

Workshop Manual

competence level 3

2011

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0312 1936 en

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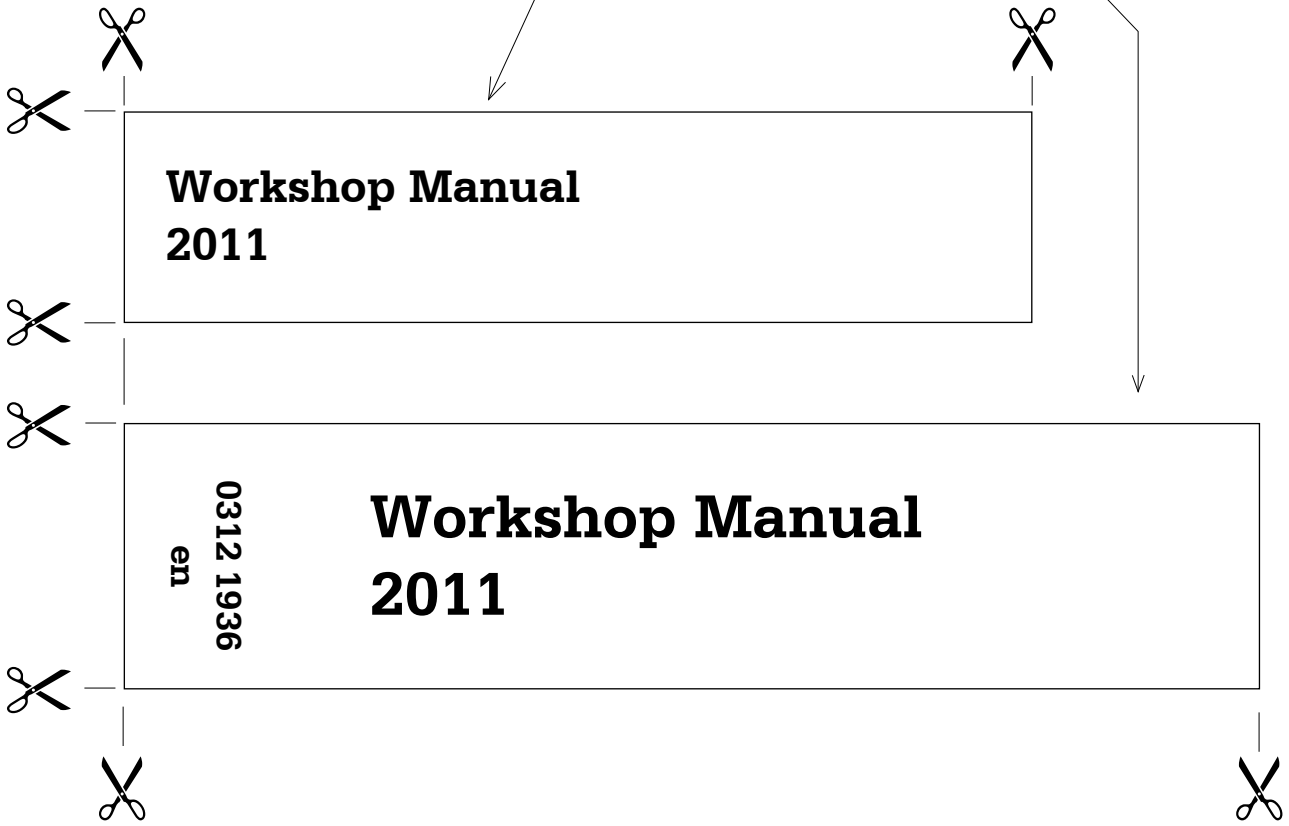
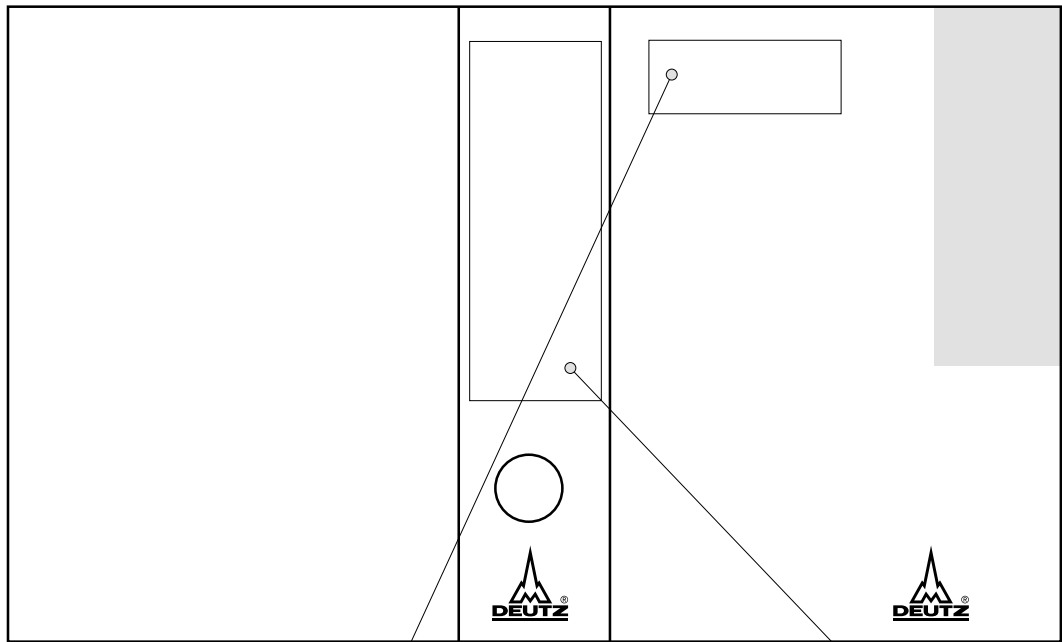
VS-DI, Mr. Sonntag
Tel.: + 49 (0) 221 822-3053
EMail: sonntag.j@deutz.com

Deutz AG
Service Information Systems
Ottostraße 1
D - 51149 Cologne
Tel.: + 49 (0) 221-8 22-0
Fax: + 49 (0) 221-8 22-58 50
<http://www.deutz.com>

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The engine company.



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Deutz AG
Service Information Systems
Deutz-Mülheimer Strasse 147-149
D - 51063 Köln
Tel.: + 49 (0) 221-8 22-0
Fax: + 49 (0) 221-8 22-53 58
<http://www.deutz.de>

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1 Foreword

1



Notes

- Read and observe the information in this documentation. You will avoid accidents, retain the manufacturer's warranty and have a fully functional, ready to use engine at your disposal.
- This engine is built exclusively for the purpose according to the scope of delivery - defined by the equipment manufacturer (use for the intended purpose). Any use above and beyond this is considered improper use. The manufacturer will not be liable for damages resulting from this. The user will bear the sole risk in this case.
- Use for the intended purpose also includes observance of the operating, maintenance and repair instructions specified by the manufacturer. The engine may only be used, maintained and repaired by persons who are familiar with it and instructed in the dangers.
- Make sure that this documentation is available to everyone involved in the operation, maintenance and repair and that they have understood the contents.
- Failure to observe this documentation can lead to malfunctions and engine damage as well as injury to persons for which the manufacturer will accept no liability.
- Prerequisite for the proper maintenance and repair is the availability of all necessary equipment, commercial tools and special tools as well as their perfect working order.
- Engine parts such as springs, clamps, elastic retaining rings etc. constitute an increased risk of injury when not used properly.
- The pertinent rules for the prevention of accidents and other generally recognized safety and industrial medicine rules must be observed.
- Maximum cost effectiveness, reliability and long life is only guaranteed when DEUTZ original parts are used.
- Repair of the engine must comply with use for the intended purpose. Only parts released by the manufacturer for the respective purpose may be used for conversion work. Unauthorized modification to the engine exclude manufacturer liability for resulting damages. Failure to observe this will lead to voiding of the warranty!
- The engines made by DEUTZ are developed for a wide range of applications. A wide range of variants ensures that the respective special requirements are met.
- The engine is equipped according to the installation, i.e. not all the parts and components described in this documentation are installed in your engine.
- We have done our best to clearly identify the differences so that you can easily find the operating, maintenance and repair instructions relevant to your engine.

We are at your service for any questions you may have in this matter.

Your DEUTZ AG





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2 General

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Notes

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DEUTZ engines

are the product of years of research and development. The profound know-how gained in connection with high quality requirements is the guarantee for manufacturing of engines with a long life, high reliability and low fuel consumption. Naturally the high requirements for protection of the environment are also met.

Maintenance and care

are decisive for whether the engine satisfactorily meets the set demands. Compliance with the prescribed maintenance times and the careful execution of maintenance and care are therefore essential. Difficult operating conditions deviation from normal operation must be observed especially.

DEUTZ AG

Please consult one of our service representatives responsible for operating faults and spare parts questions. Our trained specialist personnel ensures fast, professional repairs using original parts in the event of damage. Original parts of the DEUTZ AG are always produced according to the latest state of the art. Information about our service can be found at the end of this documentation.

Take care when the engine is running

Only perform maintenance work or repairs when the engine is at a standstill. Replace any removed protective devices upon completion of the work. When working on the running engine, work clothing must be close fitting.



Safety

This symbol accompanies all safety notes. Observe these carefully. Also pass on the safety instructions to your operating personnel. The "General safety regulations and rules for the prevention of accidents" of the legislator must be observed additionally.



Note

This symbol accompanies information of a general kind. Observe these carefully.



Asbestos

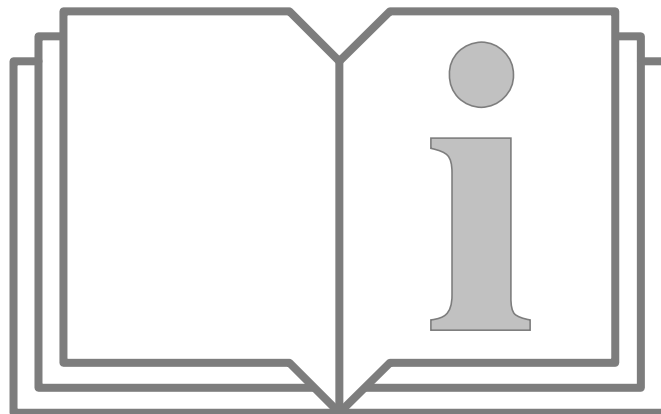
Gaskets used in this engine are asbestos-free. Please use the appropriate spare parts for maintenance and repair work.



Notes

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3 User notes





Notes

3.1 General

The maintenance work prescribed in the operating manual and in the workshop manual must be performed on schedule and completely.

The maintenance personnel must possess the necessary technical knowledge to perform the work. Safety and protection devices which are removed during maintenance work must be replaced again afterwards.



Caution!

The rules for the prevention of accidents and the safety regulations must be observed during maintenance work.

Also observe the special safety regulations for the different maintenance groups which are listed in detail as job cards in the Job cards chapter (cf. also section 1.2).

See the maintenance schedules for the maintenance intervals. These also inform you of the work to be performed.

The job cards provide technical instructions for performing the work.

3.2 Specifications

3.2.1 Safety regulations and rules for the prevention of accidents

For various maintenance groups, detailed safety notes in the form of job cards have been compiled, these precede the job cards of the respective maintenance groups.

The legally prescribed rules for the prevention of accidents (available from professional associations or from dealers) must be observed. These are dependent on the installation site, operating mode and the operating and auxiliary materials being used.

Special protection measures depending on the respective work are specified and identified in the job description.

It generally applies among other things:

- for the personnel
 - Only instructed personnel may operate or maintain the engine. Unauthorized persons may not enter the engine room.
 - Wear close fitting clothing and ear protectors in the engine room when the engine is running.
 - Only appoint qualified personnel to do repairs and maintenance.
- for the engine room:
 - Ensure adequate ventilation (do not cover air shafts)
 - Install first aid kit and suitable fire extinguishers. Check the filling and readiness for operation regularly.
 - Only store inflammable materials in the engine room if these are necessary for operating the system.
 - Smoking and naked lights are prohibited in the engine room.
- For operation and maintenance of the engine:
 - Only start the engine when all protection devices are installed. Make sure that no-one is standing in the danger area.
 - Only perform cleaning, maintenance and repair work when the engine has been shut down and secured against starting.

3.2.2 Disposal regulations

The work described in the operating manual and workshop manual necessitates renewal of parts and operating materials. The renewed parts / operating materials must be stored, transported and disposed of properly. The owner himself is responsible for this.

Disposal includes recycling and the scrapping of parts / operating materials whereby recycling has priority.

Details of disposal and their monitoring are governed by regional, national and international laws and directives which the system operator must observe on his own responsibility.

3.3 Operating manual and workshop manual

To structure the information to suit the user, the service documentation is divided into operating manual and workshop manual.

The **operating manual** contains a general description and instructions for all other maintenance work.

It contains the following chapters:

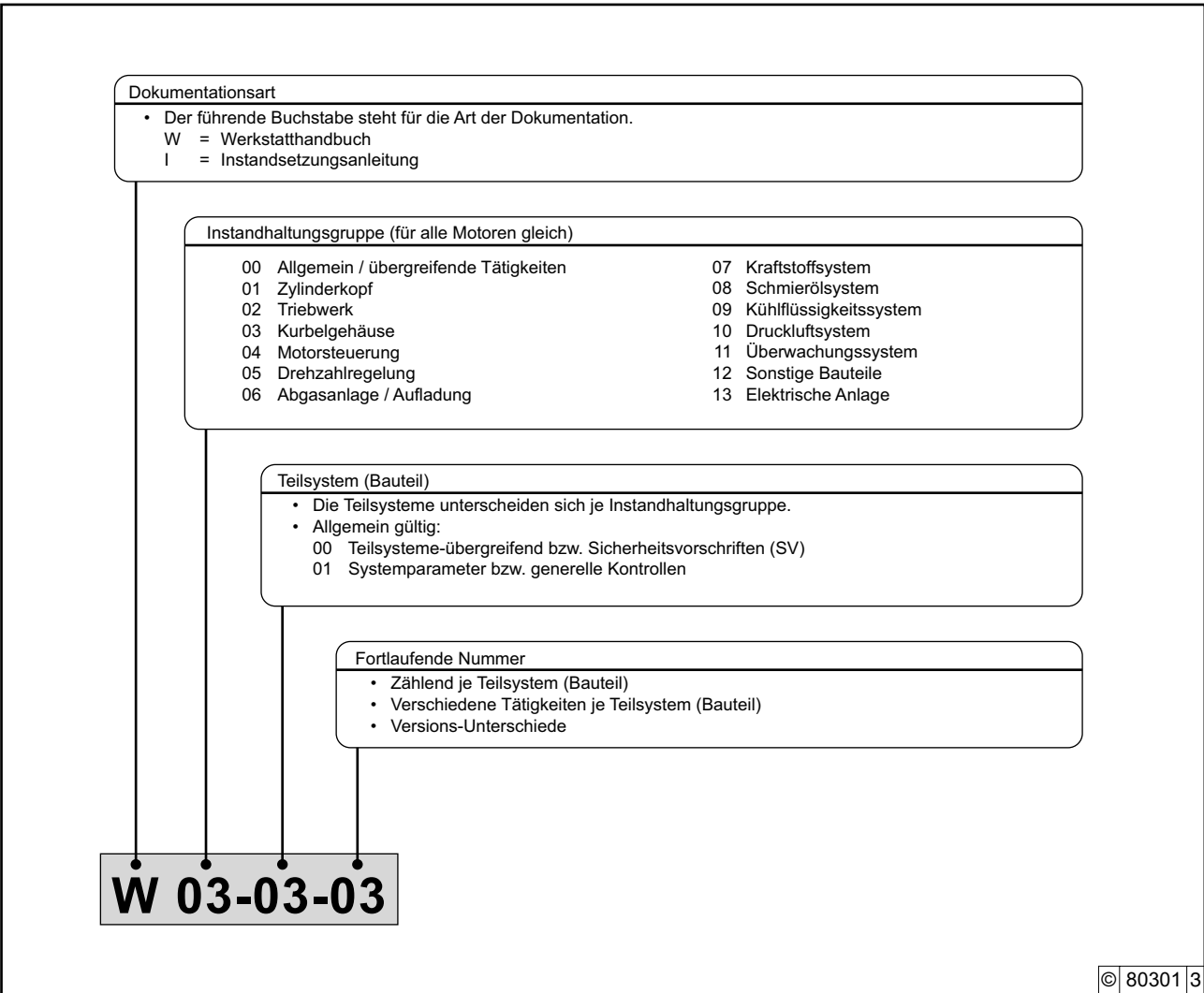
1. General, Contents
2. Engine description
3. Operation
4. Operating materials
5. Maintenance
6. Care and maintenance work
7. Faults, causes and remedies
8. Engine corrosion protection
9. Technical data
10. Service

The **workshop manual** assumes knowledge of the contents of the operating manual, this applies especially for the safety regulations. Minor repairs and emergency measures on components are described the execution of which requires more effort and appropriately qualified personnel.

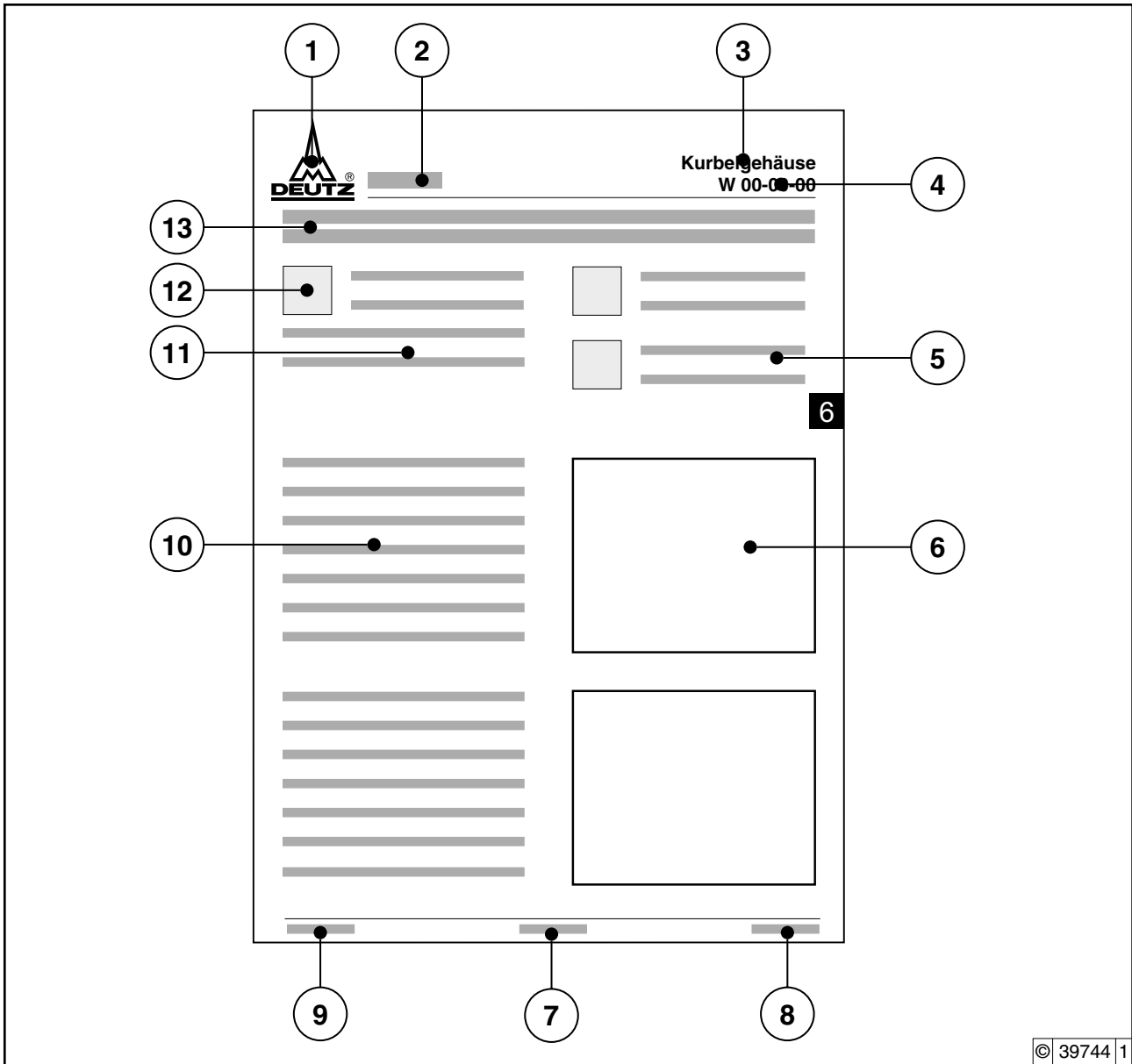
3.4 Job cards

The **job cards** are divided into job cards of the **workshop manual** e. g. **W 04-05-01** and the **maintenance manual I 04-05-01**.

Numbering of job cards



Structure of a job card



- | | |
|-------------------------------------------------------------|----------------------------------------------------------------------|
| 1. DEUTZ, publisher of the service documentation | 8. DEUTZ-internal part number of job card and technical order number |
| 2. Engine type (e. g. 914) | 9. Date of issue of the job card |
| 3. Maintenance group | 10. Work sequence |
| 4. Job card number | 11. Safety and general notes |
| 5. Reference to other job cards, Specifications and similar | 12. Necessary tools, auxiliary materials and spare parts |
| 6. Explanatory graphics | 13. Title of the job card |
| 7. Page number | |



Note

For inquiries about the job card please always state the engine type (2), the job card number (4), the page number (7), the date of issue (9) or alternatively the DEUTZ-internal part number (8).

3.5 Explanation of symbols



Caution!



Auxiliary material

For example: Lifting gear, adhesive



Tools

for example: 100 400 - meter



Note

For example: Cylinder head is dismantled.



Always renew when assembling

For example: Gaskets



References

For example: Job card no. W xx-yy-zz



See technical data (test and setting data)

Line note, for example: "01 61 – Valve clearance (inlet)"



See technical data (tightening specifications)

Line note, for example: "01001 – Cylinder head on crankcase"



Notes

4 Technical data

4.1 Test and adjustment data



Notes

00 00 Engine general

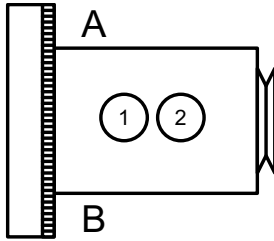
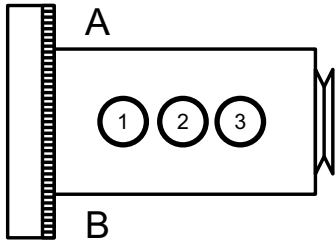
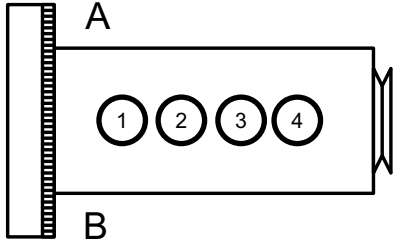
ID No.	Name	Remark	Value	Unit
00 04	Engine weight according to DIN 70020-A	F2L engine	175	kg
		F3L engine	217	
		F4L engine	256	
		F2M engine	169	
		F3M engine	210	
		F4M engine	248	
		BF3L engine	222	
		BF4L engine	257	
		BF3M engine	215	
		BF4M engine	250	
00 10	Working principle		four-stroke diesel	
00 20	Combustion process		Direct injection	
00 31	Bore	Diameter	94	mm
00 32	Stroke		112	mm
00 40	Compression ratio	FL/M engines	19:1	
		BFL/M engines	17.5:1	
00 50	Direction of rotation	looking onto the flywheel	left	
00 51	Compression pressure	FL/M engines	25 to 30	bar
		BFL/M engines	22 to 27	bar
00 70	Ignition distance	2 and 4 cylinder	180	°
		3-cylinder	120	°

4 Technical data

4.1 Test and adjustment data

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ID No.	Name	Remark	Value	Unit
00 71	Ignition sequence	2-cylinder	1 - 2	
		3-cylinder	1 - 2 - 3	
		4-cylinder	1 - 3 - 4 - 2	
00 81	Cylinder arrangement 2-cylinder A = Manifold side B = Operating side		© 39617 0	
	Cylinder arrangement 3-cylinder A = Manifold side B = Operating side		© 39618 0	
	Cylinder arrangement 4-cylinder A = Manifold side B = Operating side		© 39619 0	

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01 00 Cylinder head

ID No.	Name	Additional information	Value	Unit
01 01	Bore diameter for valve seat ring (inlet)	Standard	42.590 - 42.615	mm
01 02	Bore diameter for valve seat ring (outlet)	Standard	36.010 - 36.015	mm
01 03	Bore diameter for valve seat ring (inlet)	1. Overmeasure step	42.800 - 42.825	mm
01 04	Bore diameter for valve seat ring (outlet)	1. Overmeasure step	37.200 - 37.225	mm

ID No.	Name	Additional information	Value	Unit
01 05	Bore diameter for valve guide	Standard	8.000 - 8.025	mm
01 06	Bore diameter for valve guide	<ul style="list-style-type: none"> • 1. Overmeasure step • Repair • Fit H7 	12.000 - 12.018	mm
01 08	Height of cylinder head	Standard	118.00 ±0.1	mm
01 09	Height of cylinder head	Undermeasure	117.96 ±0.1	mm
01 10	Valve guide			
01 12	External diameter of the valve guide	<ul style="list-style-type: none"> • 1. Overmeasure step • Repair 	12.025 - 12.035	mm
01 16	Internal diameter of valve guide (inlet)	<ul style="list-style-type: none"> • Repair • Fit E7 	8.025 - 8.040	mm
01 17	Internal diameter of valve guide (outlet)	<ul style="list-style-type: none"> • Repair • Fit E7 	8.025 - 8.040	mm
01 20	Valve seat ring			
01 21	External diameter of the valve seat ring (inlet)	Standard	42.680 ±0.006	mm
01 22	External diameter of the valve seat ring (outlet)	Standard	37.075 ±0.006	mm
01 23	External diameter of the valve seat ring (inlet)	Repair standard	42.67 ±0.005	mm
01 24	External diameter of the valve seat ring (outlet)	Repair standard	37.07 ±0.005	mm
01 27	External diameter of the valve seat ring (inlet)	1. Overmeasure step	42.87 ±0.005	mm
01 28	External diameter of the valve seat ring (outlet)	1. Overmeasure step	37.27 ±0.005	mm
01 30	Valve			
01 31	Valve shaft diameter (inlet)	Standard	7.98 _{-0.015}	mm

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ID No.	Name	Additional information	Value	Unit
01 32	Valve shaft diameter (outlet)	Standard	7.96 _{-0.015}	mm
01 33	Valve shaft clearance (inlet)	Wear limit	0.5	mm
01 34	Valve shaft clearance (outlet)	Wear limit	1.3	mm
01 35	Valve edge strength on valve head (inlet)	<ul style="list-style-type: none"> • Wear limit • FL/M engines 	0.8	mm
		<ul style="list-style-type: none"> • Wear limit • BFL/M engines 	1.4	mm
01 36	Valve edge strength on valve head (outlet)	<ul style="list-style-type: none"> • Wear limit • FL/M engines 	1.2	mm
		<ul style="list-style-type: none"> • Wear limit • BFL/M engines 	1.2	mm
01 37	Valve head diameter (inlet)		41.5 ±0.1	mm
01 38	Valve head diameter (outlet)		35.4 ±0.1	mm
01 40	Valve seat			
01 41	Valve seat width on valve seat ring (inlet)	FL/M engines	1.7 ±0.4	mm
		B/FL/M engines	1.58 ±0.4	mm
01 42	Valve seat width on valve seat ring (outlet)	FL/M engines	1.7 ±0.4	mm
		B/FL/M engines	1.7 ±0.4	mm
01 45	Valve lag dimension (inlet)	<ul style="list-style-type: none"> • Wear limit • FL/M engines 	1.53	mm
		<ul style="list-style-type: none"> • Wear limit • B/FL/M engines 	1.3	mm
01 46	Valve lag dimension (outlet)	<ul style="list-style-type: none"> • Wear limit • FL/M engines 	1.53	mm
		<ul style="list-style-type: none"> • Wear limit • B/FL/M engines 	1.3	mm

4

ID No.	Name	Additional information	Value	Unit
01 47	Valve seat angle (inlet)	FL/M engines	45	°
		B/FL/M engines	30	°
01 48	Valve seat angle (outlet)	FL/M engines	45	°
		BFL/M engines	45	°
01 50	Valve spring			
01 51	Valve spring length (unclamped normal)	Wire diameter 3.35 mm	38.9	mm
		Wire diameter 3.40 mm	39.3	mm
01 60	Valve clearance			
01 61	Valve clearance (inlet)	<ul style="list-style-type: none"> after a cooling time of at least 0.5 h (oil temperature < 80 °C) 	0.3 ±0.05	mm
		<ul style="list-style-type: none"> Test and setting values in inspections from a running time of 50 operating hours of the engine or life of the cylinder head gasket (see maintenance schedule) Setting values when changing the cylinder head gasket 	(0.4 ±0.05)	
01 62	Valve clearance (outlet)	<ul style="list-style-type: none"> after a cooling time of at least 0.5 h (oil temperature < 80 °C) 	0.5 ±0.05	mm
		<ul style="list-style-type: none"> Test and setting values in inspections from a running time of 50 operating hours of the engine or life of the cylinder head gasket (see maintenance schedule) Setting values when changing the cylinder head gasket 	(0.6 ±0.05)	

4 Technical data

4.1 Test and adjustment data

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ID No.	Name	Additional information	Value	Unit
01 63	Valve clearance setting scheme			
<ul style="list-style-type: none"> • Turn over engine up until reaching the valve overlap cyl. no. 1. <div data-bbox="271 526 351 604" style="display: inline-block; vertical-align: middle;"> </div> <div data-bbox="383 526 1372 627" style="display: inline-block; vertical-align: middle;"> <p>Note According to the order below (see table) the valve clearance setting is possible with 2 crankshaft revolutions á 360°.</p> </div>				
Crankshaft setting 1			Cyl. no. 1 = overlap	
			white = not adjustable black = adjustable	
Crankshaft setting 2			white = not adjustable black = adjustable	
<div style="display: flex; flex-direction: column; align-items: center;"> <div style="margin-bottom: 20px;"> <div style="background-color: black; color: white; padding: 5px 10px; font-weight: bold; margin-bottom: 5px;">1</div> </div> <div style="margin-bottom: 20px;"> <div style="background-color: black; color: white; padding: 5px 10px; font-weight: bold; margin-bottom: 5px;">2</div> </div> </div>				

4

ID No.	Name	Additional information	Value	Unit
01 70	toggle lever / toggle lever block			
01 72	toggle lever bore for toggle lever axle (outlet)		18 ±0.27	mm
01 73	toggle lever bore for toggle lever axle (inlet)		18 ±0.27	mm
01 74	diameter of the toggle lever axle		17.97 ±0.01	mm
01 93	Roughness of the sealing surface		15 - 18	Rz
01 98	Length of the cylinder head screw	Standard	150.000 ^{+0.8} - 0.8	mm

02 00 Drive system

ID No.	Name	Additional information	Value	Unit
02 02	Main bearing pin			
02 03	Diameter of the main bearing pin	Standard	69.970 - 69.990	mm
02 04	Undermeasure graduation for main bearing pin	1. Stage	0.25	mm
		2. Stage	0.50	mm
02 05	Limit value for undermeasure graduation of the main bearing pin		69.47	mm
02 06	Unroundness of the main bearing pin	Wear limit	0.008	mm
02 07	Surface hardness of the main bearing pin	Standard	58 ⁺⁴	HRC
02 10	Fit bearing pin			
02 11	Width of fit bearing pin		35 +0.04	mm
02 12	Undermeasure graduation for fit bearing pin	1. Stage	0.4	mm
02 13	Limit value for undermeasure graduation of the fit bearing pin (width)		35.44	mm

4 Technical data

4.1 Test and adjustment data

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ID No.	Name	Additional information	Value	Unit
02 20	Lifting journal			
02 21	Width of lifting bearing journal		31 +0.2	mm
02 22	Diameter of the lifting bearing journal	Stroke 112 mm	54.970 - 54.990	mm
02 23	Undermeasure step for lifting bearing journal	1. Stage	0.25	mm
		2. Stage	0.50	
02 24	Limit for undermeasure step of the lifting bearing journal		54.47	mm
02 25	Unroundness of the lifting bearing journal	Wear limit	0.01	mm
02 26	Concentricity of the crankshaft	max. deviation	0.05	mm
02 27	Hollow throat radius lifting and main bearing journal	<ul style="list-style-type: none"> Do not damage hollow throat when reworking! Stroke 112 mm 	1.9 ^{+0.5}	mm
02 30	Crankshaft main bearing			
02 31	Internal diameter of the main bearing shells	Standard	70.020 - 70.055	mm
02 32	Undermeasure graduation for main bearing shells	1. Stage	0.25	mm
		2. Stage	0.50	
02 34	Axial clearance of crankshaft	Standard	0.100 - 0.273	mm
		Wear limit	0.4	mm
02 35	Strength of the starting rings	Standard	2.4 ^{+0.05}	mm
02 36	Strength of the starting rings	1. Overmeasure step	2.6 ^{+0.05}	mm
02 40	Con-rod			
02 41	Parallelism of the con rod to the piston bolt	at a distance of 100 mm	0.03	mm

4

ID No.	Name	Additional information	Value	Unit
02 42	Parallelism of the con rod to the piston bolt	at a distance of 100 mm max. perm. deviation	0.03	mm
02 43	Internal diameter of the piston bolt bush	<ul style="list-style-type: none"> • Standard • FL/M engines 	26.025 - 26.035	mm
		<ul style="list-style-type: none"> • Standard • BFL/M engines 	30.025 - 30.035	
02 45	Theoretical clearance between Piston bolt bush (con rod) and piston bolt	Wear limit	0.08	mm
02 48	Clearance between piston and piston bolt	Wear limit	0.004 - 0.015	mm
02 50	Con rod bearing			
02 52	Internal diameter of the con rod bearing shells (in installed state)		55.024 - 55.055	mm
02 53	Limit value for undermeasure graduation of the con rod bearing shells		54.524 - 54.555	mm
02 54	Undermeasure graduation of the con rod bearing		0.25	mm
02 55	Con rod bearing bore in con rod		58.500 - 58.520	mm
02 56	Theoretical clearance between the con rod bearing and the lifting journal		0.014 - 0.07	mm
02 57	Con rod bearing clearance	Wear limit	0.12	mm
02 60	Piston bolt			
02 61	Diameter of the piston bolt	FL/M engines	25.995 - 26.000	mm
		BFL/M engines	29.995 - 30.000	
02 62	Piston bolt clearance between con rod and piston bolt		0.025 - 0.04	mm
02 70	Piston			

4 Technical data

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ID No.	Name	Additional information	Value	Unit
02 71	Diameter of the piston	<ul style="list-style-type: none"> Measuring point 1 at height 22 mm FL/M engines 	93.920	mm
		<ul style="list-style-type: none"> Measuring point 1 at height 25 mm BFL/M engines 	93.900	
		<ul style="list-style-type: none"> Measuring point 1 at height 25 mm BFL engines without cooling duct 	93.880	
02 72	Diameter of the piston	<ul style="list-style-type: none"> Measuring point 2 at height 44.5 mm FL/M engines 	93.856	mm
		<ul style="list-style-type: none"> Measuring point 2 at height 47 mm BFL/M engines 	93.840	
		<ul style="list-style-type: none"> Measuring point 2 bat height 47 mm BFL engines without cooling duct 	93.820	
02 73	Diameter of the piston	<ul style="list-style-type: none"> Measuring point 3 at height 69.7 mm FL/M engines 	93.670	mm
		<ul style="list-style-type: none"> Measuring point 3 at height 66.5 mm BFL/M engines 	93.720	
		<ul style="list-style-type: none"> Measuring point 3 at height 66.5 mm BFL engines without cooling duct 	93.700	
02 74	Overmeasure graduation		0.5	mm
02 75	Piston overlap for cylinder head gasket	1 Notch	0.514 - 0.69	mm
02 76	Piston overlap for cylinder head gasket	2 Notches	0.691 - 0.76	mm
02 77	Piston overlap for cylinder head gasket	3 Notches	0.761 - 0.83	mm

ID No.	Name	Additional information	Value	Unit
02 78	Piston bolt bore	FM engines	26.004 - 26.010	mm
		BFL/M engines	30.004 - 30.010	mm
20 79	Determine piston class	<ul style="list-style-type: none"> • Piston class A • Stroke 112 mm • only in FL/M engines 	196.380 - 196.490	mm
		<ul style="list-style-type: none"> • Piston class B • Stroke 112 mm • only in FL/M engines 	196.491 - 196.690	mm
02 80	Piston rings			
02 81	Piston ring 1st ring <ul style="list-style-type: none"> • Rectangular ring 	<ul style="list-style-type: none"> • External diameter/ internal diameter x height • FL/M engines 	94.0 x 2.0 x 3.9	mm
	Piston ring 1st ring <ul style="list-style-type: none"> • Double-sided trapezoidal ring 	<ul style="list-style-type: none"> • External diameter/ internal diameter x height • BF3/4L/M engines 	94.0 x 3.0 x 3.9	
02 82	Piston ring 2 ring <ul style="list-style-type: none"> • minute ring 	External diameter/ internal diameter x height	94.0 x 1.99 x 4.05	mm
		External diameter/ internal diameter x height	91.0 x 2.5 x 3.8	
02 83	Piston ring 3 ring <ul style="list-style-type: none"> • Roof chamfer ring 	External diameter/ internal diameter x height	94.0 x 3.0 x 3.73	mm
	Piston ring 3 ring <ul style="list-style-type: none"> • Oil slit ring 	External diameter/ internal diameter x height	94.0 x 2.99 x 2.9	
02 84	Piston ring joint clearance of the 1st piston ring <ul style="list-style-type: none"> • BFL/M engines 	<ul style="list-style-type: none"> • Double-sided trapezoidal ring • Wear limit 	0.3 - 0.5	mm
	Piston ring joint clearance of the 1st piston ring <ul style="list-style-type: none"> • FL/M engines 	Rectangular ring	0.3 - 0.5	
		Wear limit	0.8	

4 Technical data

4.1 Test and adjustment data

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ID No.	Name	Additional information	Value	Unit
02 85	Piston ring joint clearance of the 2nd piston ring B/FL/M engines	minute ring	1.5 - 2.0	mm
		Wear limit	2.5	
02 86	Piston ring joint clearance of the 3rd piston ring	Roof chamfer ring	0.4 - 0.7	mm
		<ul style="list-style-type: none"> Wear limit FL/M engines 	1.2	
		<ul style="list-style-type: none"> Oil slit ring B/FL/M engine 	0.3 - 0.6	
02 87	<ul style="list-style-type: none"> Axial clearance of the 1st piston ring Rectangular ring 	<ul style="list-style-type: none"> Wear limit FL/M engines 	0.2	mm
	Axial clearance of the 1st piston ring	<ul style="list-style-type: none"> Wear limit BFL/M engines 	Trapezoidal groove wear gauge contact with piston	
02 88	Axial clearance of the 2nd piston ring	Wear limit	0.2	mm
02 89	Axial clearance of the 3rd piston ring	Wear limit	0.15	mm
02 91	Piston ring height 1st. piston ring	Rectangular ring	1.975 - 1.990	mm
		Double-sided trapezoidal ring	3.0	
02 92	Piston ring height 2nd piston ring	minute ring	1.975 - 1.990	mm
02 93	Piston ring height 3rd piston ring	<ul style="list-style-type: none"> Roof chamfer ring Wear limit 	2.975 - 2.990	mm
		<ul style="list-style-type: none"> Oil slit ring Wear limit 	2.975 - 2.990	
02 95	Position of the piston ring joints	Angle of twist to each other	90 - 120	°
02 96	Position of the piston ring joints roof chamfer ring	Angle of twist of spring joint to piston ring joint	180	°
20 97	Compression height	Piston class A	51.67	mm
		Piston class B	51.77	mm

4

ID No.	Name	Additional information	Value	Unit
02 99	Piston ring height 3rd piston ring	Roof chamfer ring	2.975 - 2.990	mm

03 00 Crankcase

ID No.	Name	Additional information	Value	Unit
03 10	Camshaft bearings			
03 11	Bore diameter for camshaft bearing liner in crankcase	Fit H7	58 ^{+0.030}	mm
03 12	External diameter of the camshaft bearing liner	Standard	58.075 ^{+0.045}	mm
03 13	Internal diameter of the camshaft bearing liner	in the installed state	54.000 - 54.054	mm
03 14	Camshaft bearing liner	Wear limit	54.08	mm
03 20	Bore for camshaft main bearing			
03 21	Diameter of the main bearing bore	<ul style="list-style-type: none"> • Standard • Fit H6 	75.000 ^{+0.019}	mm
03 27	Fit bearing width on crankcase		30 _{- 0.033}	mm
03 30	Cylinder			
03 31	Bore diameter of the cylinder	Standard	94.000 ^{+ 0.020}	mm
03 32	Bore diameter of the cylinder	Wear limit	94.1	mm
03 41	Bore diameter of the cylinder	Overmeasure step	94.500 ^{+ 0.020}	mm
03 42	Bore diameter of the cylinder	Wear limit of the overmeasure step	94.6	mm

4 Technical data

4.1 Test and adjustment data

2011




04 00 Engine control

ID No.	Name	Additional information	Value	Unit
04 10	Control times for 1 mm valve clearance			
04 11	Inlet opens after UT		3°12'	°
04 12	Inlet closes after LT		16°48'	°
04 13	Outlet opens before LT		27°48'	°
04 14	Outlet closes before UT		4°12'	°
04 20	Camshaft			
04 21	Cam stroke (inlet)		6.6 ±0.08	mm
04 22	Cam stroke (outlet)		6.8 ±0.08	mm
04 31	Diameter of the camshaft bearing pin	Standard	53.045 - 53.060	mm

05 00 Speed governing

ID No.	Name	Additional information	Value	Unit
05 00	Speed governing			
05 04	Setting screw for full load stop		12 ±0.5	mm
05 05	Setting screw for minimum speed		23 ±0.1	mm
05 06	Screw in depth of the adapter capsule		6.4 ±0.5	mm
05 41	Full load stop (charge pressure-dependent) in fuel filter console	Stop screw	18 ±1	mm

07 00 Fuel system

ID No.	Name	Additional information	Value	Unit
07 01	Pump			
07 02	Make/Type		no specification	
07 10	injection pump			
	 Note Only injection pumps with the same classification may be installed per engine.			
07 11	Make/Type (Motorpal)	PCIM9F2071		
		PCIM9F2073		
	Make/Type (Bosch)	PF 30 V, see rating plate		
		PF 30 V, see rating plate		

4 Technical data

4.1 Test and adjustment data

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ID No.	Name	Additional information	Value	Unit
07 16	<ul style="list-style-type: none"> Injection pump length "X" Standard roller tappet Motorpal TN 0428 1810 	<ul style="list-style-type: none"> Color marking: black Camshaft stroke 11.0 mm FL/M engine 	60.9	mm
	<ul style="list-style-type: none"> Injection pump length "X" Standard roller tappet Motorpal TN 0428 1814 	<ul style="list-style-type: none"> Color marking: green Camshaft stroke 11.0 mm BFL/M engine 	60.9	mm
	<ul style="list-style-type: none"> Injection pump length "X" Hydro-roller tappet Motorpal TN 0428 6791 	<ul style="list-style-type: none"> Color marking: blue Camshaft stroke 11.0 mm FL/M engine 	52.1	mm
	<ul style="list-style-type: none"> Injection pump length "X" Hydro-roller tappet Motorpal TN 0428 6450 	<ul style="list-style-type: none"> Color marking: red Camshaft stroke 11.0 mm BFL/M engine 	52.1	mm
	<ul style="list-style-type: none"> Injection pump length "X" Standard roller tappet Motorpal TN 0428 6681 	<ul style="list-style-type: none"> Color marking: green Camshaft stroke 11.7 mm BFL/M engine 	61.6	mm
	<ul style="list-style-type: none"> Injection pump length "X" Hydro-roller tappet Motorpal TN 0428 6792 	<ul style="list-style-type: none"> Color marking: red Camshaft stroke 11.7 mm BFL/M engine 	52.8	mm
07 17	Classification of the injection pump		A B C D	
07 19	Camshaft stroke for injection pump		11.0	mm
			11.7	mm

4

ID No.	Name	Additional information	Value	Unit
07 21	Selection of the shim gasket			
	Part number	Determined difference (S_s)	Dimension "a" of the identification	
	0417 8522	up to 0.37	9	mm
	0428 6587	0.38 – 0.42	14	
	0417 8523	0.43 – 0.47	12	
	0428 6588	0.48 – 0.52	17	
	0417 8524	0.53 – 0.57	15	
	0428 6589	0.58 – 0.62	20	
	0417 8525	0.63 – 0.67	18	
	0428 6590	0.68 – 0.72	23	
	0417 8526	0.73 – 0.77	21	
	0428 6591	0.78 – 0.82	26	
	0417 8527	0.83 – 0.87	24	
	0428 1633	0.88 – 0.92	8	
	0417 8528	0.93 – 0.97	27	
	0428 1634	0.98 – 1.02	11	
	0427 2923	1.03 – 1.07	30	
	0428 6592	1.08 – 1.12	29	
	0427 2924	1.13 – 1.17	33	
	0428 6593	1.18 – 1.22	7	
0428 1635	1.23 – 1.27	10		
0428 6696	1.28 – 1.32	13		

4 Technical data

4.1 Test and adjustment data

2011



ID No.	Name	Additional information	Value	Unit
07 31	Beginning of pumping		see company plate	°
07 50	Injection valve			
07 51	Nozzle type	<ul style="list-style-type: none"> • Bosch • FL engines 	DSLA 144 P547 5-hole	
		<ul style="list-style-type: none"> • Bosch • BFL engines 	DLLA 144 P521 5-hole	
		<ul style="list-style-type: none"> • Motorpal (leak oil-less) • B/FL engines 	DOP152P522 3898	
07 52	Nozzle opening pressure of the injection valve (leak oil-less)	Motorpal	170 ⁺¹⁰	bar
			17 ⁺¹	MPa
07 53	Pressure for leak test of the injection valve	below the previously read opening pressure	20	bar

08 00 Lube oil system

ID No.	Name	Additional information	Value	Unit
08 10	Lube oil pump			
08 41	<ul style="list-style-type: none"> • Pressure limiting valve • Standard • without cabin heater connection 	Opening pressure	3.0	bar
		Color marking	green	
	<ul style="list-style-type: none"> • Pressure limiting valve • with cabin heater connection 	Opening pressure	1.0	bar
		Color marking	yellow	
08 42	<ul style="list-style-type: none"> • Pressure limiting valve • Cabin heater connection 	Opening pressure	1.7	bar
		Color marking	red	
08 43	<ul style="list-style-type: none"> • Pressure limiting valve • Cabin heater connection • Engine input 	Opening pressure	0.3	bar
		Color marking	blue	

ID No.	Name	Additional information	Value	Unit
08 44	Length of the compression spring (green) for the oil pressure regulating valve	without heater connection	56.5	mm
	Length of the compression spring (yellow) for the oil pressure regulating valve	with heater connection	80.5	mm
08 45	Length of the compression spring (red) for the oil pressure regulating valve	with heater connection	78.4	mm
08 46	Length of the compression spring (blue) for the oil pressure regulating valve	with heater connection	61.8	mm
08 50	Lube oil pressure			
08 51	Lube oil pressure in low idle	Oil temperature approx. 110 °C	1.4	bar
08 73	Lube oil thermostat	Starts opening	93	°C
		Fully open	110	
08 74	Length of the compression spring for the lube oil thermostat		116.7	mm

09 00 Cooling system

ID No.	Name	Additional information	Value	Unit
09 91	Gap dimension between running wheel and blower jacket inlet		min. = 0.2 max. = 0.8	mm

12 00 Other components

ID No.	Name	Additional information	Value	Unit
12 11	Tension of the single V-belt	First assembly	450 ±50	N
12 21	Tension of the single V-belt	Check after 15 min running under load	300 ±20	N



Notes



4 Technical data

4.2 Tightening specifications



Notes

00000 Engine general

ID no.	Name	Pre-tightening value	Re-tightening value	Remark
00001	Clamp holder on crankcase	90 Nm		
00002	Clamp holder on adapter for assembly block	90 Nm		
00003	Engine mount on crankcase elast. mounting	180 Nm	+ 30°	

4 Technical data

4.2 Tightening specifications

2011



01000 Cylinder head

ID no.	Name	Pre-tightening value	Re-tightening value	Remark
01001	Cylinder head on crankcase	30 Nm	+ 80 Nm + 160 Nm + 90°	<ul style="list-style-type: none"> In case of provability use max. 5 times. oil lubricated See tightening order
	Tightening order 2-cylinder	<p>© 39152 1</p>		
	Tightening order 3-cylinder	<p>© 39153 1</p>		
	Tightening order 4-cylinder	<p>© 39154 1</p>		
01002	Toggle lever block on cylinder head	21 Nm		
01003	Lock nut on valve setting screw	20 ± 2 Nm		
01004	Cylinder head cover on cylinder head	8.5 Nm		

4

02000 Drive system

ID no.	Name	Pre-tightening value	Re-tightening value	Remark
02010	Main and fit bearing covers on crankcase	50 Nm	+ 60° + 45°	<ul style="list-style-type: none"> in case of provability use max. 3 times with lube oil
02015	Crankshaft gear wheel/flange hub on crankshaft	130 Nm	+ 210°	Central screw
02020	Con rod bearing cover on con rod (crack con rod)	30 Nm	+ 60° + 60°	<ul style="list-style-type: none"> tighten alternately in case of provability use max. 5 times
	Con rod bearing cover on con rod	30 Nm	+ 60° + 60°	in case of provability use max. 5 times

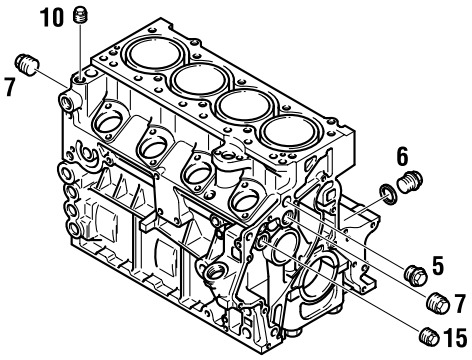
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03000 Crankcase

ID no.	Name	Pre-tightening value	Re-tightening value	Remark
03003	Locking screw on crankcase	18 ± 2 Nm		<ul style="list-style-type: none"> Setting bolt for crankshaft lock Holder for setting bolt for crankshaft lock Renew CU sealing ring
03004	Locking screw on crankcase	18 Nm		<ul style="list-style-type: none"> Setting bolt for control linkage lock Holder for setting bolt for control linkage lock Renew CU sealing ring

4 Technical data

4.2 Tightening specifications

ID no.	Name	Pre-tightening value	Re-tightening value	Remark
03007	Locking screws			
	<ul style="list-style-type: none"> M18 x 1.5mm - item 5 Note installation position of the sealing ring! Always renew after disassembly. 	50 Nm		© 33822 1
	<ul style="list-style-type: none"> M12 x 1.5mm - item 6 	26 Nm		
	<ul style="list-style-type: none"> M30 x 1.5mm - item 7 Always renew after disassembly. 	95 Nm		
	<ul style="list-style-type: none"> M20 x 1.5mm - item 10 Always renew after disassembly. 	56 Nm		
	<ul style="list-style-type: none"> M18 x 1.5mm - item 15 Always renew after disassembly. 	50 Nm		
03010	Rear cover on crankcase	21 Nm		
03020	Front cover on crankcase	21 Nm		Note tightening order!
03030	Oil tray (plate), 2, 3 and 4-cylinder,	0.5 Nm	21 Nm	<ul style="list-style-type: none"> Screws M8 x 16 mm Note tightening order!
	Oil tray (cast), 4-cylinder	0.5 Nm	31 Nm	<ul style="list-style-type: none"> Screws M8 x 30 mm Note tightening order!
	Oil tray (cast), 4-cylinder	0.5 Nm	21 Nm	<ul style="list-style-type: none"> Screws M8 x 5 mm Note tightening order!
	Oil tray (cast), 4-cylinder	0.5 Nm	180 Nm	<ul style="list-style-type: none"> Cylinder head bolts Note tightening order!
03031	Oil drain screw on lube oil tray	55 ± 5 Nm		<ul style="list-style-type: none"> oiled Renew CU sealing ring
03060	Crankcase bleeding on: <ul style="list-style-type: none"> Front cover Cylinder head cover Cylinder head 	8.5 Nm		

4

ID no.	Name	Pre-tightening value	Re-tightening value	Remark
03081	Connection housing on crankcase	106 Nm		<ul style="list-style-type: none"> • M12 x 20mm • M12 x 30mm • M12 x 35mm • M12 x 55mm • M12 x 70mm • M12 x 75mm • M12 x 95mm
03082	Connection housing on crankcase	180 Nm		<ul style="list-style-type: none"> • M14 x 55mm
	Connection housing on crankcase	45 Nm		<ul style="list-style-type: none"> • M10 x 40mm • M10 x 30mm • M10 x 25mm • hex
	Connection housing on crankcase	60 Nm		<ul style="list-style-type: none"> • M10 x 40mm • Cylinder head bolts
	Connection housing on crankcase	22 Nm		<ul style="list-style-type: none"> • M8 x 10mm • M8 x 30mm • M8 x 50mm
03085	Cap on connection housing	9 Nm		
	Cover plate on connection housing	9 Nm		

04000 Engine control

ID no.	Name	Pre-tightening value	Re-tightening value	Remark
04001	Camshaft toothed belt wheel on camshaft	30 Nm	+ 210°	Central screw
04002	Start-up disc on camshaft	21 Nm		
04052	Clamping roller on front cover	21 Nm		<ul style="list-style-type: none"> • Note tightening order! • Note assembly specification!
04053	Protective hood (toothed belt) on front cover	7 Nm		

4 Technical data

4.2 Tightening specifications

2011



05000 Speed governing

ID no.	Name	Pre-tightening value	Re-tightening value	Remark
05004	Lock nut on setting screw	9.2 Nm		Full load stop
05005	Lock nut on setting screw	6 ± 0.6 Nm		Minimum speed
05006	Lock nut on setting screw	16 ± 1.6 Nm		Screw spring pre-tension
05007	Lock nut on setting screw	4.5 Nm		Shutoff stop
05008	Lock nut on setting screw	6 ± 0.6 Nm		Adapter capsule
05011	Speed governor on connection housing	8.5 Nm		
05021	Regulator lever shaft on front cover	9.2 Nm		
05022	No load capsule on front cover	4.6 ± 0.4 Nm		
05023	Adapter capsule on front cover	10 ± 1 Nm		Lock nut
05024	Eccenter shaft on front cover	10 ± 1 Nm		
05025	Cap (speed adjustment lever) on front cover	4.5 Nm		
	Valve crankshaft housing bleeding on front cover			
05041	Lifting magnet (shutoff magnet) on front cover	8.5 Nm		
05065	Lifting magnet (start volume release) on front cover	10 Nm		

06000 Exhaust system / Charging

ID no.	Name	Pre-tightening value	Re-tightening value	Remark
06001	Exhaust manifold on cylinder head	55 Nm		with DEUTZ S1
06020	Turbocharger on exhaust manifold	21 Nm		with DEUTZ S1
06024	Reducer on turbocharger	4 ± 1 Nm		Hose clip

ID no.	Name	Pre-tightening value	Re-tightening value	Remark
06030	Air intake pipe on cylinder head	21 Nm		
	Charge air on cylinder head	21 Nm		
06094	Solenoid valve on LDA	10 Nm		

07000 Fuel system

ID no.	Name	Pre-tightening value	Re-tightening value	Remark
07001	Injection valve on cylinder head	21 Nm		
07002	Injection nozzles lock nut on nozzle holder (leak oil-less)	35 ± 5 Nm		Motorpal
	Injection nozzles lock nut on nozzle holder	45 ± 5 Nm		Bosch
07003	Injection line on: • Injection valve • injection pump	25 ± 2.5 Nm		Union nut
07012	Injection pump on (Bosch/ Motorpal) crankcase	21 Nm		
07015	Fuel supply line to injection pump	29 Nm		<ul style="list-style-type: none"> • Hollow screw • DIN 7643-8
07024	Fuel pump on crankcase	21 Nm		<ul style="list-style-type: none"> • Piston pump • Diaphragm pump
07061	Overcurrent line to injection pump	29 Nm		<ul style="list-style-type: none"> • Renew CU sealing rings • Hollow screw
07062	Overcurrent line to cylinder head bolt	8.5 Nm		
07071	Locking screw on injection pump (Motorpal)	45 ± 5 Nm		Renew CU sealing rings
07082	Fuel filter console on crankcase	21 Nm		
07087	Fuel filter console on holder	27 Nm		<ul style="list-style-type: none"> • Hexagon bolt M8 x 50mm and hexagon nut M8

4 Technical data

4.2 Tightening specifications

2011



ID no.	Name	Pre-tightening value	Re-tightening value	Remark
07095	Charge pressure-dependent full load stop (LDA) on crankcase	22 Nm		
07096	Cap on charge pressure-dependent full load stop (LDA)	8 Nm		
07099	Fuel filter on fuel filter console	9 ± 1 Nm		hand tight

08000 Lube oil system

ID no.	Name	Pre-tightening value	Re-tightening value	Remark
08001	Oil filter	10 -12 Nm		<ul style="list-style-type: none"> • Oil gasket lightly • Screw on by hand and screw tight
08003	Oil filter console on crankcase	21 Nm		Torx screw
08010	Lube oil pump on crankcase	22 Nm		
08015	Oil suction intake pipe on crankcase	21 Nm		<ul style="list-style-type: none"> • Note gasket coating • Sealant DEUTZ DW 73
08035	Pipe support oil dipstick guide pipe on oil pump	30 Nm		
08042	Oil pressure line on: <ul style="list-style-type: none"> • Turbocharger • Crankcase 	29 Nm		<ul style="list-style-type: none"> • Renew CU sealing rings • Hollow screw • Before assembling the line ATL via pressure oil connection bore, pre-oil with approx. 1 cm³ engine oil!
08044	Oil return pipe on turbocharger	40 Nm		Screwed socket
	Oil return pipe on turbocharger	8.5 Nm		Flange socket
08046	Holder for stopper on crankcase	8.5 Nm		FL/M engine
	Oil return pipe (ATL) holding plate on crankcase	8.5 Nm		BFL/M engines
08047	Oil return pipe (ATL) on crankcase	29 Nm		Hollow screw
08048	Oil line to (control line): <ul style="list-style-type: none"> • oil filter console • Crankcase 	18 Nm		<ul style="list-style-type: none"> • Injection adjustment • Renew CU sealing rings • Hollow screw

4

ID no.	Name	Pre-tightening value	Re-tightening value	Remark
08051	Oil cooler fastening screws	21 Nm		Torx screw M8
08053	Locking screw thermostat for injection adjuster on oil filter console	90 Nm		Injection adjustment
08054	Oil cooler connection on crankcase	13 Nm		<ul style="list-style-type: none"> • M6 x 60mm • Hexagon head screw
08061	Transfer nipple on crankcase (heater connection)	111 ± 11 Nm		<ul style="list-style-type: none"> • Renew sealing rings • Note installation position
08062	Locking screws M18 x 1.5 mm at transfer nipple (heater connection)	50 Nm		Renew CU sealing rings
08072	Locking screw oil cooler thermostat on crankcase	50 Nm		Hexagon socket
08091	Oil pressure switch (locking screw) on crankcase	13 ± 1.5 Nm		Oil pressure switch M10 x 1mm
08093	Oil pressure sensor on crankcase	20 +2 Nm		
08094	Locking screw (oil pressure sensor) on crankcase	50 Nm		<ul style="list-style-type: none"> • Oil pressure switch / oil pressure sensor • M18 x 1.5mm
08095	Oil temperature sensor on crankcase	25 ± 2.5 Nm		
08096	Locking screw (oil temperature sensor) on crankcase	28 Nm		<ul style="list-style-type: none"> • Renew CU sealing rings • Oil temperature sensor
08098	Locking screw (oil pressure regulating valve) on crankcase	111 Nm		<ul style="list-style-type: none"> • Renew CU sealing rings • Oil pressure regulating valve
08099	Locking screw on crankcase (without air press lubrication)	18 ± 2 Nm 60 ± 6 Nm 80 ± 8 Nm		<ul style="list-style-type: none"> • M10 x 1mm • M18 x 1.5mm • M22 x 1.5mm

4 Technical data

4.2 Tightening specifications

2011



09000 Cooling system

ID no.	Name	Pre-tightening value	Re-tightening value	Remark
09041	Fan on fan drive	22 Nm		M8 x 22mm / bolts 8.8
		30 Nm		M8 x 20mm / bolts 10.9
09042	Fan on flange hub, crankshaft	30 Nm		M8 x 40mm
09065	Cooling blower jacket on generator	4 Nm		
09066	Blower jacket on cylinder head	22 Nm		
	Cooling blower on: <ul style="list-style-type: none"> • air duct • Cylinder head 	21 Nm		
09067	Blower jacket inlet on generator	22 Nm		
09070	Stand plate on: <ul style="list-style-type: none"> • crankcase • Oil cooler 	21 Nm		Torx screw 8 x 20mm
09087	Air duct cowling on: <ul style="list-style-type: none"> • Cylinder head • Stand plate 	21 Nm		
09089	Air duct on cooling blower	3 Nm	21 Nm	
09098	Air duct on cylinder head	3 Nm	+21 Nm	

12000 Other components

ID no.	Name	Pre-tightening value	Re-tightening value	Remark
12001	Flywheel on crankcase	30 Nm	+ 60° + 30°	Renew screws after every disassembly
12030	Flange hub on toothed belt wheel, crankshaft	43 Nm		M10 x 40mm
12031	V-belt pulley on toothed belt wheel, crankshaft	42 ± 4 Nm		
12041	V-belt tensioning roller (holder) on front cover	45 Nm		

ID no.	Name	Pre-tightening value	Re-tightening value	Remark
12043	V-belt tensioning roller on holder	21 Nm		<ul style="list-style-type: none"> M8 x 20mm M8 x 30mm
12046	V-belt pulley on fan mounting	22 Nm		Torx M8 x 16mm
12047	V-belt guard on front cover	21 Nm		
12051	Hydraulic pump on hydraulic pump console	57 Nm		Hexagon bolts
12052	Toothed belt tensioning roller on hydraulic pump console	8 +2 Nm	+21 ±2 Nm	Hydraulic pump drive
12056	Protective hood on hydraulic pump console	8.5 Nm		
12057	Hydraulic pump console on crankcase	57 Nm		

4

13000 Electrical components

ID no.	Name	Pre-tightening value	Re-tightening value	Remark
13001	Starter on crankcase	43,5 Nm		
13006	Starter console on crankcase	75 ± 7 Nm		without connection housing
13009	Heat shield for starter	8.5 Nm		Bolts M6
13010	Generator console on: crankcase Cylinder head	34 Nm		<ul style="list-style-type: none"> with built up fan drive Unit design
	Generator console on crankcase	30 Nm	49°	<ul style="list-style-type: none"> with built up fan drive Unit design
13012	Generator on console	34 Nm		<ul style="list-style-type: none"> with built up fan drive Unit design
		34 Nm		<ul style="list-style-type: none"> with built up fan drive Building machine design
13015	Generator on clamping bracket	22 Nm		<ul style="list-style-type: none"> with built up fan drive Unit design
		21 Nm		<ul style="list-style-type: none"> with built up fan drive Building machine design

4 Technical data

4.2 Tightening specifications

2011



ID no.	Name	Pre-tightening value	Re-tightening value	Remark
13016	Clamping bracket on console Generator	22 Nm		<ul style="list-style-type: none"> • with built up fan drive • Unit design
		21 Nm		<ul style="list-style-type: none"> • with built up fan drive • Building machine design
13017	V-belt clamping bracket on front cover	45 Nm		
13018	Generator console on cylinder head	34 Nm		with in-built fan drive
13021	Pulley on generator	50 Nm		
	Running wheel on generator	50 Nm		
13022	Fan drive on generator console	30 Nm	120°	<ul style="list-style-type: none"> • M10 x 110mm • with built up fan drive • Unit design
13031	Helical heater plug in: charge air line Suction pipe	60 Nm		
13071	Charging current cable on starter	max. 15 Nm		
13081	Charging current cable on generator B+	5.5 -7 Nm		
13082	Cable G1.D+ on generator	4.5 ± 0.8 Nm		
13083	Cable G1.W on generator	4 Nm		
13092	Cable harness holder on crankcase	14 Nm		Torx screw M8 x 16mm
	Cable harness holder on: Starter crankcase	8.5 Nm		M6

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5 Job card overview

5.1 Sorted alphabetically

5 Job card overview

5.1 Sorted alphabetically

2011



Notes

5

Activity	Job card	Maintenance group
Assemble and disassemble engine on assembly stand	W 00-05-01	Engine general
Check and repair injection valve	W 07-07-02	Fuel system
Check and set valve clearance	W 01-01-01	Cylinder head
Check camshaft	W 04-05-06	Engine control
Check compression	W 00-02-06	Engine general
Check con rod	W 02-03-01	Drive system
Check con rod (crack con rod)	W 02-03-01	Drive system
Check crankcase	W 02-01-07	Drive system
Check cylinder	W 03-03-01	Crankcase
Check engine control times	W 04-04-11	Engine control
Check piston	W 02-09-07	Drive system
Check piston rings and piston ring grooves	W 02-10-03	Drive system
Check start of pumping	W 07-06-04	Fuel system
Check valve guide	W 01-06-03	Cylinder head
Check valve lag	W 01-07-08	Cylinder head
Check valves	W 01-05-04	Cylinder head
Check V-belt, renew (in FL and BFL engines)	W 12-02-01	Other components
Check V-belt, renew (in FM and BFM engines)	W 12-02-01	Other components
Checking and setting injection valves (leak fuel-less)	W 07-07-05	Fuel system
Determine the thickness of the shim gasket	W 07-06-03	Fuel system
Disassemble and complete, check toggle lever and toggle lever block	W 01-02-06	Cylinder head
Dismantle and complete cooling blower, check	W 09-11-02	Cooling system
Dismantle and complete fan drive	W 09-13-01	Cooling system
Dismantle and complete front cover (speed governor with torque adaption)	W 03-08-03	Crankcase

5 Job card overview

5.1 Sorted alphabetically

2011



Activity	Job card	Maintenance group
Dismantle and complete front cover (speed governor without torque adaption)	W 03-08-03	Crankcase
Machine valve seat ring	I 01-07-07	Cylinder head
Remove and install air intake pipe	W 06-07-03	Exhaust system / Charging
Remove and install cable harness	W 13-01-02	Electrical system
Remove and install camshaft	W 04-05-05	Engine control
Remove and install camshaft bearing, check	W 03-11-01	crankcase
Remove and install charge pressure-depedent full load stop (LDA)	W 07-08-02	Fuel system
Remove and install connection housing	W 03-09-04	crankcase
Remove and install cooling blower	W 09-11-01	Cooling system
Remove and install crankcase	W 02-04-01	Drive system
Remove and install crankcase bleeding	W 03-01-11	crankcase
Remove and install cylinder head	W 01-04-04	Cylinder head
Remove and install exhaust manifold	W 06-01-05	Exhaust system / Charging
Remove and install flywheel	W 12-06-01	Other components
Remove and install front cover (opposite side to flywheel)	W 03-08-01	Crankcase
Remove and install fuel filter console	W 07-10-08	Fuel system
Remove and install fuel lines (with Bosch injection pumps)	W 07-10-06	Fuel system
Remove and install fuel lines (with leak fuel line)	W 07-10-06	Fuel system
Remove and install fuel pump	W 07-11-01	Fuel system
Remove and install generator (in FL and BFL engines)	W 13-02-03	Electrical system
Remove and install generator and holder (in FM and BFM engines)	W 13-02-03	Electrical system
Remove and install control linkage and guide bushes	W 07-02-06	Fuel system
Remove and install helical heater plugs	W 13-06-01	Electrical system
Remove and install hydraulic pump	W 12-08-02	Other components

5

Activity	Job card	Maintenance group
Remove and install injection pumps (Bosch)	W 07-04-01	Fuel system
Remove and install injection pumps (Motorpal)	W 07-04-01	Fuel system
Remove and install injection valves	W 07-07-01	Fuel system
Remove and install lifting magnet (shutoff magnet)	W 11-00-03	Monitoring system
Remove and install lifting magnet for start volume release	W 07-02-07	Fuel system
Remove and install lube oil pump	W 08-04-05	Lube oil system
Remove and install lube oil tray	W 08-04-07	Lube oil system
Remove and install oil cooler	W 08-08-02	Lube oil system
Remove and install oil filter cartridge	W 08-10-06	Lube oil system
Remove and install oil filter console	W 08-11-07	Lube oil system
Remove and install oil intake pipe	W 08-04-06	Lube oil system
Remove and install oil pressure sensor	W 08-11-09	Lube oil system
Remove and install oil pressure line (turbocharger)	W 08-15-01	Lube oil system
Remove and install oil pressure regulating valve, check	W 08-11-02	Lube oil system
Remove and install oil pressure switch	W 08-11-08	Lube oil system
Remove and install oil line for injection adjuster supply	W 08-16-01	Lube oil system
Remove and install oil return line (turbocharger)	W 08-15-02	Lube oil system
Remove and install oil temperature sensor	W 08-11-11	Lube oil system
Remove and install oil temperature sensor (in engines with injection adjustment)	W 08-16-02	Lube oil system
Remove and install oil thermostat (oil cooler)	W 08-11-12	Lube oil system
Remove and install piston bolt bush	W 02-03-03	Drive system
Remove and install piston cooling nozzles	W 02-15-01	Drive system
Remove and install pistons and con rod	W 02-09-03	Drive system
Remove and install pistons and con rod (crack con rod)	W 02-09-03	Drive system
Remove and install rear cover (flywheel side)	W 03-09-01	Crankcase

5 Job card overview

5.1 Sorted alphabetically

2011



Activity	Job card	Maintenance group
Remove and install solenoid valve (LDA)	W 07-08-01	Fuel system
Remove and install speed governor	W 05-07-01	Speed governing
Remove and install starter	W 13-03-02	Electrical system
Remove and install toggle lever and toggle lever block	W 01-02-02	Cylinder head
Remove and install toothed belt and clamping roller of the hydraulic pump	W 12-08-03	Other components
Remove and install turbocharger	W 06-06-04	Exhaust system / Charging
Remove and install V-belt clamping roller	W 12-02-06	Other components
Remove and install valves	W 01-05-01	Cylinder head
Renew camshaft sealing ring (opposite side to flywheel)	W 04-03-01	Engine control
Renew crankshaft sealing ring (opposite side to flywheel)	W 02-02-04	Drive system
Renew crankshaft sealing ring (flywheel side)	W 02-02-02	Drive system
Renew injection lines	W 07-03-01	Fuel system
Renew toothed belt and clamping roller (new version of clamping roller)	W 04-04-12	Engine control
Renew toothed belt and clamping roller (old version of clamping roller)	W 04-04-12	Engine control
Renew toothed starter flywheel ring	W 12-06-03	Other components

5



2011

5 Job card overview

5.2 Sorted numerically

5

5 Job card overview

5.2 Sorted numerically

2011



Notes

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Job card	Activity	Maintenance group
W 00-02-06	Check compression	Engine general
W 00-05-01	Assemble and disassemble engine on engine block	Engine general
W 01-01-01	Check and set valve clearance	Cylinder head
W 01-02-02	Remove and install toggle lever and toggle lever block	Cylinder head
W 01-02-06	Disassemble and complete, check toggle lever and toggle lever block	Cylinder head
W 01-04-04	Remove and install cylinder head	Cylinder head
W 01-05-01	Remove and install valves	Cylinder head
W 01-05-04	Check valves	Cylinder head
W 01-06-03	Check valve guide	Cylinder head
I 01-07-07	Machine valve seat ring	Cylinder head
W 01-07-08	Check valve lag	Cylinder head
W 02-01-07	Check crankcase	Drive system
W 02-02-02	Renew crankshaft sealing ring (flywheel side)	Drive system
W 02-02-04	Renew crankshaft sealing ring (opposite side to flywheel)	Drive system
W 02-03-01	Check con rod	Drive system
W 02-03-01	Check con rod (crack con rod)	Drive system
W 02-03-03	Remove and install piston bolt bush	Drive system
W 02-04-01	Remove and install crankcase	Drive system
W 02-09-03	Remove and install pistons and con rod	Drive system
W 02-09-03	Remove and install pistons and con rod (crack con rod)	Drive system
W 02-09-07	Check piston	Drive system
W 02-10-03	Check piston rings and piston ring grooves	Drive system
W 02-15-01	Remove and install piston cooling nozzles	Drive system
W 03-01-11	Remove and install crankcase bleeding	Crankcase
W 03-03-01	Check cylinder	Crankcase

5 Job card overview

5.2 Sorted numerically

2011



5

Job card	Activity	Maintenance group
W 03-08-01	Remove and install front cover (opposite side to flywheel)	Crankcase
W 03-08-03	Dismantle and complete front cover (speed governor with torque adaption)	Crankcase
W 03-08-03	Dismantle and complete front cover (speed governor without torque adaption)	Crankcase
W 03-09-01	Remove and install rear cover (flywheel side)	Crankcase
W 03-09-04	Remove and install connection housing	Crankcase
W 03-11-01	Remove and install camshaft bearing, check	Crankcase
W 04-03-01	Renew camshaft sealing ring (opposite side to flywheel)	Engine control
W 04-04-11	Check engine control times	Engine control
W 04-04-12	Renew toothed belt and clamping roller (old version of clamping roller)	Engine control
W 04-04-12	Renew toothed belt and clamping roller (new version of clamping roller)	Engine control
W 04-05-05	Remove and install camshaft	Engine control
W 04-05-06	Check camshaft	Engine control
W 05-07-01	Remove and install speed governor	Speed governing
W 06-01-05	Remove and install exhaust manifold	Exhaust system / Charging
W 06-06-04	Remove and install turbocharger	Exhaust system / Charging
W 06-07-03	Remove and install air intake pipe	Exhaust system / Charging
W 07-02-06	Remove and install control linkage and guide bushes	Fuel system
W 07-02-07	Remove and install lifting magnet for start volume release	Fuel system
W 07-03-01	Renew injection lines	Fuel system
W 07-04-01	Remove and install injection pumps (Bosch)	Fuel system
W 07-04-01	Remove and install injection pumps (Motorpal)	Fuel system
W 07-06-03	Determine the thickness of the shim gasket	Fuel system
W 07-06-04	Check start of pumping	Fuel system

Job card	Activity	Maintenance group
W 07-07-01	Remove and install injection valves	Fuel system
W 07-07-02	Check and repair injection valve	Fuel system
W 07-07-05	Checking and setting injection valves (leak fuel-less)	Fuel system
W 07-08-01	Remove and install solenoid valve (LDA)	Fuel system
W 07-08-02	Remove and install charge pressure-depedent full load stop (LDA)	Fuel system
W 07-10-06	Remove and install fuel lines (with Bosch injection pumps)	Fuel system
W 07-10-06	Remove and install fuel lines (with leak fuel line)	Fuel system
W 07-10-08	Remove and install fuel filter console	Fuel system
W 07-11-01	Remove and install fuel pump	Fuel system
W 08-04-05	Remove and install lube oil pump	Lube oil system
W 08-04-06	Remove and install oil intake pipe	Lube oil system
W 08-04-07	Remove and install lube oil tray	Lube oil system
W 08-08-02	Remove and install oil cooler	Lube oil system
W 08-10-06	Remove and install oil filter cartridge	Lube oil system
W 08-11-02	Remove and install oil pressure regulating valve, check	Lube oil system
W 08-11-07	Remove and install oil filter console	Lube oil system
W 08-11-08	Remove and install oil pressure switch	Lube oil system
W 08-11-09	Remove and install oil pressure sensor	Lube oil system
W 08-11-11	Remove and install oil temperature sensor	Lube oil system
W 08-11-12	Remove and install oil thermostat (oil cooler)	Lube oil system
W 08-15-01	Remove and install oil pressure line (turbocharger)	Lube oil system
W 08-15-02	Remove and install oil return line (turbocharger)	Lube oil system
W 08-16-01	Remove and install oil line for injection adjuster supply	Lube oil system
W 08-16-02	Remove and install oil temperature sensor (in engines with injection adjustment)	Lube oil system

5 Job card overview

5.2 Sorted numerically

2011



Job card	Activity	Maintenance group
W 09-11-01	Remove and install cooling blower	Cooling system
W 09-11-02	Dismantle and complete cooling blower, check	Cooling system
W 09-13-01	Dismantle and complete fan drive	Cooling system
W 11-00-03	Remove and install lifting magnet (shutoff magnet)	Monitoring system
W 12-02-01	Check V-belt, renew (in FL and BFL engines)	Other components
W 12-02-01	Check V-belt, renew (in FM and BFM engines)	Other components
W 12-02-06	Remove and install V-belt clamping roller	Other components
W 12-06-01	Remove and install flywheel	Other components
W 12-06-03	Renew toothed starter flywheel ring	Other components
W 12-08-02	Remove and install hydraulic pump	Other components
W 12-08-03	Remove and install toothed belt and clamping roller of the hydraulic pump	Other components
W 13-01-02	Remove and install cable harness	Electrical system
W 13-02-03	Remove and install generator (in FL and BFL engines)	Electrical system
W 13-02-03	Remove and install generator and holder (in FM and BFM engines)	Electrical system
W 13-03-02	Remove and install starter	Electrical system
W 13-06-01	Remove and install helical heater plugs	Electrical system

5



5 Job card overview

5.3 Job card references

5 Job card overview

5.3 Job card references

2011



Explanation of job card reference:

Owing to the job card structure, individual parts of the work processes may overlap or repeat. Illustrations of the same working environment may also deviate slightly.

