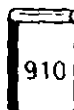
Note:

Oil groove of thrust washer must face towards crankcase.



42-4.61

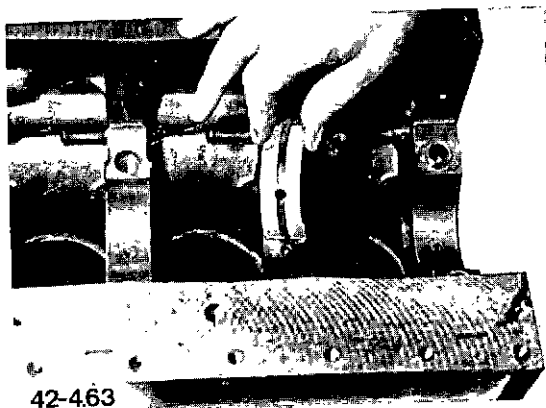
6. Retain thrust washer, tighten bolt in accordance with specifications.



42-4.62

Disassembly and reassembly of complete engine

Werkstatthandbuch B/FL 1011/T

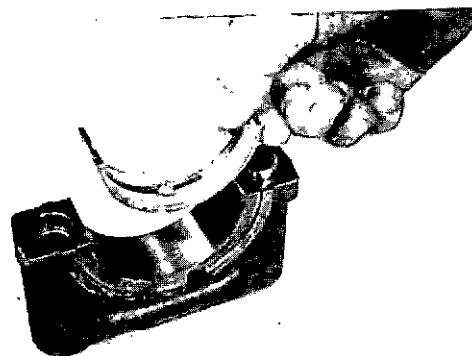


42-4.63



Crankshaft bearings

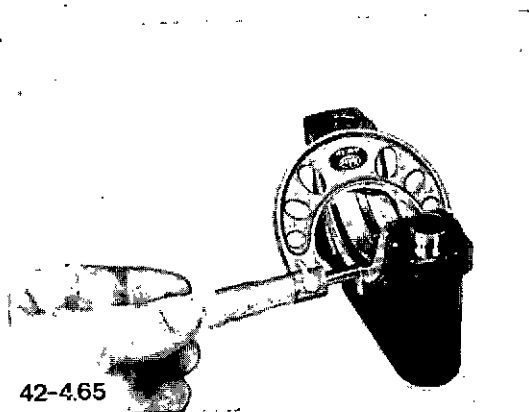
7. Fit bearing shells.



42-4.64



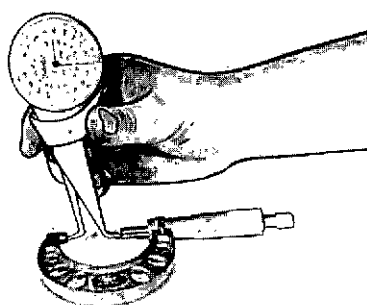
8. Insert bearing shells into main bearing caps.



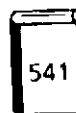
42-4.65



9. Place half thrust rings on thrust bearing cap and gauge width.



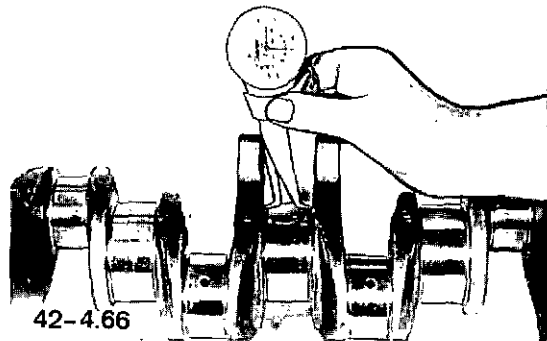
42-4.65.1



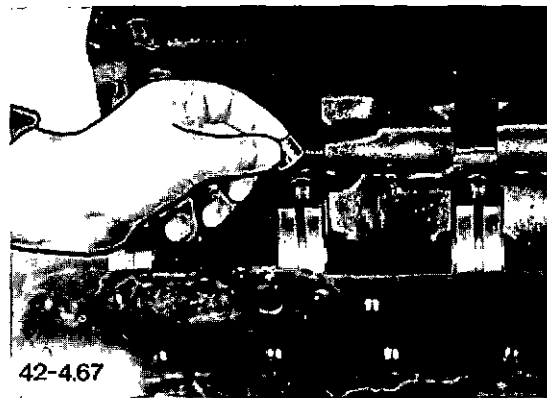
9.1 Set internal gauge.

10. Gauge width of crankshaft thrust bearing journal. Determine end float.

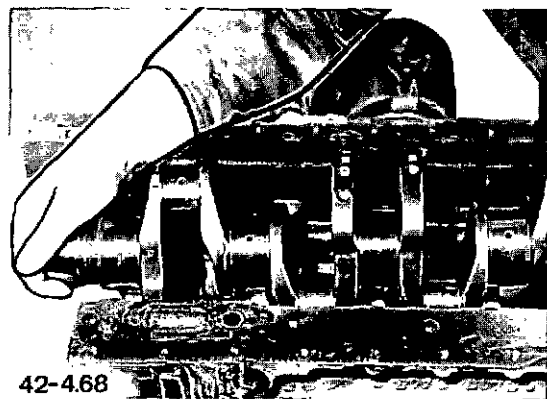
Note:
Use new thrust rings as necessary.



11. Insert dowel sleeves.



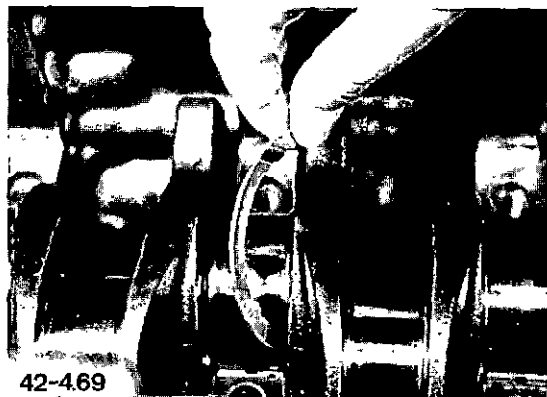
12. Introduce crankshaft.



13. Insert half thrust rings without lug.

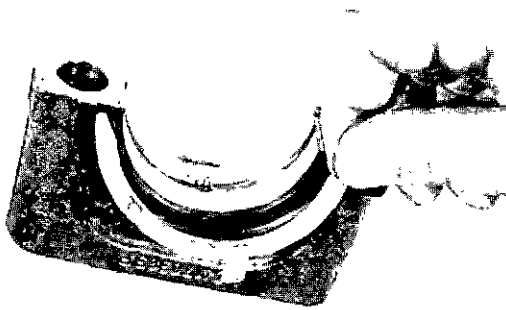


Note:
Running layer of thrust rings must face towards crankweb.



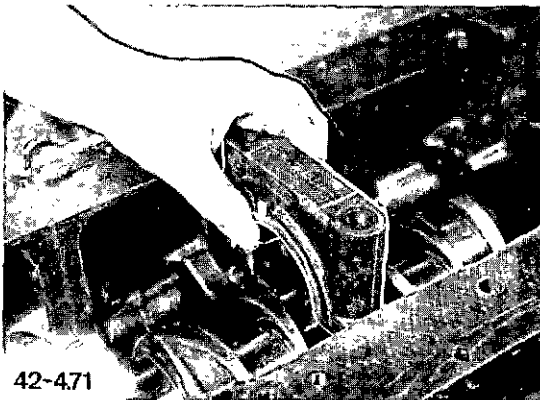
Disassembly and reassembly of complete engine

Werkstatthandbuch B/FL 1011/T



14. Stick half thrust rings with lug to thrust bearing cap using some grease.

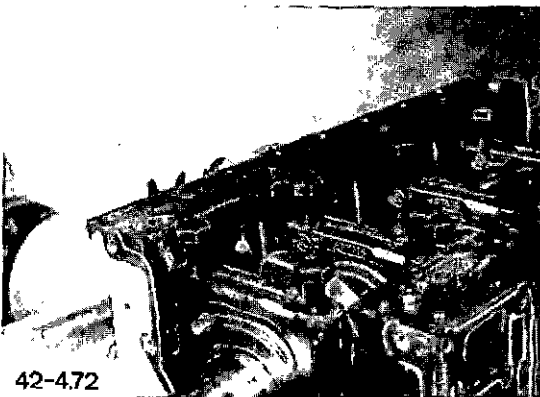
42-470



15. Mount thrust bearing cap.

Note:
Bearing cap No. 1 at flywheel end.
Chamfer must be directed away from flywheel side.

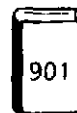
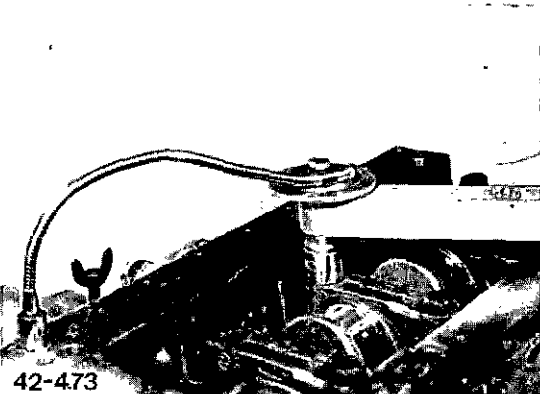
42-471



16. Mount main bearing caps, paying attention to the numbering.

4

42-472

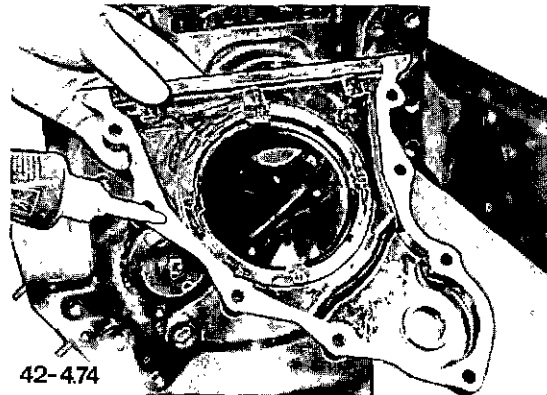


17. Tighten main bearing bolts in accordance with specifications.

42-473

Rear cover

18. Apply sealing compound Deutz DW 67 to rear cover.

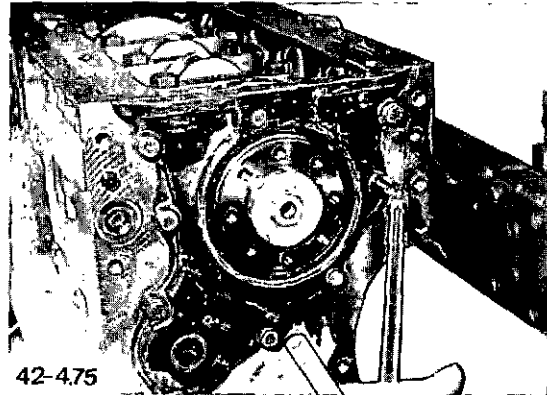


18.1. Fit cover complete with shaft seal.



Note:

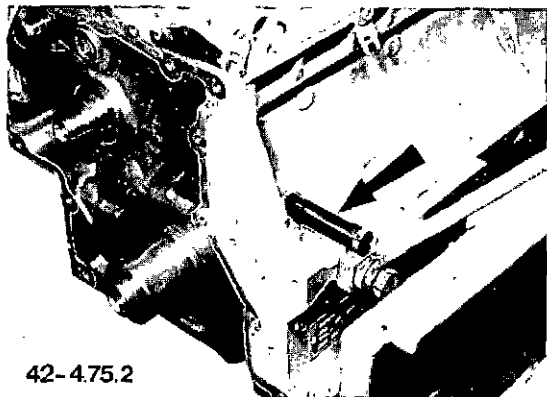
Align cover relative to oil pan sealing surface.



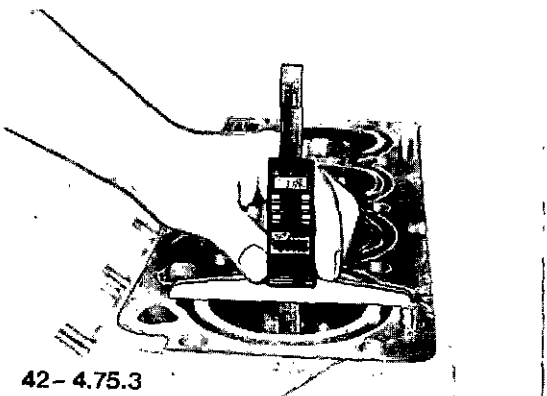
Gauge distance between top edge of crankpin TDC and cylinder head gasket seating surface.



19. Turn adjusting pin as far as stop. Turn crankshaft as far as stop.

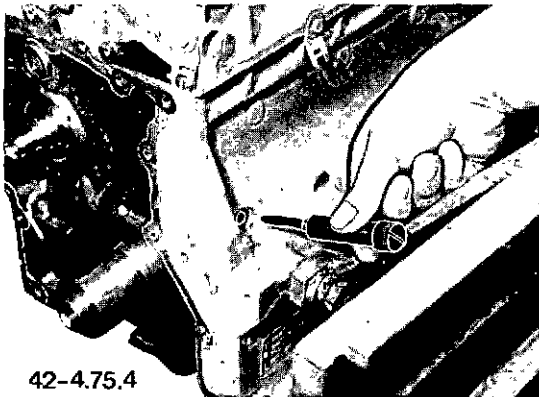


19.1 Gauge on every cylinder distance between top edge of crankpin TDC and cylinder head gasket seating surface.



Disassembly and reassembly of complete engine

Werkstatthandbuch B/FL 1011/T



42-4.75.4



19.2

| Specified dimension | Piston class |
|-----------------------|--------------|
| x1 = 199.890 - 199.99 | A |
| x2 = 199.991 - 200.09 | B |
| x3 = 200.091 - 200.19 | C |

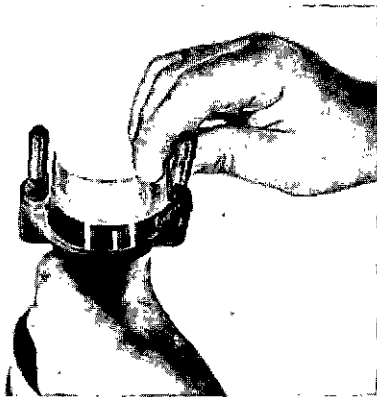
Note:
Remove adjusting pin.

19.3 Compare actual dimension with the table.
Select piston class per cylinder.
See Section 3.

Note:
In the case of undersizes of the crankshaft, 0.125 mm must be added to the dimensions indicated in the table.



4

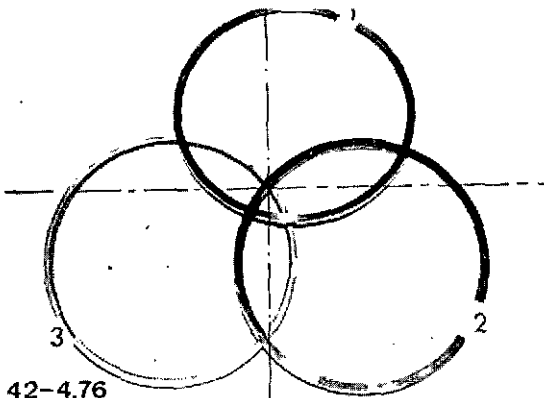


42-4.75.1



20. Insert big end bearing shells in connecting rod.

21. Piston ring gaps must be staggered.



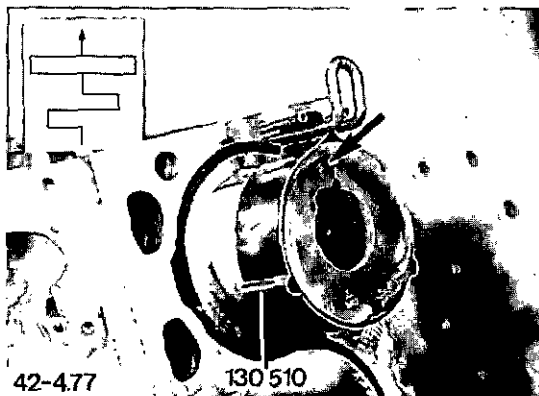
42-4.76



22. Slide piston complete with connecting rod into crankcase with integrated liners.

Note:

Flywheel symbol must point towards flywheel.

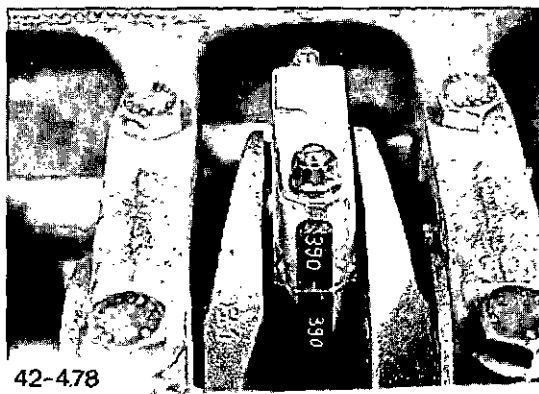


42-477

23. Press connecting rod against crankpin. Fit pertinent big end bearing cap.

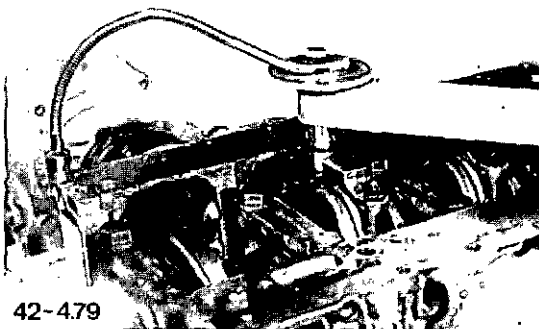
Note:

Do not use big end bolts more than 5 times.



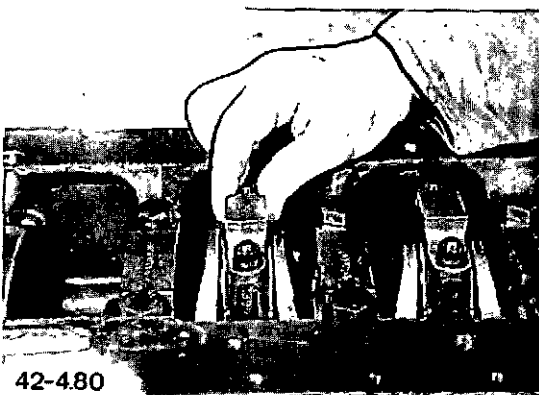
42-478

24. Tighten conrod nuts with 12-point box spanner in accordance with specifications.

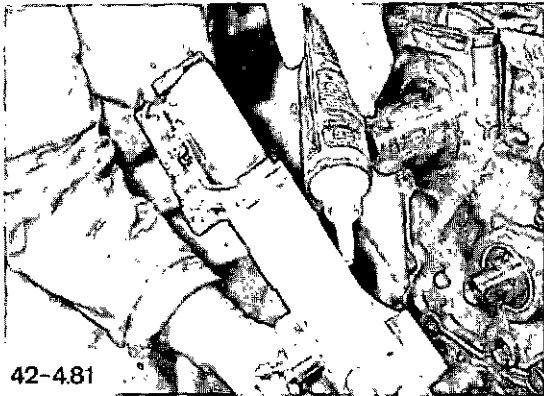


42-479

25. Check that connecting rods can be easily shifted on the crankpin.



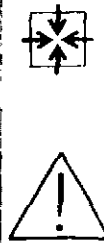
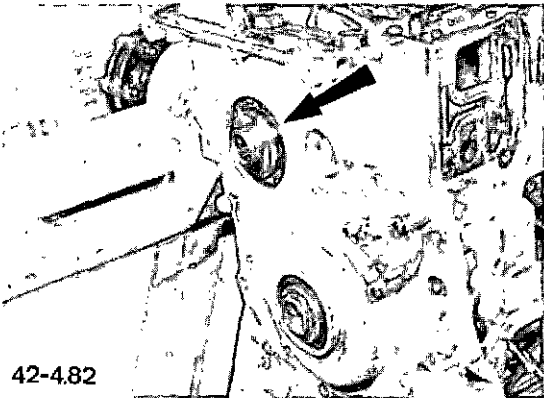
42-480



Front cover

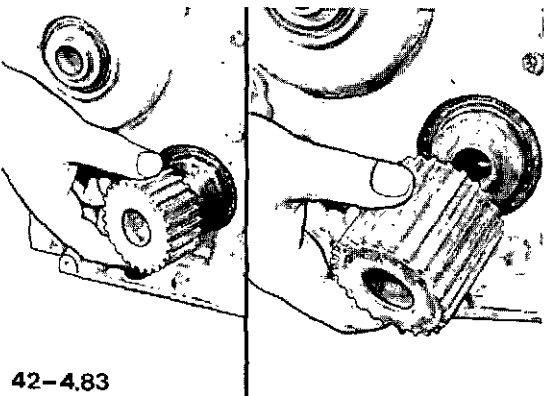
30. Spread sealing surface of front cover with Deutz DW 67.

Note:
Camshaft/centrifugal governor connection must be clean and free of oil.



31. Fit front cover.

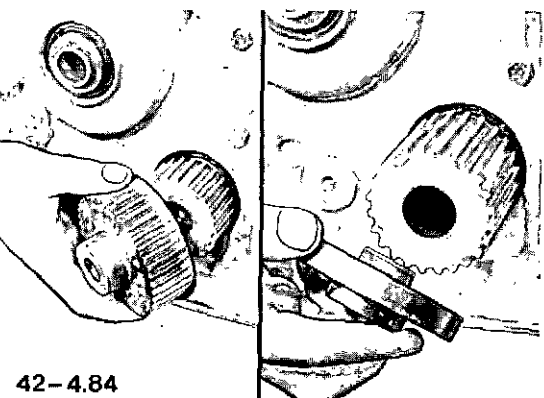
Note:
When fitting cover watch crankshaft seal.



Crankshaft toothed belt drive

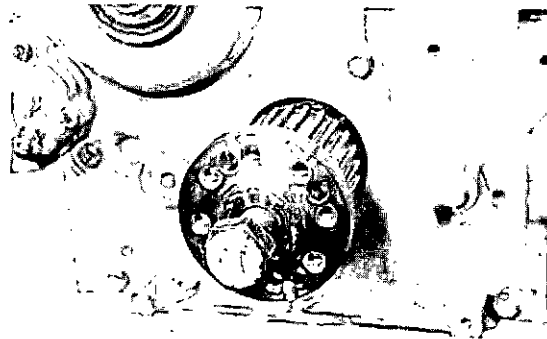
32. Slide on crankshaft toothed belt drive.

Note:
All connecting surfaces must be clean and free of oil.



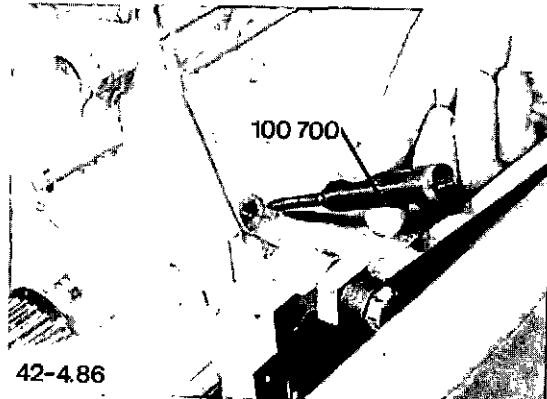
33. Insert connecting flange, in center mark.

34. Start central bolt.



42-485

35. Screw in adjusting pin for crankshaft as far as it will go. Turn crankshaft in clockwise direction against stop.

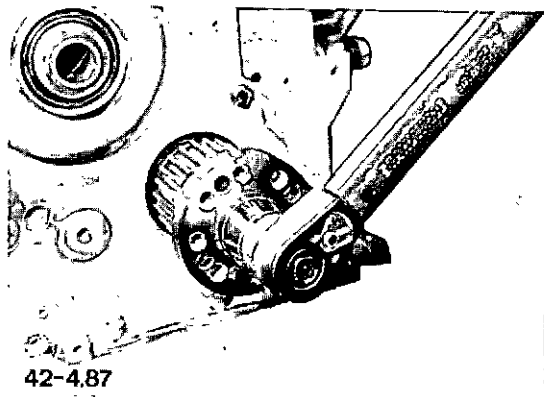
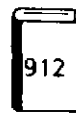


42-4.86

Note:

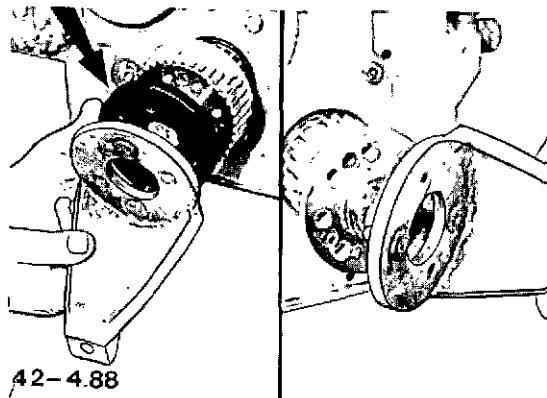
Piston at front cover is in TDC position.

36. Preload central bolt in accordance with specifications.



42-4.87

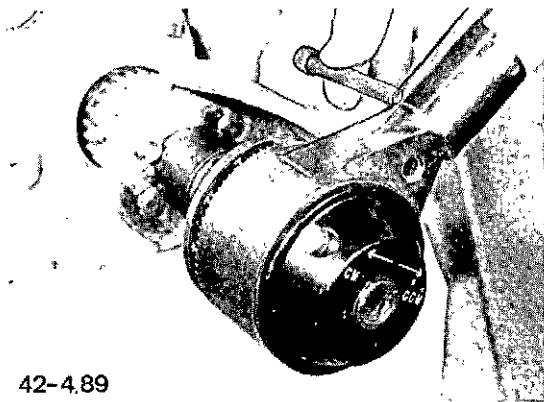
37. Fit dolly and tighten.



42-4.88

Disassembly and reassembly of complete engine

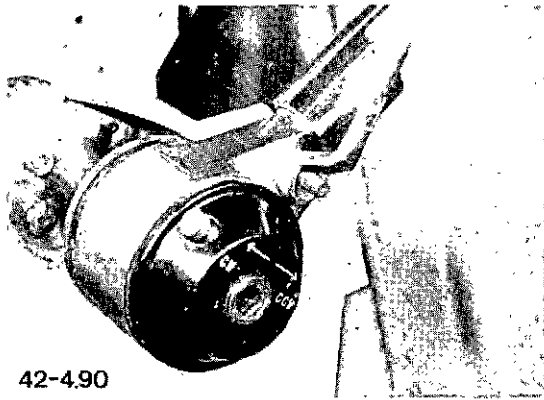
Werkstatthandbuch B/FL 1011/T



42-4.89



38. Fit multipower tool with socket to dolly –

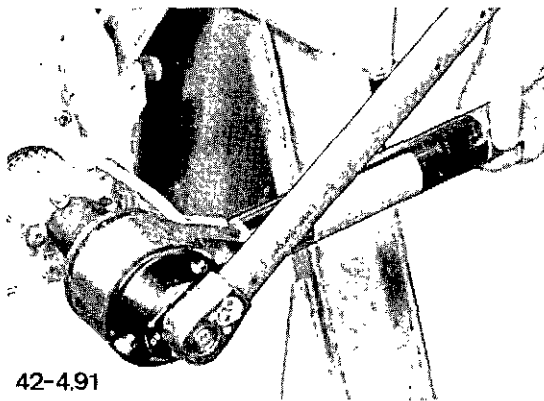


42-4.90



39. and tighten.

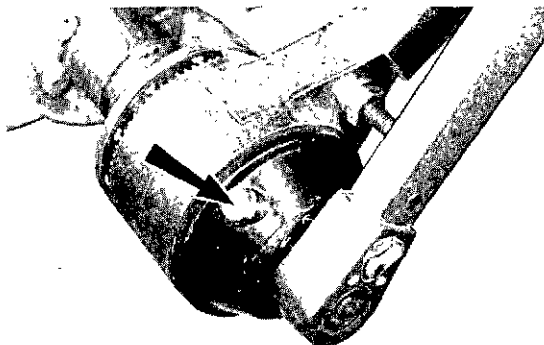
Note:
Use bolt belonging to multipower tool.