00 Engine general

Job card	Activity	Other job cards necessary for performing the activity				
W 00-02-06	Check compression	W 01-01-01	W 07-07-01	W 08-08-02		
W 00-05-01	Assemble and disassemble engine on engine block	W 13-03-02				

01 Cylinder head

Job card	Activity	Other job cards necessary for performing the activity				
W 01-01-01	Check and set valve clearance					
W 01-02-02	Remove and install toggle lever and toggle lever block	W 01-01-01				
W 01-02-06	Disassemble and complete, check toggle lever and toggle lever block	W 01-02-02				
W 01-04-04	Remove and install cylinder head	W 01-02-02	W 06-07-03	W 07-07-01	W 09-11-01	W 13-02-03
W 01-05-01	Remove and install valves	W 01-04-04				
W 01-05-04	Check valves	W 01-05-01				
W 01-06-03	Check valve guide	W 01-05-01				
I 01-07-07	Machine valve seat ring	W 01-05-01	W 01-07-08			
W 01-07-08	Check valve lag	W 01-04-04				

5 Job card overview

5.3 Job card references

2011



02 Drive system

Job card	Activity	Other job cards necessary for performing the activity				
W 02-01-07	Check crankcase	W 02-04-01				
W 02-02-02	Renew crankshaft sealing ring (flywheel side)	W 12-06-01				
W 02-02-04	Renew crankshaft sealing ring (opposite side to flywheel)	W 03-08-01	W 04-04-12 (old version)	W 04-04-12 (new version)		
W 02-03-01	Check con rod	W 02-03-03				
W 02-03-01	Check con rod (crack con rod)	W 02-03-03				
W 02-03-03	Remove and install piston bolt bush	W 02-09-03				
W 02-04-01	Remove and install crankcase	W 02-01-07	W 02-09-03	W 03-08-01	W 03-09-01	
W 02-09-03	Remove and install pistons and con rod	W 01-04-04	W 02-10-03	W 08-04-06		
W 02-09-03	Remove and install pistons and con rod (crack con rod)	W 01-04-04	W 02-10-03	W 08-04-06		
W 02-09-07	Check piston	W 02-09-03				
W 02-10-03	Check piston rings and piston ring grooves	W 02-09-03				
W 02-15-01	Remove and install piston cooling nozzles	W 02-04-01				

5

03 Crankcase

Job card	Activity	Other job cards necessary for performing the activity				
W 03-01-11	Remove and install crankcase bleeding					
W 03-03-01	Check cylinder	W 01-04-04				
W 03-08-01	Remove and install front cover (opposite side to flywheel)	W 04-03-01	W 04-04-12 (new version)	W 04-04-12 (old version)	W 08-04-05	W 08-08-02
W 03-08-03	Dismantle and complete front cover (speed governor with torque adaption)	W 03-08-01				
W 03-08-03	Dismantle and complete front cover (speed governor without torque adaption)	W 03-08-01				
W 03-09-01	Remove and install rear cover (flywheel side)	W 03-09-04	W 08-04-07			
W 03-09-04	Remove and install connection housing	W 00-05-01	W 12-06-01			
W 03-11-01	Remove and install camshaft bearing, check	W 01-02-02	W 02-04-01	W 07-04-01 (Motorpal)	W 07-04-01 (Bosch)	W 07-11-01

5 Job card overview

5.3 Job card references

2011



04 Engine control

Job card	Activity	Other job cards necessary for performing the activity				
W 04-03-01	Renew camshaft sealing ring (opposite side to flywheel)	W 04-04-12 (old version)	W 04-04-12 (new version)			
W 04-04-11	Check engine control times	W 04-04-12 (old version)	W 04-04-12 (new version)			
W 04-04-12	Renew toothed belt and clamping roller (old version of clamping roller)	W 12-02-01 (FL, BFL engines)	W 12-02-01 (FM, BFM engines)	W 12-08-03		
W 04-04-12	Renew toothed belt and clamping roller (new version of clamping roller)	W 12-02-01 (FL, BFL engines)	W 12-02-01 (FM, BFM engines)	W 12-08-03		
W 04-05-05	Remove and install camshaft	W 01-02-02	W 03-09-01	W 04-04-12 (old version)	W 04-04-12 (new version)	W 07-04-01 (Motorpal)
		W 07-04-01 (Bosch)	W 07-11-01			
W 04-05-06	Check camshaft	W 04-05-05				

05 Speed governing

Job card	Activity	Other job cards necessary for performing the activity				
W 05-07-01	Remove and install speed governor					

06 Exhaust system / Charging

Job card	Activity	Other job cards necessary for performing the activity				
W 06-01-05	Remove and install exhaust manifold	W 06-06-04				
W 06-06-04	Remove and install turbocharger					
W 06-07-03	Remove and install air intake pipe	W 06-01-05				

07 Fuel system

Job card	Activity	Other job cards necessary for performing the activity				
W 07-02-06	Remove and install control linkage and guide bushes	W 03-08-01	W 03-09-04	W 07-04-01 (Motorpal)	W 07-04-01 (Bosch)	W 07-08-02
		W 08-11-12	W 09-11-01	W 13-02-03		
W 07-02-07	Remove and install lifting magnet for start volume release					
W 07-03-01	Renew injection lines	W 08-08-02				
W 07-04-01	Remove and install injection pumps (Bosch)	W 07-03-01	W 07-06-04	W 07-10-06		
W 07-04-01	Remove and install injection pumps (Motorpal)	W 07-03-01	W 07-06-03	W 07-06-04	W 07-10-06	
W 07-06-03	Determine the thickness of the shim gasket	W 07-04-01				
W 07-06-04	Check start of pumping	W 07-03-01	W 07-10-06 (Bosch)	W 07-10-06 (Motorpal)	W 11-00-03	
W 07-07-01	Remove and install injection valves	W 07-03-01				
W 07-07-02	Check and repair injection valve	W 07-07-05	W 07-07-01			
W 07-07-05	Checking and setting injection valves (leak fuel-less)	W 07-07-01				
W 07-08-01	Remove and install solenoid valve (LDA)					
W 07-08-02	Remove and install charge pressure-depedent full load stop (LDA)					
W 07-10-06	Remove and install fuel lines (with Bosch injection pumps)	W 08-08-02				
W 07-10-06	Remove and install fuel lines (with leak fuel line)					
W 07-10-08	Remove and install fuel filter console					

5 Job card overview

5.3 Job card references

2011



Job card	Activity	Other job cards necessary for performing the activity				
W 07-11-01	Remove and install fuel pump					

08 Lube oil system

Job card	Activity	Other job cards necessary for performing the activity				
W 08-04-05	Remove and install lube oil pump	W 04-04-12 (old version)	W 04-04-12 (new version)			
W 08-04-06	Remove and install oil intake pipe	W 08-04-07				
W 08-04-07	Remove and install lube oil tray					
W 08-08-02	Remove and install oil cooler					
W 08-10-06	Remove and install oil filter cartridge					
W 08-11-02	Remove and install oil pressure regulating valve, check					
W 08-11-07	Remove and install oil filter console	W 08-10-06				
W 08-11-08	Remove and install oil pressure switch					
W 08-11-09	Remove and install oil pressure sensor					
W 08-11-11	Remove and install oil temperature sensor	W 08-08-02				
W 08-11-12	Remove and install oil thermostat (oil cooler)					
W 08-15-01	Remove and install oil pressure line (turbocharger)					
W 08-15-02	Remove and install oil return line (turbocharger)					

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Job card	Activity	Other job cards necessary for performing the activity				
W 08-16-01	Remove and install oil line for injection adjuster supply					
W 08-16-02	Remove and install oil temperature sensor (in engines with injection adjustment)					

09 Cooling system

Job card	Activity	Other job cards necessary for performing the activity				
W 09-11-01	Remove and install cooling blower	W 12-02-01 (FL, BFL engines)				
W 09-11-02	Dismantle and complete cooling blower, check	W 09-11-01				
W 09-13-01	Dismantle and complete fan drive					

5

11 Monitoring system

Job card	Activity	Other job cards necessary for performing the activity				
W 11-00-03	Remove and install lifting magnet (shutoff magnet)	W 12-02-06	W 13-02-03 (FM, BFM engines)			

12 Other components

Job card	Activity	Other job cards necessary for performing the activity				
W 12-02-01	Check V-belt, renew (in FL and BFL engines)					
W 12-02-01	Check V-belt, renew (in FM and BFM engines)					
W 12-02-06	Remove and install V-belt clamping roller	W 12-02-01 (FL, BFL engines)	W 12-02-01 (FM, BFM engines)			

5 Job card overview

5.3 Job card references

2011



Job card	Activity	Other job cards necessary for performing the activity				
W 12-06-01	Remove and install flywheel					
W 12-06-03	Renew toothed starter flywheel ring	W 12-06-01				
W 12-08-02	Remove and install hydraulic pump					
W 12-08-03	Remove and install toothed belt and clamping roller of the hydraulic pump	W 12-02-01 (FL, BFL engines)	W 12-02-01 (FM, BFM engines)			

5 13 Electrical components

Job card	Activity	Other job cards necessary for performing the activity				
W 13-01-02	Remove and install cable harness					
W 13-02-03	Remove and install generator (in FL and BFL engines)	W 12-02-01				
W 13-02-03	Remove and install generator and holder (in FM and BFM engines)	W 12-02-01				
W 13-03-02	Remove and install starter					
W 13-06-01	Remove and install helical heater plugs					



2011

6 Job cards

6



Notes

Check compression



Tools

- **Commercial tools**
8005 - Compression tester
8189 - Torx tool kit

- **Special tools**

- 100 120 - Connecting piece



References

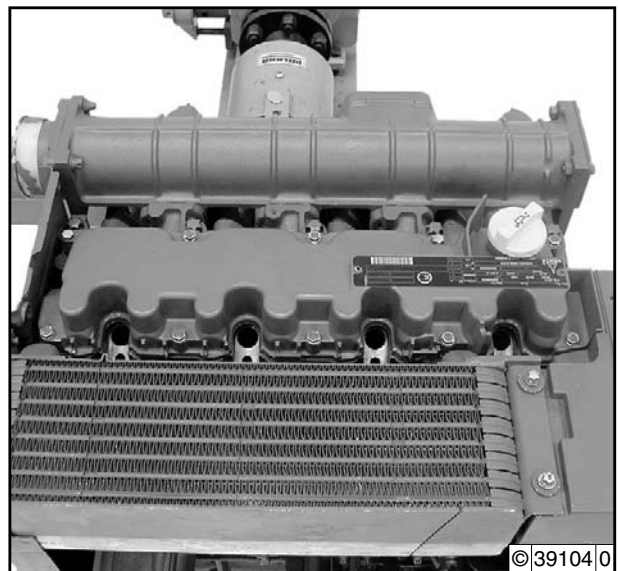
- W 01-01-01
- W 07-07-01
- W 08-08-02

Check compression

- Check and set valve clearance
→ Job card **W 01-01-01**.
- Remove injection valves
→ Job card **W 07-07-01**.

In FL, BFL engines

- Install oil cooler
→ Job card **W 08-08-02**.

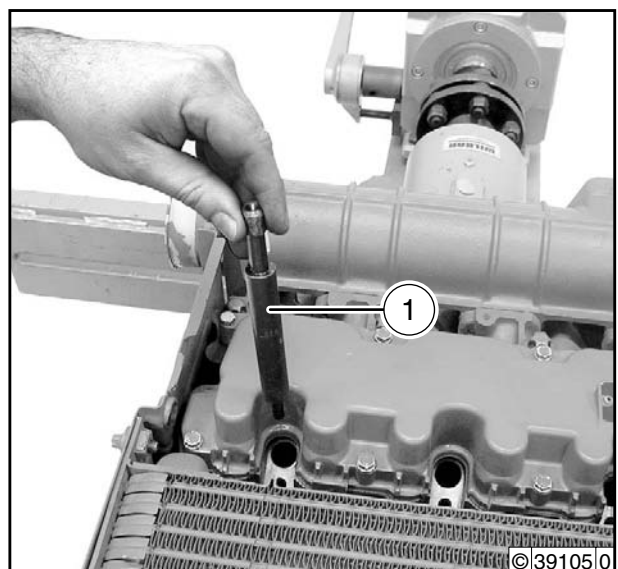


- Insert adapter (1) with sealing ring.



Note

Use sealing ring from injection valve.

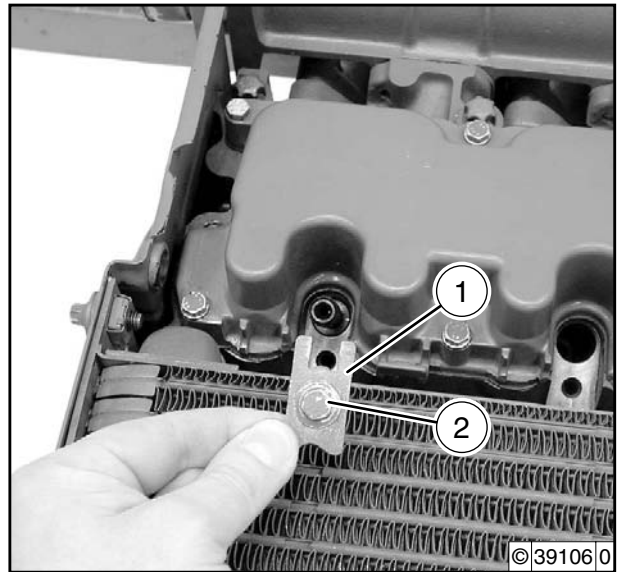


- Fit clamping claw (1) and tighten screws (2)



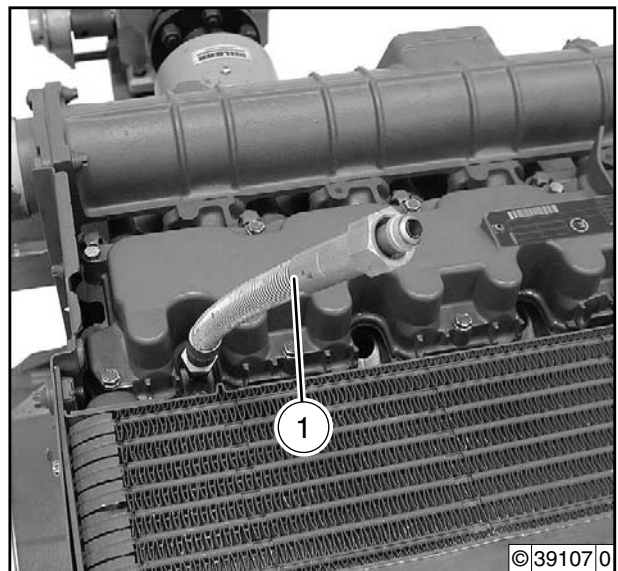
Note

Note installation position.



6

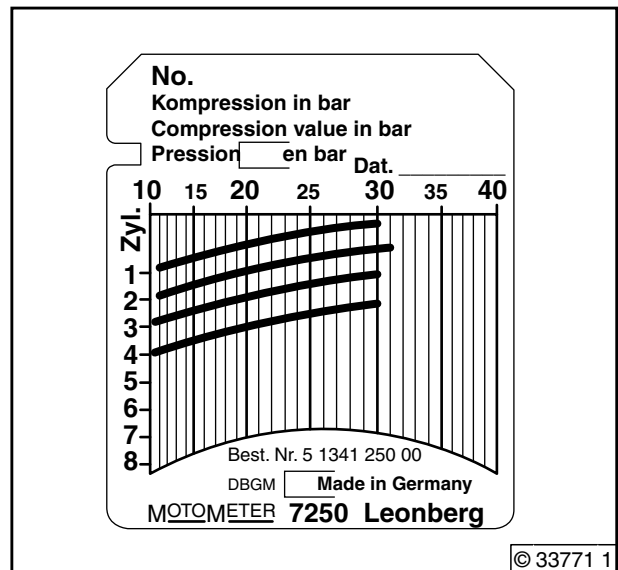
- If necessary, mount adapter (1) on connection piece.



- Connect compression tester to connection piece or adapter.
- Turn over engine with starter.



- The measured compression pressure depends on the starting speed during the measuring process and the altitude of the engine installation site. Limit values can therefore not be determined exactly. The compression measurement is only recommended as a reference measurement of all cylinders of an engine to each other. If more than 15% deviation has been determined, the cause should be determined by disassembling the cylinder unit concerned.



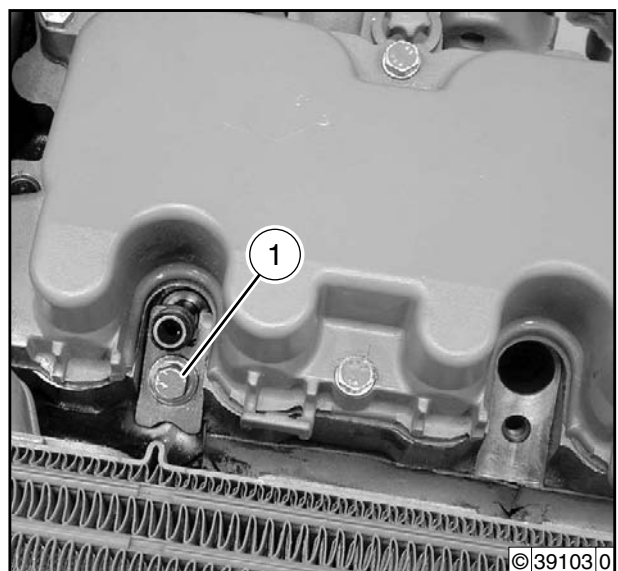
- Remove the compression tester and adapter.



- Unscrew screw (1).
- Remove connection piece with sealing ring.

In FL, BFL engines

- Remove oil cooler
 → Job card **W 08-08-02**.
- Install injection valves
 → Job card **W 07-07-01**.





Notes

Mount engine on assembly stand and disassemble



Tools

- Commercial tools

- Special tools

- 6067 - Engine assembly block
- 6067/115 - Clamping holder
- 6067/114 - Support arm



Auxiliary material

- Lifting gear
- Support ropes
- Eyebolts



References

- W 13-03-02

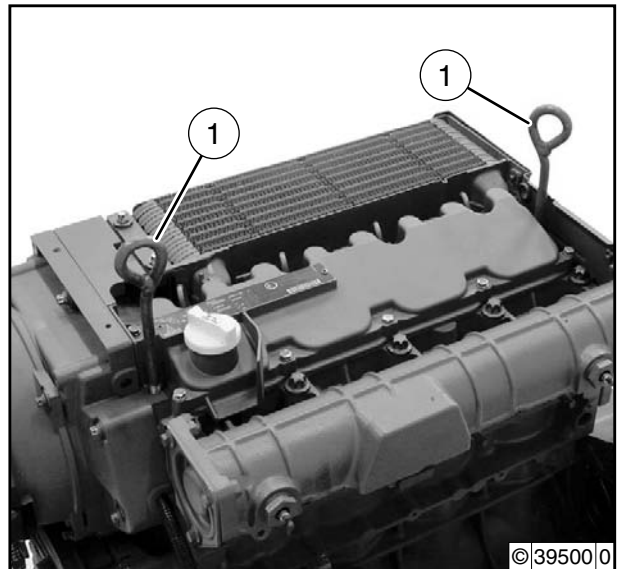


Note

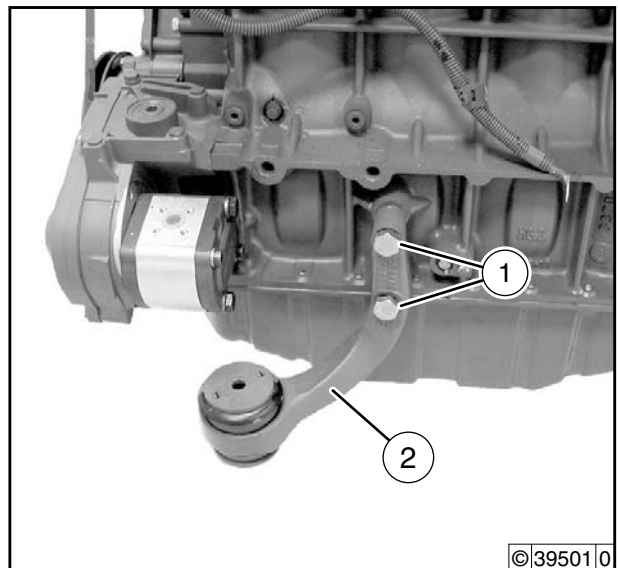
In the repair procedure shown here different customer scopes are not taken into consideration, i.e. add-on parts deviating from standard are not shown.

Assemble engine on engine block

- Remove starter
→ Job card W 13-03-02.
- Screw in eyebolt (1).
- Hang engine on suitable workshop crane.

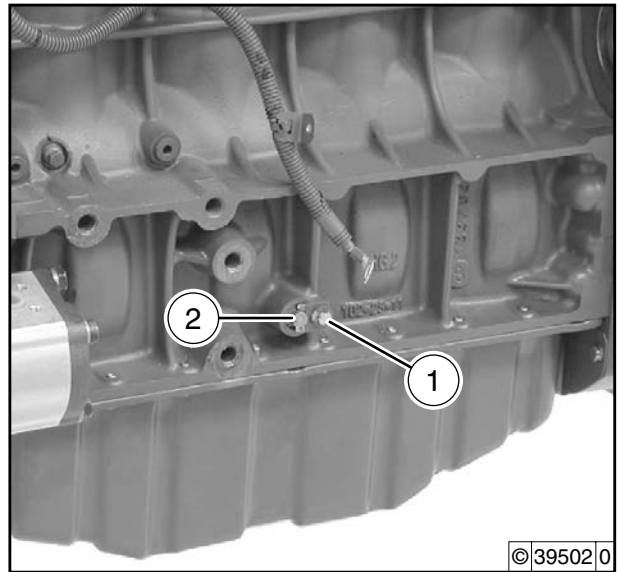


- Unscrew screws (1) and remove engine bearing (2) of the Manifold side.



In FL, FM engines

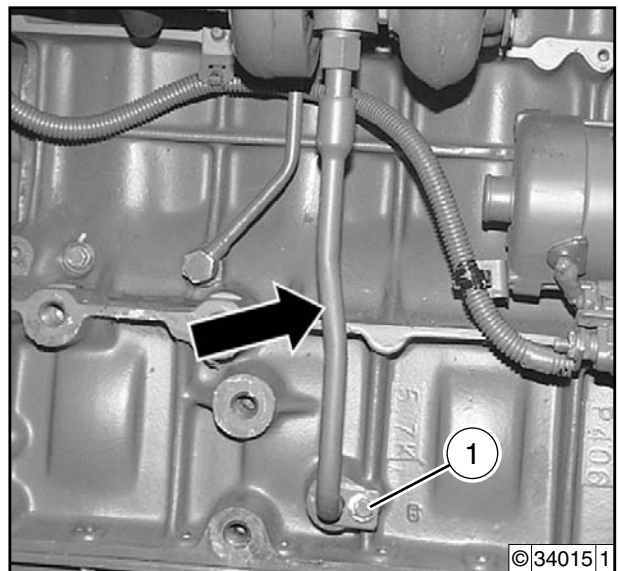
- Unscrew screw (1) and remove holder.
- Pull out stopper (2).



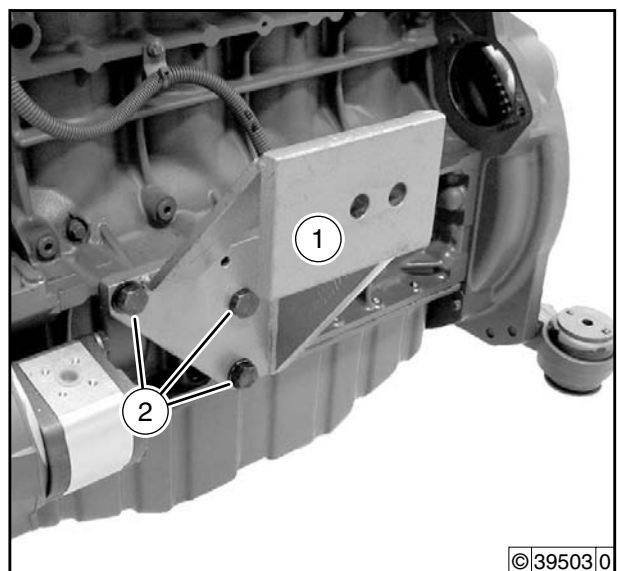
6

In BFL, BFM engines

- Unscrew screw (1) and remove holder.
- Remove oil return pipe (arrow).



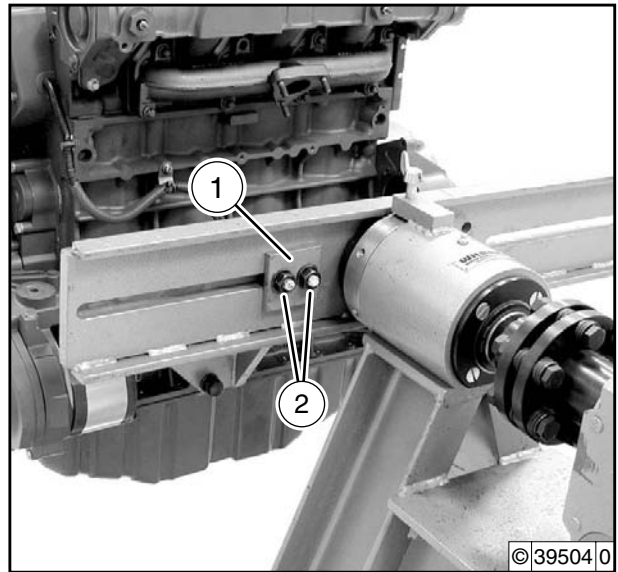
- Mount clamping holder (1) on the Manifold side and tighten screws (2).



- Mount clamping holder on engine assembly block.
- Fit counter plate (1).
- Insert screws and nuts (2).

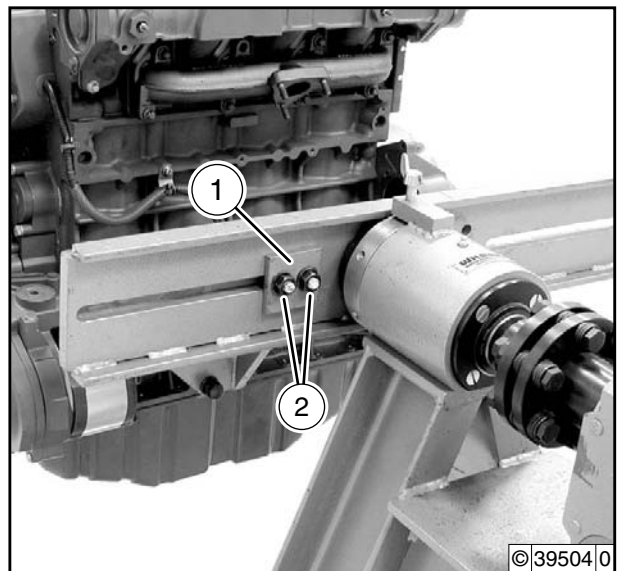


- Unhook engine from workshop crane and unscrew eyebolt.

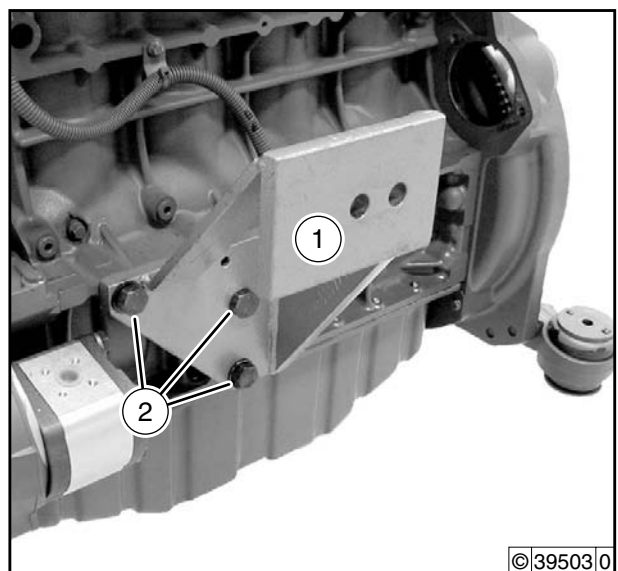


Remove engine from assembly block.

- Screw in eyebolt.
- Hang engine on suitable workshop crane.
- Unscrew nuts (2), remove counter plate (1) and bolts.

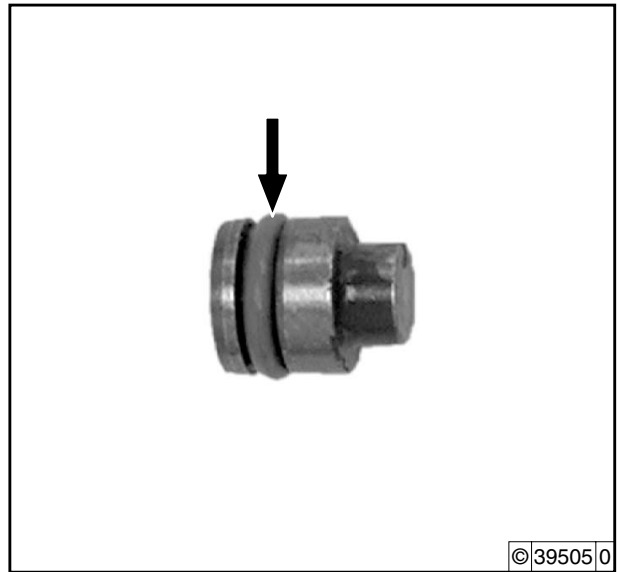


- Unscrew screws (2) and remove clamping holder (1).



In FL, FM engines

- Pull new round sealing ring (arrow) onto stopper.



6

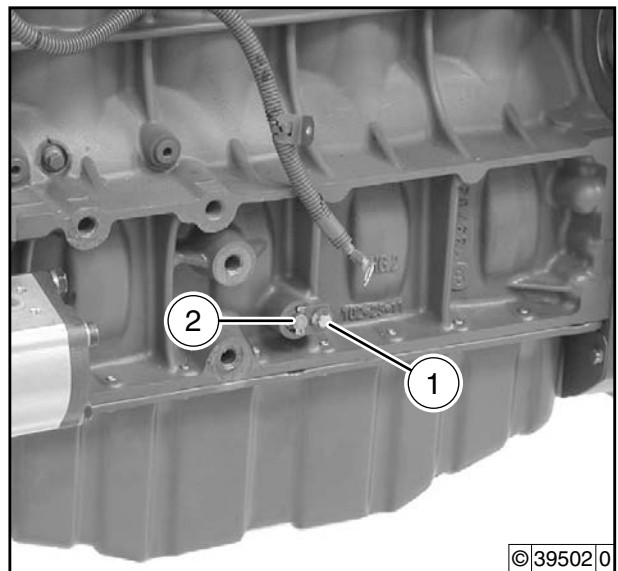
- Insert stopper (2).



Note

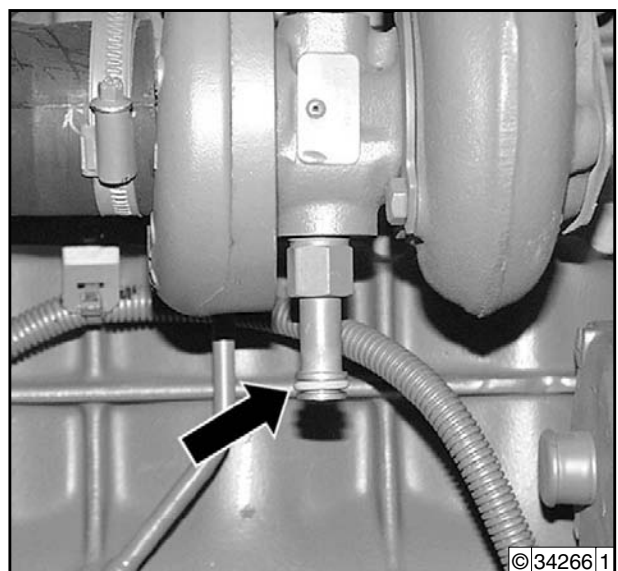
Oil round sealing ring lightly

- Mount holder and tighten screw (1).

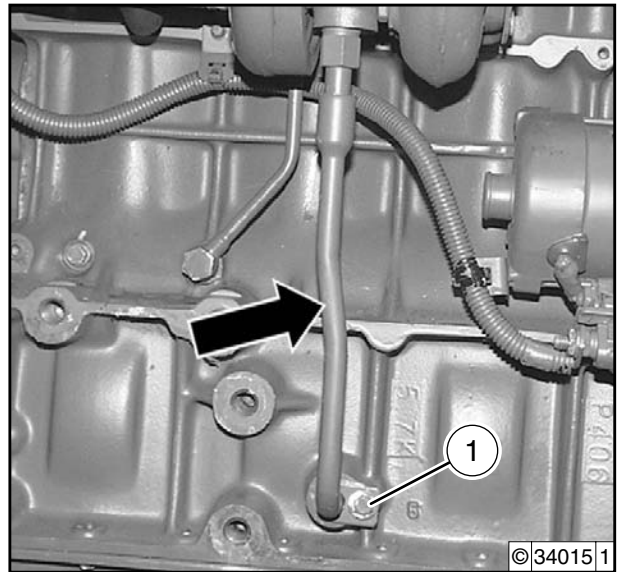


In BFL, BFM engines

- Pull new round sealing rings onto screwed socket (arrow) and oil return pipe.



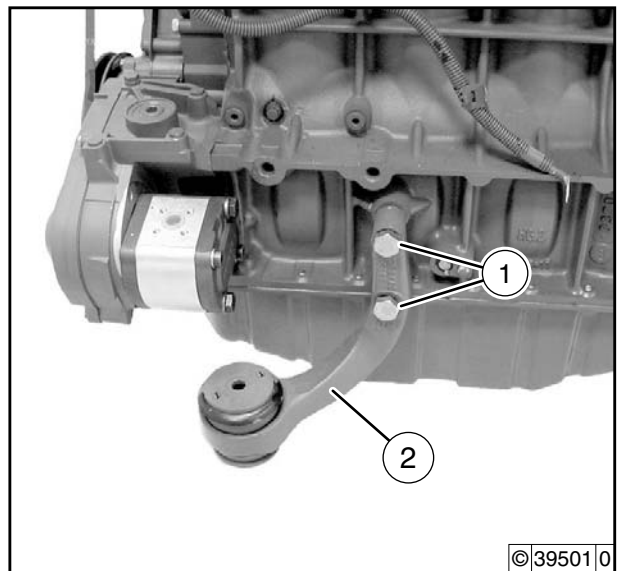
- Insert oil return pipe (arrow).
- Mount holder and tighten screw (1).



- Mount engine bearing (2) and tighten screws (1).



- Unhook engine from workshop crane and unscrew eyebolt.
- Install starter
→ Job card W 13-03-02





Notes

Check and set valve clearance



Tools

- Commercial tools
- Feeler gauges

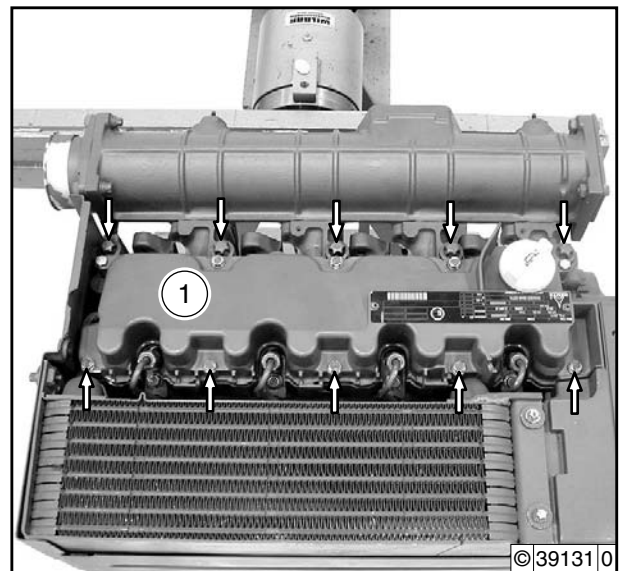


Note

- The standard valve clearance setting is possible:
- On cold or warm engine after a cooling time of at least 0.5 h.
 - Oil temperature < 80 °C.

Removal

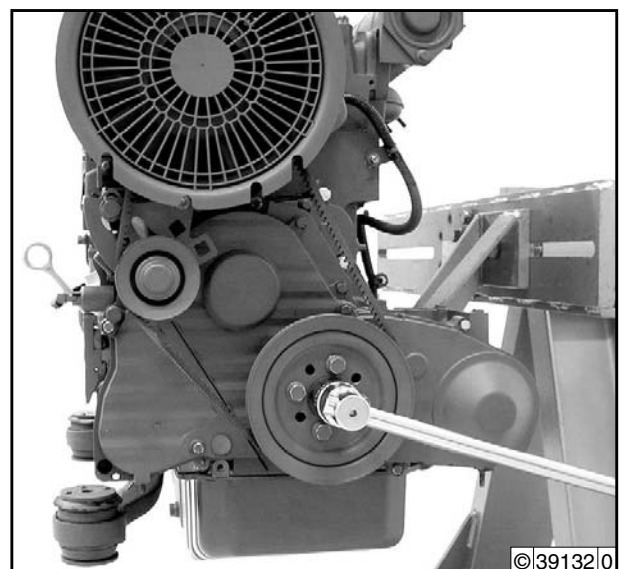
- Unscrew screws (arrows), remove starter cylinder head cover (1) and gasket.



6

Set engine to valve overlap

- Turn crankshaft until reaching valve overlap on cylinder no. 1.

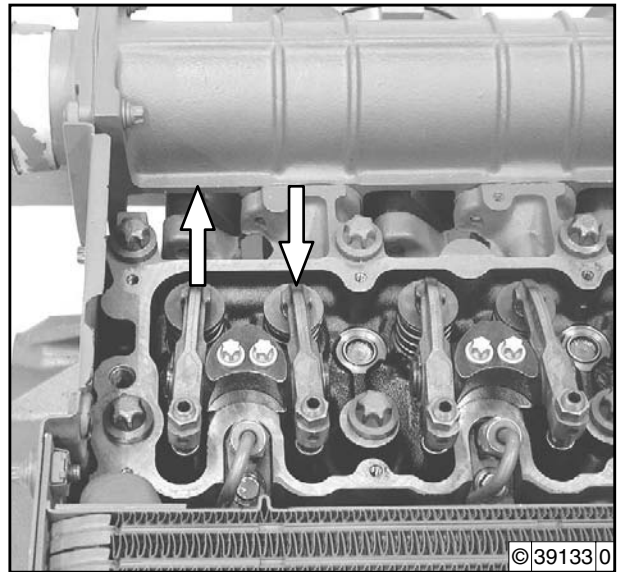




Note

Valve overlap means:

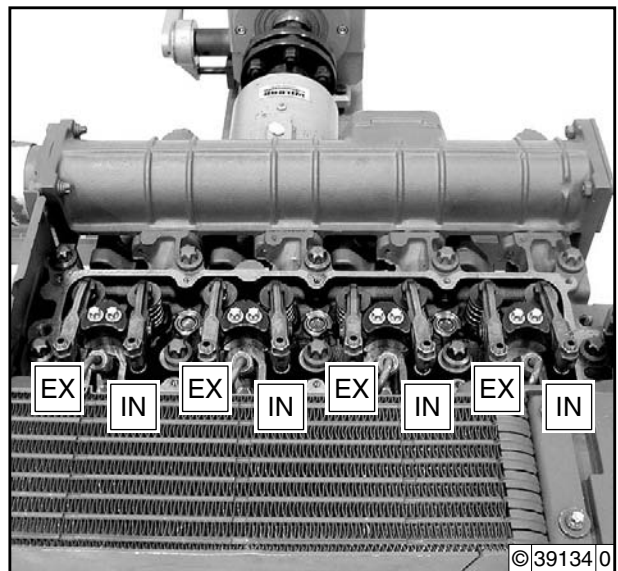
- Outlet valve not yet closed.
- The inlet valve starts opening.



6

Check valve clearance

- Arrangement of inlet and outlet valves.
 - IN = inlet valve
 - EX = outlet valve

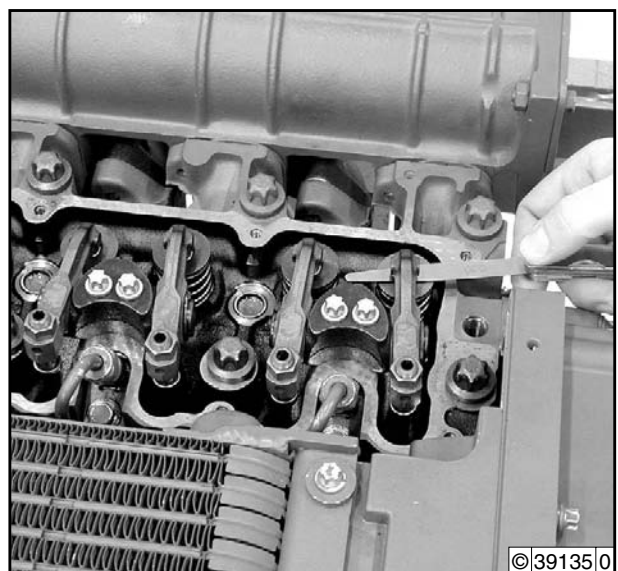


- Check valve clearance setting with feeler gauge blade on the appropriate cylinder.



Note

The feeler gauge blade must go between the toggle lever sliding surface and the valve with little resistance.



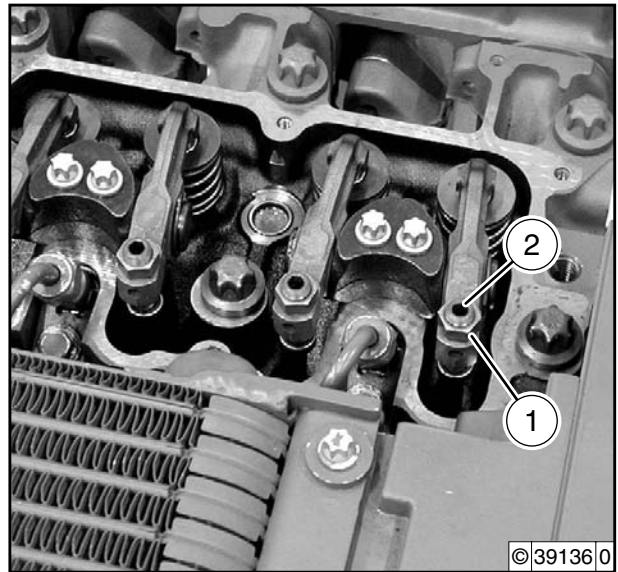
Setting valve clearance

- Loosen lock nut (1).
- Correct valve clearance by turning the setting screw (2).



Note

- If valve clearance is too small, unscrew the setting screw.
- If valve clearance is too great, screw in the setting screw.



- Tighten lock nut (1).

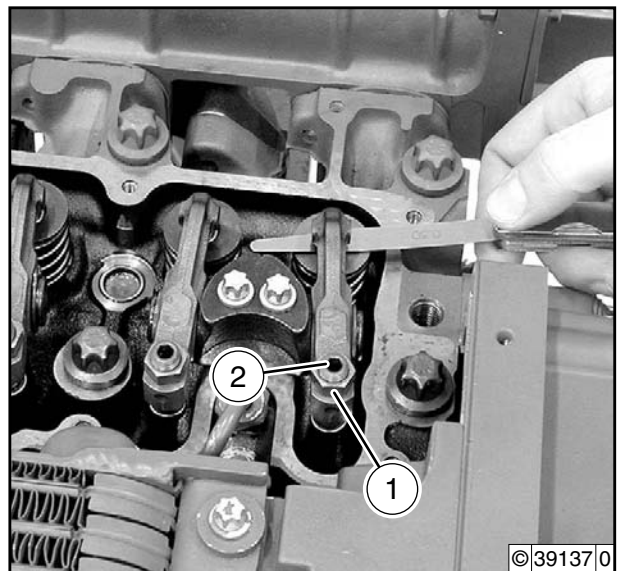


Note

Do not turn the setting screw (2) when tightening the lock nut.



- Check the valve clearance again with a feeler gauge blade.



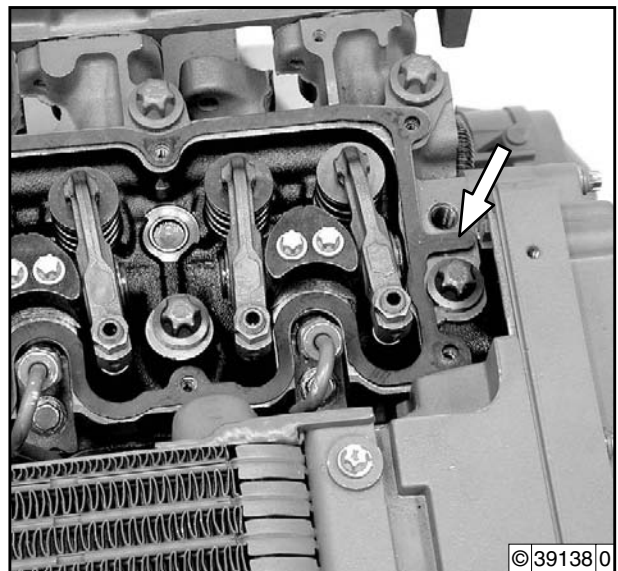
Assembly

- Clean the sealing surface on the cylinder head cover and cylinder head.
- Fit gasket.



Note

Note installation position, the gate (arrow) must face the front cover.



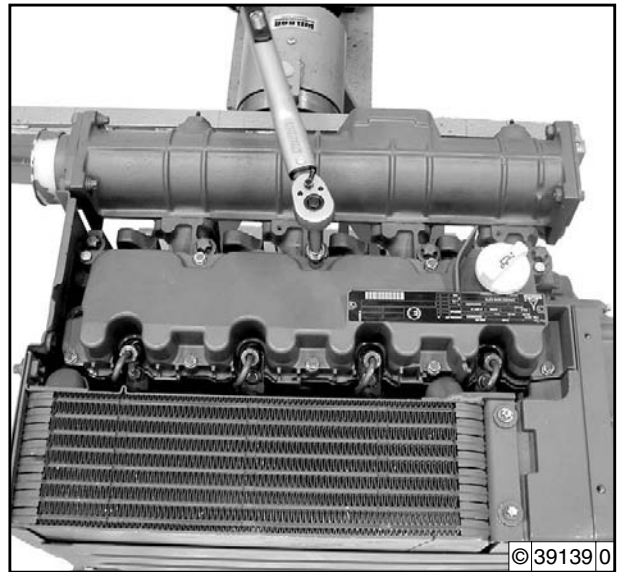
Cylinder head

W 01-01-01

2011



- Mount cylinder head cover and tighten screws alternately.



Remove and install toggle lever and toggle lever block



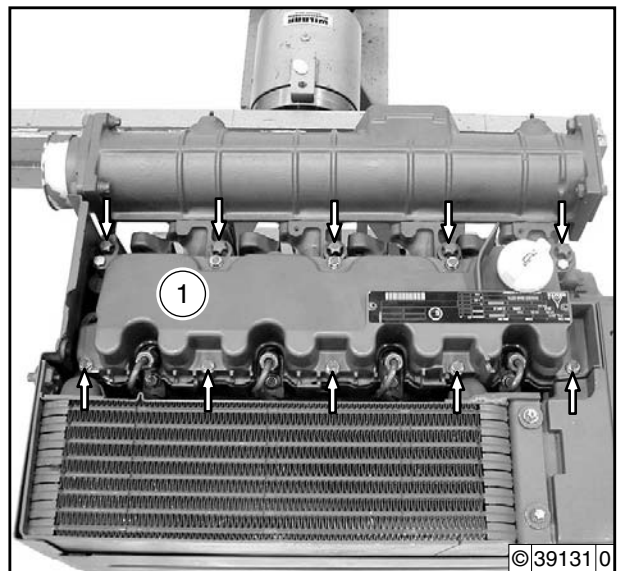
Tools
- Commercial tools



References
- W 01-01-01

Remove toggle lever and toggle lever block

- Unscrew screws (arrows).
Remove cylinder head cover (1) and gasket.

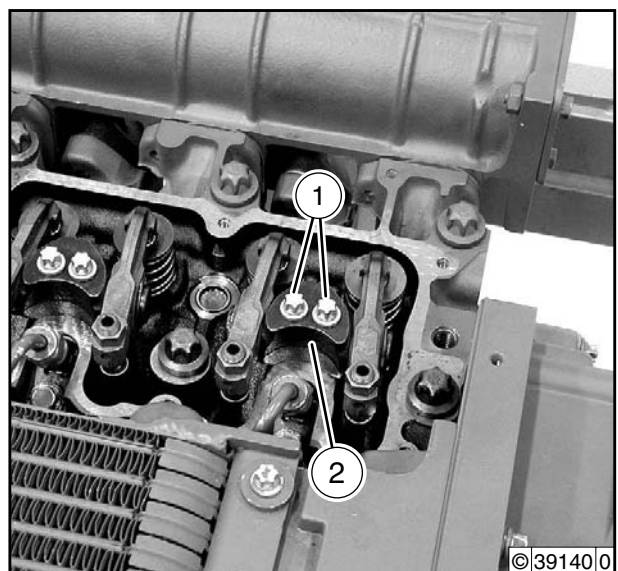


- Unscrew screws (1) and remove toggle lever with toggle lever block (2).



Note

- Loosen screws evenly to avoid jamming the toggle lever blocks.
- Set down the components in the order of installation.



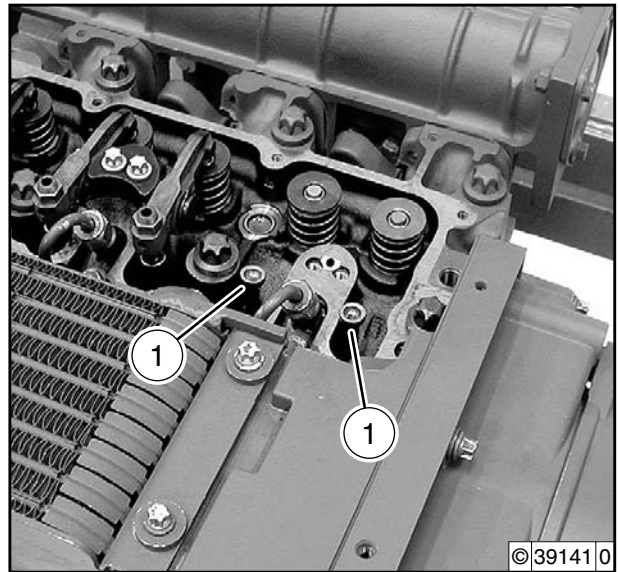
- Remove stop rods (1).



Note

Set down the components in the order of installation.

- Check stop rods for visible signs of damage.



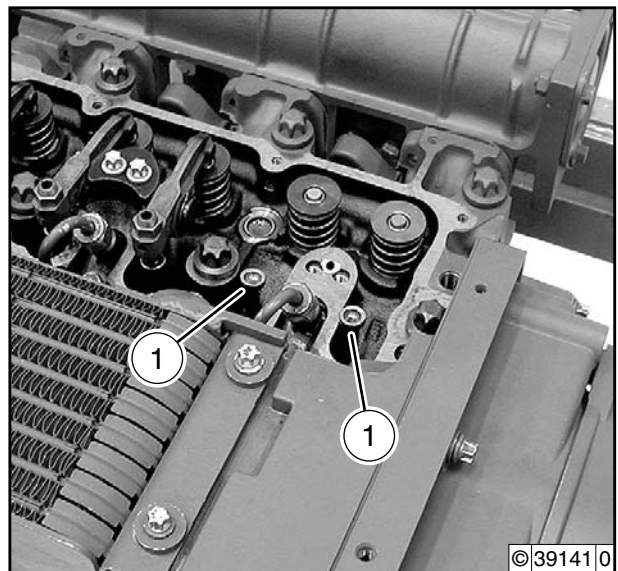
6

- Insert stop rods (1).



Note

- Note the assignment of the stop rods.
- The stop rod must be seated in the socket of the ram with the ball head.



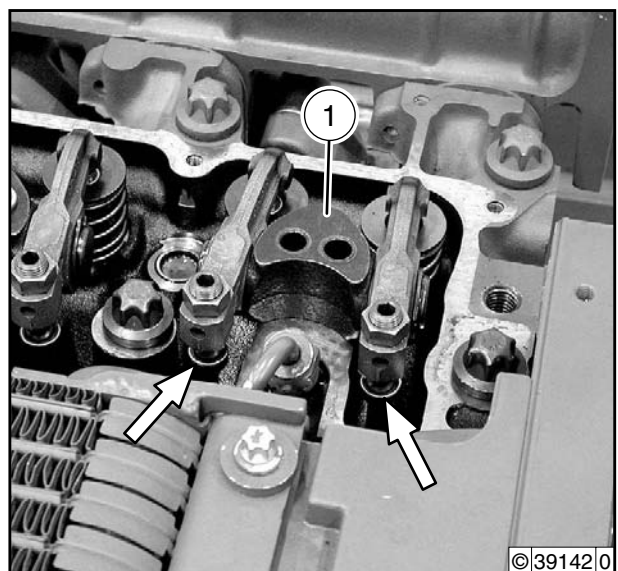
Install toggle lever and toggle lever block

- Loosen the lock nuts of the setting screws and turn back the setting screws.
- Mount toggle lever block (1).



Note

The ball heads must be seated in the sockets of the stop rods (arrows).



- Tighten (1) screws alternately.

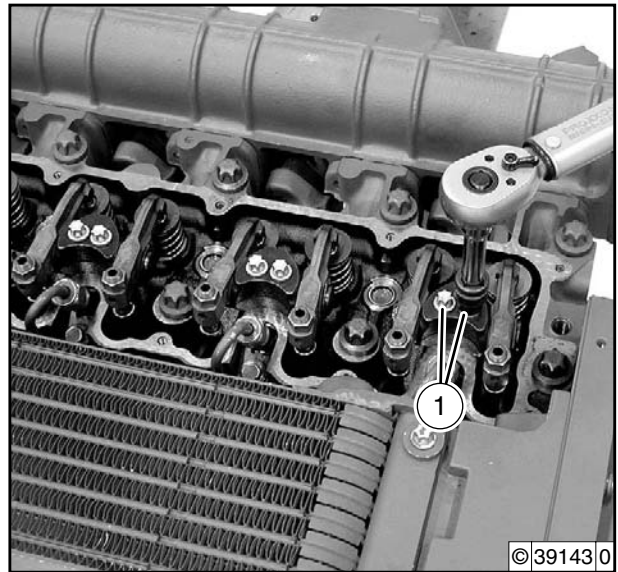


Note

- Make sure that the stop rods are not under stress due to valve overlap when tightening the bolts.
- Align toggle lever to the stop rods/valves.



- Check and set valve clearance
→ Job card W 01-01-01.

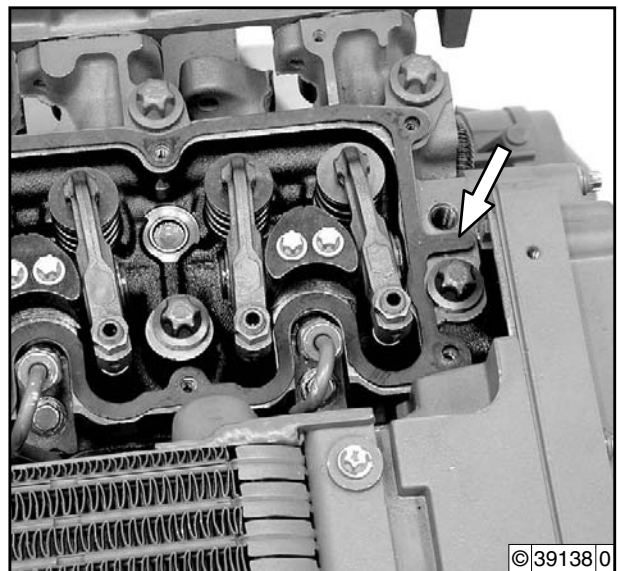


- Clean the sealing surface on the cylinder head cover and cylinder head.
- Fit gasket.

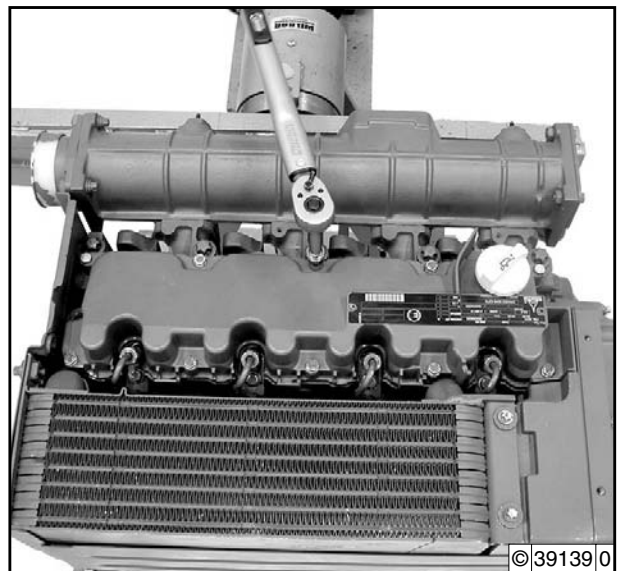


Note

Note installation position, the gate (arrow) must face the front cover.



- Mount cylinder head cover and tighten screws alternately.





Notes

Disassemble and complete, check toggle lever and toggle lever block



Tools

- Commercial tools
- Internal measuring device
- Micrometer gauge

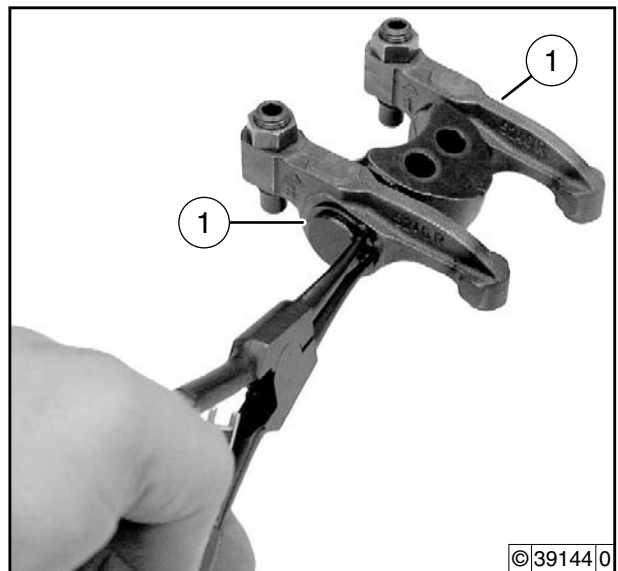


References

- W 01-02-02

Dismantle toggle lever block

- Remove toggle lever and toggle lever block
→ Job card W 01-02-02.
- Remove locking rings (1).



- Remove toggle lever.



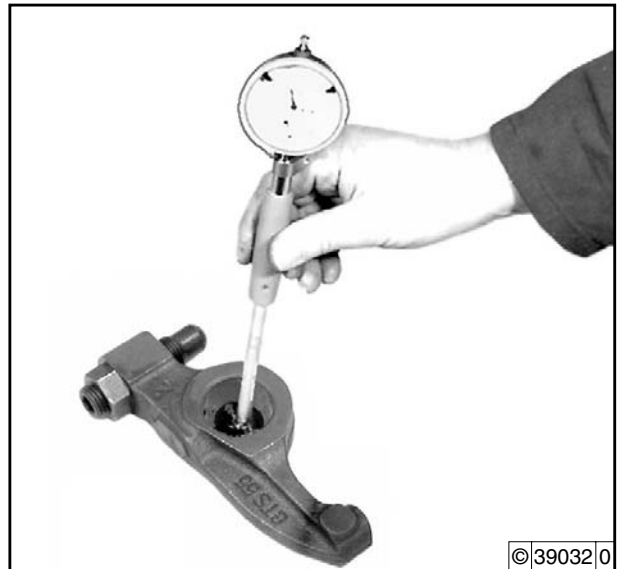
Check toggle lever

- Measure toggle lever bore with internal measuring device.



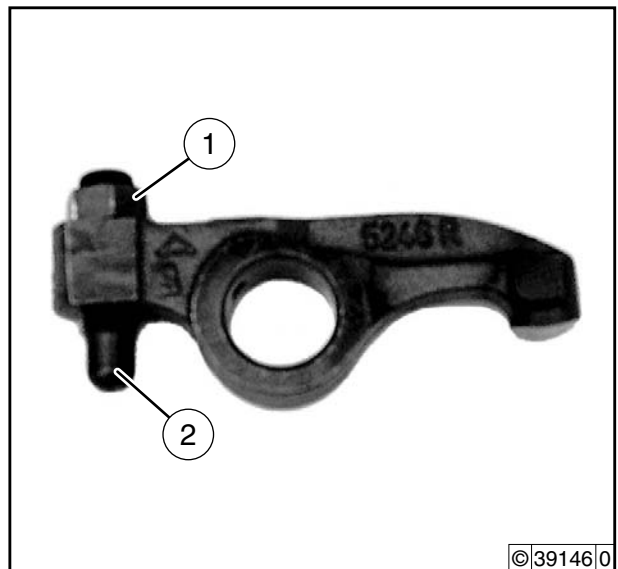
Note

If the wear limit is reached, change the toggle lever.

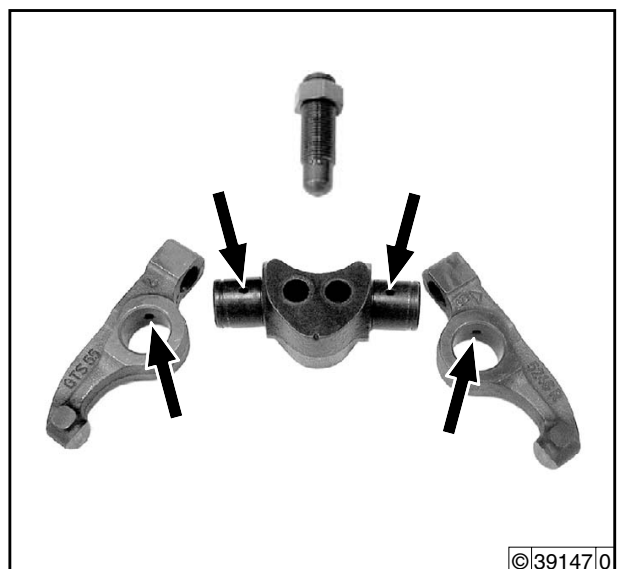


6

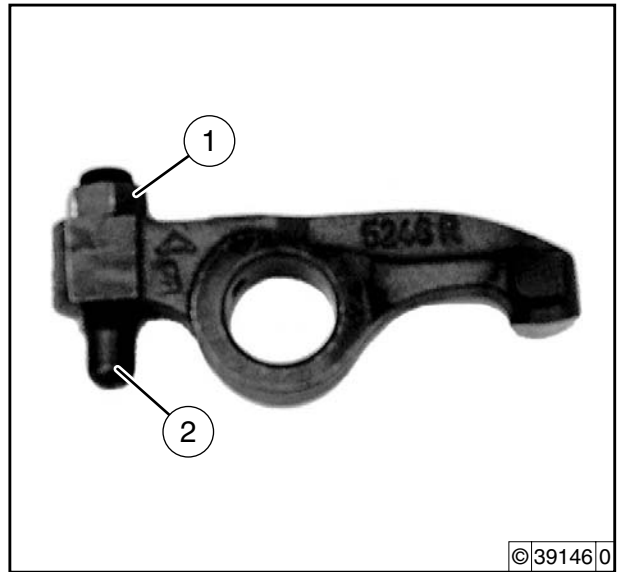
- Unscrew lock nut (1) and turn out setting screw (1).



- Check components for visible signs of wear.
- Check oil channels (arrows) for free passage.



- Turn setting screw (2) into the toggle lever and tighten the lock nut (1).



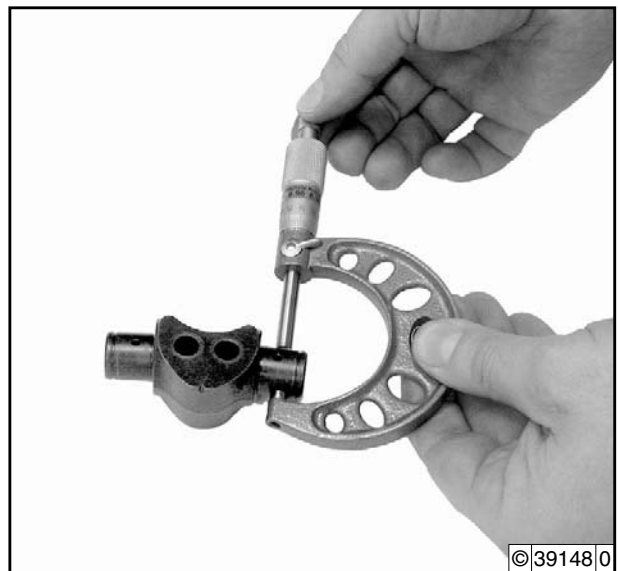
Check the toggle lever axis

- Measure toggle lever diameter with micrometer gauge.



Note

If the wear limit is reached, the toggle lever block has to be changed.



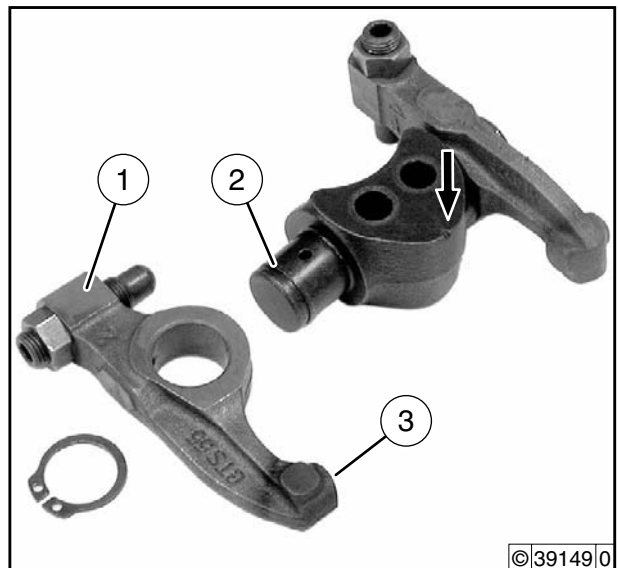
Complete the toggle lever block

- Push toggle lever (1) onto the toggle lever axle (2).



Note

- Oil the toggle lever axle (2) lightly.
- The toggle lever sliding surface (3) must face the side with the notch (arrow).



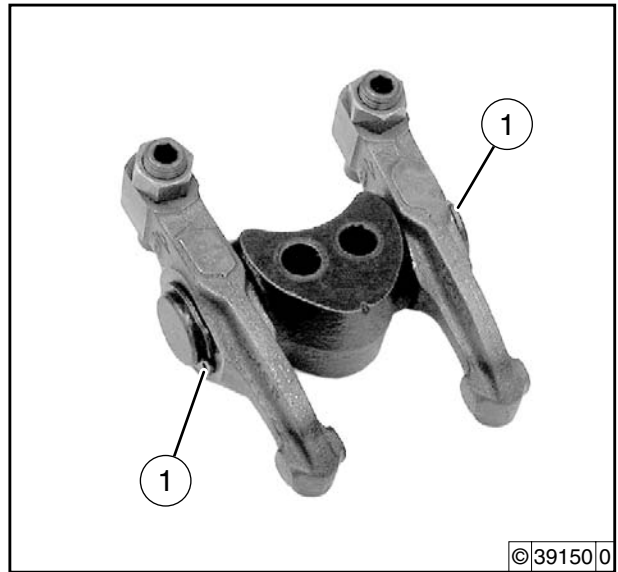
- Install locking rings (1).



Note

Pay attention to correct fit of the locking ring in the groove.

- Install toggle lever and toggle lever block
→ Job card **W 01-02-02**.



Remove and install cylinder head



Tools

- Commercial tools

8189 - Torx tool kit

- Special tools

100 400 - Meter

100 750 - Measuring device



References

- W 01-02-02

- W 06-07-03

- W 07-07-01

- W 09-11-01

- W 13-02-03

Remove cylinder head

- Remove air intake pipe
→ Job card **W 06-07-03**.
- Remove injection valve
→ Job card **W 07-07-01**.
- Remove toggle lever and toggle lever block
→ Job card **W 01-02-02**.

In FM, BFM engines

- Remove generator
→ Job card **W 13-02-03**.



In FL, BFL engines

- Remove cooling blower
→ Job card **W 09-11-01**.

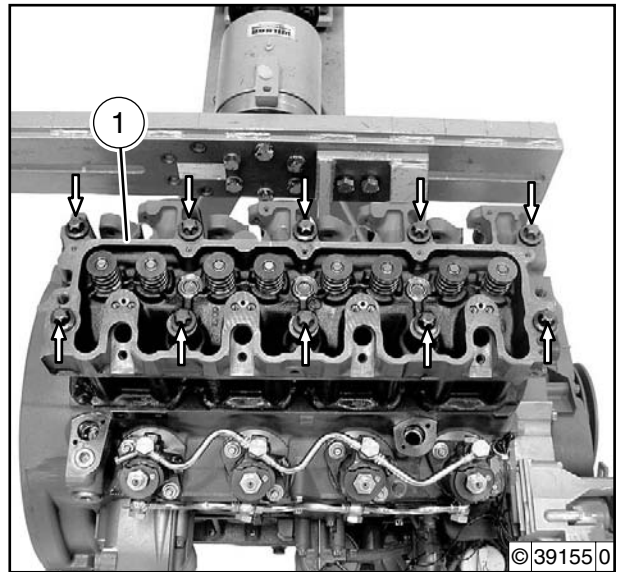


Note

Put down the components in the order of installation, note order of cylinders.



- Unscrew screws (arrows), remove cylinder head (1) and gasket.
- Clean sealing surfaces on cylinder head and crankcase.



6

Determine cylinder head gasket



Note

- The piston overlap must be measured on all pistons to determine the cylinder head gasket.
- The cylinder head gasket must be selected according to the greatest measured piston overlap.



Determine piston UT

- Turn crankshaft until the piston closes flush with the crankcase.

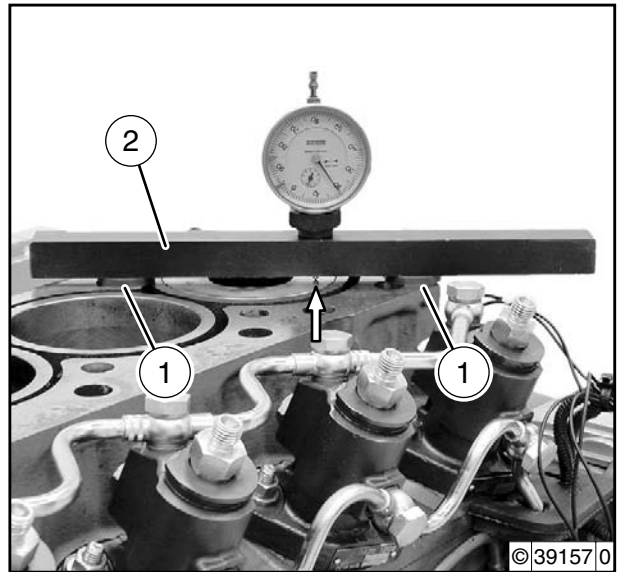


Note

- Turn crankshaft in direction of rotation of engine.

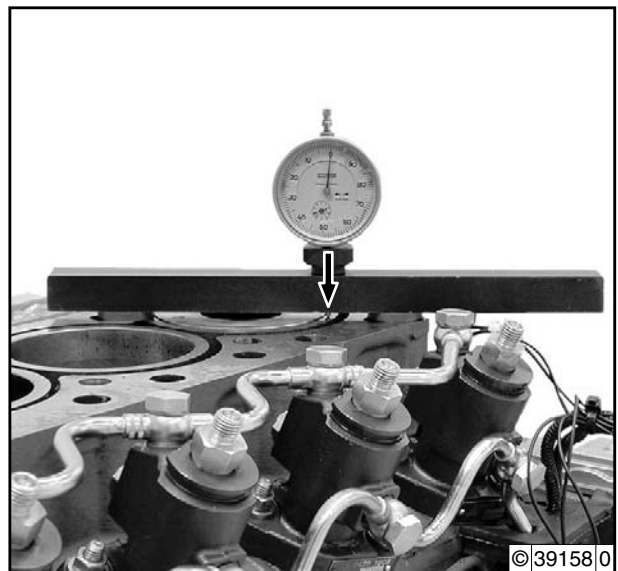


- Mount shim (1) and measuring bridge (2) on crankcase.
- Insert meter in measuring bridge and position the stylus with pre-tension on the piston base (arrow).
- Turn the crankshaft on evenly until the reversal point of the pointer on the meter is reached. The piston is now in UT.



Determine piston overlap

- Move measuring bridge and shim.
- Place the stylus of the meter under pre-tension on the sealing surface of the crankcase (arrow).
- Adjust meter to "0".

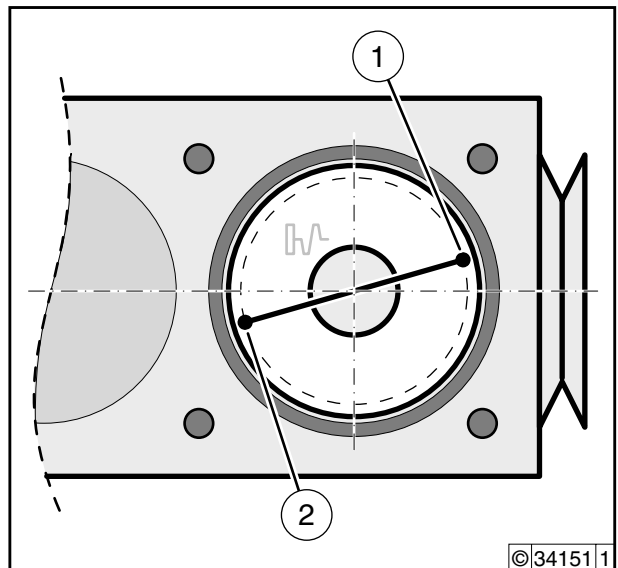


- Read measuring points.



Note

Schematic representation for measuring the piston overlap at the points "1" and "2".



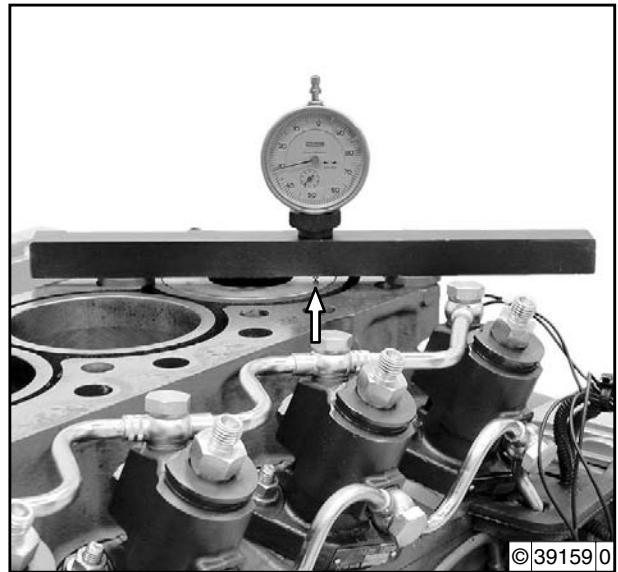
- Move the measuring bridge on the shims so that the stylus is applied to the specified measuring points.



Note

- Measuring points, see schematic diagram.
- The stylus may not be positioned on the labeling of the piston.

- Note the greatest measured value.

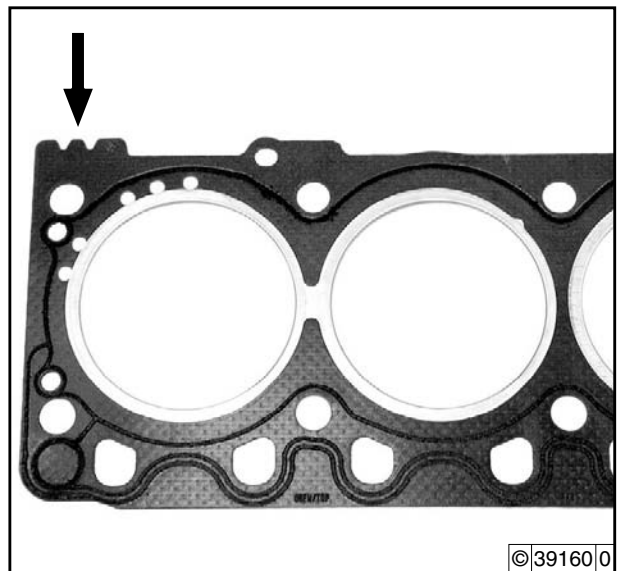


6

- Select the cylinder head gasket according to the greatest measured piston overlap.

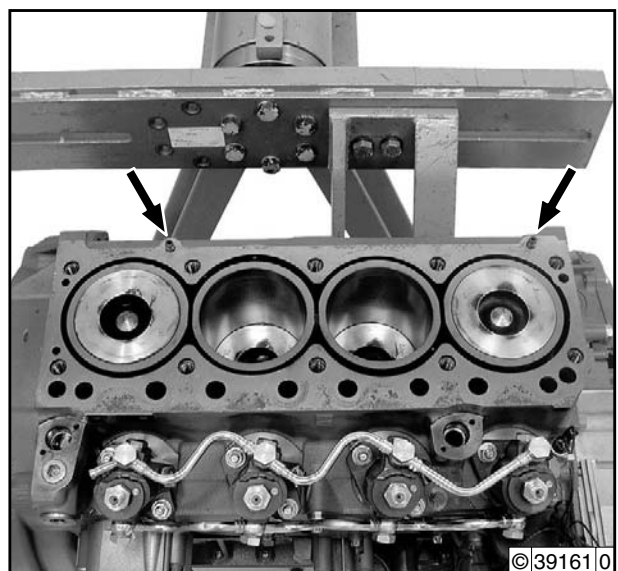


- Example: **Piston overlap = 0.73 mm**, corresponds to cylinder head gasket with **2 notches** (arrow).



Install cylinder head

- Make sure the clamping pins (arrows) are in place.

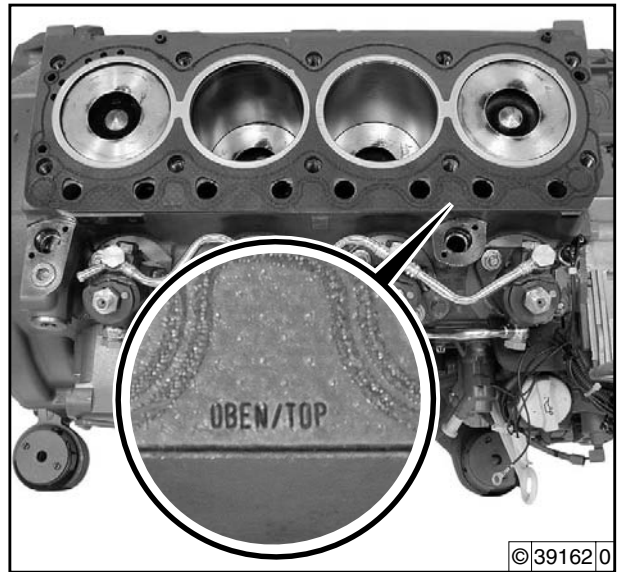


- Mount new cylinder head gasket.



Note

- Sealing surfaces for the cylinder head gasket must be clean and free of oil.
- Identification "OBEN / TOP" must face up.

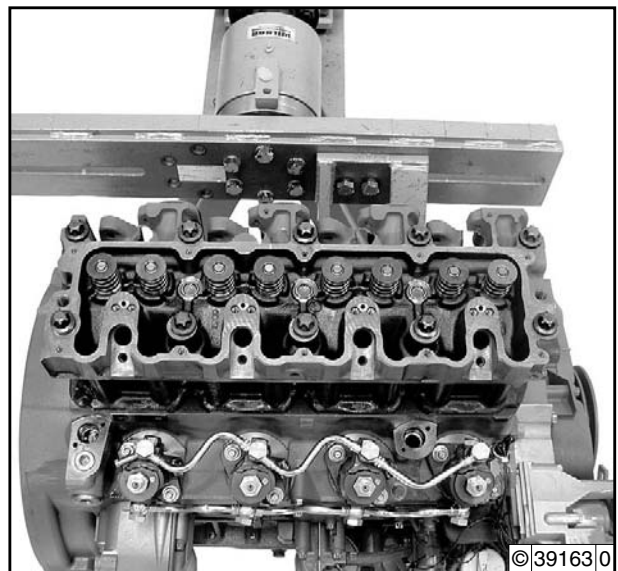


- Mount cylinder head, oil cylinder head bolts lightly and tighten.



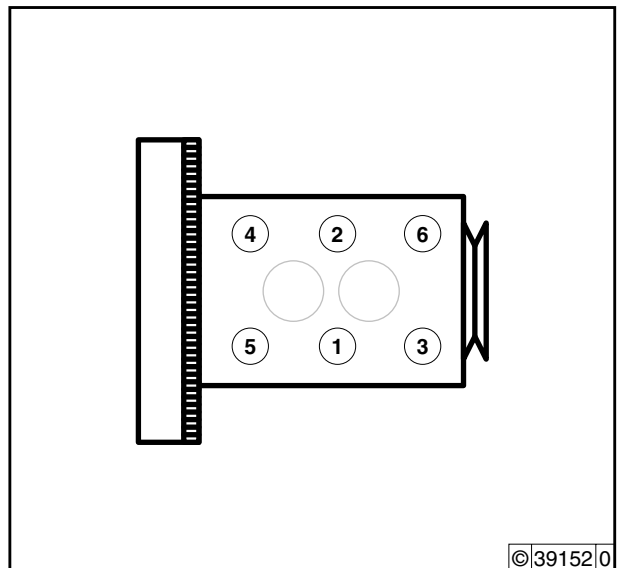
Note

- Cylinder head bolts can be used a maximum 5 times in case of provability.



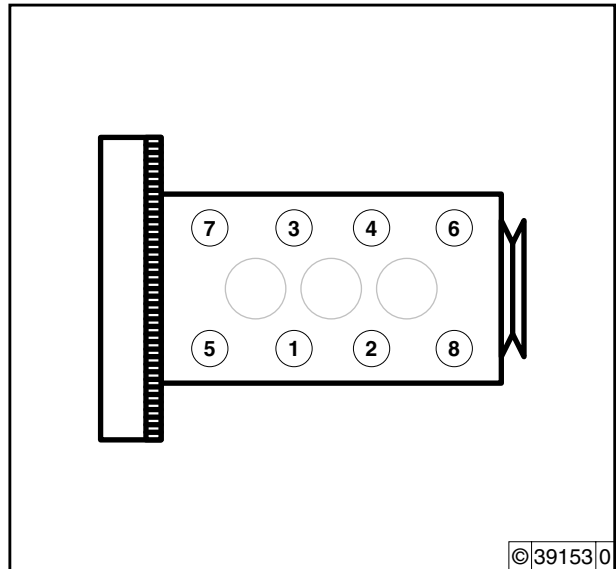
Tightening order 2-cylinder

- Tighten all bolts in the right order.



Tightening order 3-cylinder

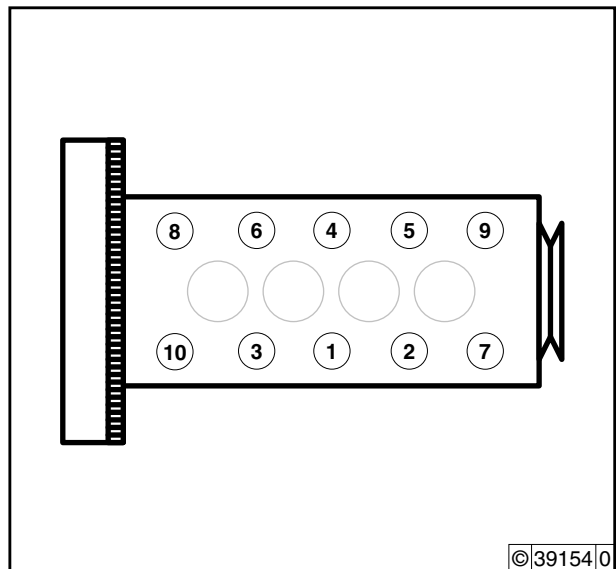
- Tighten all bolts in the right order.



6

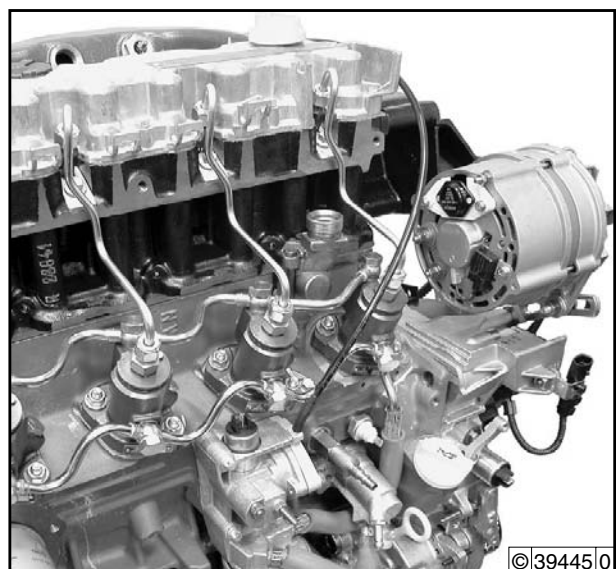
Tightening order 4-cylinder

- Tighten all bolts in the right order.



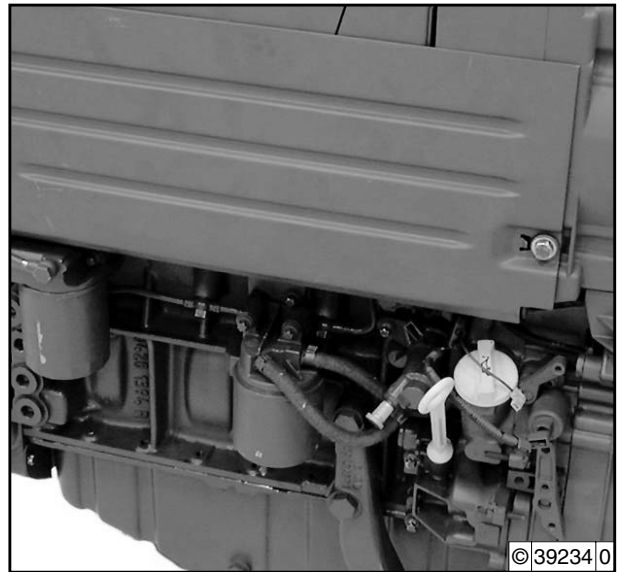
In FM, BFM engines

- Install generator
→ Job card W 13-02-03.



In FL, BFL engines

- Install cooling blower
→ Job card **W 09-11-01**.
- Install toggle lever and toggle lever block
→ Job card **W 01-02-02**.
- Install injection valve
→ Job card **W 07-07-01**.
- Install air intake pipe
→ Job card **W 06-07-03**.





Notes

Remove and install valves



Tools

- Commercial tools

- Caliper gauge
- 8024 - Assembly pliers
- 9017 - Assembly lever

- Special tools

- 120 900 - Clamping block
- 120 910 - Clamping plate
- 121 410 - Assembly tool

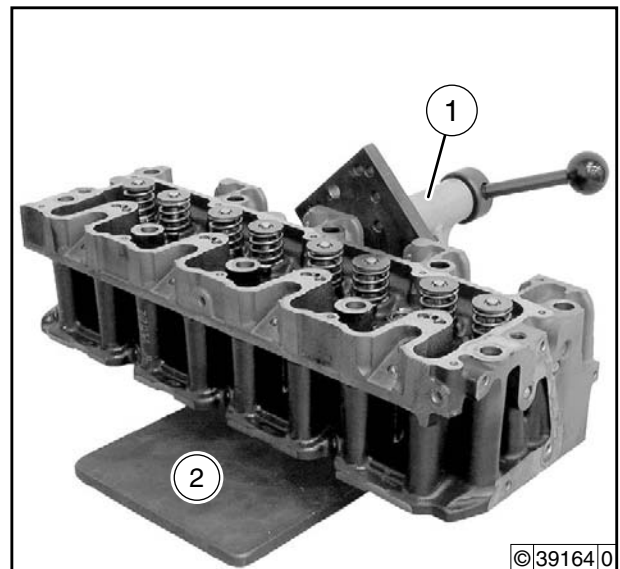


References

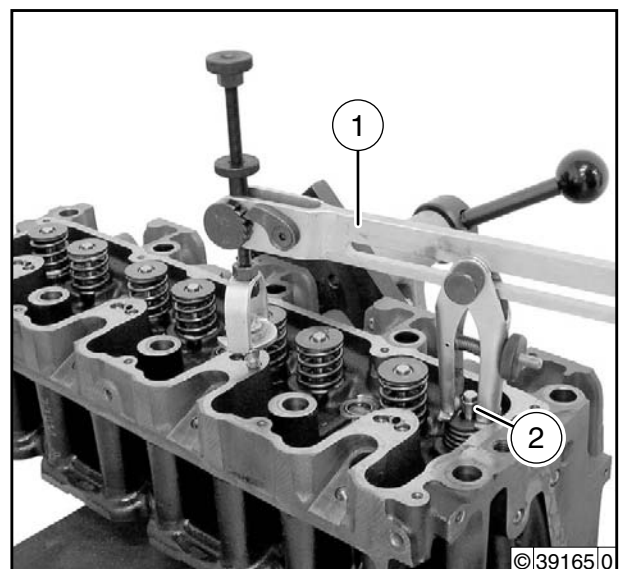
- W 01-04-04

Remove valves

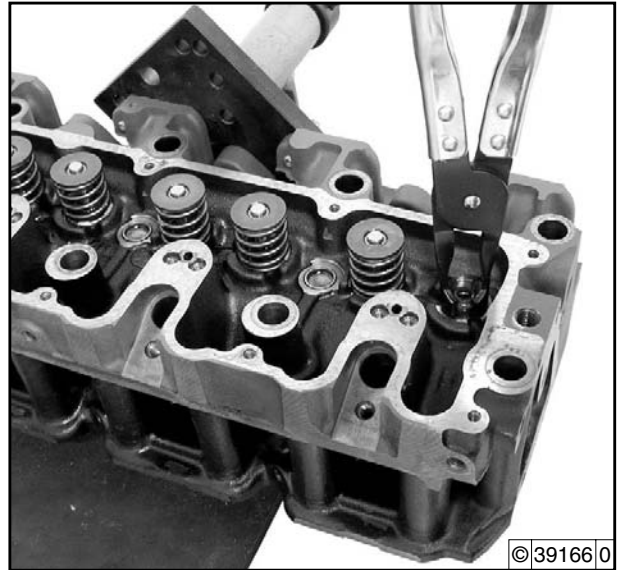
- Remove cylinder head
→ Job card **W 01-04-04**.
- Install clamping block (1) on clamping plate (2).
- Install cylinder head on clamping block.



- Install valve assembly lever (1).
- Press down the valve spring with the valve assembly lever and remove both clamping cones (2).
- Remove valve spring plates, valve springs and valves.
- Remove valve assembly lever.



- Remove valve shaft seal with valve sealing ring pliers.



6

- Clean cylinder head, check and inspect for damage.
- Check components for visible signs of damage.



Install valves

- Measure valve spring length with caliper gauge.



Note

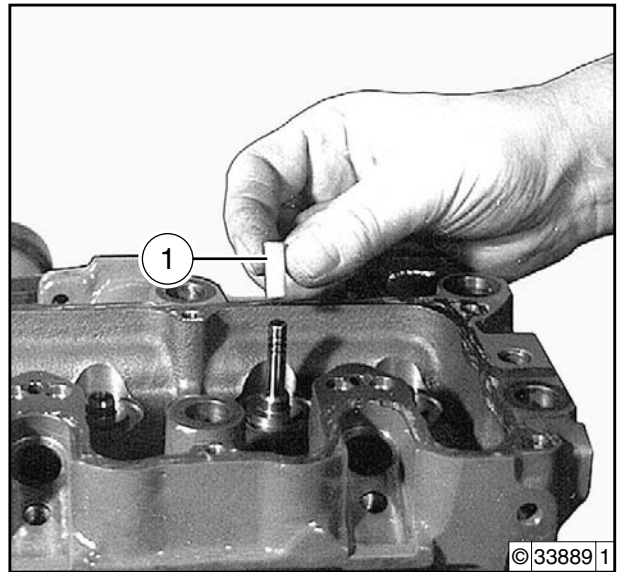
If the wear limit is reached, the valve spring has to be changed.



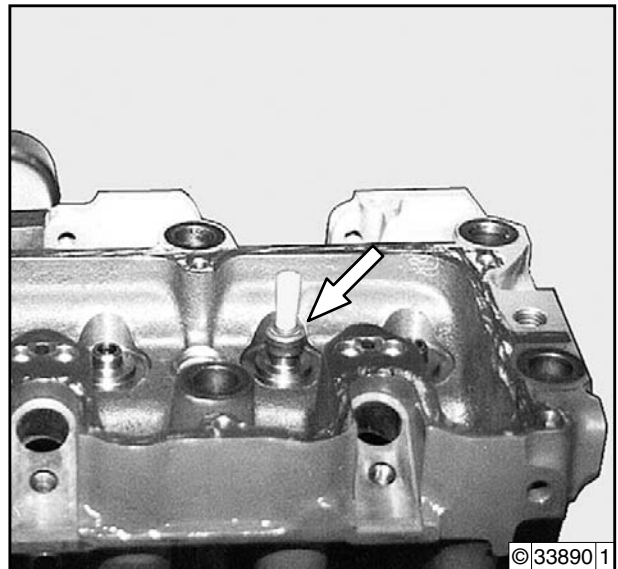
- Insert valve, hold tight and push the protective sleeve (1) onto the valve shaft.

**Note**

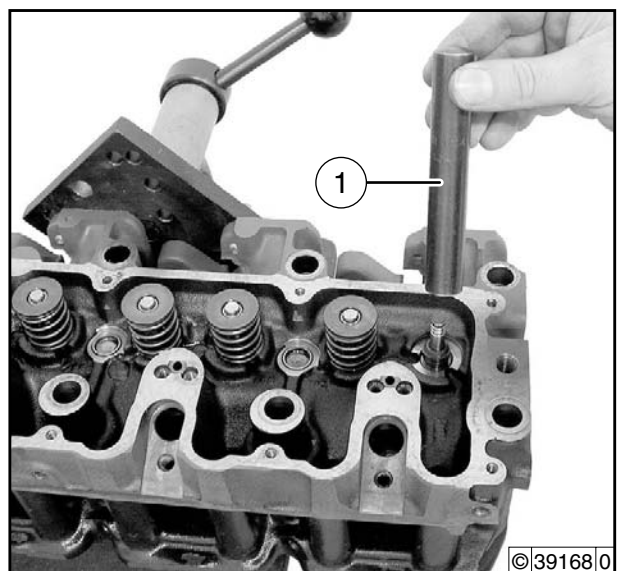
- Oil the valve shaft slightly.
- Cover the valve V-grooves with the protective sleeve (1) or adhesive foil before installing the valve shaft seal every time.



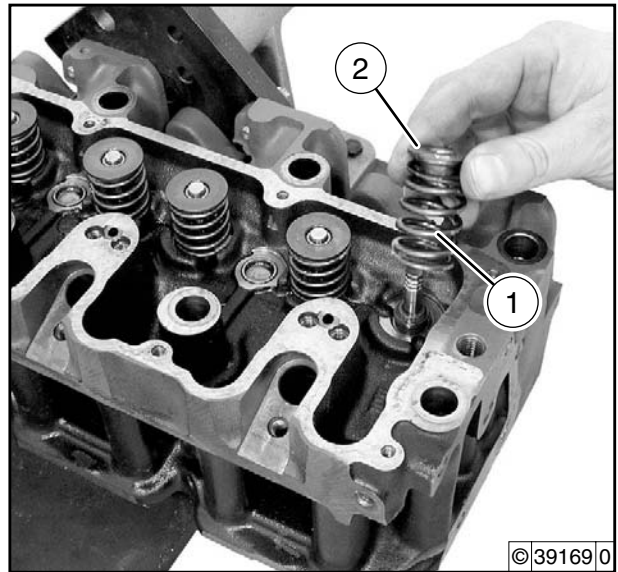
- Push the new valve shaft seal over the protective sleeve (arrow).



- Remove the protective sleeve.
- Press the valve shaft seal in with the assembly tool (1) until it touches.



- Insert valve spring (1) and valve spring head (2).



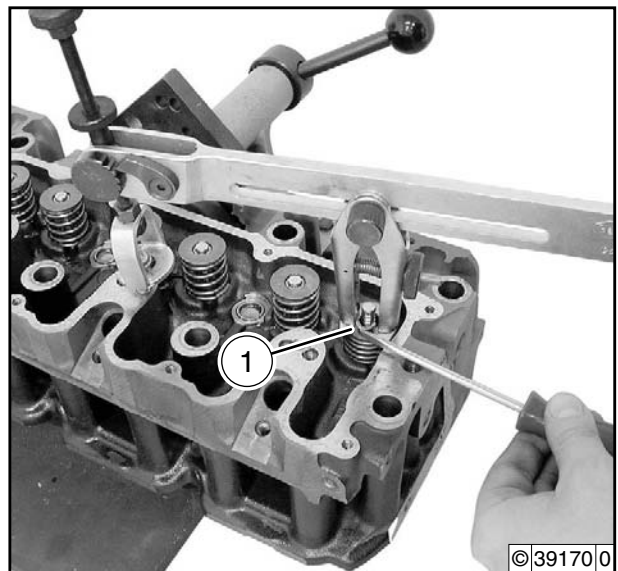
6

- Install valve assembly lever.
- Press down the valve spring with the valve assembly lever and insert both clamping cones (1).

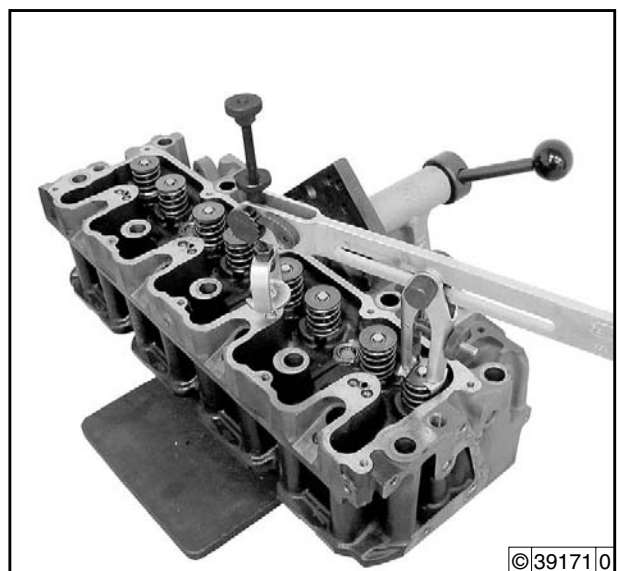


Note

Pay attention to correct fit of the clamping cones in the valve V-groove.



- Remove valve assembly lever
- Remove cylinder head from clamping block.
- Install cylinder head
→ Job card **W 01-04-04**.



Check valves



Tools

- Commercial tools
- Micrometer gauge
- Caliper gauge



References

- W 01-05-01



Note

- Clean all valves.
- If the wear limit is reached, the valve has to be changed.

Valve shaft diameter

- Remove valves
→ Job card **W 01-05-01**.
- Measure valve shaft diameter with micrometer screw.



©42182 0

Valve edge strength

- Measure valve edge thickness with caliper gauge.



©42183 0

Valve plate diameter

- Measure head diameter with caliper gauge.



- Install valves
→ Job card **W 01-05-01**.



Check valve guide



Tools

- **Commercial tools**
Magnetic measuring stand

- **Special tools**
100 400 - Meter



References

- W 01-05-01

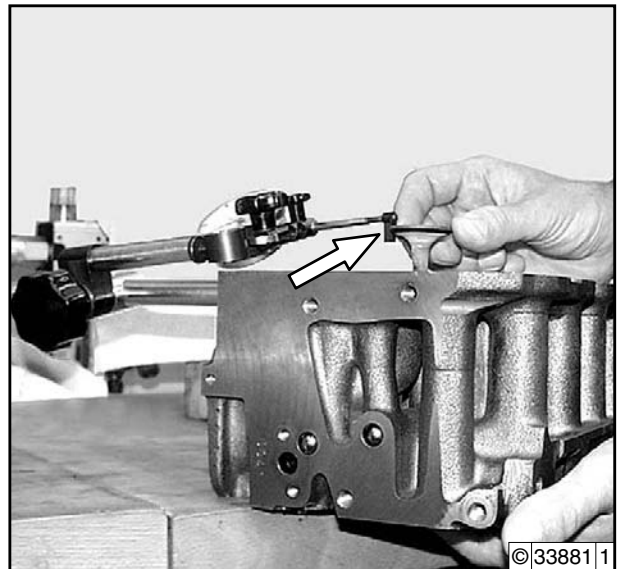


Note

- New valves are used for testing.
- If the wear limit is reached, the valve guide has to be changed.

Check valve guide

- Remove valves
→ Job card **W 01-05-01**.
- Check valve guide for visible signs of wear.
- Attach magnetic measuring stand and insert meter.
- Insert new valve.
- Apply stylus to the valve head with pre-tension (arrow) and set meter to "0".



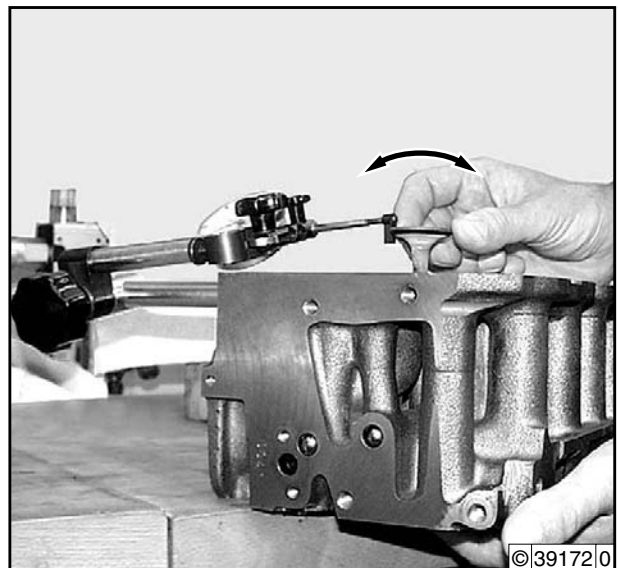
Measure valve shaft clearance

- Move valve to and fro in direction of arrow.



Note

- The end of the valve shaft must be flush with the valve guide to measure the valve shaft clearance.
- The whole tilt angle must be taken into consideration.



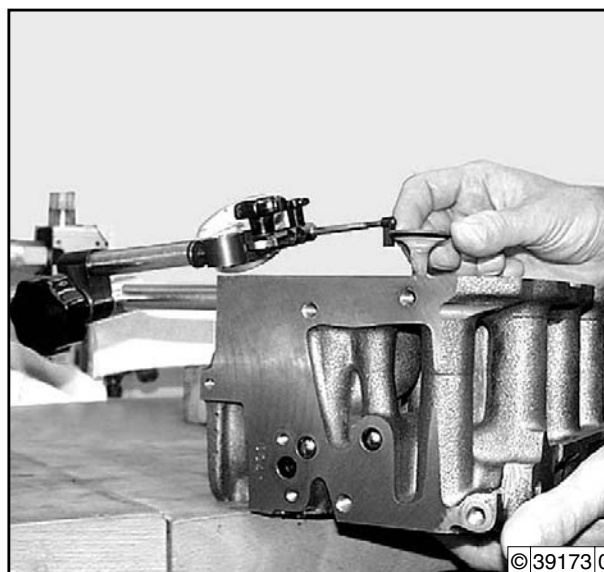
Cylinder head

W 01-06-03

2011



- Remove magnetic measuring stand and meter.
- Install valves
 - ➔ Job card W 01-05-01.



6

Machine valve seat ring



Tools

- Commercial tools
- Caliper gauge
- Valve seat rotating device



References

- W 01-05-01
- W 01-07-08



Note

- The valve seat ring must be reworked in the installed state in the cylinder head.
- For handling the valve seat rotating device, observe the respective manufacturer's operating manual.

Check valve seat ring

- Check valve lag
→ Job card W 01-07-08.
- Remove valves and valve shaft seals
→ Job card W 01-05-01.



- Check valve seat rings for tight fit and damage.



Note

If the wear limit of valve seat and valve lag is not yet reached and there are no burn-throughs, blow-throughs, tears or marks, it is possible to rework the valve seat ring for further use.



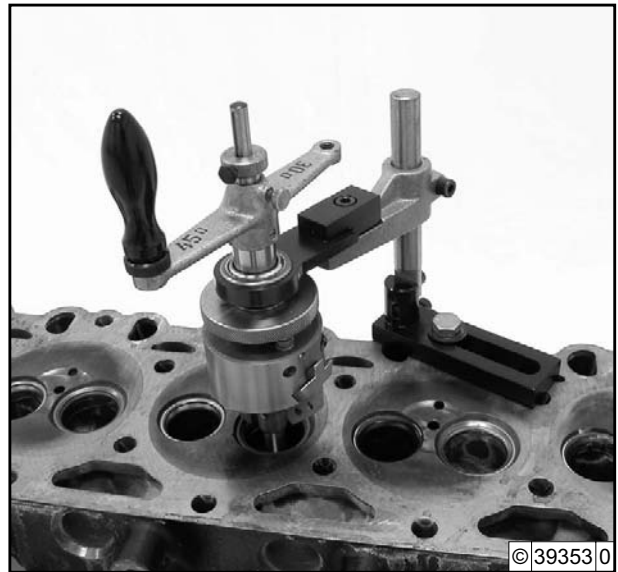
Machine valve seat ring

- Install valve seat rotating device



Note

Observe different valve seat angles.



6

- Turn out the valve seat carefully until it is level all round.

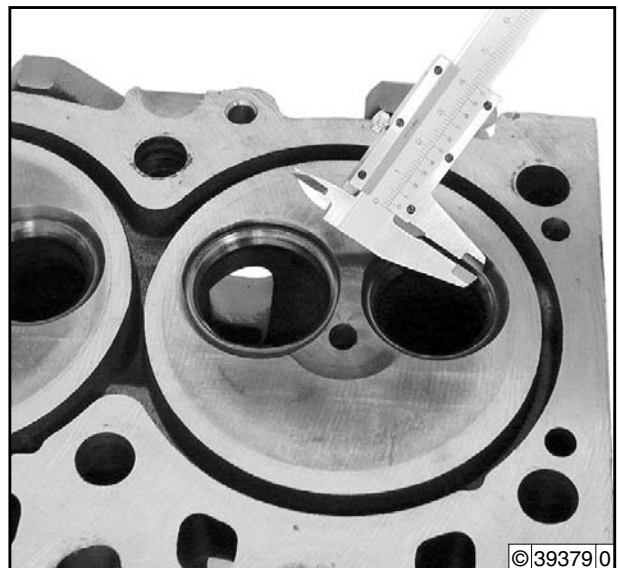


Note

- Do not remove more material than necessary from the valve seat.
- Check the valve seat after every step.



- Measure valve seat width with caliper gauge.



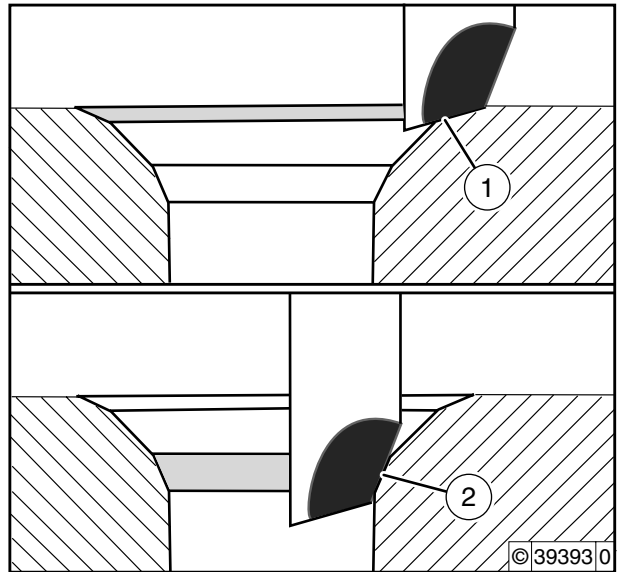


Note

The valve set is a little wider after reworking. If necessary, the valve seat width can be reduced by reworking the outer correction angle (1) and also the inner correction angle (2) if necessary.



- Remove valve seat rotating device
- Remove chips.



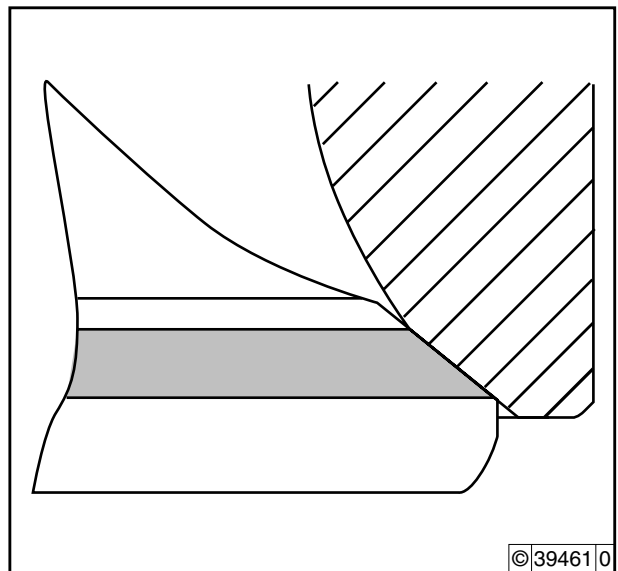
Check contact pattern

- Coat the sitting surface of the valve cone thinly with varnish.
- Insert valve and turn 45° to 90°.
- Remove the valve and check the contact pattern.



Note

A continuous surrounding contact between the valve cone and the valve seat ring must be guaranteed at the greatest valve seat diameter (outer contact) with a radial contact percentage of 60 to 100%.

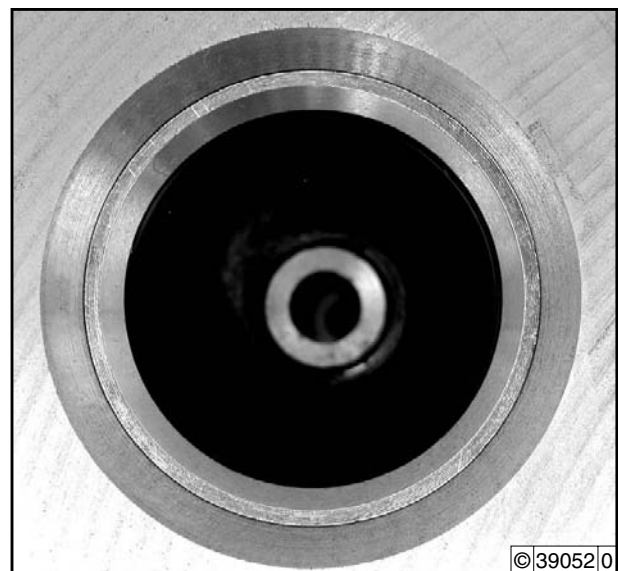


- Clean valve and valve seat ring.
- Check valve lag
→ Job card W 01-07-08.



Note

Do not rework valve seat with lapping compound.





Notes

Check valve lag



Tools

- **Commercial tools**
Depth-measuring appliance

- Special tools

120 900 - Clamping block
120 910 - Clamping plate



References

- W 01-04-04

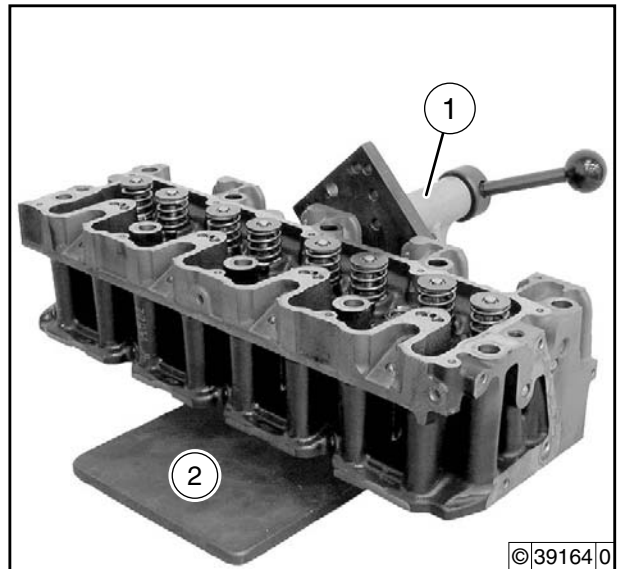


Note

If the wear limit is reached, the valve seat ring or the valve itself must be changed, both together if necessary.

Check valve lag

- Remove cylinder head
→ Job card **W 01-04-04**.
- Install clamping block (1) on clamping plate (2).
- Mount the cylinder head on the clamping block.



- Measure valve lag with depth measuring appliance from the valve head to the cylinder head sealing surface.



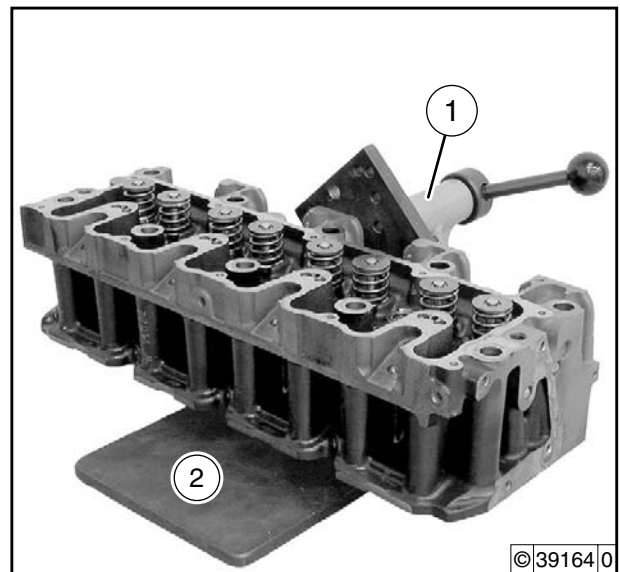
Cylinder head

W 01-07-08

2011



- Remove cylinder head from clamping block (1).
- Remove clamping block from clamping plate (2).
- Install cylinder head
→ Job card **W 01-04-04**.



Check crankcase



Tools

- **Commercial tools**
 - Magnetic measuring stand
 - Micrometer gauge
 - Internal measuring device
 - Prisms
 - Hardness tester

- **Special tools**

- 100 400 - Meter



Note

If the crankshaft is worn it is possible to have the crankshaft repaired in our Service Centers.



References

- W 02-04-01



Note

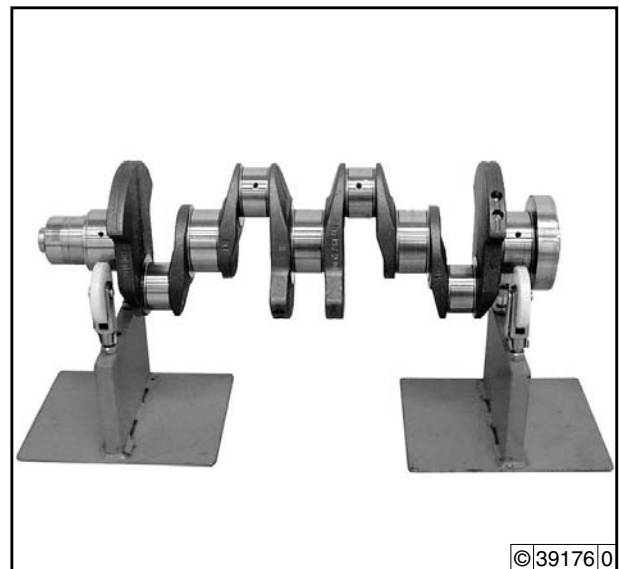
The rework stages are marked on the outer contour of the crankshaft face on the flywheel side.

H = ground main bearing pin

P = ground con rod bearing pin

Check bearing pin hardness

- Remove crankshaft
 - Job card **W 02-04-01**.
- Place the crankshaft on prisms.

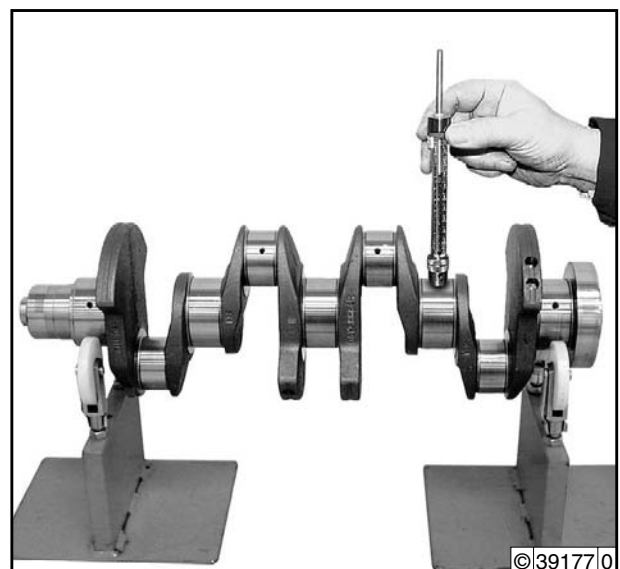


- Check bearing pin with hardness tester.



Note

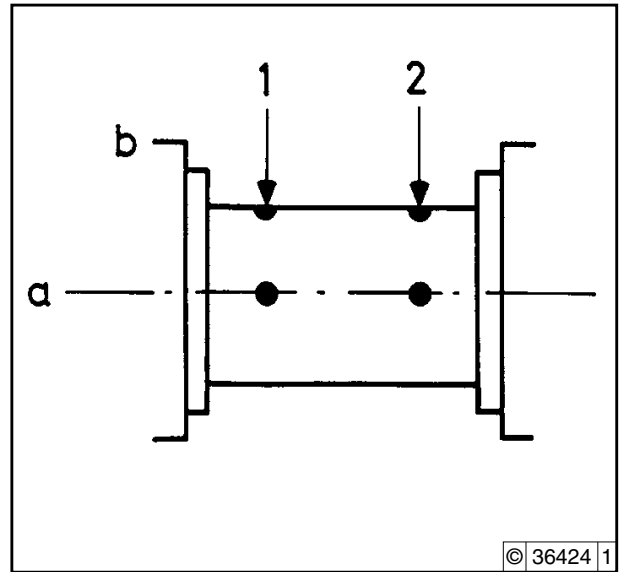
The measured values must be converted according to the table of the measuring instrument.





Note

Schematic representation for measuring the bearing pins at the points "1" and "2" in the levels "a" and "b".



6

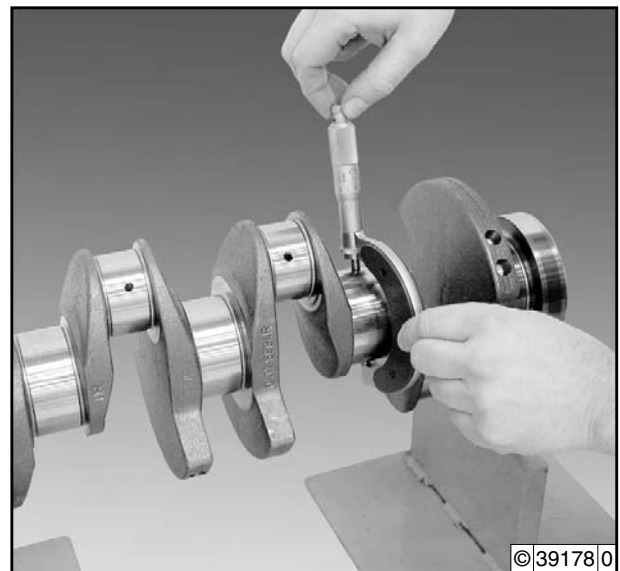
Check the diameter of the main bearing pins

- Measure main bearing pin with micrometer screw.



Note

Measuring points, see schematic diagram



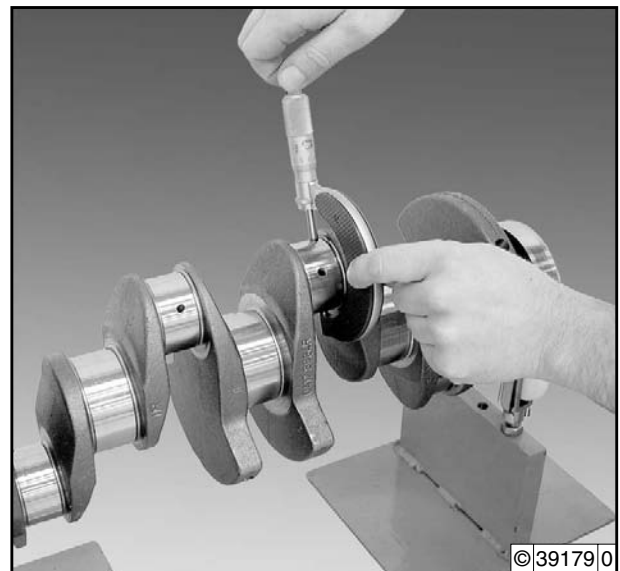
Check the diameter of the lifting bearing journal

- Measure lifting bearing journal with micrometer gauge.



Note

Measuring points, see schematic diagram

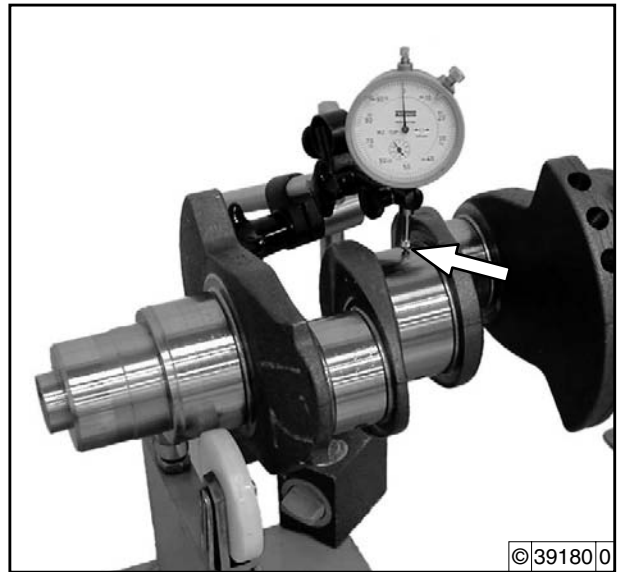


Check runout

- Attach magnetic measuring stand and insert meter.
- Apply stylus to the main bearing pin with pre-tension (arrow) and set meter to "0".
- Turn crankshaft evenly and check shells.



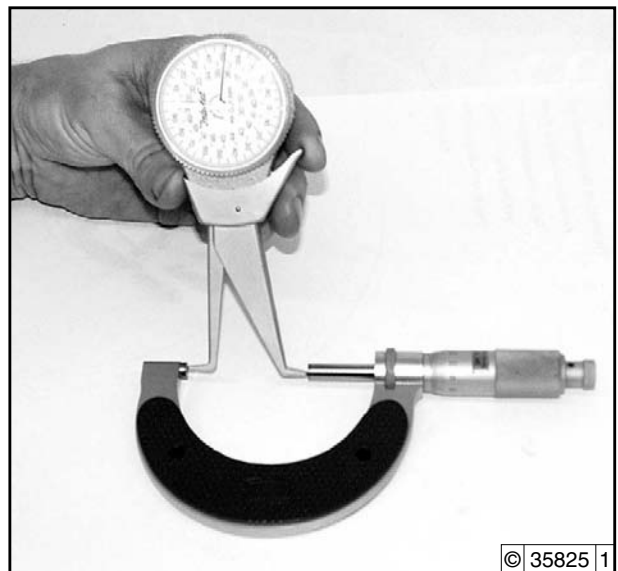
- Remove magnetic measuring stand and meter.



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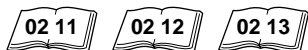
Measure fit bearing width

- Set micrometer gauge to 35 mm.
- Push the internal measuring device between the test surfaces of the micrometer gauge and set to "0".



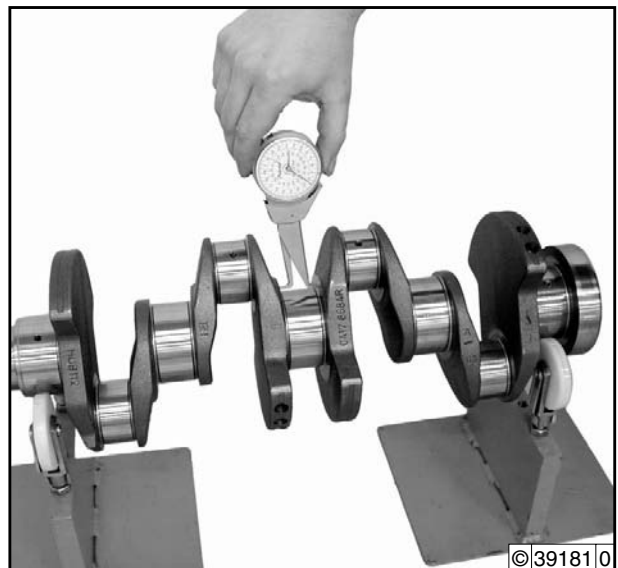
© 35825 1

- Measure fit bearing width with internal measuring device between the contact surfaces of the starting rings.
- Note the measured value (dimension "A").



Note

The dimension "A" is required for determining the axial clearance.



© 39181 0

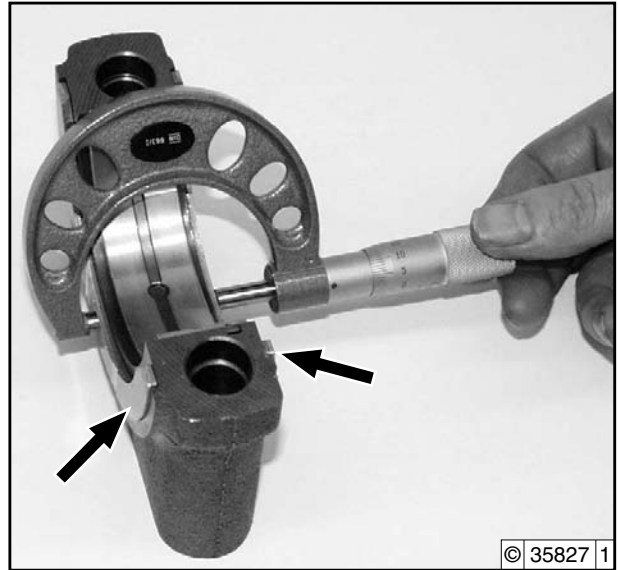
Check axial clearance

- Place startup ring halves on fit bearing cover (arrows).
- Measure width with micrometer gauge.
- Note the measured value (dimension "B").



Note

The dimension "B" is required for determining the axial clearance.



© 35827 | 1

6

- Determine axial clearance
Axial clearance = dimension "A" – dimension "B"



Example:

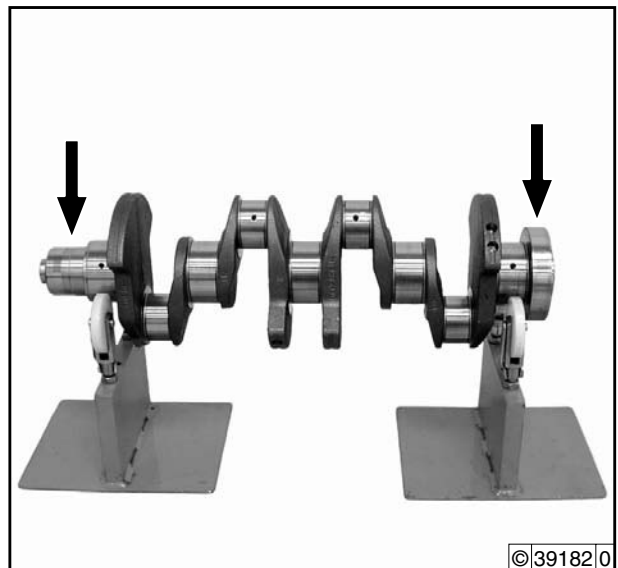
Dimension "A"	35.00 mm
- Dimension "B"	34.80 mm
= Axial clearance	0.20 mm

- Use the appropriate startup ring halves.



Visual inspection

- Visually inspect the running surfaces (arrows) of the shaft sealing rings.
- Install crankshaft
→ Job card **W 02-04-01**.



© 39182 | 0

Renew crankshaft sealing ring (flywheel side)



Tools

- Commercial tools
Assembly lever

- Special tools

142 860 - Assembly tool

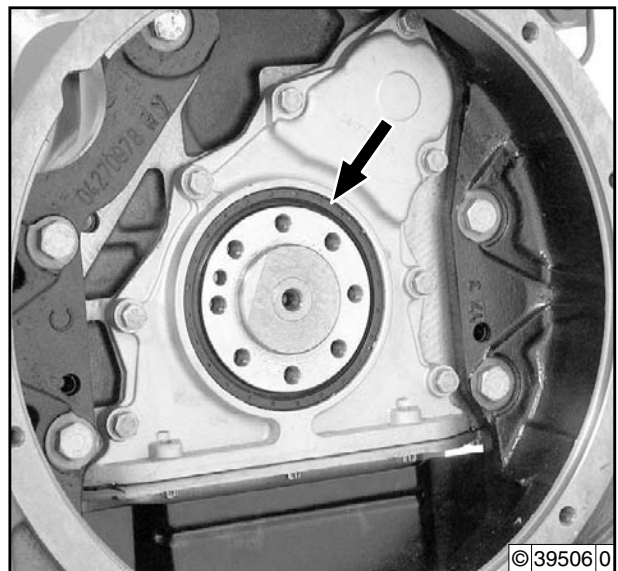


References

- W 12-06-01

Remove crankshaft sealing ring

- Remove flywheel
→ Job card W 12-06-01.
- Loosen the crankshaft sealing ring (arrow) in its seat with a pin.



- Carefully drill a hole (at least 3 mm Ø) diameter in the crankshaft sealing ring.

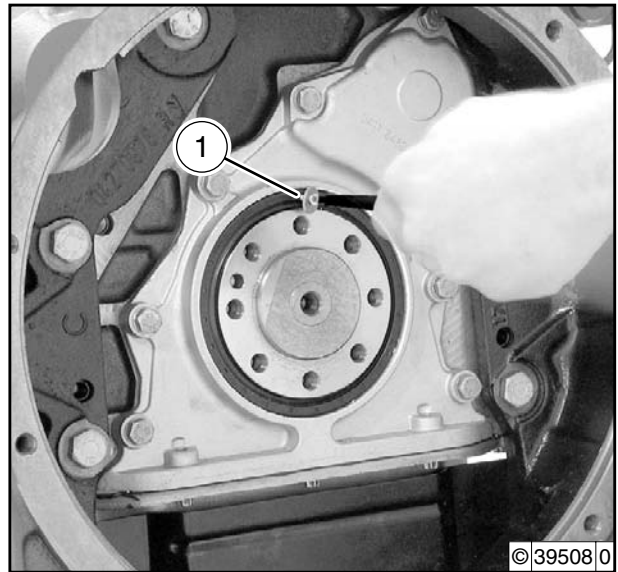


Note

- Coat the drill thickly with grease so that no drill chips fall into the crankcase.
- Do not damage the rear cover and crankshaft.

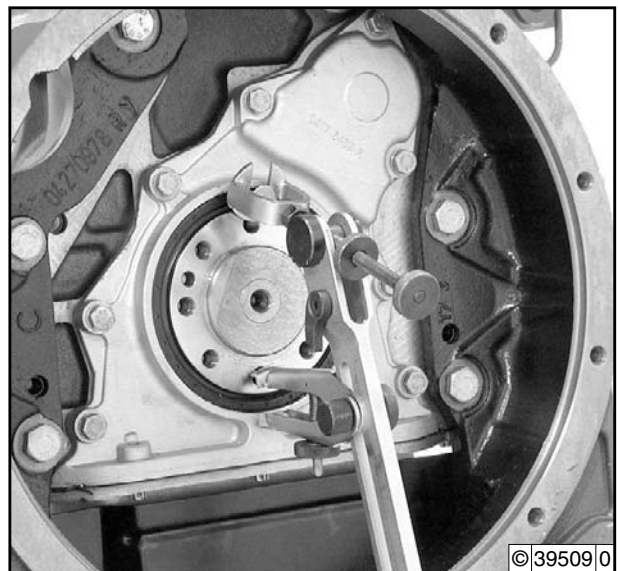


- Turn in self-tapping screw (1) with washer.



6

- Remove crankshaft sealing ring with suitable tool, e.g. assembly lever.
- Visually inspect the crankshaft flange and rear cover.



Install crankshaft sealing ring

- Oil the sealing lip of the new crankshaft sealing ring lightly with engine oil.
- Fit the crankshaft sealing ring (1) to the assembly sleeve (2).



Note

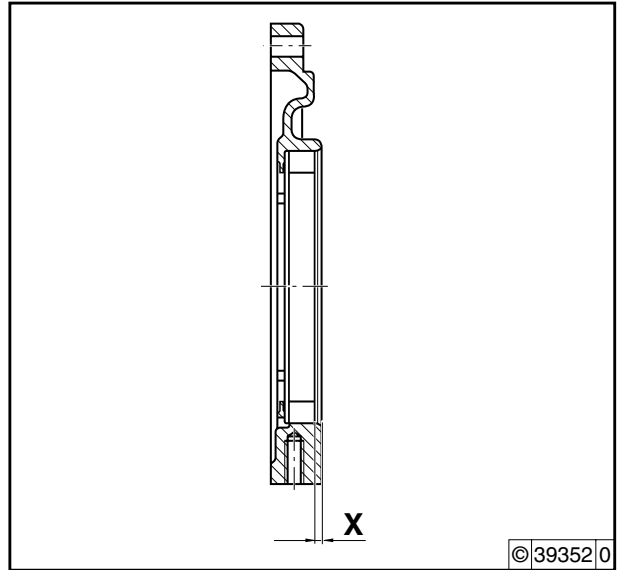
The sealing lip must face the crankshaft in assembly.





Note

Installation depth X = approx. 2.5 mm of the crankshaft sealing ring.



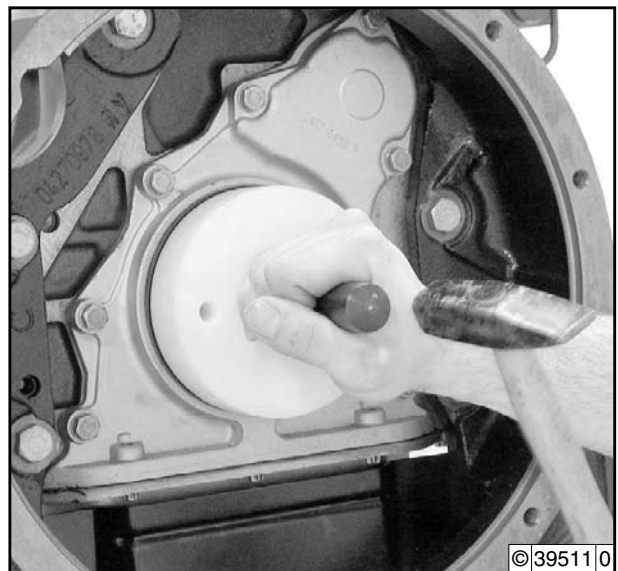
- Drive in crankshaft sealing ring with assembly tool.



Note

Note installation depth.

- Install flywheel.
→ Job card W 12-06-01.





Notes

Renew crankshaft sealing ring (opposite side to flywheel)



Tools

- **Commercial tools**
9017 - Assembly lever

- **Special tools**

100 700 - Setting bolt
142 850 - Assembly tool

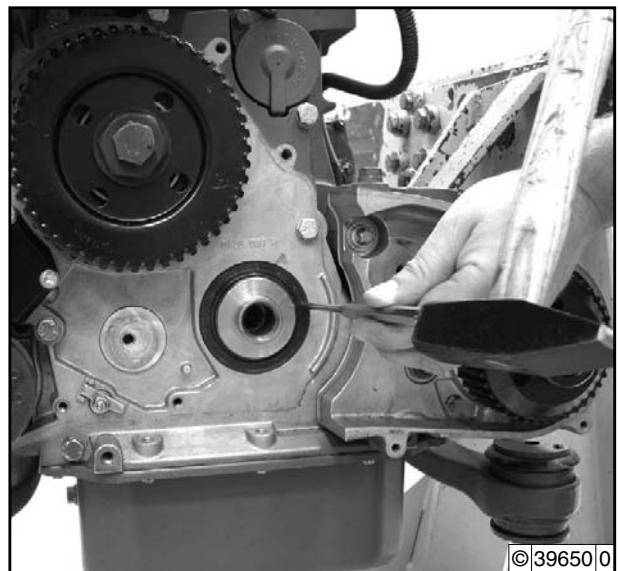


References

- W 03-08-01
- W 04-04-12 old version
- W 04-04-12 new version

Remove crankshaft sealing ring

- Remove toothed belt and clamping roller, loosen camshaft toothed belt wheel
→ Job card **W 04-04-12** old version.
→ Job card **W 04-04-12** new version.
- Remove crankshaft toothed wheel
→ Job card **W 03-08-01**.
- Loosen crankshaft sealing ring in its seat with a pin.

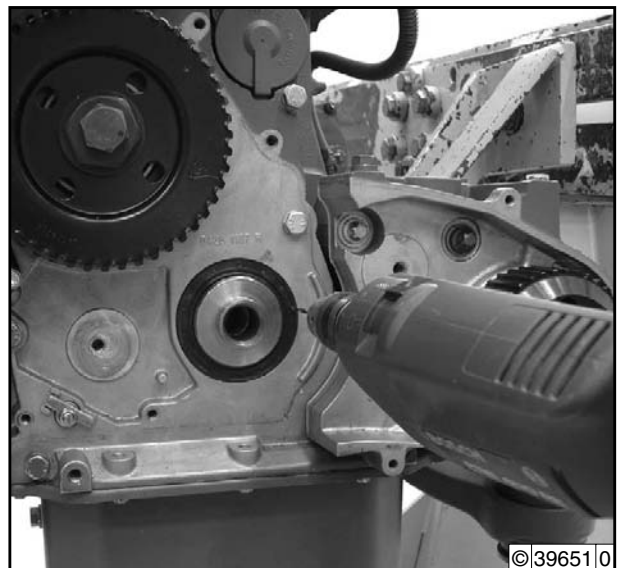


- Carefully drill a hole (at least 3 mm Ø) diameter in the crankshaft sealing ring.

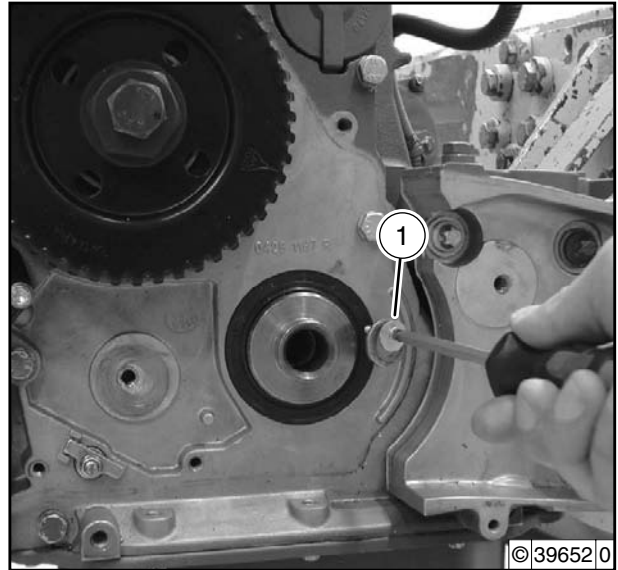


Note

- Coat the drill thickly with grease so that no drill chips fall into the crankcase.
- Do not damage the front cover and crankshaft.

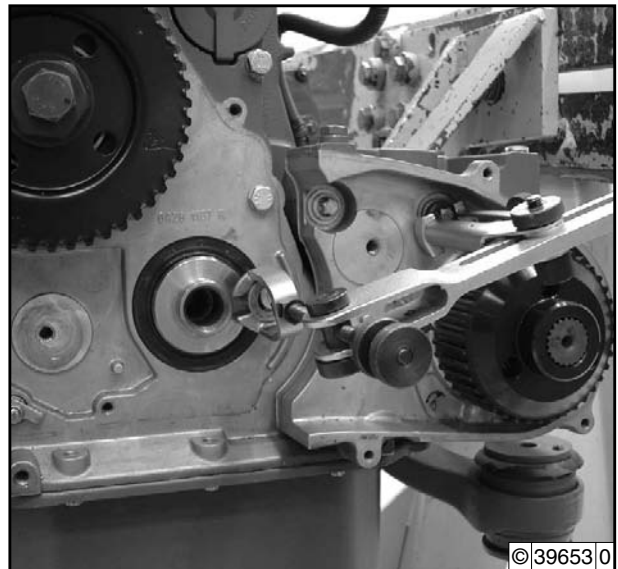


- Turn in self-tapping screw (1) with washer.



6

- Remove crankshaft sealing ring with suitable tool, e.g. assembly lever.
- Visually inspect the running surface of the crankshaft flange and front cover.



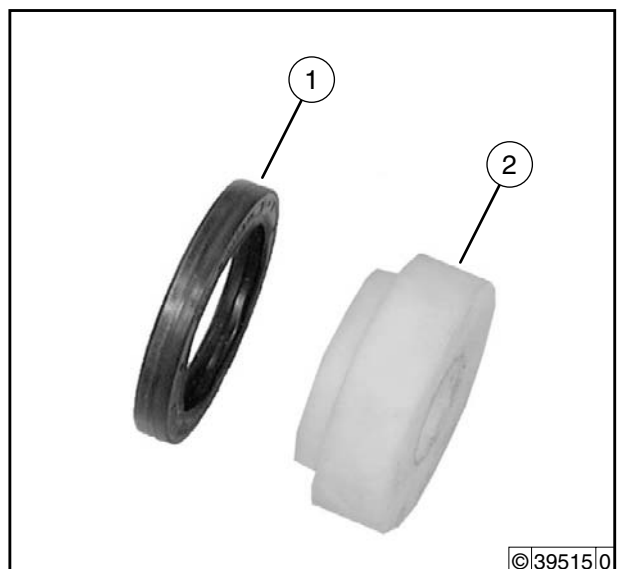
Install crankshaft sealing ring

- Oil the sealing lip of the new crankshaft sealing ring lightly with engine oil.
- Fit the crankshaft sealing ring (1) to the assembly tool (2).

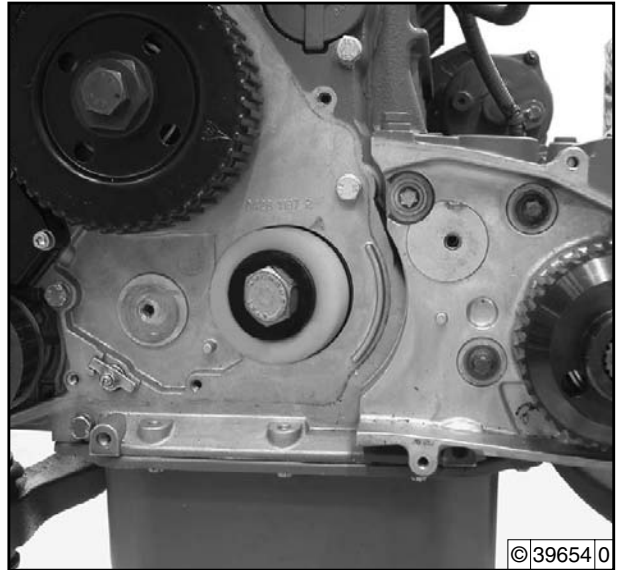


Note

The sealing lip must face the crankshaft in assembly.



- Mount the crankshaft sealing ring with the assembly tool and turn in the screw.



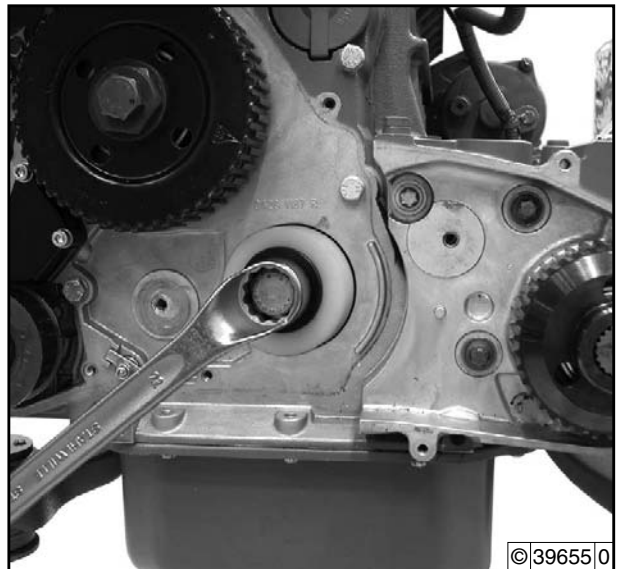
- Pull in the assembly tool to the stop by turning in the screw.



Note

The installation depth of the crankshaft sealing ring is determined by the assembly tool.

- Unscrew screw and remove assembly tool.
- Install crankshaft toothed wheel
→ Job card **W 03-08-01**.
- Install toothed belt and clamping roller, fix camshaft toothed belt wheel
→ Job card **W 04-04-12** old version.
→ Job card **W 04-04-12** new version.





Notes

Check con rod



Tools

- **Commercial tools**
- Micrometer gauge
- Internal measuring device
- Con rod test device
- 8021 - Socket size 15

- **Special tools**

- 100 400 - Meter



Note

The con rod is removed and the piston disassembled.



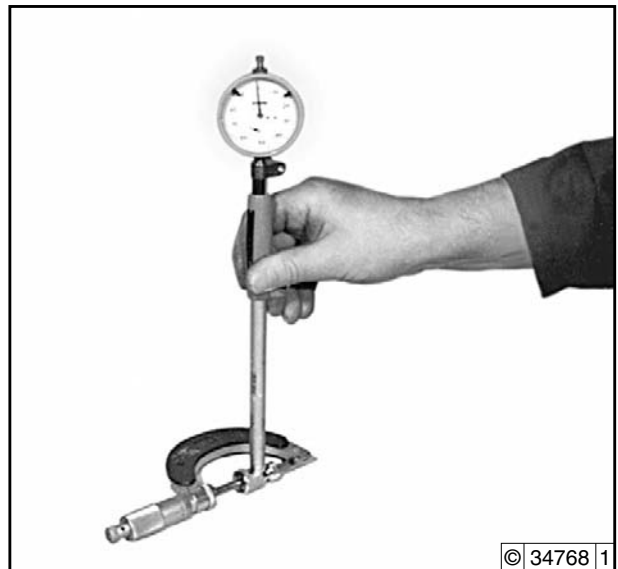
References

- W 02-03-03

Check piston bolt bush

Prepare internal measuring device

- Mount probe bolt for the appropriate measuring range in the internal measuring device.
- Mount meter with approx. 1 mm pre-tension in the internal measuring device.
- Set micrometer gauge to
 - 26 mm in FL/M engines
 - 30 mm in BFL/M engines.
- Balance the internal measuring device between the test surfaces of the micrometer gauge and set the meter to the reversal point of the pointer to "0".

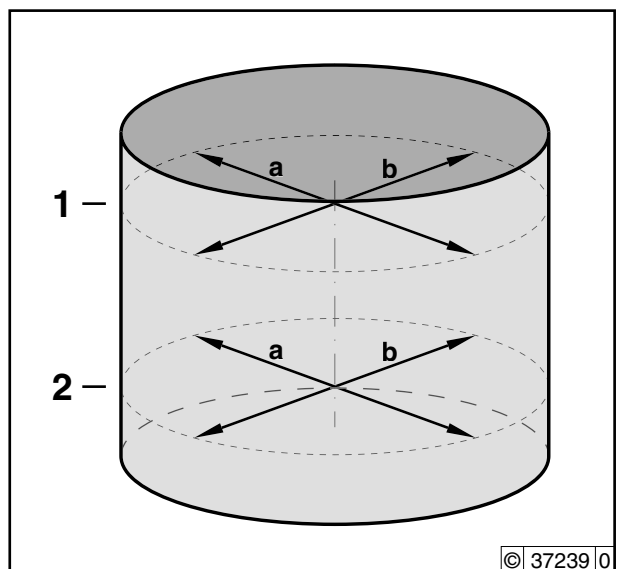


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Note

Schematic representation for measuring the piston bolt bush at the points "a" and "b" in the levels "1" and "2".



© 37239 0

- Measure piston bolt bush with internal measuring device.
Insert the internal measuring device in the piston bolt bush.
- Balance the internal measuring device respectively at the given measuring points and read off the measured value at the reversal point of the pointer.



Note

- Piston bolt bush pressed in.
- Measuring points, see schematic diagram.



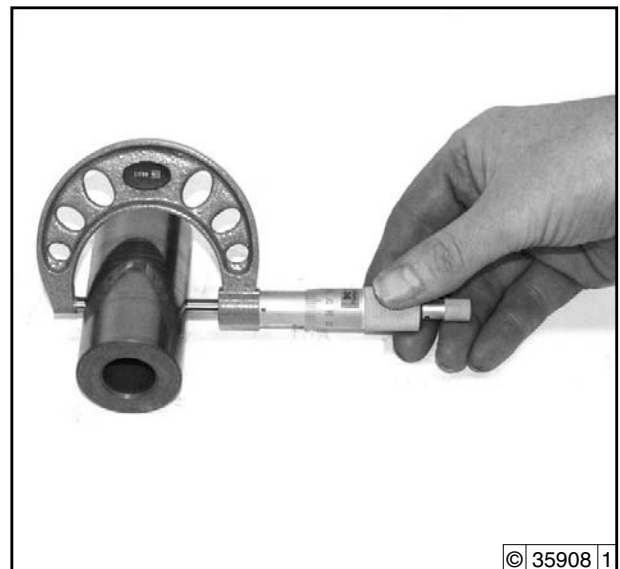
- Remove and install piston bolt bush
→ Job card W 02-03-03.



© 34770 1

Check diameter of the piston bolt

- Measure piston bolt with micrometer gauge.



© 35908 1

Determine piston bolt clearance



Note

The piston bolt clearance is given by the difference between the piston bolt bush internal diameter "A" and the diameter of the piston bolt "B".



Example:

	Dimension "A"	26.035 mm
—	Dimension "B"	26.000 mm
=	Piston bolt clearance	0.035 mm

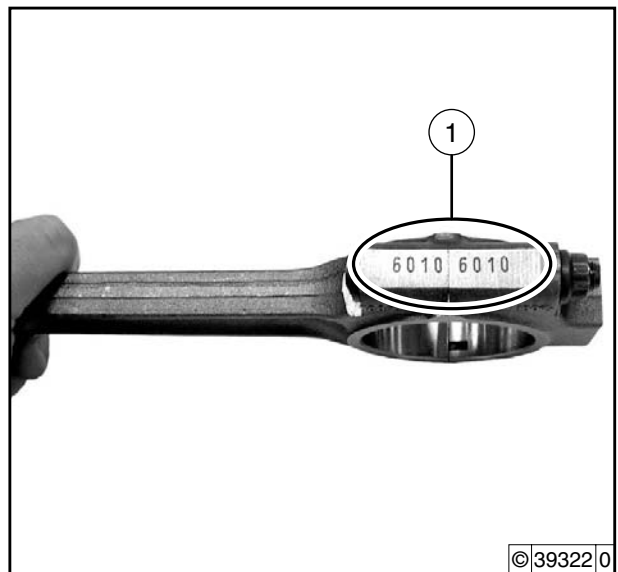
Check the con rod bearing bore

- Mount con rod bearing cover on con rod.



Note

The numeric identification (1) on the con rod and the con rod bearing cover must be identical and be opposite each other in assembly.



- Tighten nuts.



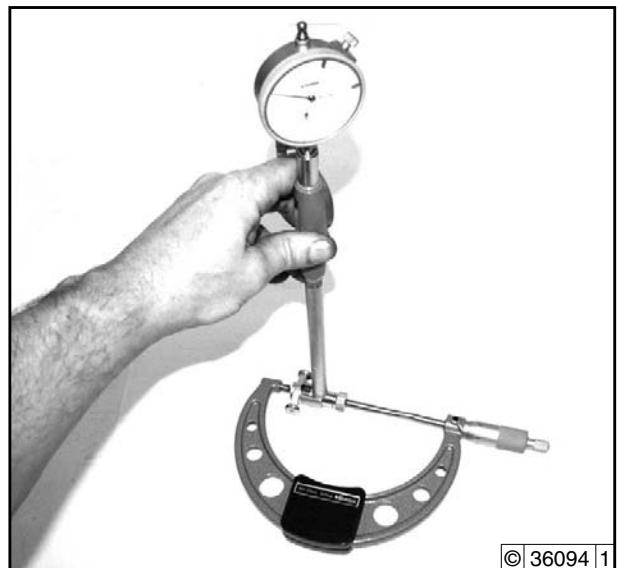
Note

Use a twelve-edge box wrench.



Prepare internal measuring device

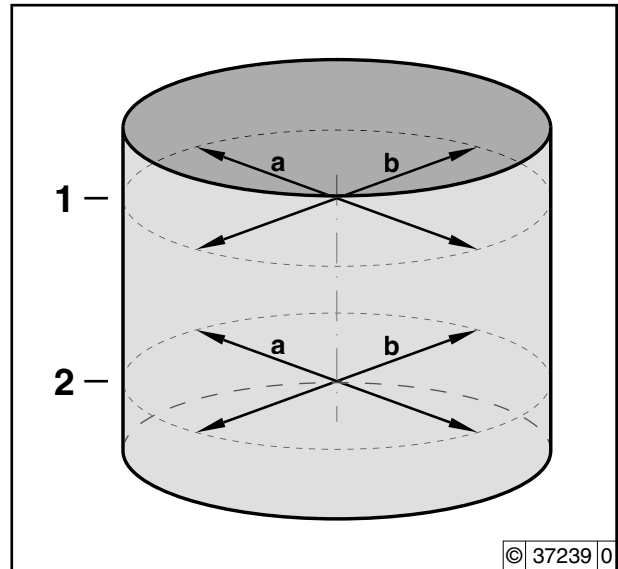
- Mount probe bolt for the appropriate measuring range in the internal measuring device.
- Mount meter with approx. 1 mm pre-tension in the internal measuring device.
- Set micrometer gauge to 58.50 mm.
- Balance the internal measuring device between the test surfaces of the micrometer gauge and set the meter to the reversal point of the pointer to "0".





Note

Schematic representation for measuring the con rod bearing bore at the points "a" and "b" in the levels "1" and "2".



6

- Measure con rod bearing bore with internal measuring device. Insert internal measuring device in the con rod bearing bore.
- Balance the internal measuring device respectively at the given measuring points and read the measured value at the reversal point of the pointer.



Note

If the measured values deviate slightly, additional measurements must be made with new bearing shells.



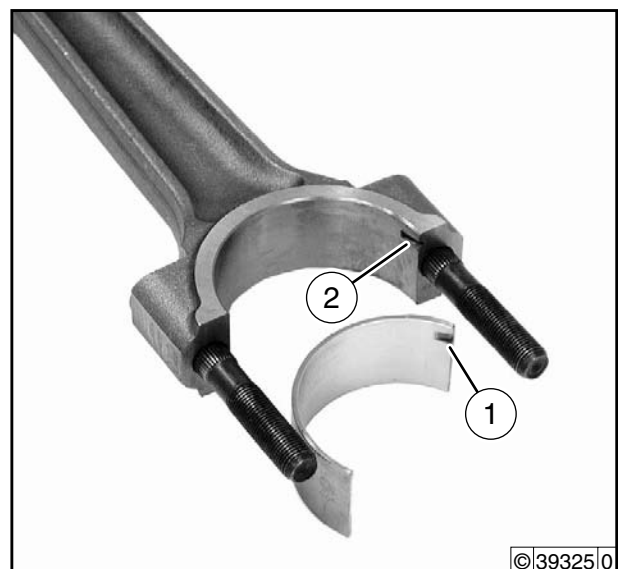
Check con rod bearing shell internal diameter

- Unscrew nuts and remove con rod bearing cover.
- Insert con rod bearing shell in the con rod.



Note

- Note the assignment of the bearing shells.
- The twist protection (1) must engage in the groove (2).

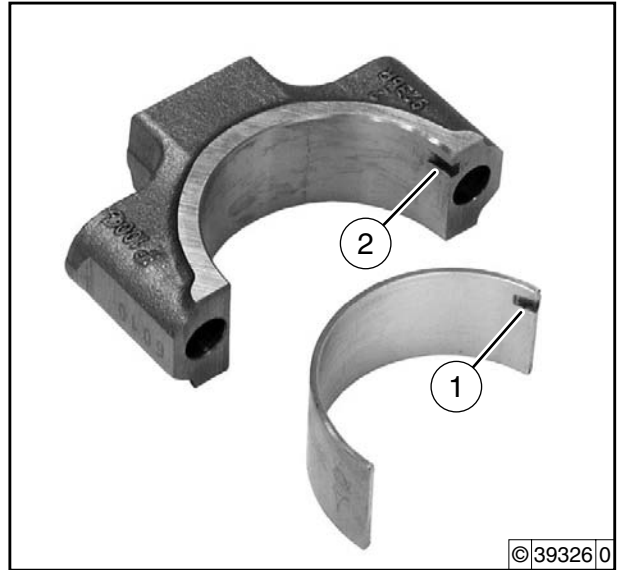


- Insert con rod bearing shell in the appropriate con rod bearing cover.



Note

The twist protection (1) must engage in the groove (2).

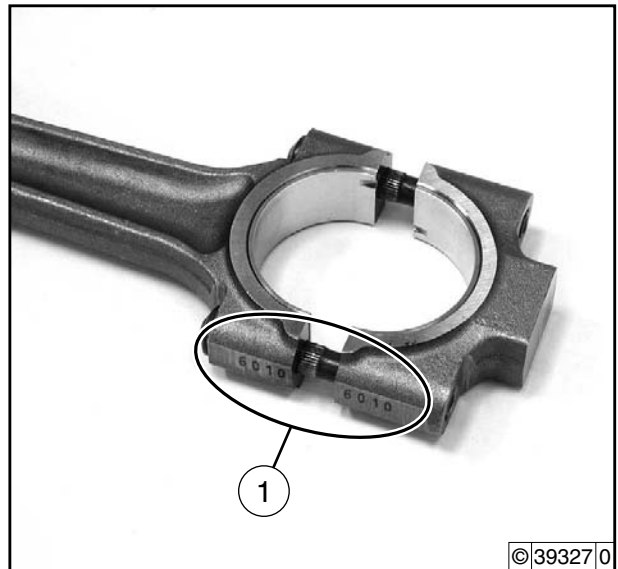


- Mount the con rod bearing cover and tighten the nuts.



Note

The numeric identification (1) on the con rod and the con rod bearing cover must be identical and be opposite each other in assembly.



- Tighten nuts.



Note

Use a twelve-edge box wrench.



Prepare internal measuring device

- Mount probe bolt for the appropriate measuring range in the internal measuring device.
- Mount meter with approx. 1 mm pre-tension in the internal measuring device.
- Set micrometer gauge to 55 mm.
- Balance the internal measuring device between the test surfaces of the micrometer gauge and set the meter at the reversal point of the pointer to "0".

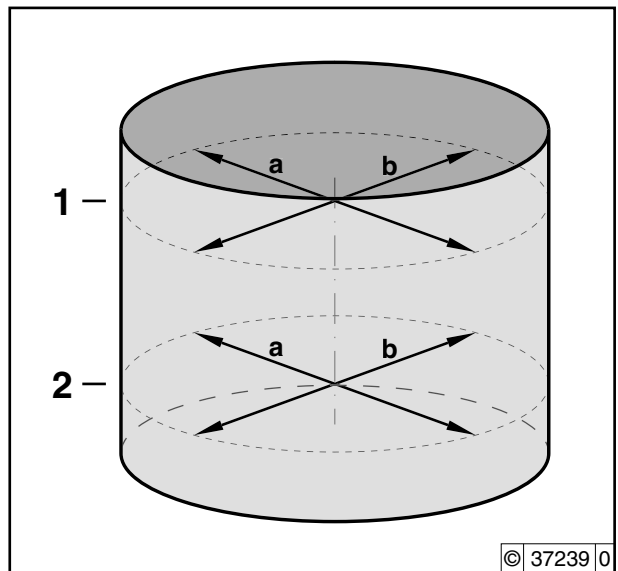


6



Note

Schematic representation for measuring the con rod bearing shell internal diameter at the points "a" and "b" in the levels "1" and "2".

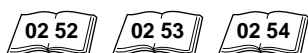


- Measure con rod bearing shell internal diameter with internal measuring device. Insert internal measuring device between the con rod bearing shells.
- Balance the internal measuring device respectively at the given measuring points and read off the measured value at the reversal point of the pointer.



Note

- If the values are up to max. **0.015 mm** above the bearing tolerances, the con rod can be used further.
- If the wear limit is reached, the con rod has to be changed.



Determine con rod bearing clearance



Note

The con rod bearing clearance is given by the difference of the con rod bearing shell internal diameter "A" and the diameter of the lifting bearing journal "B".

Example:

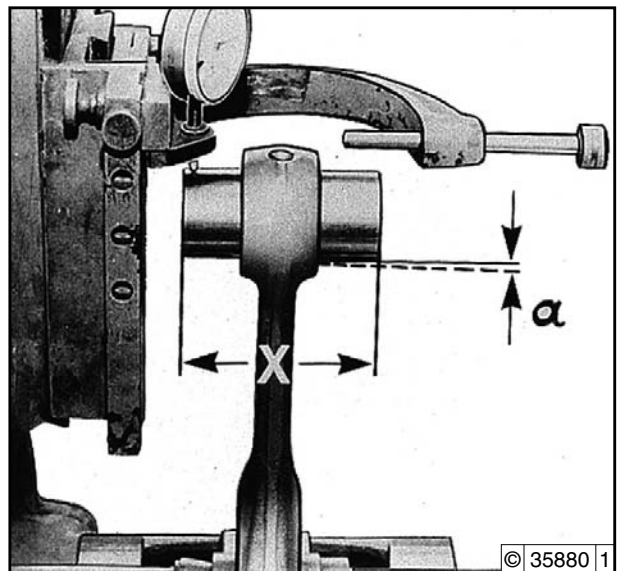
Dimension "A"	35.00 mm
— Dimension "B"	34.80 mm
= Con rod bearing clearance	0.20 mm



- Unscrew nuts and remove con rod bearing cover.

Check con rod parallelism

- Check con rod without bearing shells on the con rod test device.
- Permissible deviation "a" = max. **0.03 mm** at a distance of "X" = **100 mm**.



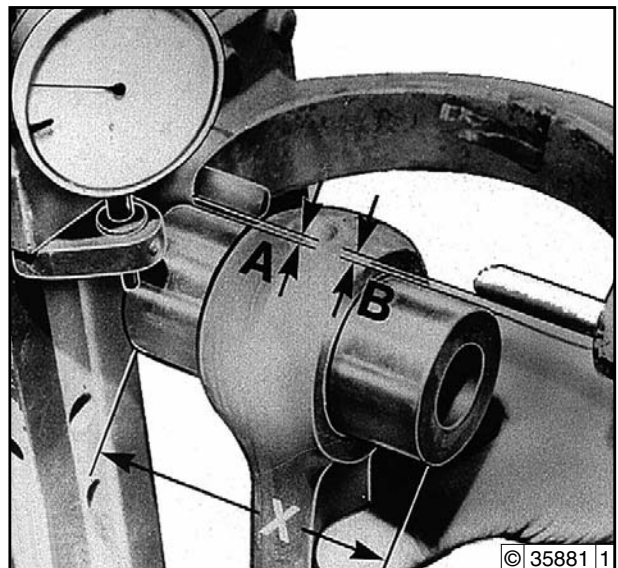
Check con rod right-angledness

- Permissible deviation "A" to "B" = max. **0.03 mm** at a distance of "X" = **100 mm**.



Note

Aligning the con rod is not permissible.





Notes

Remove and install piston bolt bush



Tools

- Commercial tools

- Special tools

131 340 - Assembly tool for FL/M engines

131 350 - Assembly tool for BF/M engines



Note

- The con rod is removed and the piston disassembled.
- The piston bolt bush must be mechanically machined after assembly.



References

- W 02-09-03

- Remove piston and con rod
- ➔ Job card **W 02-09-03**.

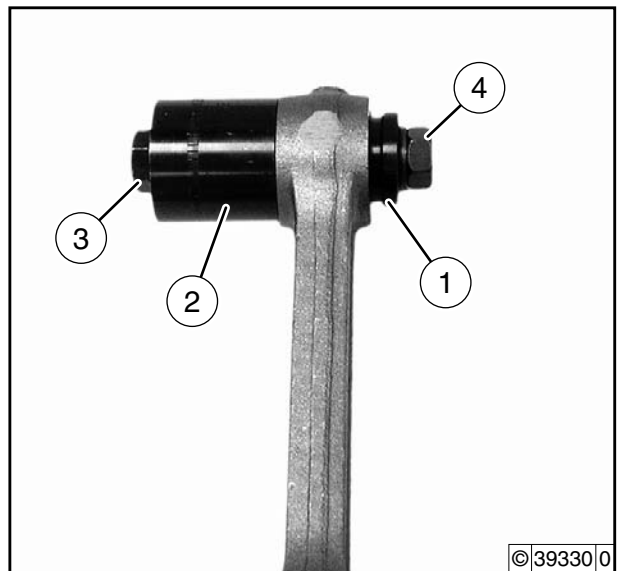
Remove piston bolt bush

- Insert extraction socket (1) in piston bolt bush.
- Place counterbearing (2) with the open side on the con rod and insert the screw (3).
- Fit washer and tighten nut (4).



Note

- 131 340 for FL/M engines.
- 131 350 for BFL/M engines.



- Pull out piston bolt bush.
- Dismantle disassembly tool and remove piston bolt bush.



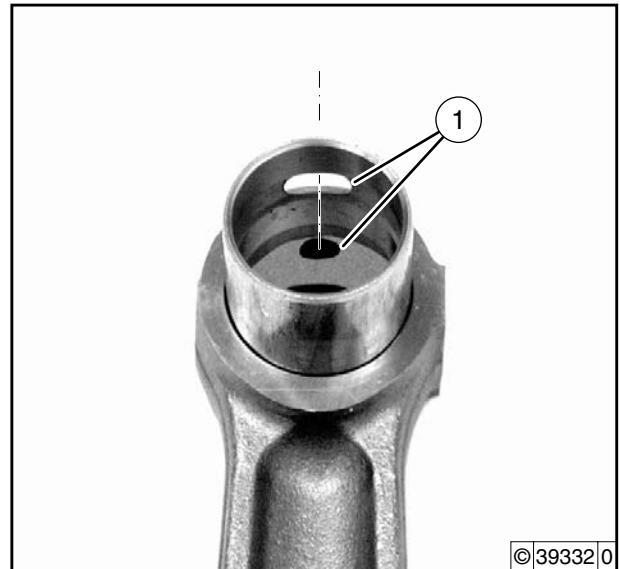
Install piston bolt bush

- Mount piston bolt bush on con rod.



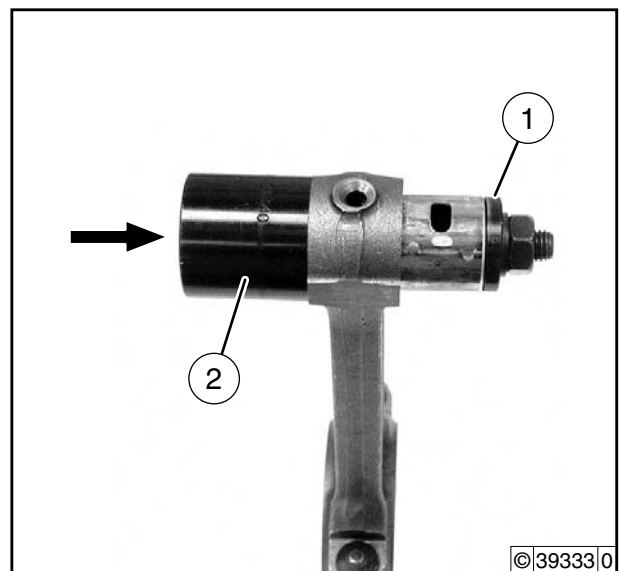
Note

Pay attention to matching of the oil bores (1) in the piston bolt bush and the con rod.



6

- Insert extraction socket (1) in new piston bolt bush.
- Place counterbearing (2) with the closed side on the con rod and insert the screw (arrow).
- Fit washer and tighten nut.



- Pull in piston bolt bush flush.
- Remove disassembly tool.
- Check matching of oil bores in the piston bolt bush and con rod again.



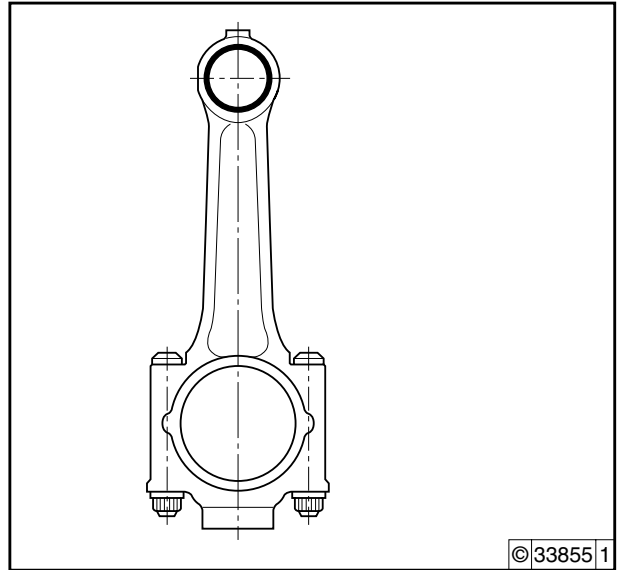


Note

The piston bolt bush must be mechanically machined after assembly.