42-4.91



40. Retain multipower tool and tighten central bolt in accordance with specifications.



42-4.92



41. Depress detent knob. Unload multipower tool.

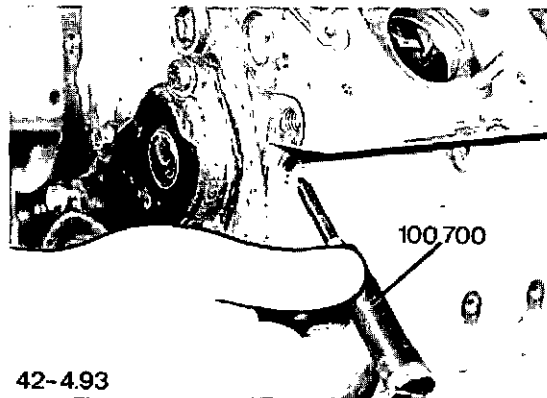
4

Camshaft toothed belt drive

42. Screw adjusting pin for camshaft into crankcase as far as it will go.

Note:

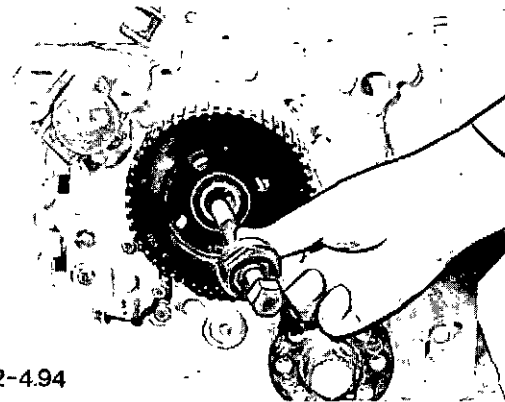
Bore of camshaft must overlap with bore in crankcase.



43. Position toothed belt gear, shim and bolt.

Note:

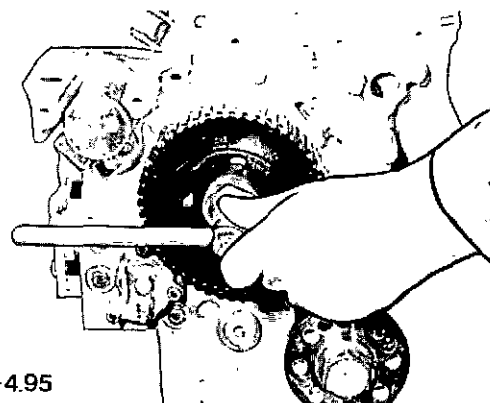
All connecting surfaces must be clean and free of oil.



44. Lock camshaft central bolt fingertight.

Note:

Camshaft gear must still turn freely.

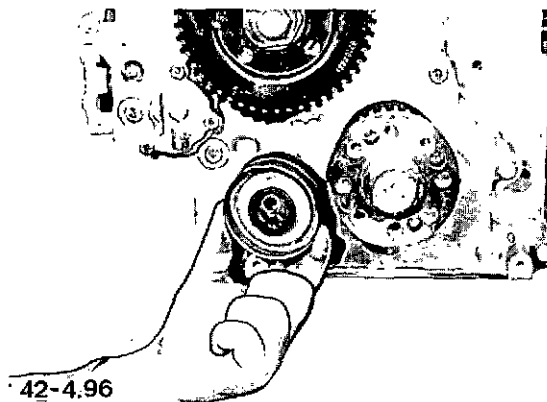


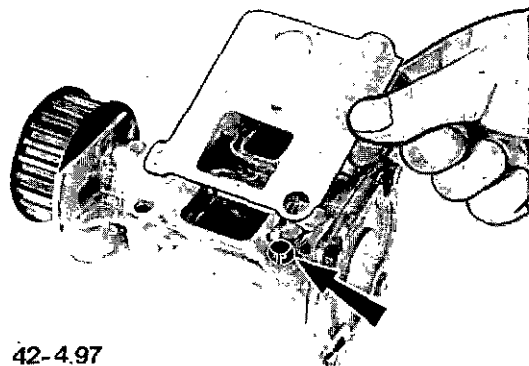
Toothed belt idler pulley

45. Fit toothed belt idler pulley and lock fingertight.

Note:

All connecting surfaces must be clean and free of oil. Hexagon bore must face towards oil pan sealing surface.





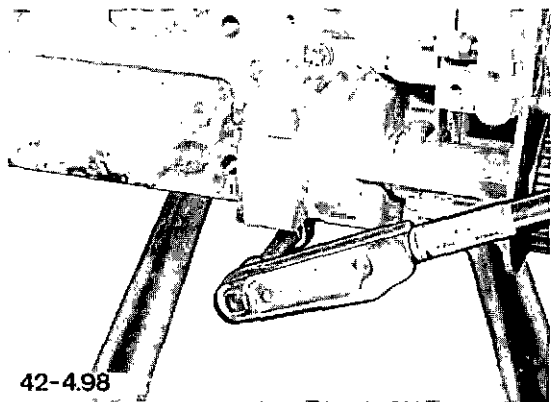
42-4.97



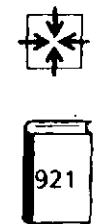
Lube oil pump

46. Position gasket and mount oil pump.

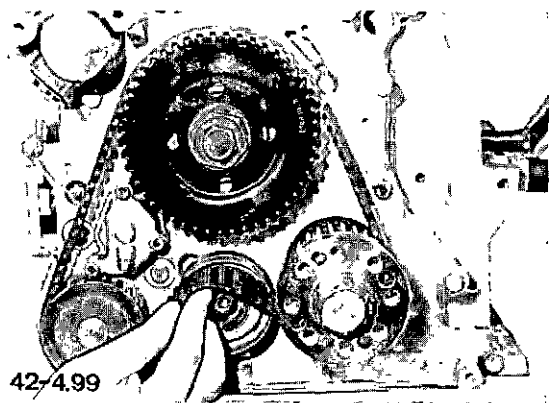
Note:
Watch dowel sleeves.



42-4.98



47. Secure lube oil pump in accordance with specifications.



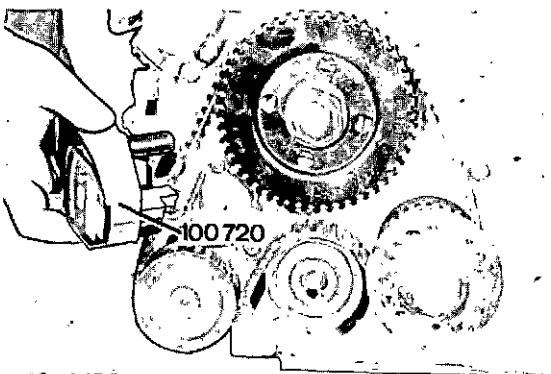
42-4.99



Toothed belt adjustment

48. Position toothed belt so as to ensure a uniform distance from front cover of 8 - 9 mm.

Note:
Hold crankshaft in stop position while adjusting toothed belt.



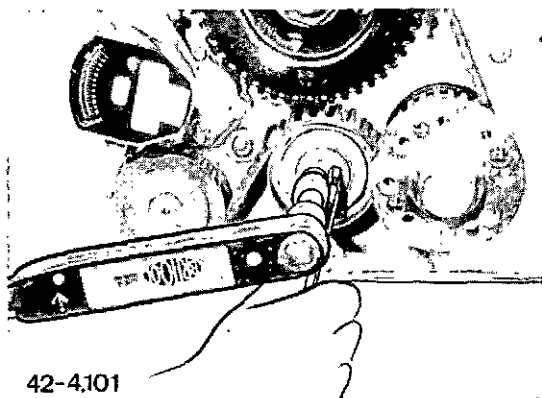
42-4.100



49. Fit device for measuring toothed belt tension.

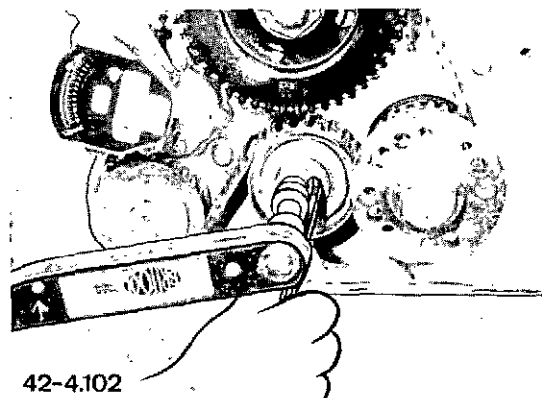
Note:
Measuring device may only have contact with toothed belt.

50. Preload toothed belt. Turn idler pulley in anti-clockwise direction to obtain a scale reading of 3.0 – 3.5.



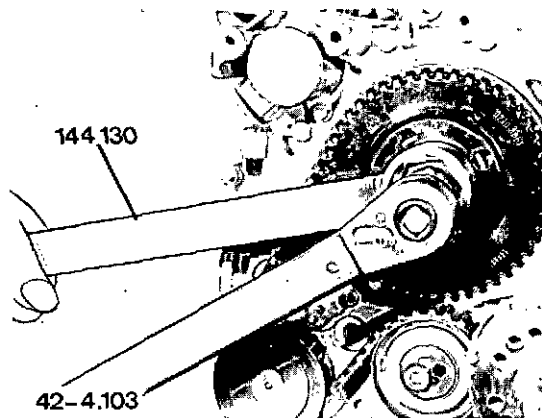
42-4.101

51. Tighten idler pulley bolt with 45 Nm.



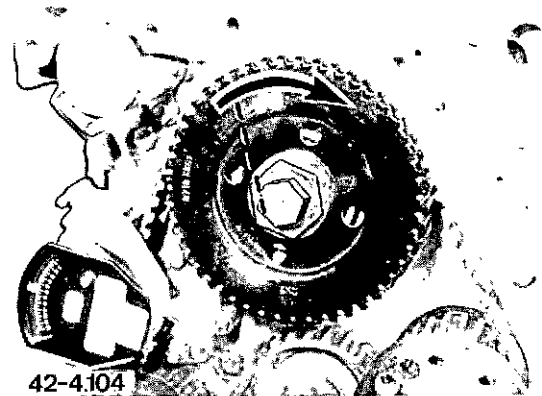
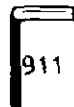
42-4.102

52. Retain centering washer. Tighten central bolt with 30 Nm preload.

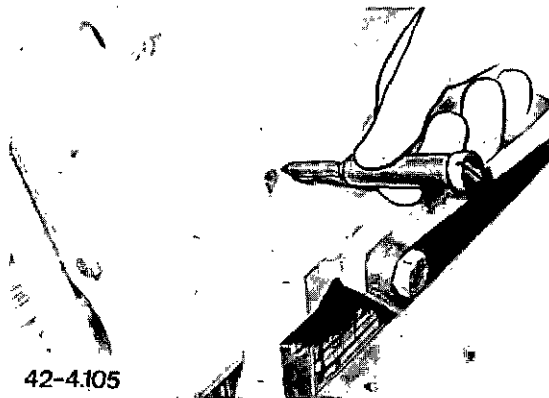


42-4.103

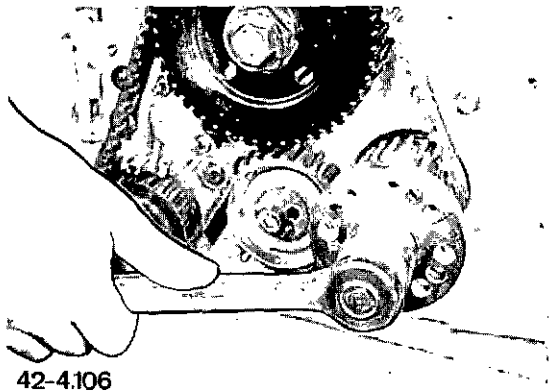
53. Mark camshaft bolt and centering washer and tighten in accordance with specifications.



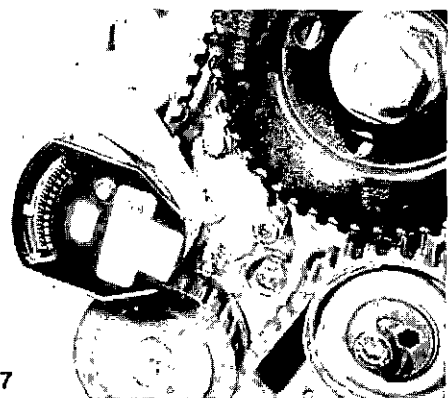
42-4.104



54. Remove adjusting pin for camshaft and crankshaft. Take off toothed belt tension measuring device.



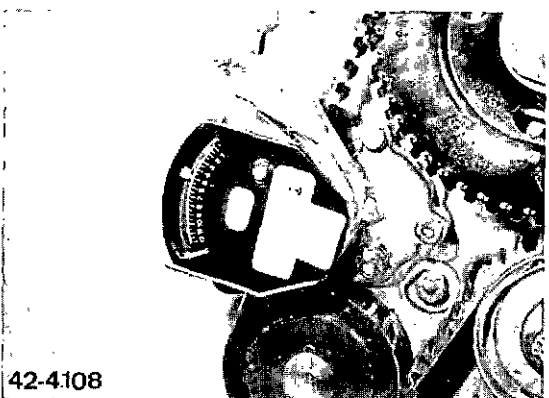
55. Make four complete crankshaft rotations in direction of engine rotation.



56. Fit toothed belt tension measuring device. Measure toothed belt tension.

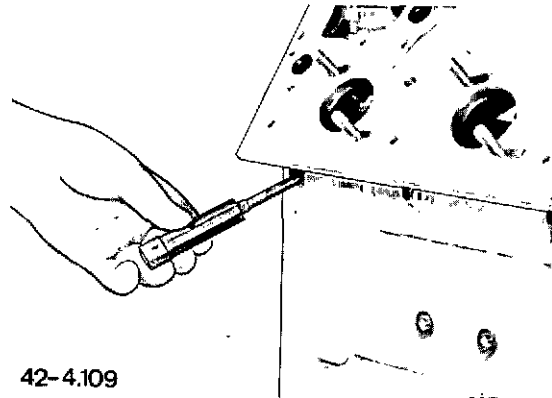
Nominal value: scale reading:
6.5 - 9.5

When a toothed belt is to be re-used that has been running for a longer period - ≥ 200 h, adjust tension to scale reading 3-5.



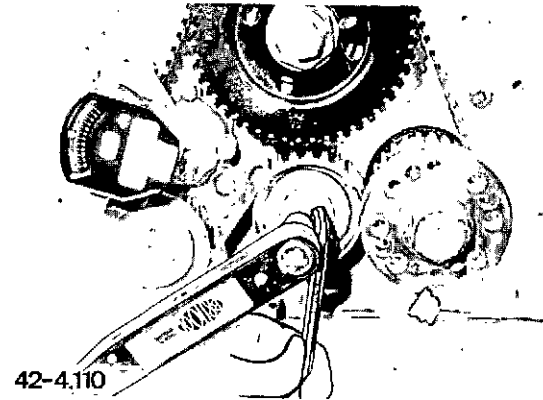
57. If the specified scale reading is not obtained, readjust with idler pulley.

58. Screw in again adjusting pin for crankshaft and camshaft as far as it will go.



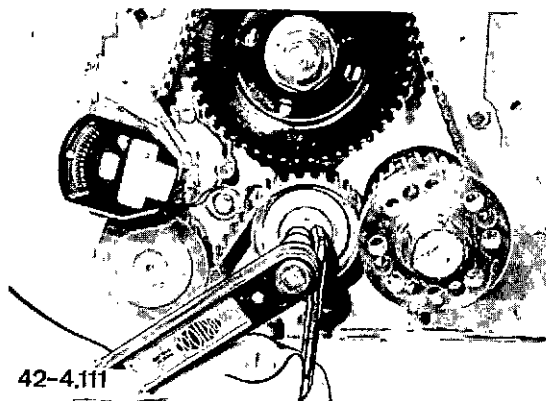
42-4.109

59. Slacken idler pulley and turn in anti-clockwise direction to obtain a scale reading of 5-6.



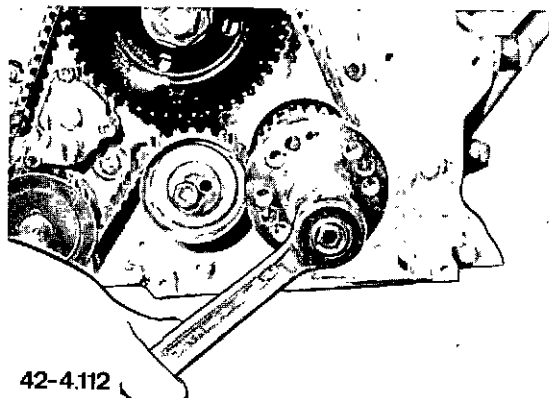
42-4.110

60. Tighten idler pulley again with 45 Nm.



42-4.111

61. Remove adjusting pin and toothed belt tension measuring device. Make four crankshaft rotations in direction of engine rotation.

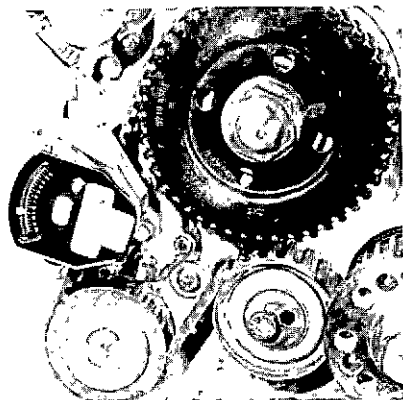


42-4.112

Disassembly and reassembly of complete engine

Werkstatthandbuch B/FL 1011/T

42-4.113

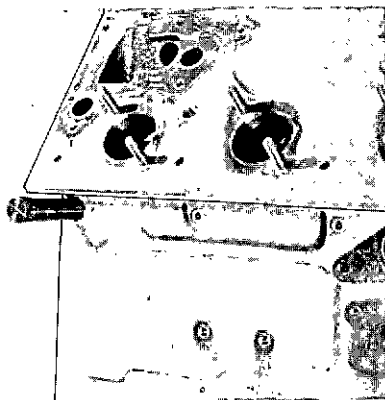


62. Fit toothed belt tension measuring device.

Nominal value: scale reading 6.5 - 9.5

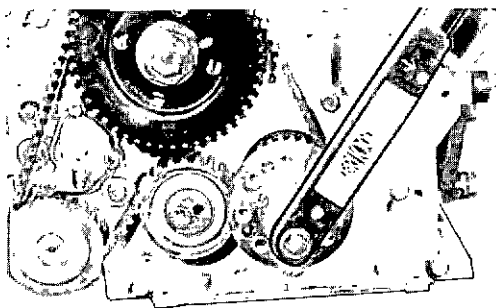
Remove toothed belt tension measuring device.

42-4.114



63. Valve timing check
Screw in camshaft adjusting pin as far as it will go.

4



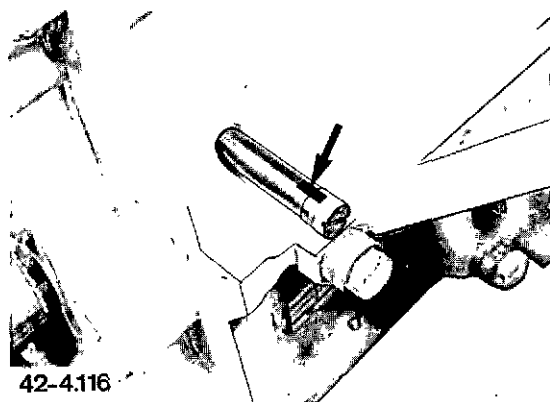
64. Tighten central bolt with torque spanner 40 Nm in direction of engine rotation, unload torque spanner again.

Note:

Do not change crankshaft position anymore.



42-4.115



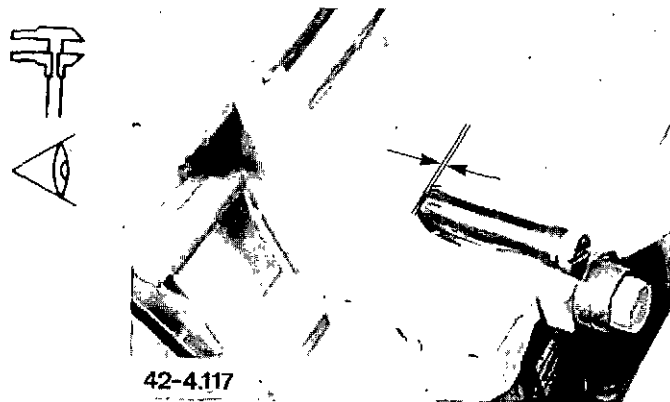
65. Screw in adjusting pin for crankshaft until it has slight contact with crankshaft.



Mark position of adjusting pin

42-4.116

66. The setting is correct when the adjusting pin can still be screwed into crankcase another 0.75 to 2.25 turns until stop.



Note:

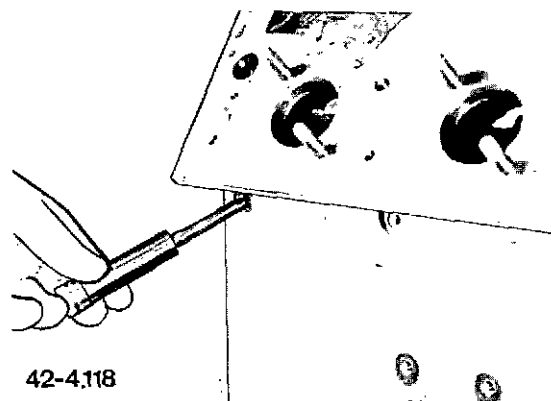
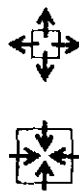
If the adjusting pin cannot be screwed into crankcase over its full effective length, the basic camshaft setting has to be redone.



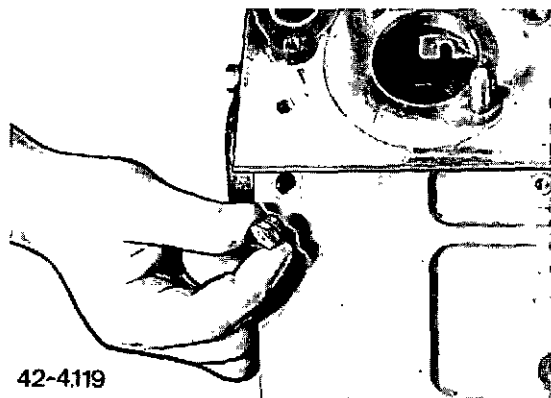
See point 48.

Release camshaft toothed belt gear again.

67. Remove adjusting pin for camshaft and crankshaft.

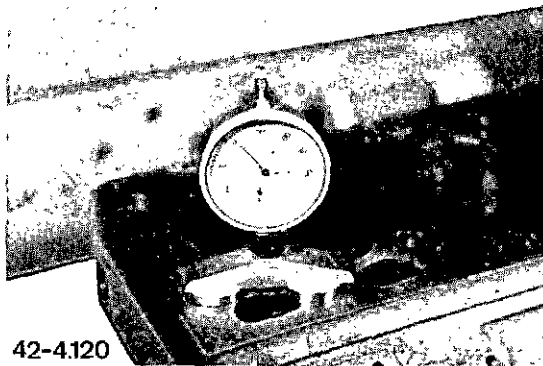


67.1 Cover up bores with new Cu-seals.



Cylinder head

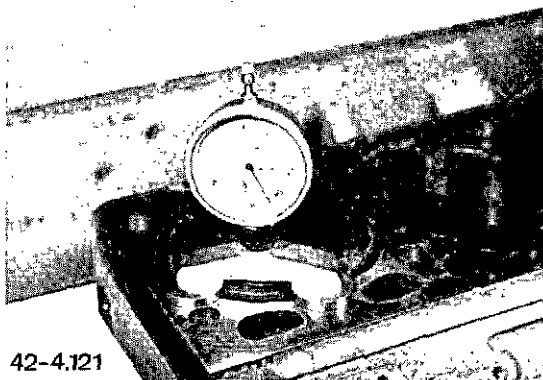
68. Determine cylinder head gasket.



42-4.120



68.1 Place spacer plate on sealing surface of crankcase with integrated liners and set dial gauge to „0“.



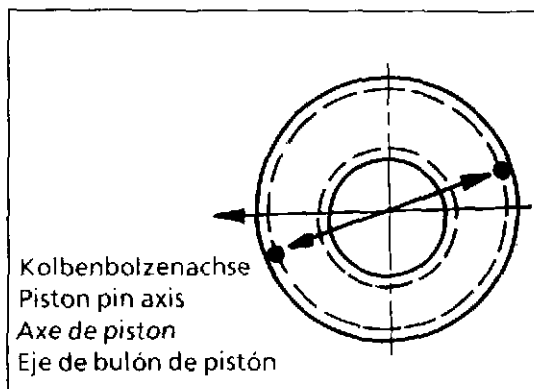
42-4.121



68.2 Position dial gauge on piston at gauge points and determine max. piston projection.

Note:
All pistons must be gauged.

4



68.3 Watch gauge points.

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68.4 Compare max. value with table and determine appropriate cylinder head gasket.

| Piston projection | Marking of cylinder head gasket |
|-------------------|---------------------------------|
| 0.590 - 0.69 mm | 1 notch |
| 0.691 - 0.76 mm | 2 notches |
| 0.761 - 0.83 mm | 3 notches |



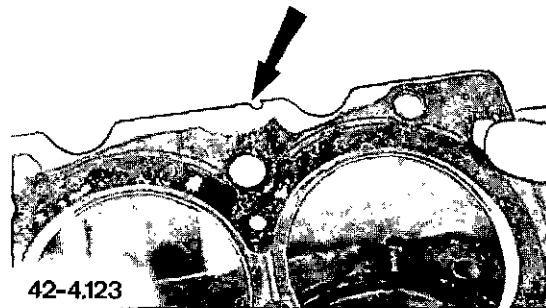
69. Place on cylinder head gasket.



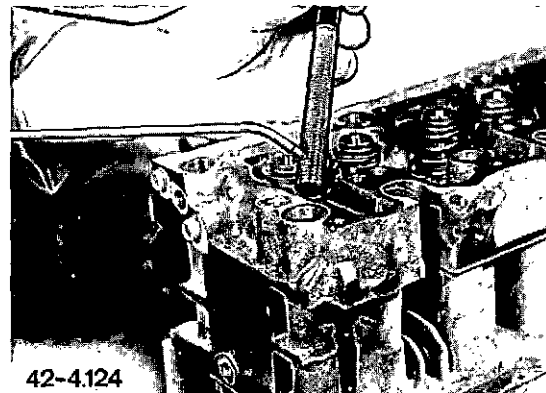
Note:
Sealing surfaces of cylinder head gasket must be free of oil.



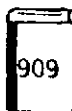
Watch dowel sleeves.



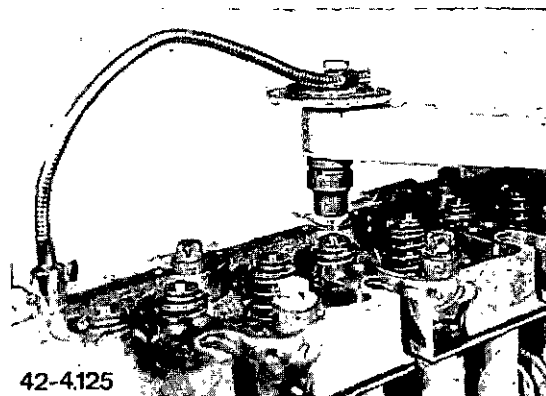
70. Fit cylinder head, oil cylinder head bolts slightly

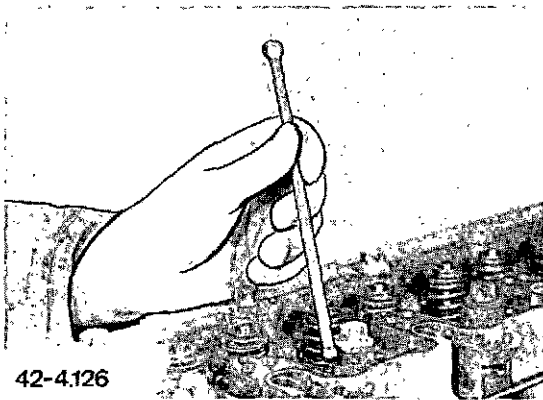


71. Tighten cylinder head bolts in accordance with specifications.



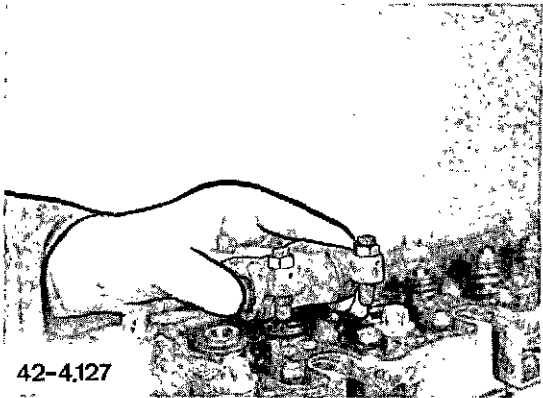
Note:
Watch tightening order (see page 1/37).