- Install piston and con rod
- Job card **W 02-09-03**.





Notes

Remove and install crankshaft



Tools

- Commercial tools
8021 - Socket size 15



References

- W 02-01-07
- W 02-09-03
- W 03-08-01
- W 03-09-01



Note

Only in FL, FM engines
When replacing the crankshaft and/or crankcase, the piston class must be redetermined.

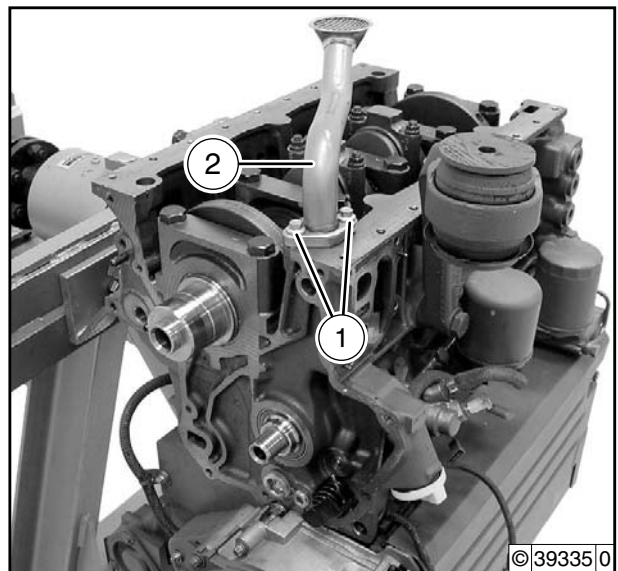


Auxiliary material

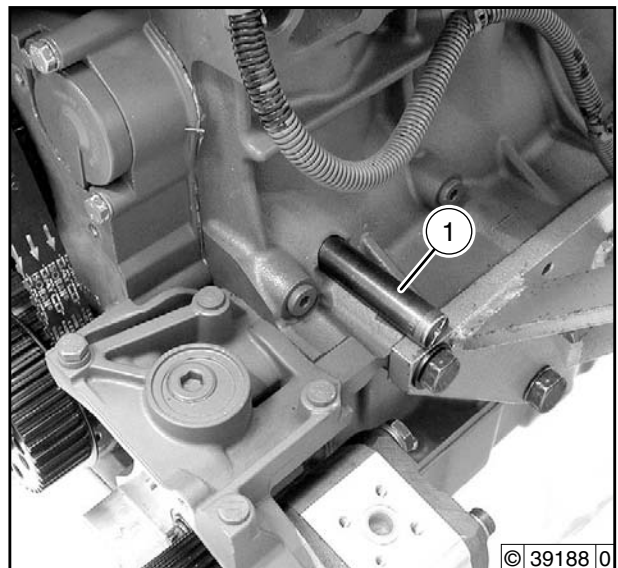
- DEUTZ DW 74

Remove crankshaft

- Remove rear cover (flywheel side)
→ Job card **W 03-09-01**.
- Remove front cover (opposite side to flywheel)
→ Job card **W 03-08-01**.
- Unscrew screws (1) and remove oil intake pipe (2).



- Unscrew setting bolts (1) of the crankshaft lock.



Remove all con rod bearing covers

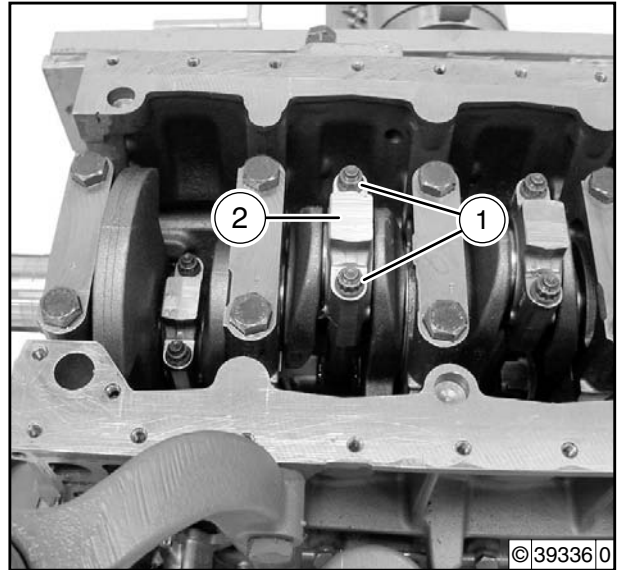
- Unscrew nut (1) and remove con rod bearing cover (2).



Note

- Use a twelve-edge box wrench.
- Put down the con rod bearing cover in the order of installation, note order of cylinders.
- Do not turn the crankshaft.

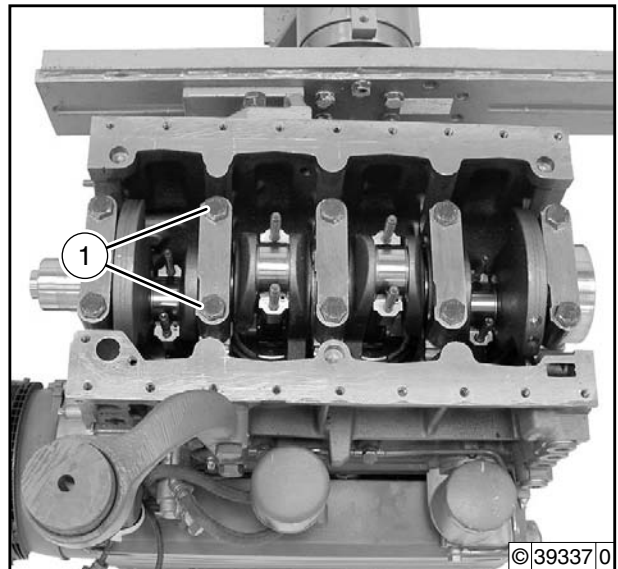
- Remove con rod bearing cover and con rod bearing shell.



6

Remove fit bearing and all main bearing covers

- Unscrew screws (1).

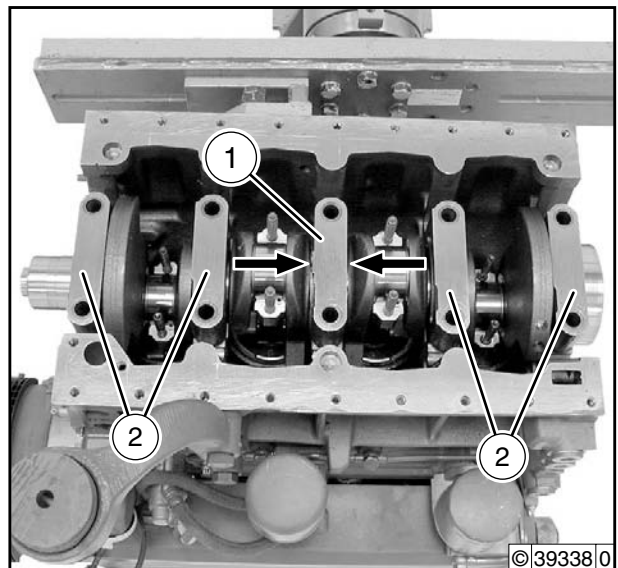


- Remove fit bearing cover (1), bearing shell and both startup ring halves (arrows).
- Remove main bearing cover (2) and bearing shells.

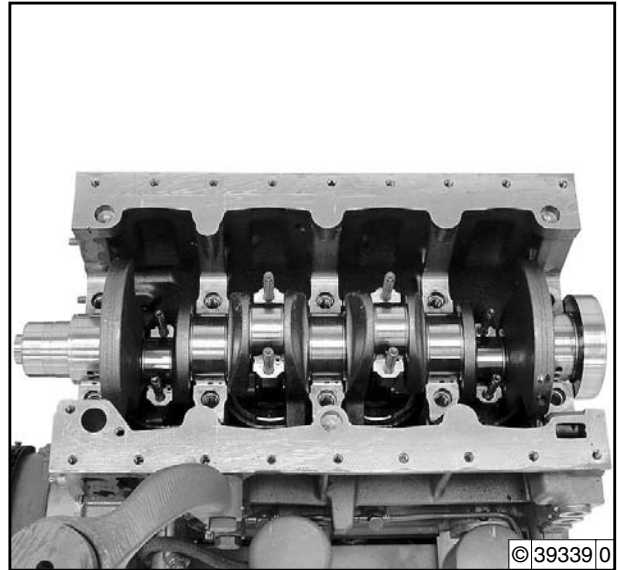


Note

- Put down the components in the order of installation, note order of cylinders.



- Remove crankshaft.



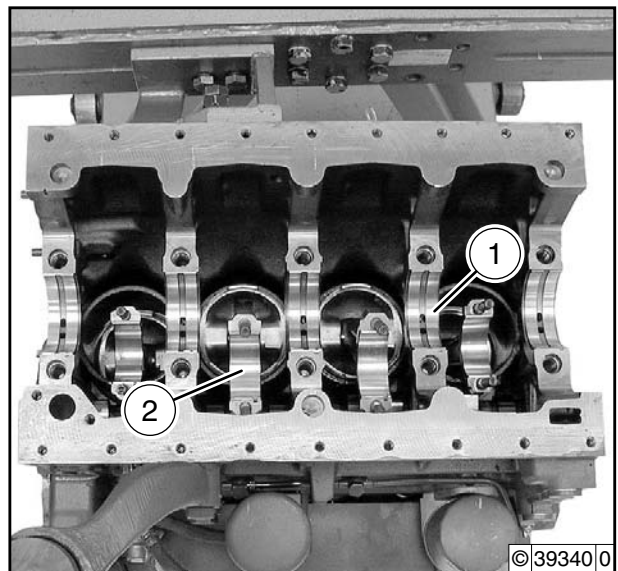
- Remove all main bearing shells (1) and all con rod bearing shells (2).



Note

Put down the components in the order of installation, note order of cylinders.

- Check components for visible signs of wear.
- Check axial clearance of crankshaft
→ Job card W 02-01-07.



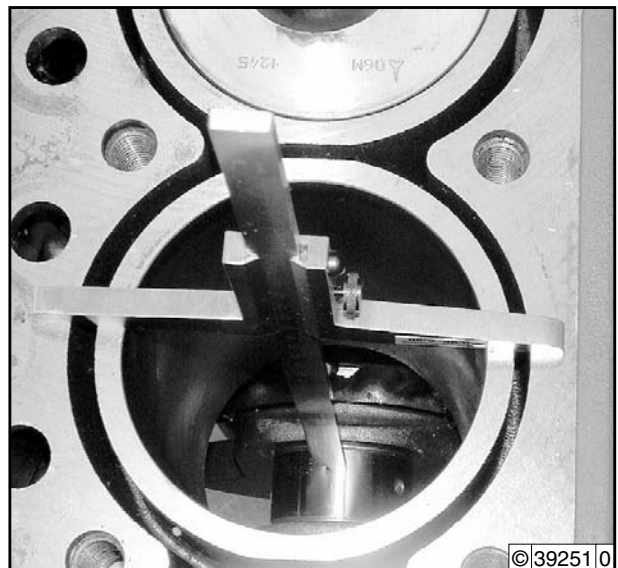
Only in FL, FM engines



Note

When replacing the crankshaft and/or crankcase, the distance from the cylinder head sealing surface to the highest point of the lifting bearing pin in UT position must be redetermined to define the piston class.

- Remove and install pistons and con rod
→ Job card W 02-09-03.



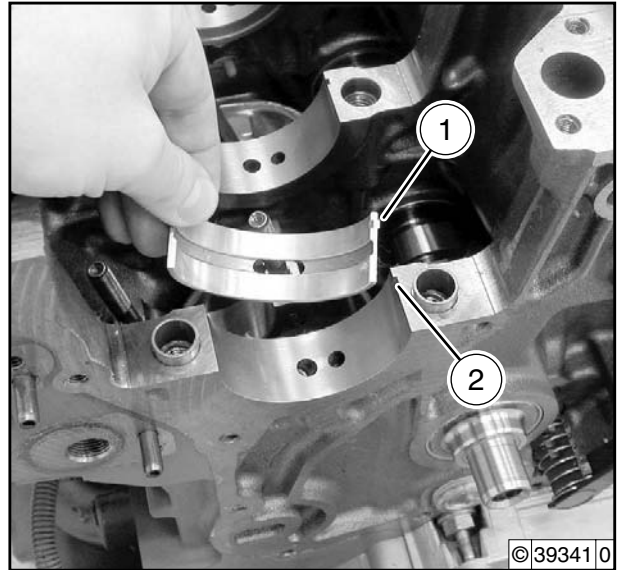
Install crankshaft

- Insert main bearing shells in the crankcase.



Note

- Note the assignment of the bearing shell.
- The twist protection (1) must engage in the groove (2).



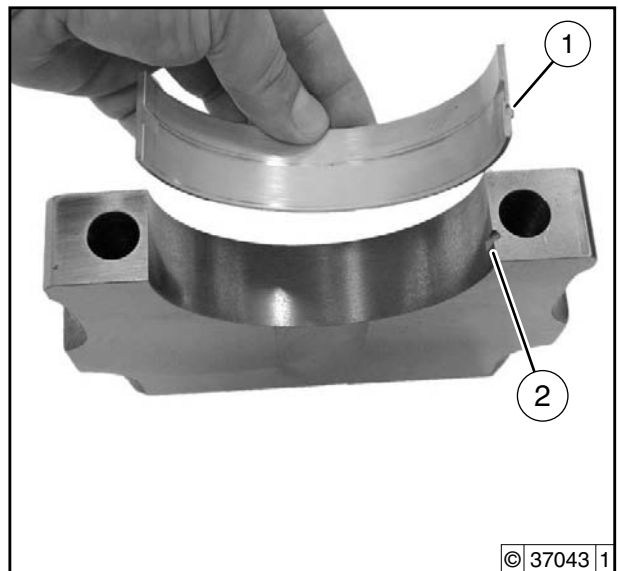
6

- Insert main bearing shell in the appropriate main bearing cover.



Note

- Note the assignment of the main bearing cover.
- The twist protection (1) must engage in the groove (2).

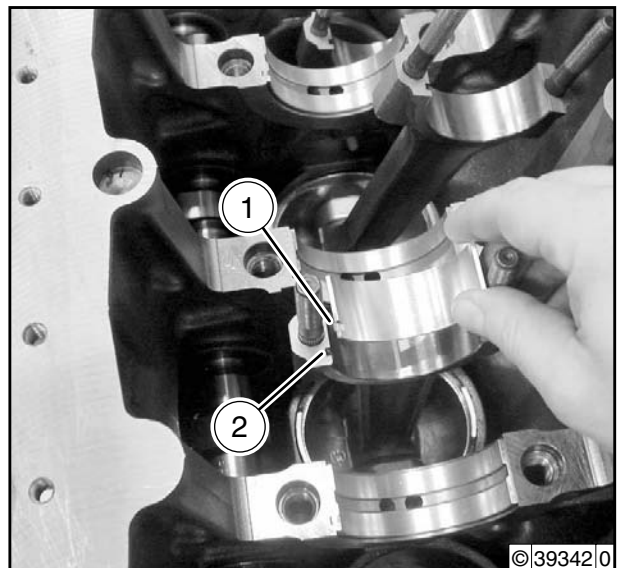


- Insert con rod bearing shell in the con rod.



Note

- Note the assignment of the bearing shell.
- The twist protection (1) must engage in the groove (2).

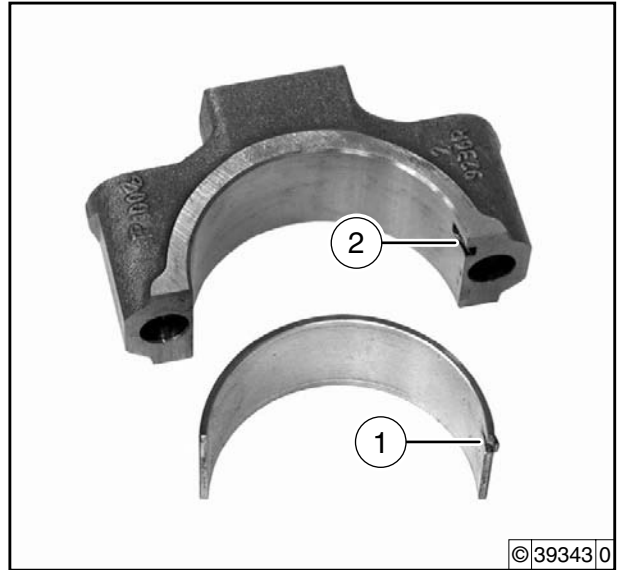


- Insert con rod bearing shell in the appropriate con rod bearing cover.

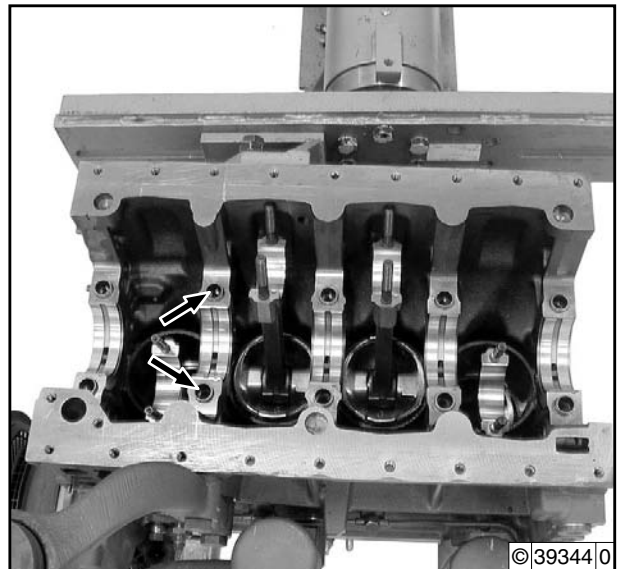


Note

- Note the assignment of the bearing shell.
- The twist protection (1) must engage in the groove (2).



- Check all clamping bushes are in place (arrows).

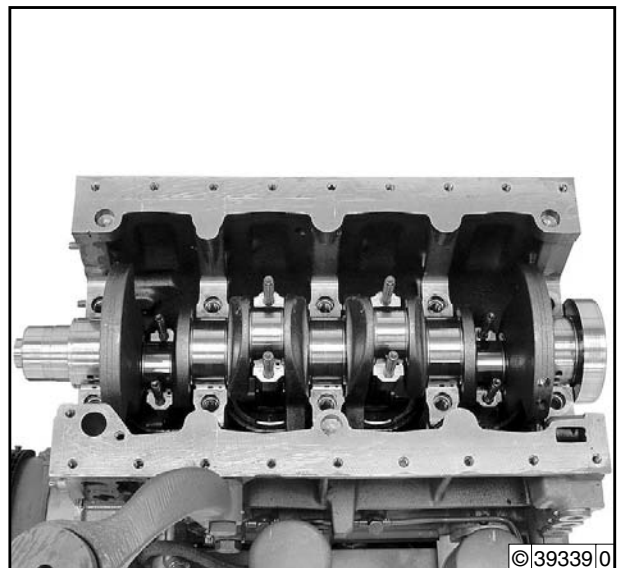


- Oil all bearing surfaces on the bearing pin and bearing shells lightly.
- Insert the crankshaft carefully in the crankcase.



Note

- Do not jam the con rods when inserting the crankshaft.

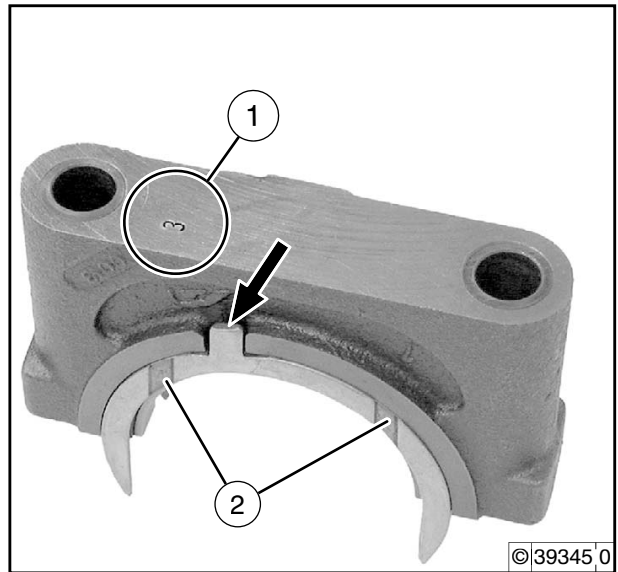


- Stick both startup ring halves with guide lugs (arrow) to the fir bearing cover with a little grease.



Note

- The installation position of the fit bearing cover is given by the numeric identification (1):
Number "1" in 2-cylinder
Number "2" in 3-cylinder
Number "3" in 4-cylinder
- The oil groove (2) must face the face mirror of the crankshaft.



© 39345 0

6

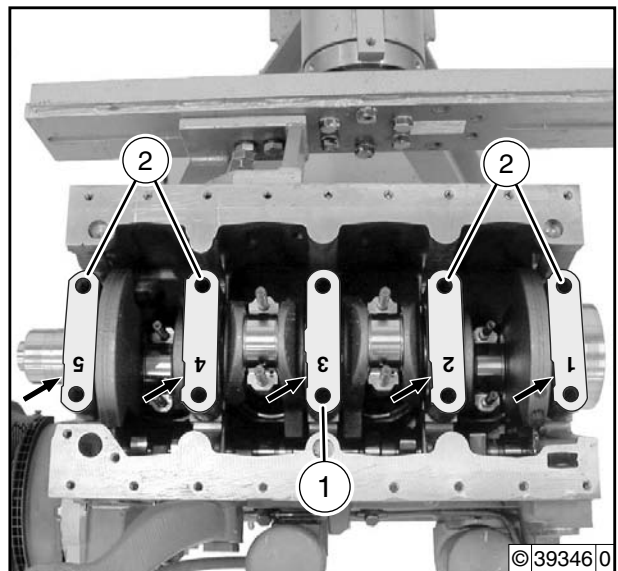
Install fit bearing and main bearing covers

- Insert fit bearing cover (1) and main bearing cover (2) according to the numbering.



Note

- Note assignment and installation position.
- Insert bearing cover with number "1" on flywheel side.
- The bevel (arrow) must face the front cover.



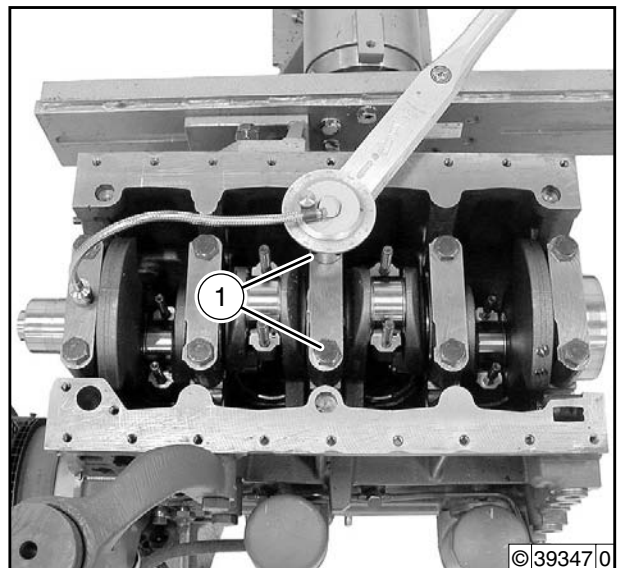
© 39346 0

- Oil lightly and tighten all screws (1) of the fit bearing and main bearing covers.



Note

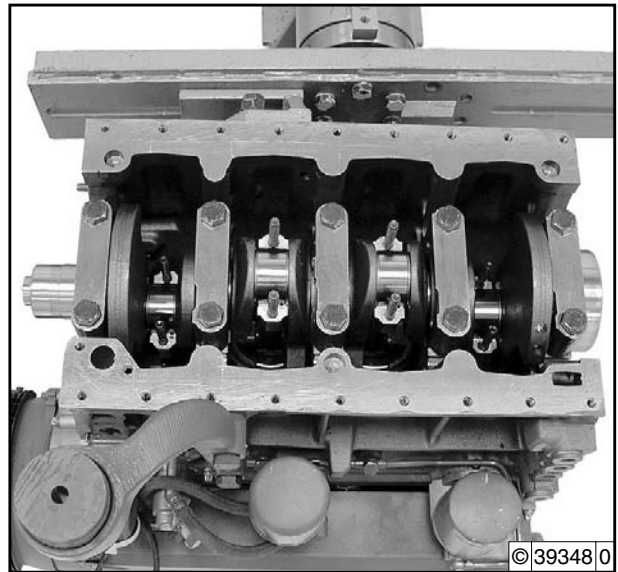
- Screws can be used a max. 3 times in case of provability, otherwise always change them.



© 39347 0

Install all con rod bearing covers

- Pull the con rods carefully onto the lifting bearing journal.

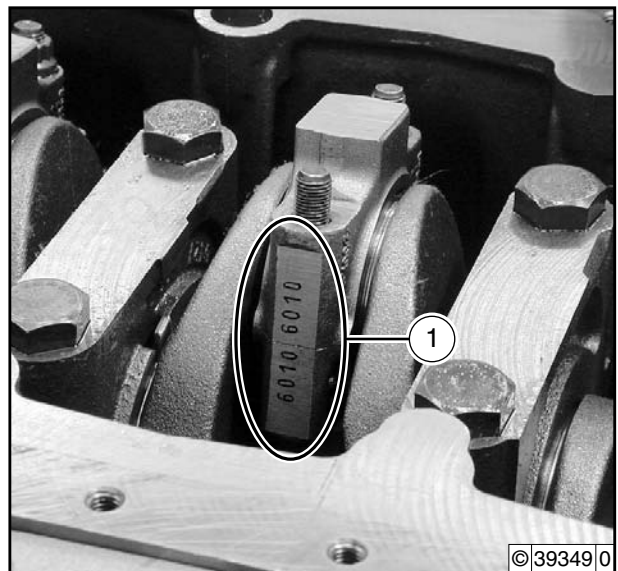


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Note

- Note the assignment of the con rod bearing cover.
- The numeric identification on the con rod bearing cover and the con rod must be identical and be opposite each other in assembly (1).
- The numeric identification is facing the operating side.



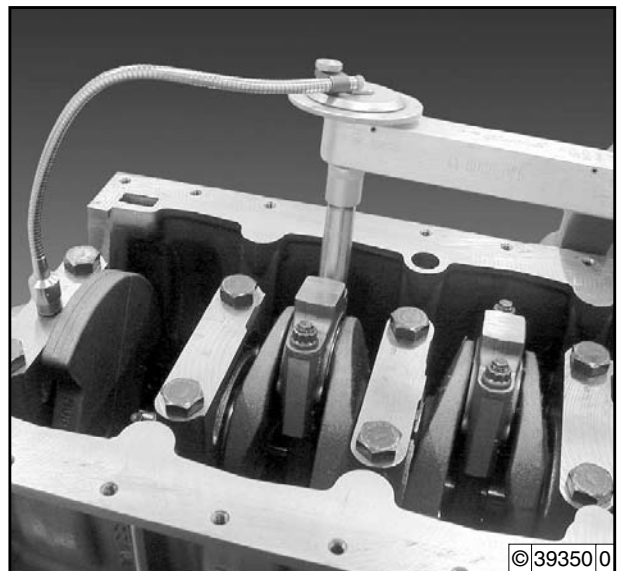
© 39349 0

- Tighten nuts.



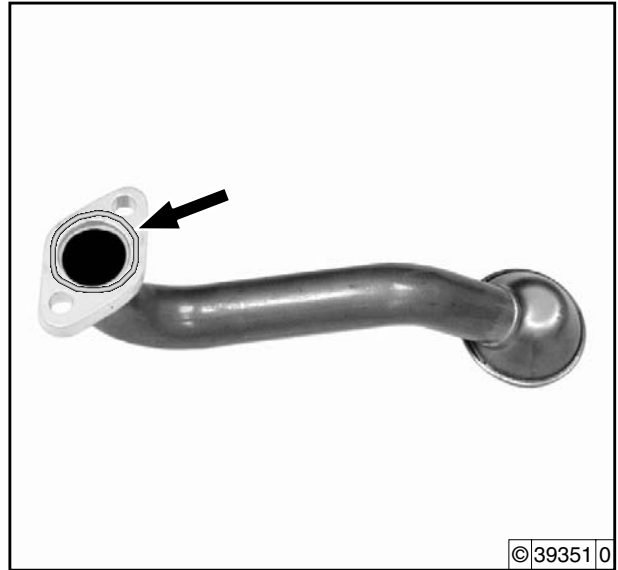
Note

- Con rod bolts and nuts can be used a max. 5 times in case of provability, otherwise always change them.
- Use a twelve-edge box wrench.



© 39350 0

- Clean the sealing surface on the oil intake pipe and crankcase.
- Apply sealant **DEUTZ DW 74** to oil suction pipe (arrow).



6

- Mount oil intake pipe (2) and tighten screws (1).

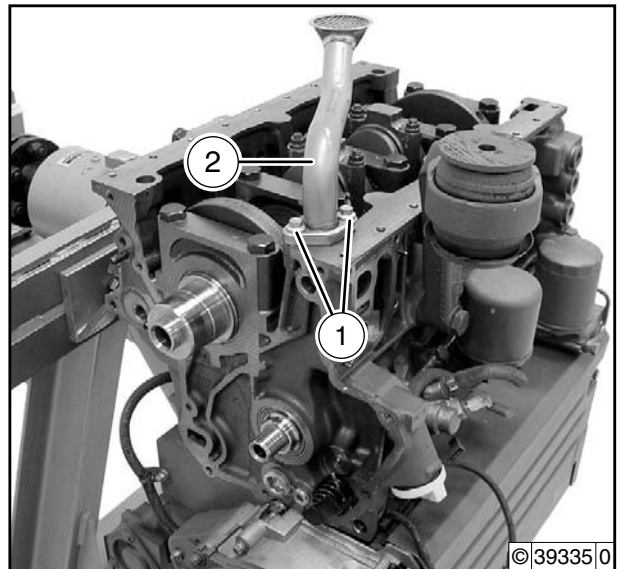


Note

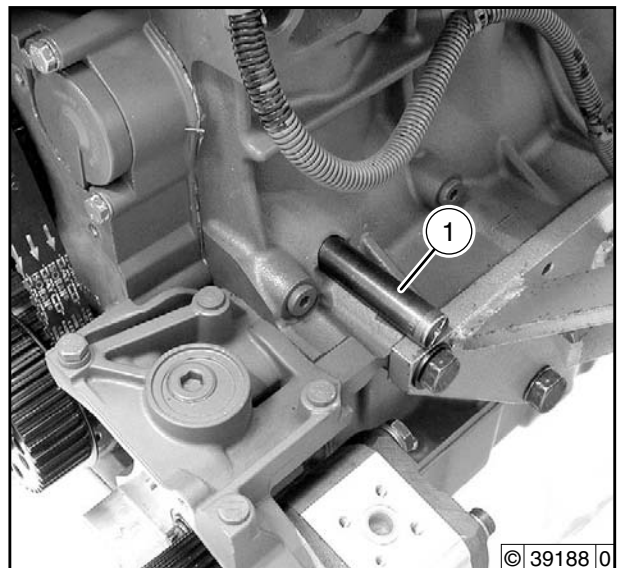
Do not move sealant when mounting the oil intake pipe.



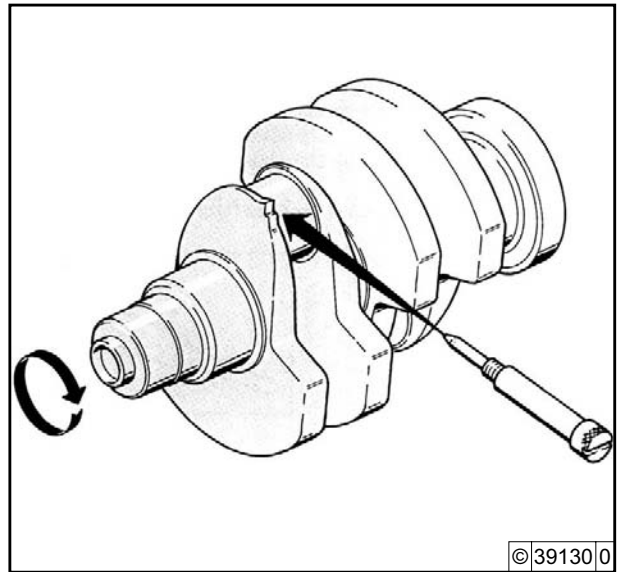
08015



- Screw setting bolts (1) into the crankcase to the stops.



- Turn the crankshaft carefully in the direction of rotation of the engine (clockwise) until it touches the setting bolts.
- Install rear cover (flywheel side)
→ Job card **W 03-09-01**.
- Install front cover (opposite side to flywheel)
→ Job card **W 03-08-01**.





Notes

Remove and install pistons and con rod



Tools

- **Commercial tools**
8021 - Socket size 15

- Special tools

101 910 - Device
130 630 - Piston ring tensioning band
131 100 - Disassembly tool



References

- W 01-04-04
- W 02-10-03
- W 08-04-06

Notes on piston classes of the pistons

When replacing a piston, make sure you use the same piston class.



Note

- The pistons are divided into piston classes by different compression values.
- The piston classes are marked on the base of the piston by "A" or "B" (1).



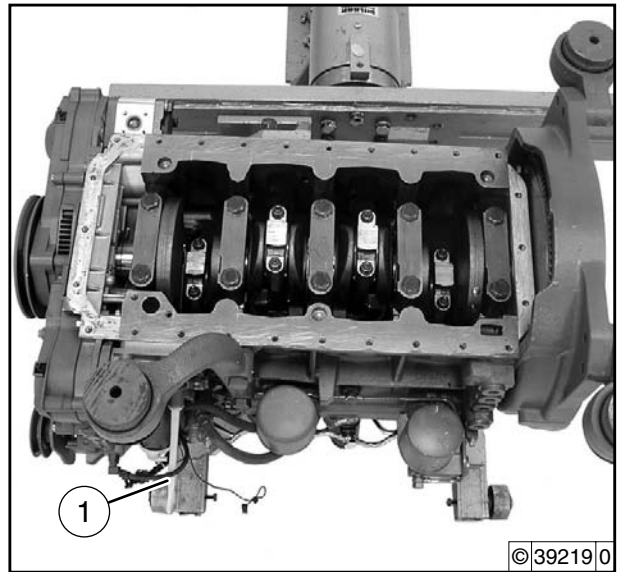
Note

- For **FL-** and **FM** engines pistons with different compression values are available.
- In **BFL** and **BFM**-engines pistons with piston class "A" (1) are used exclusively.



Remove piston and con rod.

- Remove cylinder head
→ Job card **W 01-04-04**.
- Remove oil intake pipe
→ Job card **W 08-04-06**.
- Pull out oil dipstick (1).



6

Remove con rod bearing cover

- Set lifting bearing journal in the lower dead point.
- Unscrew nuts (1).

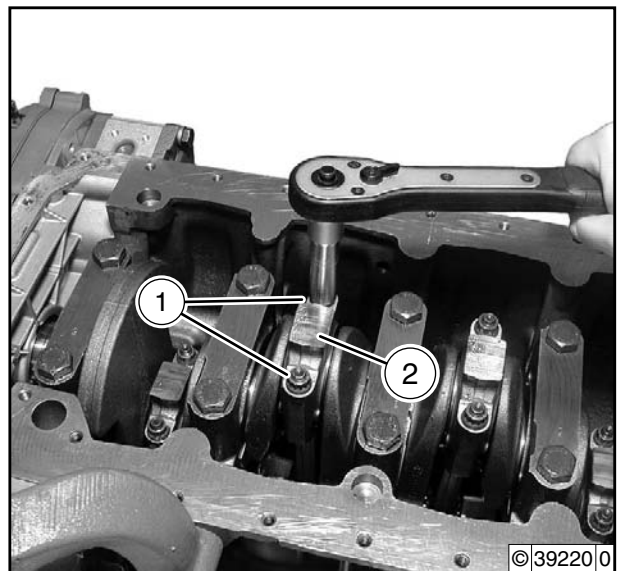


Note

- Use a twelve-edge box wrench.
- Put down the components in the order of installation, note order of cylinders.



- Remove con rod bearing cover (2) and con rod bearing.

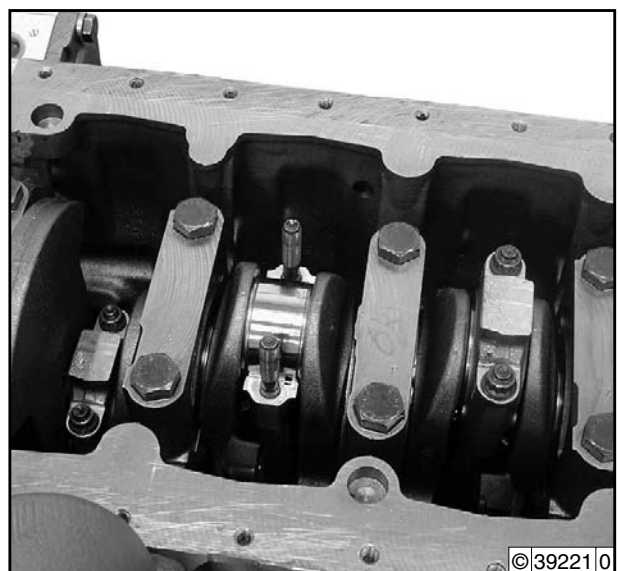


- Press out piston and con rod.

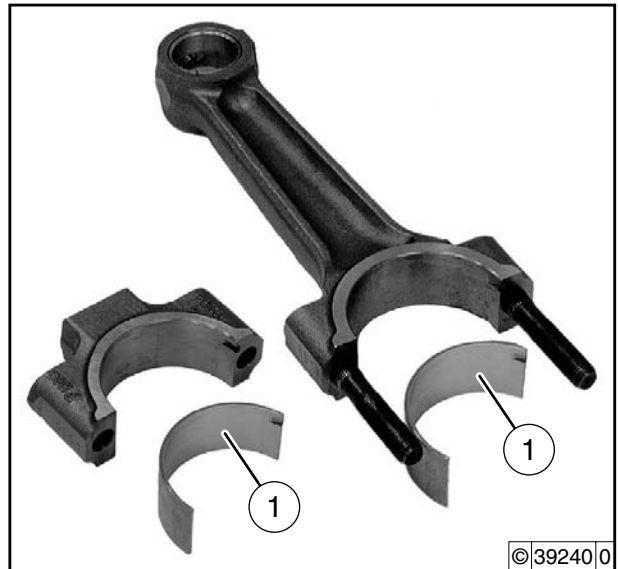


Note

- Set down the components in the order of installation, note cylinder order.



- Remove con rod bearing shells (1).
- Check components for visible signs of wear.



Remove piston from con rod.

- Insert disassembly tool (1) in the piston bolt.



Caution!

Risk of injury! The spring ring jumps off. Always use the disassembly tool.



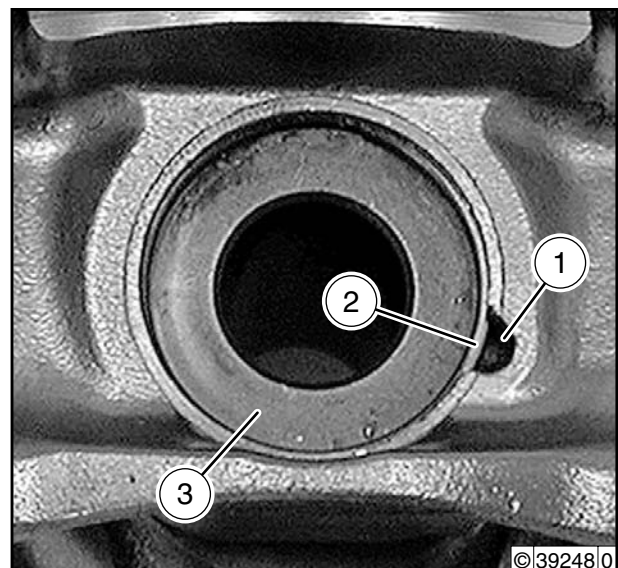
- Place suitable tool in recess (1).
- Remove spring rings (2) on both sides and press out piston bolt (3).



Note

The tools are not inserted for a better representation.

- Check components for visible signs of wear.



Only in FL, FM engines

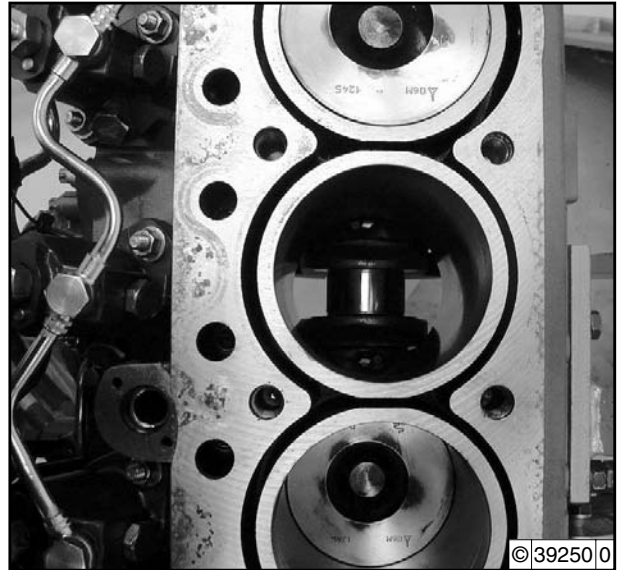
Determine piston class



Note

If the crankshaft and/or the crankcase are replaced, the piston class must be redetermined for every single cylinder.

- Place lifting bearing journal of the respective cylinder in the upper dead point (UT).



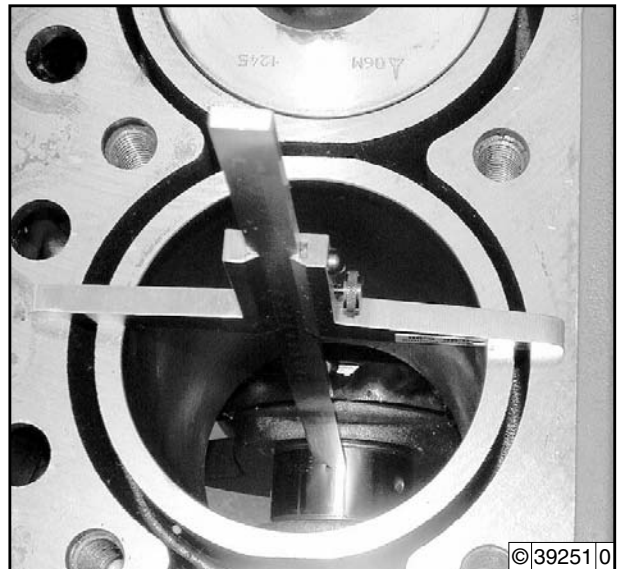
- Measure the distance with the depth measuring appliance, from the cylinder head sealing surface to the highest point of the lifting bearing journal in UT position.



Note

The sealing surface must be clean.

- Read and note measured value.



- Select piston class (1) per cylinder.



Note

In undermeasure steps of the crankshaft 0.125 must be added to the values in the technical data.



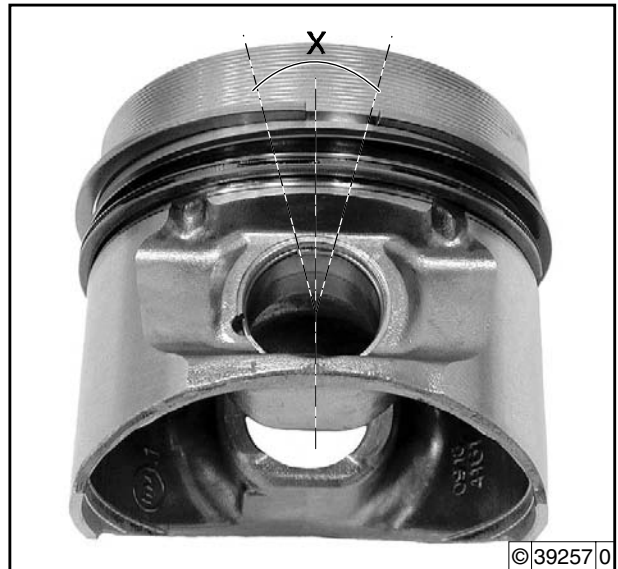
Complete the con rod and the piston

- Insert a spring ring.



Note

- The ring joint must face the piston base, X = +/- 20°
- Pay attention to correct fit of the locking ring in the groove.

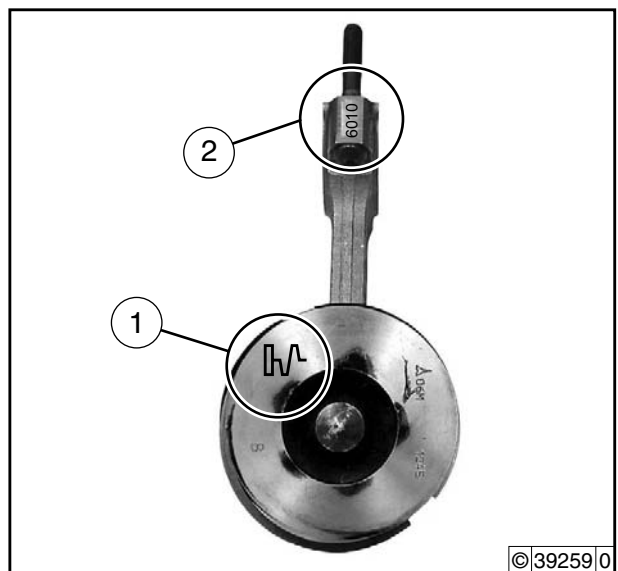


- Insert con rod in piston.



Note

- The symbol flywheel/crankshaft (1), on the piston base, must face left and the numeric identification (2) on the con rod up.



- Oil lightly and press in the piston bolt.
- Insert the second spring ring.



Note

- The ring joint must face the piston compression bolt.
- Pay attention to correct fit of the spring ring in the groove.



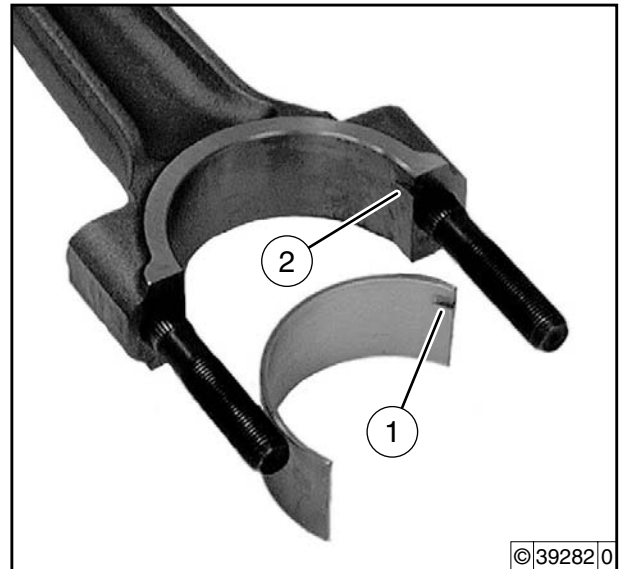
Install piston and con rod

- Insert con rod bearing shell in the con rod.



Note

- Note the assignment of the bearing shells.
- The twist protection (1) must engage in the groove (2).



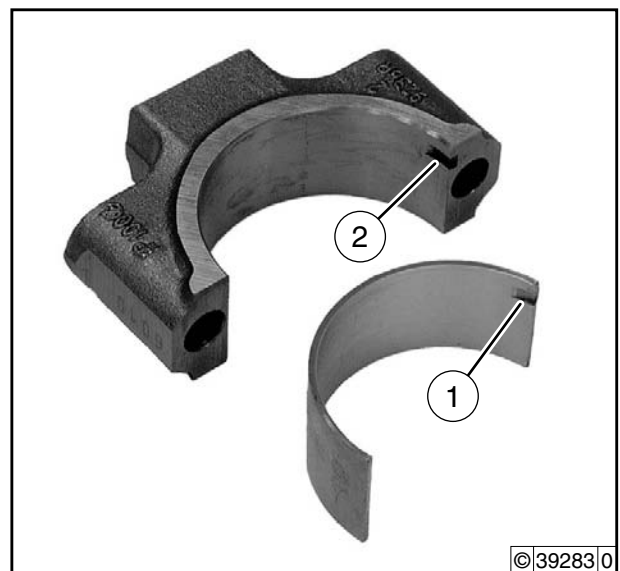
6

- Insert con rod bearing shell in the appropriate con rod bearing cover.

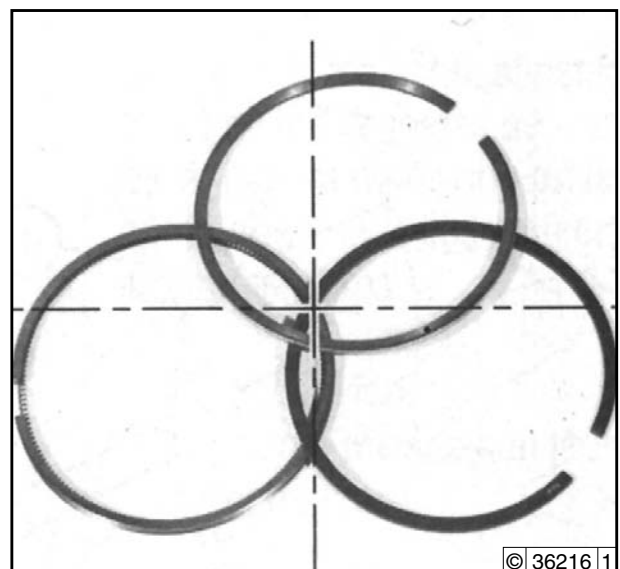


Note

- The twist protection (1) must engage in the groove (2).



- Arrange piston ring joints offset by about 120°.
- Check piston rings and piston ring grooves
→ Job card W 02-10-03.



- Oil cylinder running surface, piston, piston rings and lifting bearing journal lightly.
- Clamp piston rings with piston ring tensoning band (1).



Note

Do not turn the piston rings any more.



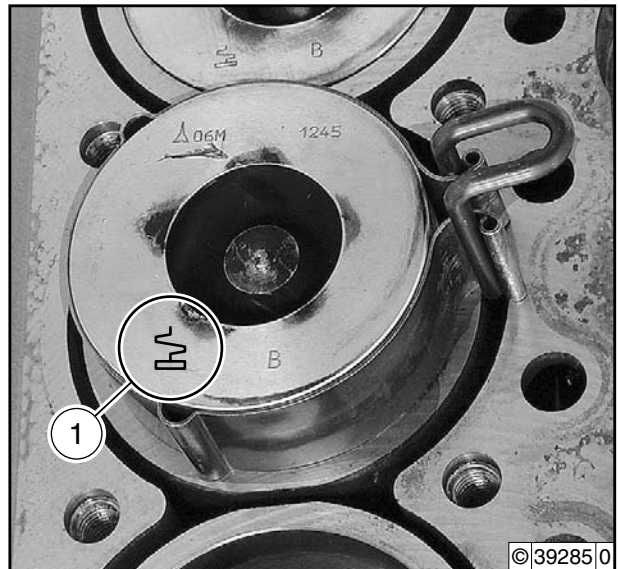
- Set lifting bearing journal in the lower dead point.



Note

- Note the cylinder assignment of the piston.
- Note the identification (1) of the installation position on the piston base, the symbol flywheel/crankshaft must face the flywheel.
- The piston ring tensoning band must lie flat on the crankcase.

- Push the piston into the cylinder with the con rod.

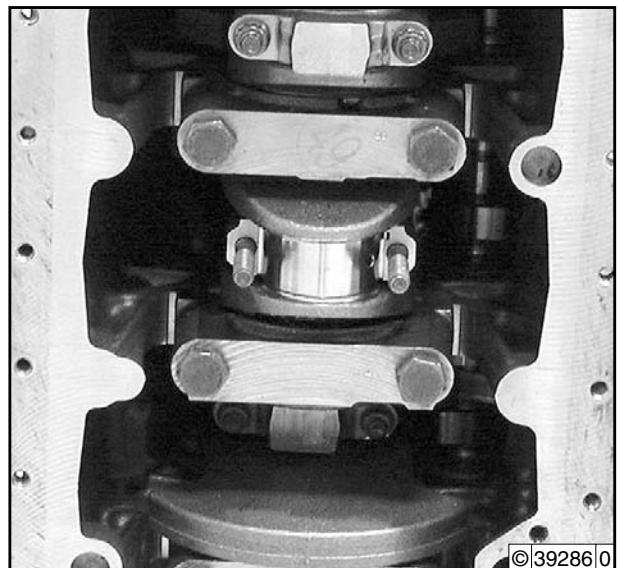


- Press the con rod carefully against the lifting journal.



Note

Do not jam the con rod with the crankshaft.

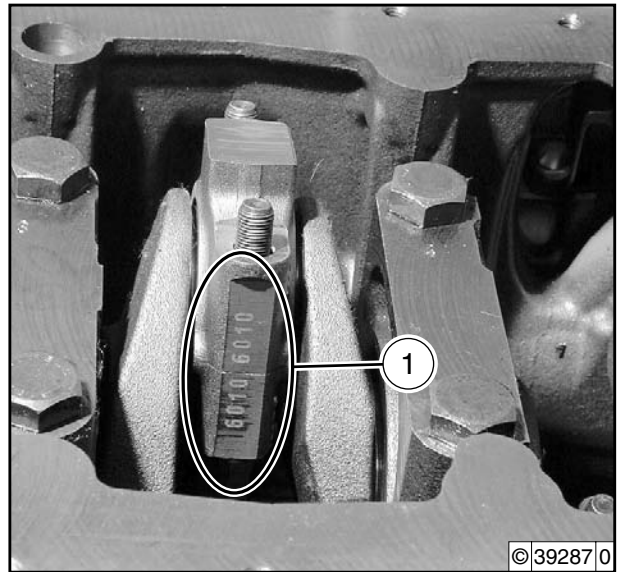


- Install the con rod bearing cover.



Note

- Note the assignment of the con rod bearing cover.
- The numeric identifications (1) on the con rod and the con rod bearing cover must be identical and opposite each other when assembled.
- The numeric identification is facing the operating side.



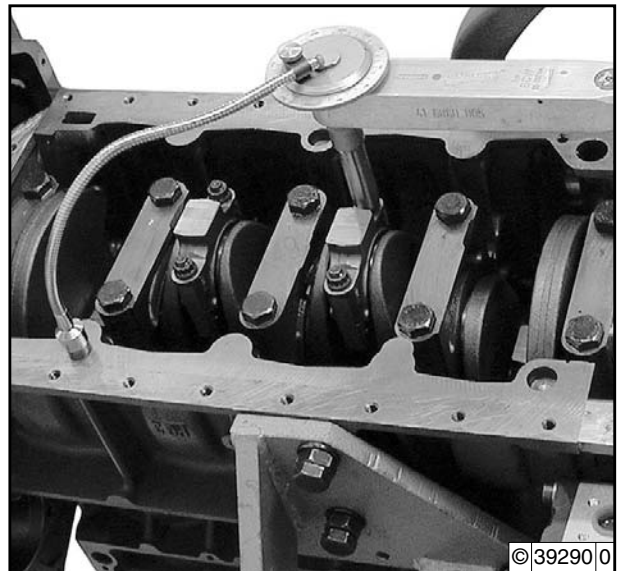
6

- Tighten nuts.

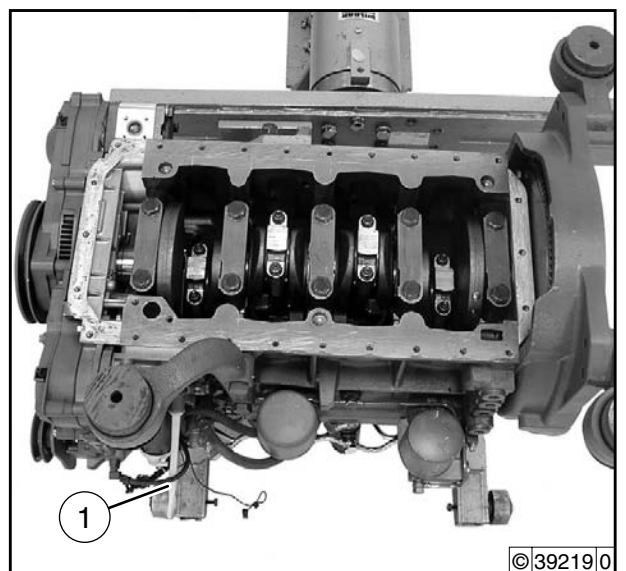


Note

- Con rod bolts and nuts can be used a max. 5 times in case of provability, otherwise always change them.
- Use a twelve-edge box wrench.



- Insert oil dipstick (1).
- Install oil intake pipe.
→ Job card **W 08-04-06**.
- Install cylinder head
→ Job card **W 01-04-04**.



Check piston



Tools

- **Commercial tools**
Micrometer gauge
Internal measuring device

- **Special tools**
100 400 - Meter



Note

If the wear limit is reached, the piston has to be changed.



References

- W 02-09-03

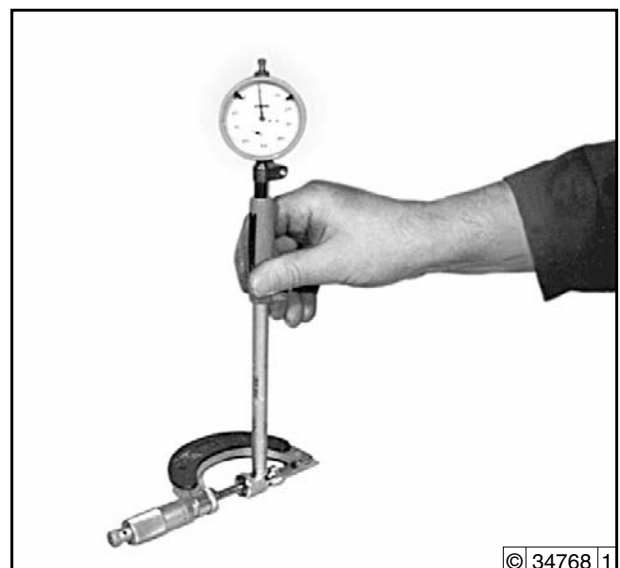
Check the piston bolt bore

- Remove piston from con rod.
→ Job card W 02-09-03.



Prepare internal measuring device

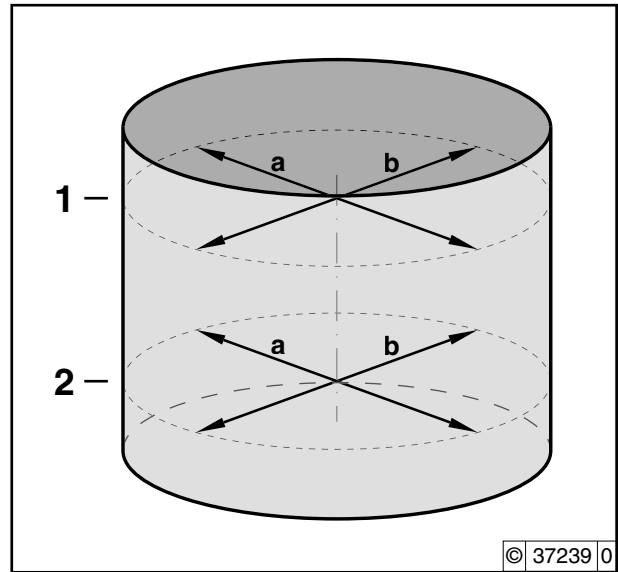
- Mount probe bolt for the appropriate measuring range in the internal measuring device.
- Mount meter with approx. 1 mm pre-tension in the internal measuring device.
- Set micrometer gauge to
 - 26 mm in FL/M engines
 - 30 mm in BFL/M engines.
- Balance the internal measuring device between the test surfaces of the micrometer gauge and set the meter to the reversal point of the pointer to "0".





Note

Schematic representation for measuring the piston bolt bore at the points "a" and "b" in the levels "1" and "2".



6

- Measure piston bolt bore with internal measuring device. Insert the internal measuring device in the piston bolt bush.
- Balance the internal measuring device respectively at the given measuring points and read off the measured value at the reversal point of the pointer.



Note

Measuring points, see schematic diagram.

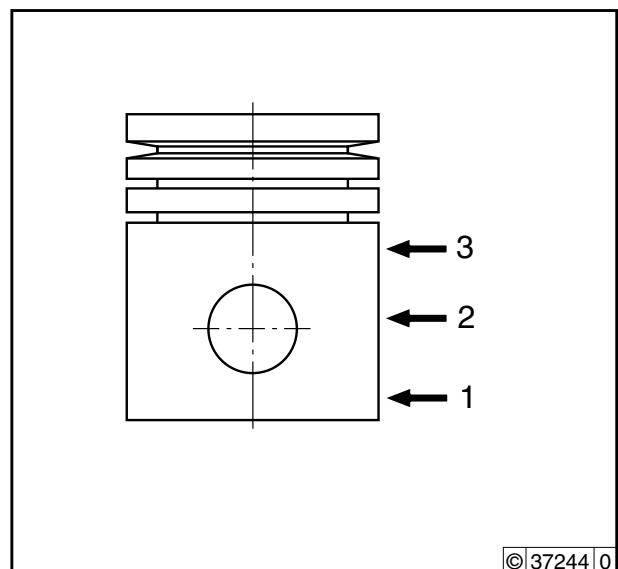


Check the piston diameter



Note

Schematic representation for measuring the piston diameter at the measuring points "1, 2 and 3", transverse to the piston bolt bore.



- Measure piston diameter with micrometer gauge.



Note

Measuring points, see schematic diagram.



- Complete the con rod with piston
→ Job card W 02-09-03.





Notes

Check piston rings and piston ring grooves



Tools

- **Commercial tools**
Feeler gauges

- **Special tools**

130 300 - Universal piston ring pliers
130 420 - Trapezoidal wear gauge



References

- W 02-09-03

Check piston rings and piston ring grooves

- Remove piston from con rod.
→ Job card **W 02-09-03**.
- Set universal piston ring pliers to the piston diameter.



- Remove piston rings with universal piston ring pliers.

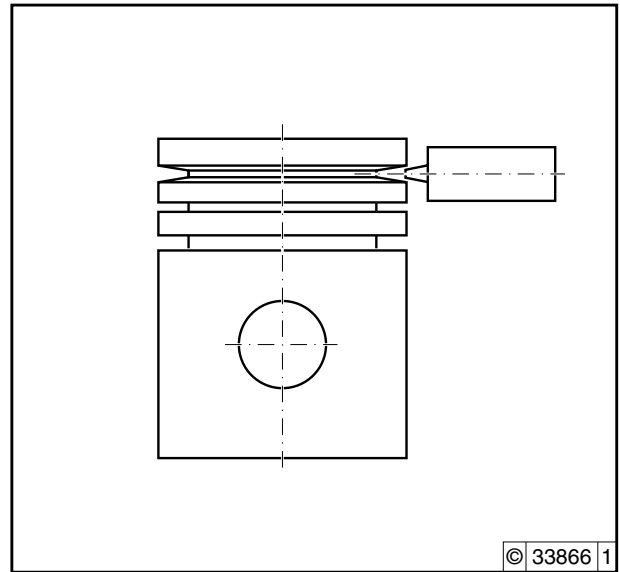


- Clean and inspect the pistons and ring grooves.



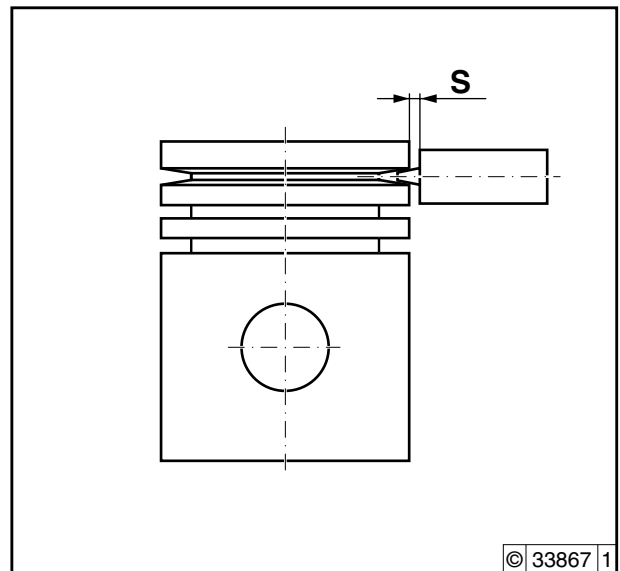
Only in BFL, BFM engines

- Measure piston ring trapezoidal groove for first piston ring with trapezoidal groove wear gauge.

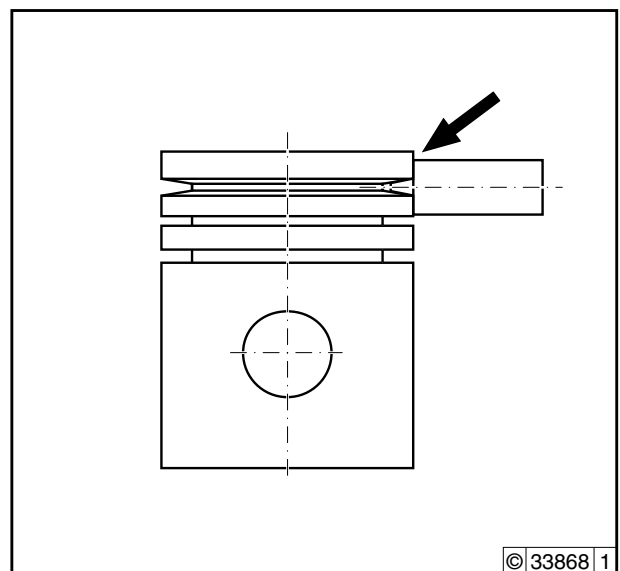


6

- If there is a gap (S) between the trapezoidal wear gauge and piston, the piston is still usable.



- If the trapezoidal groove wear gauge is touching the piston (arrow), the piston must be changed.



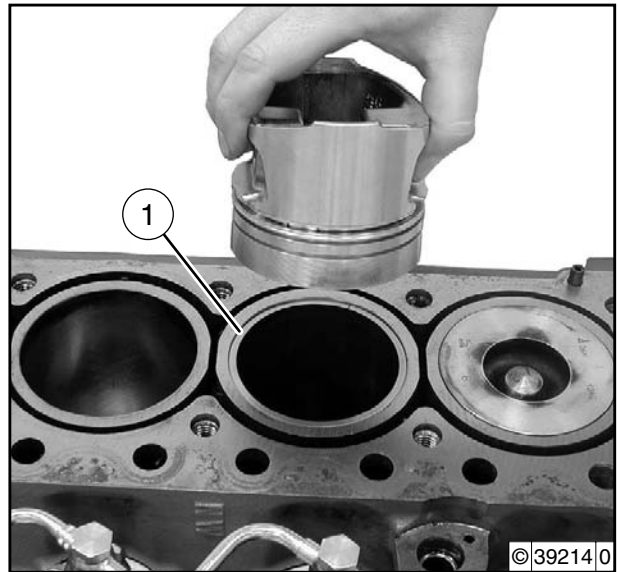
Check the piston ring joint clearance

- Insert the piston ring (1) in the cylinder.



Note

Align the piston ring in the cylinder by pushing the piston.

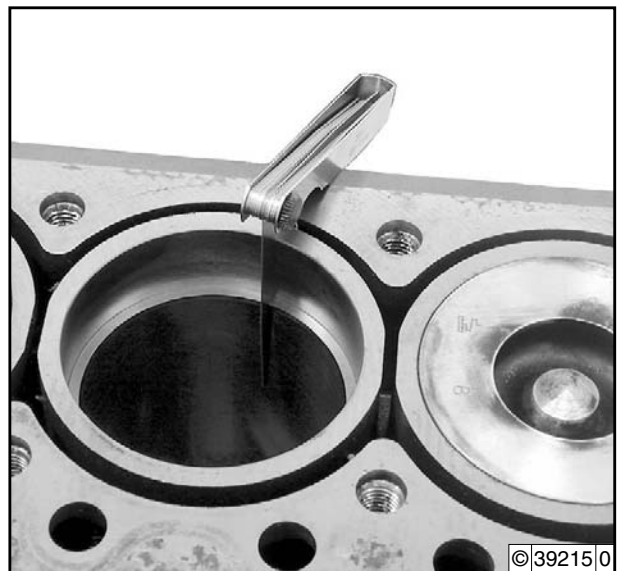


- Measure the piston ring joint clearance with a feeler gauge.



Note

If the wear limit is reached, change the piston ring.



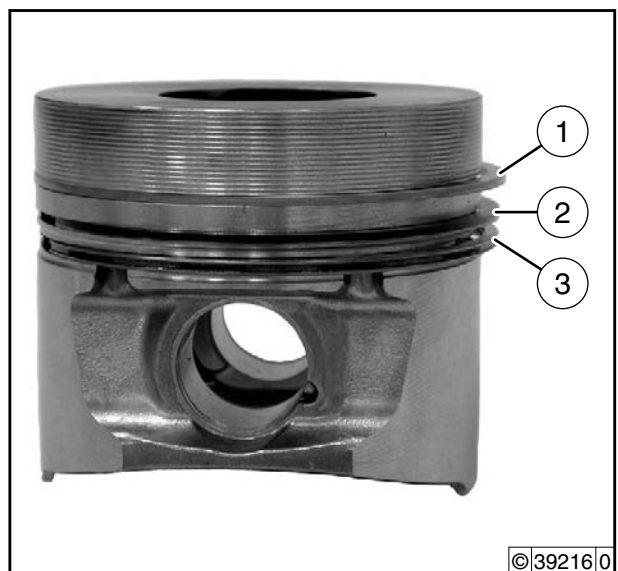
- Install piston rings.



Note

- Order and position of the piston rings seen from the piston base.
- On the piston rings (1, 2 and 3) the identification "Top" must face the combustion chamber.

1. Rectangular ring in FL/M engines.
1. Double trapeze ring for BFL/M engines.
2. Minute ring.
3. Roof chamfer ring with hose spring.



- Install rings with universal piston ring pliers.



Note

Set spring joint of the roof chamfer ring 180° to the ring joint.



6

Check the piston ring axial clearance

- Measure piston ring axial clearance in the piston ring groove with a feeler gauge.



Note

- Do measurement with new piston rings.
- In BF engines, only check axial clearance with feeler gauge in piston ring groove 2 and 3.
- If the wear limit is reached, the piston has to be changed.



- Mount piston on con rod
→ Job card **W 02-09-03**.

Remove and install piston cooling nozzles



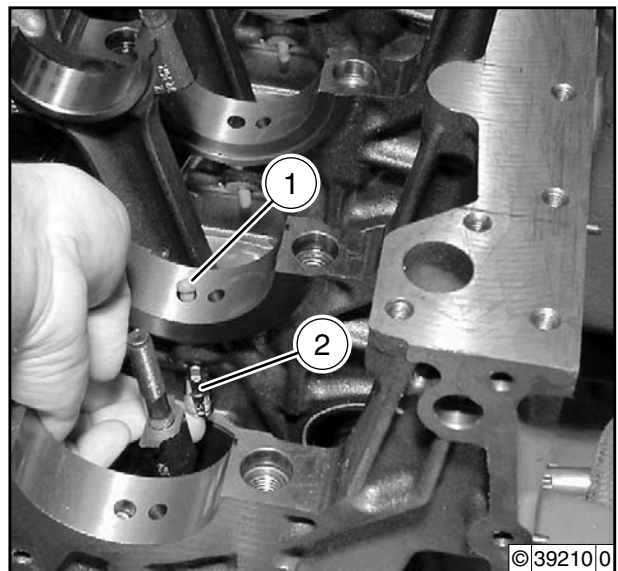
Tools
- Commercial tools



References
- W 02-04-01

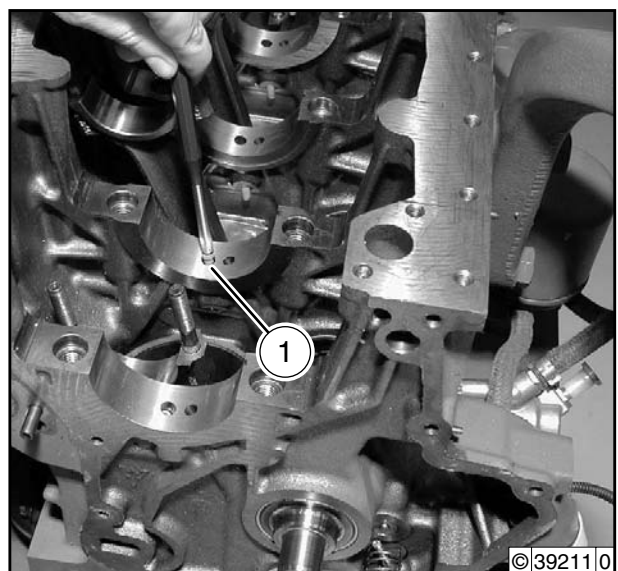
Remove piston cooling nozzles

- Remove crankshaft
→ Job card **W 02-04-01**.
- Press out piston cooling nozzle (1) with a suitable tool (2).



Install piston cooling nozzles

- Clean bores for piston cooling nozzles in the crankcase.
- Press in piston cooling nozzle (1) with suitable tool to the stop.
- Install crankshaft
→ Job card **W 02-04-01**.





Notes

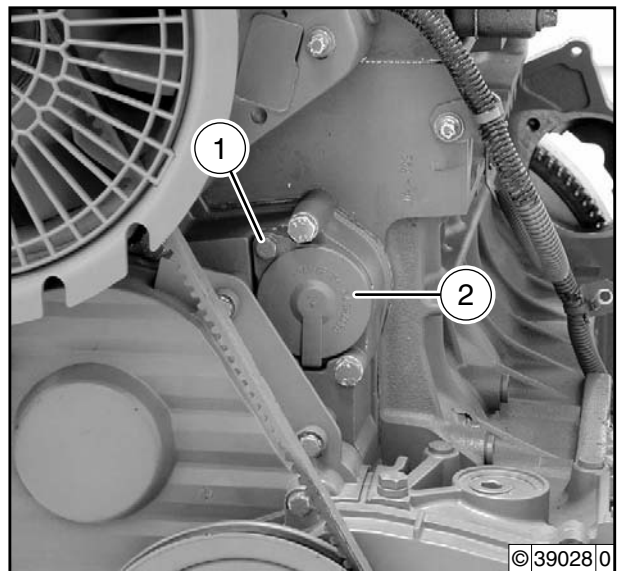
Remove and install crankcase bleeding



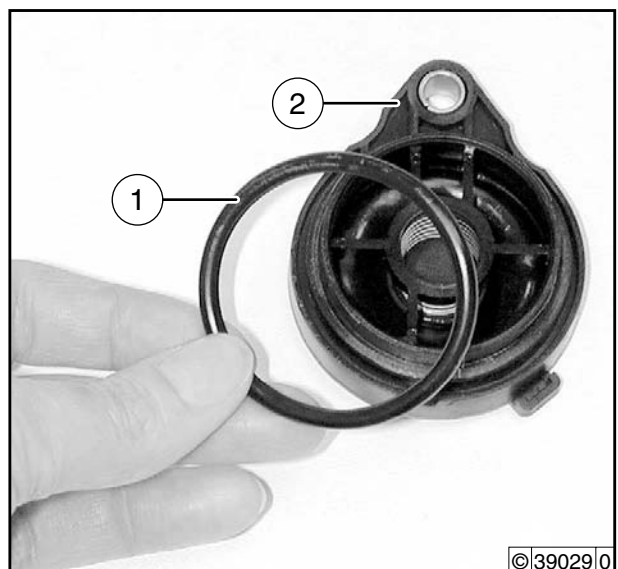
Tools
- Commercial tools

Remove bleed valve

- Unscrew screw (1) and remove bleed valve (2).
- Clean components and check for visible signs of wear.



- Pull new round sealing ring (1) onto bleed valve (2).



Install bleed valve

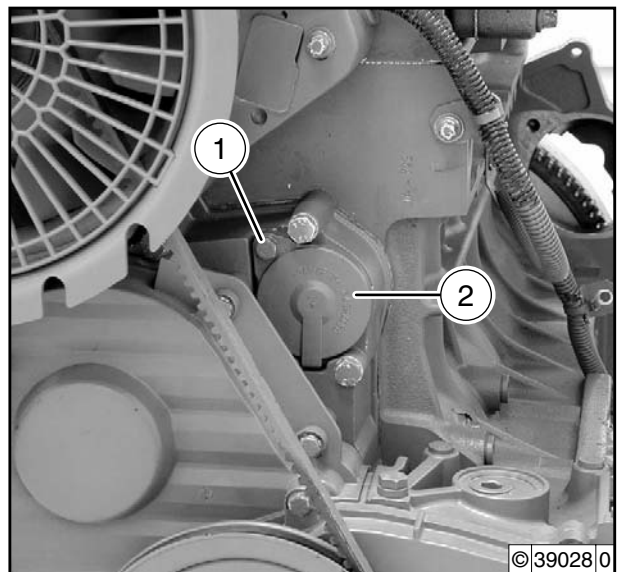
- Mount bleed valve (2) and press in.



Note

The bleed valve must contact the front cover evenly.

- Tighten screw (1).

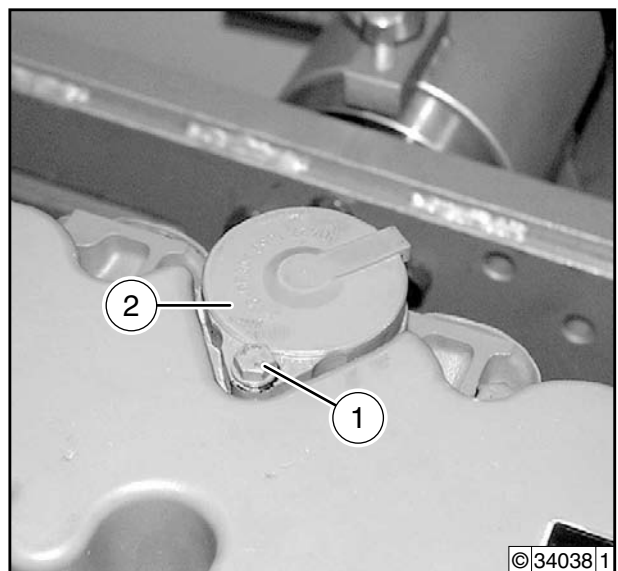


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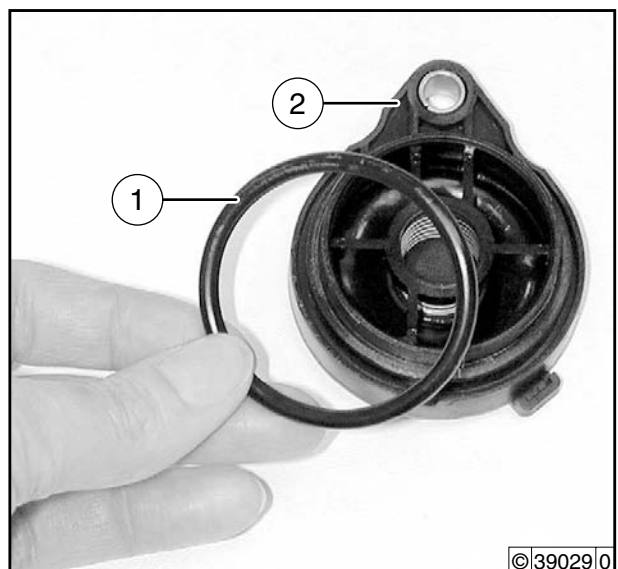
In BFL, BFM engines

Remove bleed valve

- Unscrew screw (1) and remove bleed valve (2).
- Clean components and check for visible signs of wear.



- Pull new round sealing ring (1) onto bleed valve (2).



Install bleed valve

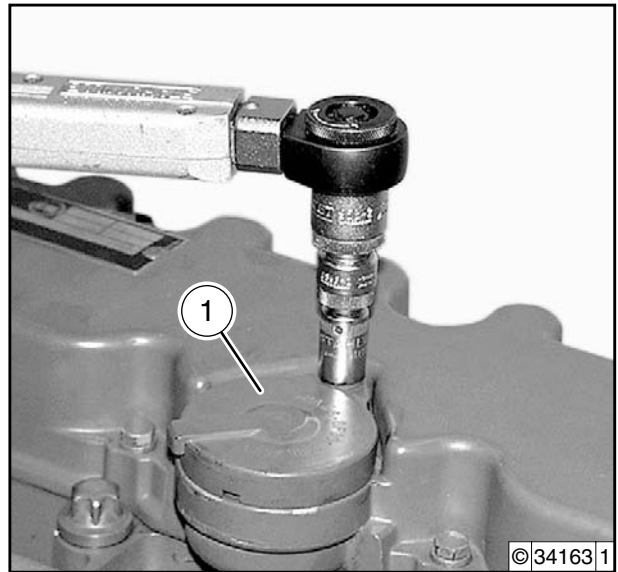
- Mount bleed valve (1) and press in.



Note

The bleed valve must touch the cylinder head cover evenly.

- Tighten screw.





Notes

Renew camshaft sealing ring (opposite side to flywheel)



Tools

- **Commercial tools**
9017 - Assembly lever

- **Special tools**

142 050 - Press-in device



References

- W 04-04-12 (old version)
- W 04-04-12 (new version)

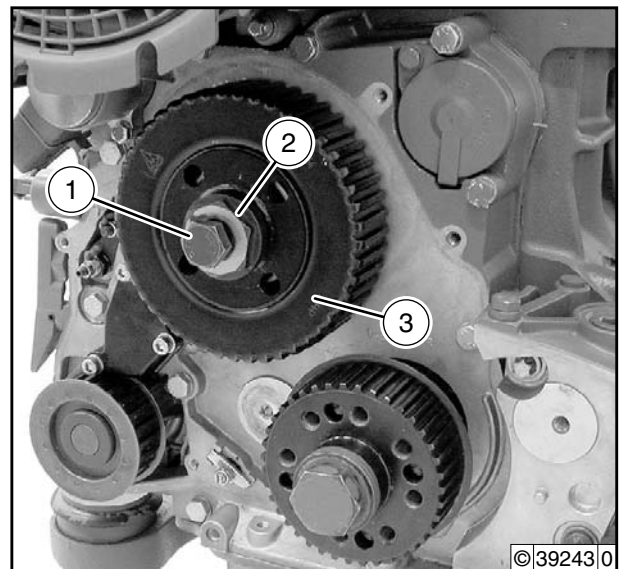
Remove camshaft sealing ring

- Remove toothed belt and clamping roller, loosen camshaft toothed belt wheel
→ Job card **W 04-04-12**(old version)
→ Job card **W 04-04-12**(new version)
- Unscrew center screw (1) with washer (2) and remove the camshaft toothed belt wheel (3).