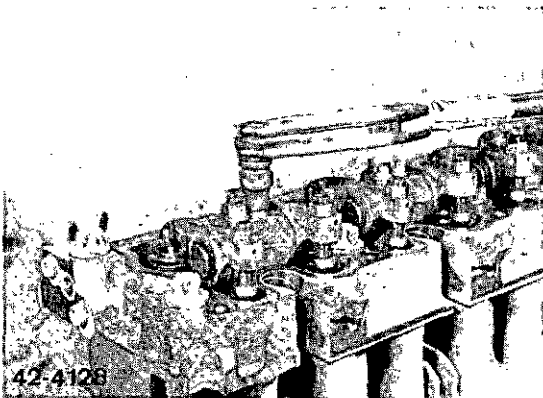


Valve gear

72. Insert pushrods.



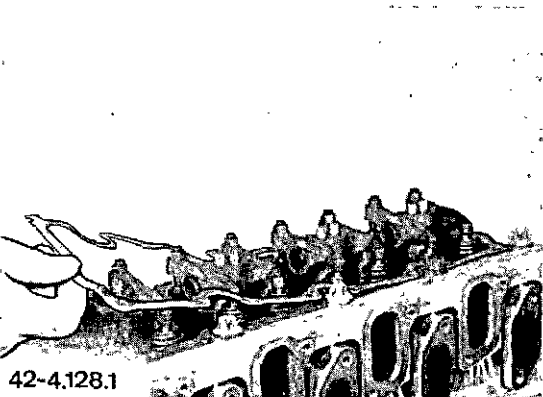
73. Fit rocker arm bracket and align relative to pushrods/valves.



74. Tighten bolts in accordance with specifications.



4

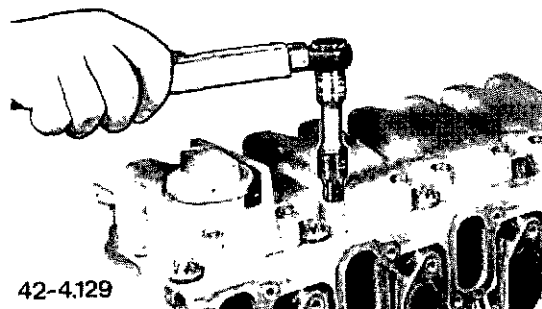
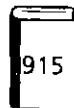


Note:
Adjust valve clearance – see chapter 2.

75. Place on seal.



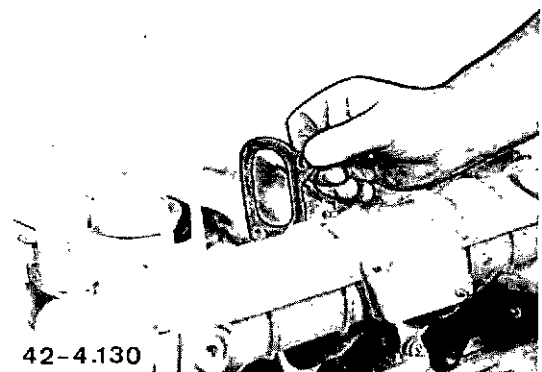
79. Fit cylinder head cover.
Tighten bolts in accordance with specifications.



42-4.129

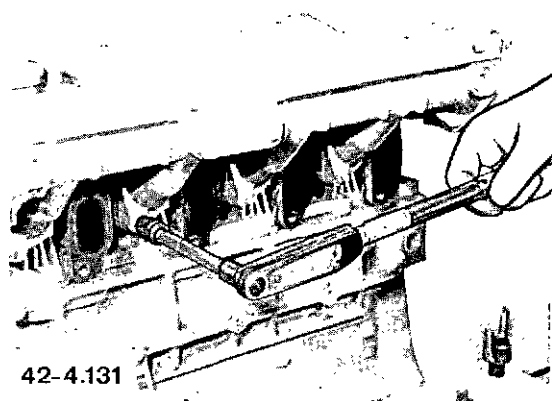
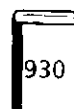
Air intake manifold/ Exhaust manifold

80. Fit air intake manifold with seals.



42-4.130

81. Tighten bolts for air intake manifold in accordance with specifications.

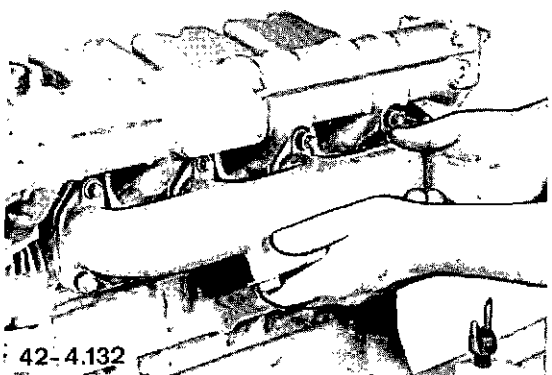


42-4.131

82. Fit exhaust manifold with seals.



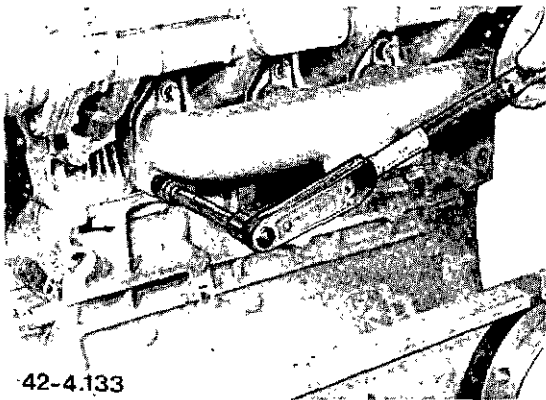
Note:
Spread bolts with Deutz S1 Never Seize Paste.



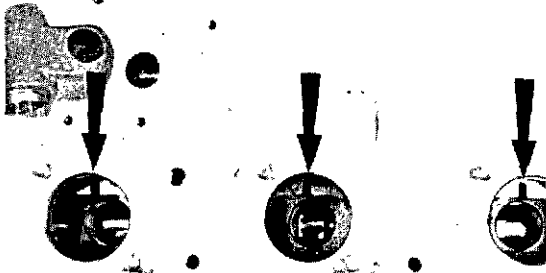
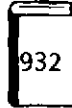
42-4.132

Disassembly and reassembly of complete engine

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83. Tighten bolts for exhaust manifold in accordance with specifications.

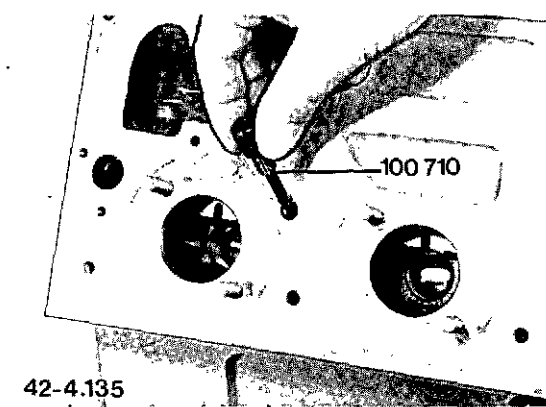


Injection pump

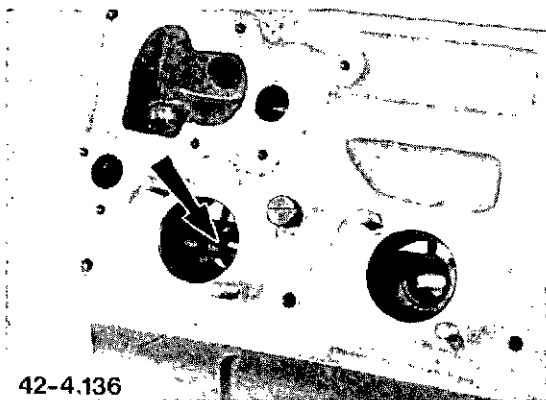
84. Bring control rod in central position.



85. Screw locating pin for control rod into crankcase.

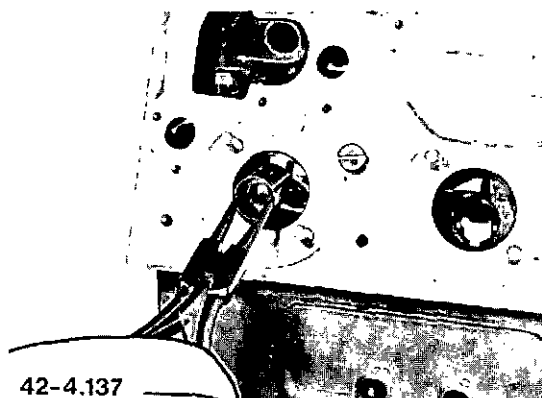


86. Rotate camshaft until tappet stroke of respective cylinder is at BDC.



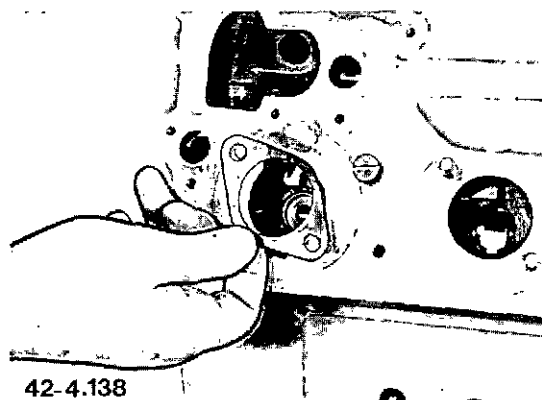
4

87. Fit injection pump tappets.



42-4.137

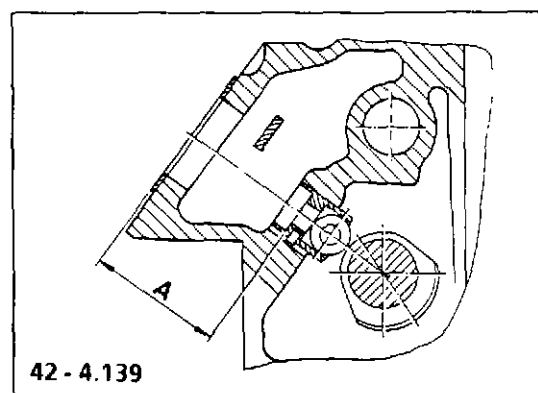
88. Place on seal.



42-4.138

89. Determining shims.

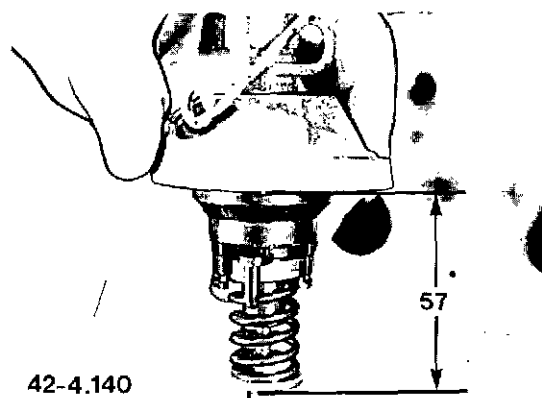
Gauge dimension „A“ between contact surface of seal and spring plate contact surface of tappet.



42-4.139

89.1 Installation dimension of injection pump:
e.g. FL engines = 57 mm

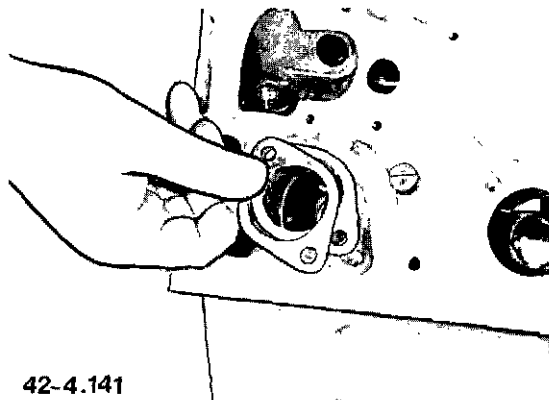
$$\frac{57 \text{ mm} - "A"}{0.2 \text{ mm}} = \text{number of shims}$$



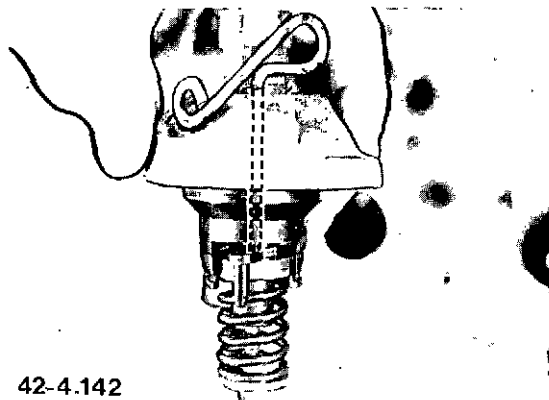
42-4.140

Disassembly and reassembly of complete engine

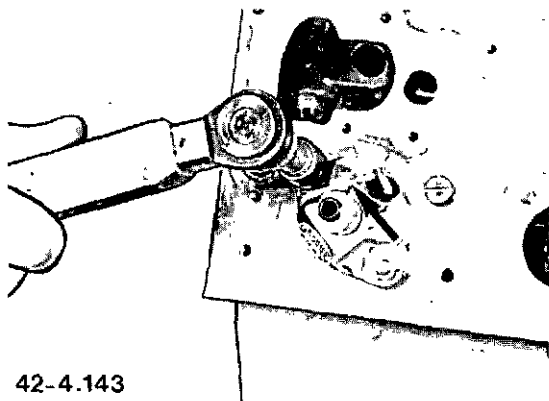
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90. Place on appropriate number of shims.

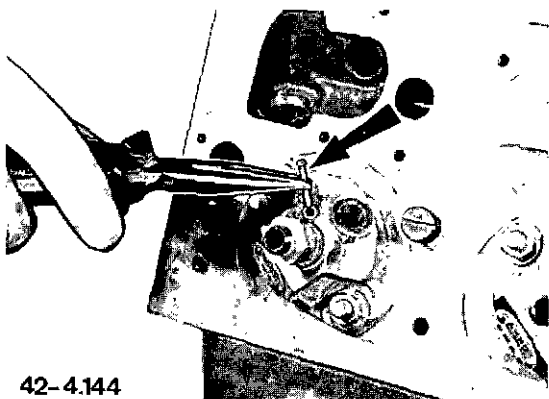


91. **Note:**
Before mounting injection pump, make sure that centering pin is engaged in control lever.



92. Fit injection pump in place. Then press pump down onto its seat, taking care that it is accurately centered. Tighten nuts in accordance with specifications.

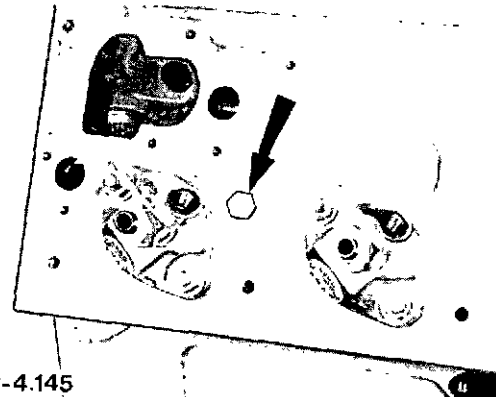
Note:
Remove centering pin.



93. Close bore with plug.

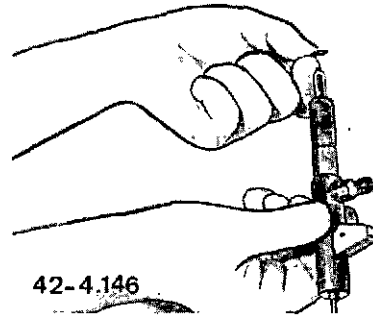
Werkstatthandbuch B/FL 1011/T

94. Remove locating pin for control rod. Cover up bore with new Cu sealing ring.



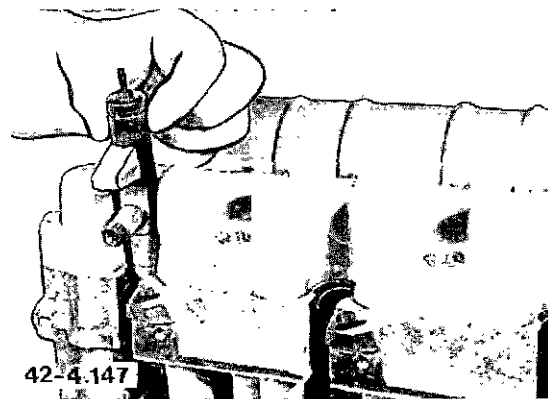
42-4.145

95. Slide sealing ring over injector using some grease.



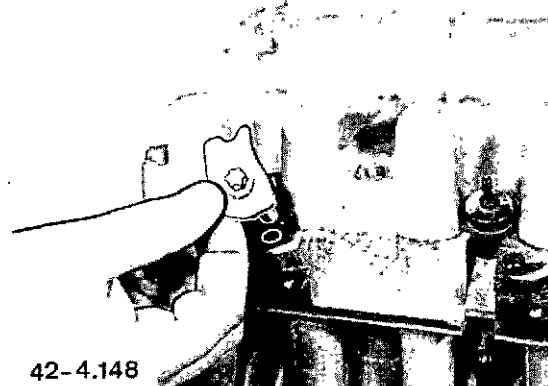
42-4.146

96. Insert injector.

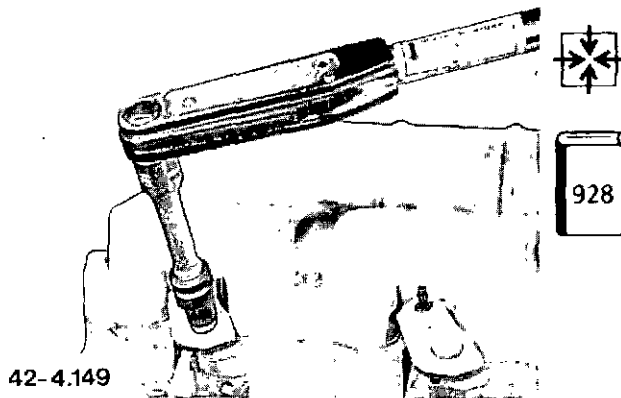


42-4.147

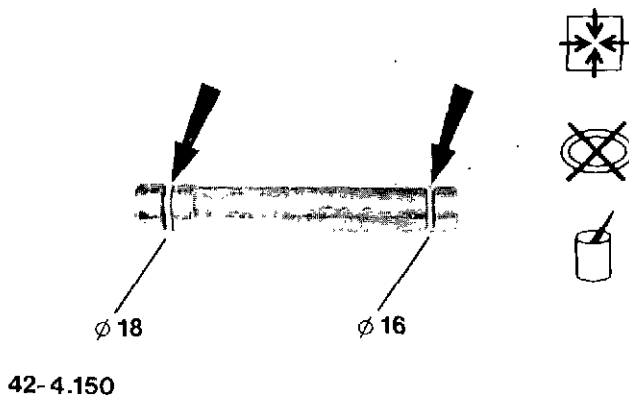
97. Fit clamping pad.



42-4.148

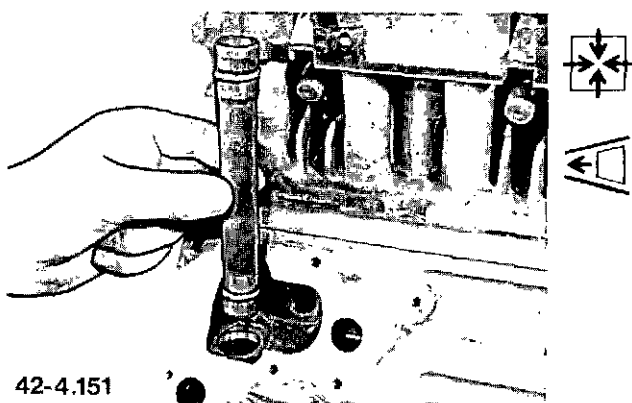


98. Tighten bolts in accordance with specifications.

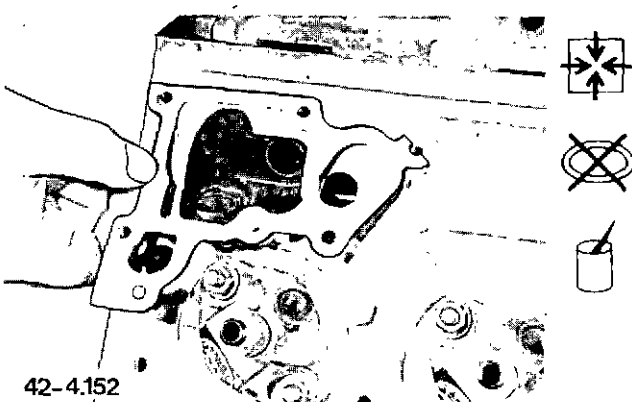


Connecting pipe

99. Fit O-seals.

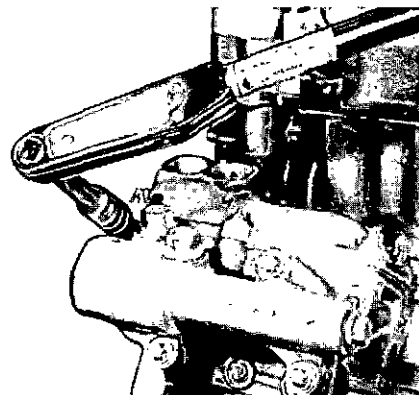
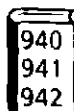


100. Press in connecting pipe as far as it will go.



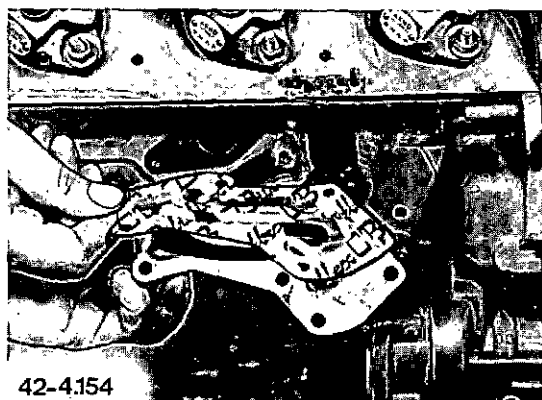
101. Stick gasket in position using grease.

102. Fit thermostat housing.
Tighten bolts in accordance with specifications.



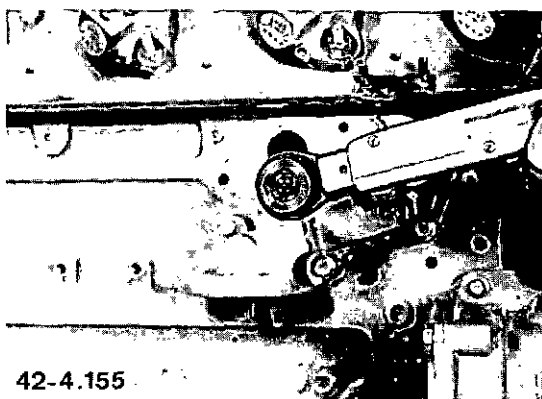
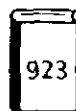
42-4.153

103. Stick gasket in position
using grease.



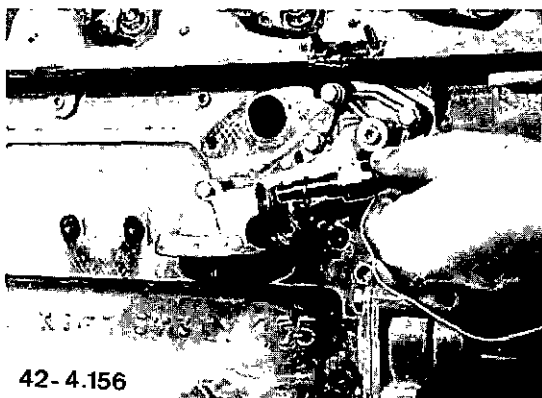
42-4.154

104. Fit oil filter bracket. Tighten
bolts in accordance with speci-
fications.



42-4.155

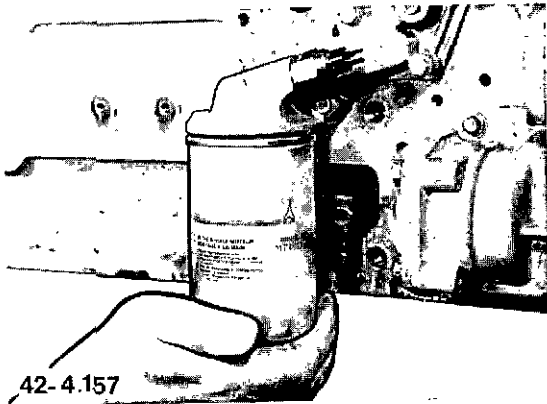
105. Fit temperature pick-up with
new Cu seal.



42-4.156

Disassembly and reassembly of complete engine

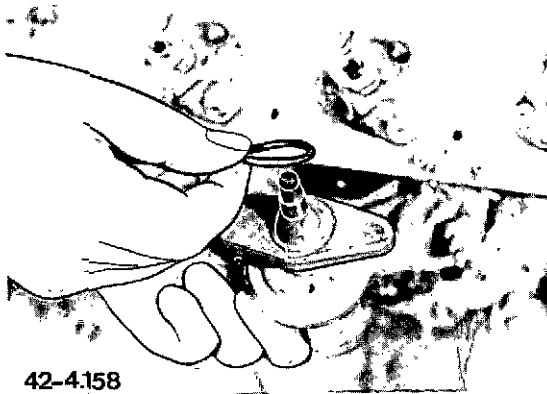
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42-4.157



106. Slightly oil oil filter gasket.
Lock oil filter cartridge finger-tight.

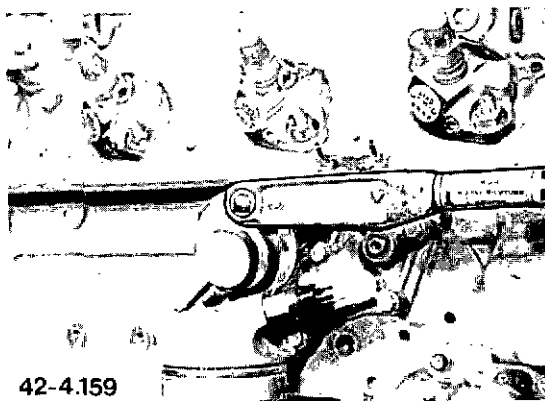


42-4.158



Fuel feed pump

107. Fit new O-seal.

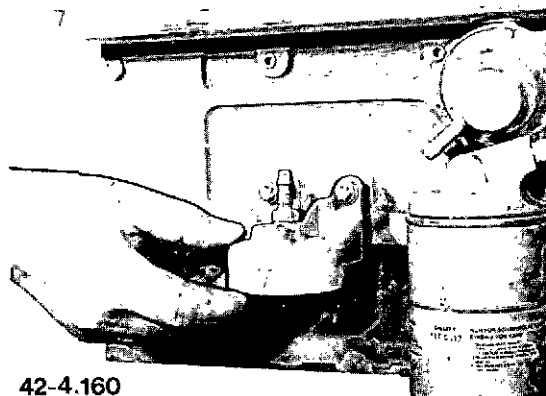


42-4.159



108. Mount fuel feed pump. Tighten bolts evenly in accordance with specifications.

Note:
Set lift cam to BDC.