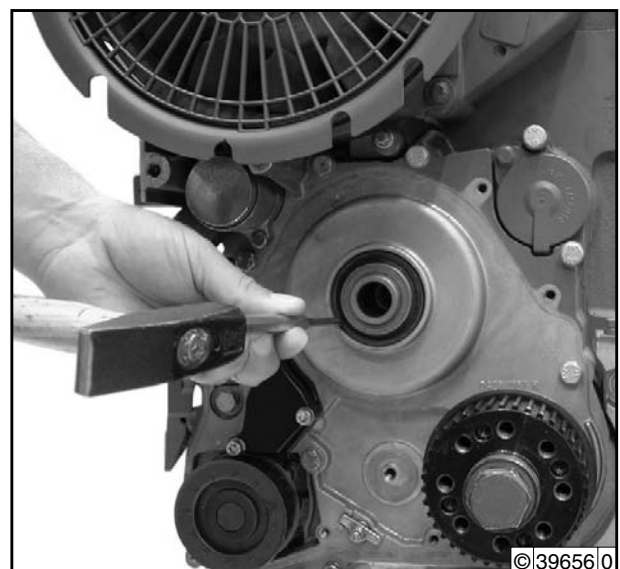


Note

There is no washer (2) on the camshaft toothed belt wheel with torsional vibration damper.



- Loosen crankshaft sealing ring in its seat by hitting with a mandrel.

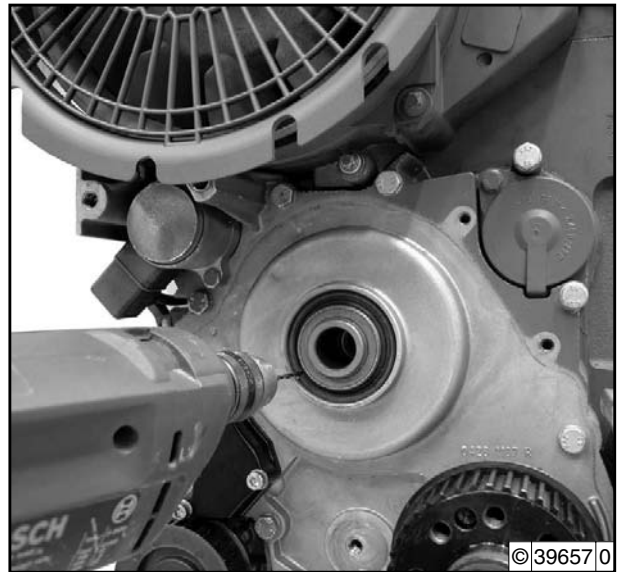


- Carefully drill a hole (at least 3 mm Ø) diameter in the crankshaft sealing ring.



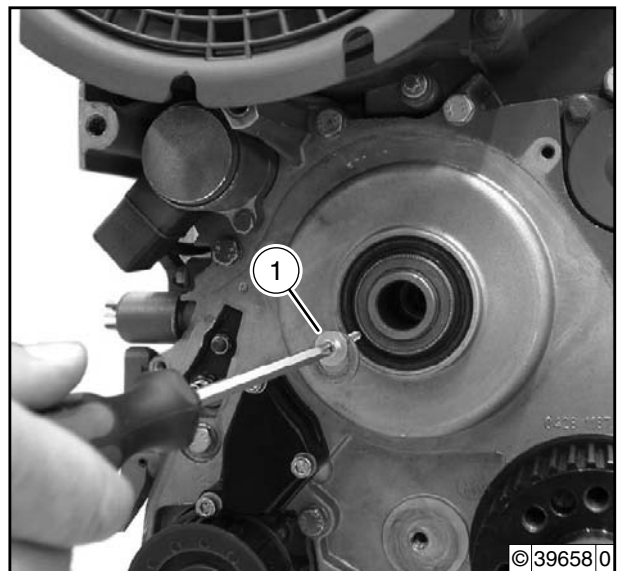
Note

- Coat the drill thickly with grease so that no drill chips fall into the crankcase.
- Do not damage the front cover and crankshaft.

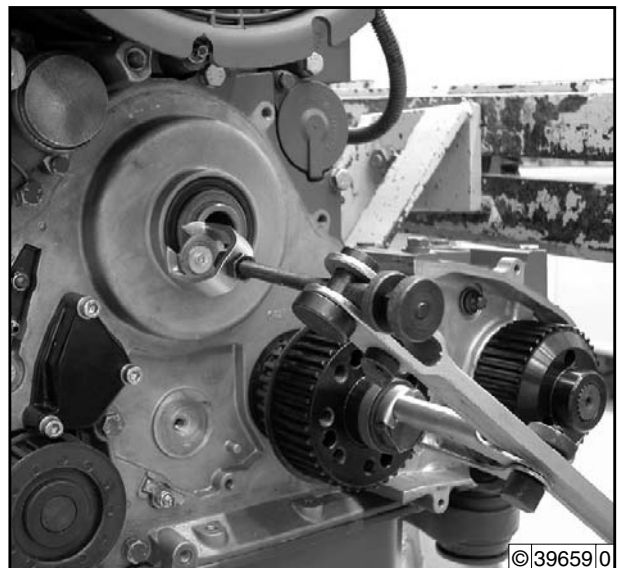


6

- Turn in self-tapping screw (1) with washer.



- Pull out crankshaft sealing ring with assembly lever.
- Visually inspect the running surface of the crankshaft flange and front cover.



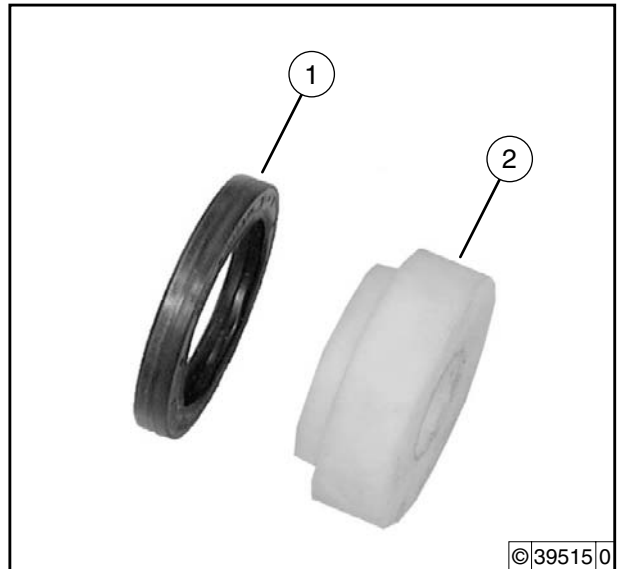
Install camshaft sealing ring

- Oil the sealing lip of the new camshaft sealing ring lightly with engine oil.
- Fit the camshaft sealing ring (1) to the assembly tool (2).

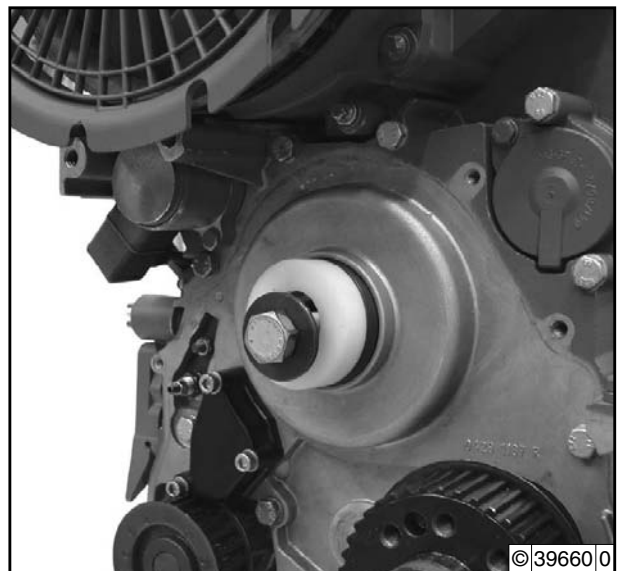


Note

The sealing lip must face the camshaft in assembly.



- Mount the camshaft sealing ring with the assembly tool and turn in the screw.



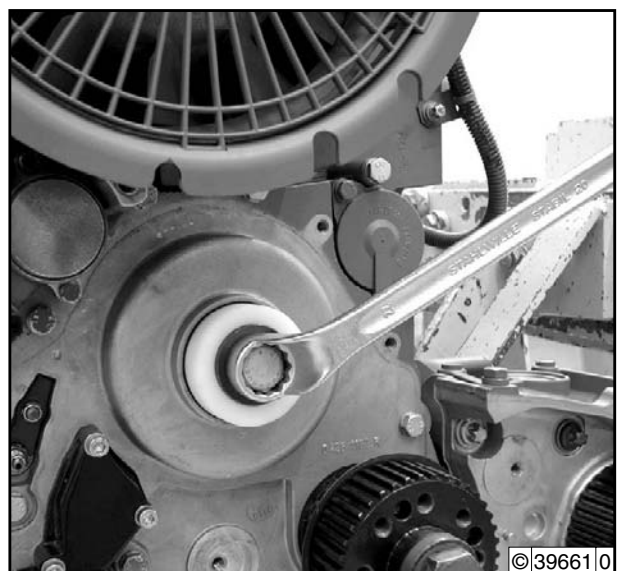
- Pull in the assembly tool to the stop by turning in the screw.



Note

The installation depth of the crankshaft sealing ring is determined by the assembly tool.

- Unscrew screw and remove assembly tool.



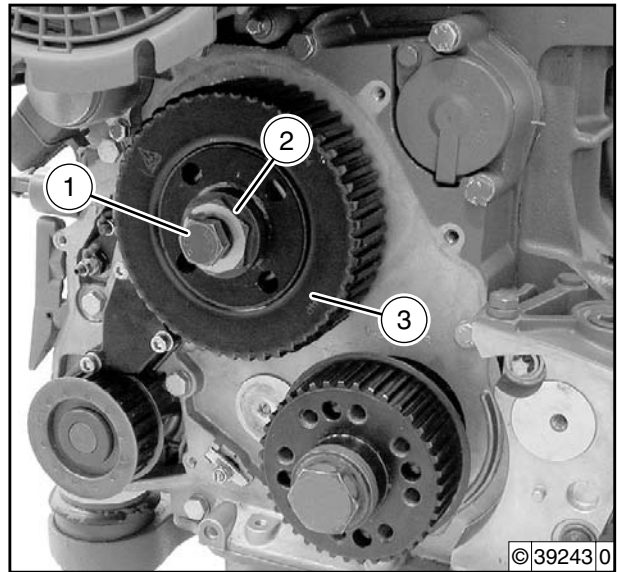
- Mount camshaft toothed belt wheel (3) and tighten center screw (1) with washer (2).



Note

- There is no washer (2) on the camshaft toothed belt wheel with torsional vibration damper.
- All connections must be clean and oil free.

- Install toothed belt and clamping roller, fix camshaft toothed belt wheel.
 - Job card **W 04-04-12** (old version)
 - Job card **W 04-04-12** (new version)



Check cylinder



Tools

- **Commercial tools**
Internal measuring device
Micrometer gauge

- **Special tools**
100 400 - Meter



References

- W 01-04-04



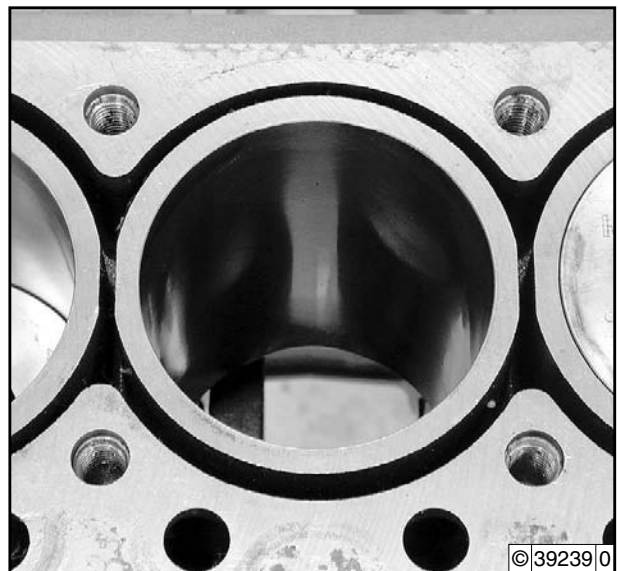
Note

- The crankshaft bearing cover must be mounted properly to measure the cylinder.
- If the wear limit is reached, it is possible to rework the crankshaft for further use. Use pistons and piston rings according to the repair stage.

- Remove cylinder head
→ Job card **W 01-04-04**.

Check cylinder

- Check cylinder for visible signs of wear.



6

Check the cylinder running surface

Prepare internal measuring device.

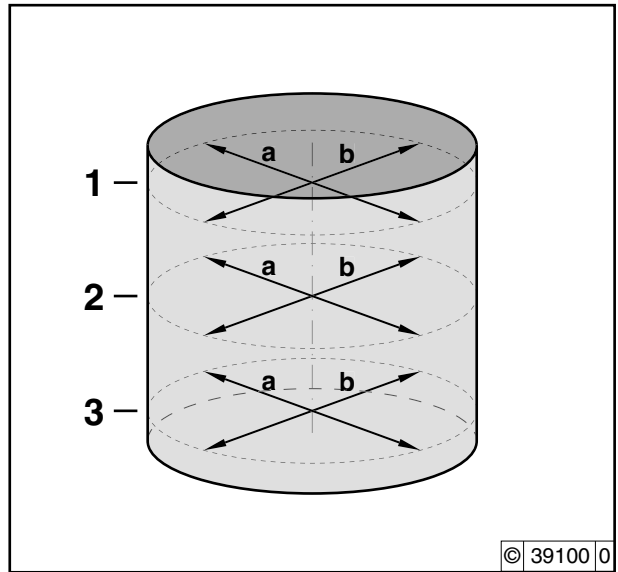
- Mount probe bolt for the appropriate measuring range in internal measuring device.
- Install meter with approx. 1 mm pre-tension in the internal measuring device.
- Set micrometer gauge to 94 mm.
- Balance internal measuring device between the test surfaces of the micrometer gauge and set the meter at the reversal point of the pointer to "0".





Note

Schematic representation for measuring the cylinder running surface at the points "a" and "b" in the levels "1 - 3".



6

- Measure cylinder with internal measuring device. Insert internal measuring device in the cylinder.
- Balance the internal measuring device respectively at the given measuring points and read off the measured value at the reversal point of the pointer.

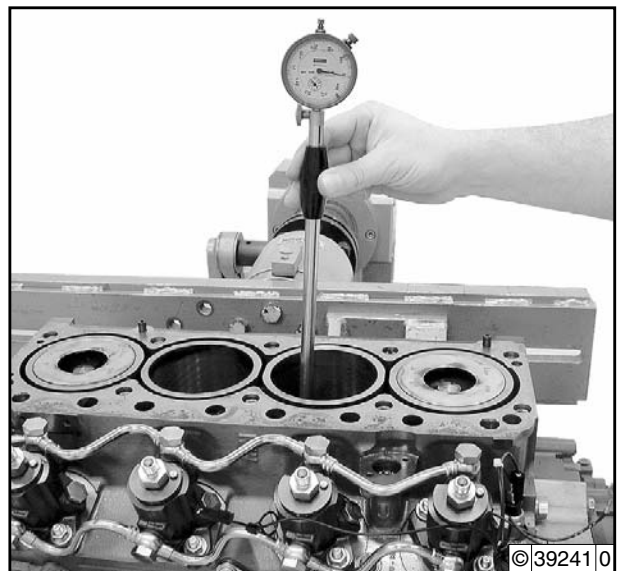


Note

Measuring points, see schematic diagram.



- Install cylinder head
→ Job card **W 01-04-04**.



Remove and install front cover (opposite side to flywheel)



Tools

- Commercial tools

- 8036 - Socket
- 8049 - Force multiplier
- 8189 - Torx tool kit

- Special tools

- 142 850 - Assembly tool
- 143 420 - Holder
- 143 430 - Intermediate disc



Auxiliary material

DEUTZ DW 67



References

- W 04-03-01
- W 04-04-12(new version)
- W 04-04-12 (old version)
- W 08-04-05
- W 08-08-02

Remove front cover

- Remove toothed belt and clamping roller, loosen camshaft toothed belt wheel
 → Job card W 04-04-12(new version)
 → Job card W 04-04-12(old version)

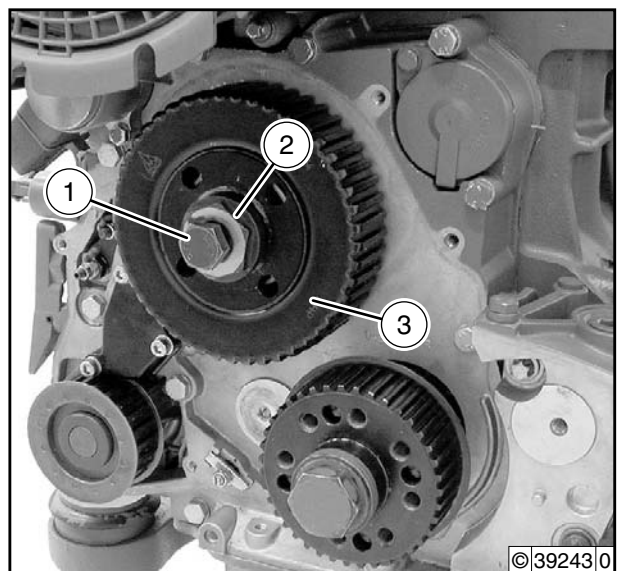
Remove camshaft toothed belt wheel

- Unscrew center screw (1) with washer (2) and remove the camshaft toothed belt wheel (3).



Note

There is no washer (2) on the camshaft toothed belt wheel with torsional vibration damper.



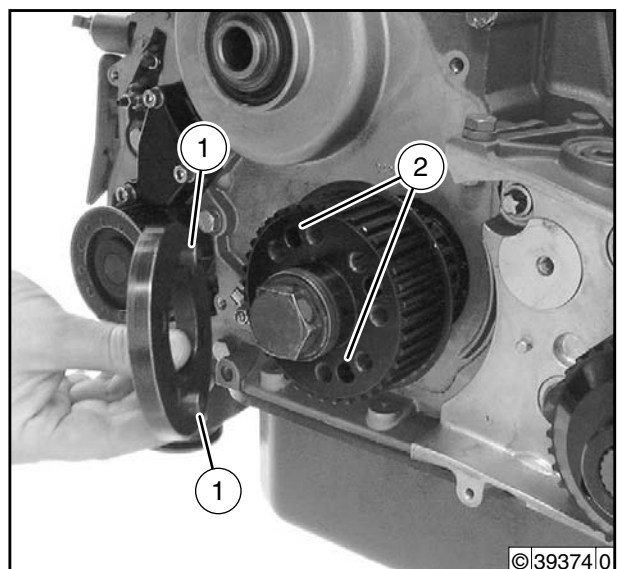
Remove crankshaft toothed wheel.

- Mount intermediate disc.



Note

The fixing bolts (1) must engage the bores (2).

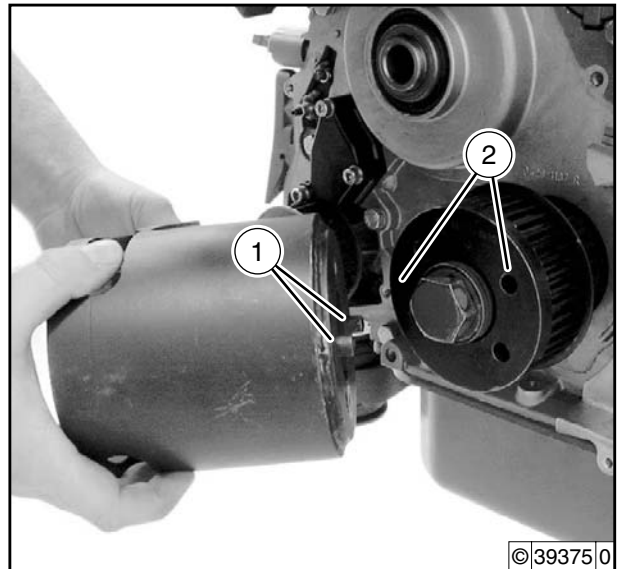


- Mount holder.



Note

- The fixing bolts (1) must engage the bores (2).
- Do not turn the crankshaft.



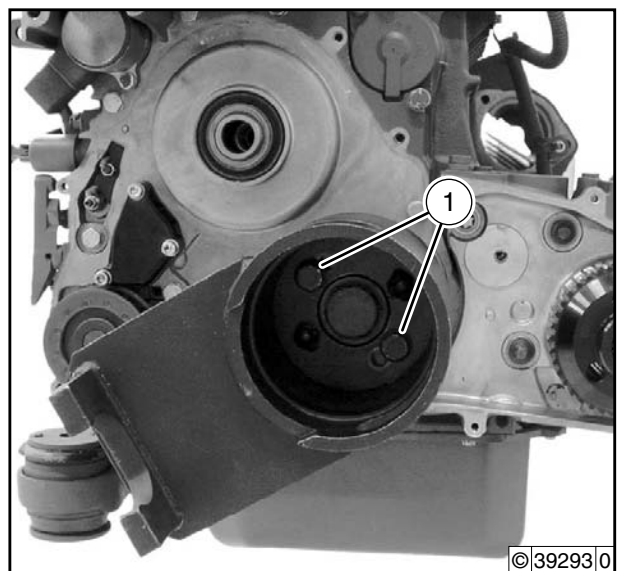
6

- Tighten screws (1).



Note

- Do not turn the crankshaft.

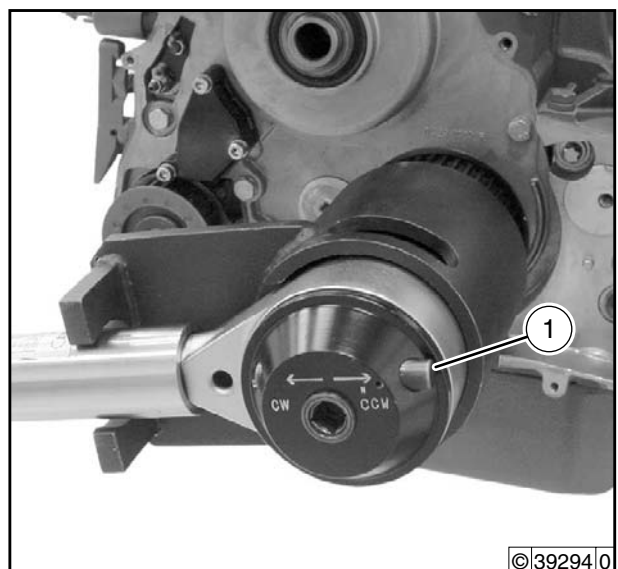


- Mount force multiplier with socket.

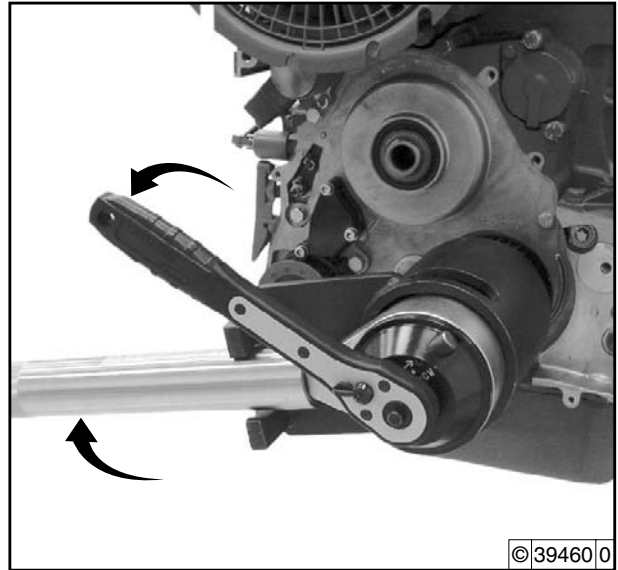


Note

- Snap in setting bolts (1) in "CCW" position.



- Hold the force multiplier and loosen the center screw.
- Remove the force multiplier, holder and intermediate disc.



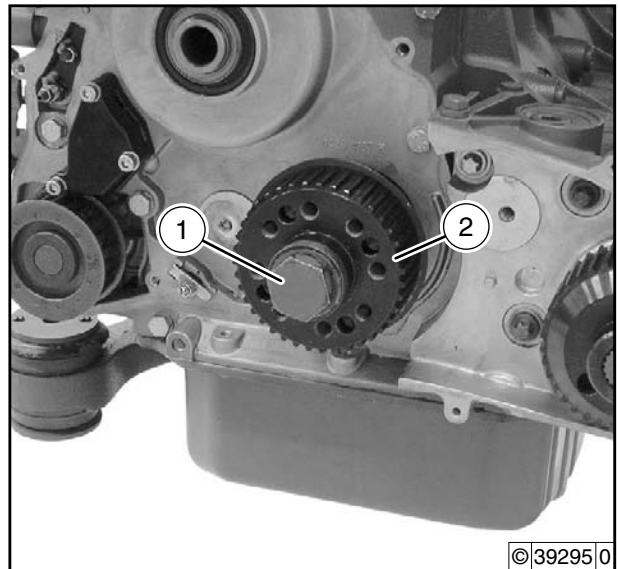
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- Unscrew center screw (1) and remove toothed wheel (2).



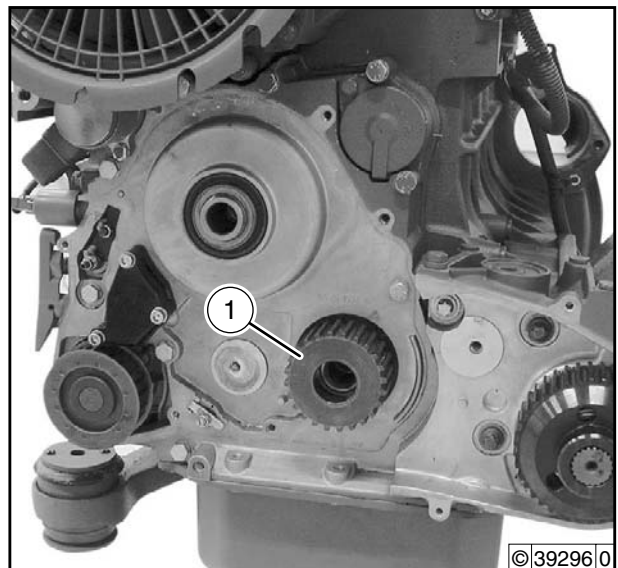
Note

An adapter is used in place of the toothed wheel without a hydraulic pump mounted.



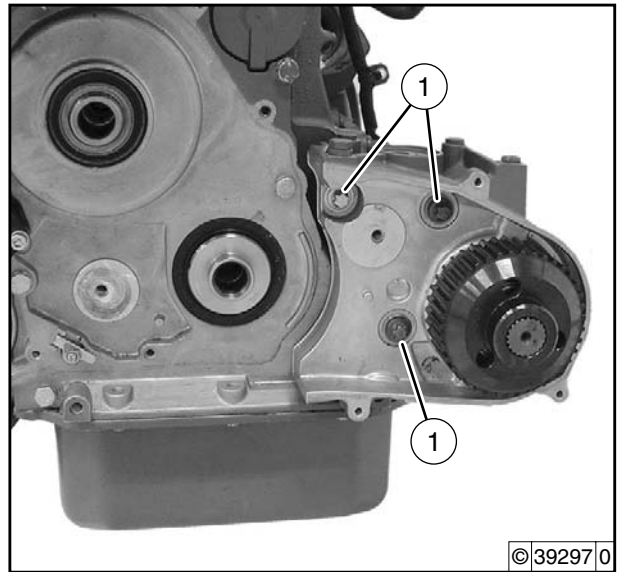
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- Remove crankshaft toothed wheel (1).
- Remove lube oil pump
→ Job card W 08-04-05.



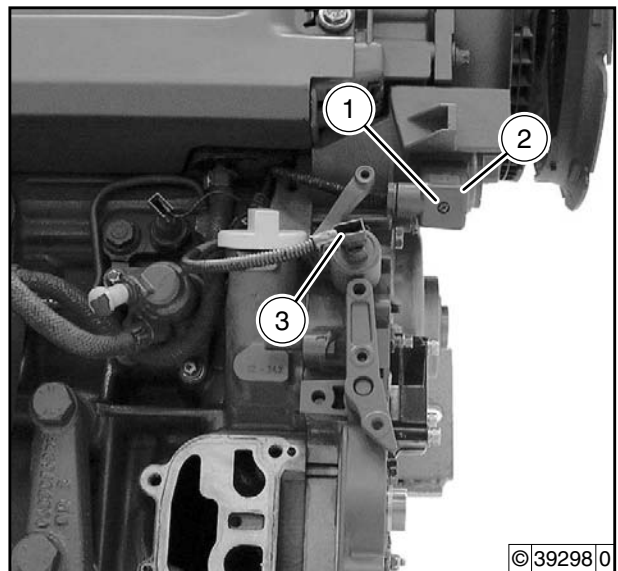
©39296 0

- Unscrew screws (1) and remove hydraulic pump console with hydraulic pump.



6

- Unscrew screw (1) and remove cable plug (2) from engine shutdown.
- Pull out cable plug (3) from lifting magnet for start volume release.
- Remove lube oil tray
→ Job card **W 08-08-02**.



- Unscrew screws (arrows) and remove front cover.
- Check components for visible signs of damage.



Install front cover

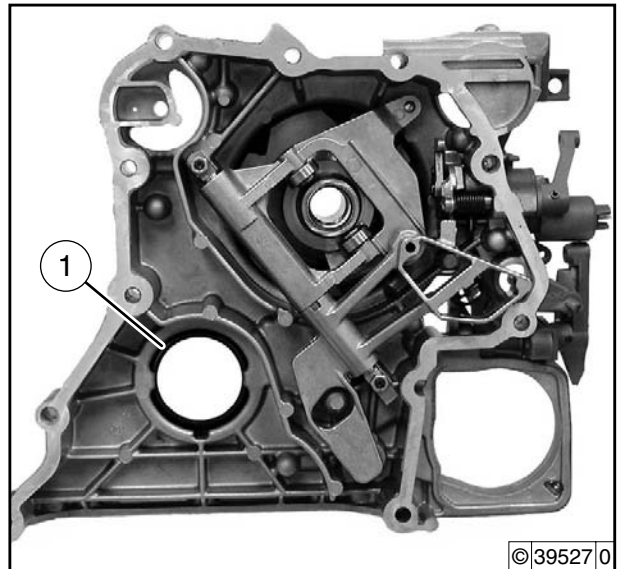
- Knock out crankshaft sealing ring (1).



Note

Do not damage the sealing surface when knocking out.

- Clean the sealing surfaces on the front cover and crankcase.

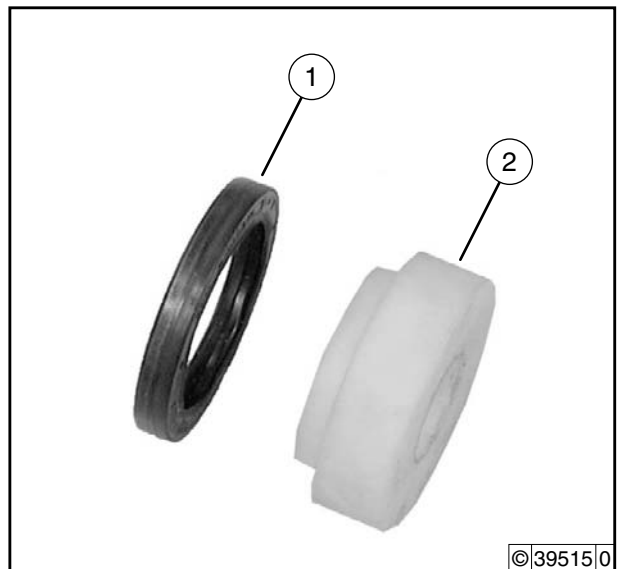


- Oil the sealing lip of the new crankshaft sealing ring lightly with engine oil.
- Fit the crankshaft sealing ring (1) to the assembly sleeve(2).



Note

The sealing lip must face the crankshaft in assembly.

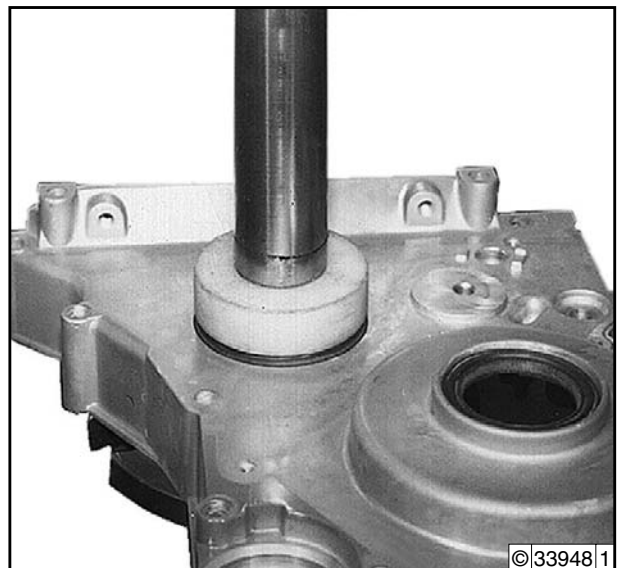


- Drive in crankshaft sealing ring with assembly tool.
- Press in assembly tool to stop.



Note

The installation depth of the crankshaft sealing ring is determined by the assembly tool.



- Coat sealing surface of the front cover with sealant DEUTZ DW 67.



Note

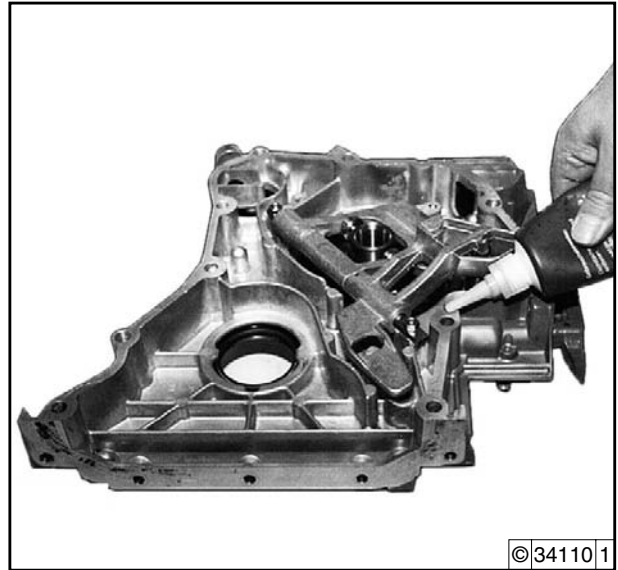
The connection between the camshaft pin and the centrifugal force regulator must be clean and free of oil.

- Turn engine 180°.



Note

The oil tray sealing surface on the crankcase must face up.



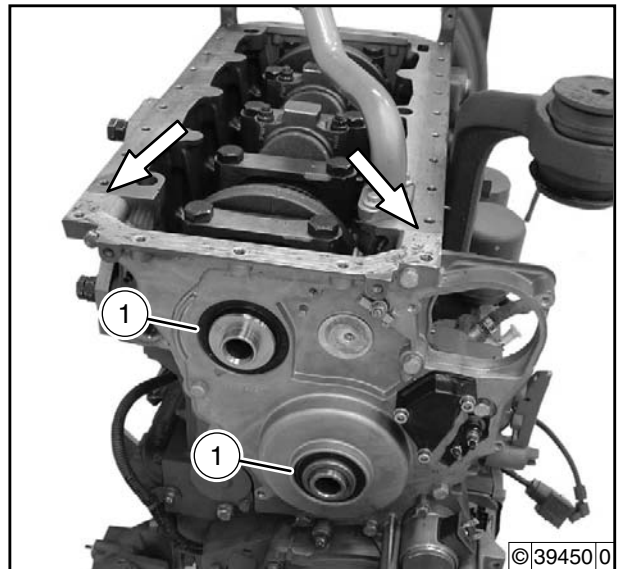
6

- Mount the front cover with shaft sealing ring and tighten the screws.
- Align the front cover flush with the oil tray sealing surface (arrows).



Note

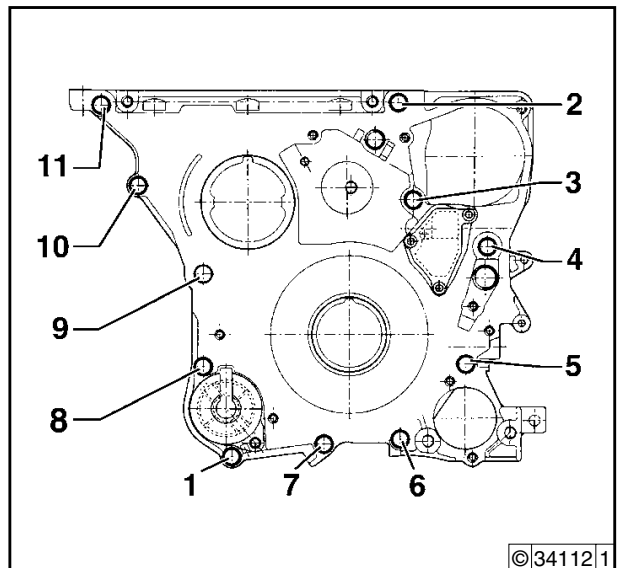
- The sealing lips of the shaft sealing rings (1) must touch the bearing journal all round.
- Do not tighten screws.



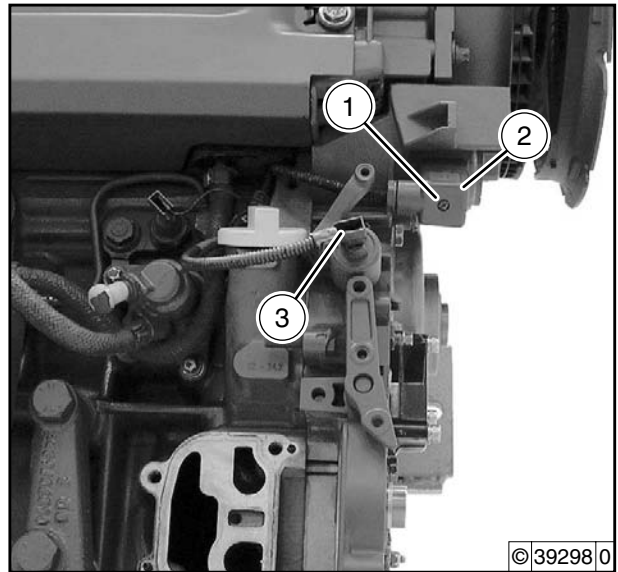
- Tighten the screws in the tightening order.



- Install the lube oil tray
→ Job card W 08-08-02.



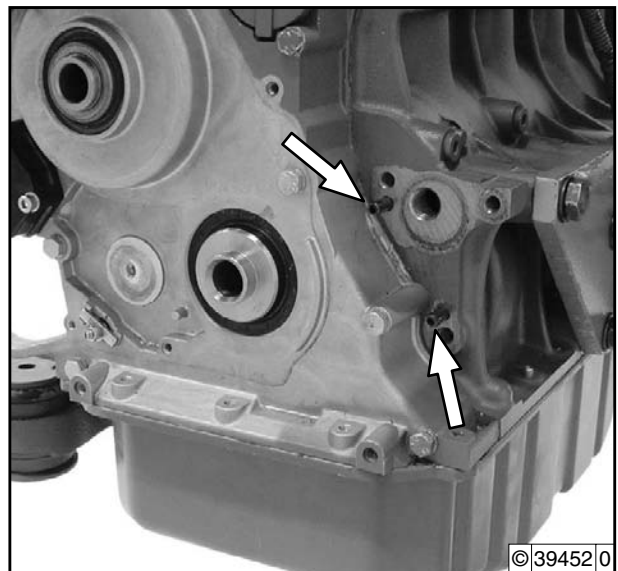
- Plug the cable plug (2) to the engine shutdown and tighten the screw (1).
- Plug the cable plug (3) to the lifting magnet for start volume release.



- Clean the sealing surface on the hydraulic pump console and crankcase.
- Insert new round sealing ring (arrow).



- Check all clamping sleeves are in place (arrows).

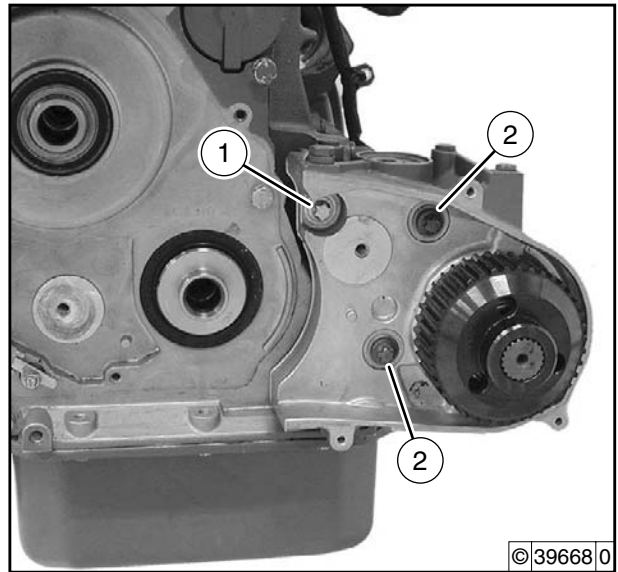


- Mount the hydraulic pump console and tighten the screws.



Note

Note different screw length:
Screw M10 x 75 mm (1)
Screws M10 x 90 mm (2)



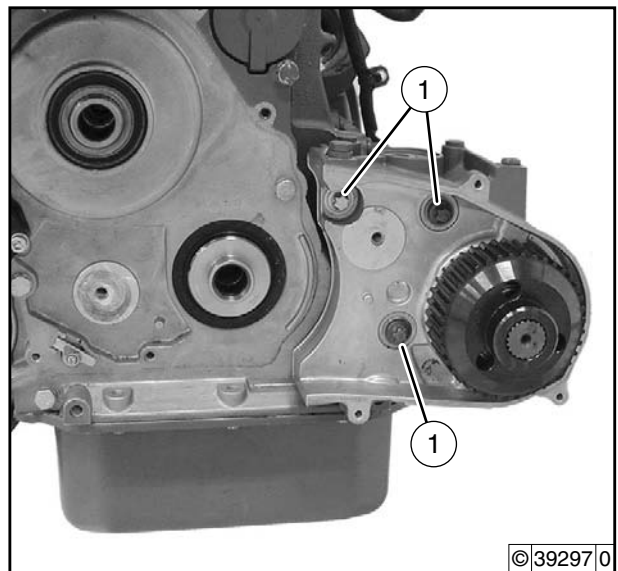
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- Tighten screws (1).



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- Install lube oil pump
→ Job card **W 08-04-05**.
- Renew camshaft sealing ring
→ Job card **W 04-03-01**.



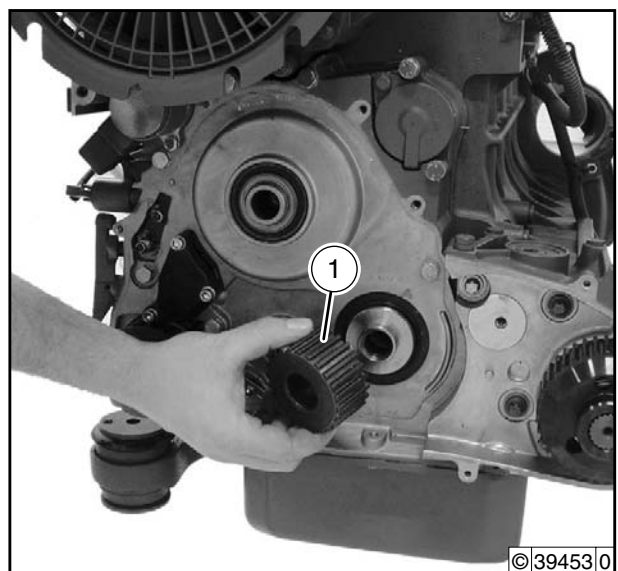
Install crankshaft toothed wheel

- Mount crankshaft toothed wheel (1).



Note

All connections must be clean and oil free.

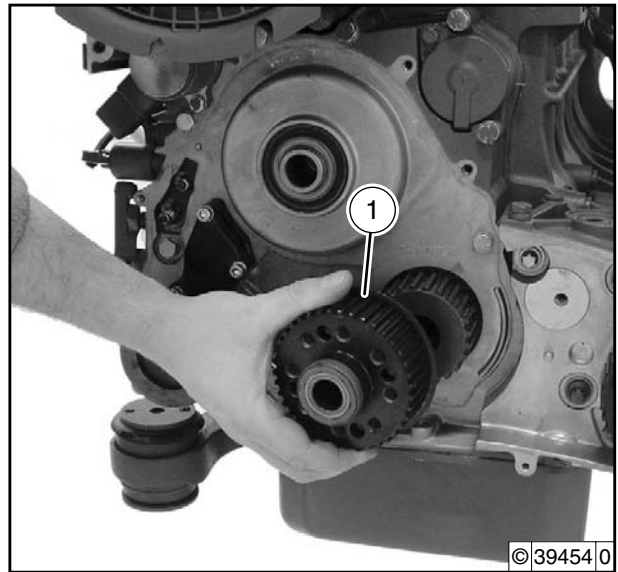


- Mount toothed wheel (1) for hydraulic pump.



Note

- An adapter is used in place of the toothed wheel without a hydraulic pump mounted.
- All connections must be clean and oil free.

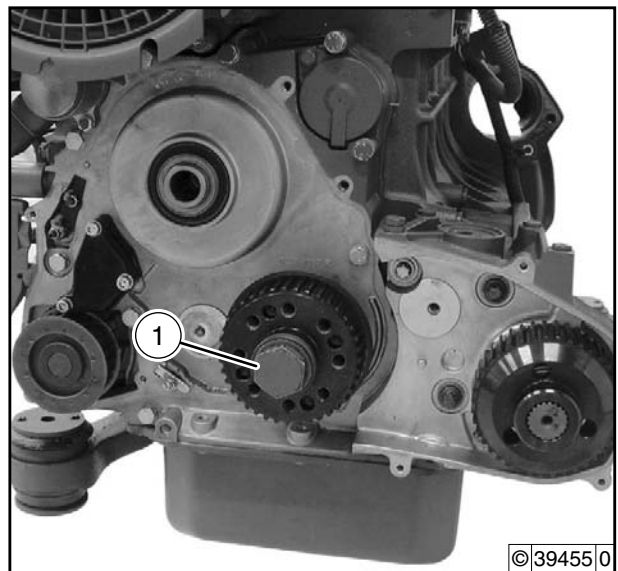


- Tighten the center screw (1).

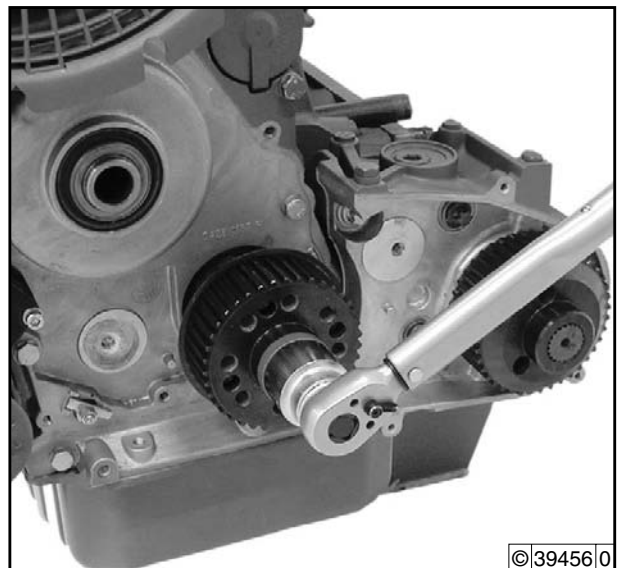


Note

- Use new screw.



- Pre-tighten center screw.

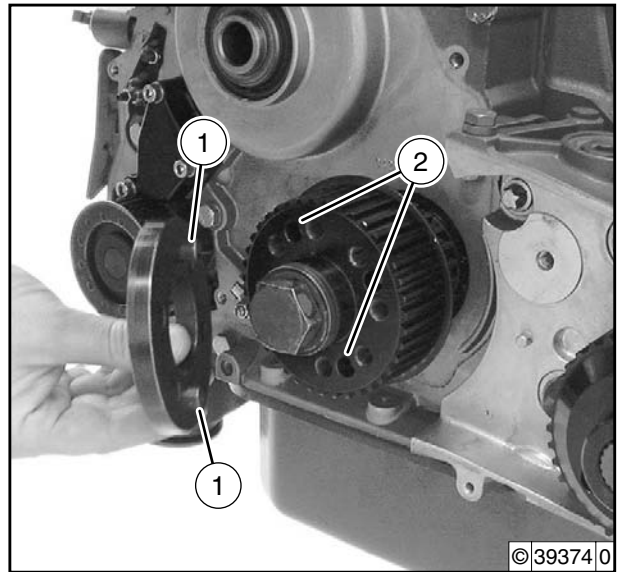


- Mount intermediate disc.



Note

The fixing bolts (1) must engage the bores (2).



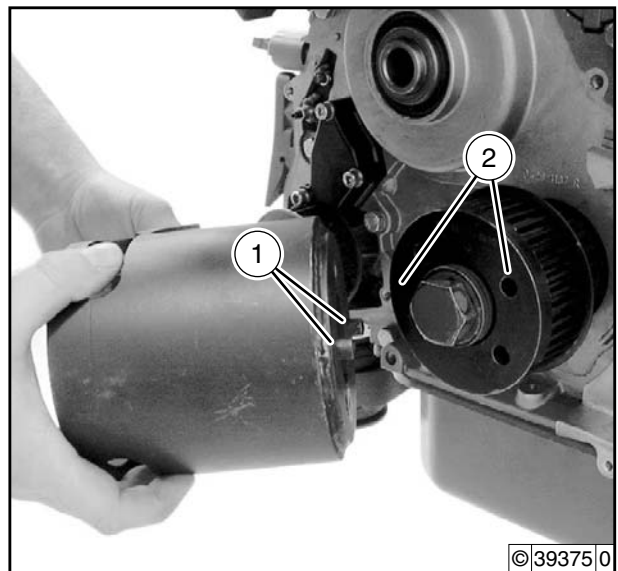
6

- Mount holder.



Note

- The fixing bolts (1) must engage the bores (2).
- Do not turn the crankshaft.

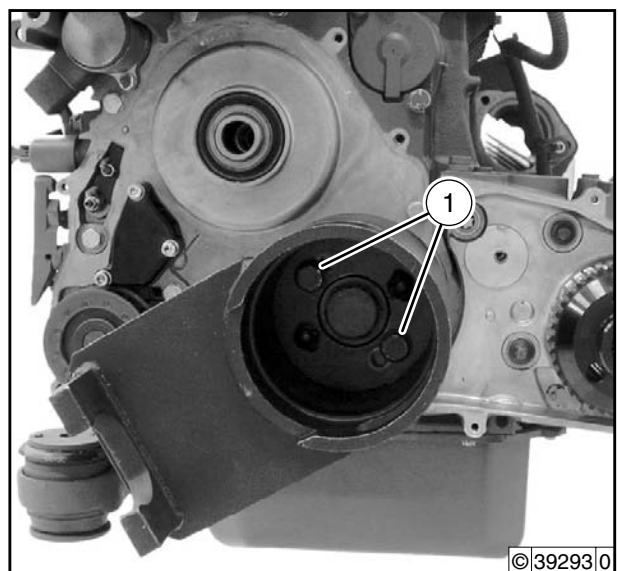


- Tighten screws (1).



Note

Do not turn the crankshaft.

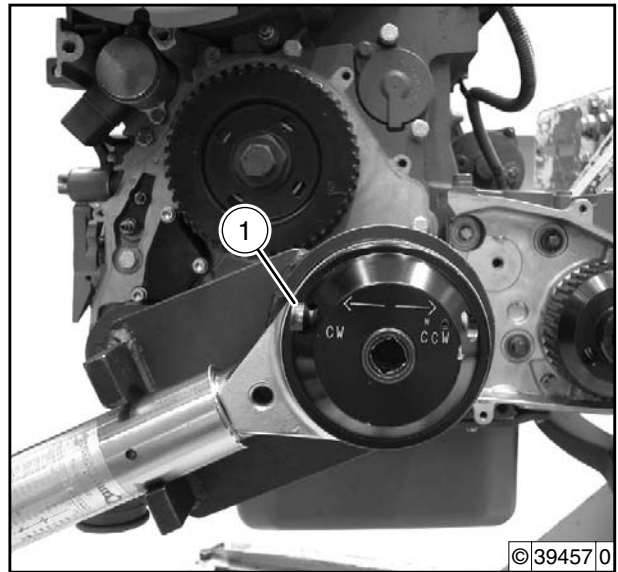


- Mount force multiplier with socket.

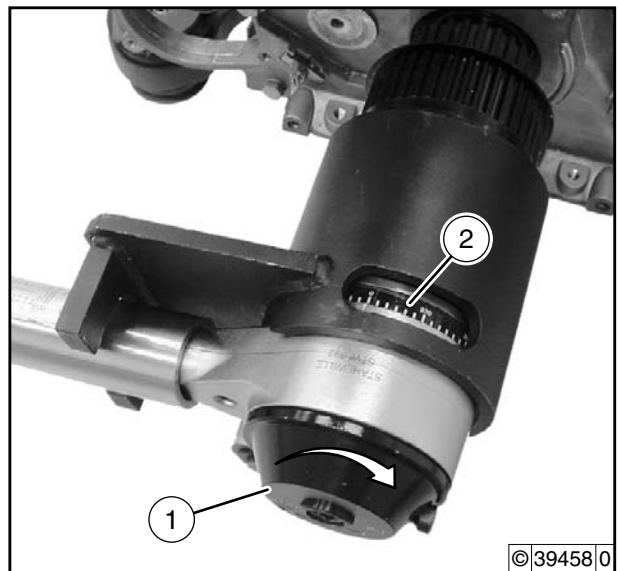


Note

Snap in setting bolts (1) in "CW" position.



- Turn the ratchet (1) of the force multiplier to the stop (arrow).
- Set scale dial (2) to "0".



- Hold the force multiplier and tighten the center screw.



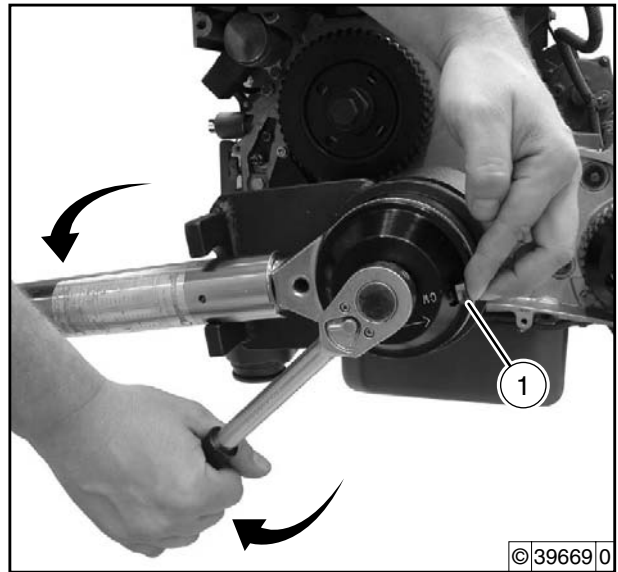
- Hold the force multiplier to counter (arrows), press setting bolts (1) and release force multiplier.



Caution!

Danger of injury when removing an unreleased force multiplier.

- Remove the force multiplier with socket, holder and intermediate disc.



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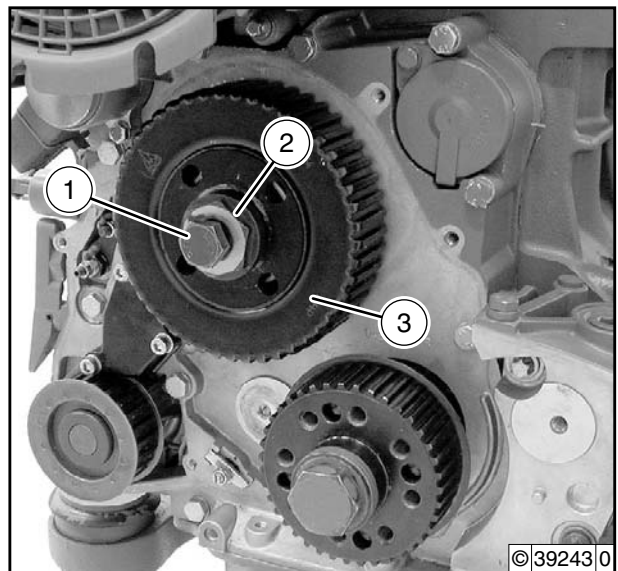
Install camshaft toothed belt wheel

- Mount camshaft toothed belt wheel (3) and tighten center screw (1) with washer (2).



Note

- There is no washer (2) on the camshaft toothed belt wheel with torsional vibration damper.
- All connections must be clean and oil free.



- Install toothed belt and clamping roller, fix camshaft toothed belt wheel
 - Job card **W 04-04-12**(new version)
 - Job card **W 04-04-12**(old version)

Dismantle and complete front cover (Speed governor with torque adjustment)



Tools

- **Commercial tools**
Depth-measuring appliance

- **Special tools**

100 400 - Meter
100 750 - Measuring device



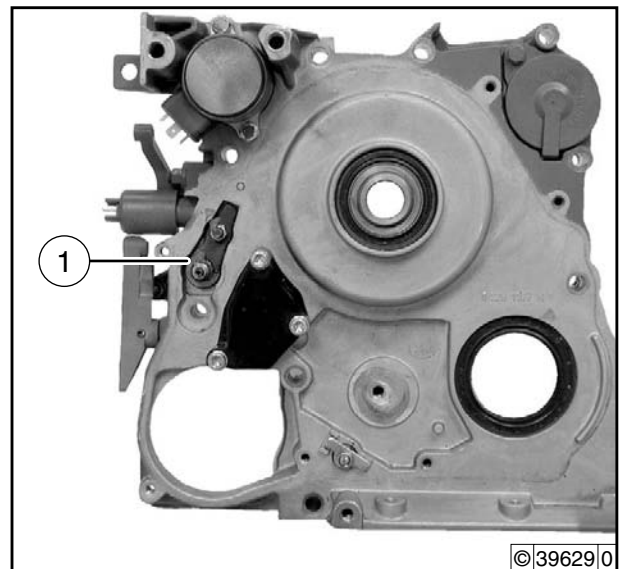
References

- W 03-08-01



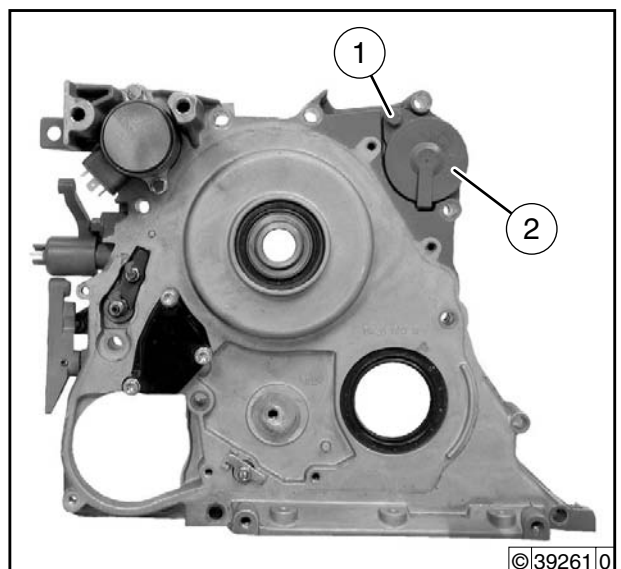
Note

Distinguishing mark for a speed governor with torque adjustment:
Adjustment capsule with clamping claw (1) in place of a full load volume stop.

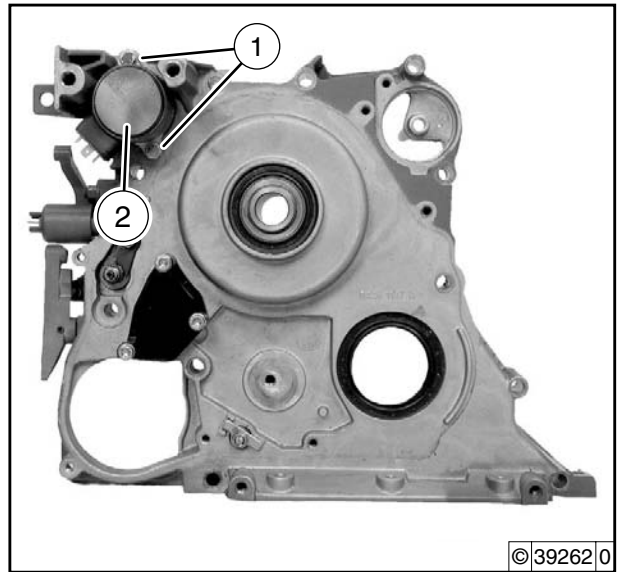


Dismantle front cover

- Remove front cover
→ Job card W 03-08-01.
- Unscrew screw (1) and remove bleed valve (2).

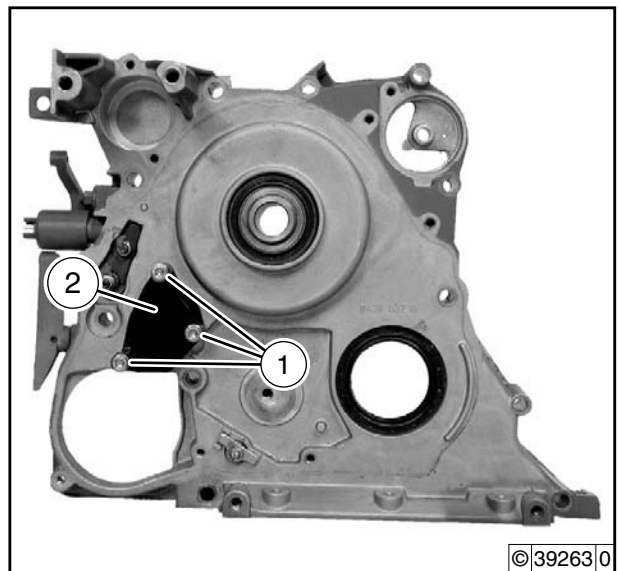


- Unscrew screws (1) and remove lifting magnet (2).

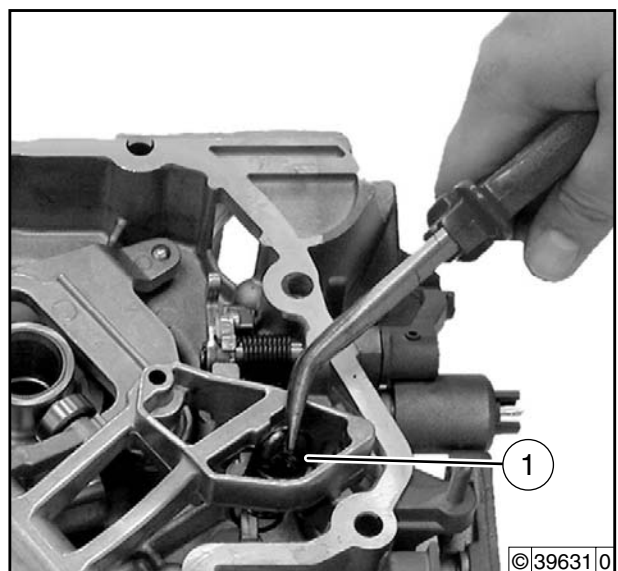


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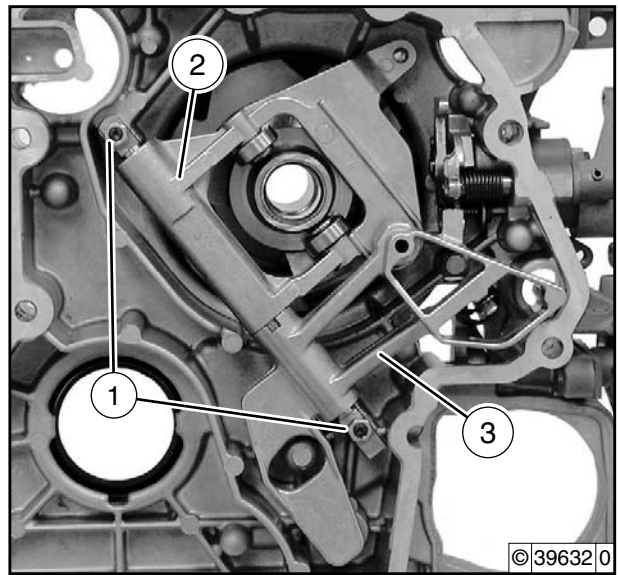
- Unscrew screws (1) and remove cap (2) with gasket.



- Unhook regulator spring (1).



- Unscrew nuts (1).
- Remove controller lever shaft with roller lever (2) and adjustment lever (3).

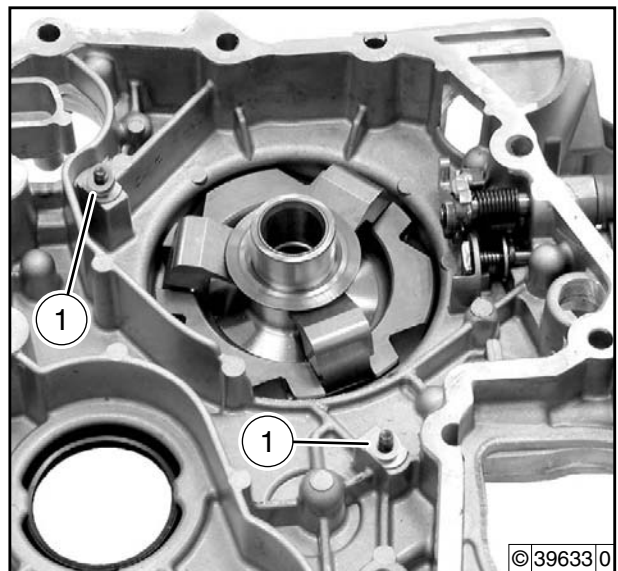


- Remove shims (1).

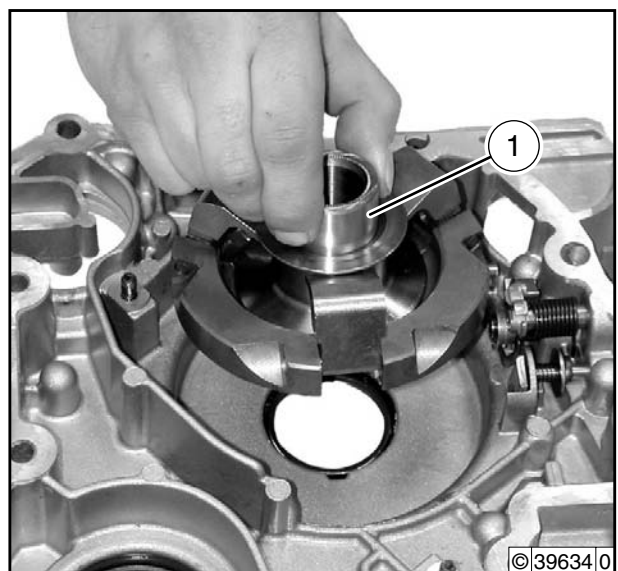


Note

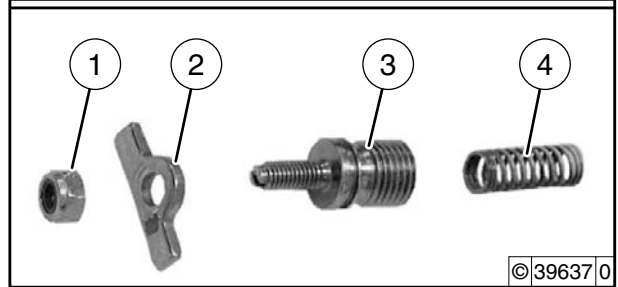
Pay attention to number and arrangement.



- Remove centrifugal force measuring mechanism (1).

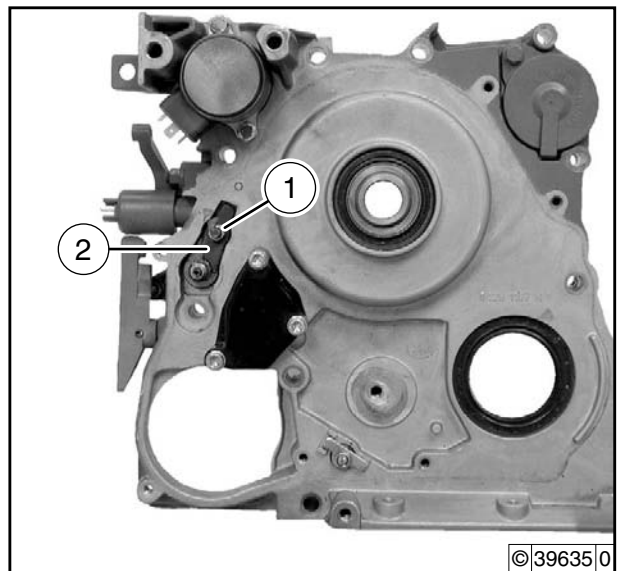


- Unscrew nut (1) and remove clamping claw (2).
- Unscrew idling capsule (3) and remove spring (4).

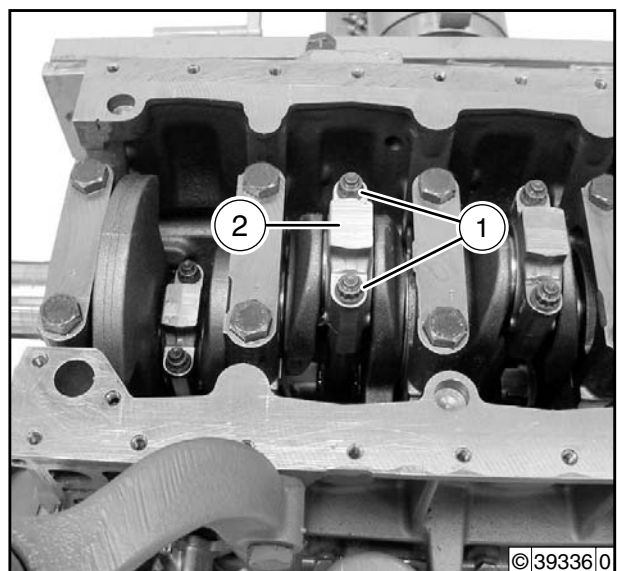


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- Unscrew nut (1) and remove clamping claw (2).

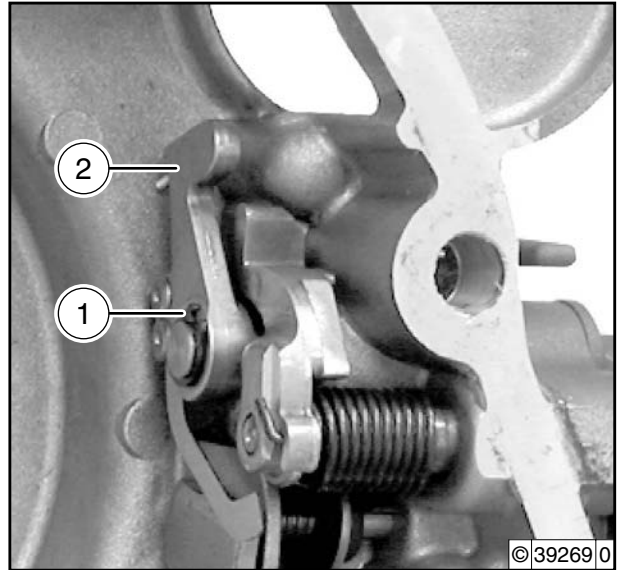


- Unscrew adjustment capsule (1).

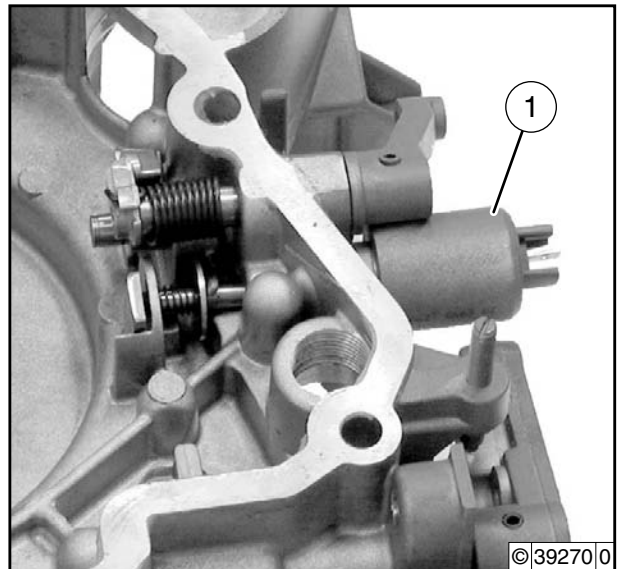


For speed governor with minus adjustment

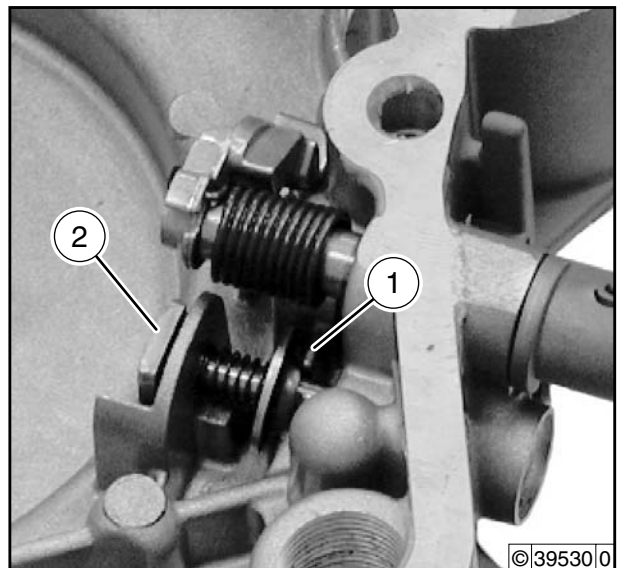
- Remove locking ring (1) and deflector lever (2).



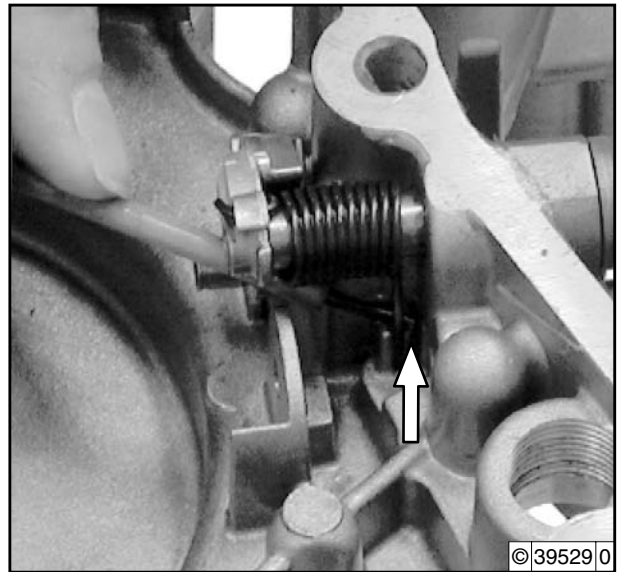
- Unscrew lifting magnet for start volume release (1).



- Remove locking ring (1).
- Pull out actuating lever (2), remove spring and washer.

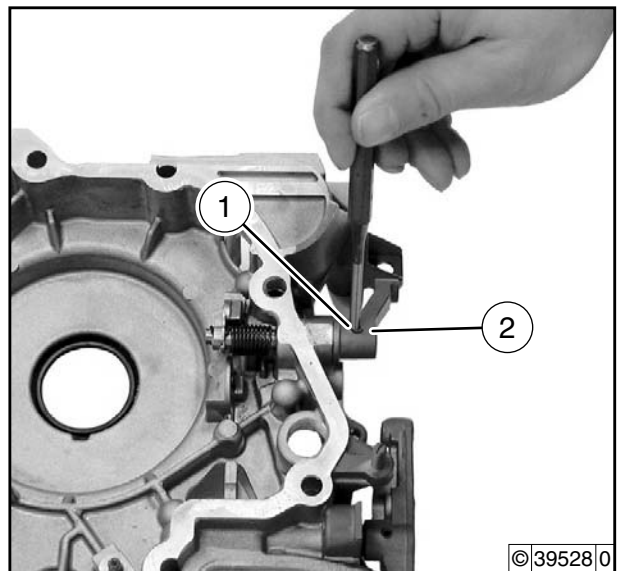


- Unhook spring from stop (arrow).

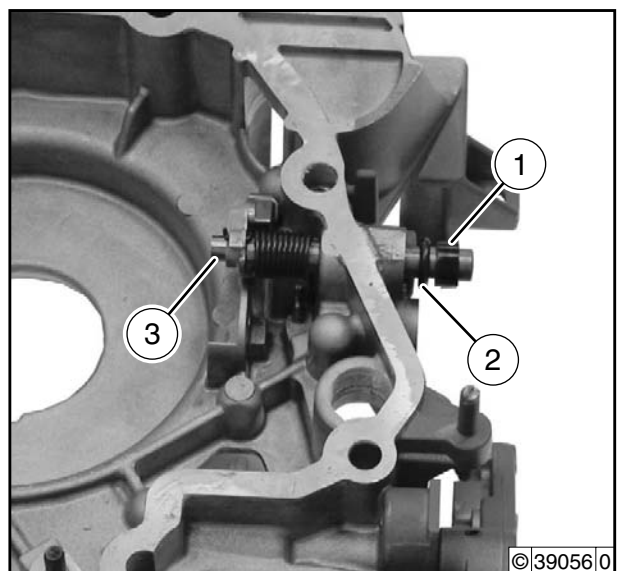


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- Knock out clamping pin (1), remove shutoff lever (2) and disc.

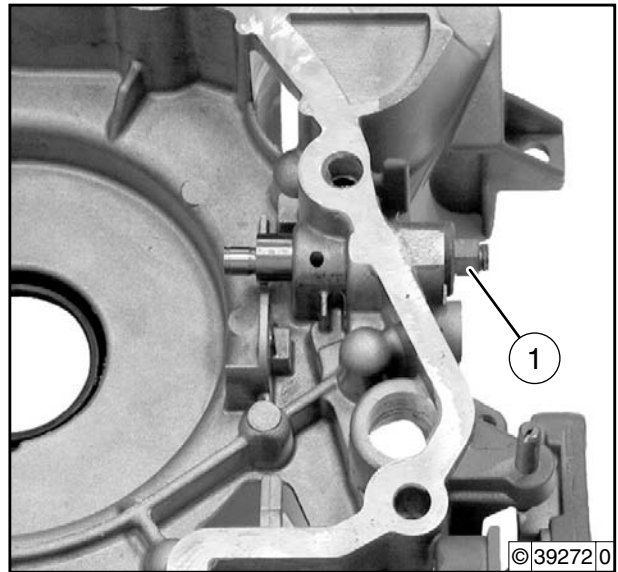


- Remove guide bush (1) and round sealing ring (2).
- Pull out shutoff shaft (3).



For speed governor with minus adjustment

- Unscrew nut (1) and remove washer.

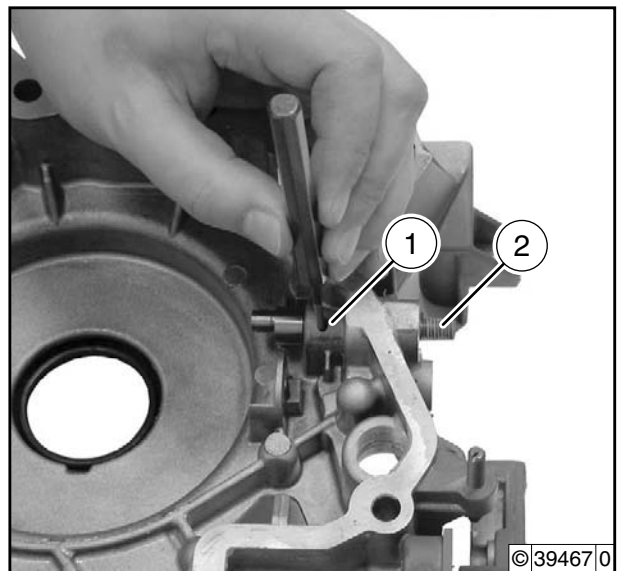


- Knock out clamping pin (1).

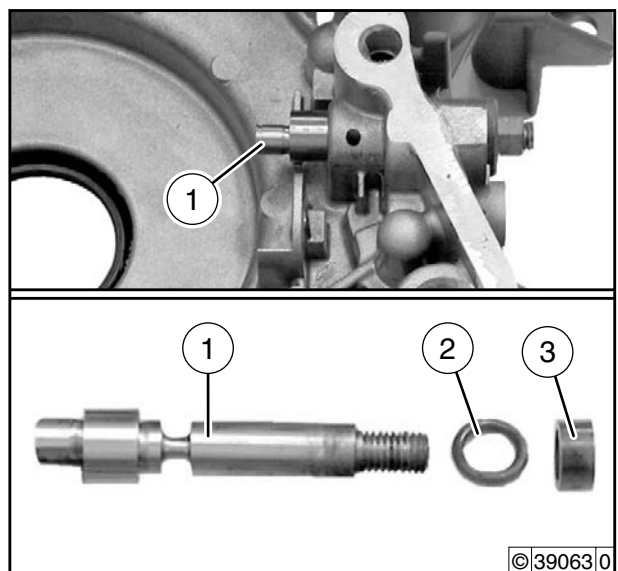


Note

Mark the installation position of the eccentric shaft (2) before removing.



- Pull out eccentric shaft (1).
Remove guide bush (2) and round sealing ring (3).

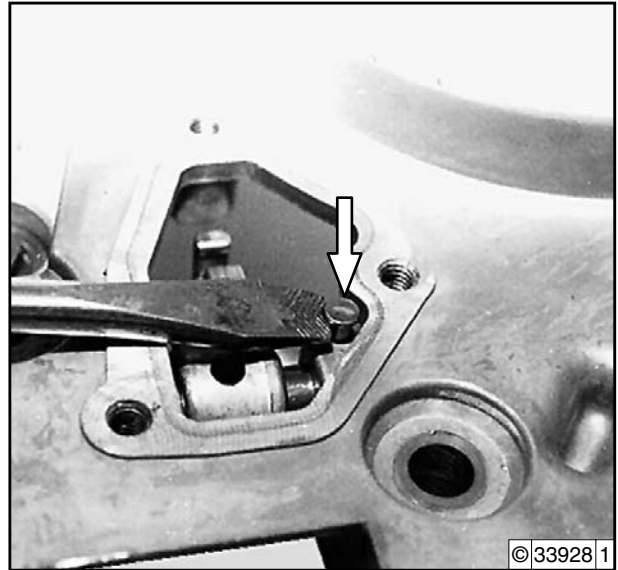


- Remove locking bolt (arrow).



Note

Do not damage the sealing surface on the front cover.



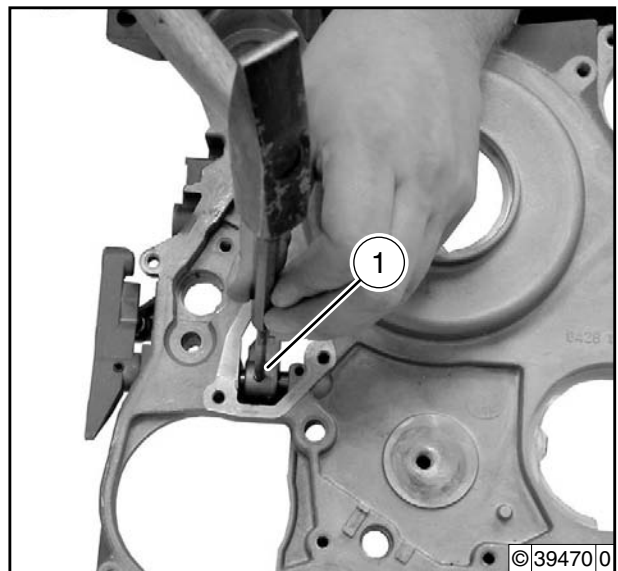
6

- Knock out clamping pin (1).

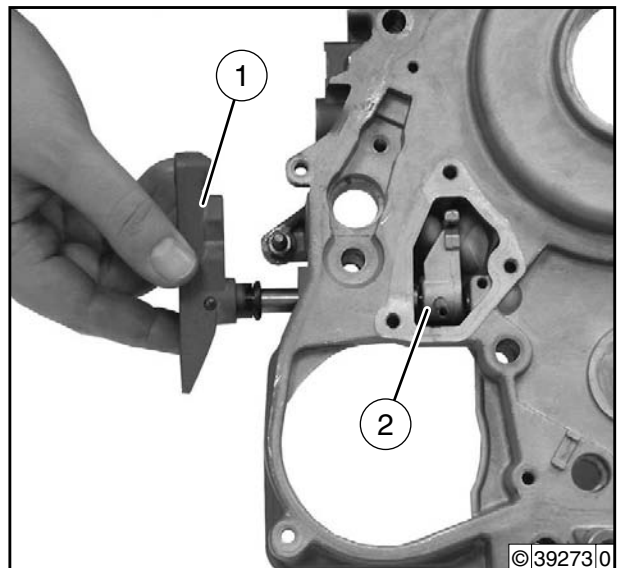


Note

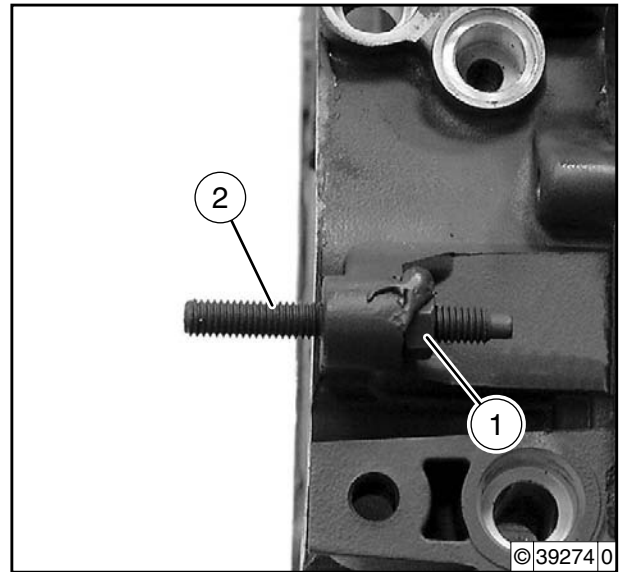
Do not jam the clamping pin in the cover when knocking out.



- Insert the speed adjustment lever (1) with shaft, guide bush and round sealing ring.
- Remove adjustment lever (2).

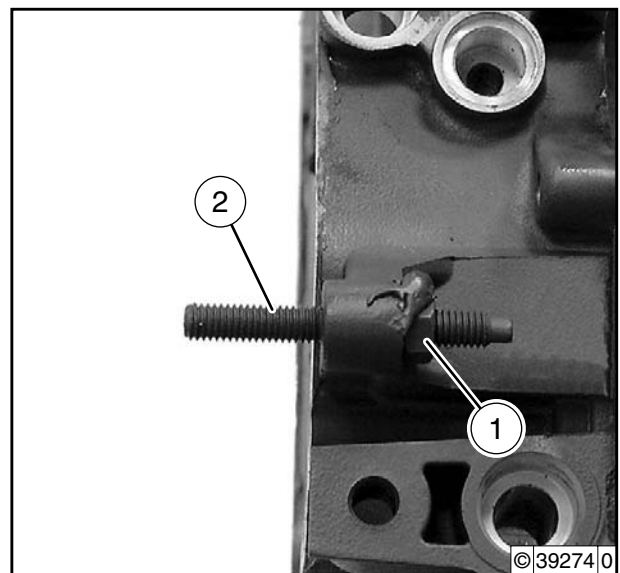


- Unscrew lock nut (1) and turn out setting screw for minimum speed (2).
- Check components for visible signs of damage.



Complete front cover

- Turn in setting screw for minimum speed (2) and put on lock nut (1).



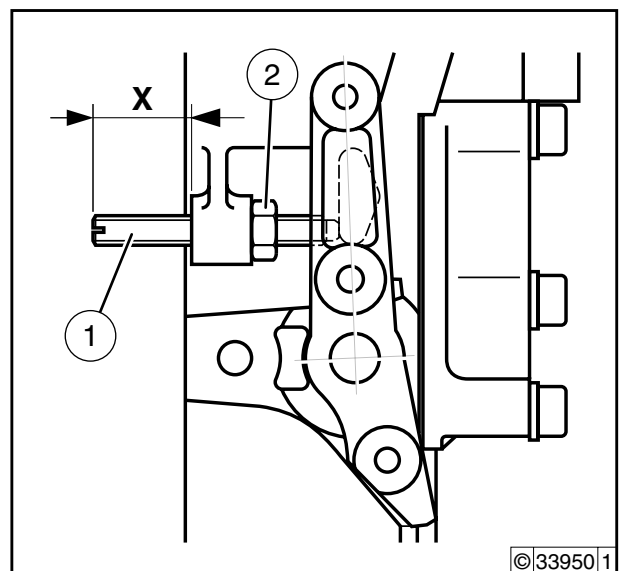
- Set setting screw (1) for minimum speed to dimension "X".



Note

The setting dimension "X" only serves as a basic setting.
A test stand run is necessary for the performance and speed setting.

- Tighten lock nut (2).

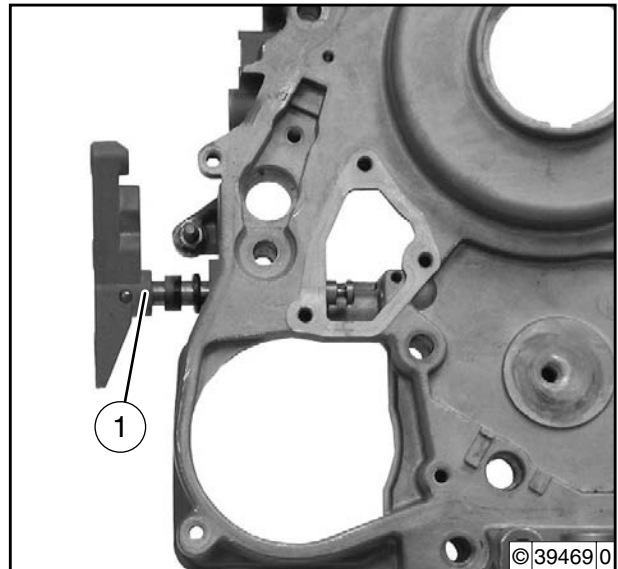


- Insert the speed adjustment lever (1) with shaft, guide bush and new round sealing ring.



Note

Oil the speed adjustment shaft lightly.



6

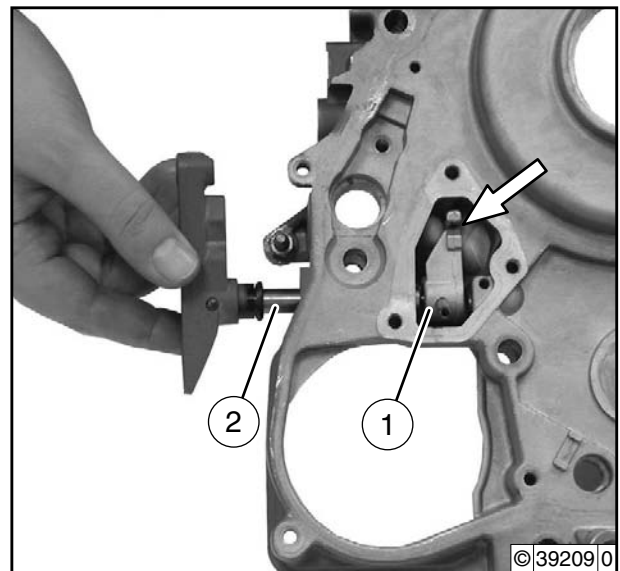
- Insert adjustment lever (1) with clamping pin.



Note

Note the installation position, the hole for hooking in the regulator spring (arrow) must face the outside of the front cover.

- Press the speed adjustment shaft (2) into the front cover to the stop.

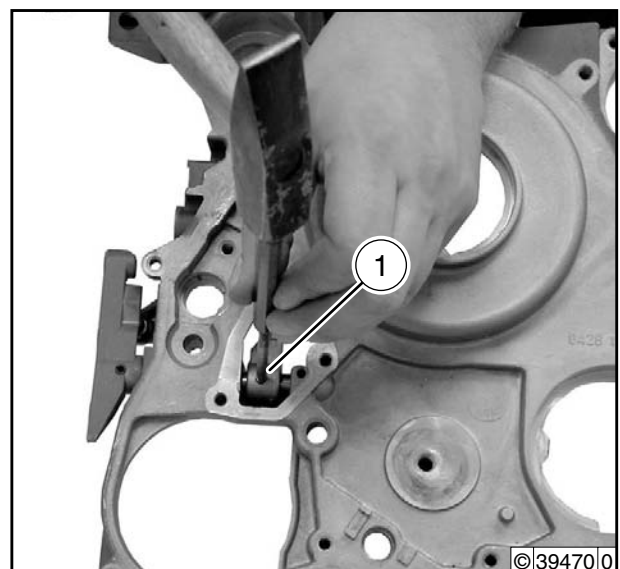


- Drive in clamping pin (1) flush with the adjustment lever.



Note

The bore in the speed adjustment shaft must match up with the bore in the adjustment lever.

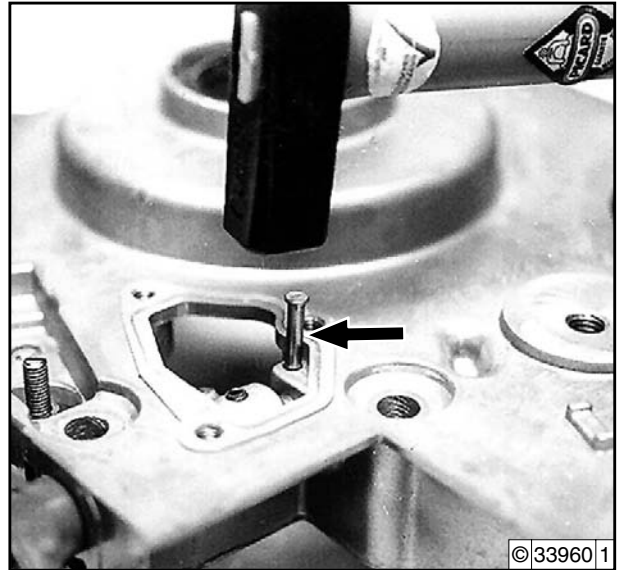


- Knock in the locking bolt (arrow) to the stop.



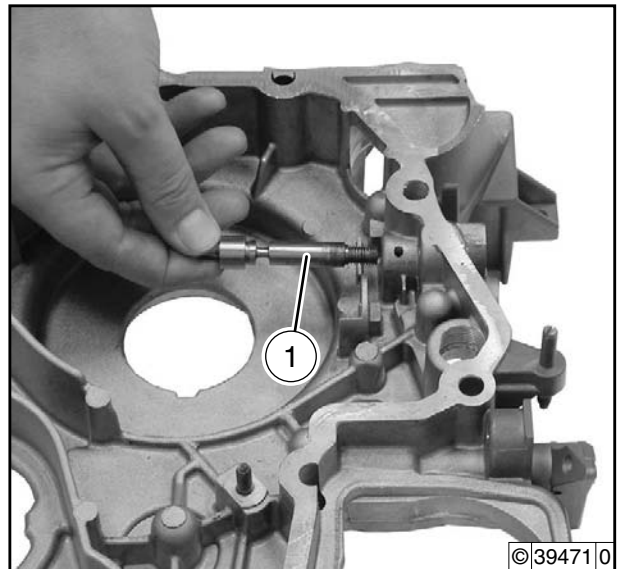
Note

The groove in the speed adjustment shaft must match up with the bore in the front cover.



For speed governor with minus adjustment

- Oil lightly and insert the eccentric shaft (1).

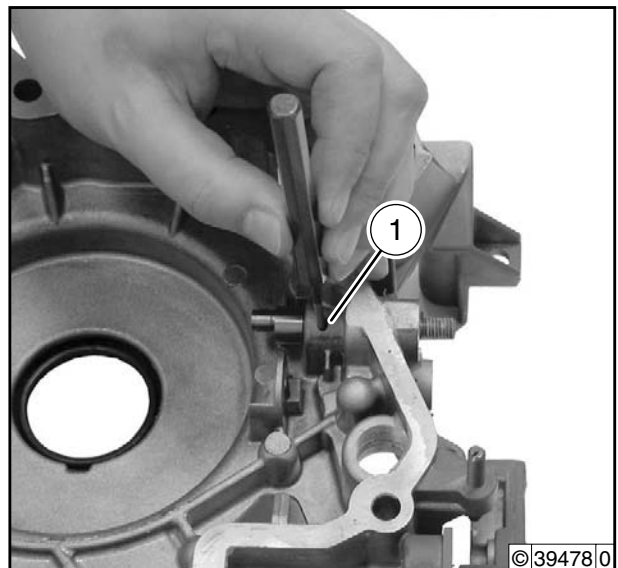


- Drive in clamping pin (1) flush with the front cover.



Note

The groove in the eccentric shaft must match up with the bore for the clamping pin.

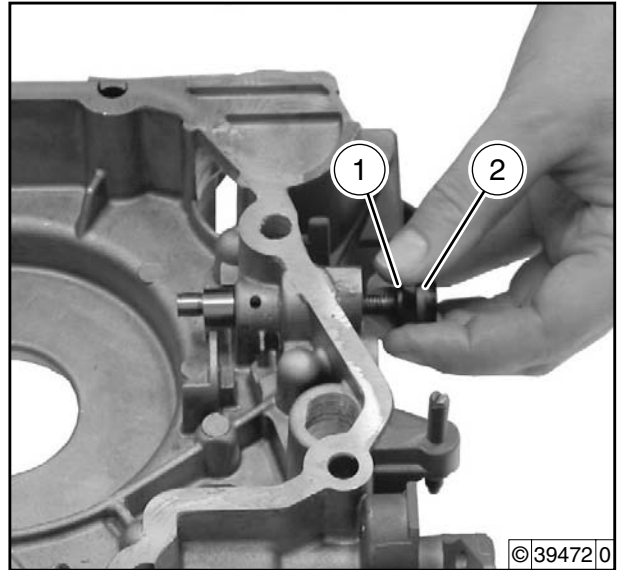


- Put on new round sealing ring (1) and guide bush (2).



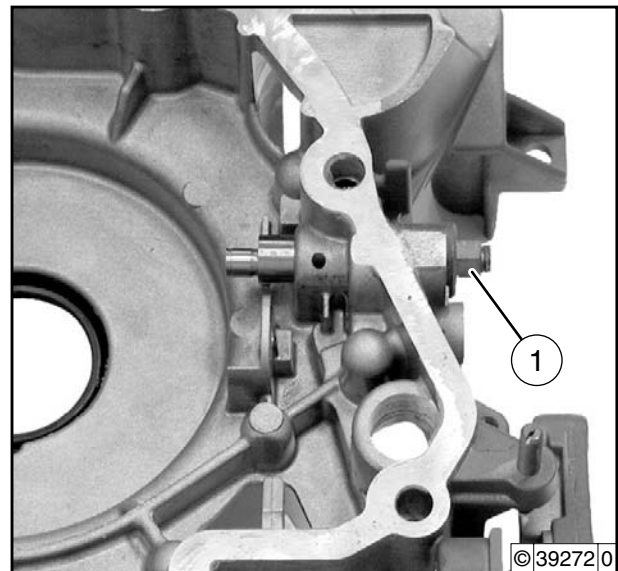
Note

Oil round sealing ring lightly.



6

- Fit washer and tighten nut (1).
- Position the eccentric shaft at the mark made before removal.
- Tighten nut (1).

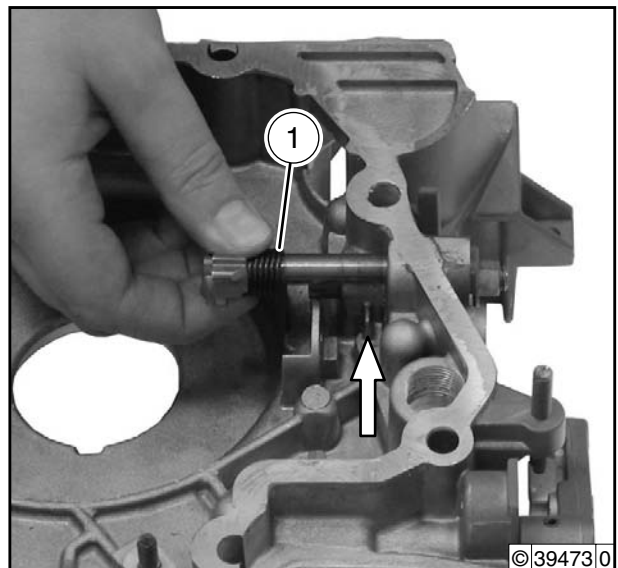


- Insert shutoff shaft, pre-tension spring (1) and hang into stop (arrow).



Note

- Note installation position.
- Oil the shutoff shaft lightly.

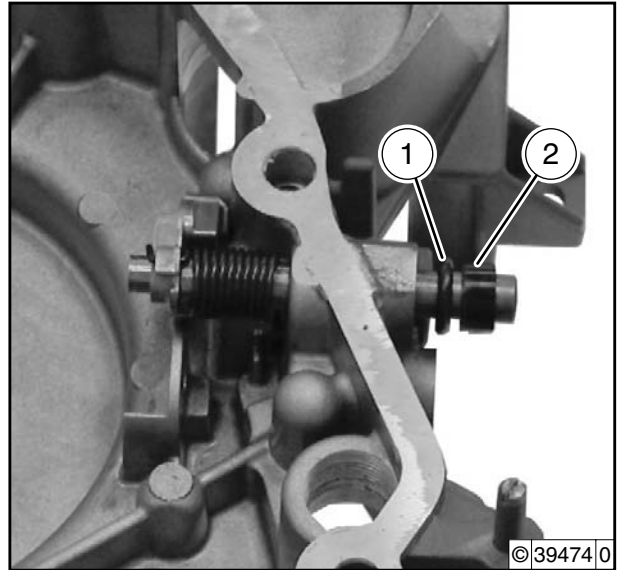


- Put on new round sealing ring (1) and guide bush (2).



Note

Oil round sealing ring lightly.

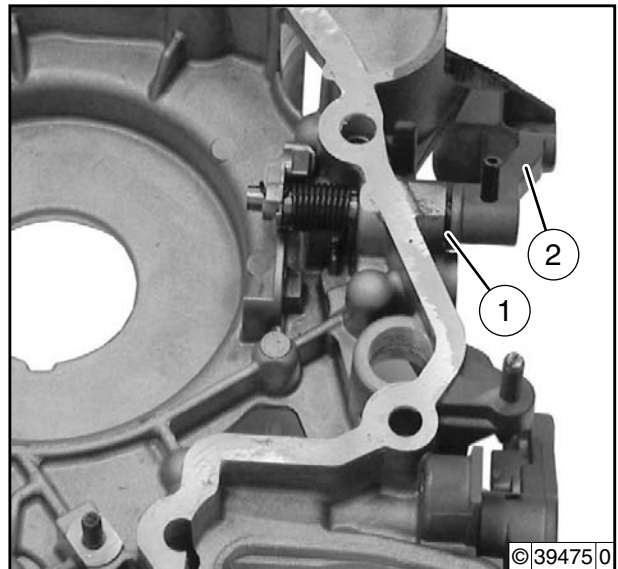


- Press the shutoff shaft into the front cover inlet.
- Put on washer (1) and shutoff lever (2) with clamping pin.



Note

Note installation position of the shutoff lever.

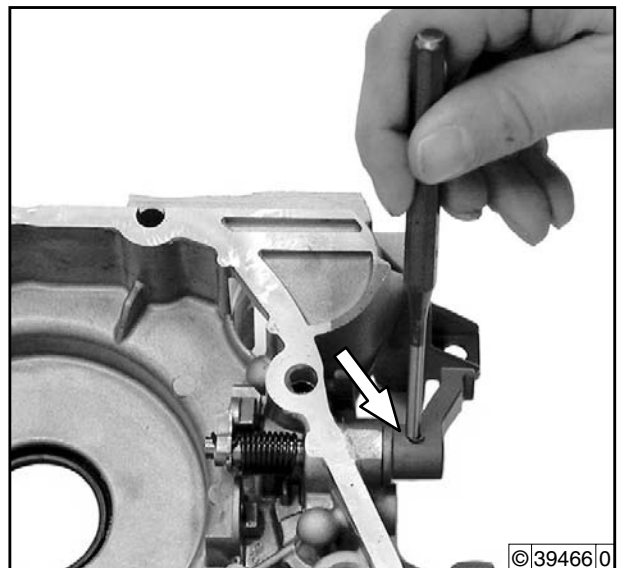


- Drive in clamping pin (arrow) flush with the shutoff lever.



Note

The bore in the shutoff shaft must match up with the bore in the shutoff lever.



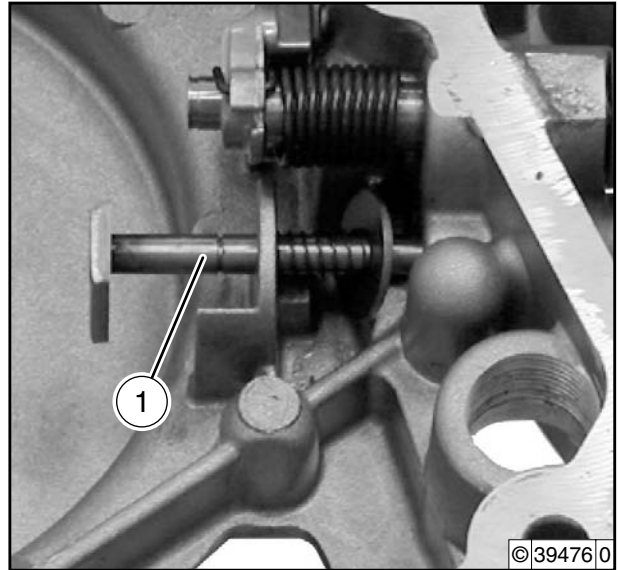
For speed governor with minus adjustment

- Insert actuating lever (1), spring and washer.



Note

Note installation position of the actuating lever.



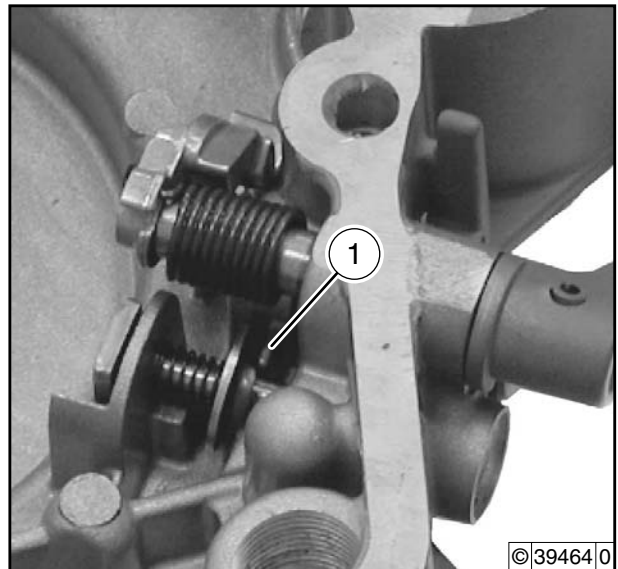
6

- Put on locking ring (1).



Note

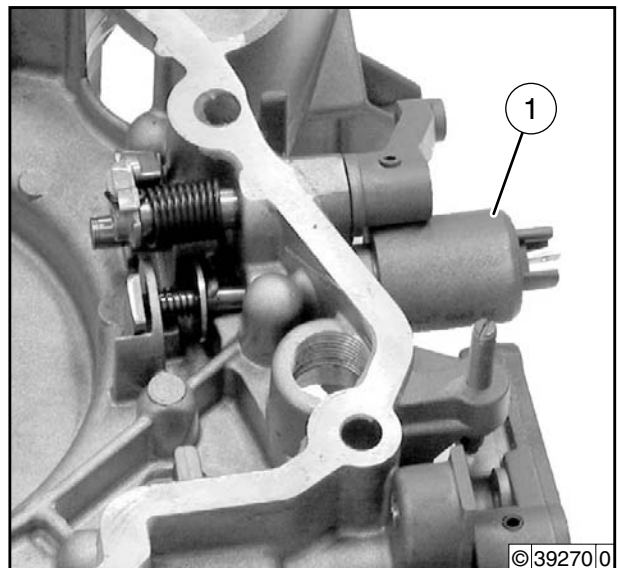
Pay attention to correct fit of the locking ring in the groove.



- Tighten lifting magnet for start volume release (1) with new round sealing ring.



05065

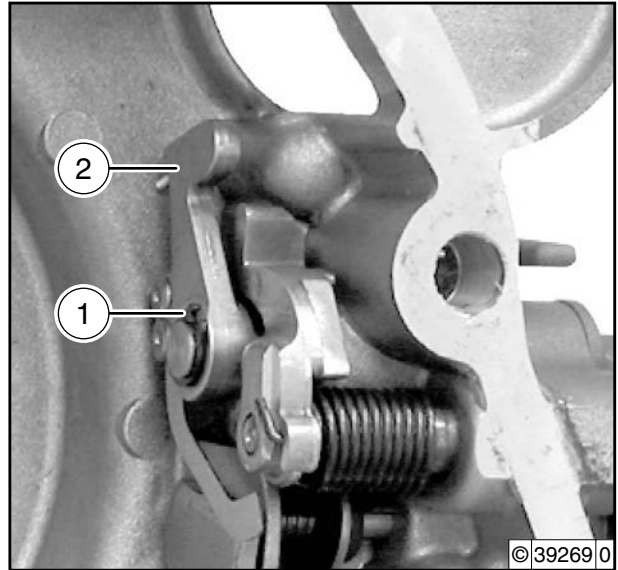


- Remove deflector lever (2) and locking ring (1).



Note

- Note installation position of the deflector lever.
- Pay attention to correct fit of the locking ring in the groove.

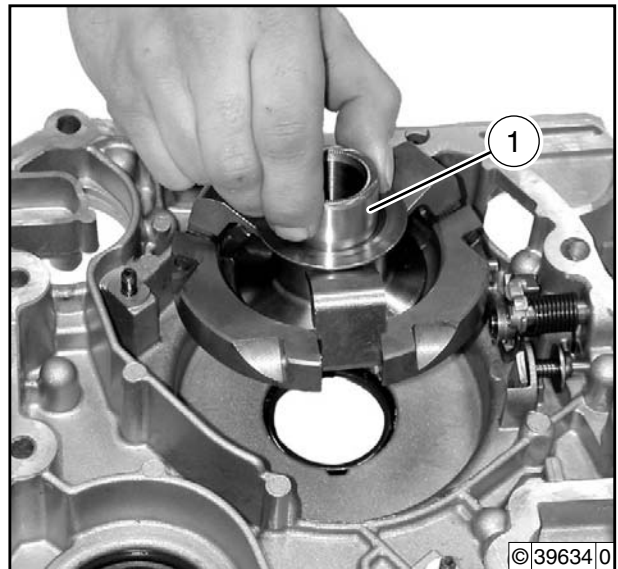


- Insert centrifugal force measuring mechanism (1).



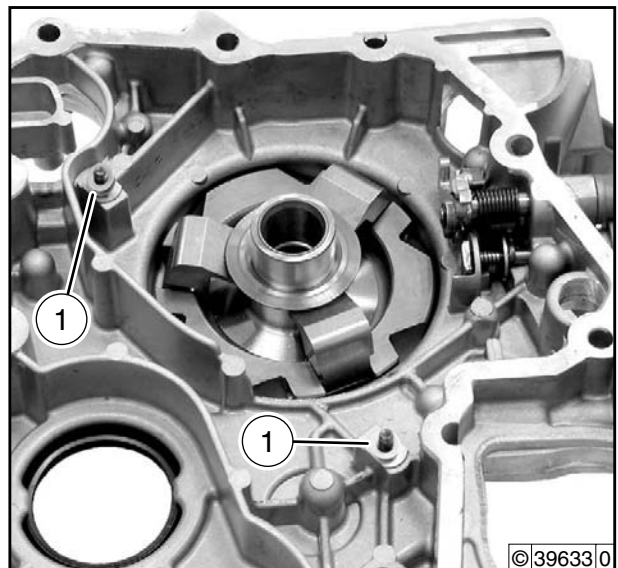
Note

- Do not damage the sealing lip of the shaft sealing ring.



Measure and set the parallelism of the roller lever.

- Place shim discs of at least **0.3 mm** on the stud bolts (1).



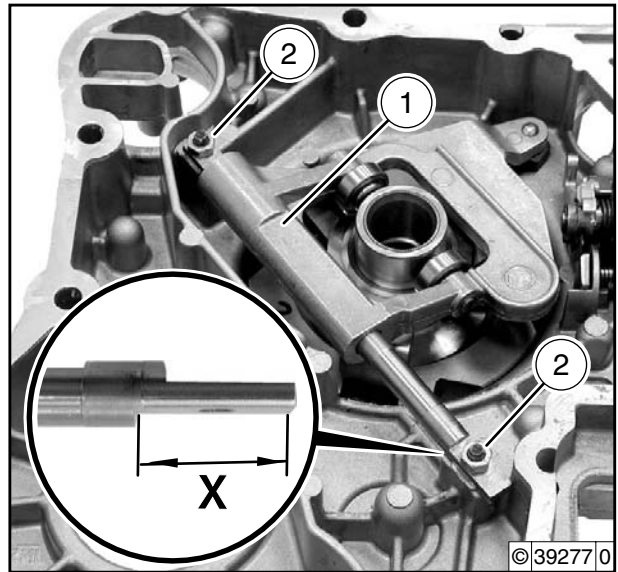
- Insert regulator lever shaft with roller lever (1) and tighten nuts (2).

05021



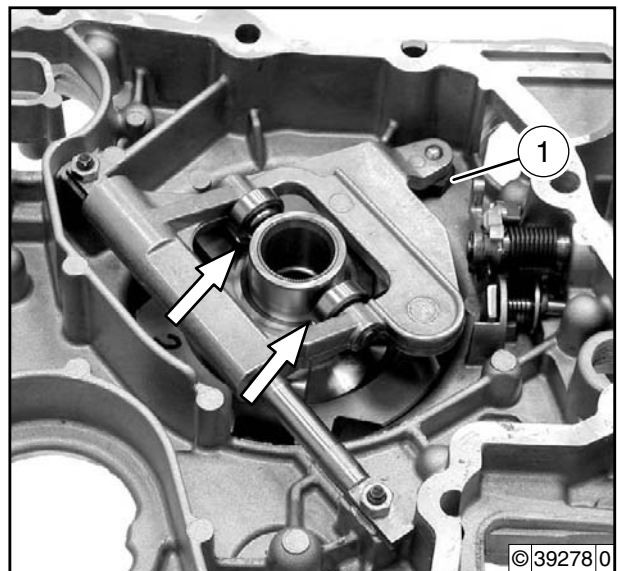
Note

Note the installation position of the regulator lever shaft, the side with the long cut-out "X" must face the opening for the lube oil pump and the shim disc.

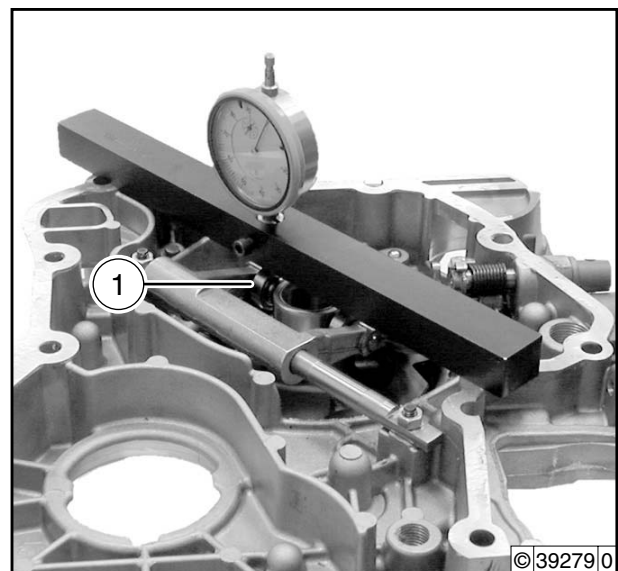


6

- Place shims underneath the contact surface of the roller lever (1) so that the ball bearings do not touch the muff (arrows)



- Insert meter in measuring bridge and position the stylus with pre-tension on the ball bearing (1).
- Adjust meter to "0".

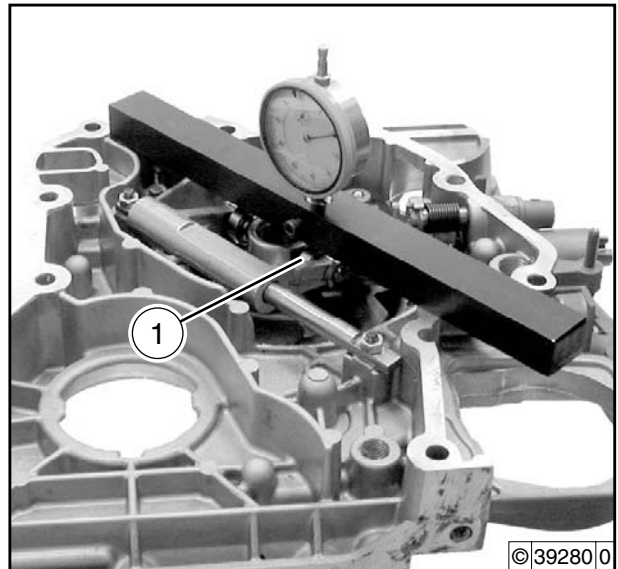


- Move the measuring bridge and position the stylus on the ball bearing (1).
- Read and note measured value.

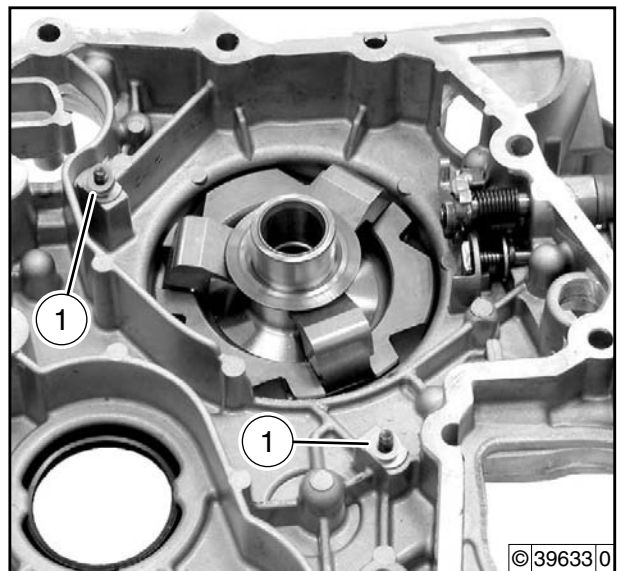


Note

The difference between both measured values is max. **0.05 mm**.
To achieve the required tolerance shims of max. **0.5 mm** may be placed under one stud bolt.



- Compensate the tolerance by using shim discs (1) of suitable thickness.
- Repeat the measuring process after setting.

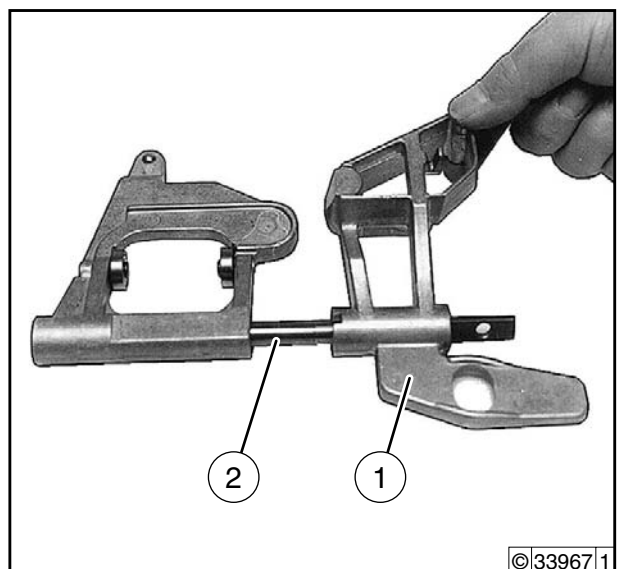


- Unscrew nuts and remove regulator lever shaft.
- Push the adjustment lever (1) onto the regulator lever shaft (2).



Note

Note installation position of the adjustment lever.

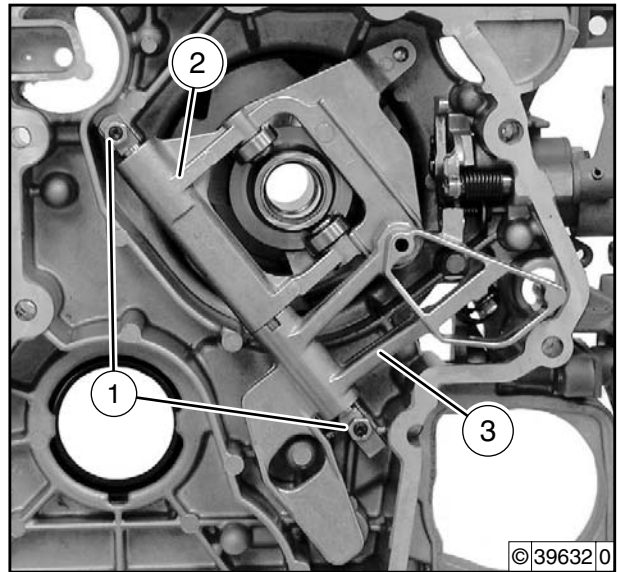


- Remove regulator lever shaft with roller lever (2) and adjustment lever (3).
- Tighten nuts (1).



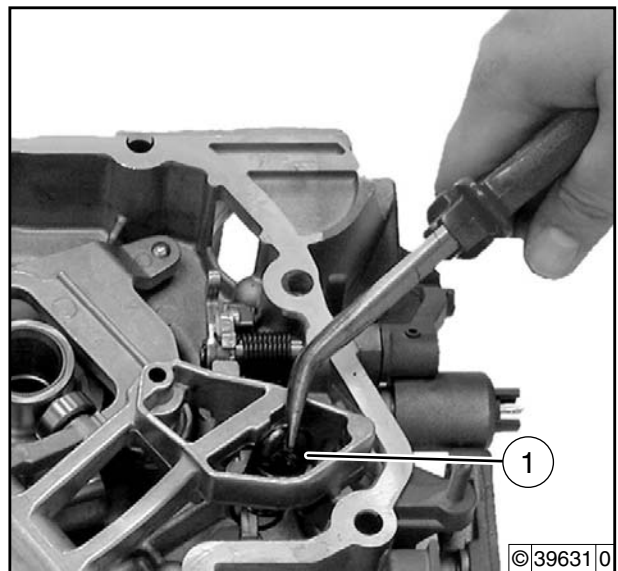
Note

Note installation position of the regulator lever shaft.

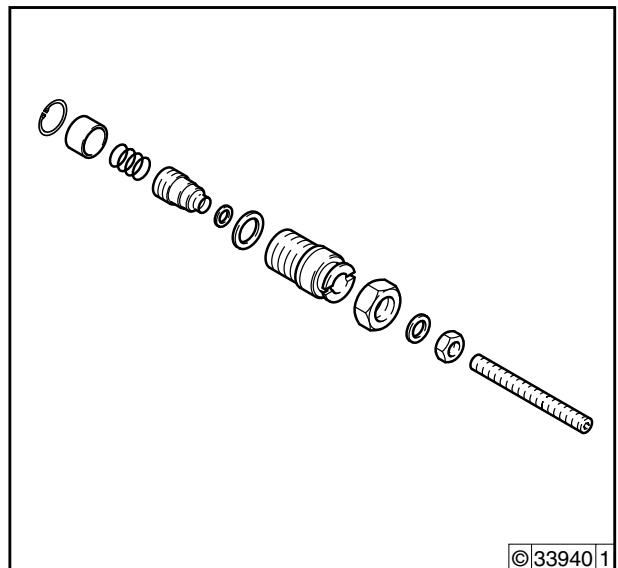


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- Hook in regulator spring (1).

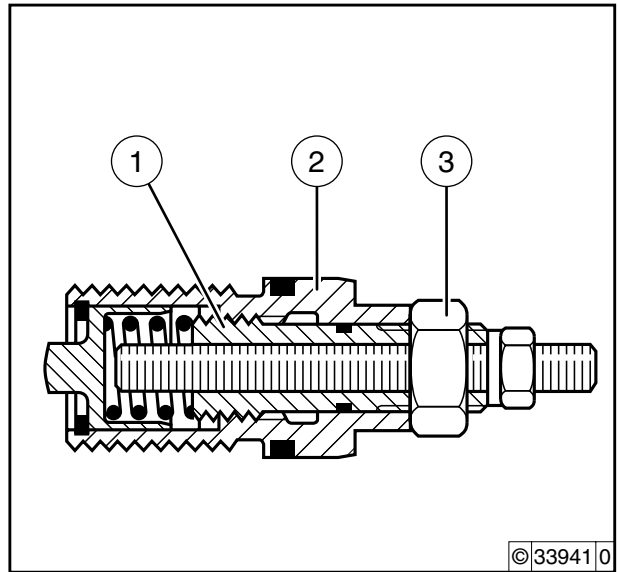


- Visually inspect the components of the adjustment capsule, renew if necessary.

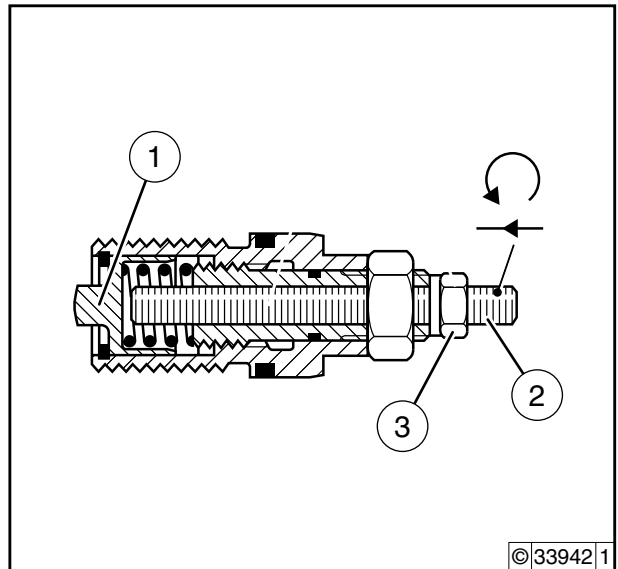


Pre-assemble the adjustment capsule

- Turn in the spring pre-tensioner (1) to the stop in the housing (2) with max. **1 Nm**.
- Turn out the spring pre-tensioner **1 + 0.5 turns** again.
- Tighten lock nut (3).



- Turn in setting screw (2) to the stop on the pressure capsule (1).
- Turn out the setting screw **1 turn** again.
- Tighten lock nut (3).

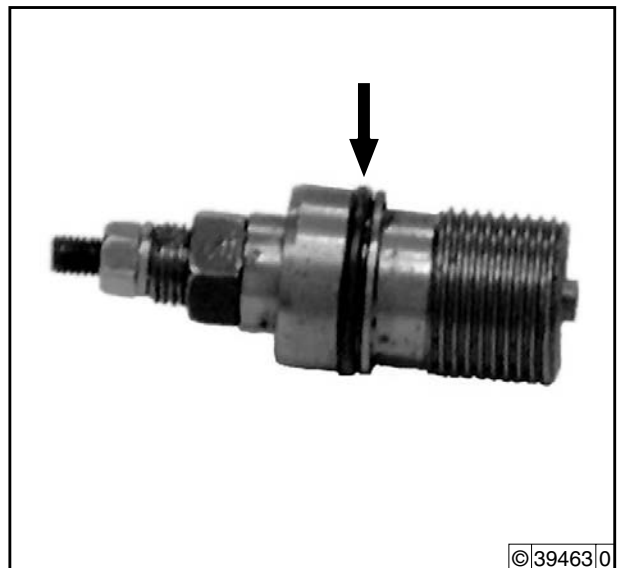


- Fit new round sealing ring (arrow) onto adjustment capsule.

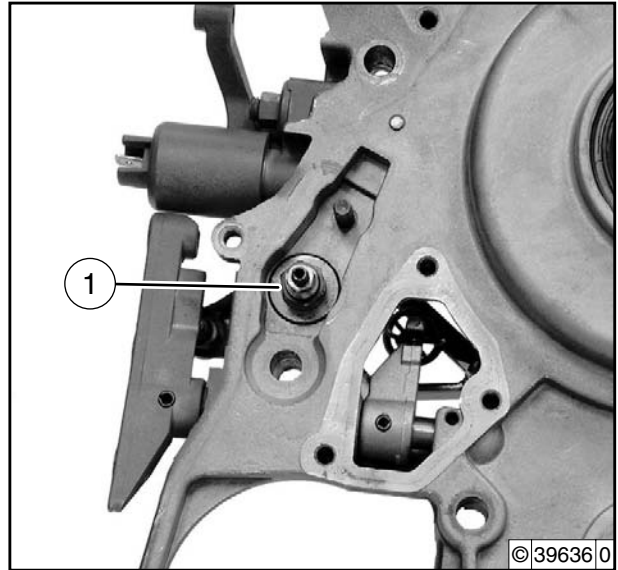


Note

Oil round sealing ring lightly.



- Screw in adjustment capsule (1).



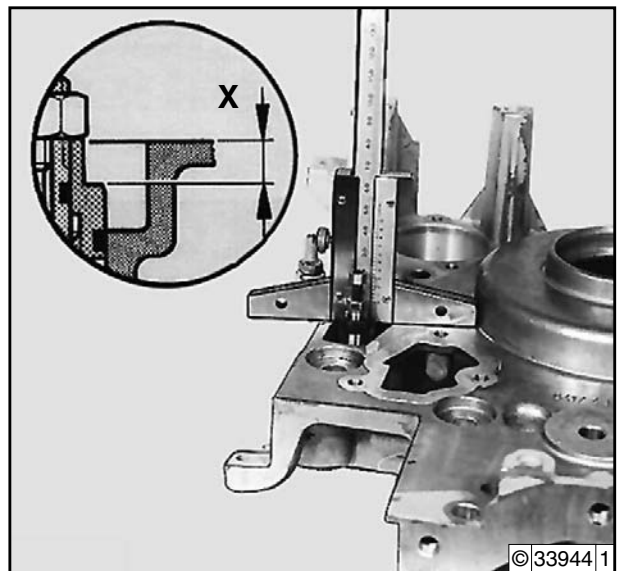
6

- Measure screw-in depth "X" of the adjustment capsule with depth measuring appliance from the front cover to the housing.

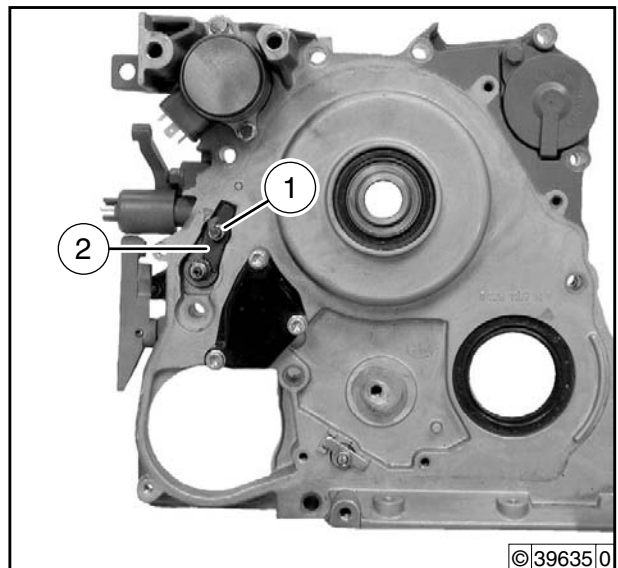


Note

- If necessary, correct the screw-in depth of the adjustment capsule.
- The setting dimension "X" only serves for basic setting, a test stand run is necessary for the exact setting.



- Insert clamping claw (2) and tighten nut (1).

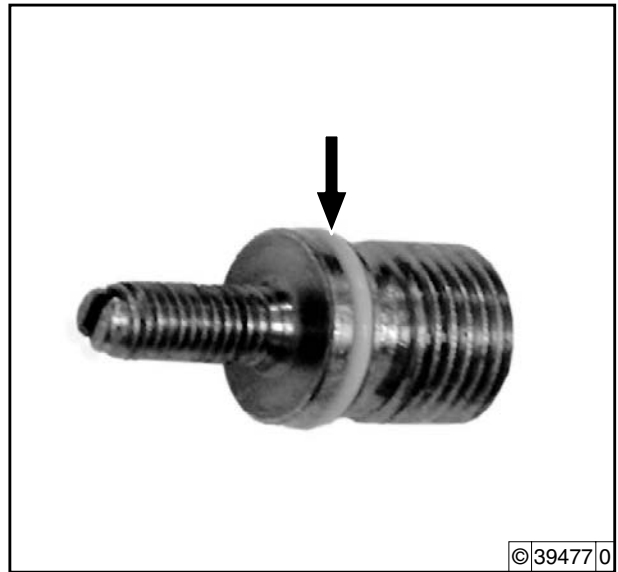


- Fit new round sealing ring (arrow) onto idling.



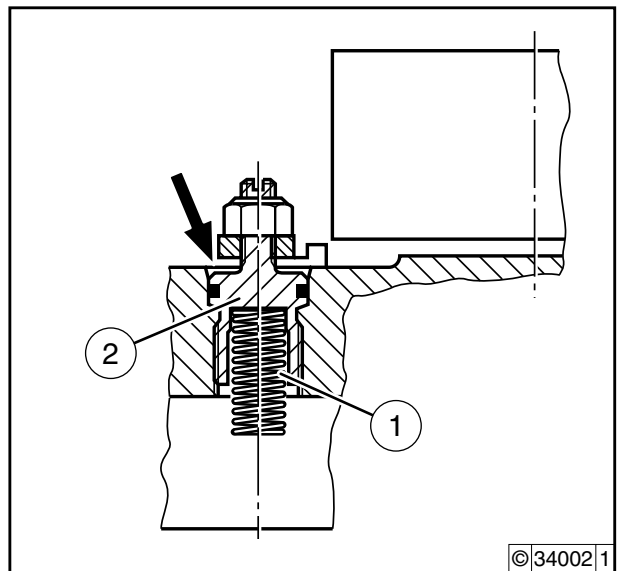
Note

Oil round sealing ring lightly.



©39477|0

- Insert spring (1) and turn in idling capsule (2) flush with the inside edge of the front cover (arrow).



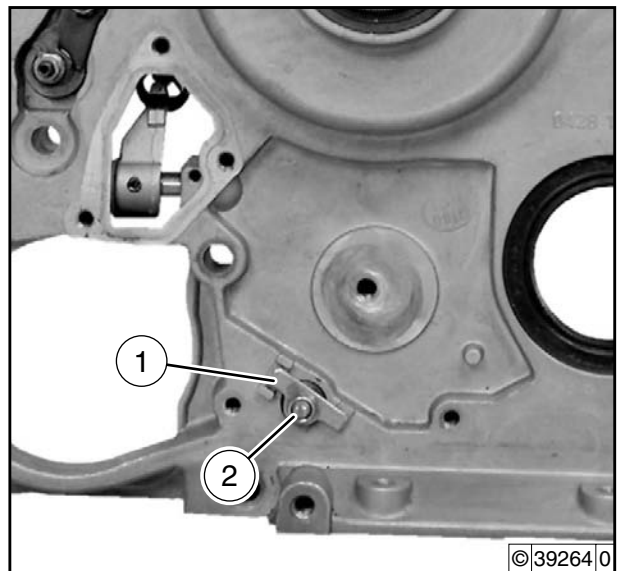
©34002|1

- Insert clamping claw (1) and tighten nut (2).



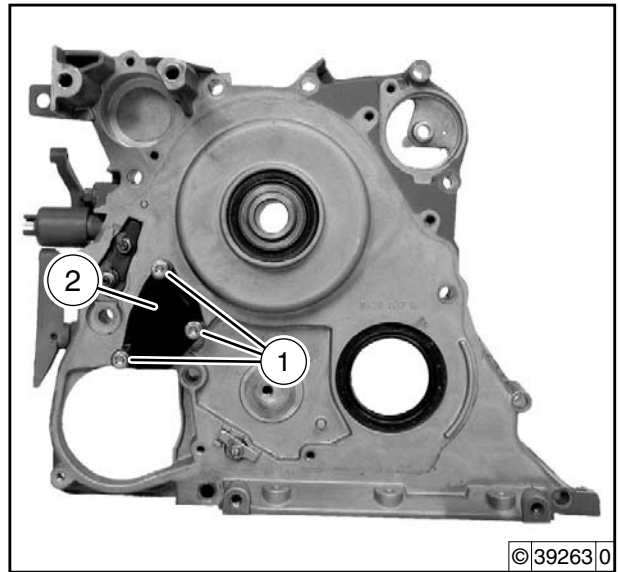
Note

Note installation position of the clamping claw.



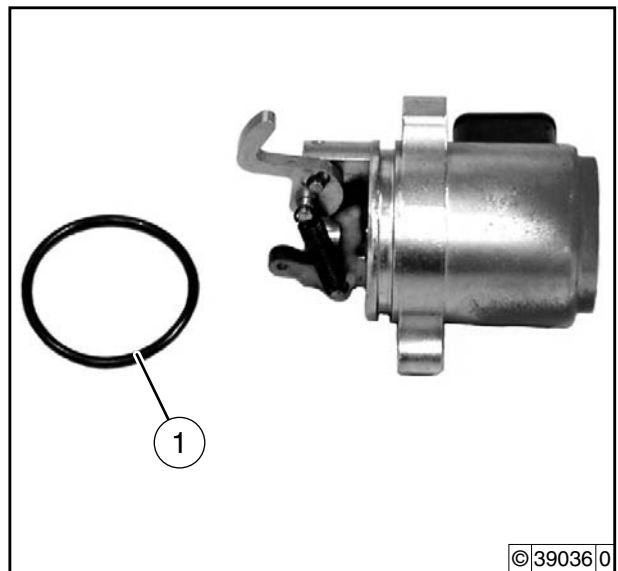
©39264|0

- Mount cover (2) with new gasket and tighten screws (1).

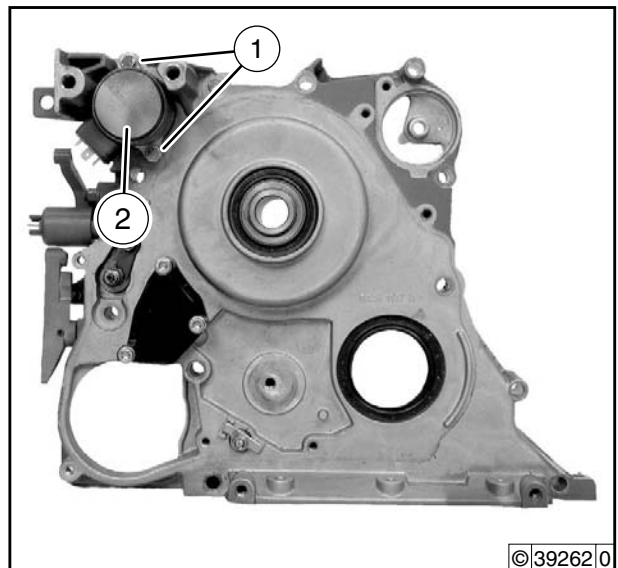


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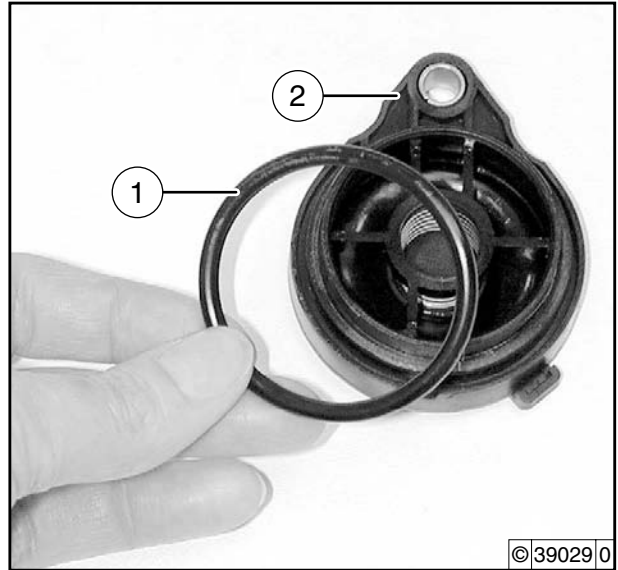
- Pull new round sealing ring (1) onto lifting magnet.



- Insert lifting magnet (2) and tighten screws (1).



- Pull new round sealing ring (1) onto bleed valve (2).



- Mount bleed valve (2) and press in.



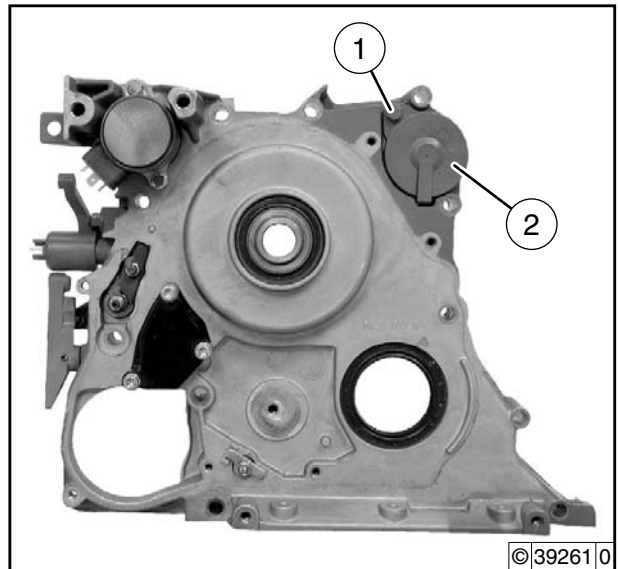
Note

The bleed valve must contact the front cover evenly.

- Tighten screw (1).



- Install front cover
→ Job card W 03-08-01.





Notes

Dismantle and complete front cover (Speed governor without torque adjustment)



Tools

- **Commercial tools**
Depth-measuring appliance

- **Special tools**

100 400 - Meter
100 750 - Measuring device



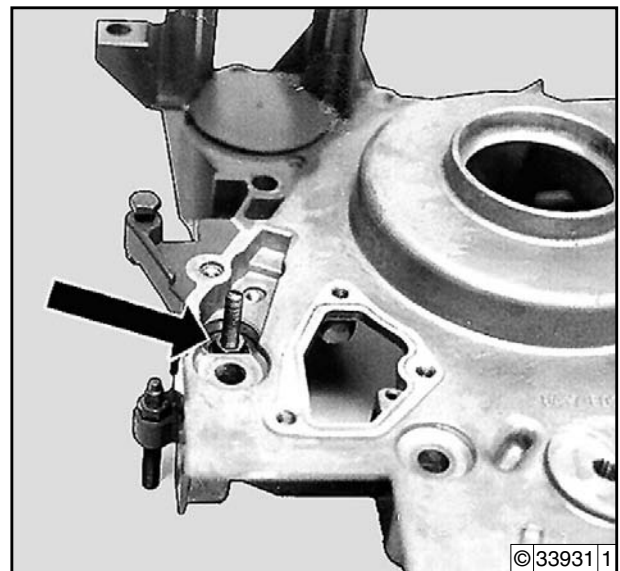
References

- W 03-08-01



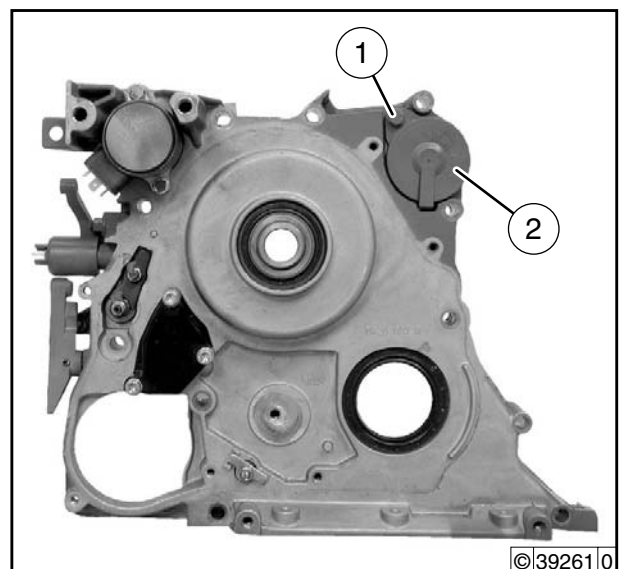
Note

Distinguishing mark for a speed governor without torque adjustment:
Full load volume stop (arrow) in place of adjustment capsule.

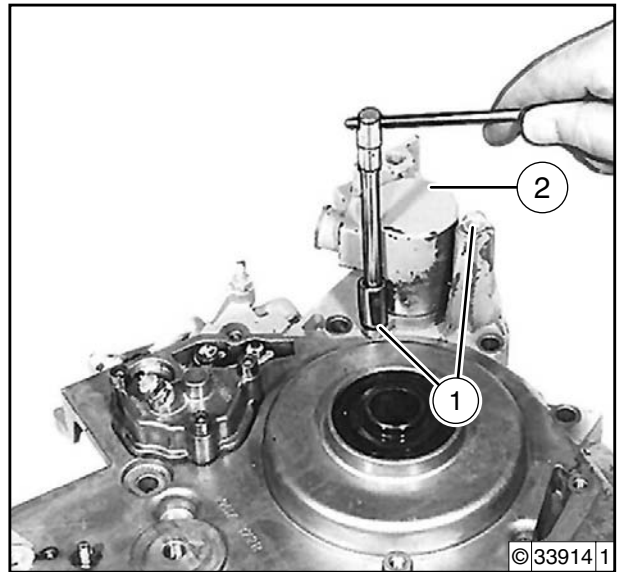


Dismantle front cover

- Remove front cover
→ Job card W 03-08-01.
- Unscrew screw (1) and remove bleed valve (2).

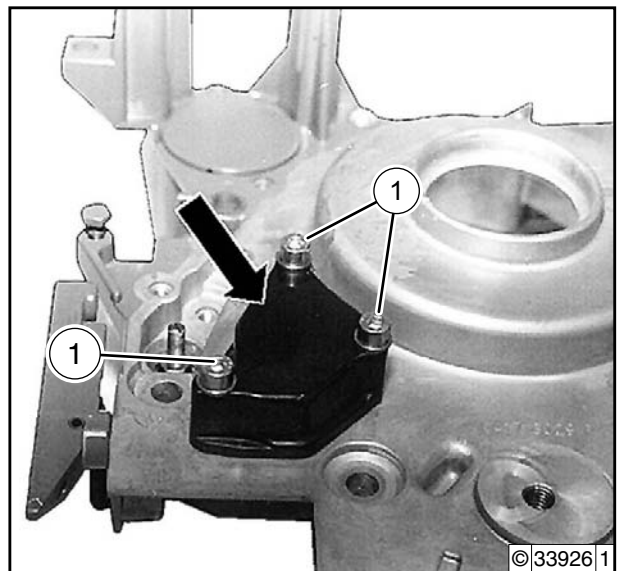


- Unscrew screws (1) and remove lifting magnet (2).

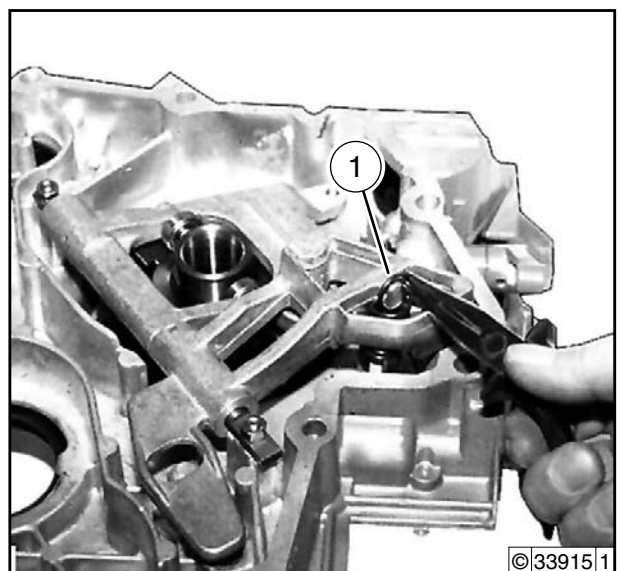


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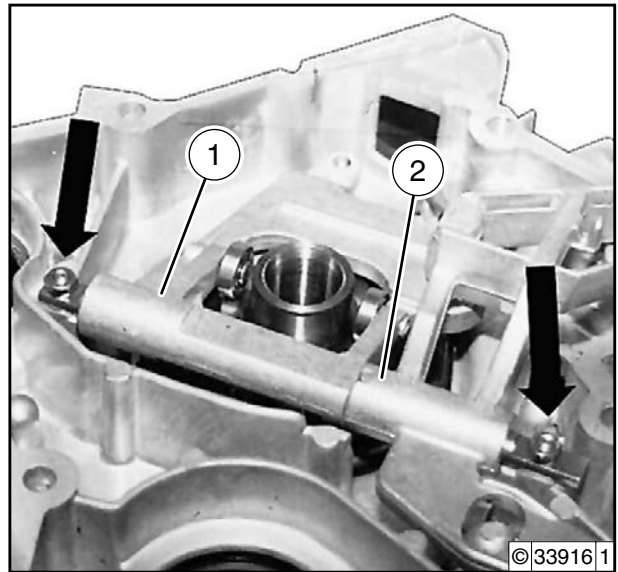
- Unscrew screws (1) and remove cap (arrow) with gasket.



- Unhook regulator spring (1).



- Unscrew nuts (arrows).
- Remove controller lever shaft with roller lever (1) and adjustment lever (2).

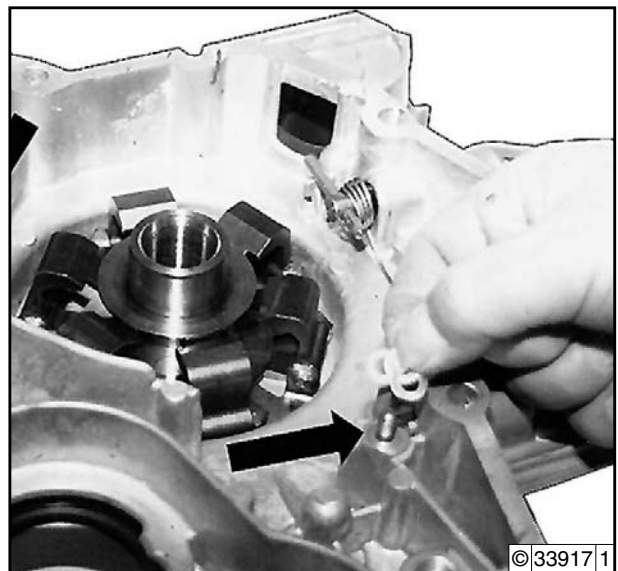


- Remove shim discs (arrow).

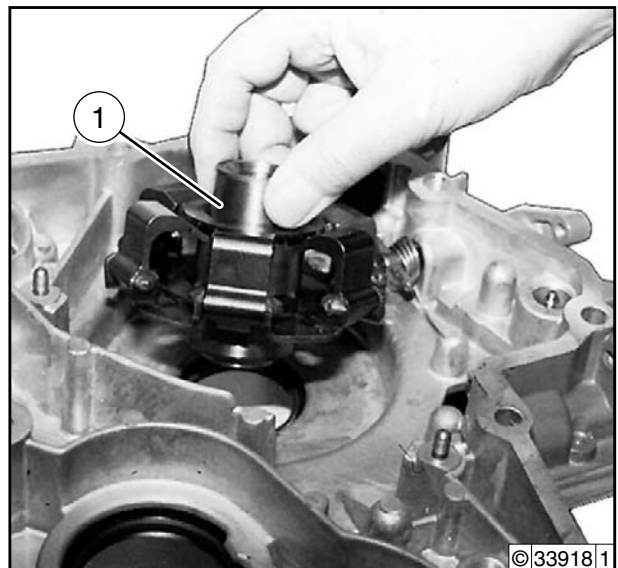


Note

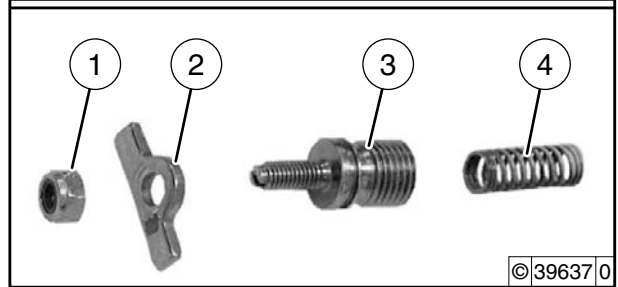
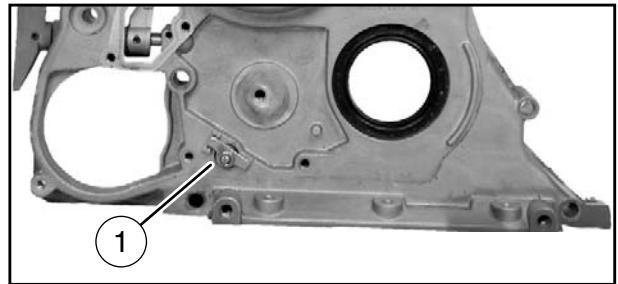
Pay attention to number and arrangement.



- Remove centrifugal force measuring mechanism (1).

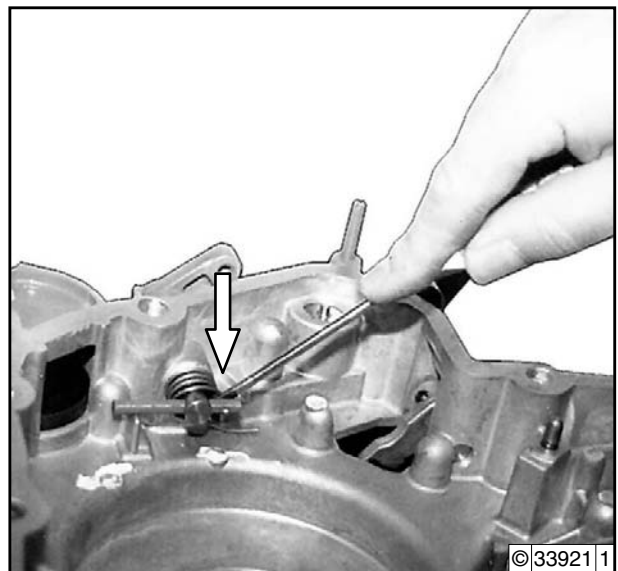


- Unscrew nut (1) and remove clamping claw (2).
- Unscrew idling capsule (3) and remove (4) spring.

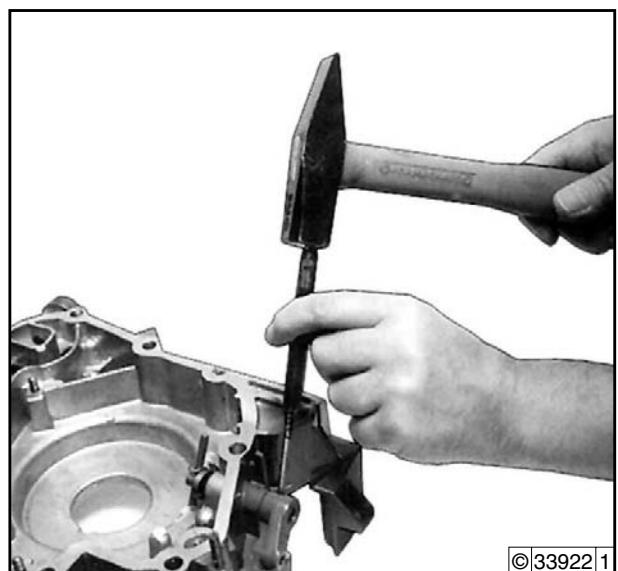


6

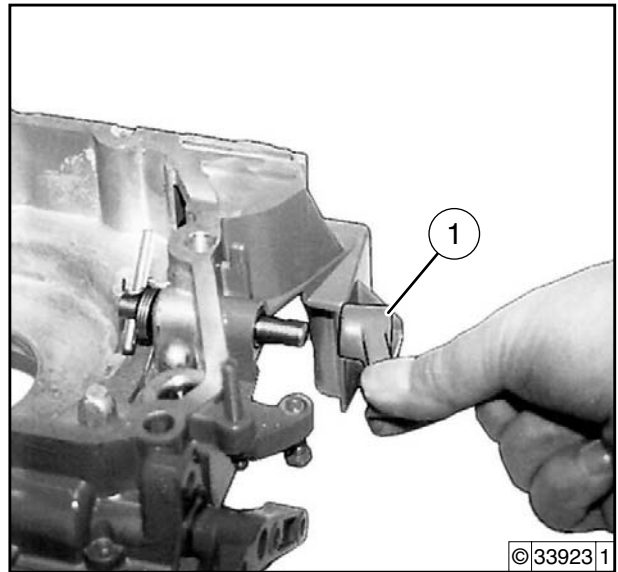
- Unhook spring from stop (arrow).



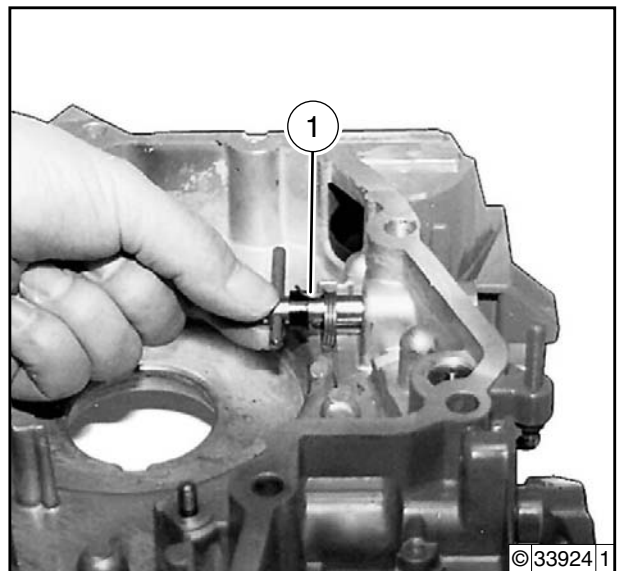
- Drive out clamping pin.



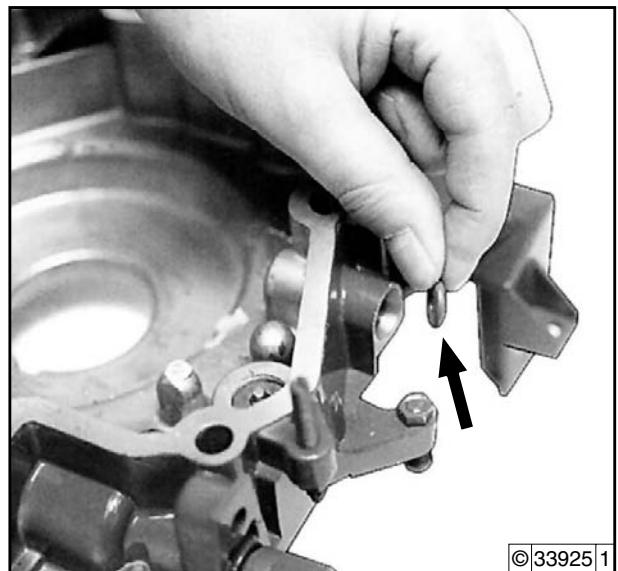
- Remove shutoff lever (1) and guide bush.



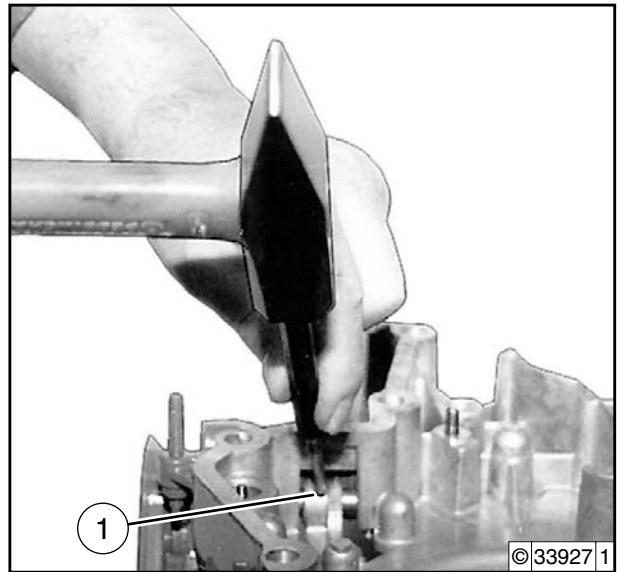
- Pull out shutoff shaft (1) with spacing bush and spring.



- Remove round sealing ring (arrow).



- Knock out clamping pin (1).



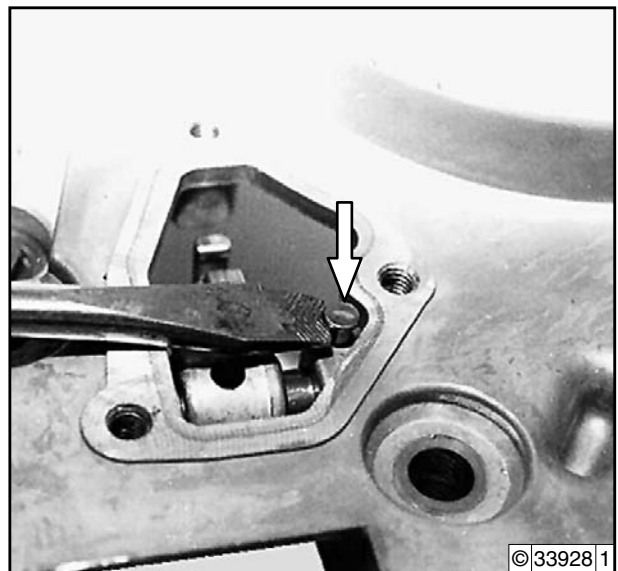
6

- Remove locking bolt (arrow).

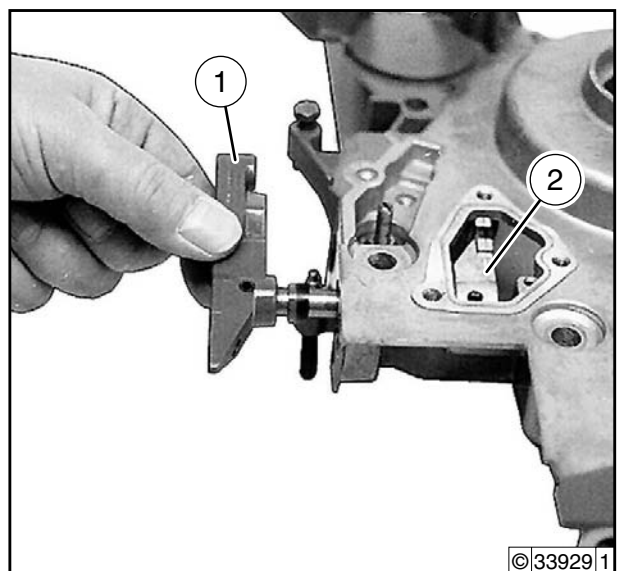


Note

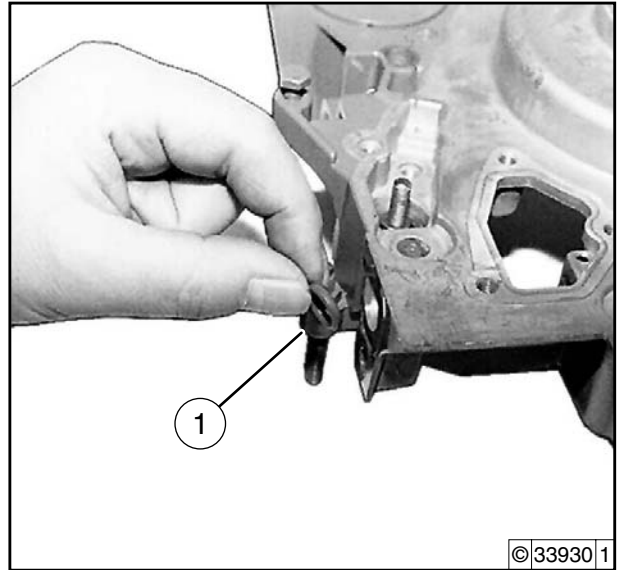
Do not damage the sealing surface on the front cover.