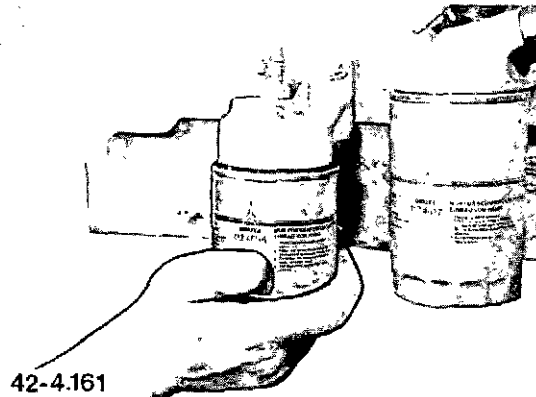


42-4.160



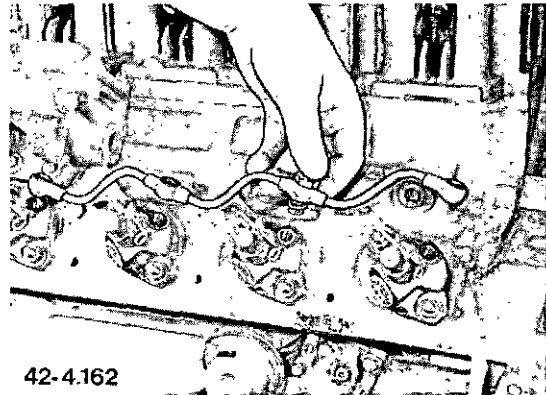
109. Fit fuel filter bracket

110. Slightly oil fuel filter gasket.
Lock filter cartridge fingertight.



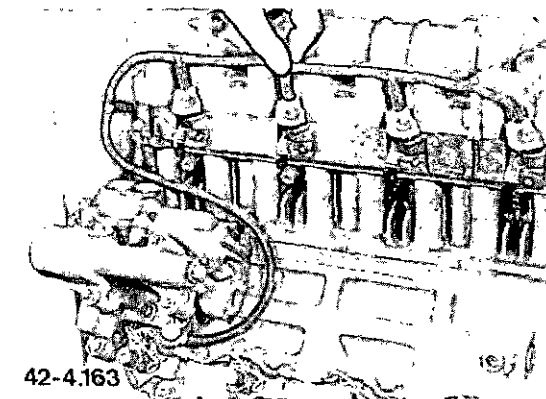
42-4.161

111. Fit fuel line with new Cu
sealing rings.



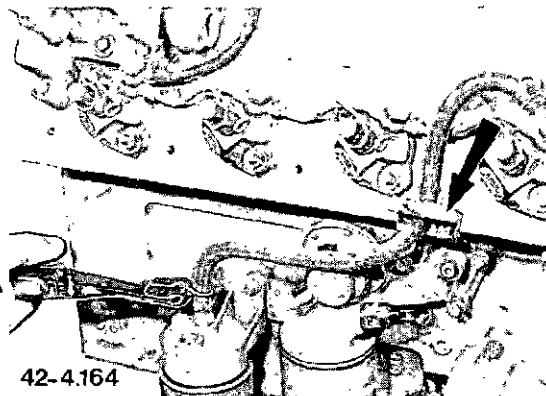
42-4.162

112. Fit leakage fuel line.



42-4.163

113. Fit fuel hose to injection
pump and fuel filter. Press on
profiled rubber.



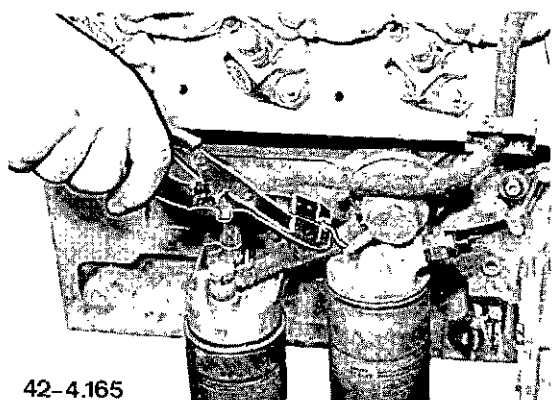
42-4.164

Note:
Use hose clip pliers.



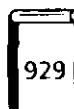
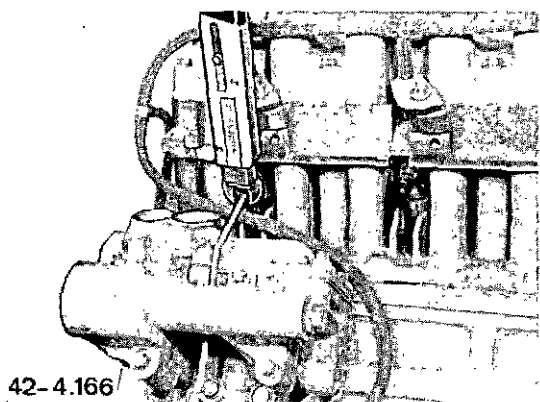
Disassembly and reassembly of complete engine

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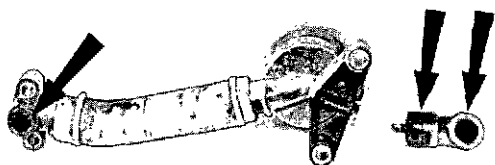
114. Fit fuel hose between fuel filter and fuel pump.

Note:
Use hose clip pliers.

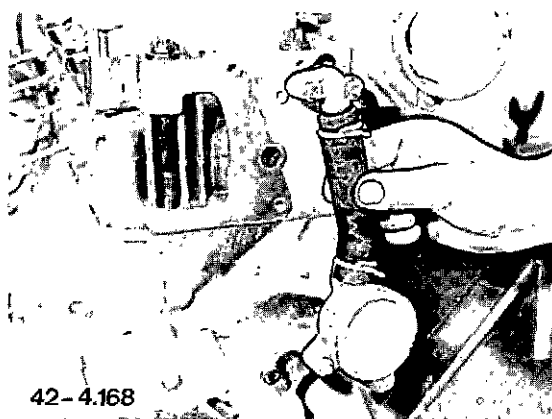


115. Fit injection lines and tighten in accordance with specifications.

4

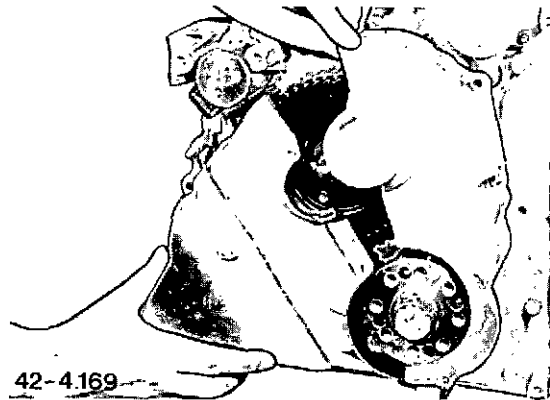


116. Fit new O-seals for crankcase breather.



117. Mount crankcase breather.

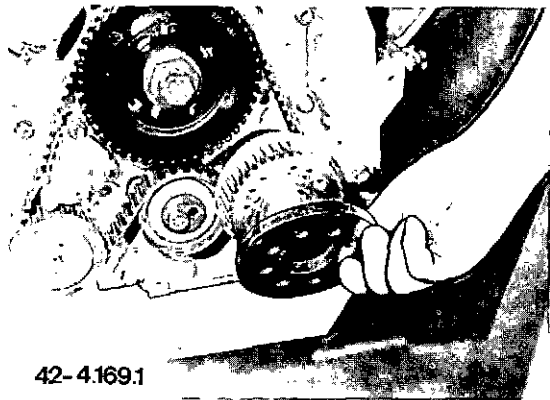
118. Fit toothed belt guard



42-4.169

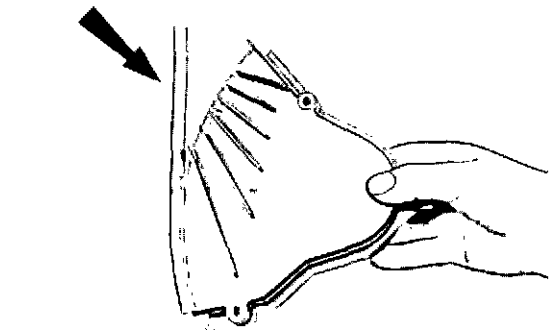
New version

118.1 Position shim with chamfered side facing the engine.



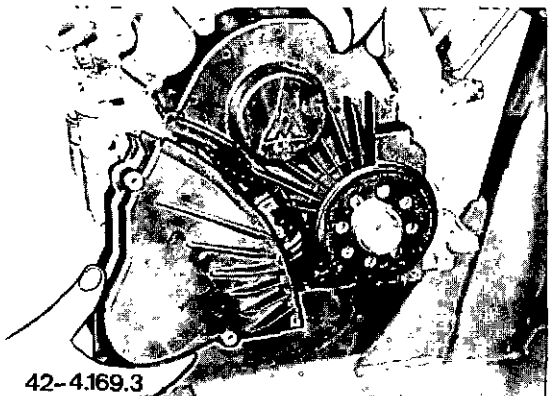
42-4.169.1

118.2 Push in sealing rubber.



42-4.169.2

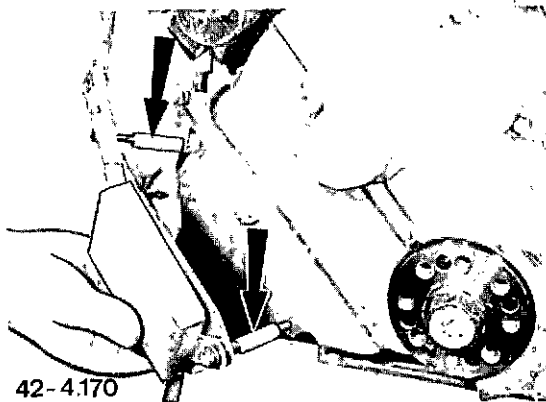
118.3 Fit toothed belt guard.



42-4.169.3

Disassembly and reassembly of complete engine

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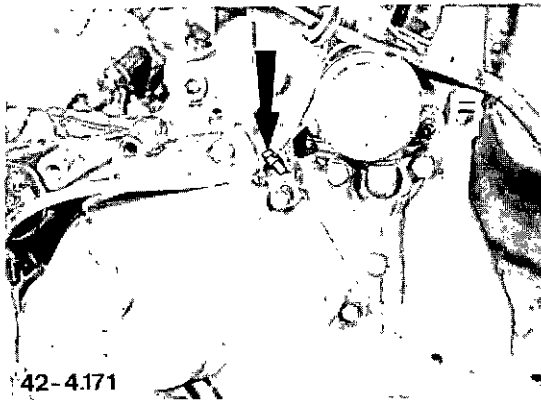
42-4.170



119. Fit cable terminal box and wiring harness with spacer sleeves and special washers.

Note:

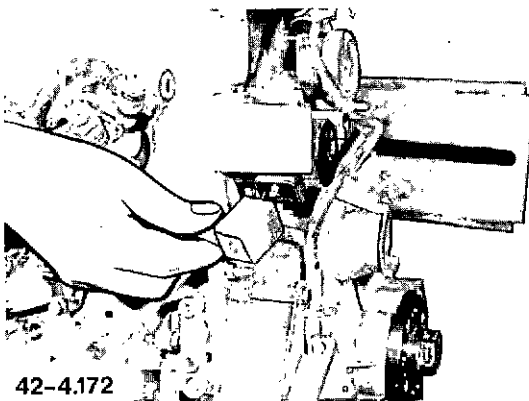
On new toothed belt guard version: without spacer sleeves and special washers.



42-4.171



120. Fit securing clip to toothed belt guard.



42-4.172



121. Fit cable plug connection and secure.

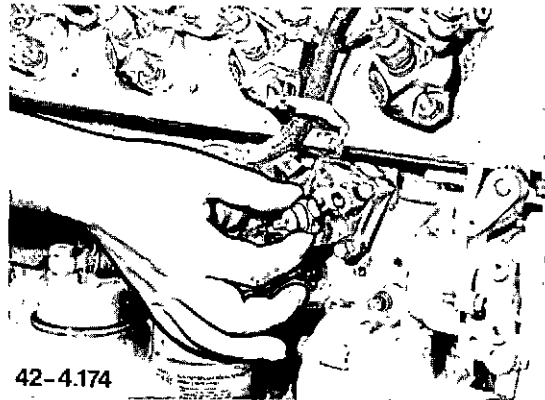


42-4.173

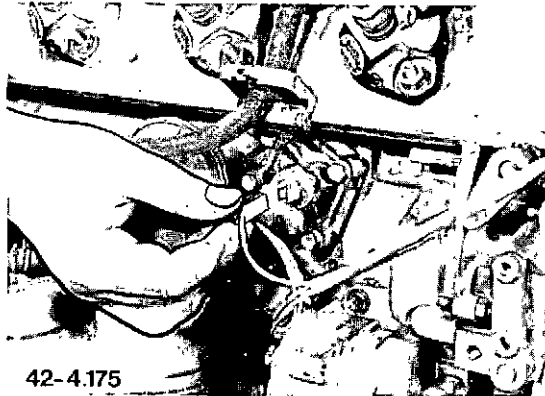


122. Fit cable plug connection.

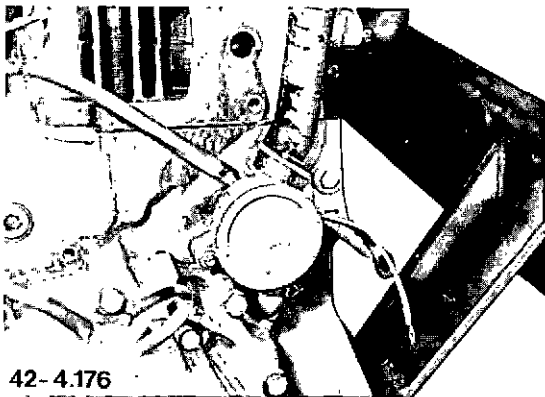
123. Install oil pressure pickup with new Cu sealing ring.



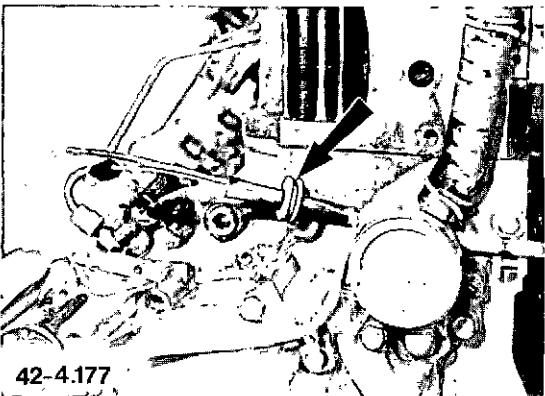
124. Fit cable plug connection.



125. Install wiring harness behind crankcase breather.

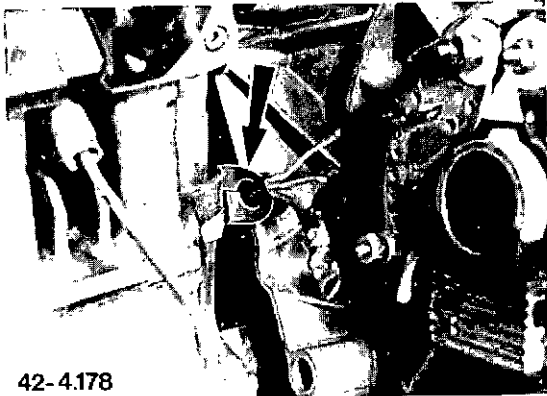


126. Fit rubber grommet to wiring harness.



Disassembly and reassembly of complete engine

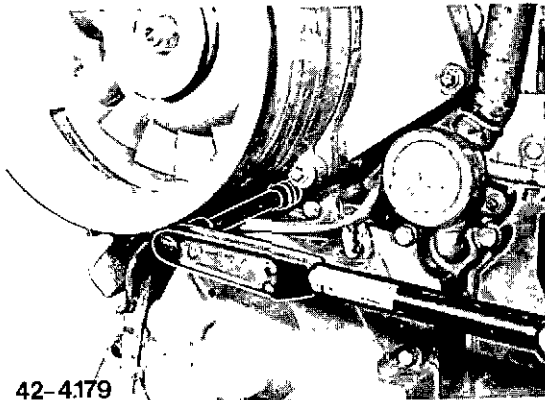
Werkstatthandbuch B/FL 1011/T



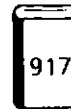
42-4.178



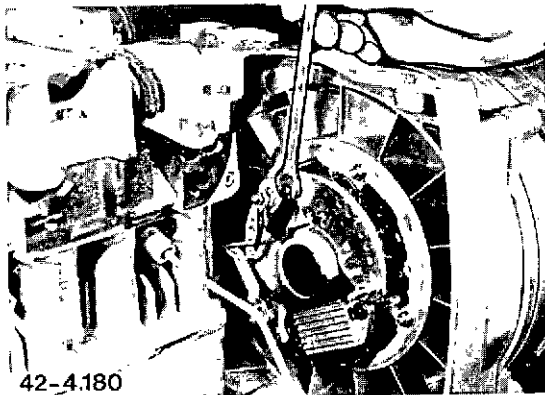
127. Press rubber grommet into blower.



42-4.179



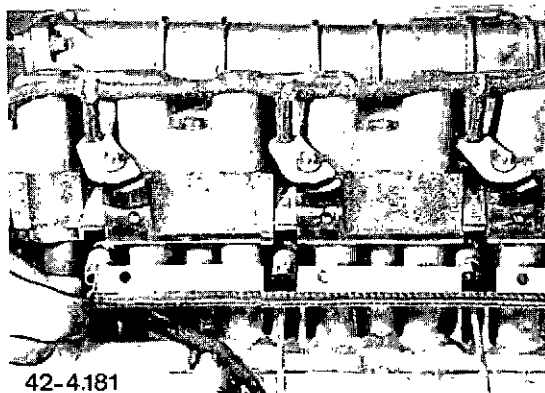
128. Mount blower Tighten bolts in accordance with specifications.



42-4.180



129. Install cables as marked.



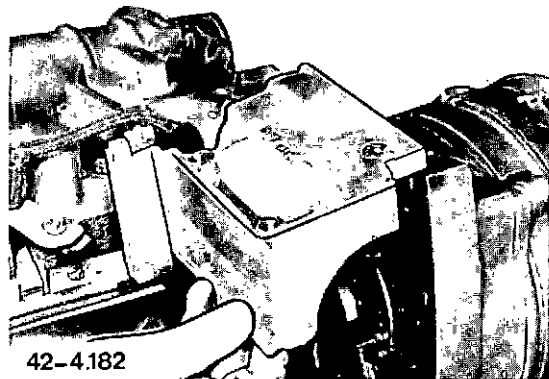
42-4.181



130. Fit cover strip.

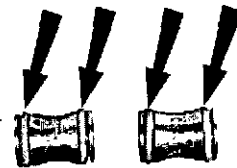
4

131. Fit cooling air ducting.



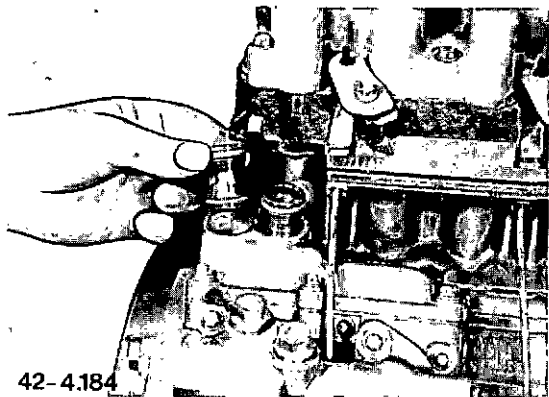
42-4.182

132. Slide new O-seals over adapters.



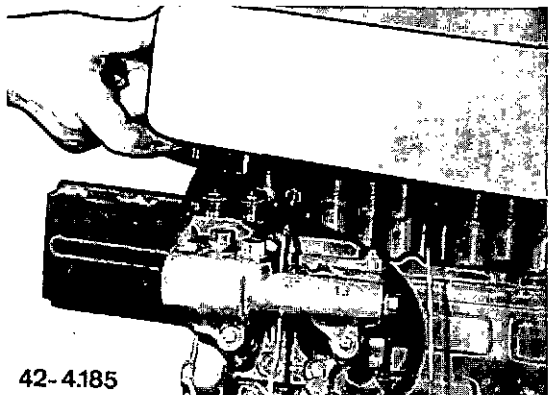
42-4.183

133. Press adapters into thermostat housing.



42-4.184

134. Mount oil cooler.



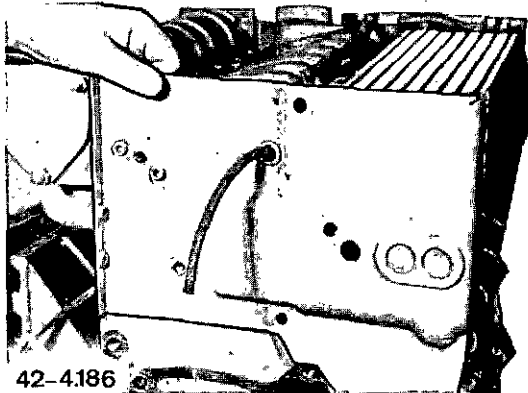
Note:
Do not tighten bolts yet.



42-4.185

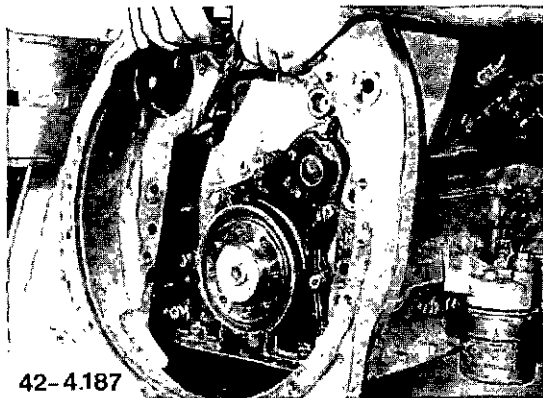
Disassembly and reassembly of complete engine

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135. Fit stay plate.

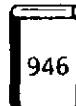
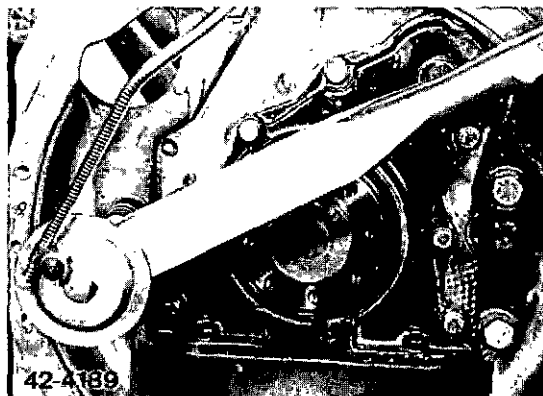
Note:
Tighten bolts for oil cooler and stay plate.



136. Mount adapter housing.

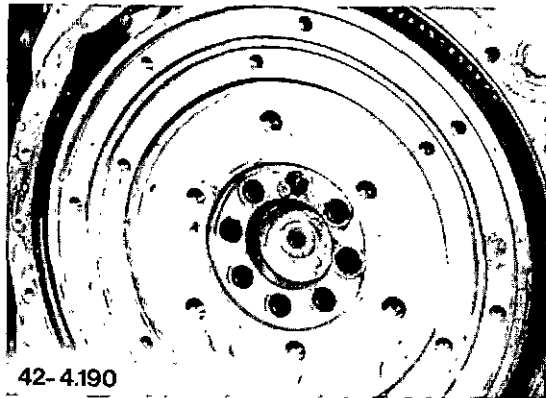
Note:
Make sure that centering bushes are fitted.

4



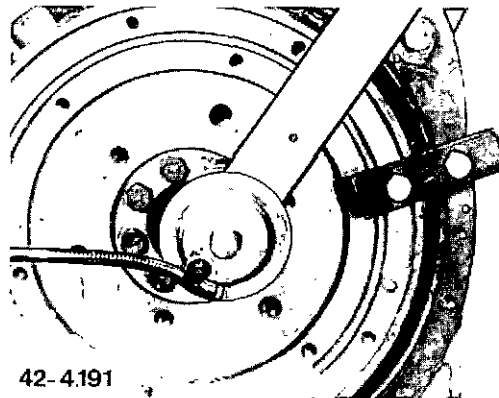
138. Tighten bolts in accordance with specifications.

139. Mount flywheel, using a selfprepared threaded mandrel (sketch). Lock bolts fingertight.



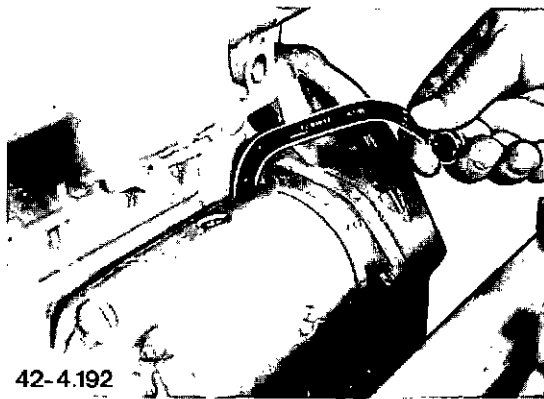
42-4.190

140. Retain flywheel, using a selfprepared dolly (sketch). Tighten bolts in accordance with specifications.



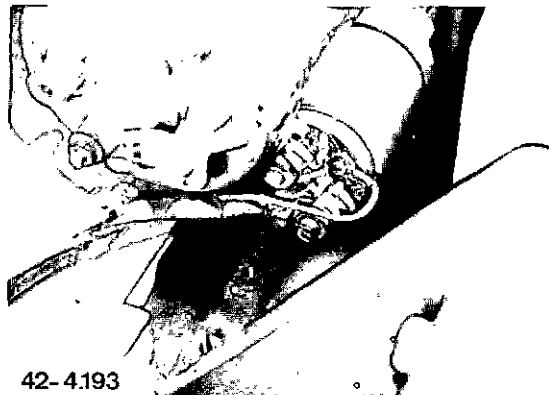
42-4.191

141. Mount starter.



42-4.192

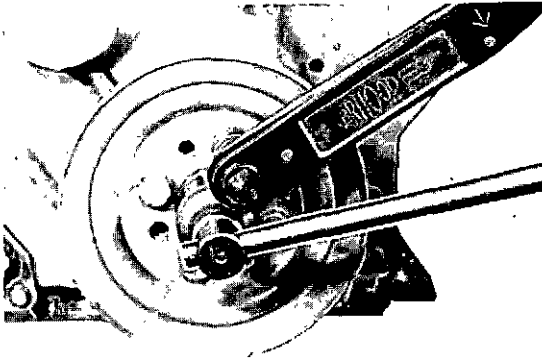
142. Fit cables to starter and fasten clips.



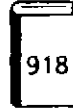
42-4.193

Disassembly and reassembly of complete engine

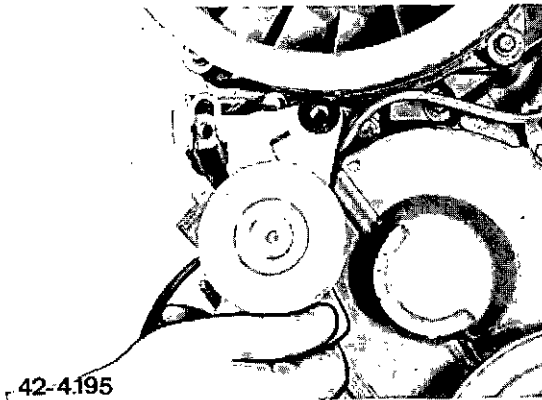
Werkstatthandbuch B/FL 1011/T



42-4.194



143. Fit V-belt pulley.
Tighten bolts in accordance with specifications.

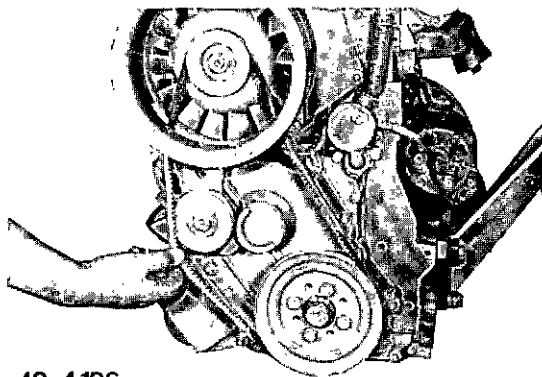


42-4.195



144. Fit V-belt idler pulley.

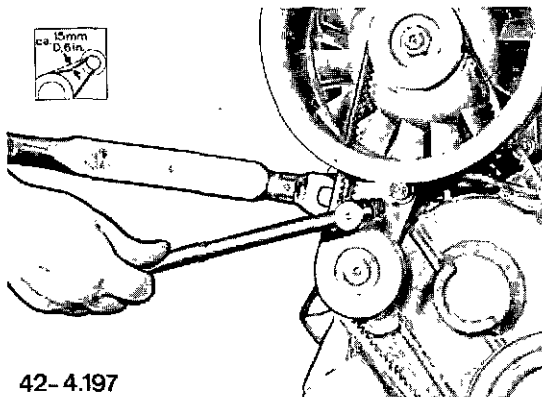
Note:
Start bolts.



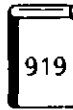
42-4.196



145. Place on V-belt.

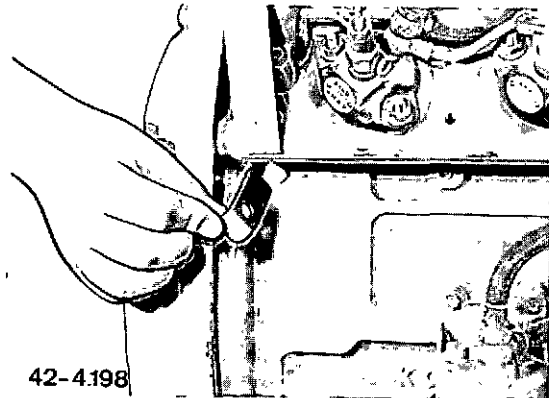


42-4.197



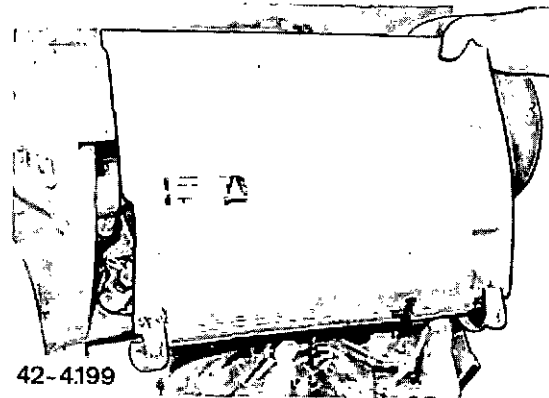
146. Tension V-belt. Tighten bolts in accordance with specifications.

147. Mount holding bracket.



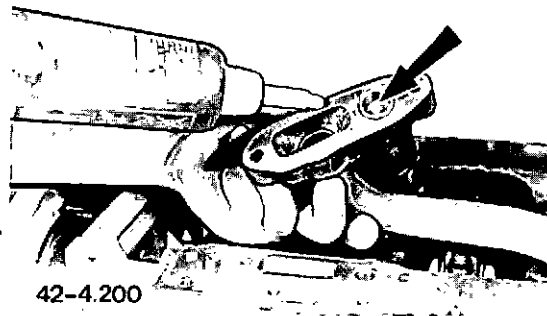
42-4.198

148. Mount air cowling.



42-4.199

149. Spread sealing surface of oil suction housing with Deutz DW 67.

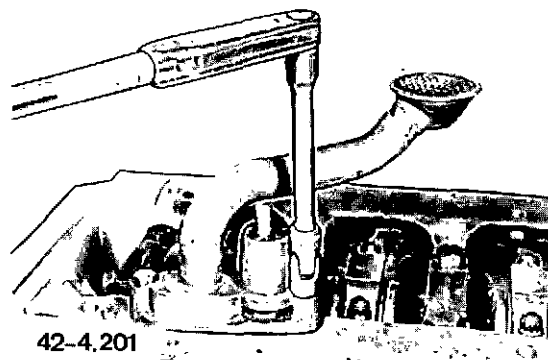
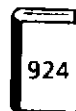


42-4.200

Note:

Make sure that no sealing paste penetrates into pressure valve bore.

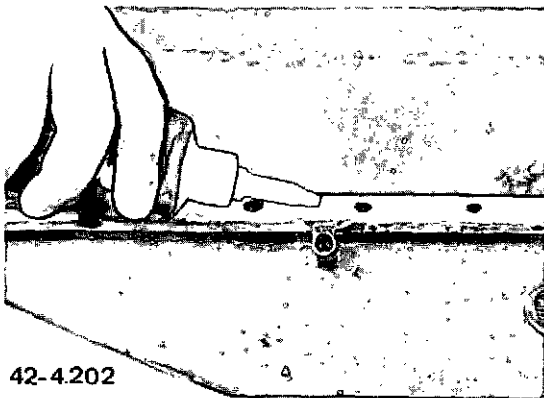
150. Mount oil suction housing. Tighten bolts in accordance with specifications.



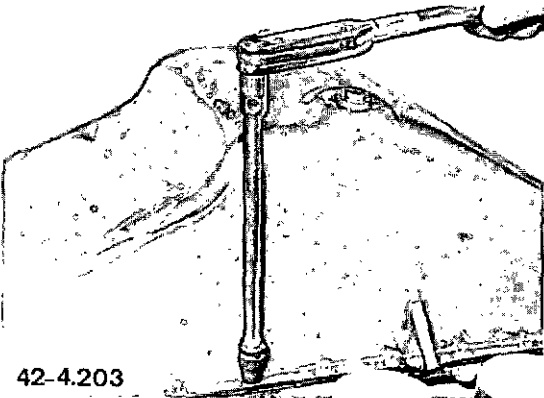
42-4.201

Disassembly and reassembly of complete engine

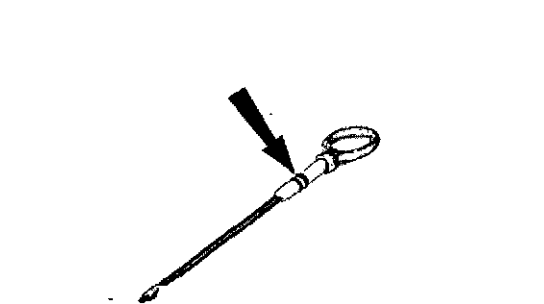
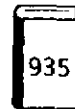
Werkstatthandbuch B/FL 1011/T



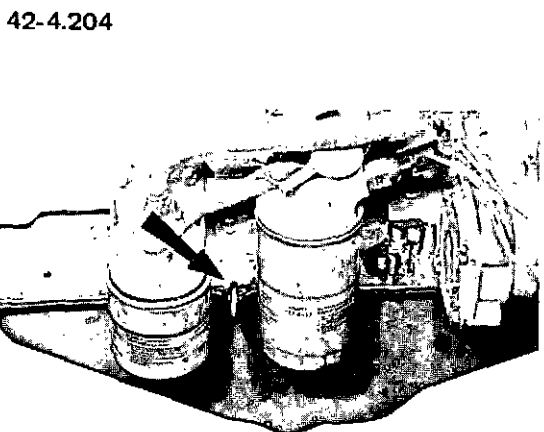
151. Spread sealing surface of oil pan with Deutz DW 47.



152. Mount oil pan. Tighten bolts: Turn clockwise in accordance with specifications.



153. Insert new O-seal



154. Press in oil dipstick as far as it will go.

4

Renewing shaft seals on complete engine.

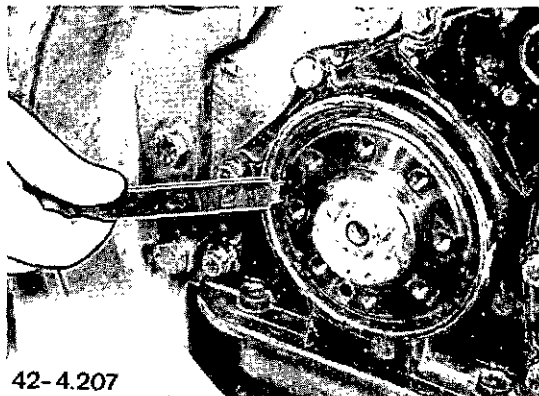
Special tools required:

- Puller for shaft seals..... 142700
- Assembly tool front..... 142850
- Assembly tool front..... 142050
- Assembly tool rear 142860

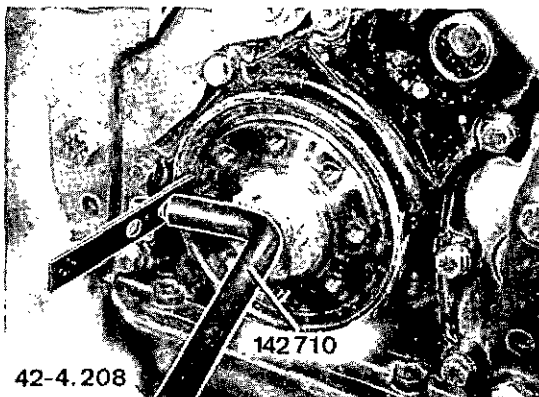
- Flywheel end -

Flywheel has been removed.

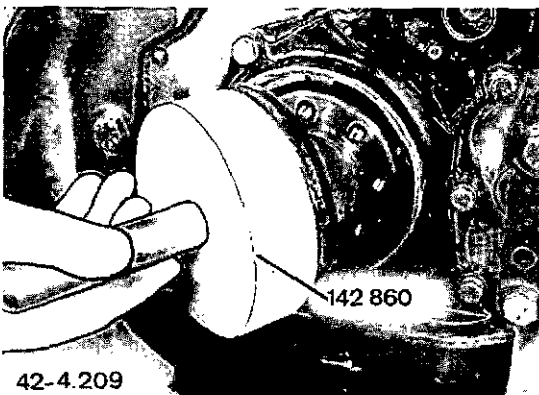
1. Press angle hook into shaft seal.

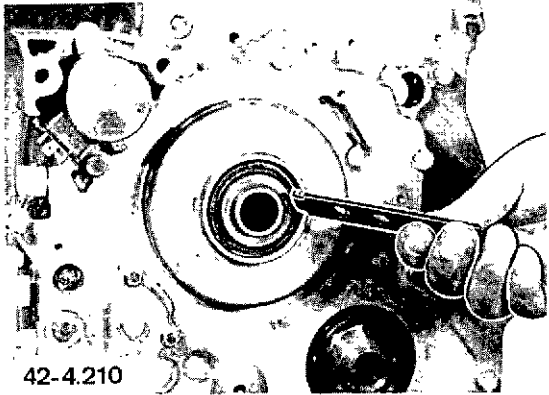


2. Lever shaft seal out of cover using puller.



3. Oil sealing lip. Fit shaft seal using press-in device.

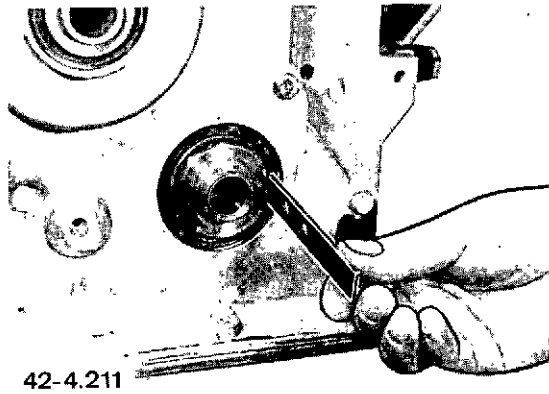




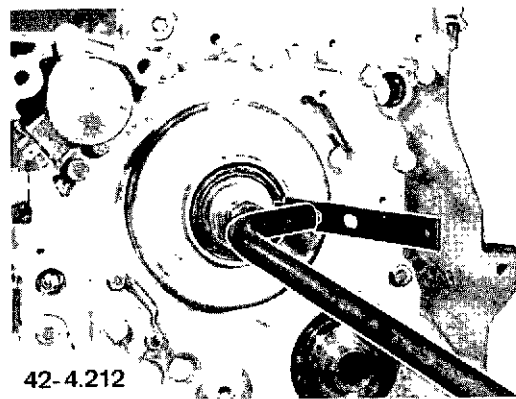
- Front cover -

Toothed belt guard/camshaft and crankshaft gears have been removed.

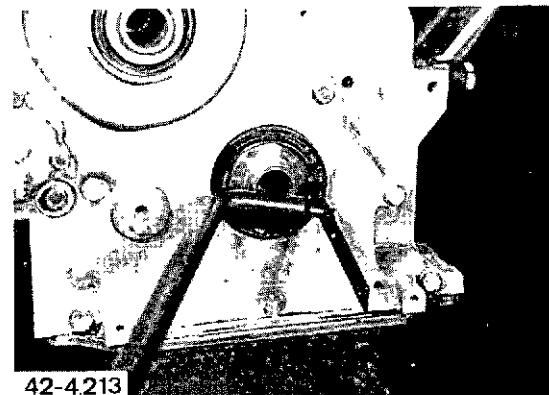
1. Press angle hook into seal of camshaft



and crankshaft.

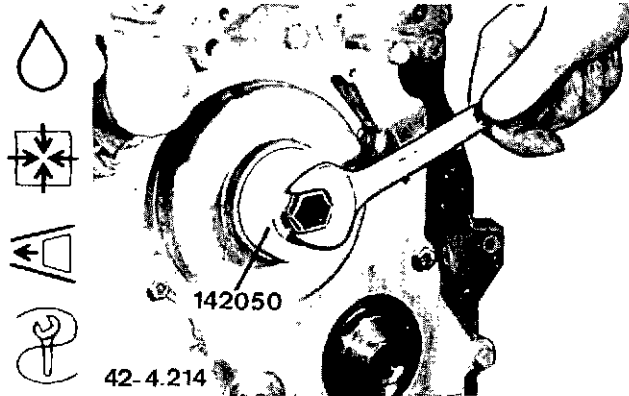


2. Lever out seal for camshaft

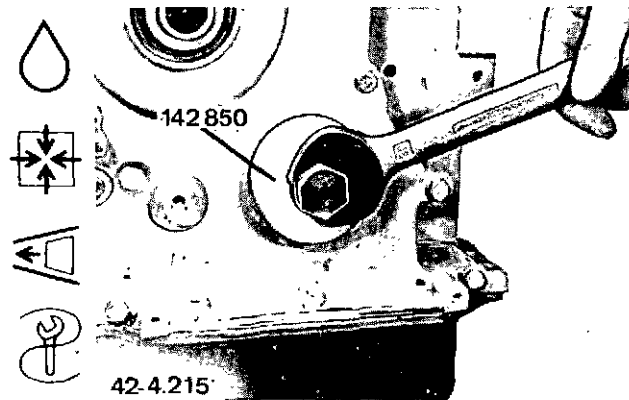


and crankshaft using puller.

3. Oil sealing lips. Fit seal for camshaft



and crankshaft using press-in device.



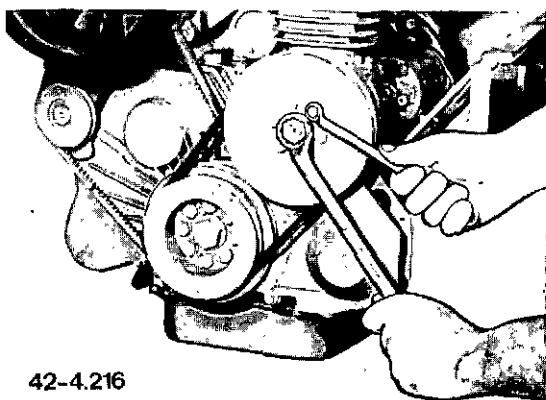
Note:
After having fitted shaft seals basic setting of „camshaft relative to crankshaft“ has to be redone (see pages 4/24 – 4/33).



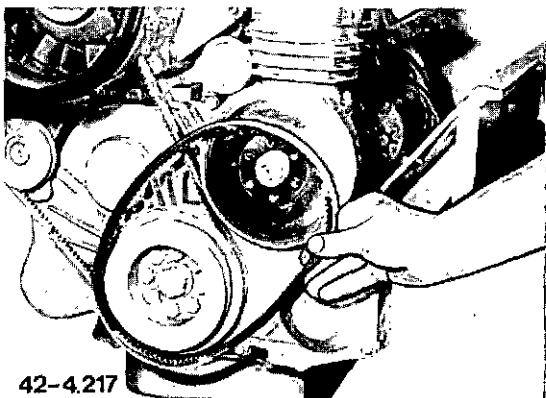
Removal and refitment of air compressor

Commercial tools required:

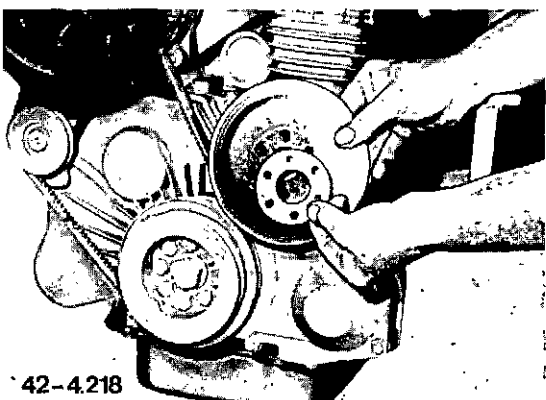
V-belt tension gauge..... 91107



1. Remove outer V-belt half-pulley together with shims.

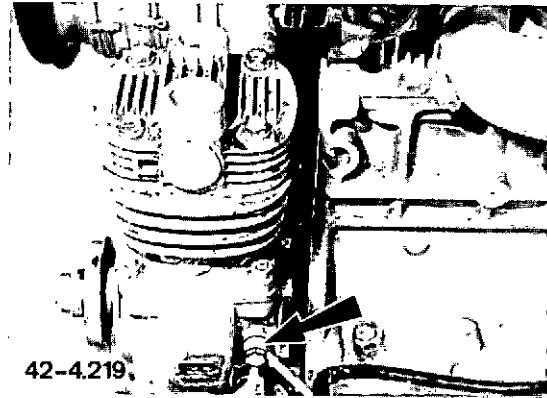


2. Remove V-belt.

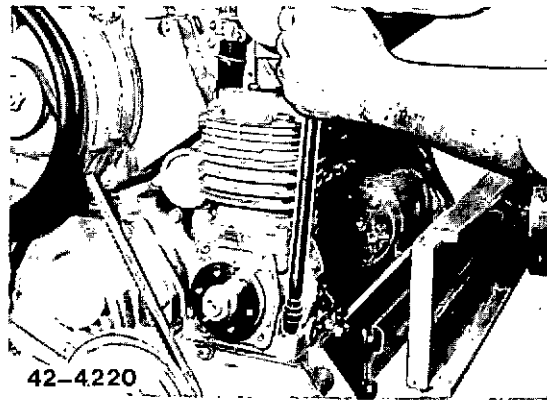


3. Remove shims and inner V-belt half-pulley.

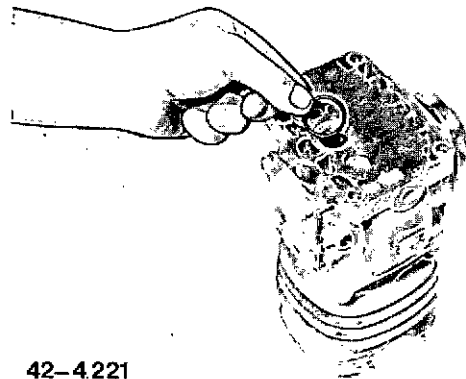
4. Take down lube oil pipe.



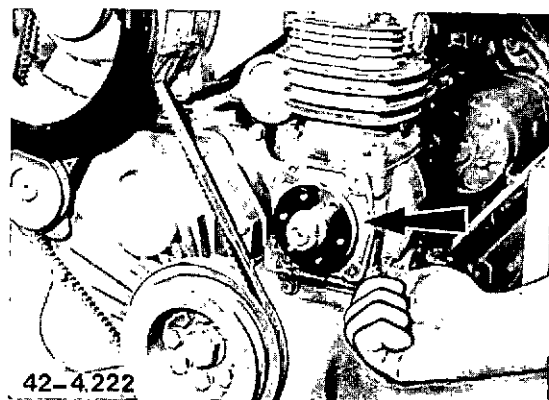
5. Remove air compressor.



6. Insert new O-seal, using grease.

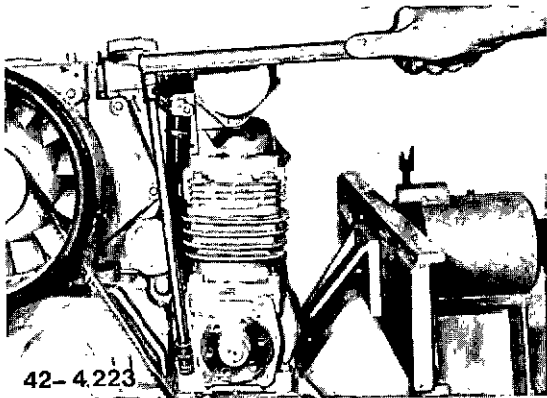


7. Fit air compressor in place, as indicated by arrow.

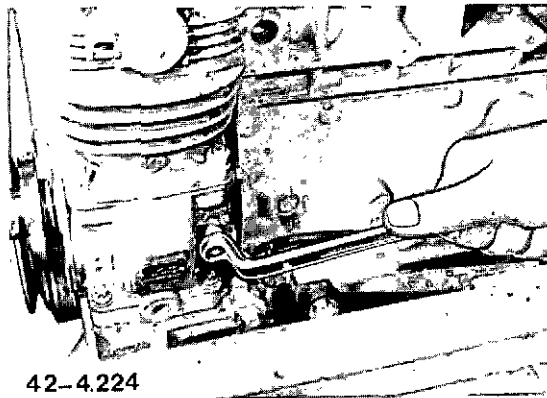


Disassembly and reassembly of complete engine

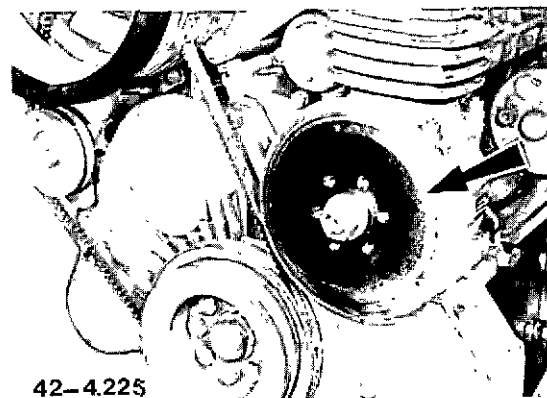
Werkstatthandbuch B/FL 1011/T



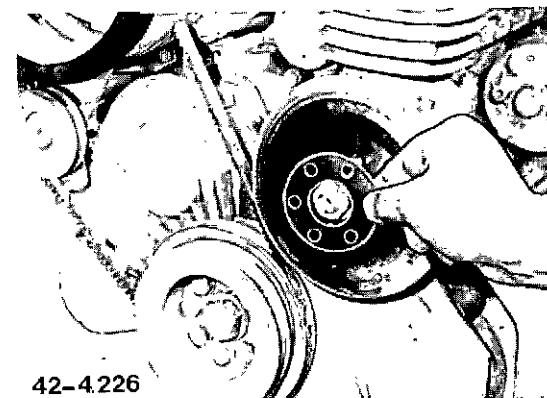
8. Tighten bolts.



9. Fit lube oil pipe together with new Cu sealing rings.



10. Position inner V-belt half-pulley.

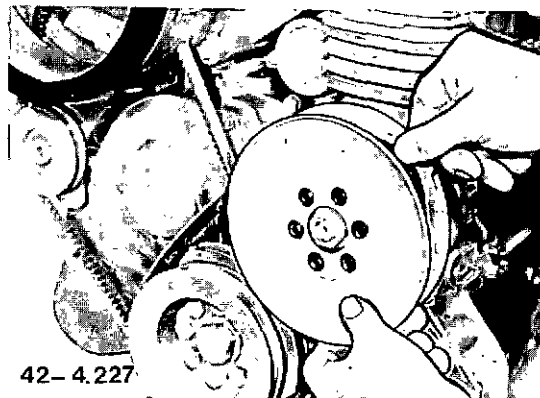


11. Position removed shims.

4

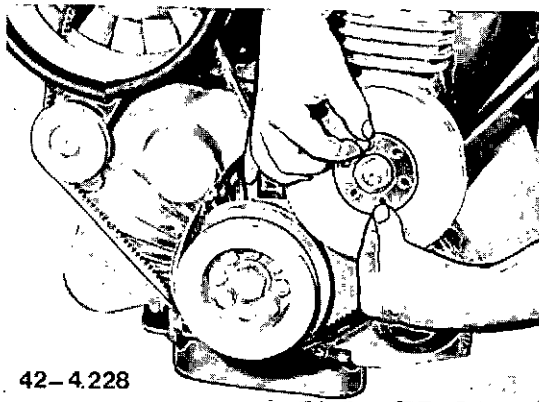
42-4.226

12. Fit V-belt and outer V-belt pulley.



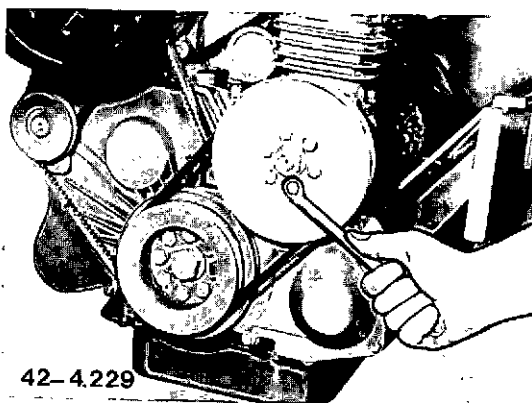
42-4.227

13. Position remaining shims, if provided.
Finger start the bolts.



42-4.228

14. Tighten bolts while turning engine over.

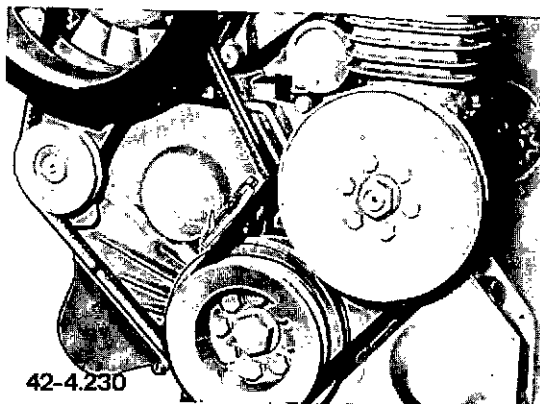


42-4.229

15. Check belt tension.
In case of failure to attain the specified scale reading, repeat procedure.



V-belt tension.:
Tension of new belt: 510 Nm.
Retension after 20 min.: 410 Nm



42-4.230

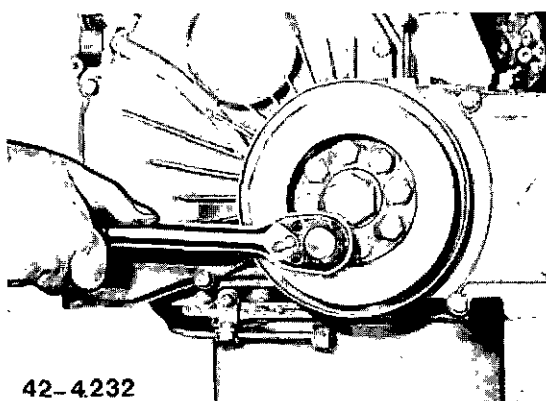
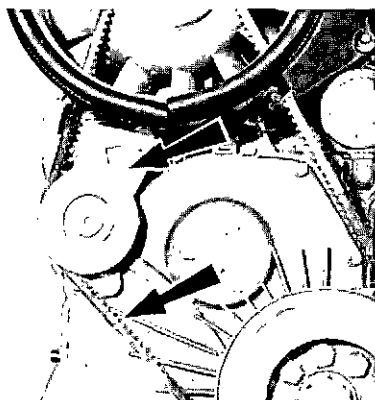
Renewal of toothed belt and bracket for hydraulic pump on complete engine

Special tools required:

Toothed belt tension gauge 100720
Tensioning device 144600

1. Remove V-belt idler pulley.
Remove V-belt.

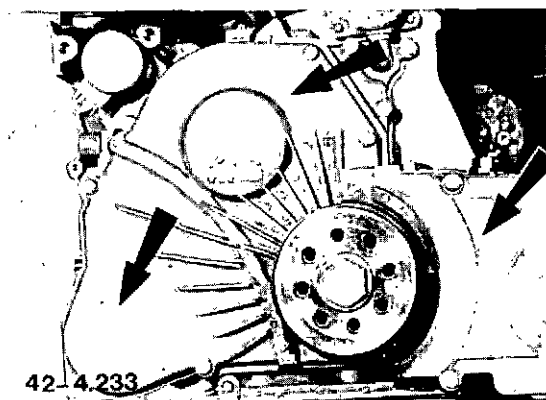
42-4.231



42-4.232



2. Remove V-belt pulley.



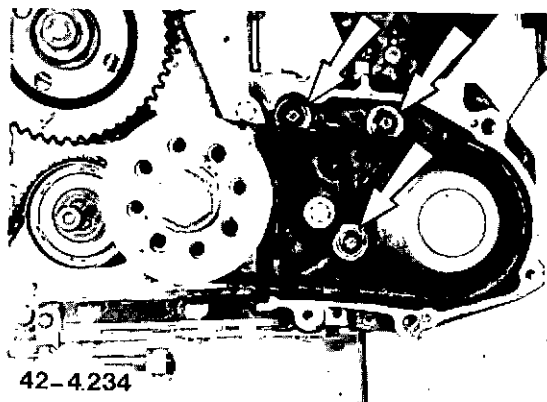
42-4.233



3. Remove toothed belt guard.

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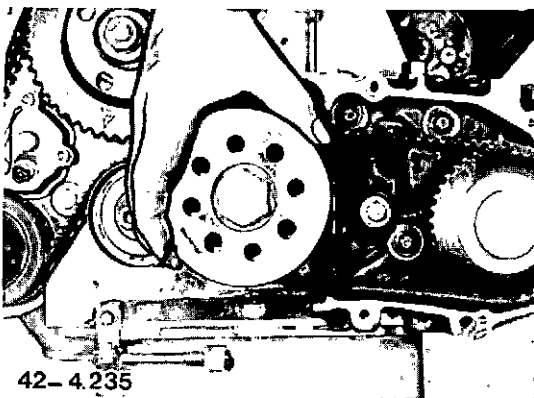
4. Unscrew bolts from hydraulic pump bracket.