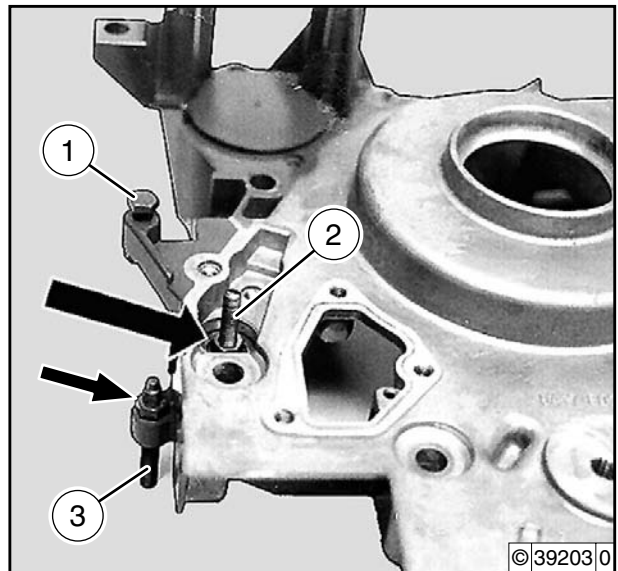
- Pull out the speed adjustment lever (1) with shaft and guide bush, remove the adjustment lever (2).



- Remove round sealing ring (arrow).



- Loosen lock nut (arrows).
- Unscrew setting screw for shutoff stop (1), full load stop (2) and minimum speed (3).
- Check components for visible signs of damage.



Complete front cover

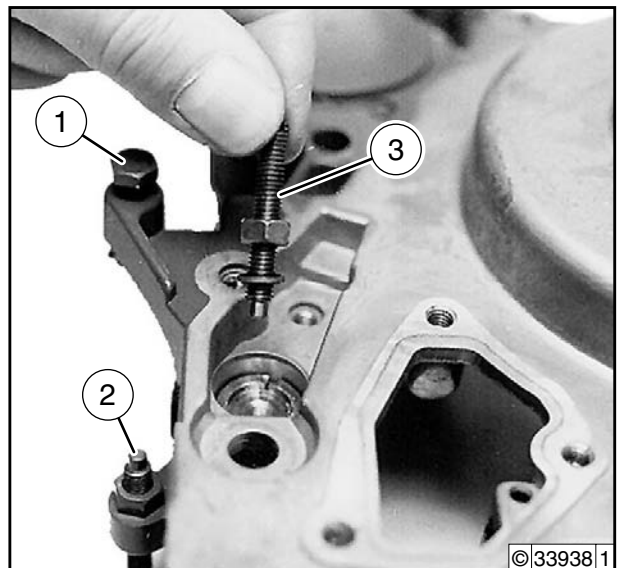
- Screw in setting screw for shutoff stop (1), minimum speed (2) and full load stop (3).



Note

Renew round sealing ring on full load stop.

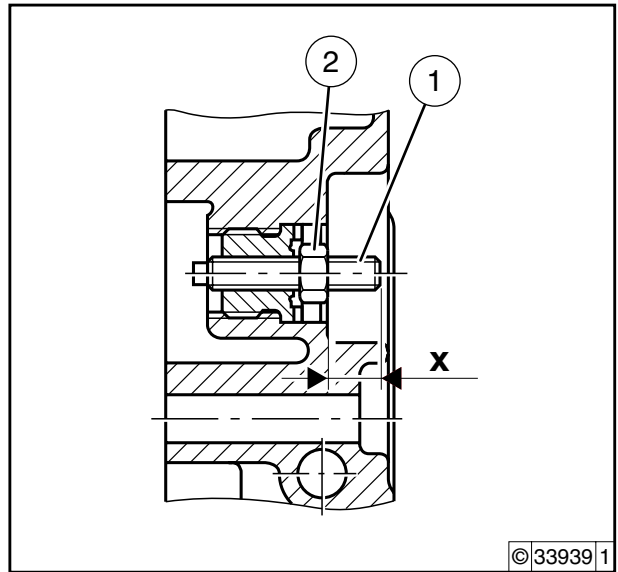
- Screw on lock nuts.



- Set setting screw (1) for full load stop to dimension "X".

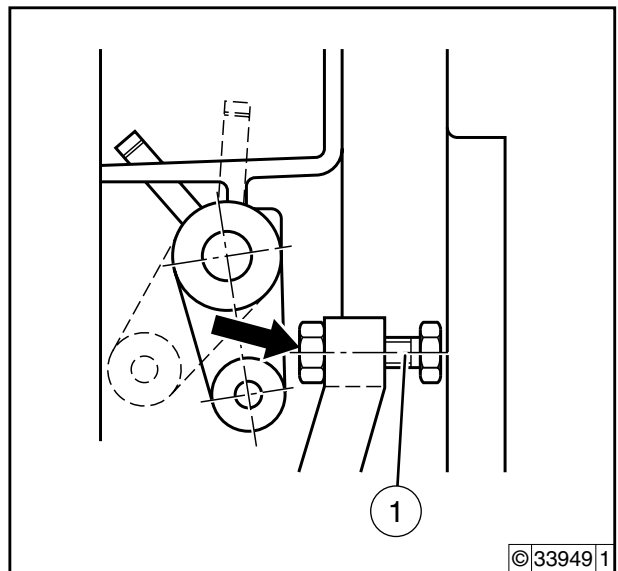


- Tighten lock nut (2).



6

- Screw in setting screw (1) for shutoff stop so that the lock nut is flush with the end of the bolt (arrows).
- Tighten lock nut.



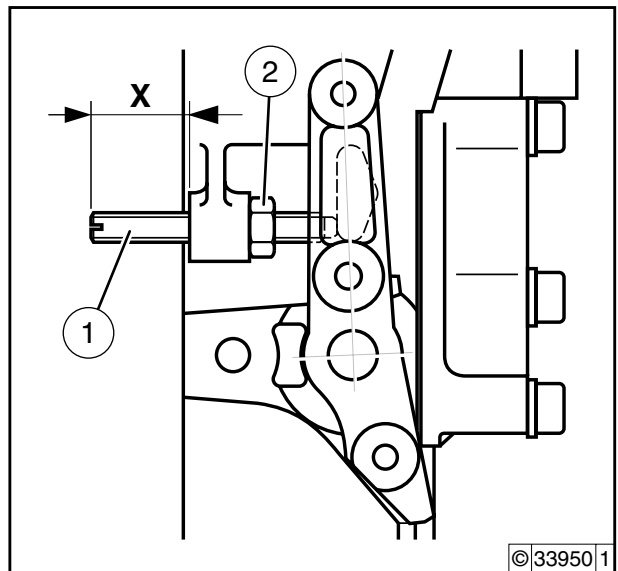
- Set setting screw (1) for minimum speed to dimension "X".



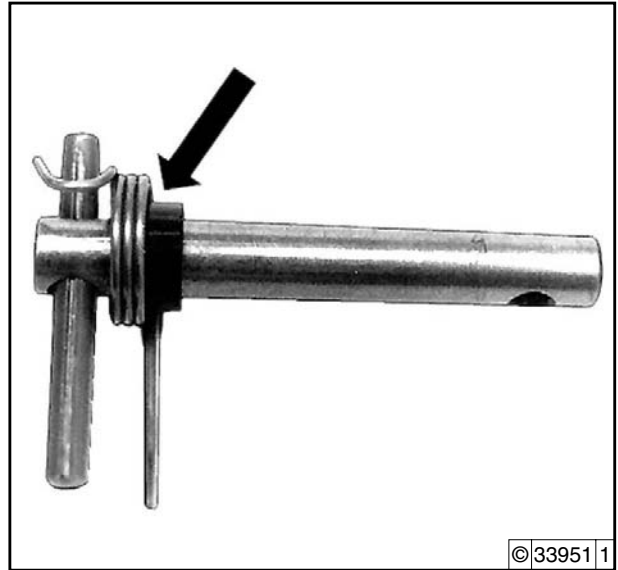
Note

The setting dimension "X" only serves as a basic setting. A test stand run is necessary for the performance and speed setting.

- Tighten lock nut (2).



- Push the spacer bush (arrow) and spring onto the shutoff shaft.

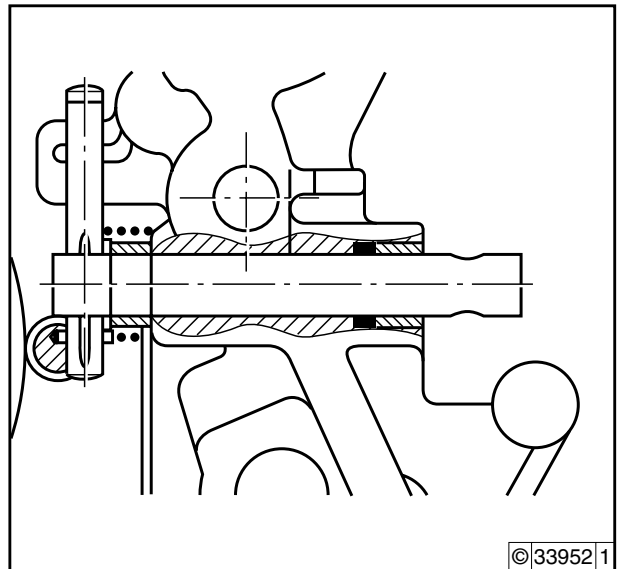


- Insert shutoff shaft and hook in spring.



Note

- Note installation position.
- Oil the shutoff shaft lightly.

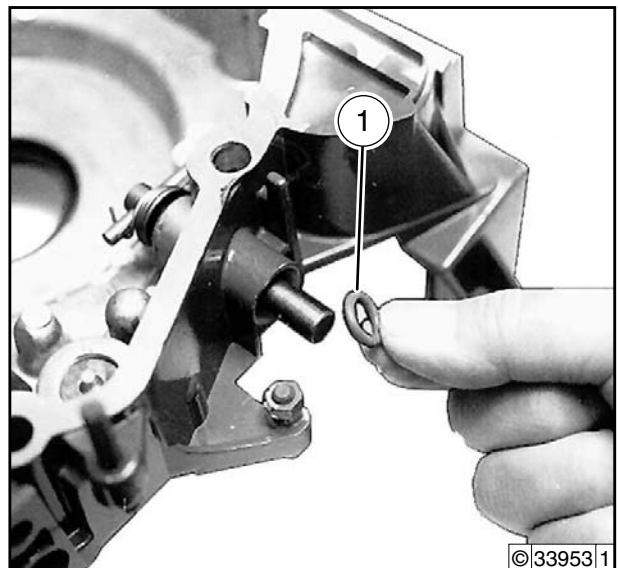


- Insert new round sealing ring (1).

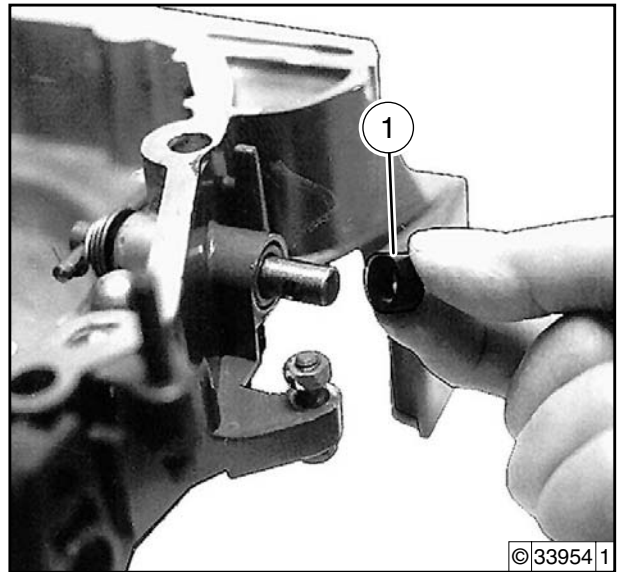


Note

- Oil round sealing ring lightly.



- Insert guide bush (1).



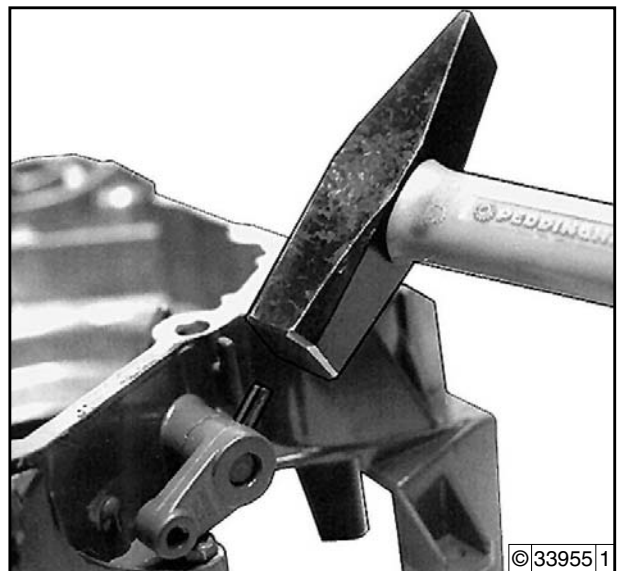
6

- Press the shutoff shaft into the front cover to the stop.
- Push on shutoff lever with clamping pin.



Note

Note installation position of the shutoff lever.

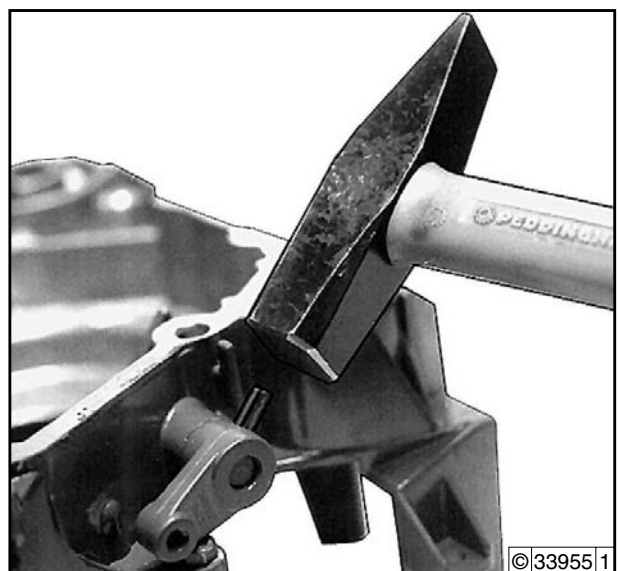


- Drive in clamping pin flush with the shutoff lever.



Note

The bore in the shutoff shaft must match up with the bore in the shutoff lever.

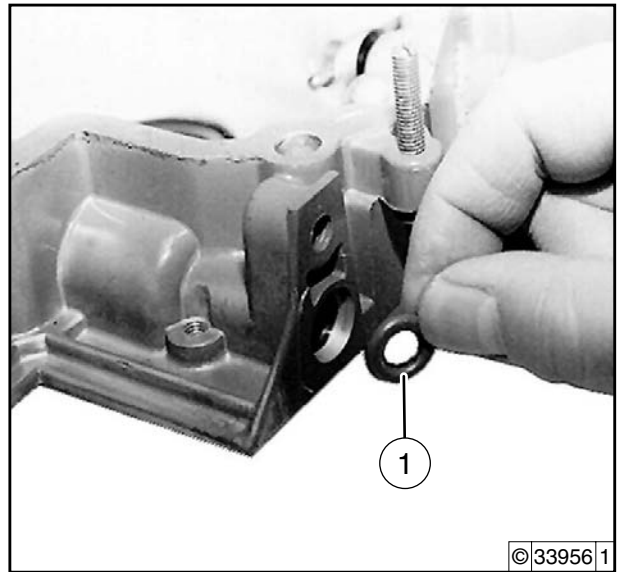


- Insert new round sealing ring (1).



Note

Oil round sealing ring lightly.

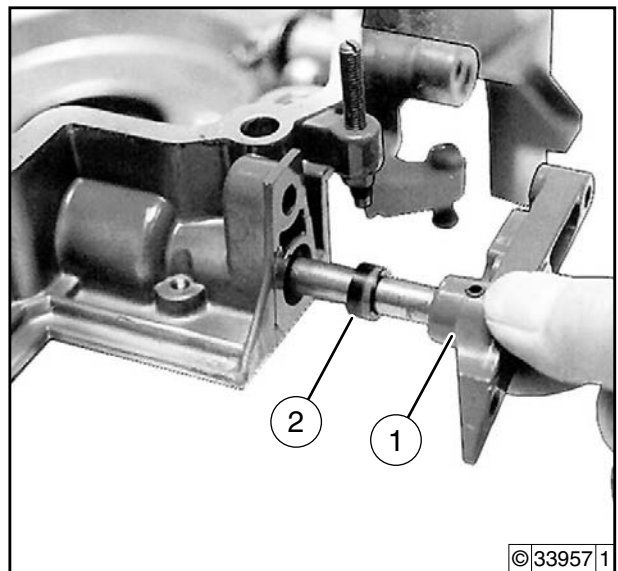


- Insert the speed adjustment lever (1) with shaft and guide bush (2).



Note

- Oil the speed adjustment shaft lightly.
- Observe the installation position of the speed adjustment lever.



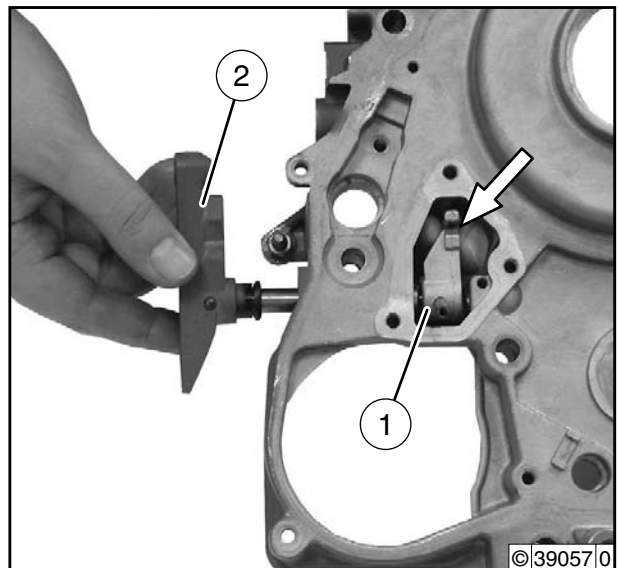
- Insert adjustment lever (1) with clamping pin.



Note

Note the installation position, the hole for hooking in the regulator spring (arrow) must face the outside of the front cover.

- Press the speed adjustment shaft (2) into the front cover to the stop.

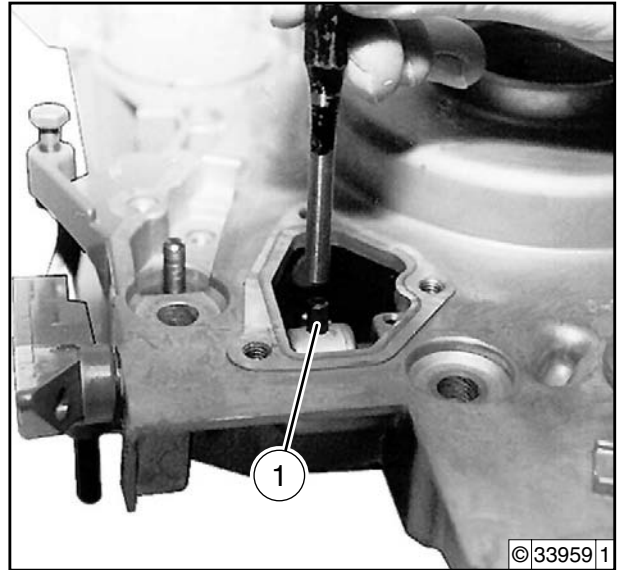


- Drive in clamping pin (1) flush with the adjustment lever.



Note

The bore in the speed adjustment shaft must match up with the bore in the adjustment lever.



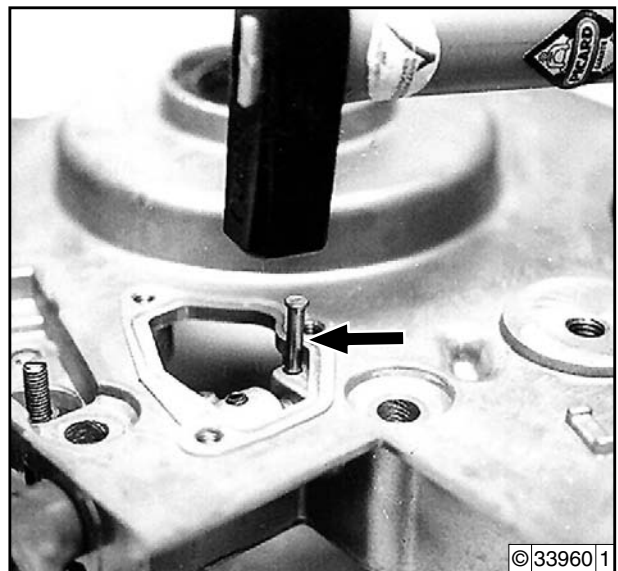
6

- Knock in the locking bolt (arrow) to the stop.



Note

The groove in the speed adjustment shaft must match up with the bore in the front cover.

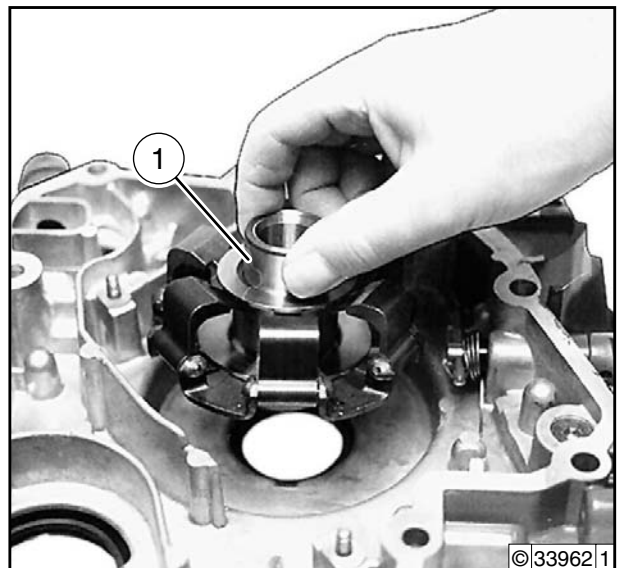


- Insert centrifugal force measuring mechanism (1).



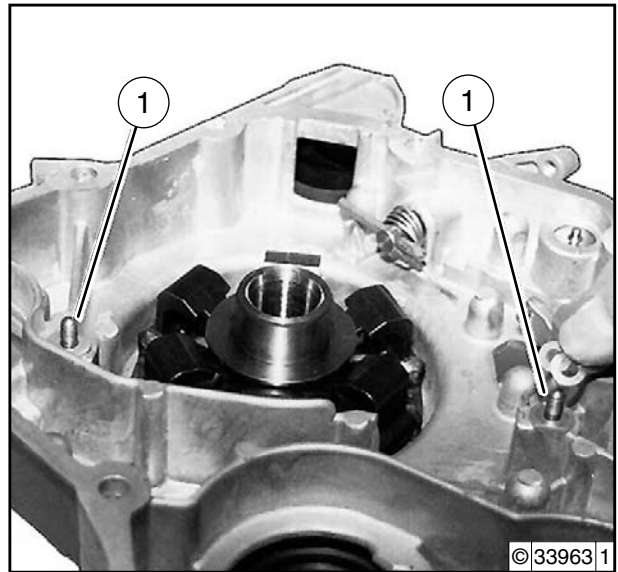
Note

Do not damage the sealing lip of the shaft sealing ring.



Measure and set the parallelism of the roller lever.

- Place shim discs of at least **0.3 mm** on the stud bolts (1).



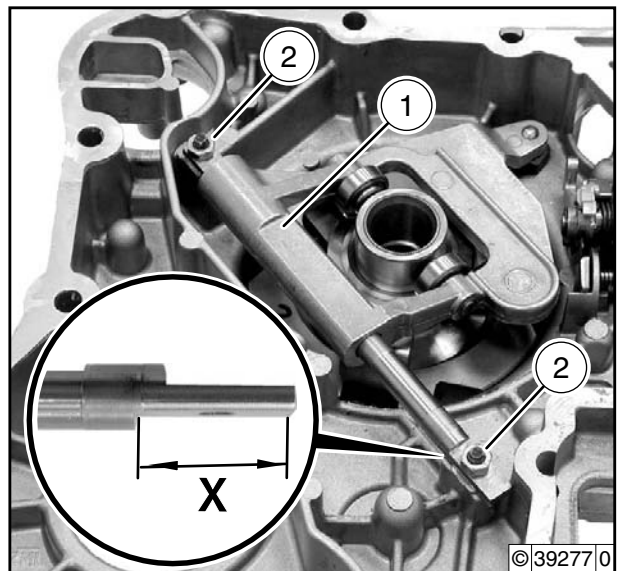
- Insert regulator lever shaft with roller lever (1) and tighten nuts (2).

05021

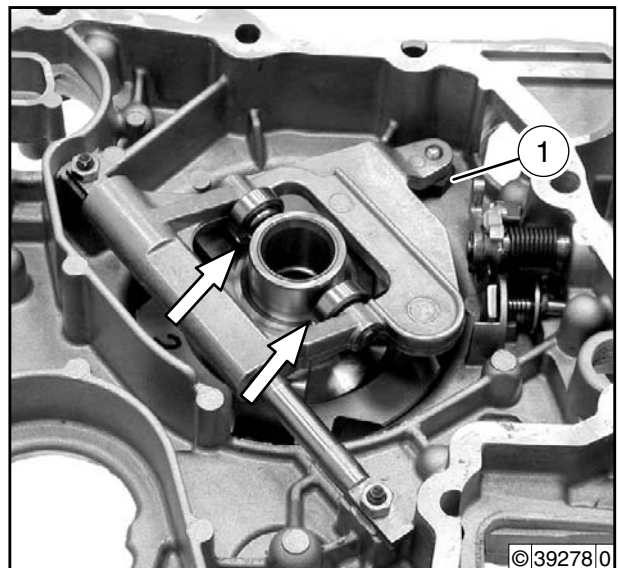


Note

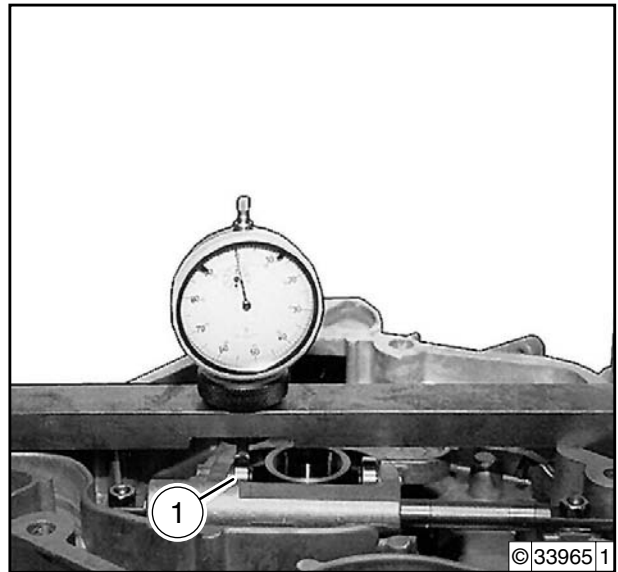
Note the installation position of the regulator lever shaft, the side with the long cut-out "X" must face the opening for the lube oil pump and the shim disc.



- Place shims underneath the contact surface of the roller lever (1) so that the ball bearings do not touch the muff (arrows).



- Insert meter in measuring bridge and position the stylus with pre-tension on the ball bearing (1).
- Adjust meter to "0".



6

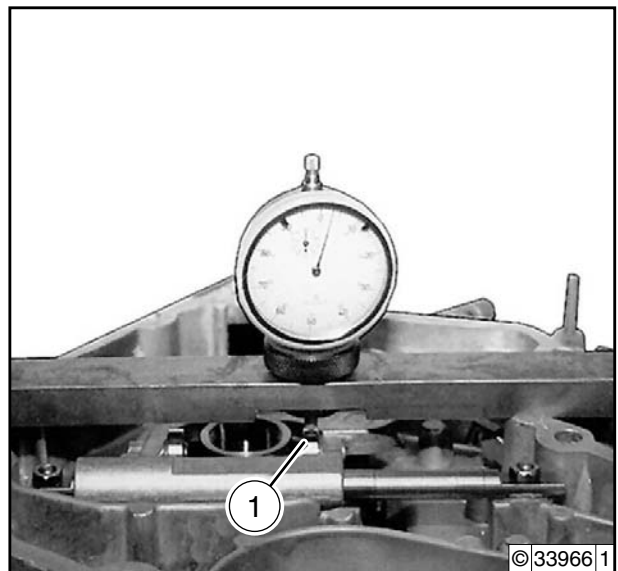
- Move the measuring bridge and position the stylus on the ball bearing (1).
- Read and note measured value.



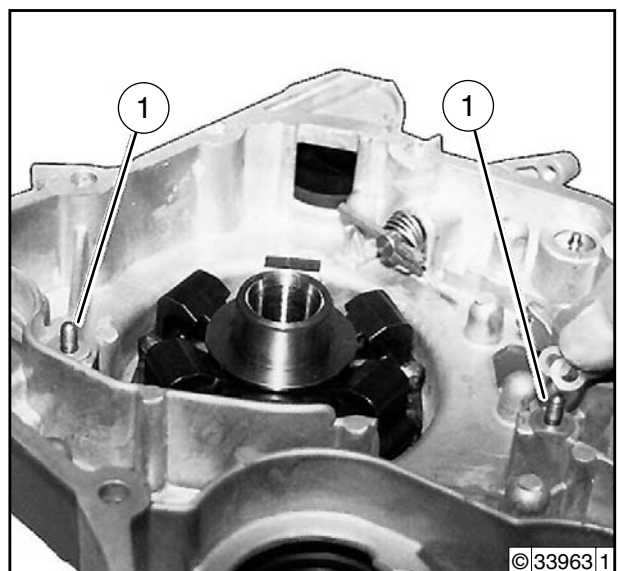
Note

The difference between both measured values is max. **0.05 mm**.

To achieve the required tolerance shims of max. **0.5 mm** may be placed under one stud bolt.



- Compensate the tolerance by using shim discs (1) of suitable thickness.
- Repeat the measuring process after setting.

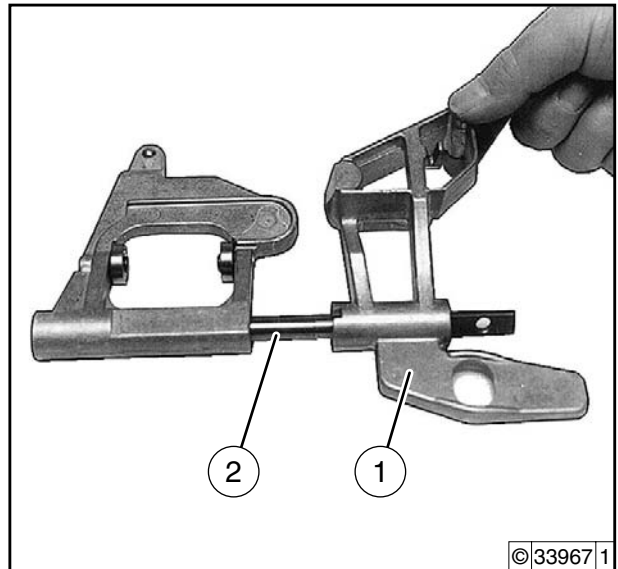


- Unscrew nuts and remove regulator lever shaft.
- Push the adjustment lever (1) onto the regulator lever shaft (2).



Note

Note installation position of the adjustment lever.

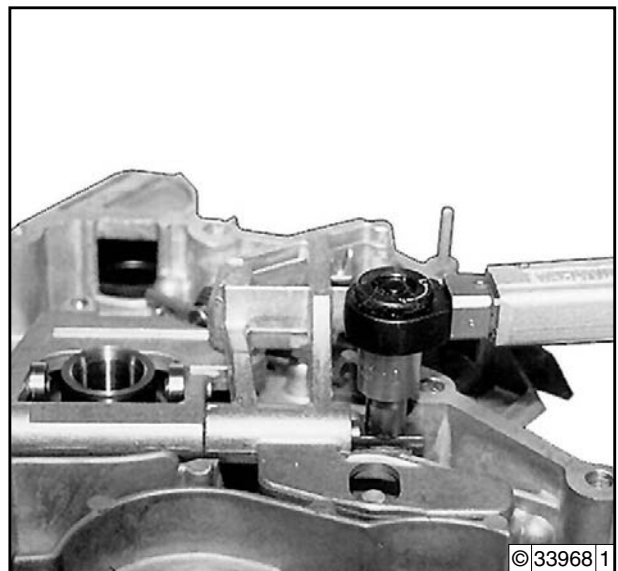


- Insert regulator lever shaft with roller lever and adjustment lever.
- Tighten nuts.

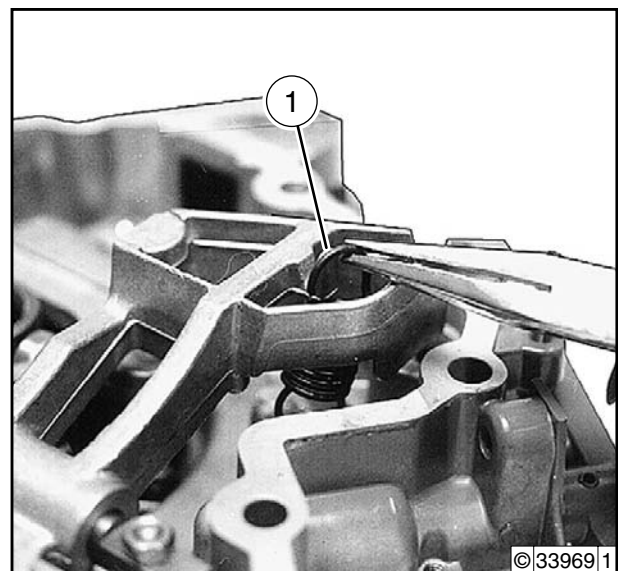


Note

Note installation position of the regulator lever shaft.



- Hook in regulator spring (1).

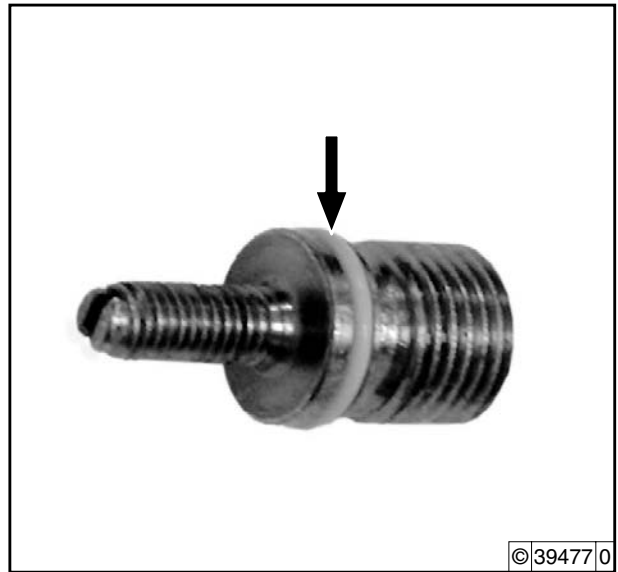


- Fit new round sealing ring (arrow) onto idling capsule.



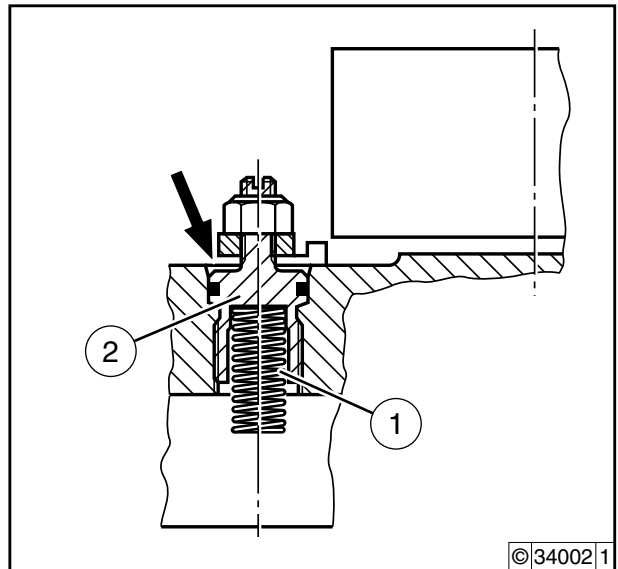
Note

Oil round sealing ring lightly.



6

- Insert spring (1) and turn in idling capsule (2) flush with the inside edge of the front cover (arrow).

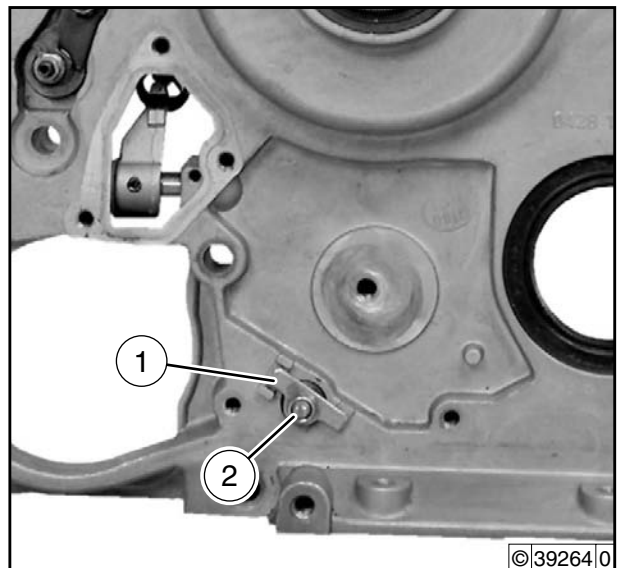


- Insert clamping claw (1) and tighten nut (2).

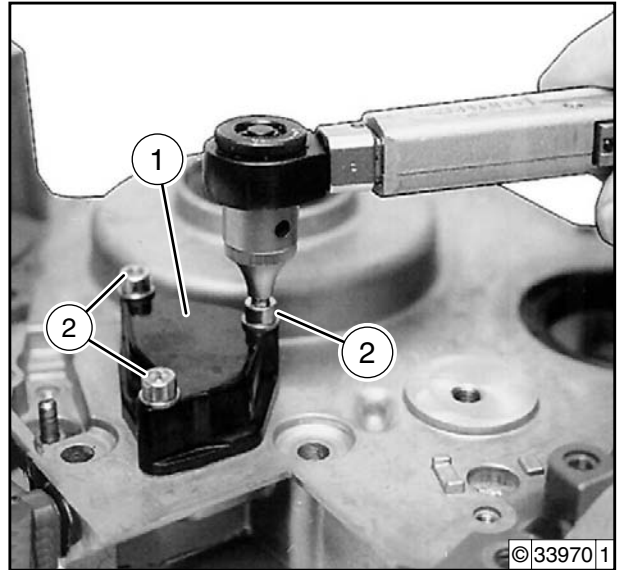


Note

Note installation position of the clamping claw.



- Mount cover (1) with new gasket and tighten screws (2).



- Pull new round sealing ring (1) onto lifting magnet.

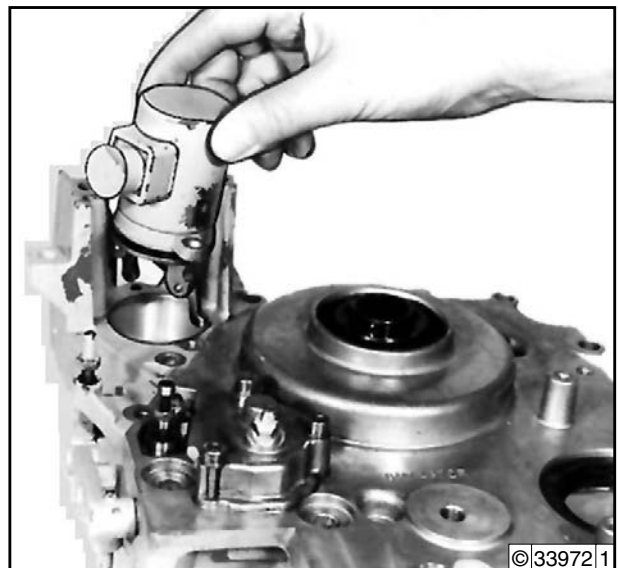


- Insert lifting magnet and tighten screws.

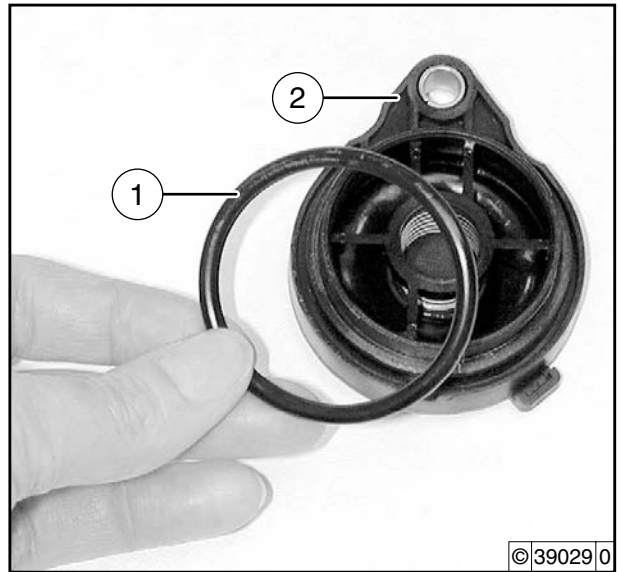


Note

Note installation position of the lifting magnet.



- Pull new round sealing ring (1) onto bleed valve.



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- Mount bleed valve (1) and press in.



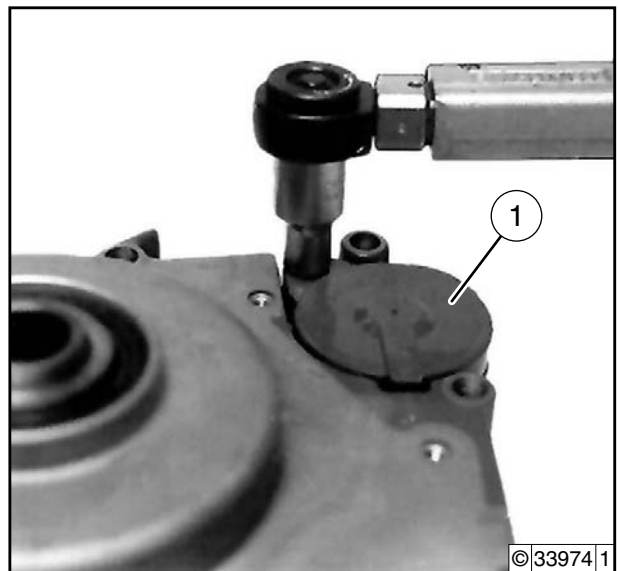
Note

The bleed valve must contact the front cover evenly.

- Tighten screw.



- Install front cover
→ Job card W 03-08-01.



Remove and install rear cover (flywheel side)



Tools

- Commercial tools

- Special tools

142 860 - Assembly tool



Auxiliary material

- DEUTZ DW 67



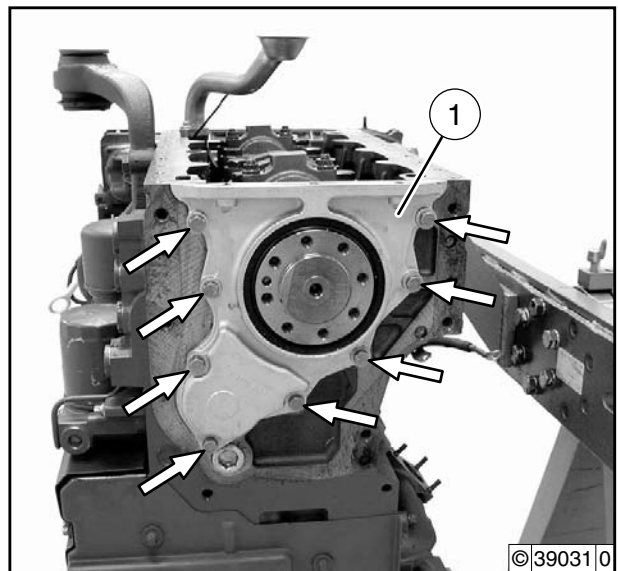
References

- W 03-09-04

- W 08-04-07

Remove rear cover (flywheel side)

- Remove connection housing
→ Job card **W 03-09-04**.
- Remove oil tray
→ Job card **W 08-04-07**.
- Unscrew screws (arrows) and remove rear cover (1).



Renew crankshaft sealing ring

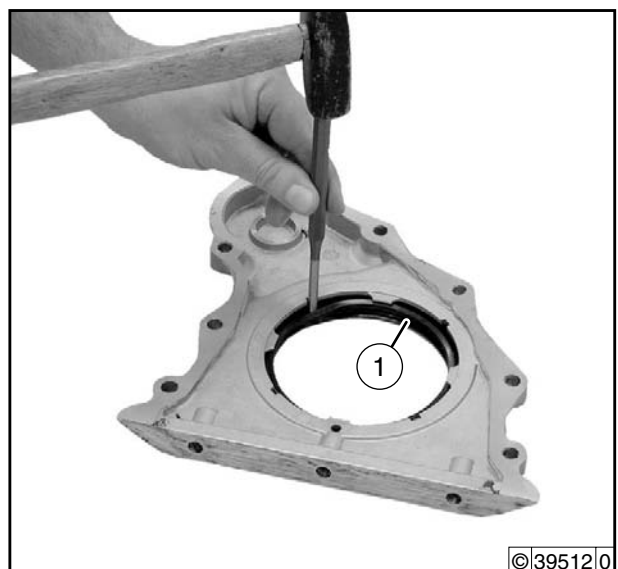
- Knock out crankshaft sealing ring (1).



Note

- Do not damage the sealing surface when knocking out.

- Check the rear cover visually, renew if necessary.

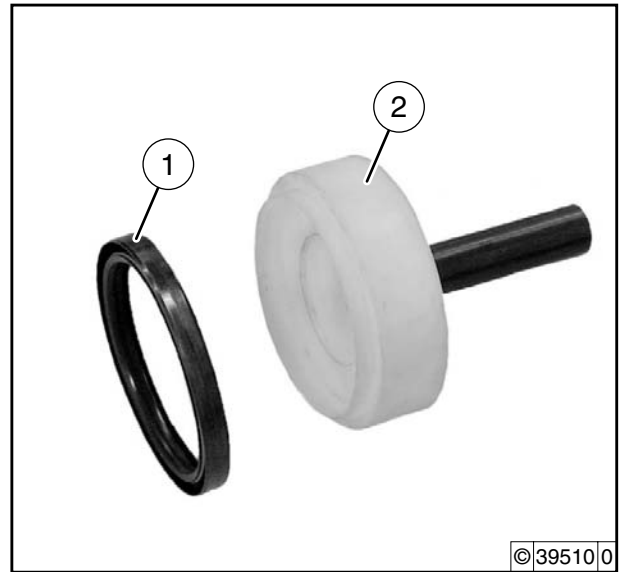


- Oil the sealing lip of the new crankshaft sealing ring lightly with engine oil.
- Fit the crankshaft sealing ring (1) to the assembly sleeve (2).



Note

The sealing lip must face the crankshaft in assembly.

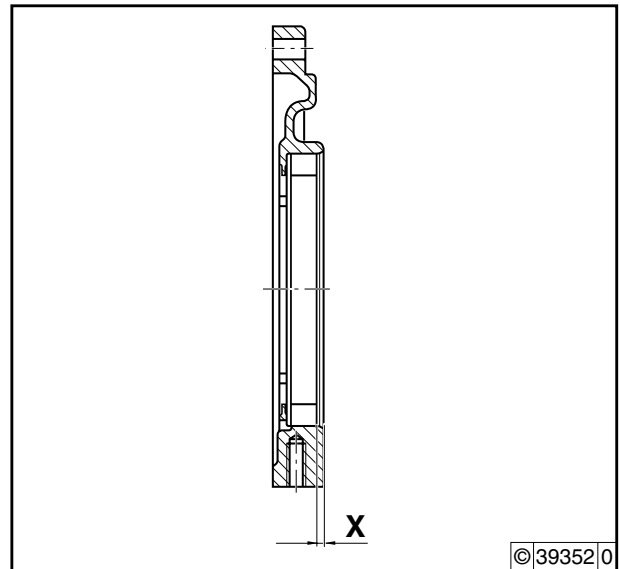


6



Note

Installation depth X = approx. 2.5 mm of the crankshaft sealing ring.

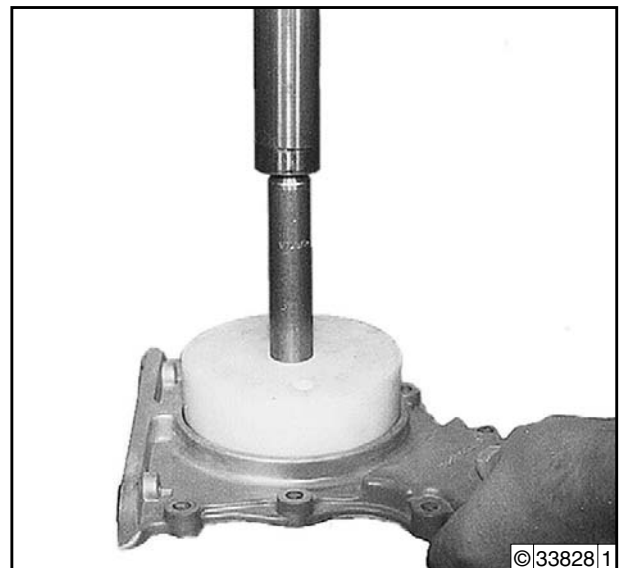


- Press in crankshaft sealing ring with assembly tool.



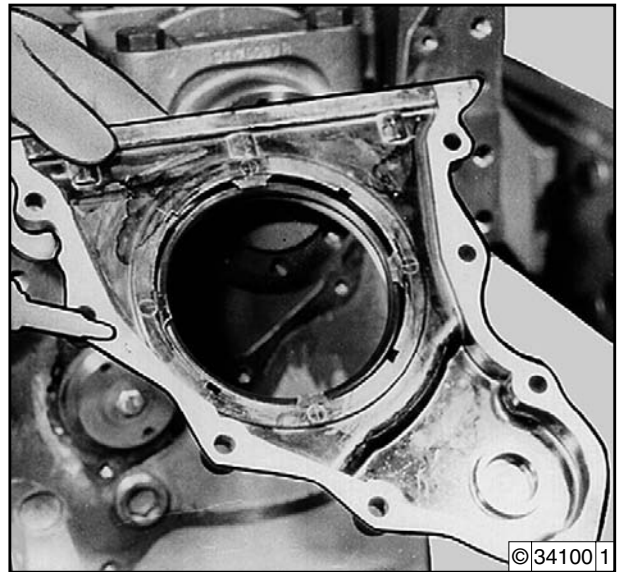
Note

- Note installation depth.



Install rear cover (flywheel side)

- Clean the sealing surface on the rear cover and crankcase.
- Apply sealant **DEUTZ DW 67** to rear cover.



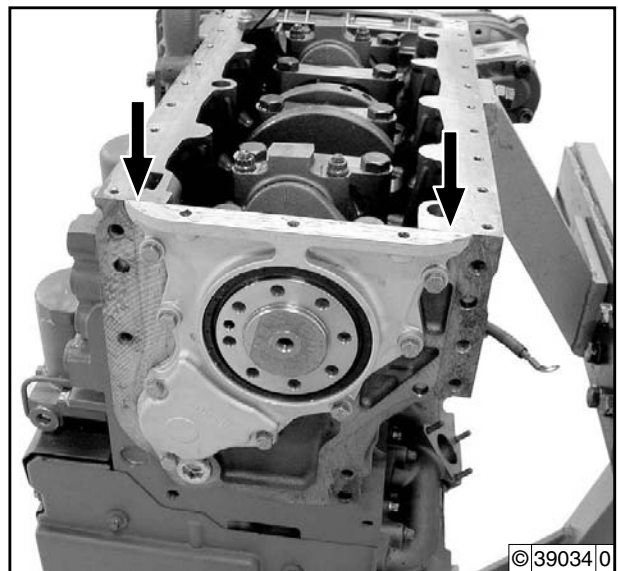
- Mount the rear cover with crankshaft sealing ring and tighten the screws.



Note

- The sealing lip of the crankshaft sealing ring must be touching the crankshaft journal all round.
- Do not tighten screws.

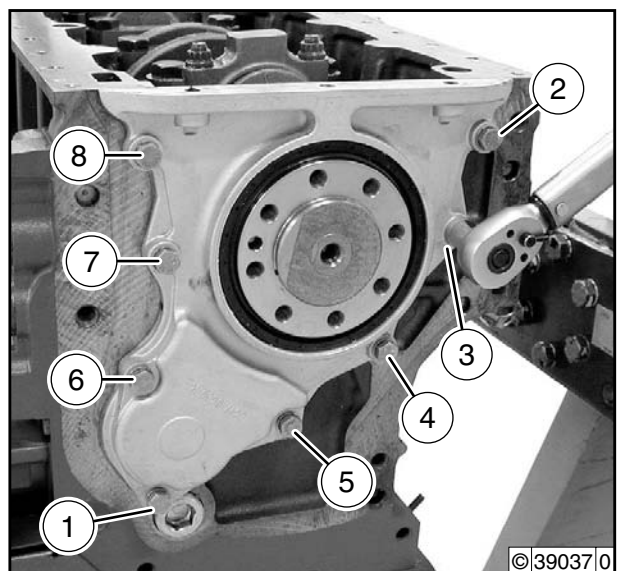
- Align the rear cover to the sealing surface of the oil tray (arrows).



- Tighten screws in tightening order (1 to 8).



- Install oil tray
→ Job card **W 08-04-07**.
- Install connection housing
→ Job card **W 03-09-04**.





Notes

Remove and install connection housing



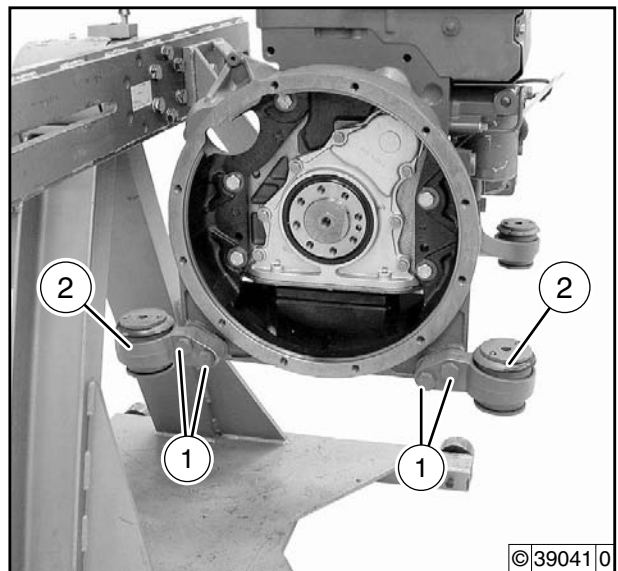
Tools
- Commercial tools



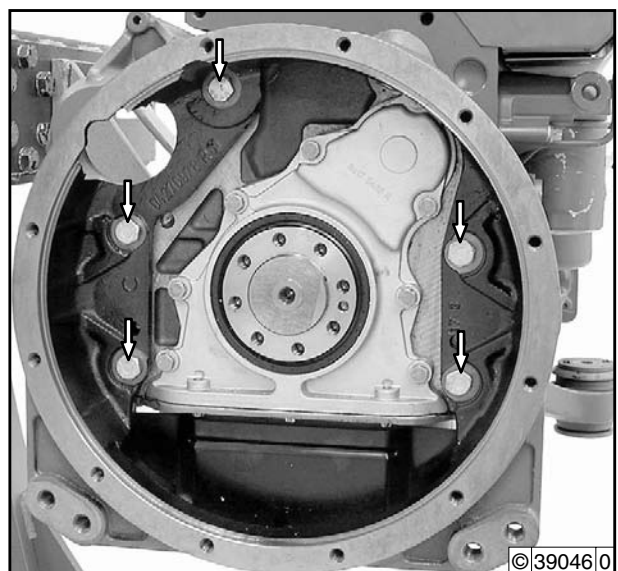
References
- W 00-05-01
- W 12-06-01

Remove connection housing

- Mount engine on engine assembly stand
→ Job card **W 00-05-01**.
- Remove flywheel
→ Job card **W 12-06-01**.
- Unscrew screws (1) and remove engine mounting (2).



- Unscrew screws (arrows) and remove connection housing.



Install connection housing

- Clean contact surfaces on connection housing and crankcase.



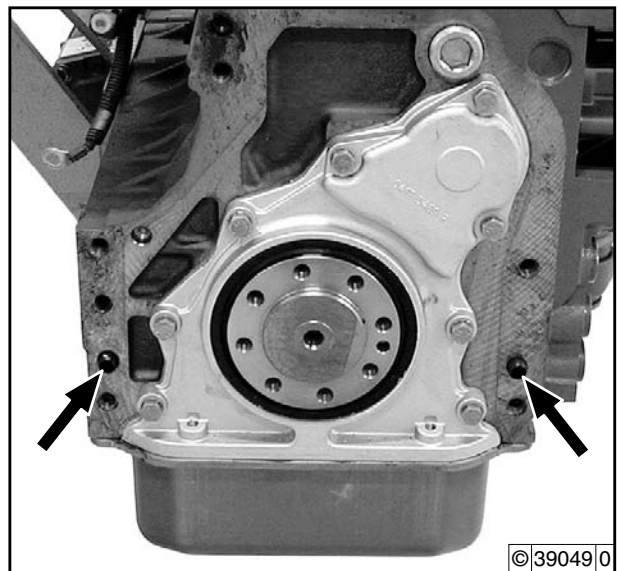
6



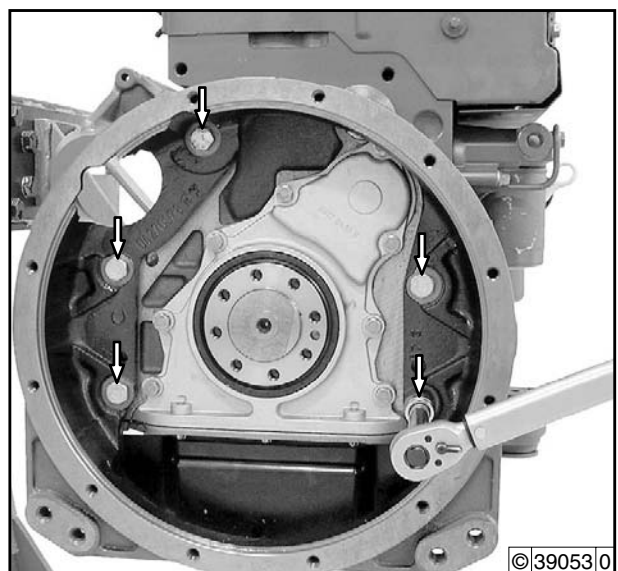
Note

Make sure the clamping sleeves (arrows) are in place.

- Knock clamping sleeves into the crankcase to the stop.
- Mount the connection housing and center over the clamping sleeves.



- Tighten screws (arrows) alternately.



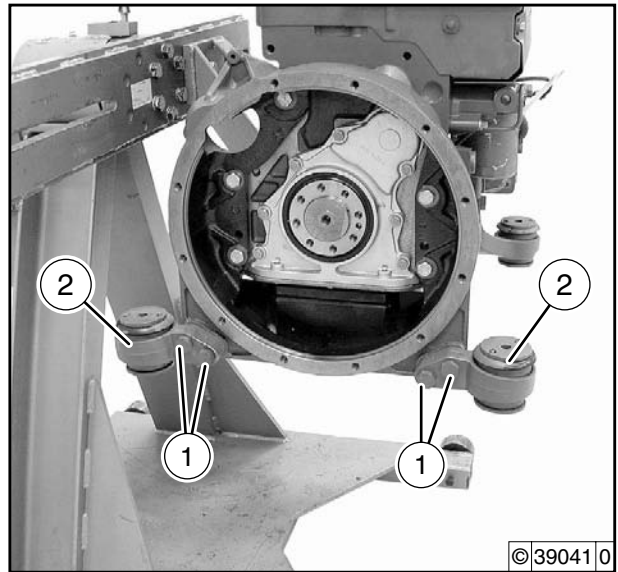
- Mount engine bearing (2) and tighten screws (1).



Note

Note installation position.

- Install flywheel.
→ Job card **W 12-06-01**.
- Disassemble engine from engine assembly stand
→ Job card **W 00-05-01**





Notes

Remove and install camshaft bearing, check



Tools

- Commercial tools

- Special tools

100 700 - Setting bolt

143 820 - Assembly tool



References

- W 01-02-02

- W 02-04-01

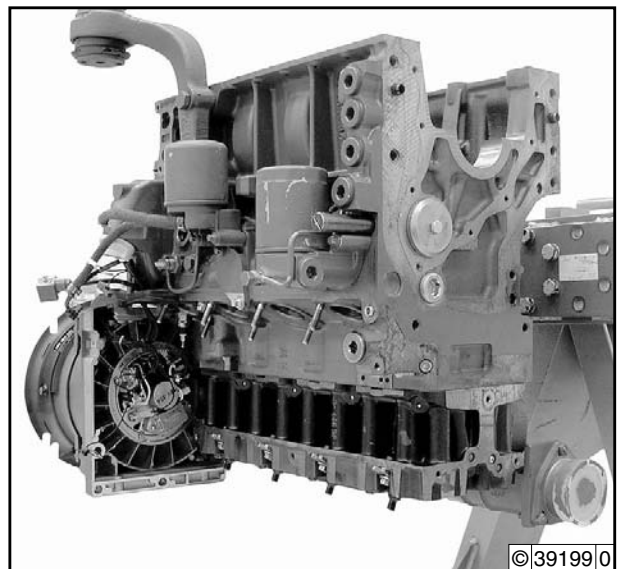
- W 07-04-01(Motorpal)

- W 07-04-01(Bosch)

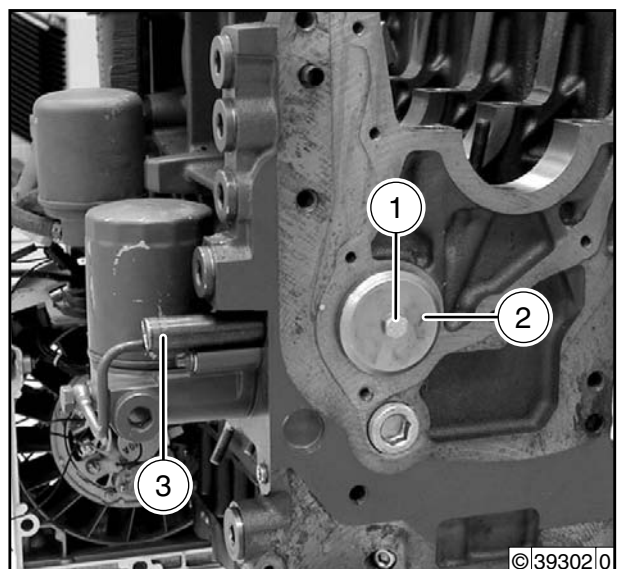
- W 07-11-01

Remove camshaft

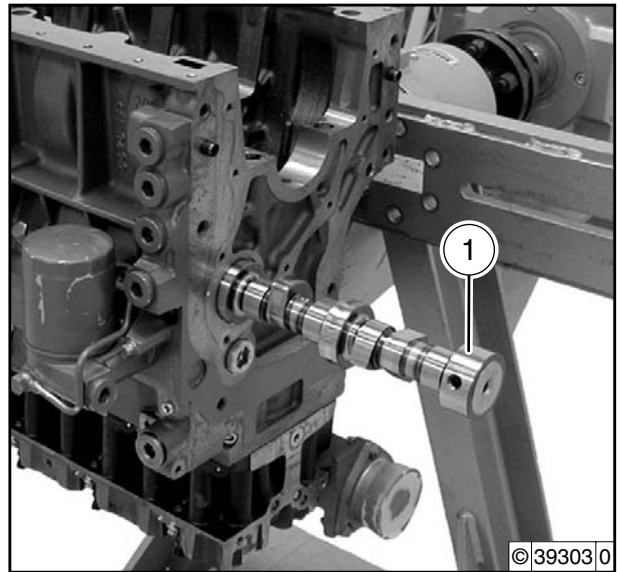
- Remove crankshaft
→ Job card **W 02-04-01**.
- Remove toggle lever and toggle lever blocks
→ Job card **W 01-02-02**.
- Remove injection pumps
→ Job card **W 07-04-01** (Motorpal)
→ Job card **W 07-04-01** (Bosch)
- Remove fuel pump
→ Job card **W 07-11-01**.



- Unscrew screw (1) and remove startup disc (2).
- Unscrew setting bolts (3).



- Press in all tappets.
- Pull out camshaft (1) carefully to the flywheel side.

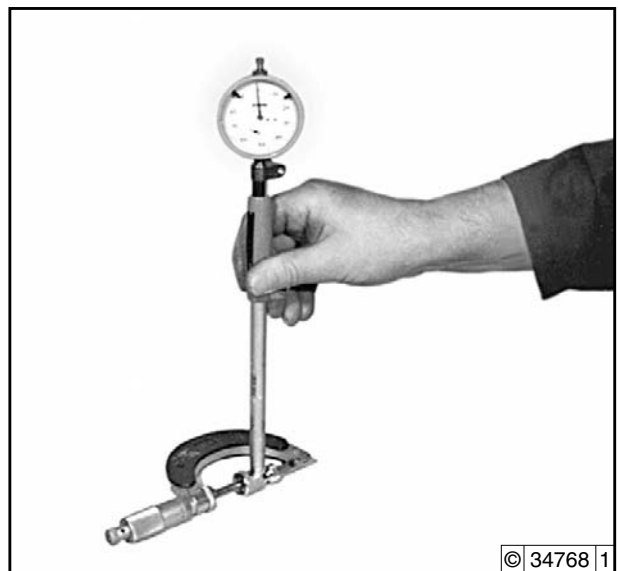


6

Check the camshaft bearing.

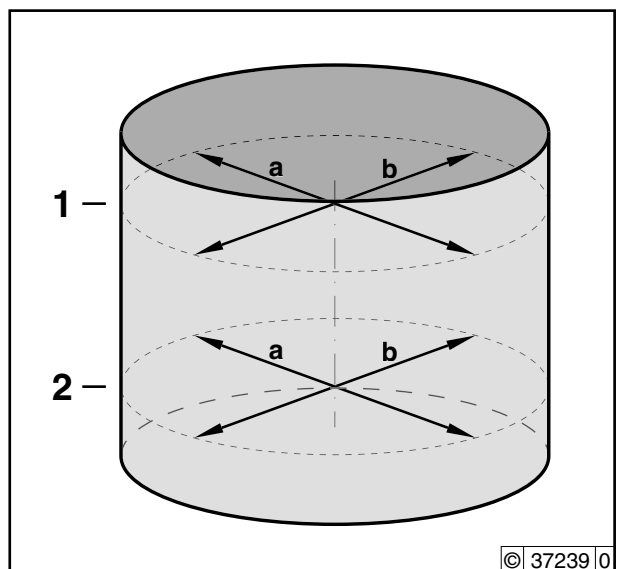
Prepare internal measuring device

- Mount probe bolt for the appropriate measuring range in the internal measuring device.
- Mount meter with approx. 1 mm pre-tension in the internal measuring device.
- Set micrometer gauge to 54 mm.
- Balance the internal measuring device between the test surfaces of the micrometer gauge and set the meter to the reversal point of the pointer to "0".



Note

Schematic representation for measuring the camshaft bearing at the points "a" and "b" in the levels "1" and "2".

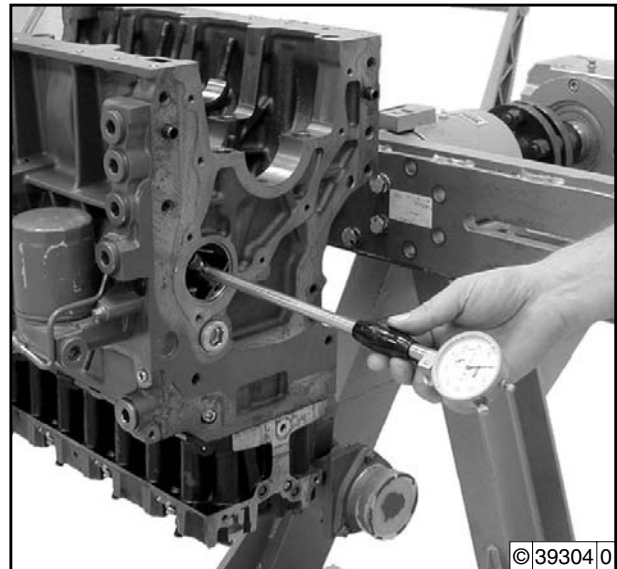


- Measure camshaft bearing with internal measuring device. Insert internal measuring device in the camshaft bearing.
- Balance the internal measuring device respectively at the given measuring points and read off the measured value at the reversal point of the pointer.



Note

- Measuring points, see schematic diagram.
- If the wear limit is reached, the bearing has to be changed.



©39304|0

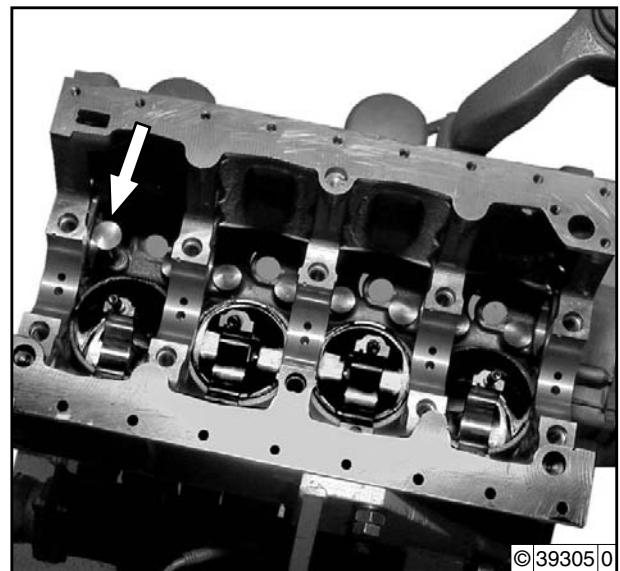
Remove camshaft bearing

- Remove all tappets (arrow).



Note

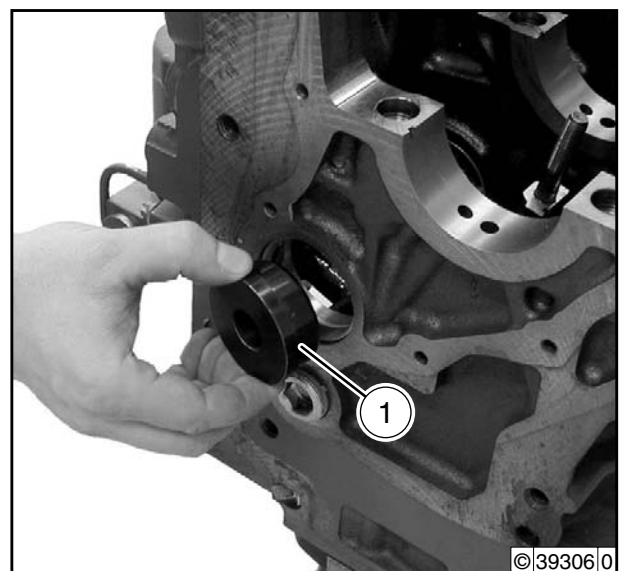
- Put down the components in the order of installation, note order of cylinders.



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Remove outer camshaft bearing

- Insert extraction bush (1) in outer camshaft bearing.



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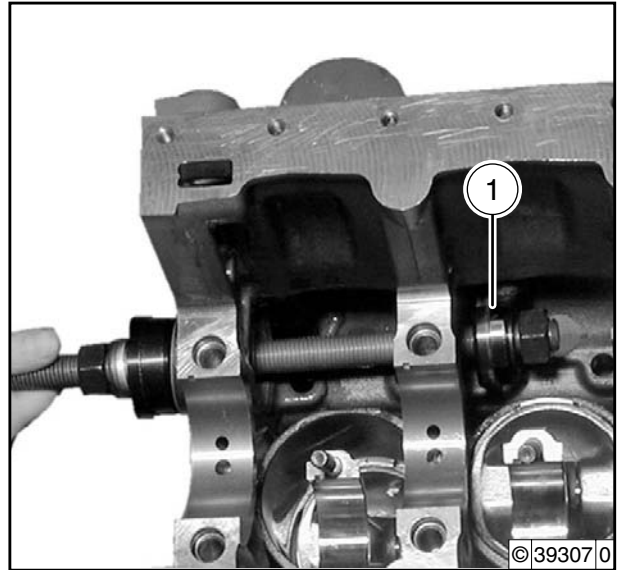
- Push in spindle, push on holder (1) and insert in inside camshaft bearing.



Note

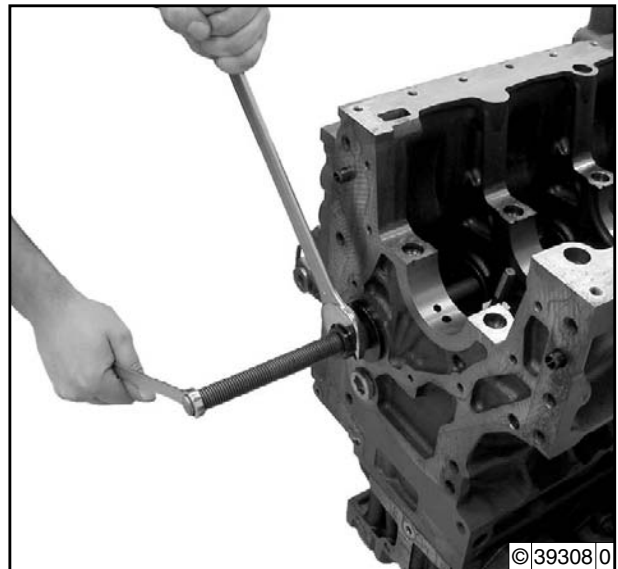
Make sure that the holder is evenly in contact with the crankcase.

- Fit washer and nut.



6

- Press out outer camshaft bearing.
- Dismantle assembly tool and remove camshaft bearing.



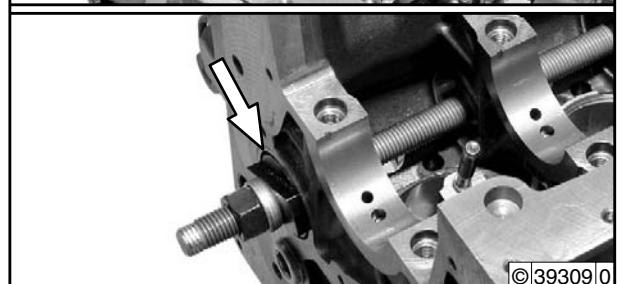
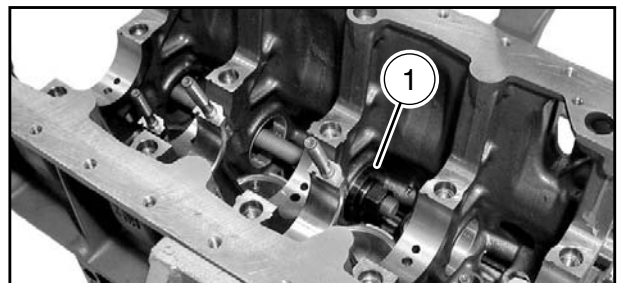
Remove inner camshaft bearing

- Insert extraction bush (1) in inner camshaft bearings.
- Insert spindle and fit washer and nut.

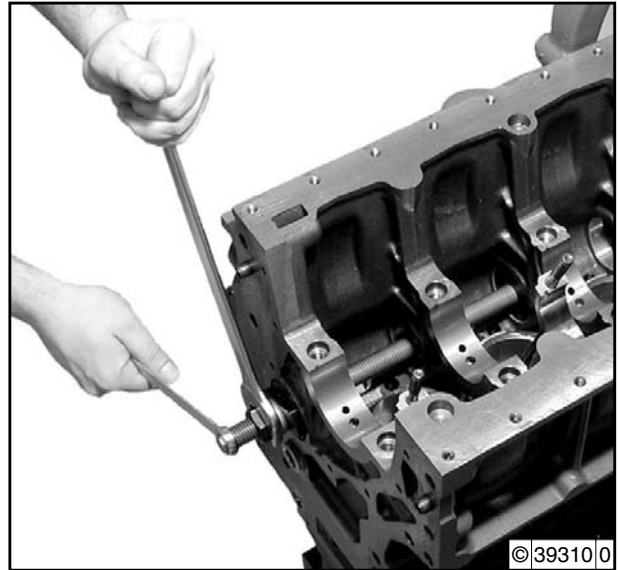


Note

Align counterbearing in the center of the bearing bore (arrow).



- Pull out inner camshaft bearing.
- Dismantle assembly tool and remove camshaft bearing.

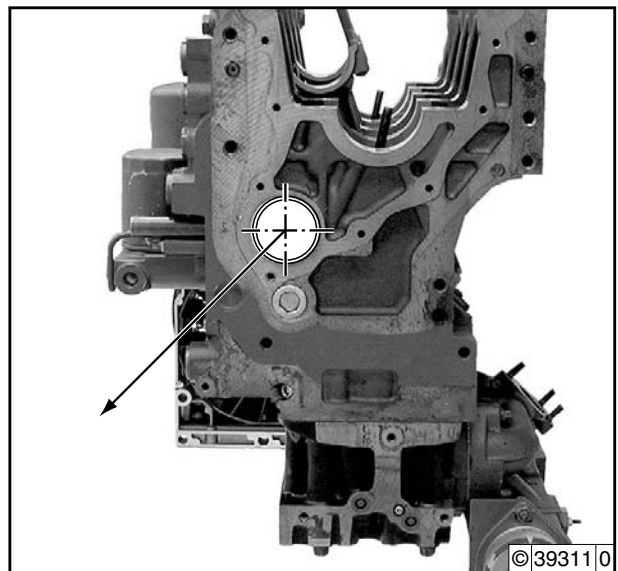


Install camshaft bearing



Note

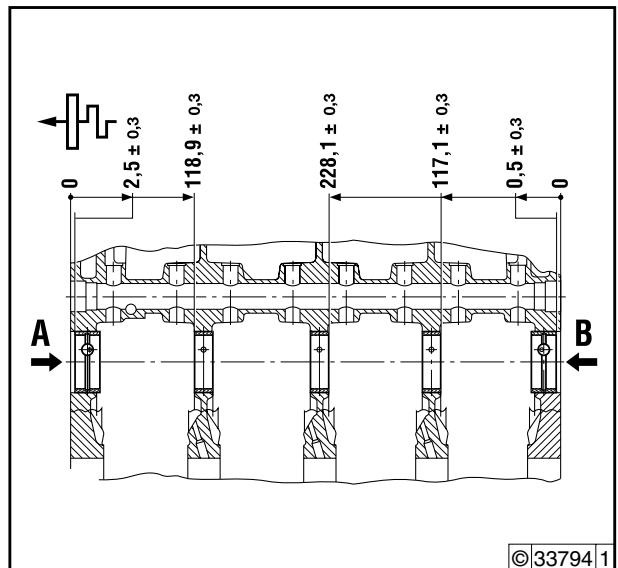
Schematic for installation direction of the joint in the camshaft bearing.



Note

Schematic for the installation depth of the camshaft bearing.

Number of cylinders	A = flywheel side	B = opposite side to flywheel
2-cylinder	2.5 ± 0.3 mm	0.5 ± 0.3 mm 117.1 ± 0.3 mm
3-cylinder	2.5 ± 0.3 mm 118.9 ± 0.3 mm	0.5 ± 0.3 mm 117.1 ± 0.3 mm
4-cylinder	2.5 ± 0.3 mm 118.9 ± 0.3 mm	0.5 ± 0.3 mm 117.1 ± 0.3 mm 228.1 ± 0.3 mm



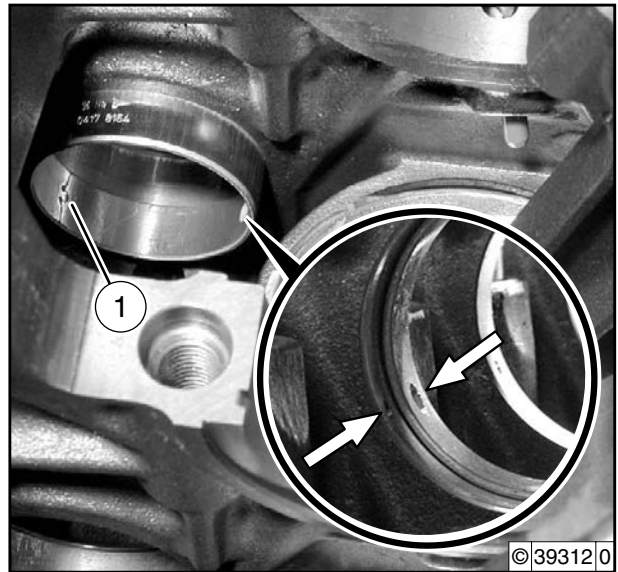
Install inner camshaft bearing

- Mount inner camshaft bearing.



Note

- Note position of joint (1), see schematic diagram.
- Check that the oil bores (arrows) in the camshaft bearing and the crankcase match up.



6

- Insert extraction bush (1) in the inner camshaft bearing.
- Insert spindle and fit washer and nut.



Note

- Do not change the installation position of the camshaft bearing.
- Counterbearing centered to bearing bore.

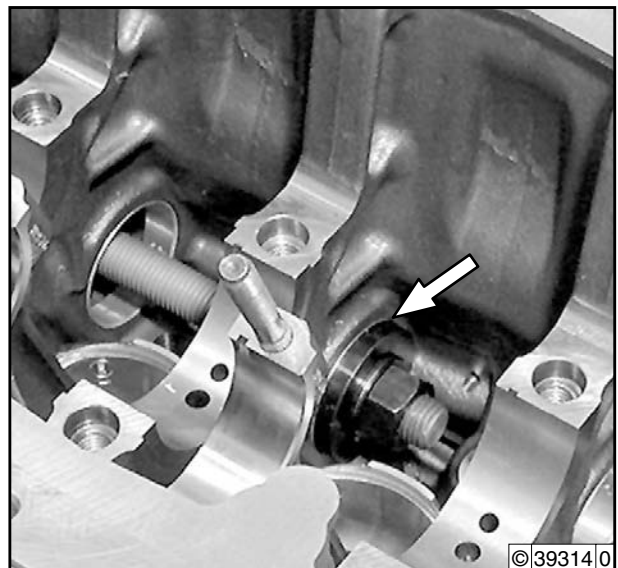


- Pull in camshaft bearing until the extraction socket is almost flush with the crankcase (arrow).
- Loosen assembly tool.
- Check that the lube oil bores match up.



Note

- If the lube oil bores do not match up, the camshaft bearing must be mounted again.