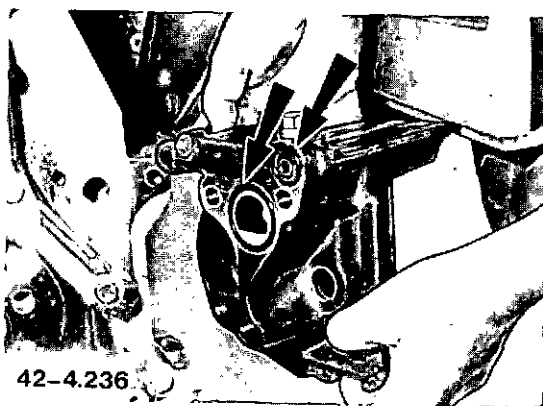
5. Remove shim and toothed belt.



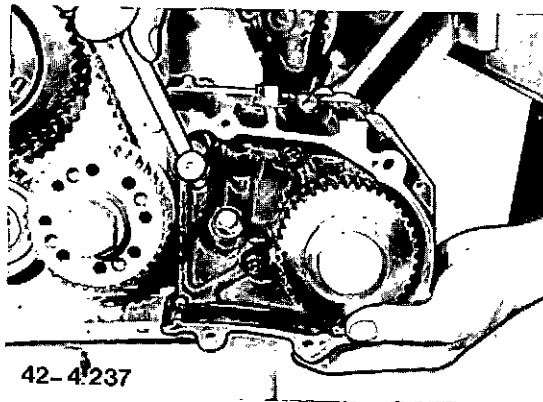
Note:
If necessary, renew complete hydraulic pump bracket.



5.1 Insert new O-seals.

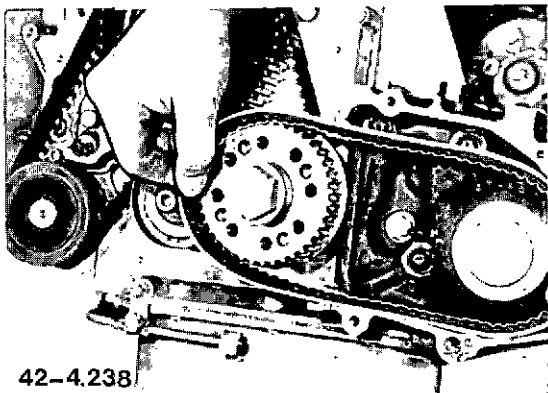


5.2 Fit hydraulic pump bracket, turn fastening bolts lightly.

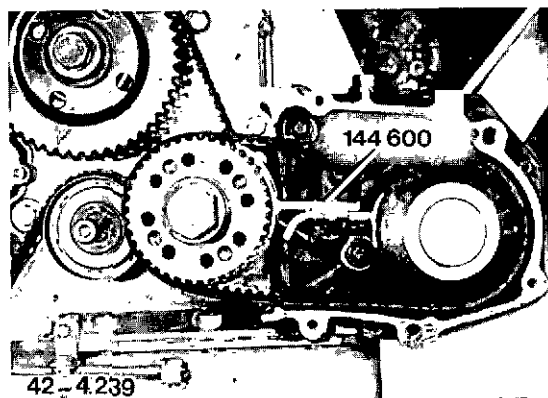


Disassembly and reassembly of complete engine

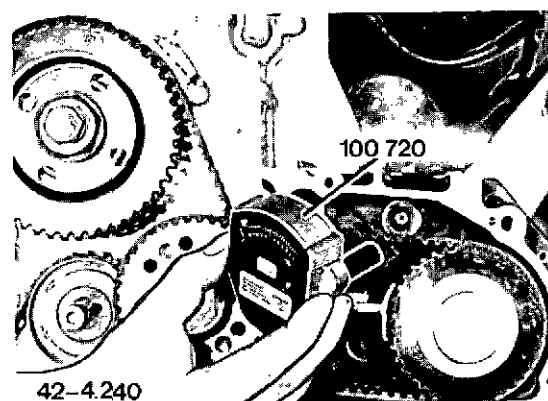
Werkstatthandbuch B/FL 1011/T



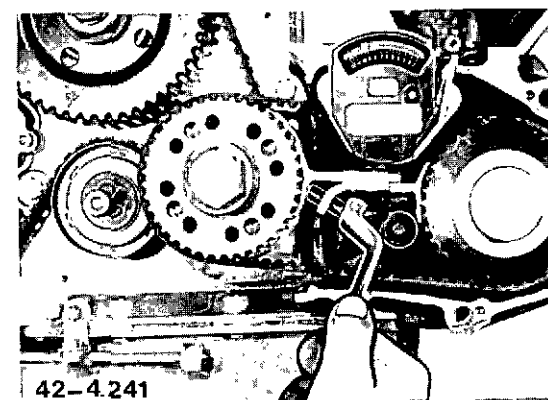
6. Position toothed belt.
On crankshaft gear as far as rear guide plate and on hydraulic pump gear with approx. 4 mm distance from front edge.



7. Position tensioning device.



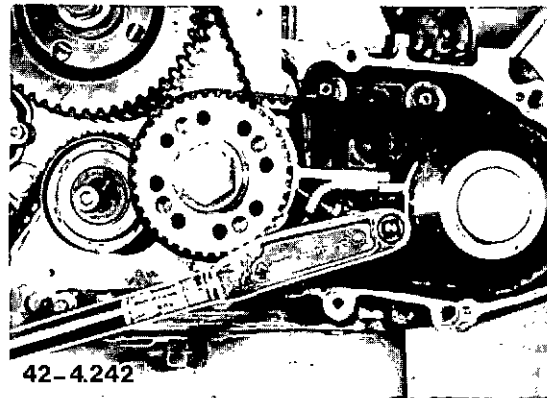
8. Position toothed belt tension gauge.



9. Tension toothed belt with tensioning device so as to attain a scale reading between 10.5 and 11.5.

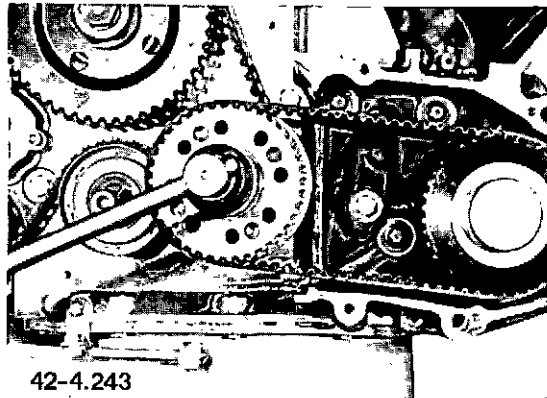
Remove tension gauge.

10. Tighten fastening bolts of bracket in accordance with specifications.



11. Remove tensioning device.

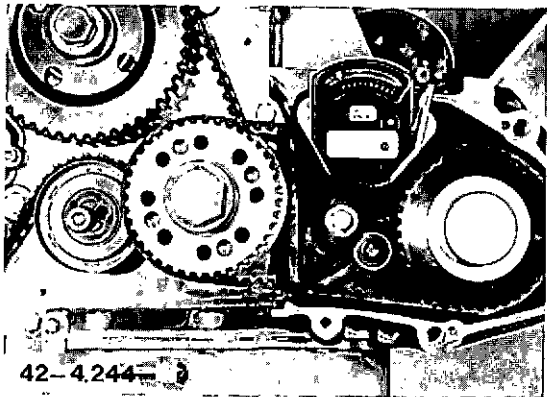
Turn crankshaft one revolution in direction of engine rotation.



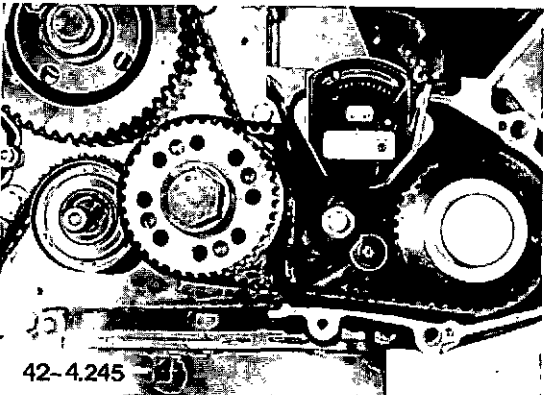
12. Position toothed belt tension gauge.

Take reading.

Specified scale reading: 10 to 12.

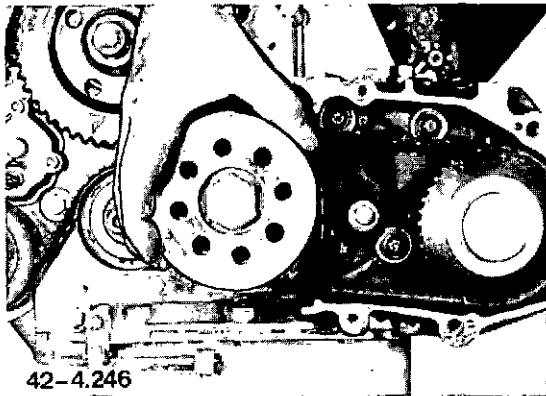


13. In case of failure to attain the specified scale reading, repeat procedure.



Disassembly and reassembly of complete engine

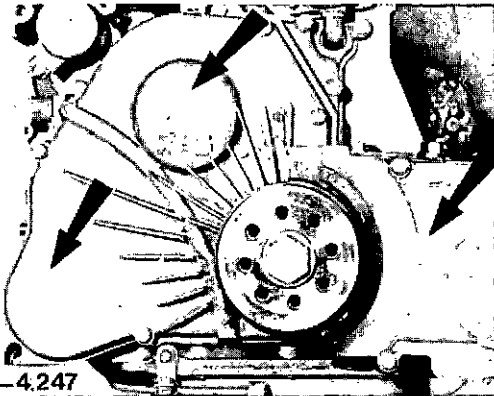
Werkstatthandbuch B/FL 1011/T



42-4.246



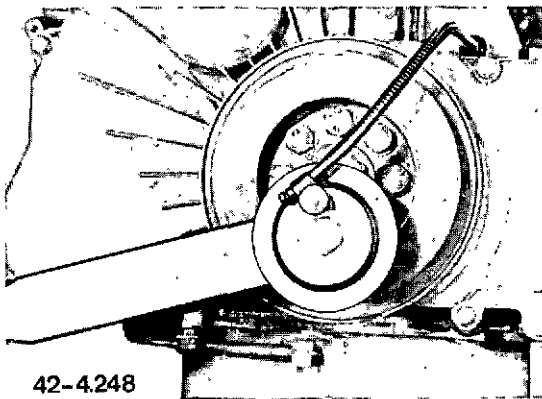
14. Position shim with chamfered side facing the engine.



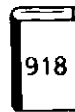
42-4.247



15. Replace toothed belt guard.

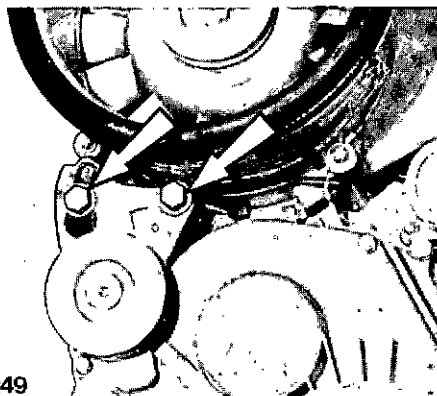


42-4.248



16. Refit V-belt pulley, tighten bolts in accordance with specifications.

4



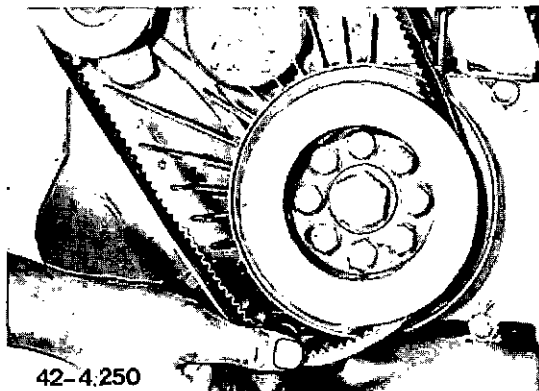
42-4.249



17. Fit V-belt idler pulley.

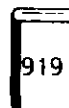
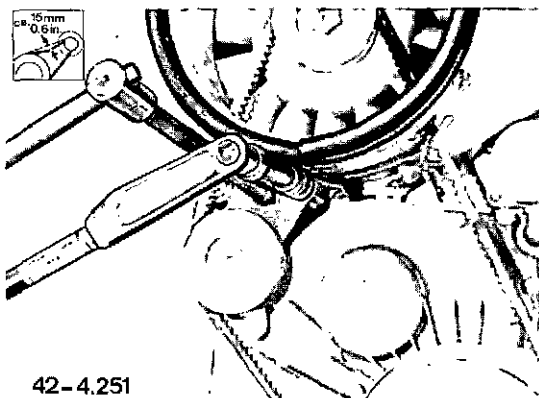
Note:
Turn bolts lightly.

18. Position V-belt.



42-4.250

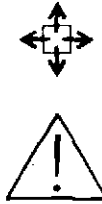
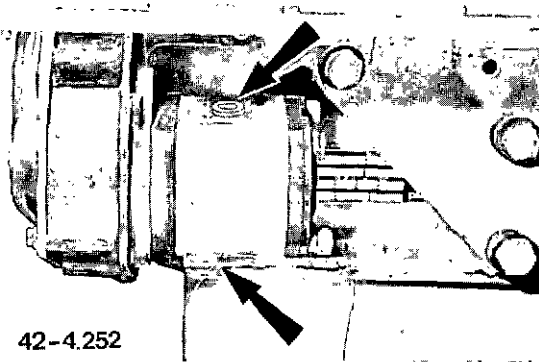
19. Tension V-belt.
Tighten bolts in accordance with specifications.



42-4.251

Disassembly and reassembly of complete engine

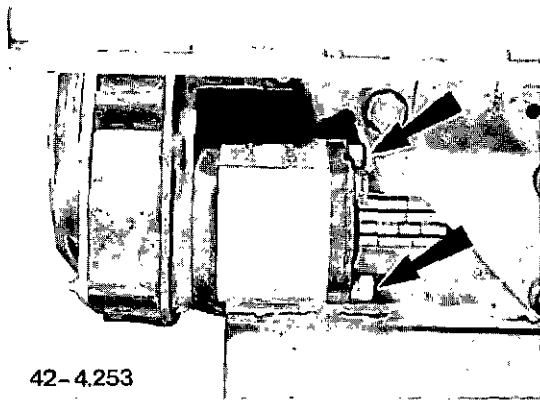
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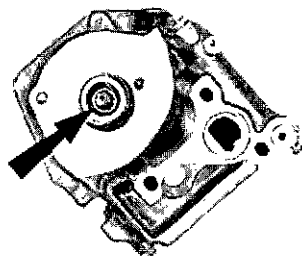
Removal and refitment of hydraulic pump:

1. Release connections.

Note:
Close openings.

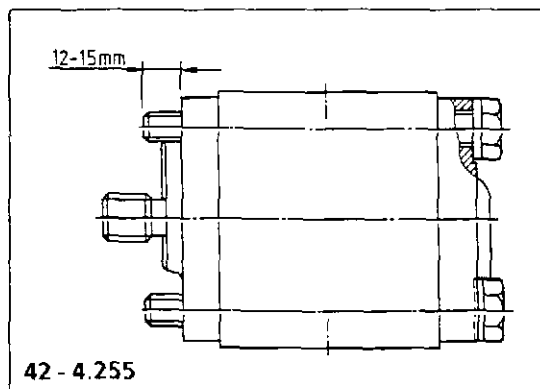


2. Take down hydraulic pump.



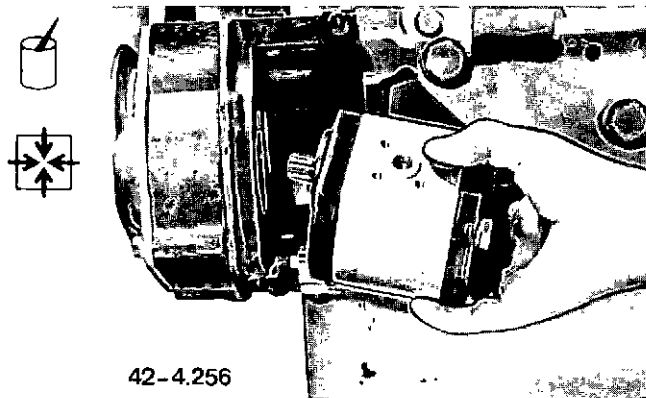
3. Make sure that a coupling sleeve is fitted.

4



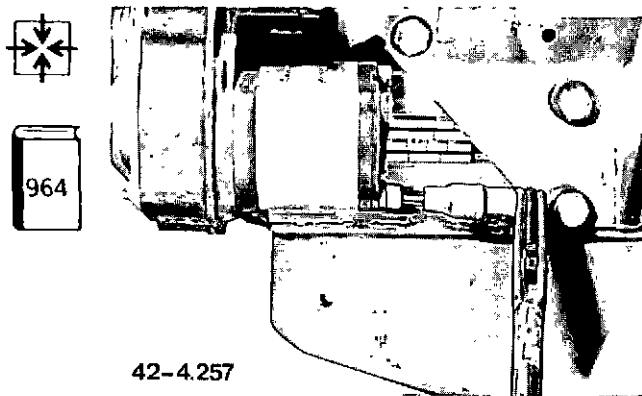
4. Fit fastening bolts together with washers.
Measure projection.

5. Apply graphite grease to serrated shaft, mount hydraulic pump.

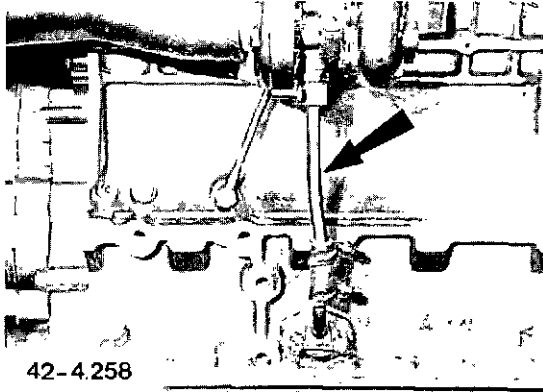


42-4.256

6. Tighten bolts in accordance with specifications.

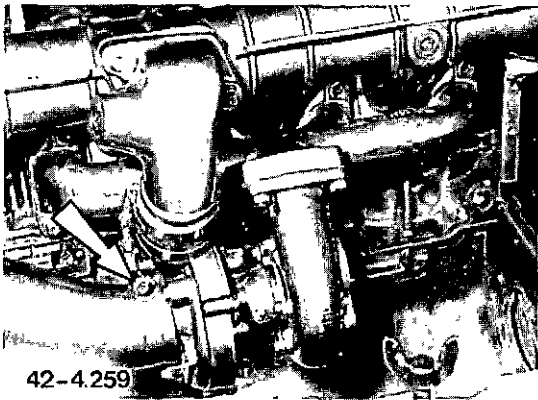


42-4.257

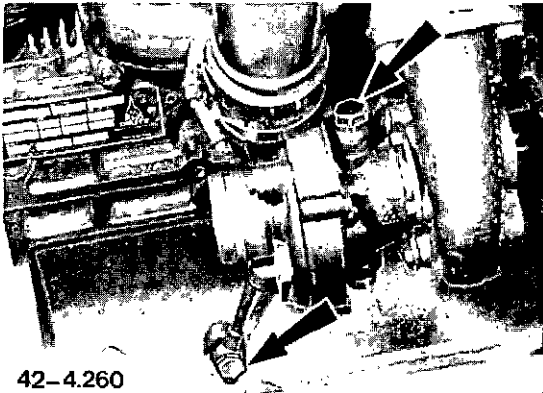


Removal and refitment of exhaust turbocharger

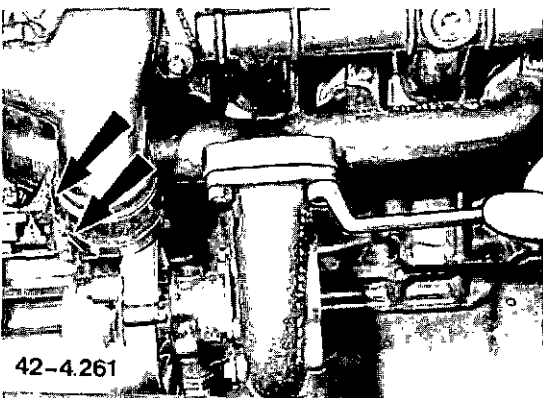
1. Take down oil return pipe.



2. Release hose clip.
Remove suction hose.



3. Take down pressure oil pipe.

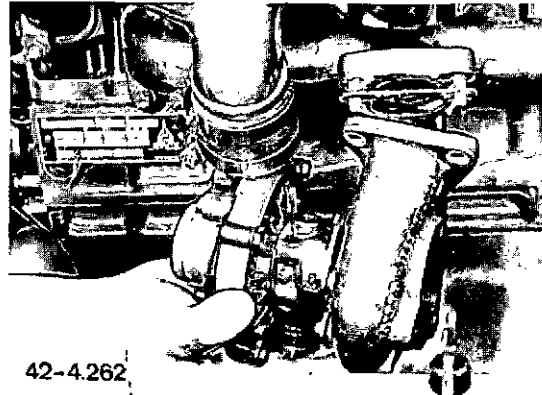


4. Release hose clips.
Remove turbocharger.
Renew exhaust turbocharger if damaged.



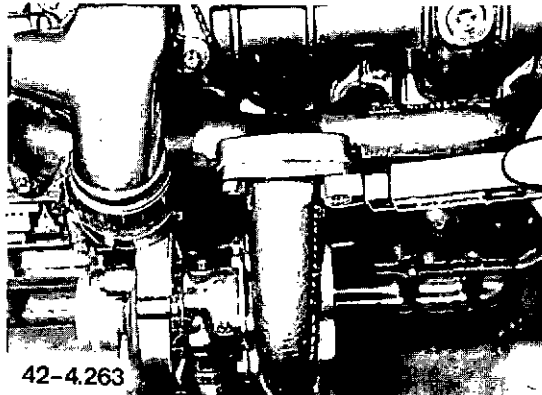
4

5. Fit exhaust turbocharger together with new gasket.



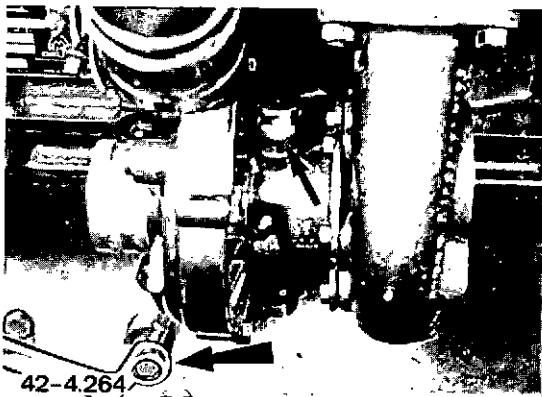
42-4.262

6. Tighten nuts in accordance with specifications.



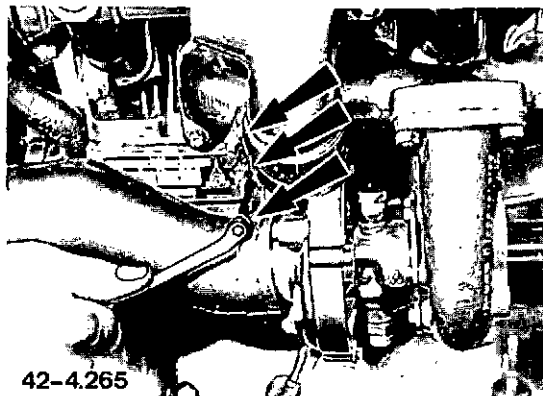
42-4.263

7. Fit pressure oil line with new Cu sealing rings.



42-4.264

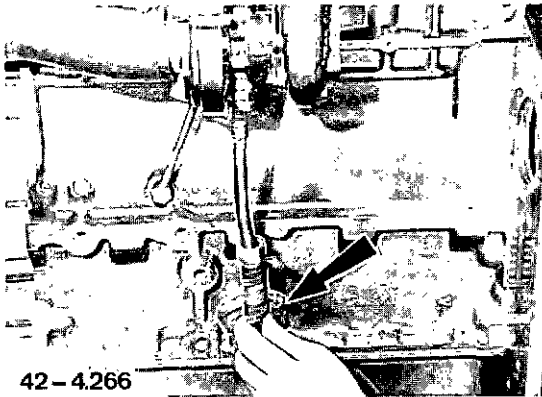
8. Tighten hose clips.



42-4.265

Disassembly and reassembly of complete engine

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9. Fit oil return pipe with gasket.
Tighten cap nut in accordance
with specifications.,

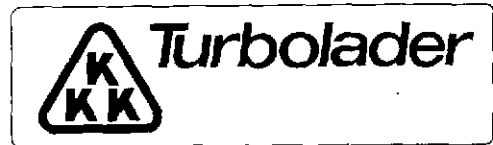


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| 5. Turbocharger | |
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REPAIR INSTRUCTIONS

SERIES K1/K2 uncontrolled



Gültig: 5900 008 25 32 07.89 D
Ersetzt: 5900 008 25 32 03.87 D

The numbers in brackets are the item nos. of the parts concerned. (See: Turbocharger parts description and sectional illustrations).

1. DISMANTLING

1.1 Turbine housing (25) and compressor housing (22).

- Mark the position of the housing with respect to the bearing housing (1) and backplate (17).

Illustration 1.1.1

- Using a vice, clamp the turbine housing (25) at the gas inlet flange. (Use vice jaw guards).

- Remove the fixings (23, 24, 27, 28) from the compressor housing (22) and turbine housing (25).

Illustration 1.1.2

- Remove the turbine housing (25) (when tight, heat at the tight sections)

- Remove the compressor housing (22), when tight loosen, using rubber hammer.

Attention:
Danger of blade damage when tilted.

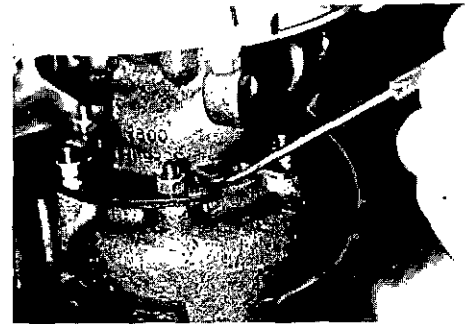
1.2 Compressor Wheel (20)

- Clamp the hub of the shaft and turbine wheel assy. (5) in the special vice jaw plates (See: Repair Tools). Illustration 1.2.1

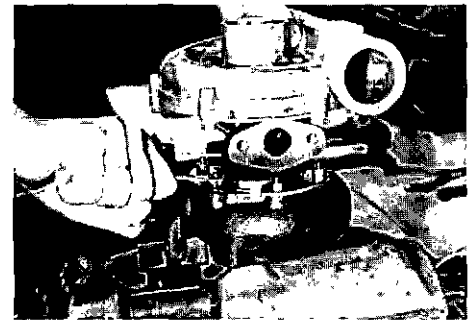
- Remove the shaft nut (21), using T spanner.

- When the shaft nut is jammed heat to a max. temperature of 130° C, using hot air blower (See: Repair Tools; the threads of the shaft and turbine wheel assy. (5) must be protected from overheating during this process). Illustration 1.2.2

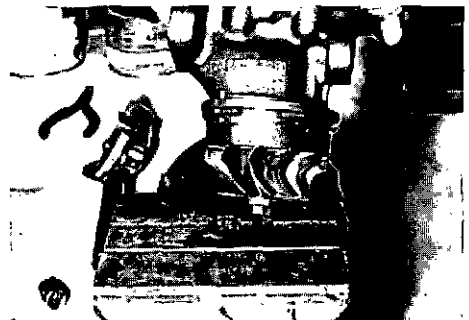
Attention:
Shaft nut (21) is secured with LOCTITE 640. Take care to incur no bending effects on shaft during shaft nut removal.



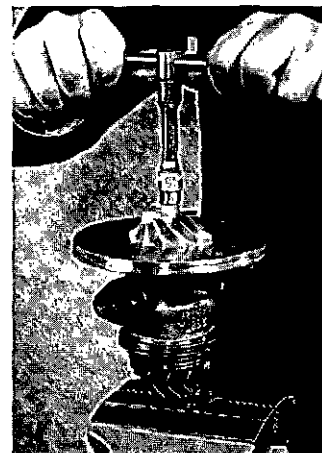
1.1.1



1.1.2



1.2.1



1.2.2

REPAIR INSTRUCTIONS

SERIES K1/K2

uncontrolled


Turbolader

Gültig: 5900 008 25 32 07.89 D
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- Heat compressor wheel (20) to a max. temp. of 130° C, using hot air blower (See: Repair Tools) (Protect the rotor threads from overheating), and carefully push out shaft and turbine wheel assy. (5), using a press (a vertical drilling machine).

Illustrations 1.2.3, 1.2.4

Attention:

Fit heat shield (31) concentrically.

1.3 Bearing Housing (1)

- Carefully remove the shaft and turbine wheel assy. (5) from the bearing housing (1).

- Remove piston rings (6) from shaft and turbine wheel assy. (5). Illustration 1.3.1

- Remove heat shield (31).

- Clamp bearing housing (1) in vice between the oil feed and return flanges.

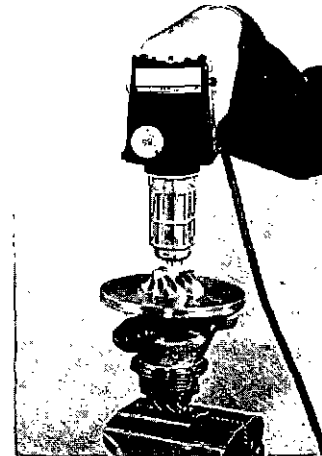
Remark:

Use vice jaw guards.

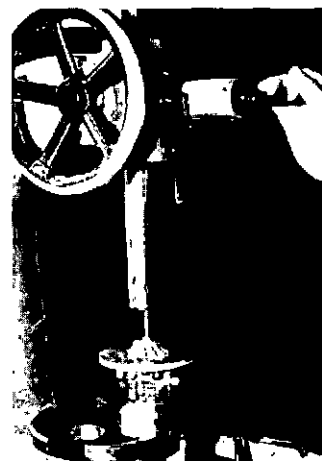
- Remove the fixing screws (18). Illustration 1.3.2

Attention:

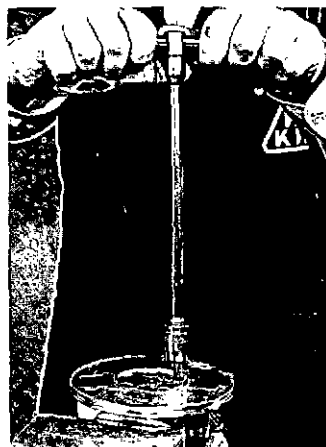
Fixing screws (18) are secured with LOCTITE 640.



1.2.3



1.2.4



1.3.1



1.3.2

REPAIR INSTRUCTIONS

SERIES K1/K2 uncontrolled



Gültig: 5900 008 25 32 07.89 D
Ersetzt: 5900 008 25 32 03.87 D

- Remove backplate (17) from bearing housing (1).
- Press flinger sleeve (11) out of backplate (17).
- Remove O-rings (16,34), from backplate.
- Remove piston rings (6) from flinger sleeve (11).
- Remove oil deflector ring (11), oil deflector (13) and thrust bearing (10) from bearing housing (1). *Illustration 1.3.3*



1.3.3

- Remove spacer sleeve (9) and thrust ring (8) from bearing housing (1). *Illustration 1.3.4*



1.3.4

- Remove snap rings (2) and bearings (3). (For snap ring pliers see: Repair Tools). *Illustrations 1.3.5, 1.3.6*



1.3.6



1.3.5

REPAIR INSTRUCTIONS

SERIES K1/K2 uncontrolled


Turbolader

Gültig: 5900 008 25 32 07.89 D
Ersetzt: 5900 008 25 32 09.88 D

2. CLEANING AND INSPECTING OF THE PARTS.

2.1 Cleaning of the parts

- Carefully clean all parts: housings (1,22,25), shaft and turbine wheel Assy. (5), compressor wheel (20), backplate (17) and heat shield (31) must be wet sand-blasted.
- Threads of the shaft and turbine wheel Assy: remove the LOCTITE residues!

ATTENTION:

The bearing holes and piston ring sealing surfaces of the bearing housing (1), the shaft of the shaft and turbine wheel Assy. (5) and the piston ring sealing surface of the backplate (17) must be protected from the blasting medium.

2.2 Checking the parts

2.2.1 Visual check

- Examine housings (1,22,25), heat shield (31) and turbine and compressor wheels for cracks, any foreign matter and scratches. Inspect the oil feed holes in the bearing housing (1) for foreign matter. Inspect piston ring sealing surfaces and bearing areas for damage.
- Examine the turbine housing (25) for scaling.
- Examine the gas inlet and outlet flanges of the turbine housing (25) for distortion.
- Examine the turbine and compressor wheels (5,20), for bend or broken blades and the shaft for scoring at the bearing seals.

LIMITS OF REUSAGE:

Wear parts which have excessive wear (see: permissible wear), as well as rotating parts with cracks must be replaced.

Turbine housing: Radial cracks up to 10 mm long are permissible in the vicinity of the tongue and the partitioning wall. Illustrations 2.2.1.1, 2.2.1.2

Cracks which are fully through the material are not permissible.

Light scratching at the contour is permissible.

When scaling occurs at bridge of the gas inlet flange and contour, the part must be replaced.

When deformity occurs at the gas inlet and outlet flanges, such parts must be replaced.

Shaft and turbine wheel assembly: Do not straighten any bent blades. When blades are bent, the shaft and turbine wheel Assy. must be replaced.

Shaft and turbine wheel Assy. with scratching and cracks must be replaced.

2.2.2 Checking of dimensions

- Place the shaft and turbine wheel Assy. (5), supported at the bearing points, in the twin V-blocks (See "Repair Tools").
- Set the clock gauge feeler on the shaft, 5 mm from the compressor wheel end of the shaft.
- During measurement, press shaft firmly into V-blocks, distributing the pressure equally.
- When it is more than 0.008 mm out of truth, replace the shaft and turbine wheel Assy (5). Illustration 2.2.2

2.3 Dynamic balancing check of rotor Assy.

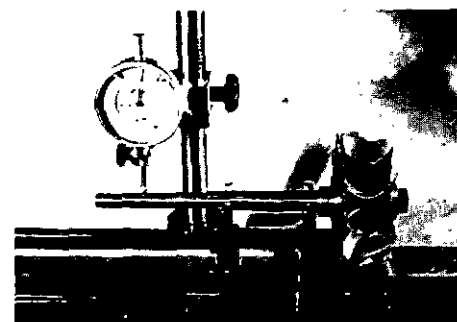
- When the rotating parts are to be used again a dynamic balance check is necessary. Refer to the service information leaflet, code no: 7/03/007.



2.2.1.1



2.2.1.2



2.2.2

REPAIR INSTRUCTIONS

SERIES K1/K2 uncontrolled



Turbolader

Gültig: 5900 008 25 32 07.89 D
Ersetzt: 5900 008 25 32 03.87 D

3. Assembly

• ABSOLUTE CLEANLINESS IS NECESSARY

• The following bearing parts must be oiled before fitting:

- Bearing seat of the shaft
- Bearings (3)
- Thrust bearing (10)
- Flinger sleeve (11)
- Oil deflector ring (11)
- Thrust ring (8)
- Piston rings (6)
- Spacer sleeve (9)

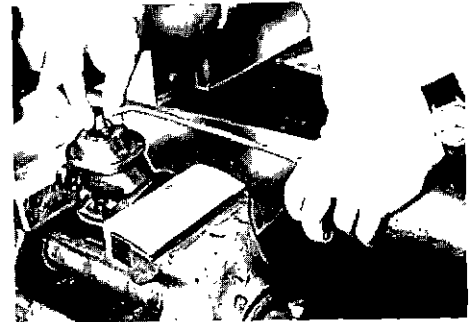
3.1 Bearings (3)

• Fit bearings (3) and snap rings (2) in the bearing housing.

Illustrations 3.1.1, 3.1.3

Attention:

During installation of bearings, particular attention should be paid to cleanliness.



3.1.1



3.1.2



3.1.3

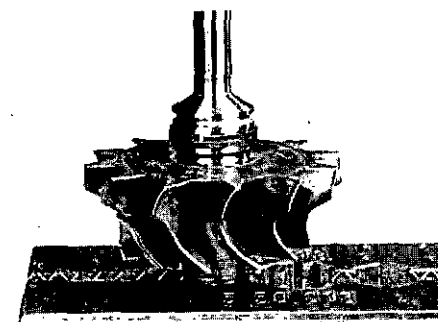
3.2 Bearing housing (1)

• Clamp shaft and turbine wheel assembly (5) in the vice (jaw plates equipped with the six/twelve edged cutouts).

• Fit the one/two piston rings (6) to shaft and turbine wheel assembly (5). Attention must be paid to concentricity.

The piston ring slots must be positioned at 180° to another.

Illustration 3.2.1



3.2.1

REPAIR INSTRUCTIONS

SERIES K1/K2

uncontrolled



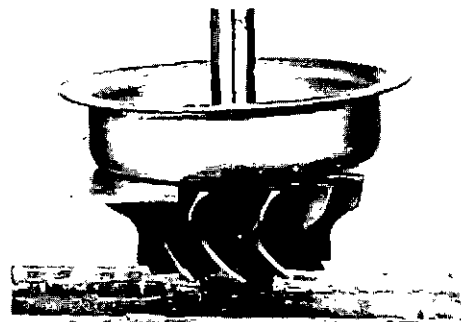
Gültig: 5900 008 25 32 07.89 D
Ersetzt: 5900 008 25 32 03.87 D

- Place heat shield (31) concentrically on shaft and turbine wheel asy. (5).

For K1:

- Insert a strip of sheet metal 1 mm thick between heat shield and turbine wheel backside (to ensure that the piston ring is guided inside the bearing housing bore).

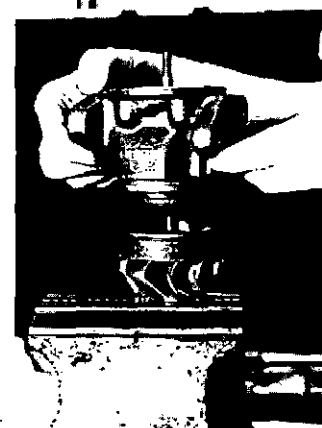
Illustration 3.2.2



3.2.2

- Guide bearing housing (1) carefully onto rotor shaft.

Illustration 3.2.3



3.2.3

CHECK:

Piston rings (6) are properly seated, when heat shield (31) and bearing housing (1) turn freely.

- Guide thrust ring (8) and spacer sleeve (9) onto rotor shaft.

Illustration 3.2.4

- Place thrust bearing (10) in bearing housing (1).

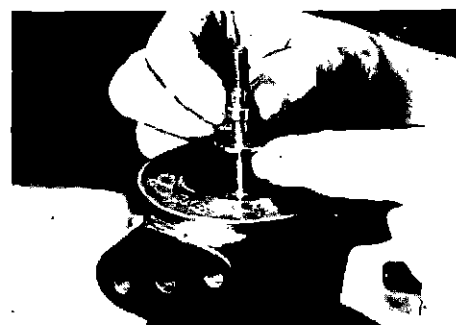
Illustration 3.2.5

- Place a new oil deflector plate (13) on thrust bearing (10).

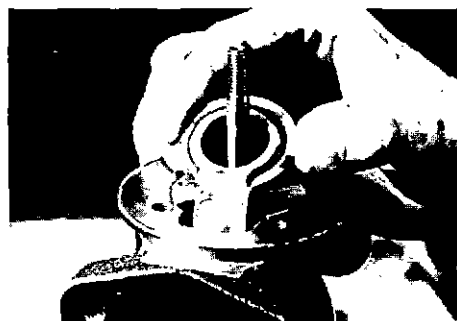
Illustration 3.2.6

- Arrangement with oil deflector ring: Guide the oil deflector ring (11) onto the rotor shaft with the large collar at the top.

- Fit one/two piston rings (6) onto flinger sleeve (11). Position piston ring slots at 180° to one another.

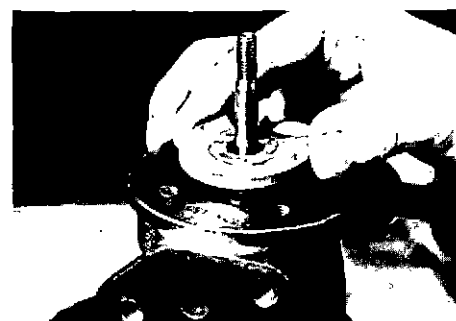


3.2.4



5/6

3.2.5



3.2.5

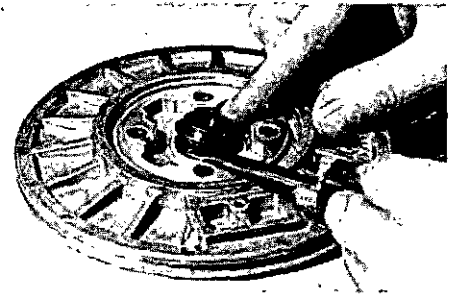
REPAIR INSTRUCTIONS

SERIES K1/K2 uncontrolled

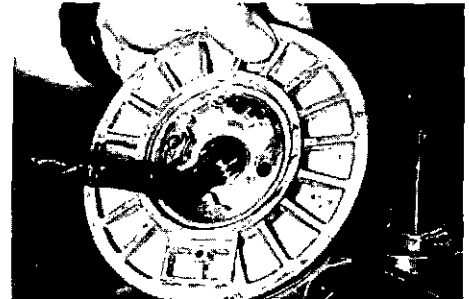


Gültig: 5900 008 25 32 07.89 D
Ersetzt: 5900 008 25 32 03.87 D

- Insert finger sleeve (11), complete with piston rings (6) into backplate (17). When necessary press piston rings together using screw driver.
Illustration 3.2.7
 - Sealing backplate (17) to bearing housing: Coat seating face of backplate (17) with LOCTITE 573.
Illustration 3.2.8
 - For constructions with O-ring seals, coat the O-ring (16) with acid-free grease, e.g. SKF ball bearing grease and place in groove provided.
 - Place backplate (17) on bearing housing.
 - Fix backplate (17) to bearing housing (1), using the screws (18) and washers (18). The screws must be secured with LOCTITE 640.
Illustration 3.2.9
 - For tightening torques see: Data Sheet.
- 3.3 Compressor Wheel (20)
- Heat compressor wheel (20) to a max. temp. of 130° C, using hot air blower (See: Repair Tools), or, in a masonry oven.
 - Oil the compressor wheel seat of the shaft (e.g. with Shell Ensis 20 W 20).
 - Push warm compressor wheel (20) onto shaft and turbine wheel assy. and, within 5 minutes, tighten a new shaft nut to tightening torque after preheating.
After a total cooling time of min. 10 minutes bring up LOCTITE 640 (see mounting sketch), loosen the shaft nut (1 or 2 turns) and tighten to the specified torque and angle setting.
Illustration 3.3.1
 - For tightening torques and angle settings see: Data Sheet.



3.2.7



3.2.8

ATTENTION:
When tightening shaft nut take care that no bending effects occur at shaft.

CHECK:
Piston ring (6) is properly seated when heat shield (31) and bearing housing (1) turn freely.

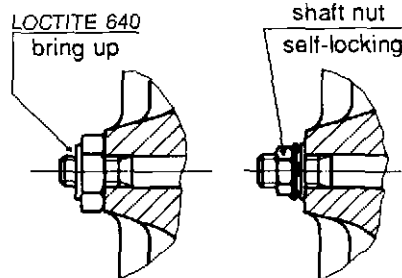
- Plug shaft nut and projecting threads of shaft with security paint.
- Measure the axial and radial plays (See: Determination of bearing play).



3.2.9



3.3.1



Mounting sketch of the shaft nut

REPAIR INSTRUCTIONS

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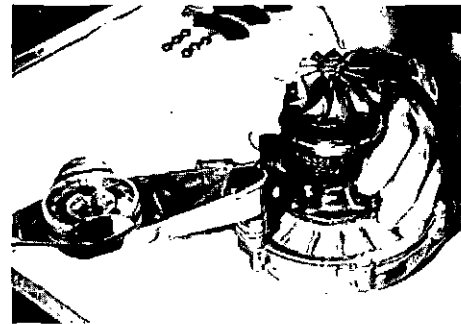
Gültig: 5900 008 25 32 07.89 D
Ersetzt: 5900 008 25 32 03.87 D

3.4 Compressor housing (22)

- Coat O-ring (34) with brake cylinder paste, e.g. ATE and place in groove in backplate (17).

- Fit compressor housing (22) to backplate (17) in the position marked, using corresponding fixing components (23,24).

Illustration 3.4.1



3.4.1

For tightening torques, see: Data Sheet.

ATTENTION:
Avoid tilting when positioning housing (22).

3.5 Turbine housing (25).

Instal turbine housing (25) in the position marked, using corresponding fixing components (27, 28).

ATTENTION:
Avoid tilting when positioning housing (25).

- Coat fixing screws with heat resistant lubricating paste, e.g. NEVER SEEZ.

- For tightening torques, see: Data Sheet.

3.6 Nameplate (29).

- For turbochargers which have been repaired the blue nameplate (29) must be replaced by a red one, which is fixed with rivets (30).

REPAIR INSTRUCTIONS

SERIES K1/K2 uncontrolled



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4. REPAIR TOOLS

4.1 Standard tools.

- Ring spanners 10 mm & 13 mm AF
- Socket spanner - With T extension. 10 mm, 12 mm, 14 mm AF
- Torque spanner, Range: 0 - 60 Nm
Sockets: 10 mm, 12mm, 14 mm AF
Square-drive hexagon socket wrench 3/8 "
- Snap ring pliers
KKK Order No: 1550 155; Points: 0,7 mm
- Screw driver, hammer, rubber hammer, vice jaw guards.
- Dial gauge: Scale increment 0,01 mm
Corresponding to clock gauge A1 DIN 878
- Dial gauge: Precision indicator 0,001mm
Correspondig to clock gauge B1-20 DIN 879

4.2 Special tools.

- Splined internal wrench insert.
(Company: Ribe) WN 22000

Splined srew driver insert for internally splined socket screws Ribe CV from the company Hommel.
Make: Hazet. Order No: 8809-6 (M6).

- Socket insert (open-ended) for the MANOSKOP torque spanner 10 mm, 13 mm AF
- Hot air blower
e.g. Co. Leister: Leister Hot Air Tool
Type "Ghibli 2"
Order No: 08 L 130
- Transition piece with angle settings, 1/2" drive.
- Vice jaw plates, Drg. No: 1550013
- Inspection device, Drg. No: 1582036
- Support tube

| | |
|-------------|----------------------|
| K14: Di | = 54 mm, 100 mm long |
| K16: Di | = 59 mm, 100 mm long |
| K24/K26: Di | = 66 mm, 100 mm long |
| K27: Di | = 84 mm, 100 mm long |
| K28: Di | = 94 mm, 100 mm long |

- Punch Ø 5,2 mm (K1)

- Punch Ø 6,8 mm (K2)

To loosen compressor and turbine housing fixing screws.

To loosen shaft nut.

To tighten shaft nut and fixing screws.

To extract and fit bearing snap rings.

Auxiliary tools.

To check radial and axial play.

To check trueness of shaft and turbine wheel assy.

To loosen and tighten fixings for backplate.

To tighten the fixing screws on the turbine side.

To fit and remove compressor wheel.

To tighten shaft nut.

To clamb hub of shaft and turbine wheel assy during repair.

To check trueness of shaft and turbine wheel assy.

To support the cartridge assy when compressor wheel seizes.

Used together with the supporting tube to dismantle the shaft and turbine wheel assy when compressor wheel seizes.

REPAIR INSTRUCTIONS

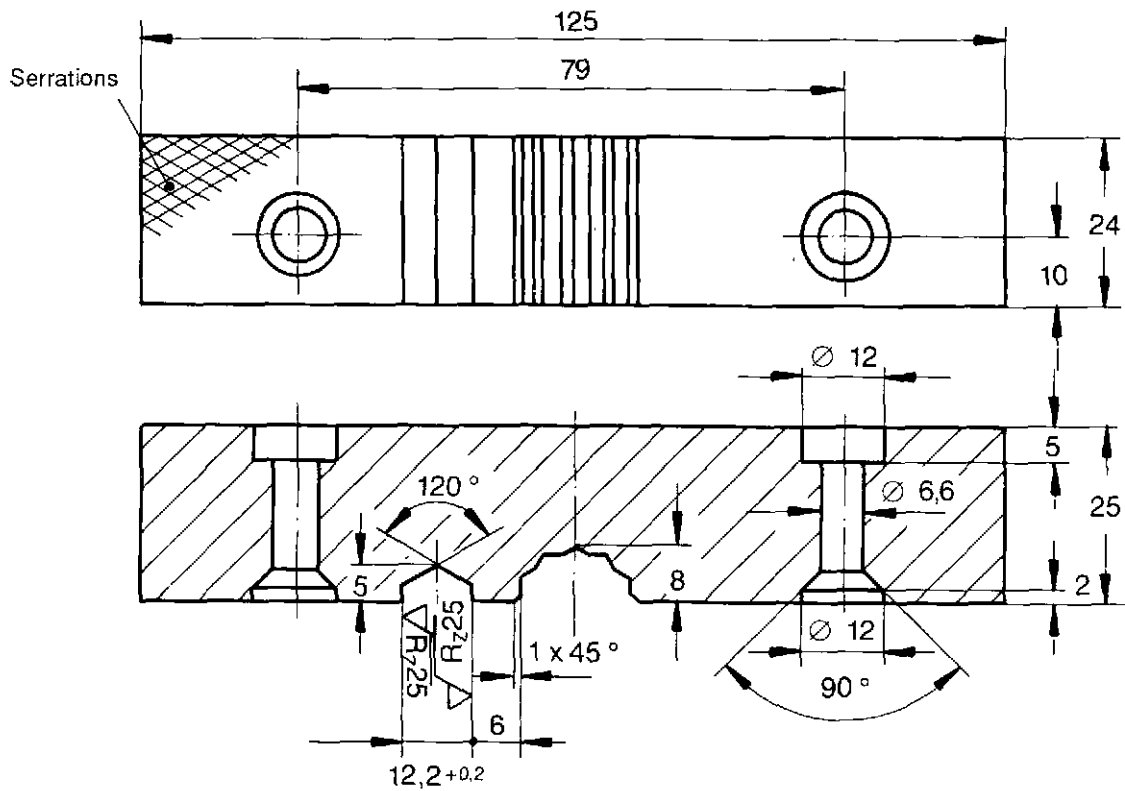
SERIES K1/K2 uncontrolled



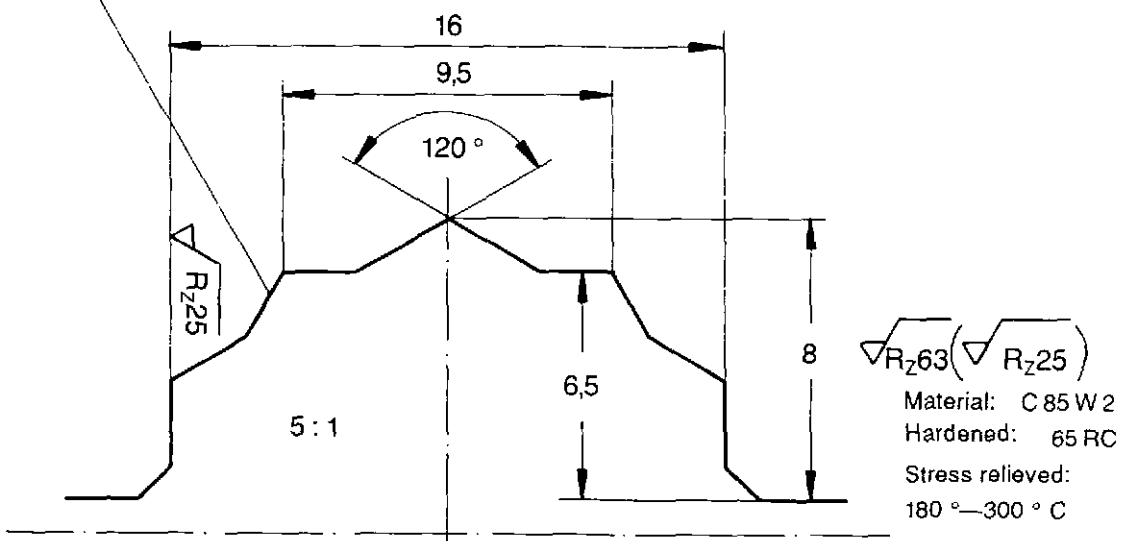
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Ersetzt: 5900 008 25 32 03.87 D

Seite 10

Vice jaw plate (15 500 13)



fitted to suit the rotor



REPAIR INSTRUCTIONS

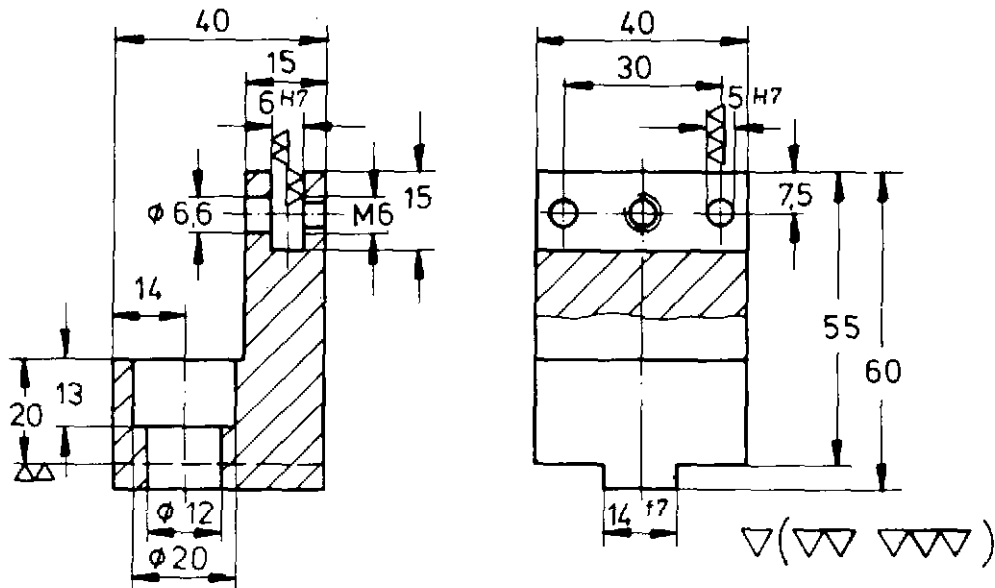
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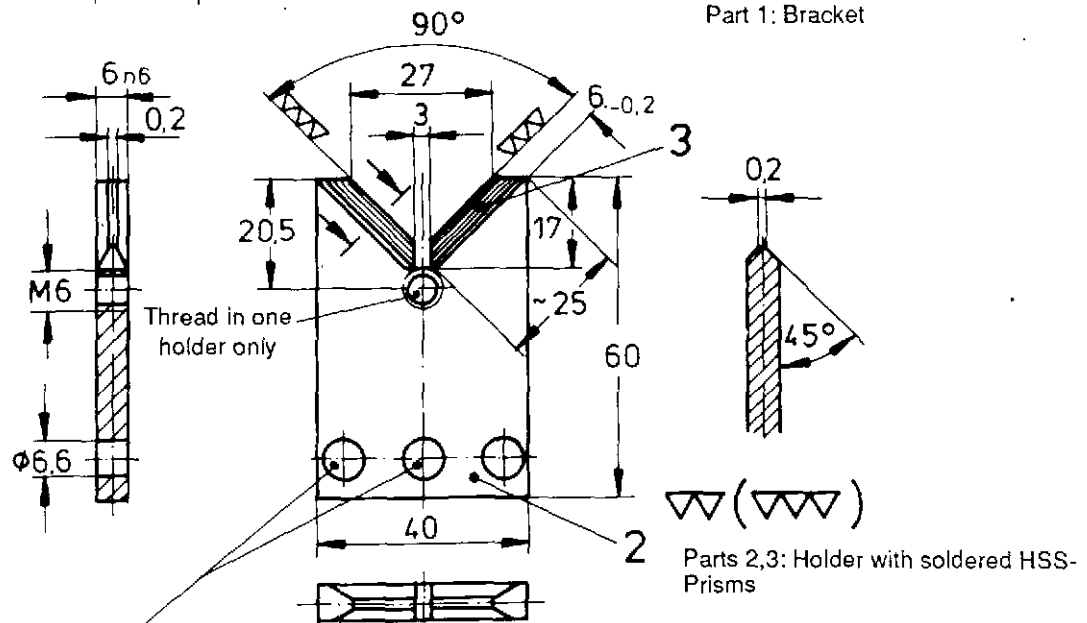
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Ersetzt: 5900 008 25 32 03.87 D

Seite 11

Inspection device for checking rotor
truth (1582036)



Part 1: Bracket



Parts 2,3: Holder with soldered HSS-Prisms

Holes to suit part 1
Teil 2 mit Teil 3 hartgelötet

REPAIR INSTRUCTIONS

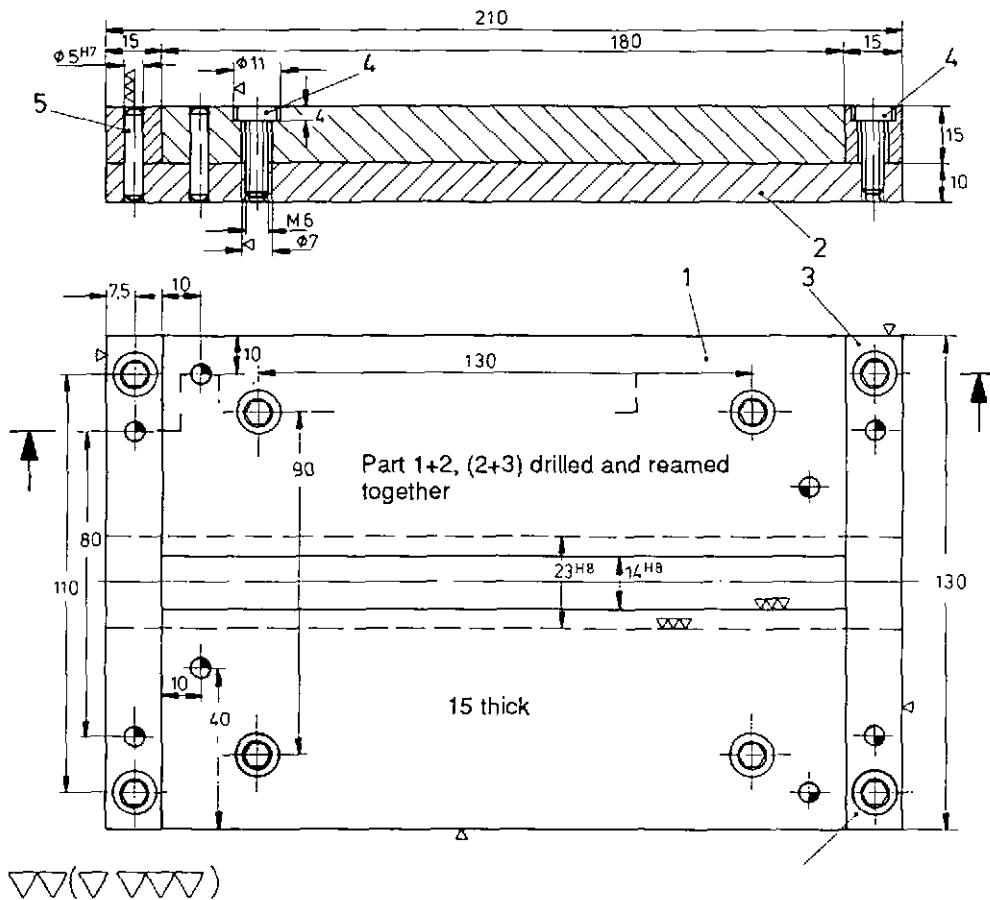
SERIES K1/K2 uncontrolled



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Ersetzt: 5900 008 25 32 03.87 D

Seite 12

Inspection device for checking rotor
truth (1582036)



| Pos. | Piece | Description | Material | Dimension | DIN |
|------|-------|-------------------|----------|---------------|--------|
| 1 | 2 | flat steel | St-50K | 180 x 60 x 15 | 17 100 |
| 2 | 2 | flat steel | St-50K | 210 x 60 x 10 | 17 100 |
| 3 | 2 | flat steel | St-50K | 130 x 15 x 15 | 17 100 |
| 4 | 10 | socket head screw | 10.9 | M6 x 18 | 7 984 |
| 5 | 8 | cylindrical pin | St-50K | 5m6 x 20 | 7 |
| 6 | 2 | T-tongue | St-50K | 14 | 508 |
| 7 | 2 | socket head screw | 10.9 | M12 x 25 | 912 |
| 8 | 4 | cylindrical pin | St-50K | 5m6 x 15 | 7 |

REPAIR INSTRUCTIONS

SERIES K1/K2

uncontrolled

Admissible wear dimensions



Gültig: 5900 008 25 32 07.89 D

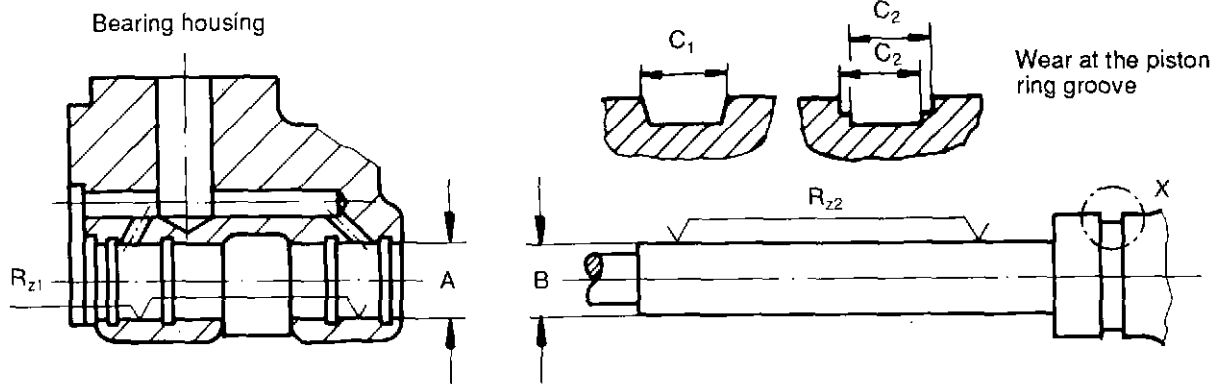
Ersetzt: 5900 008 25 32 03.87 D

Seite 13

Piston rings and bearing bushes must always be replaced

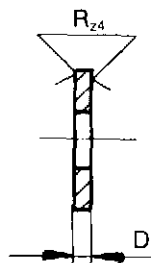
Shaft and turbine wheel assy

Detail X

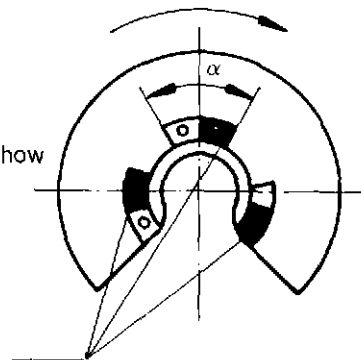


Wear at the piston ring groove

Thrust ring



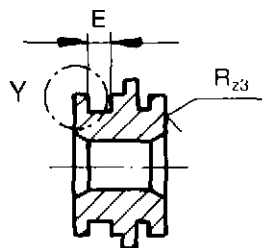
Thrust bearing Rotation



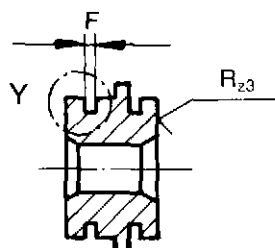
The thrust surfaces may only show running traces of up to $\alpha/2 = 30^\circ$

Flinger sleeve

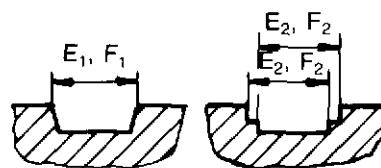
2 Piston rings



1 Piston ring



Detail Y



Wear at the piston ring groove

Dimensions A to F in mm
Dimensions Rz1 to Rz4 in μm

| Series | A | B | C ₁ | C ₂ | D | E ₁ | E ₂ | F ₁ | F ₂ | R _{z1} | R _{z2} | R _{z3} | R _{z4} | | |
|--------|--------|-------|----------------|----------------|------|----------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|-----------------|--|--|
| K1 | 13,091 | 8,469 | 1,49 | 1,54 | 1,47 | — | — | 1,49 | 1,54 | 4 | 1,6 | 4 | 4 | | |
| K2 | 16,064 | 9,95 | 2,89 | 2,94 | 1,47 | 2,89 | 2,94 | 1,49 | 1,54 | 4 | 1,6 | 4 | 4 | | |

REPAIR INSTRUCTIONS

SERIES K1/K2 uncontrolled


Turbolader

Gültig: 5900 008 25 32 07.89 D
Ersetzt: 5900 008 25 32 03.87 D

Seite 14

Determination of Bearing Play

1. Measuring the axial play

- Place measuring point of clock gauge on top face of turbine wheel hub.

Illustration 1.1

- Press down shaft and turbine wheel assy and set the clock gauge at "0".
- Press shaft and turbine wheel assy. against clock gauge and note indicator "throw".

- The permissible axial plays can be seen in the data sheet.

2. Measuring the radial play

- Determination of radial play is only necessary at turbine side.

- Place clock gauge measuring point on the centre of the cone on the turbine wheel.

Illustrations 2.1, 2.2

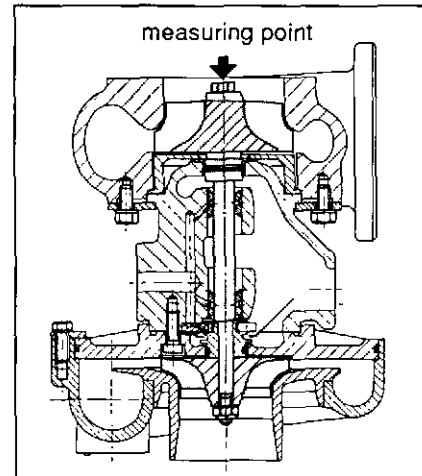
- Pull turbine wheel downwards using spring scale. Measuring force: 50 N. Set clock gauge at "0"!

- Pull turbine wheel upwards using spring scale. Measuring force 50 N.

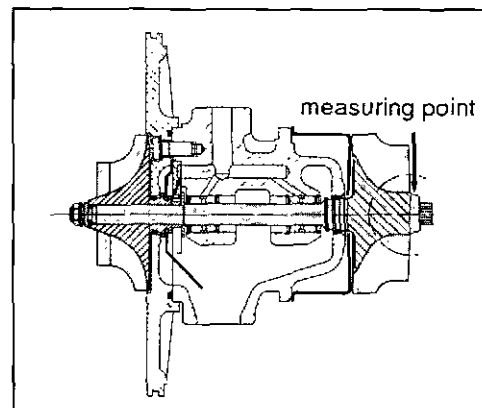
- Note the clock gauge "throw".

- Take this measurement again, with shaft and turbine wheel assy. turned through 90°.

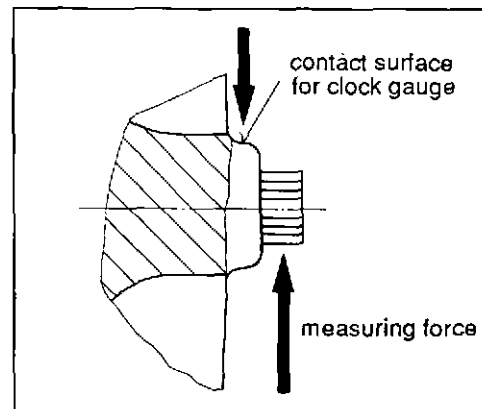
- The permissible radial plays can be seen in the data sheet.



1.1



2.1



2.2

REPAIR INSTRUCTIONS

SERIES K1/K2

uncontrolled

Data Sheet



Gültig: 5900 008 25 32 07.89 D
Ersetzt: 5900 008 25 32 03.87 D

Seite 15

1. Tightening torques in Nm

| part | | size | K14/K16 | K24 | K26 | K27 | K28 | K29 | |
|---------------------------------|------------------------------------|-------------------|-----------|------------------------------|------------------------------------|-----|-----------------|-----|---|
| | | | shaft nut | AF 10/12 mm self-locking M 6 | tightening torque after preheating | — | 5 ⁺² | | |
| tightening torque | — | 12 ⁺¹ | | | — | — | | | |
| AF 10/12 mm M 6 | tightening torque after preheating | — | | 7 ⁺² | | — | — | — | |
| | tightening torque + angle setting | — | | 5 ^{+60° -5°} | | — | — | — | |
| AF 14 mm M 6 | tightening torque after preheating | — | | 7 ⁺² | | | — | — | |
| | tightening torque + angle setting | — | | 5 ^{+60° -5°} | | | — | — | |
| AF 10 mm M 5 | tightening torque after preheating | 5 ⁺² | | — | | | — | — | |
| | tightening torque | 6 ^{+0,5} | | — | | | — | — | |
| backplate fixing without washer | | | | — | 8 | | | — | — |
| backplate fixing with washer | | | | 6 | 10 | | | — | — |
| compressor housing | | | 7 | | | — | — | — | |
| turbine housing (M 6) | | | 8 | | — | | | — | |
| turbine housing (M 8) | | | 20 | 22,5 | | | — | — | |

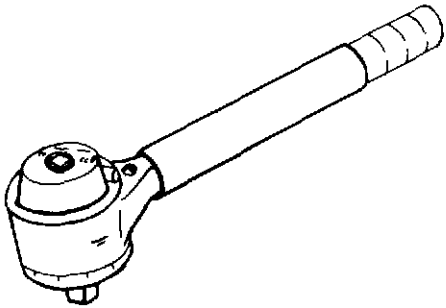
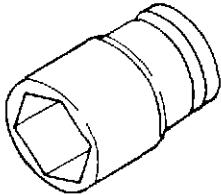
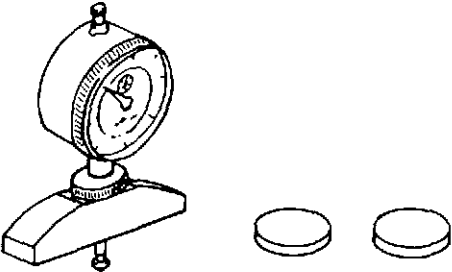
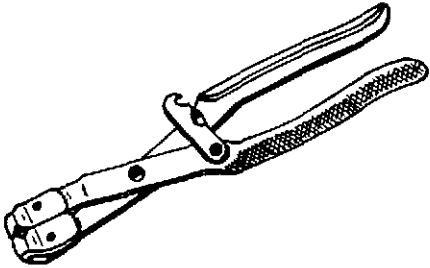
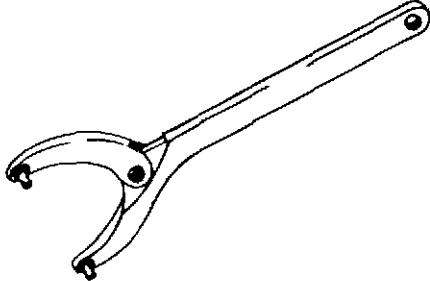
2. Axial play in mm

| size | K14/K16 | K24 | K26 | K27 | K28 | K29 |
|-----------|---------|------|-----|-----|-----|-----|
| max. play | 0,10 | 0,16 | | | — | — |

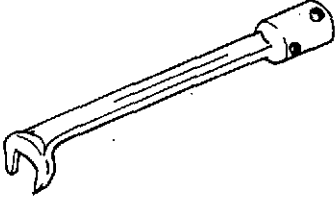
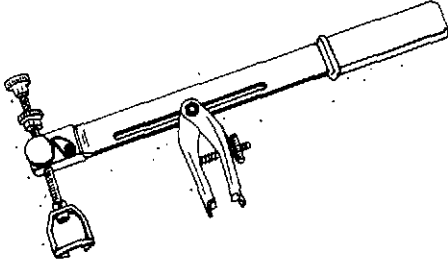
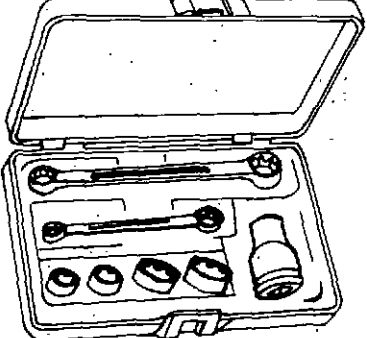

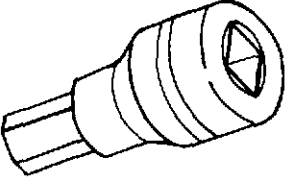
3. Radial play in mm

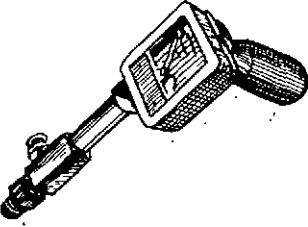
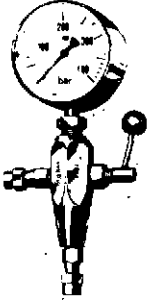
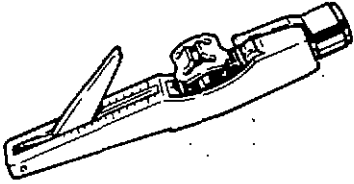
| size | K14/K16 | 24 | K26 | K27 | K28 | K29 |
|-----------|---------|------|-----|------|-----|-----|
| max. play | 0,35 | 0,42 | | 0,46 | | |



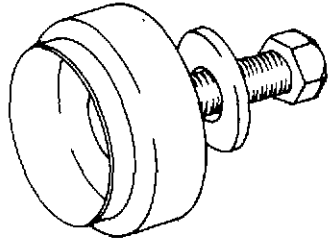
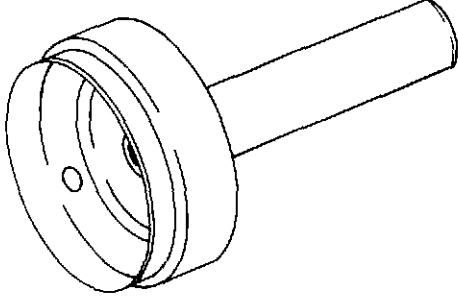
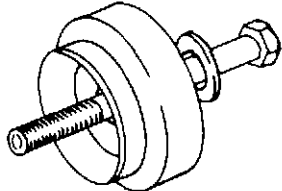
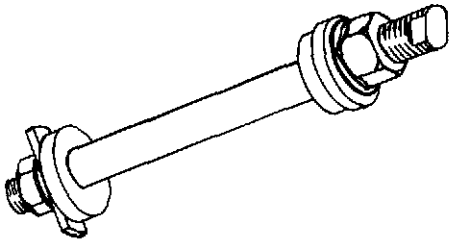
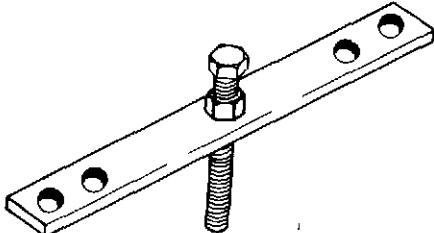
| | | |
|---|---|--|
| <p>No.</p> <p>STW 392</p> <p>030 1124</p> | <p>Multipower tool for central bolt.</p> |  |
| <p>SW 32</p> <p>030 1083</p> | <p>Socket 60 JMP.</p> |  |
| <p>TM2</p> <p>030 1084</p> | <p>Depth gauge with spacer discs.</p> |  |
| <p>2465</p> | <p>Hose clip pliers</p> |  |
| <p>764</p> <p>030 1086</p> | <p>Special two-pin spanner, swivel-type</p> |  |

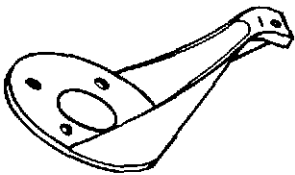
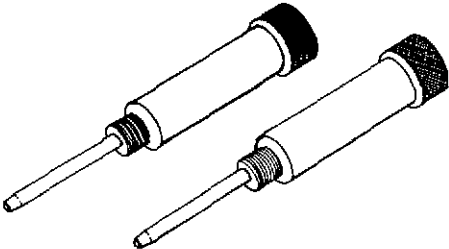
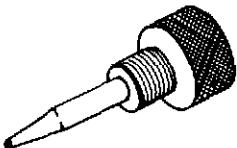
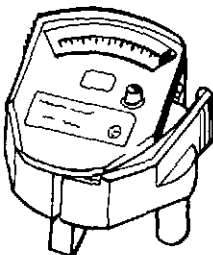
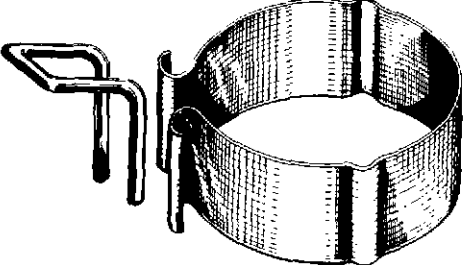
Tools

| | | |
|--|---|--|
|  | <p>Crowfoot spanner SW 13 a/flats 13</p> | <p>No. 380 030 1087</p> |
|  | <p>Valve spring assembly lever</p> | <p>210 450 030 1088</p> |
|  | <p>Torx tool kit</p> | <p>8189 030 1089</p> |
|  | <p>Bent spanner for starter a/flats 13 x 17</p> | <p>304 030 1090</p> |
|  | <p>Screw driver socket 1/2" a/flats 17</p> | <p>740 C 030 1091</p> |


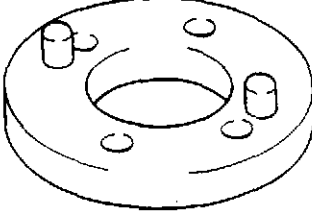
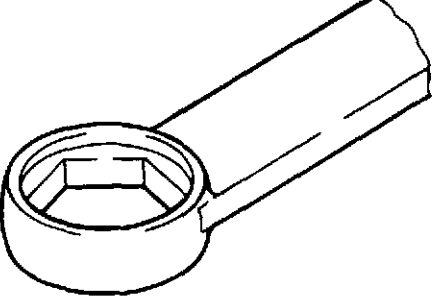
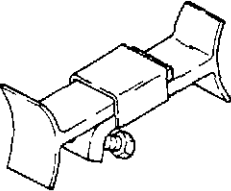
| | | |
|---|-------------------------------|---|
| <p>No.</p> <p>2461</p> <p>030 1156</p> | <p>Compression tester</p> |  |
| <p>3202</p> <p>003 1077</p> | <p>Injection pump tester</p> |  |
| <p>91107</p> <p>030 1095</p> | <p>V - belt tension gauge</p> |  |
| | | |
| | | |

Tools

| | | |
|---|---|--|
|  | <p>Assembly tool for crankshaft seal, front</p> | <p>No. 142 850 030 1096</p> |
|  | <p>Assembly tool for crankshaft seal, rear</p> | <p>142 860 030 1097</p> |
|  | <p>Assembly tool for camshaft seal</p> | <p>142 050 030 1098</p> |
|  | <p>Assembly tool for camshaft sleeve</p> | <p>143 720 030 1099</p> |
|  | <p>Puller for flywheel</p> | <p>143 100 030 1111</p> |

| | | |
|--|---|---|
| <p>No.</p> <p>143 420</p> <p>030 1125</p> | <p>Dolly for multipower tool</p> |  |
| <p>100 700</p> <p>030 1093</p> | <p>Adjusting pin for crankshaft and camshaft</p> |  |
| <p>100 710</p> <p>030 1094</p> | <p>Adjusting pin for injection pump control rod</p> |  |
| <p>100 720</p> <p>030 1095</p> | <p>Device for measuring toothed belt tension</p> |  |
| <p>130 510</p> <p>003 0473</p> | <p>Piston ring compressor</p> |  |

Tools

| | | No. |
|---|--|--|
|  | Centering pin for control lever, injection pump | <p>100 730</p> <p>030 1177</p> |
|  | Shim for dolly 143 420 | 143 430 |
|  | Dolly for camshaft gear | <p>144 130</p> <p>030 1129 New OTC</p> |
|  | Tensioning device for toothed belt, hydraulic pump | <p>144 600</p> <p>030 1128</p> |
| | | |

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