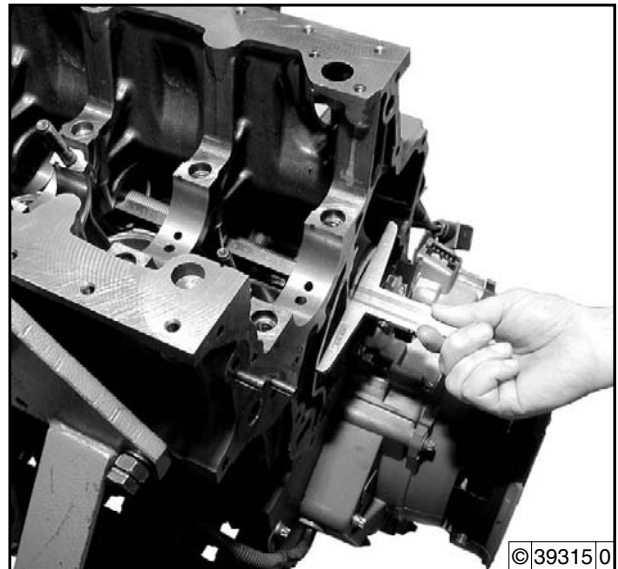
- Measure the installation depth of the camshaft bearing with the depth measuring appliance from the crankcase joint to the camshaft bearing.



Note

- Correct the installation depth of the camshaft bearing if necessary.
- Installation depth, see schematic diagram.

- Remove the assembly tool.



©39315/0

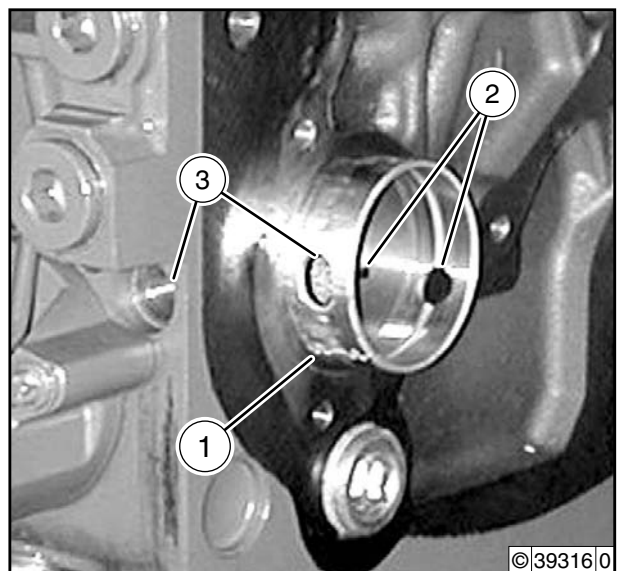
Install outer camshaft bearing

- Mount outer camshaft bearing.



Note

- Note position of joint (1), see schematic diagram.
- Check that the oil bores (2) in the camshaft bearing and the crankcase match up.
- In the camshaft bearing on the flywheel side, the bores (3) for the setting bolts must match up with the camshaft lock.



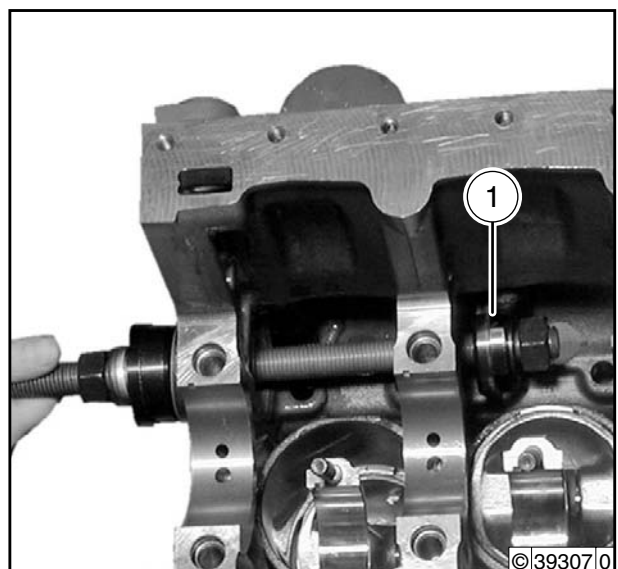
©39316/0

- Insert counterbearing (1) in inner camshaft bearing.
- Insert spindle and fit washer and nut.
- Insert extraction bus in outer camshaft bearing.



Note

- Do not change the installation position of the camshaft bearing.
- Make sure that the counterbearing is evenly in contact with the crankcase.



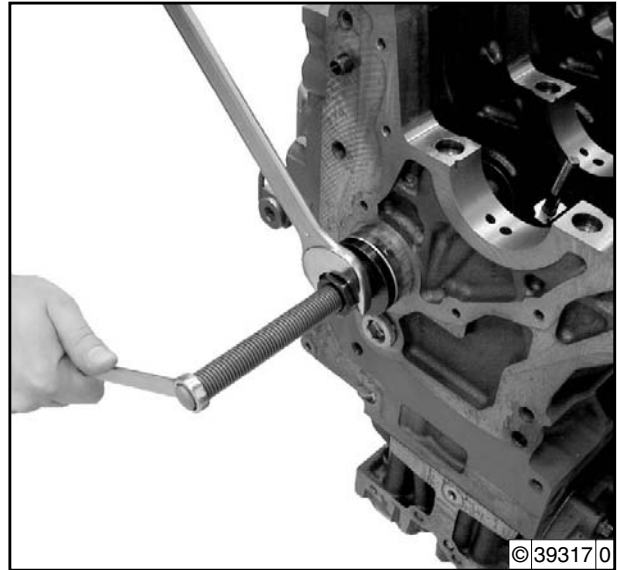
©39307/0

- Pull in the camshaft bearing.
- Loosen assembly tool.
- Check that the lube oil bores match up.



Note

If the lube oil bores do not match up, the camshaft bearing must be mounted again.



6

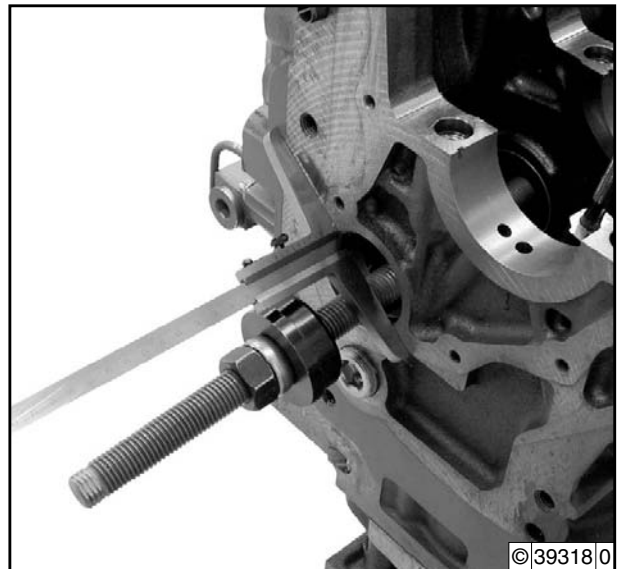
- Measure the installation depth of the camshaft bearing with the depth measuring appliance from the crankcase joint to the camshaft bearing.



Note

- Correct the installation depth of the camshaft bearing if necessary.
- Installation depth, see schematic diagram.

- Remove the assembly tool.

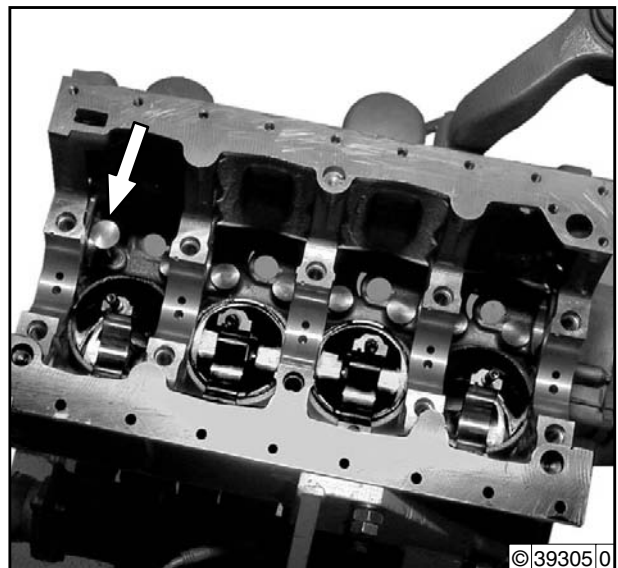


- Oil tappets lightly with engine oil and insert (arrow).



Note

Note assignment.



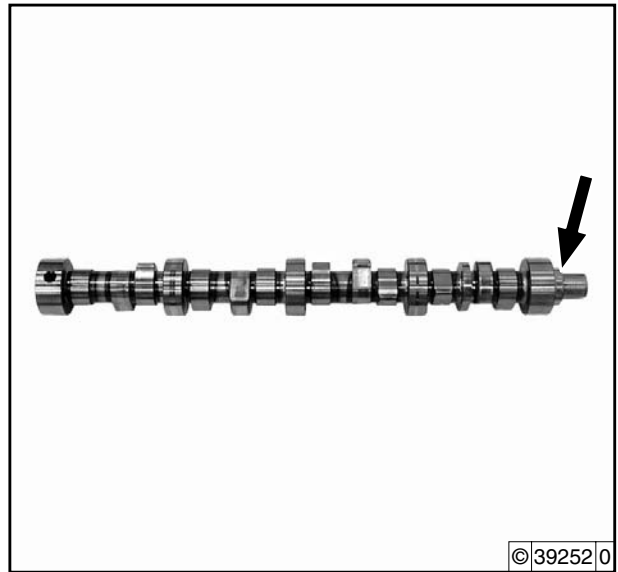
Install camshaft

- Oil camshaft bearing and camshaft journal lightly.



Note

The connecting surface (arrow) with the muff of the measuring mechanism must be clean and oil free.

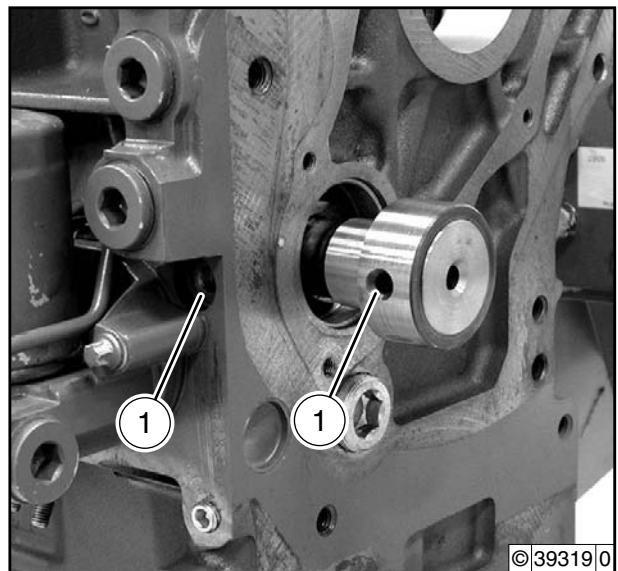


- Insert camshaft carefully.



Note

Check that the bores (1) in the camshaft and the crankcase match up.

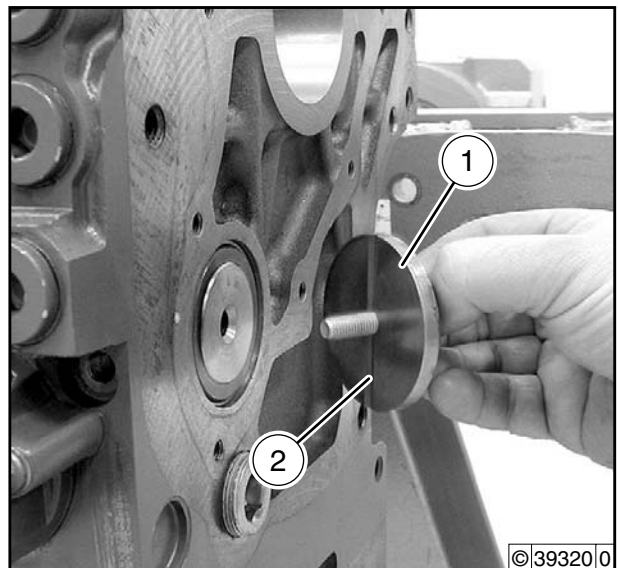


- Fit startup disc (1) and tighten screw.



Note

The lubricating groove (2) of the startup disc must face the crankcase.



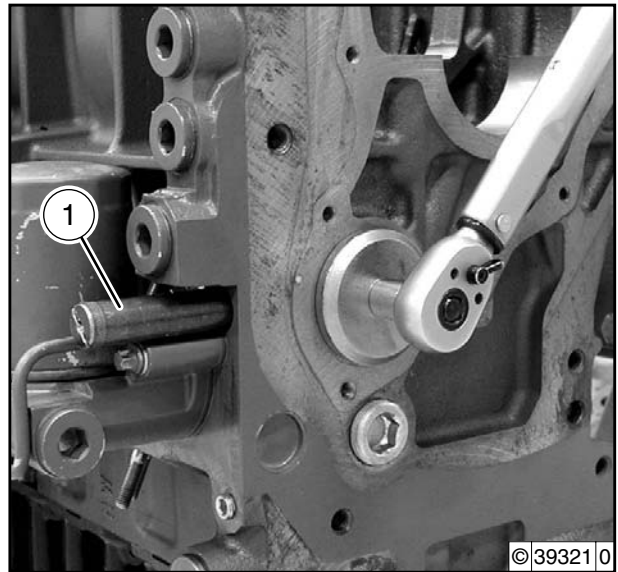
Crankcase

W 03-11-01

2011

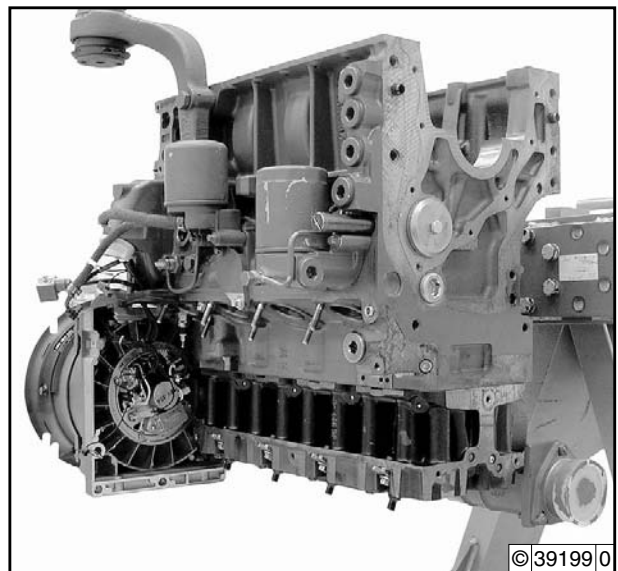


- Turn in the setting bolt (1), for locking the camshaft, to the stop in the crankcase.
- Tighten screw.



6

- Install crankshaft
→ Job card **W 02-04-01**.
- Install toggle lever and toggle lever blocks
→ Job card **W 01-02-02**.
- Install fuel pump
→ Job card **W 07-11-01**.
- Install injection pumps.
→ Job card **W 07-04-01**(Motorpal)
→ Job card **W 07-04-01**(Bosch)



Check engine control times



Tools

- Commercial tools

- Special tools

100 700 - Setting bolt



References

- W 04-04-12 (old version)

- W 04-04-12 (new version)



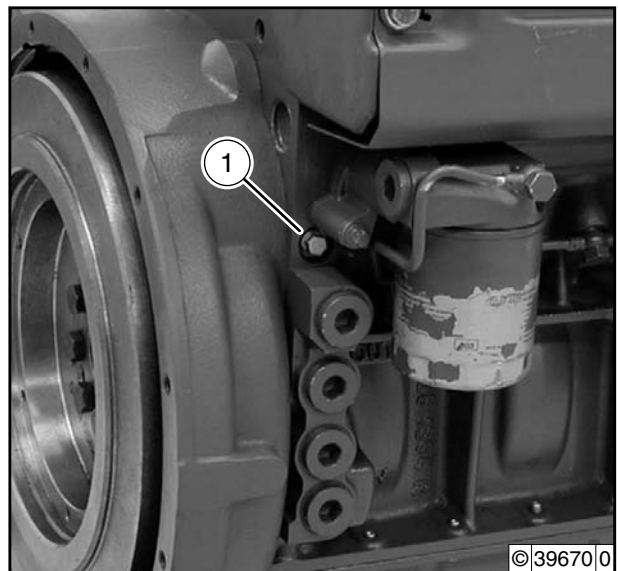
Caution!

It is not permissible to retighten a toothed belt which has already been in operation and to set the engine control times.

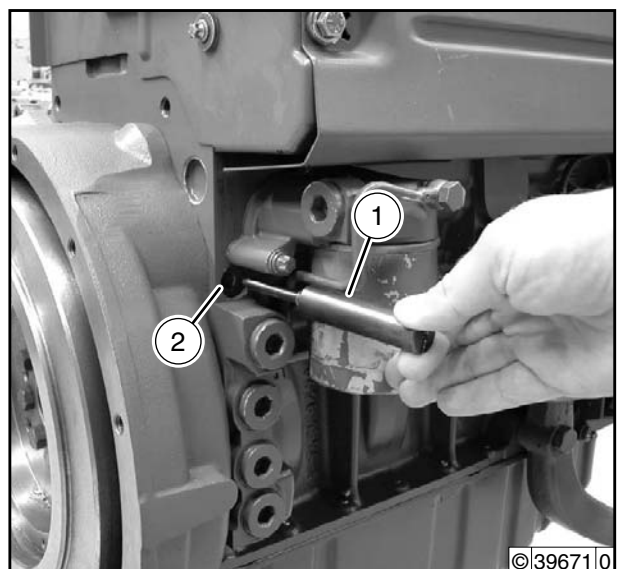
Check engine control times

Lock camshaft.

- Unscrew cap (1) and remove sealing ring.



- Insert setting bolt (1) in the bore (2) to lock the camshaft.

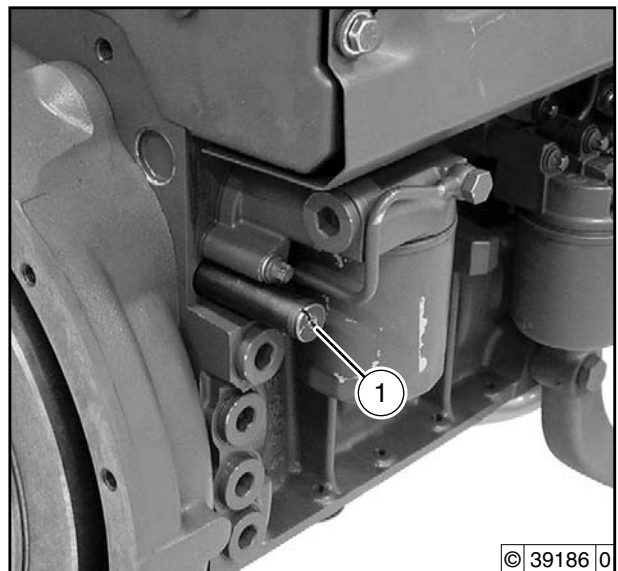


- Hold the setting bolt lightly and turn the crankshaft in the direction of rotation of the engine (clockwise) until the setting bolt engages the bore of the camshaft.

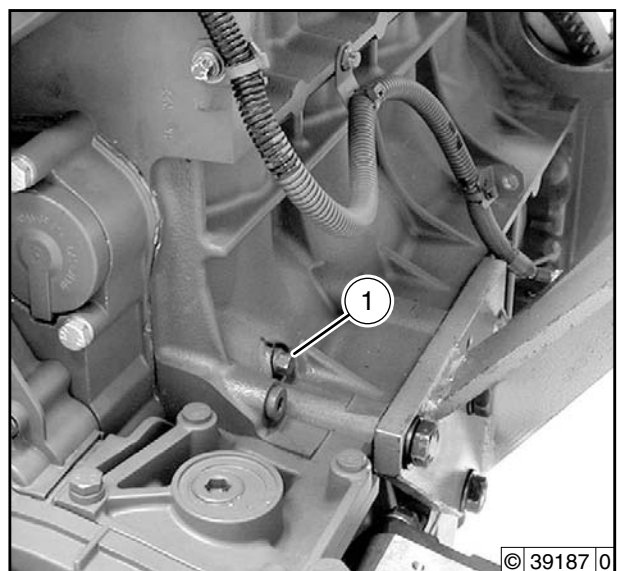


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- Screw setting bolts (1) into the crankcase.



- Unscrew cap (1) and remove sealing ring.

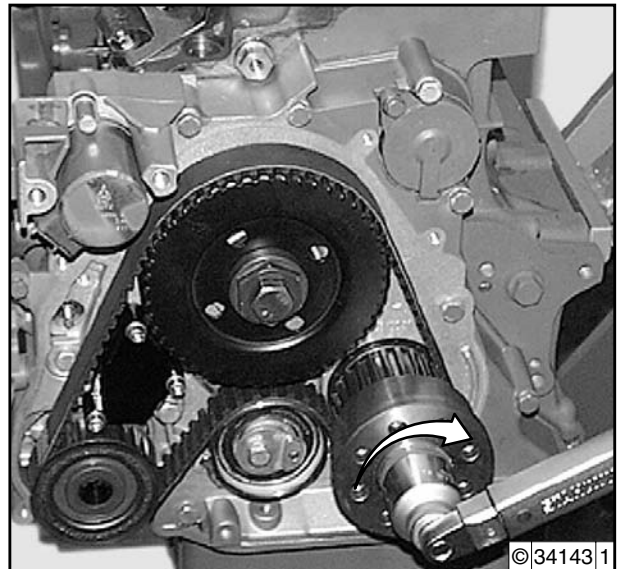


- Tighten center screw with the torque wrench in engine direction of rotation with **40 Nm**. Carefully relieve pressure on the torque wrench.



Note

Do not turn the crankshaft any more.



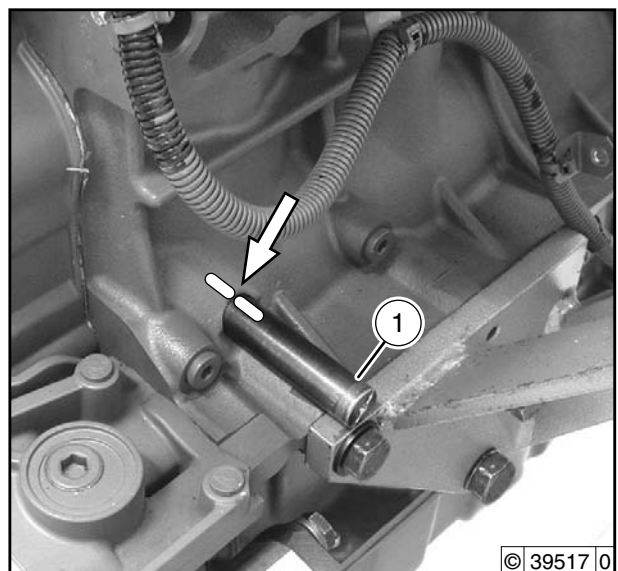
- Turn in the setting bolt (1) to the crankshaft lock until it is lightly touching the crankshaft.



Note

Do not turn the crankshaft when screwing in the setting bolt.

- Make help marks (arrow) on the crankcase and setting bolt.



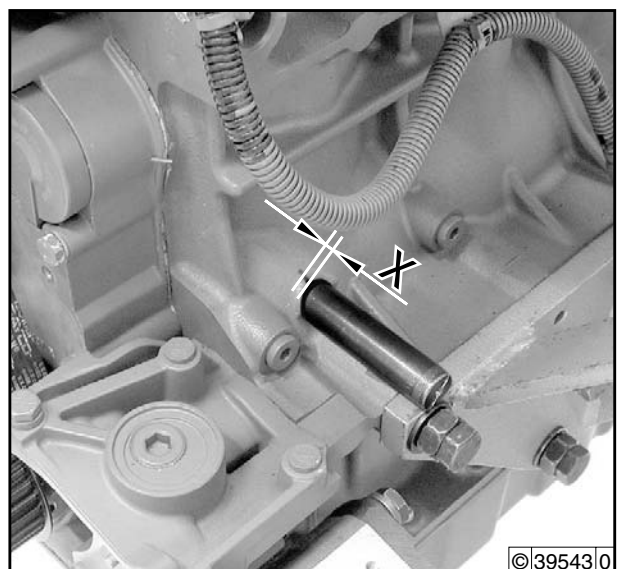
- The engine control times are set correctly when the setting bolt can be turned another **0.75 to 2.25** turns up to the stop in the crankcase.



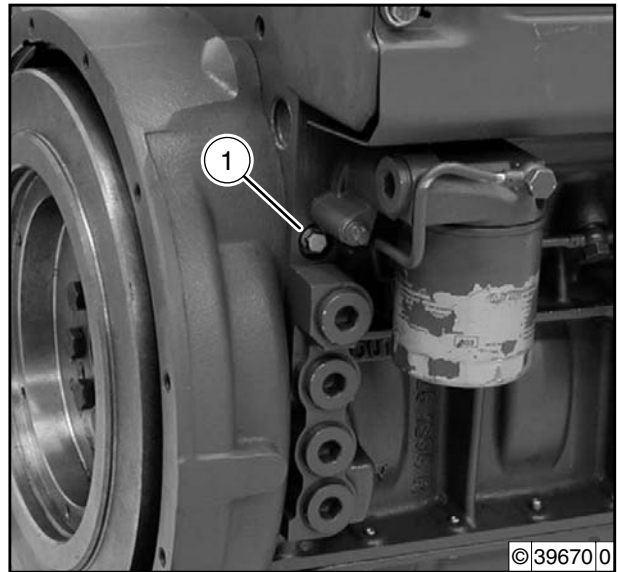
Note

If the screw-in depth "X" deviates from the specification, the toothed belt and the clamping roller must be changed.

- Renew toothed belt and clamping roller
 - ➔ Job card **W 04-04-12**(old version)
 - ➔ Job card **W 04-04-12**(new version)
- Unscrew the setting bolts for camshaft and crankshaft locking.

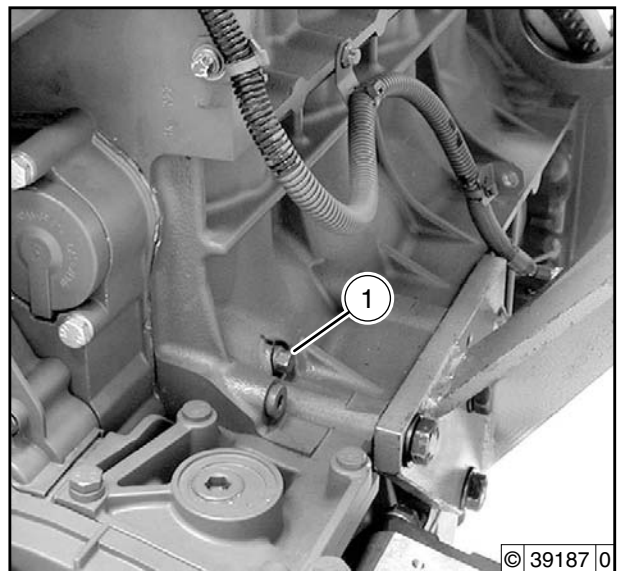


- Tighten locking screw (1) with new CU sealing ring.



6

- Tighten locking screw (1) with new CU sealing ring.



Renew toothed belt and clamping roller (old version of the clamping roller)



Tools

- Commercial tools

- 8189 - Torx tool kit
- 9120 - Special bit, 70 mm long
- 9122 - Special bit, 25 mm long

- Special tools

- 100 700 - Setting bolt
- 144 130 - Holder



References

- W 12-02-01 (FL, BFL engines)
- W 12-02-01 (FM, BFM engines)
- W 12-08-03



Caution!

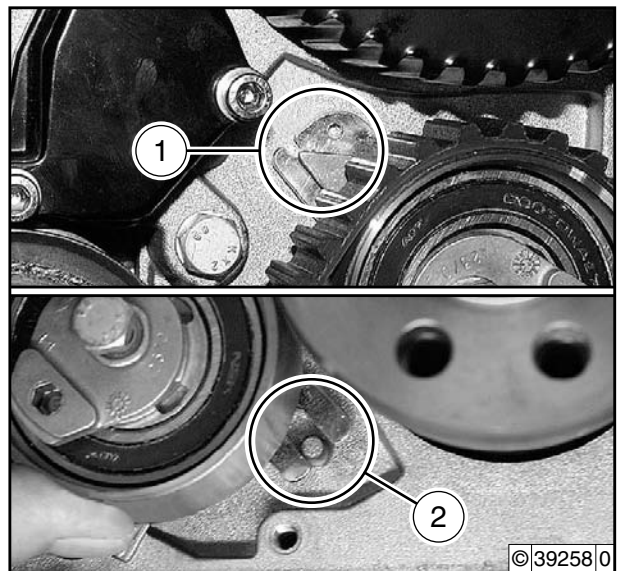
The toothed belt and the clamping roller must be renewed after every disassembly regardless of their time in operation.



Note

Distinguishing features of the old version of the clamping roller:

- Pointer and notch (1) serve to set and check the toothed belt tension.
- The clamping roller is locked by a guide fork (2) on the front cover.

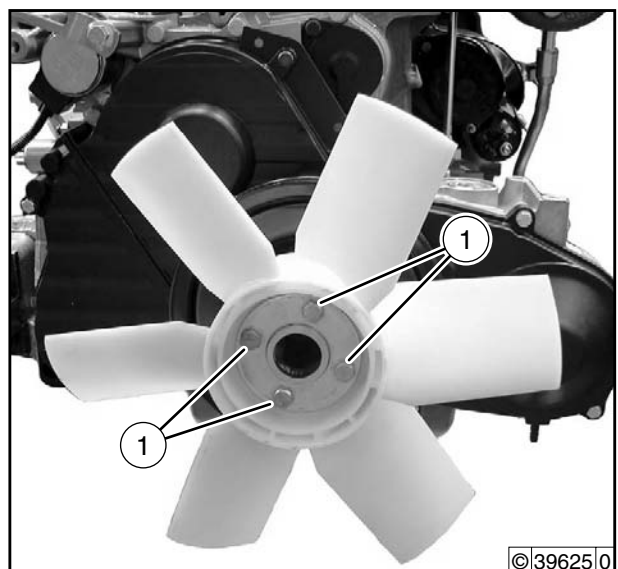


Renew toothed belt and clamping roller

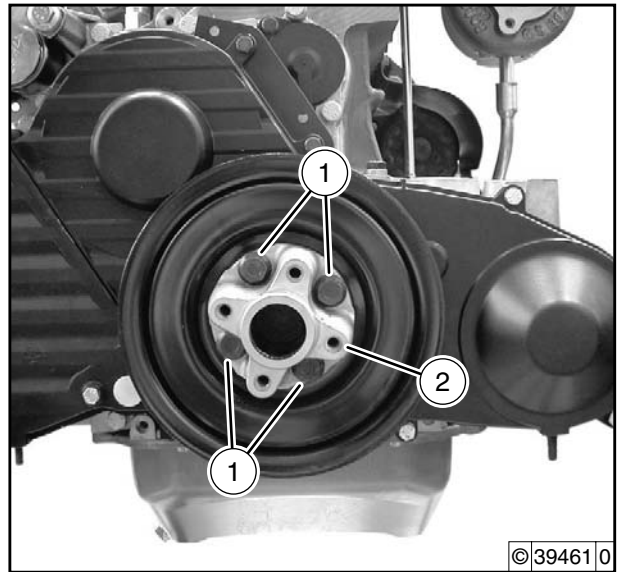
- Remove V-belt
 - ➔ Job card W 12-02-01 (FL, BFL engines)
 - ➔ Job card W 12-02-01 (FM, BFM engines)

In FM, BFM engines

- If available, unscrew screws (1) and remove fan.



- Unscrew screws (1), flange hub (2) and remove V-belt pulley.



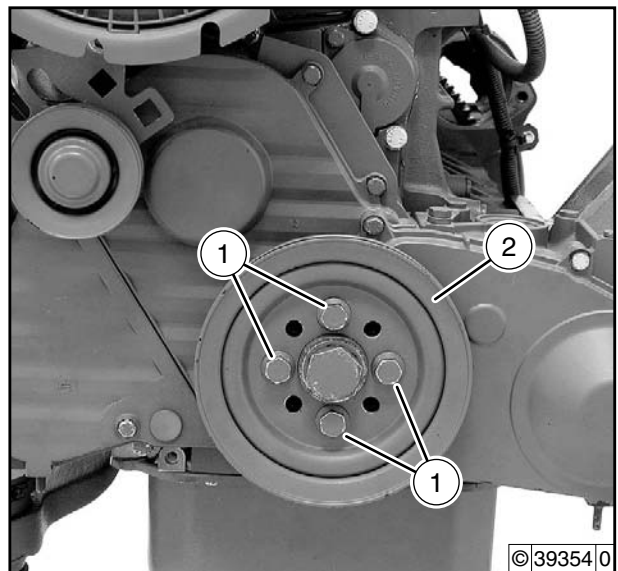
6

- Unscrew screws (1) and remove V-belt pulley (2).

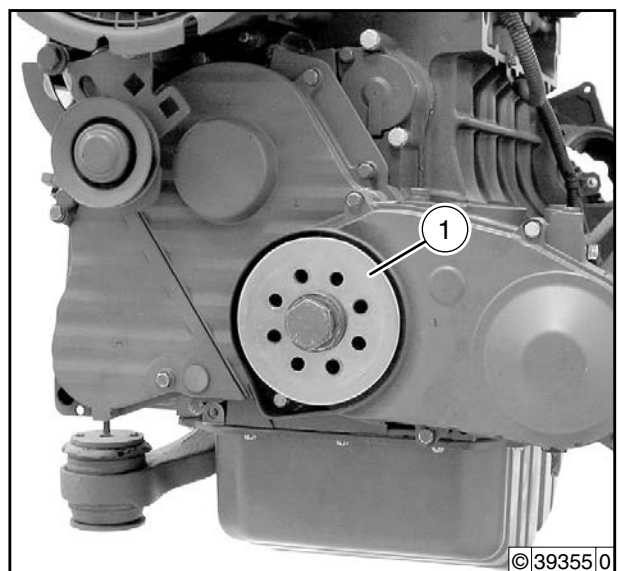


Note

Hold at the center screw.

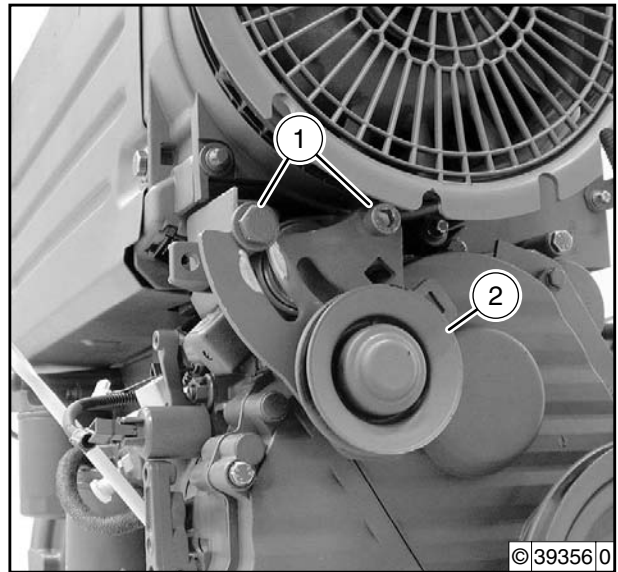


- Remove centrifugal disc (1).
- Remove toothed belt and clamping roller of the hydraulic pump
→ Job card W 12-08-03.



In FL, BFL engines

- Unscrew screws (1) and remove V-belt clamping roller (2).



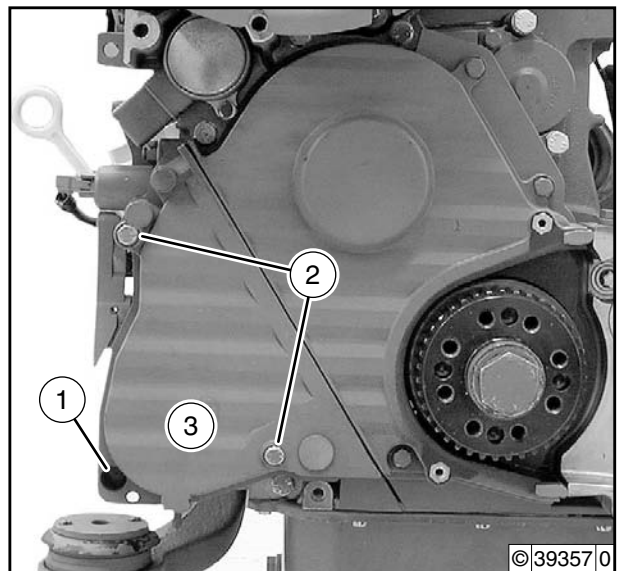
- Unscrew locking screw (1).



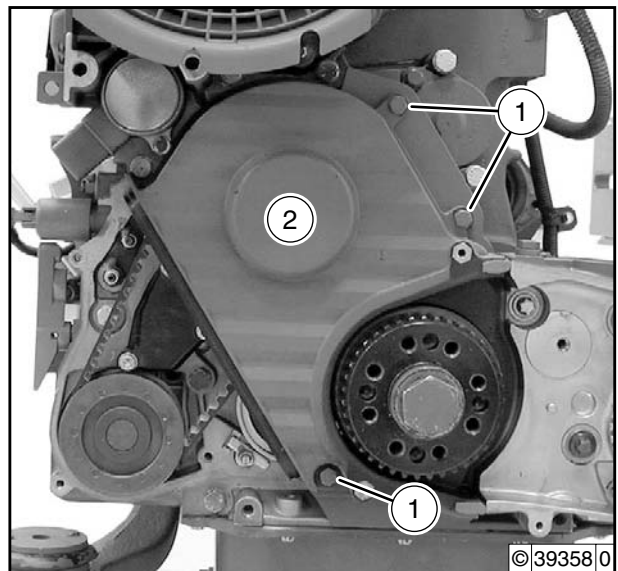
Note

Use a special bit, 70 mm long.

- Unscrew screws (2) and remove protective cover (1).

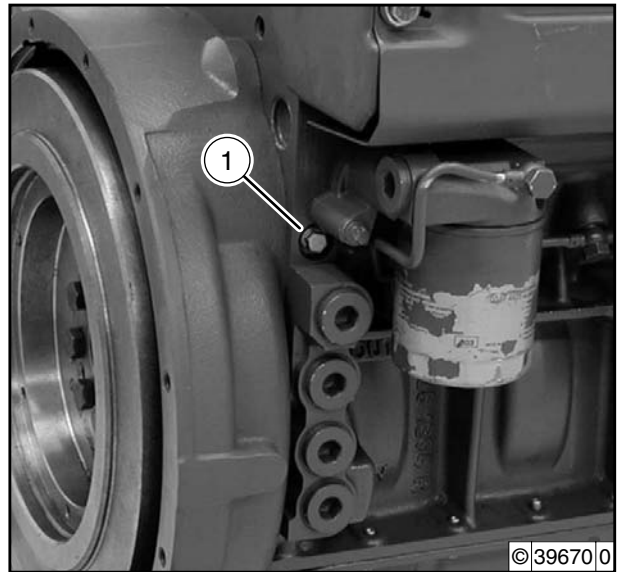


- Unscrew screws (1) and remove protective cover (2).



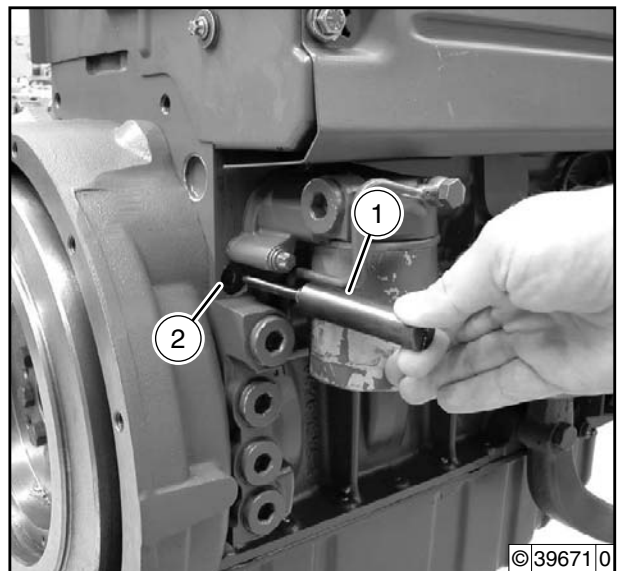
Lock camshaft

- Unscrew cap (1) and remove sealing ring.

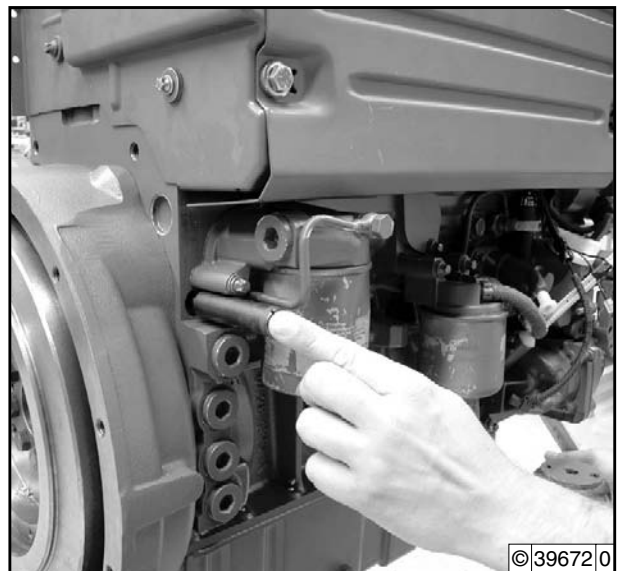


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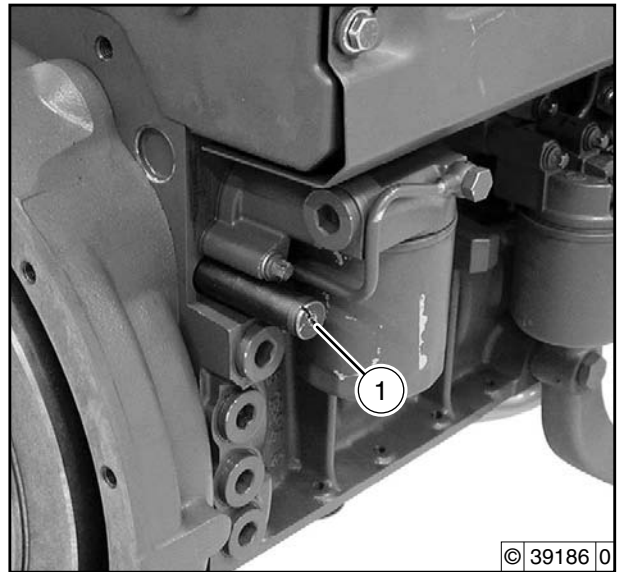
- Insert setting bolt (1) in the bore (2) to lock the camshaft.



- Hold the setting bolt lightly and turn the crankshaft in the direction of rotation of the engine (clockwise) until the setting bolt engages the bore of the camshaft.

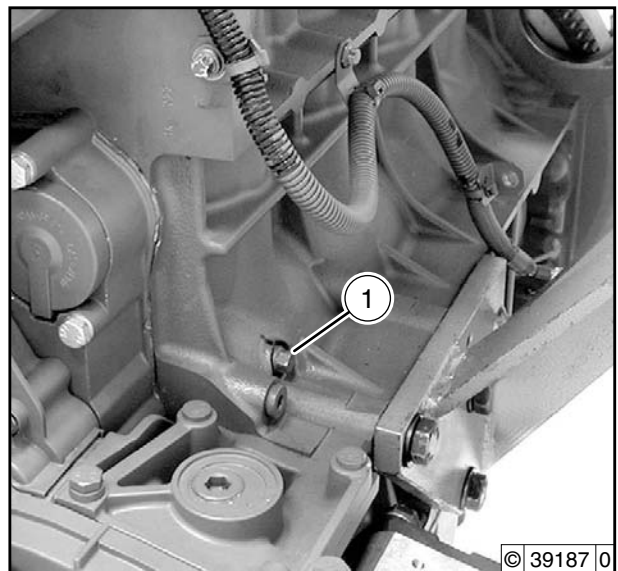


- Screw setting bolt (1) into the crankcase to the stop.

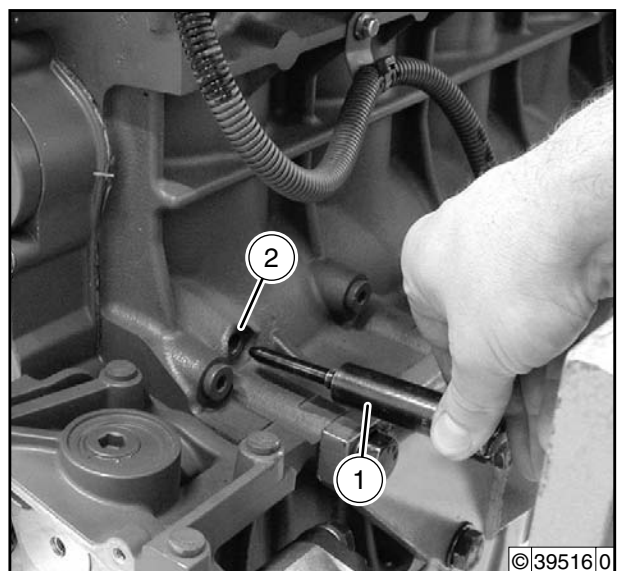


Lock the crankshaft

- Unscrew cap (1) and remove sealing ring.



- Insert setting bolt (1) in the bore (2) to lock the crankshaft.

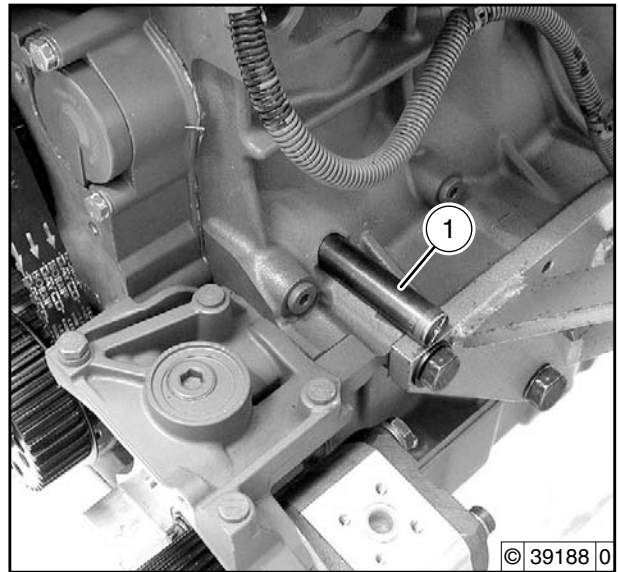


- Screw setting bolts (1) into the crankcase.



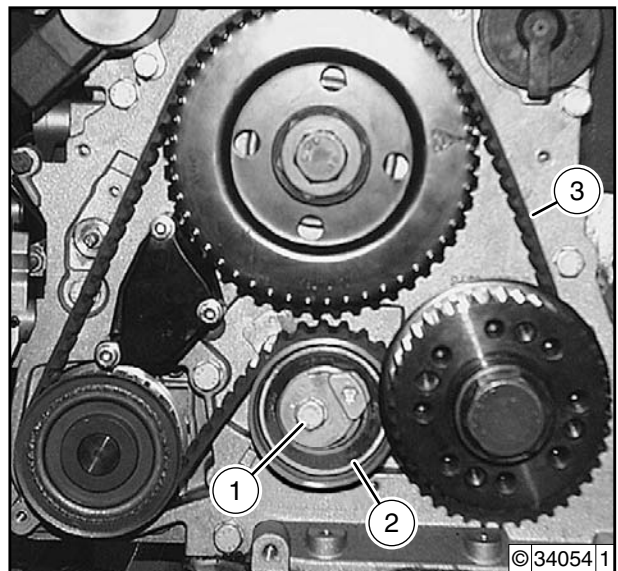
Note

The cylinder at the front cover is now in the ignition UT.



6

- Unscrew screw (1) and remove clamping roller (2).
- Remove toothed belt (3).



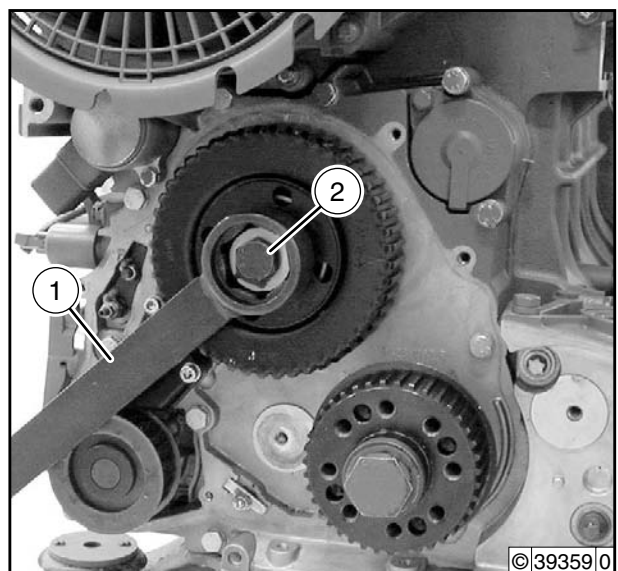
Loosen camshaft toothed belt wheel

- Mount holder (1) and loosen center screw (2).



Note

Do not turn the camshaft.



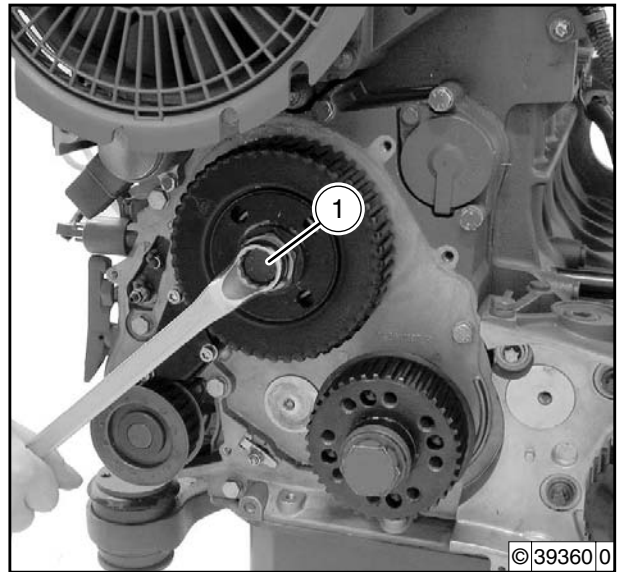
Install toothed belt and clamping roller

- Tighten the center screw (1) hand tight.

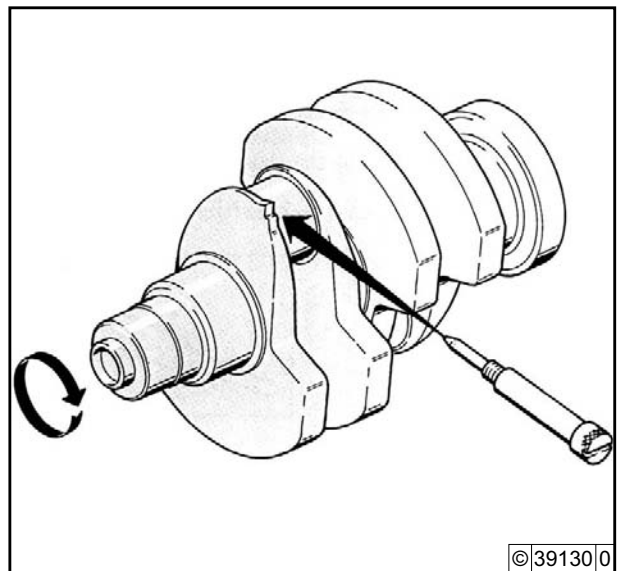


Note

- To guarantee the length compensation of the toothed belt, the camshaft toothed belt wheel must still be turnable.
- Use new center screw.



- Turn the crankshaft carefully in the direction of rotation of the engine (clockwise) until it touches the setting bolts.

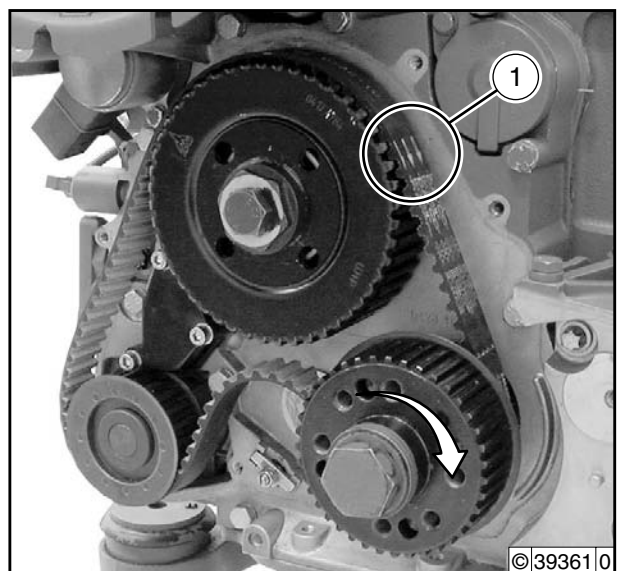


- Mount new toothed belt.



Note

Note the running direction of the toothed belt, the arrows (1) must point in the direction of rotation of the engine (arrow).



- Insert new clamping roller with the guide fork (1) of the base plate in the guide pin (2) of the front cover.



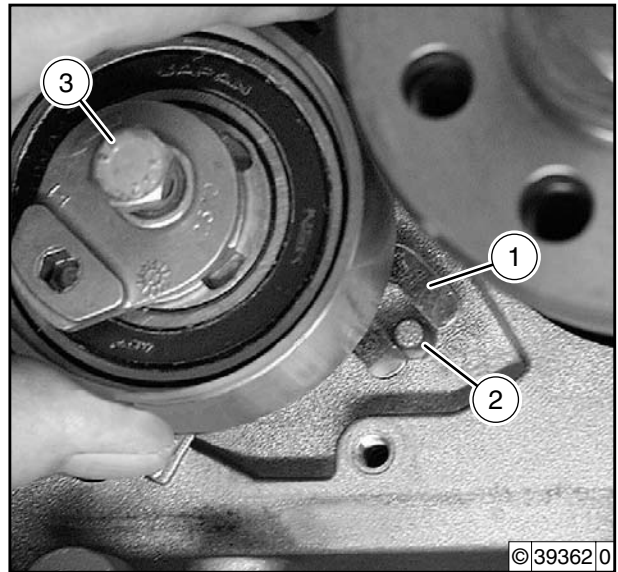
Note

When installing a hydraulic pump, watch out for different clamping rollers.

Width of clamping roller for:

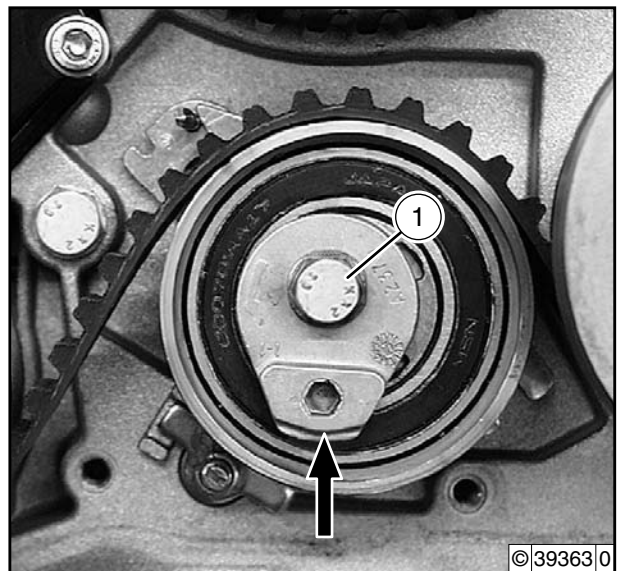
- Camshaft drive 30 mm
- Hydraulic pump drive 35 mm

- Screw in screw (3).

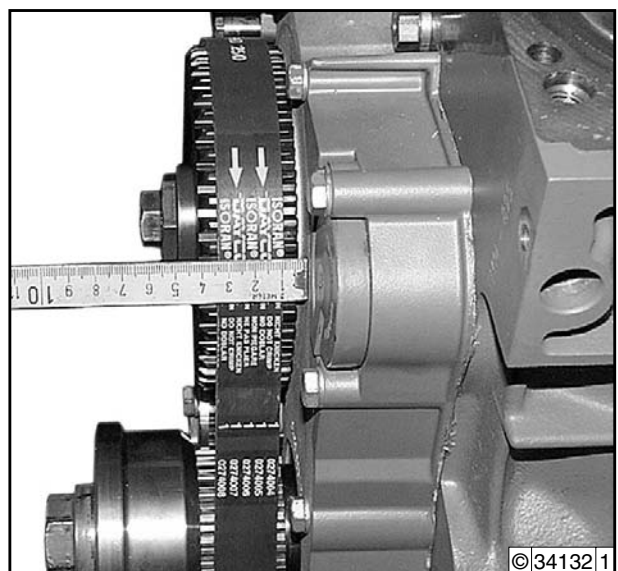


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- Position setting eccentric (arrow) in 6:00 h position.
- Press the clamping roller against the toothed belt and pre-tighten the screw (1).



- Align the toothed belt so that there is an even distance between the cover and toothed belt of **8 to 9 mm**.

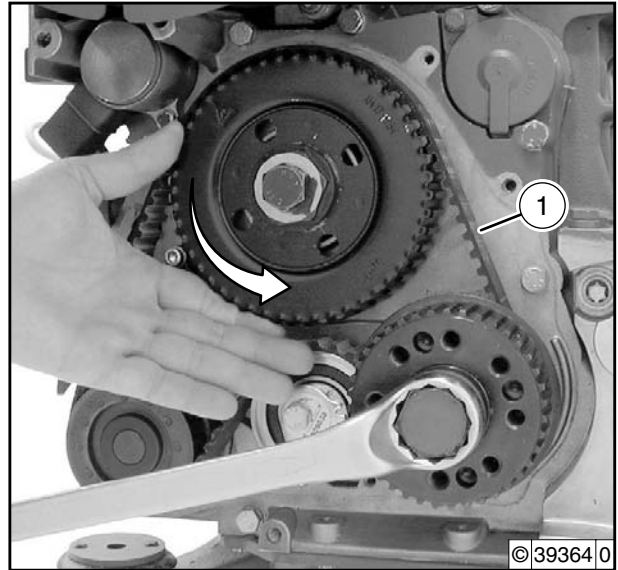


- Tighten the draw side (1) of the toothed belt by turning the camshaft toothed belt wheel in the direction of the arrow (counterclockwise).

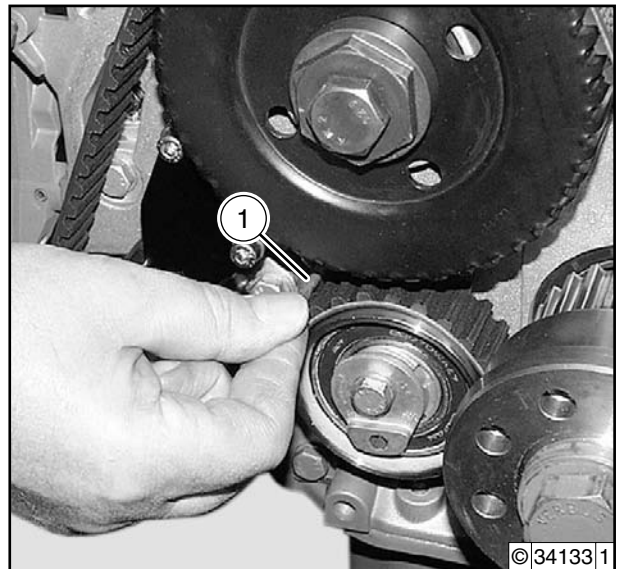


Note

- Turn the camshaft toothed wheel by hand, not by the center screw.
- The crankshaft must be held against the stop whilst setting the toothed belt.



- Remove locking pin (1).



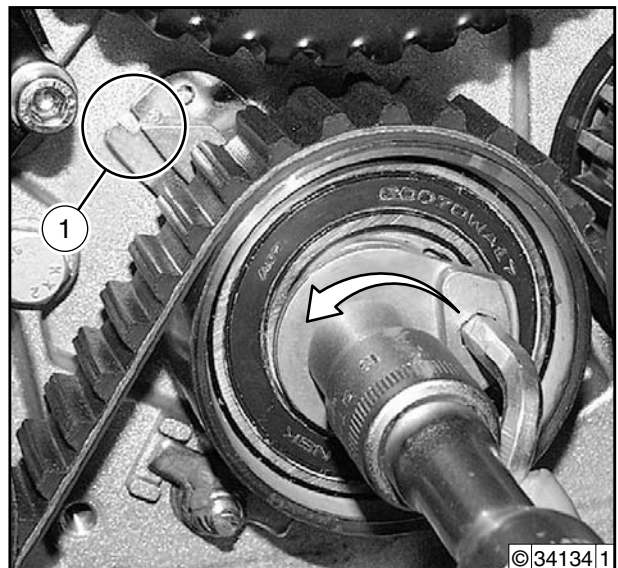
- Turn the setting eccentric in the direction of the arrow (counterclockwise) until the pointer of the clamping roller is in line with the notch (1).



Note

- Turn the setting eccentric at the hexagon socket.

- Tighten screw.



Fix the camshaft toothed belt wheel

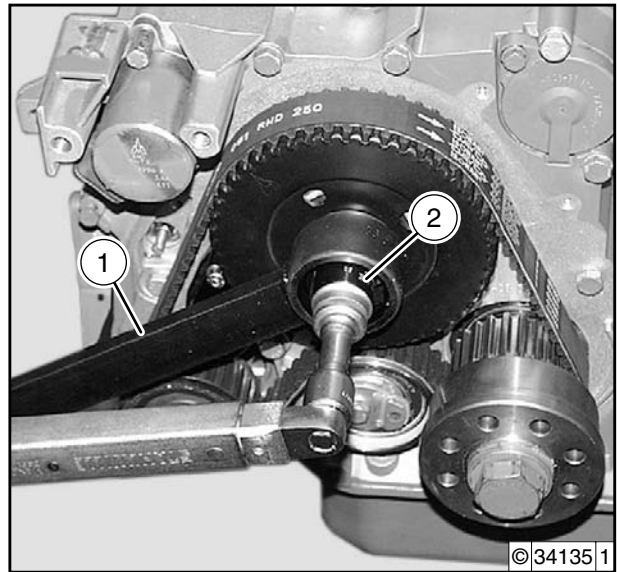
- Mount holder (1) and pre-tighten center screw (2).
- Tighten center screw (2).

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Note

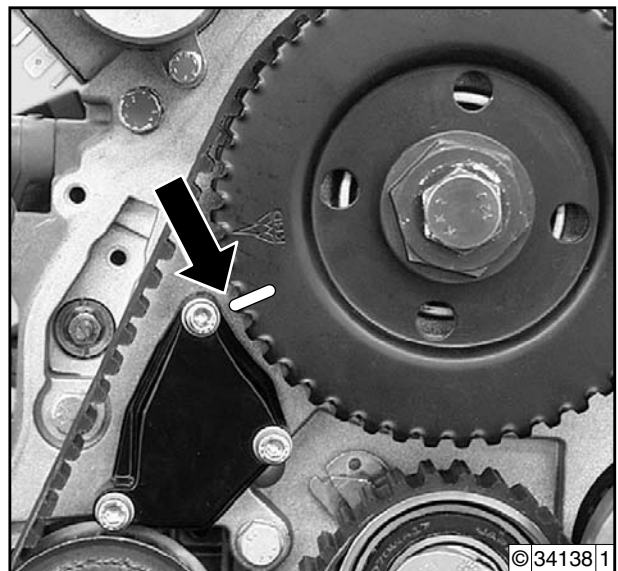
- Hold the toothed belt wheel.
- Hold the crankshaft against the stop.



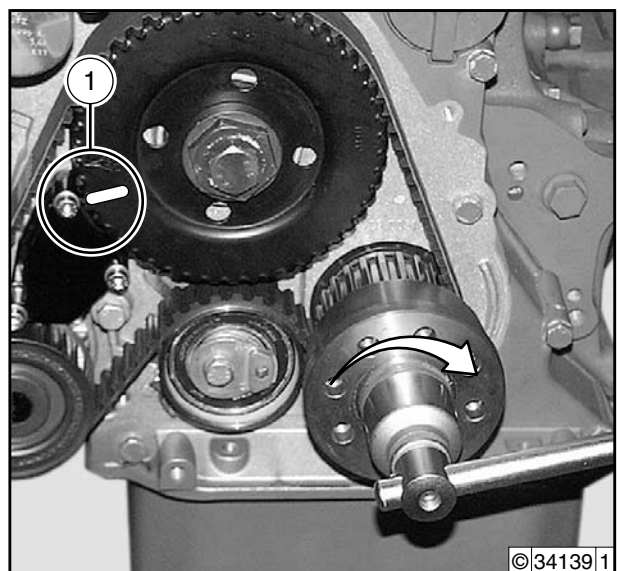
6

Check the toothed belt tension

- Unscrew the setting bolts for camshaft and crankshaft locking.
- Make help marks on the camshaft toothed belt wheel and the screw opposite (arrow).



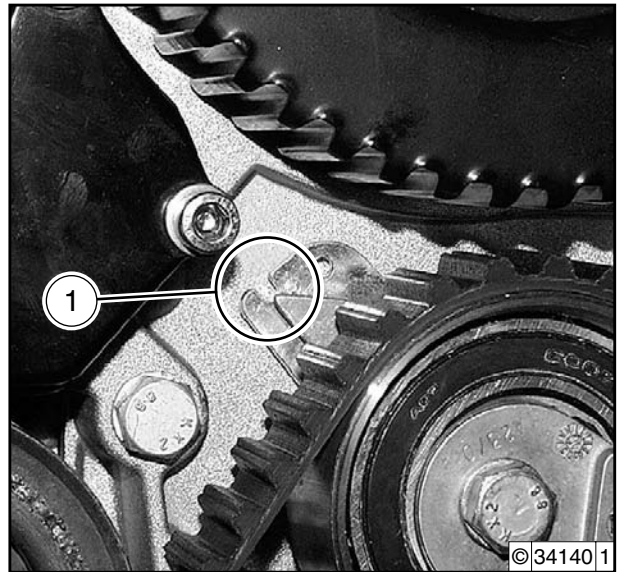
- Turn the crankshaft 2 turns in the direction of rotation of the engine (clockwise) until the help marks (1) are in line.





Note

- The pointer of the clamping roller must be in line with the notch (1).
- If the marks are not in line, the toothed belt tension must be corrected.

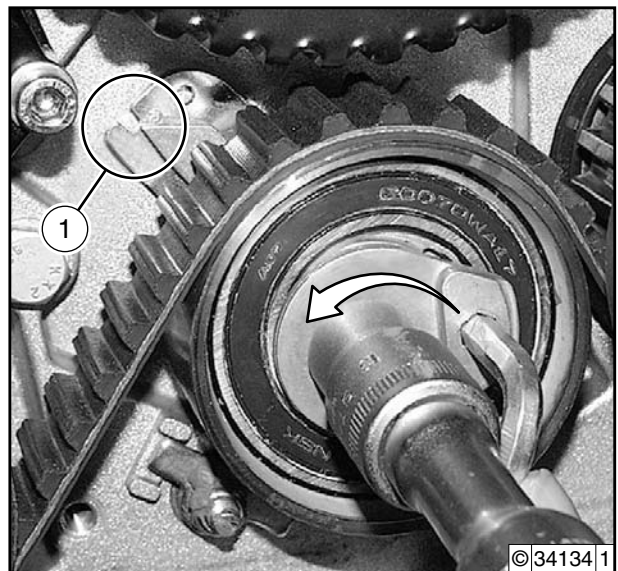


Correct the toothed belt tension

- Loosen screw and re-tighten.



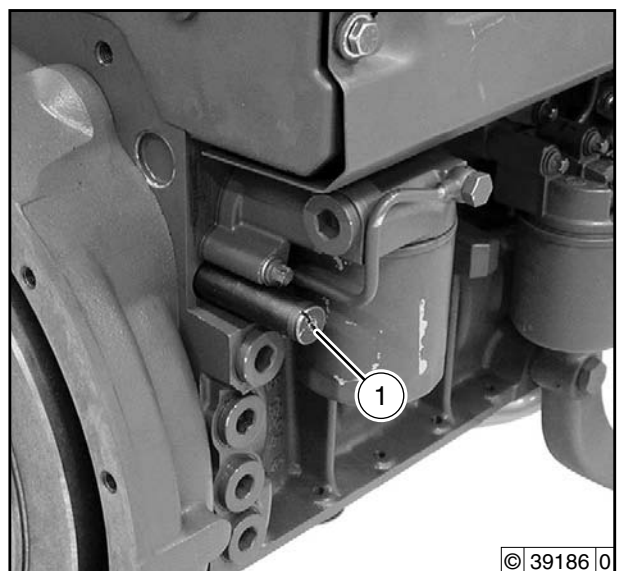
- Turn the setting eccentric in the direction of the arrow (counterclockwise) until the pointer of the clamping roller is in line with the notch (1).
- Tighten screw.



Check engine control times

Lock camshaft.

- Insert setting bolt (1) for the camshaft lock in the bore and hold lightly.
- Turn the crankshaft in the direction of rotation of the engine (clockwise) until the setting bolt engages the bore of the camshaft.
- Turn the setting bolt into the crankcase to the stop.

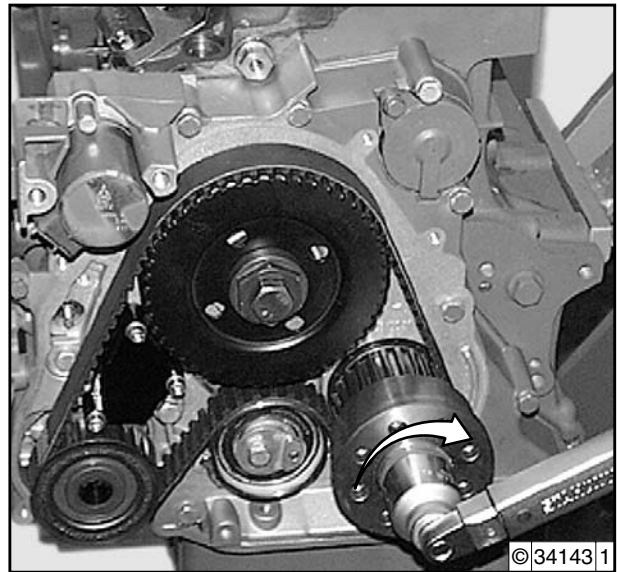


- Tighten center screw with the torque wrench in engine direction of rotation with **40 Nm**. Carefully relieve pressure on the torque wrench.



Note

Do not turn the crankshaft any more.



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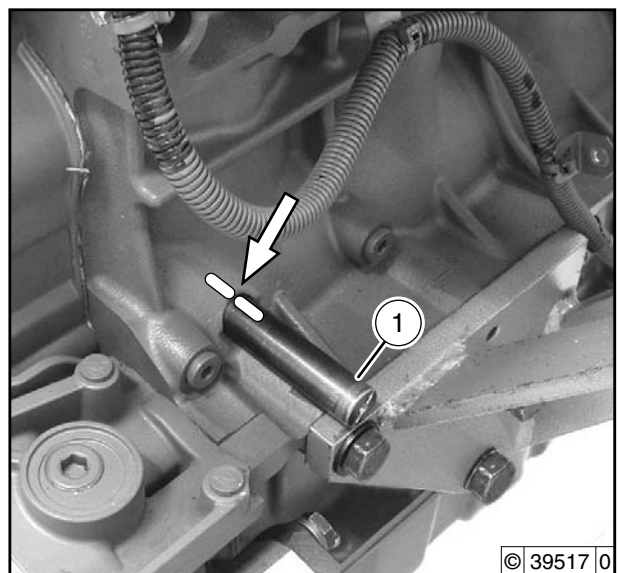
- Turn in the setting bolt (1) for the crankshaft lock until it is lightly touching the crankshaft.



Note

Do not turn the crankshaft when screwing in the setting bolt.

- Make help marks (arrow) on the crankcase and setting bolt.



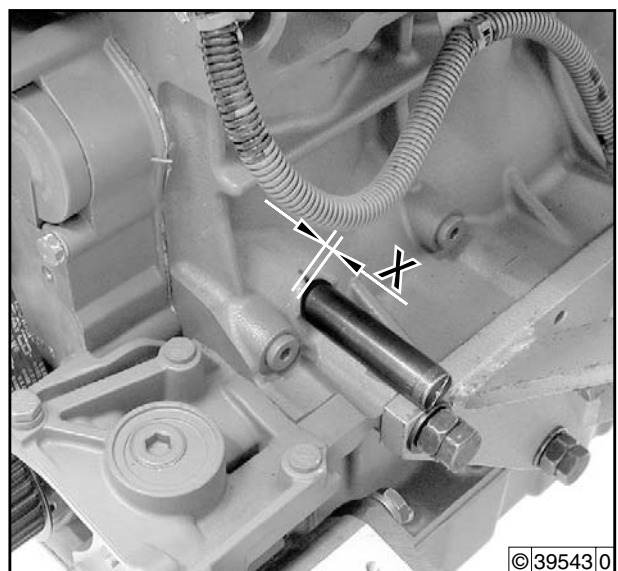
- The engine control times are set correctly when the setting bolt can be turned another **0.75 to 2.25** turns up to the stop in the crankcase.



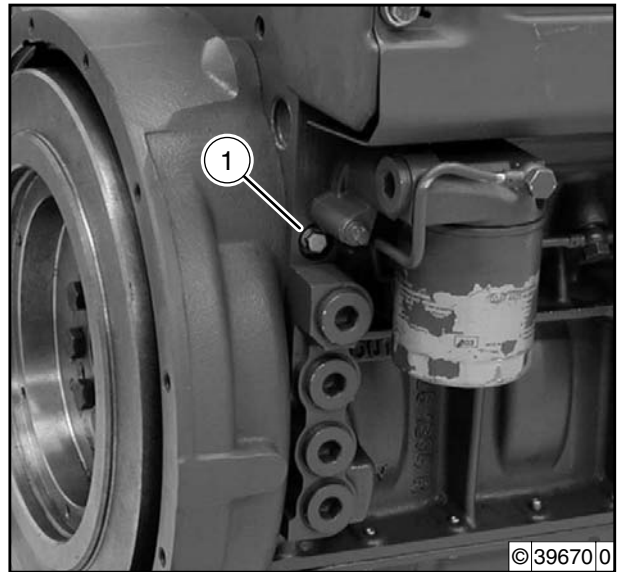
Note

If the screw-in depth "X" deviates from the specification, the toothed belt and the clamping roller must be changed.

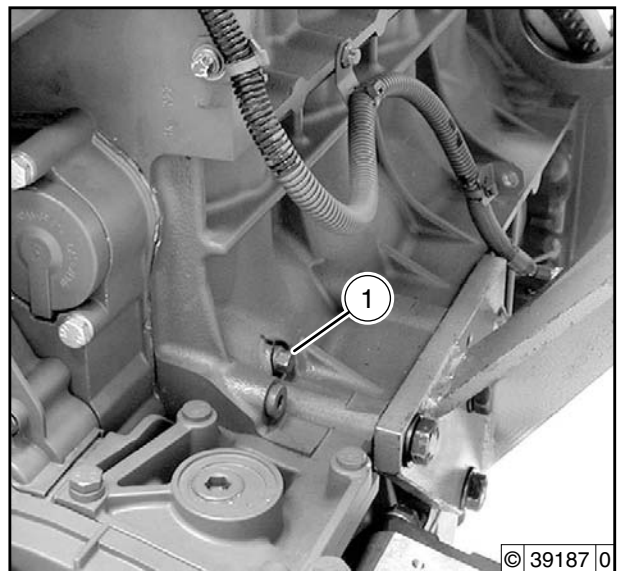
- Unscrew the setting bolts for camshaft and crankshaft locking.



- Tighten locking screw (1) with new CU sealing ring.



- Tighten locking screw (1) with new CU sealing ring.



- Inspect the protective covers visually, renew the sealing profile if necessary.

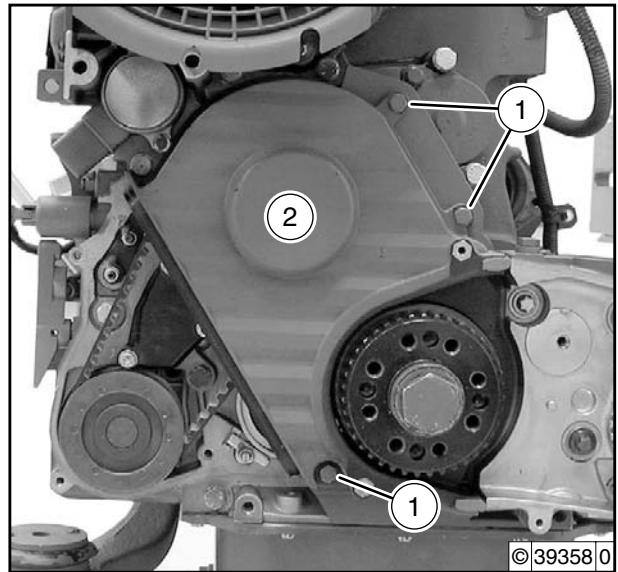


- Mount protective cover (2) and tighten screws (1).



Note

Pay attention to the correct fitting of the protective cover.



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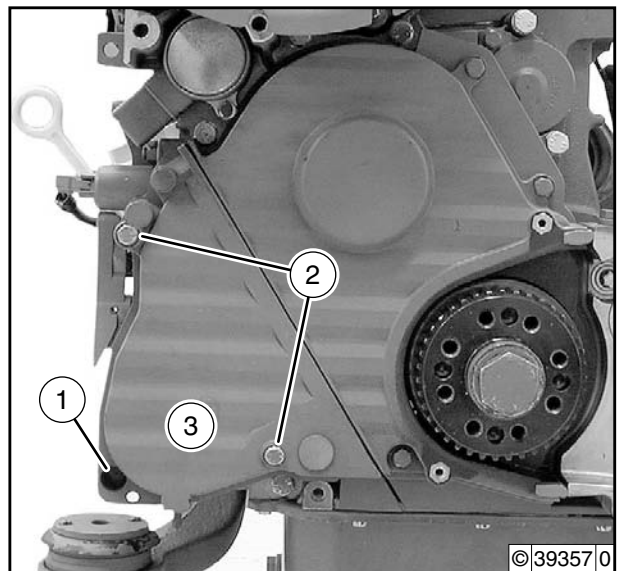
- Mount protective cover (3) and tighten screws (2)
- Screw in locking screw (1).



Note

Use a special bit, 70 mm long.

- Tighten screws.

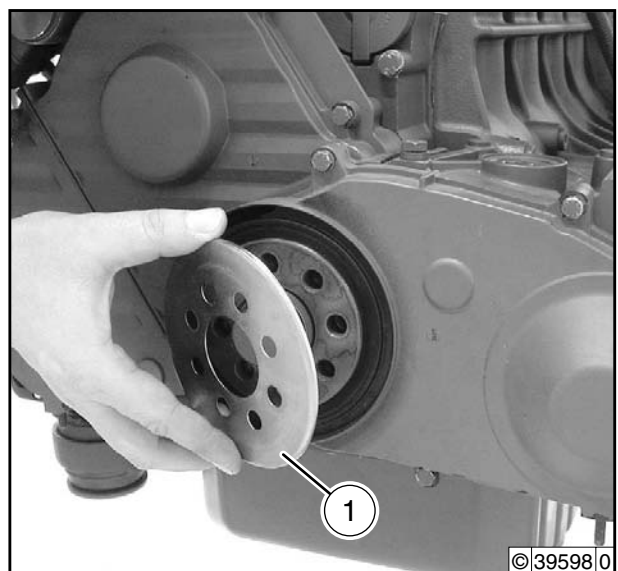


- Install toothed belt and clamping roller of the hydraulic pump
→ Job card W 12-08-03.
- Mount centrifugal disc (1).



Note

The hollow throat must face the adapter.

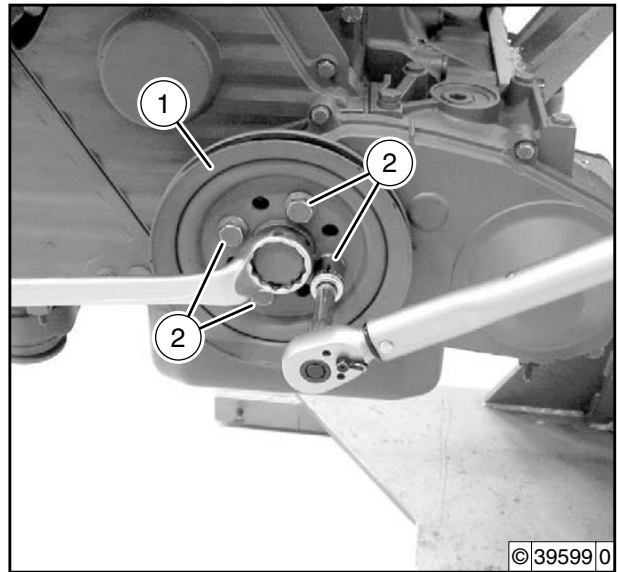


- Fit V-belt pulley (1) and tighten screws (2) alternately.



Note

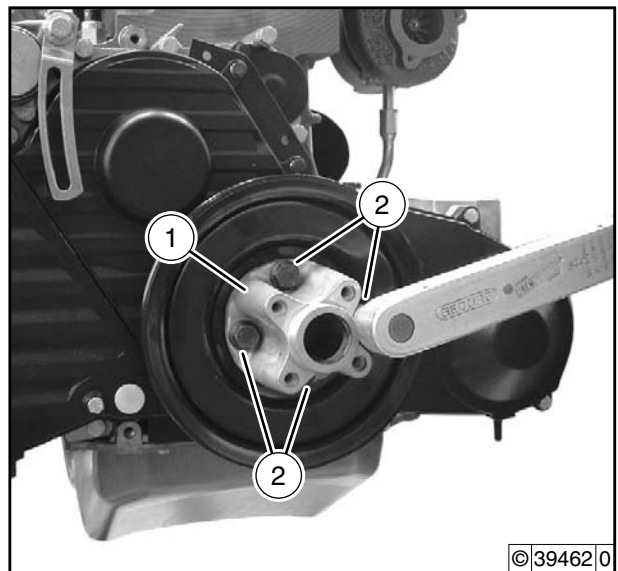
Hold at the center screw.



©39599 0

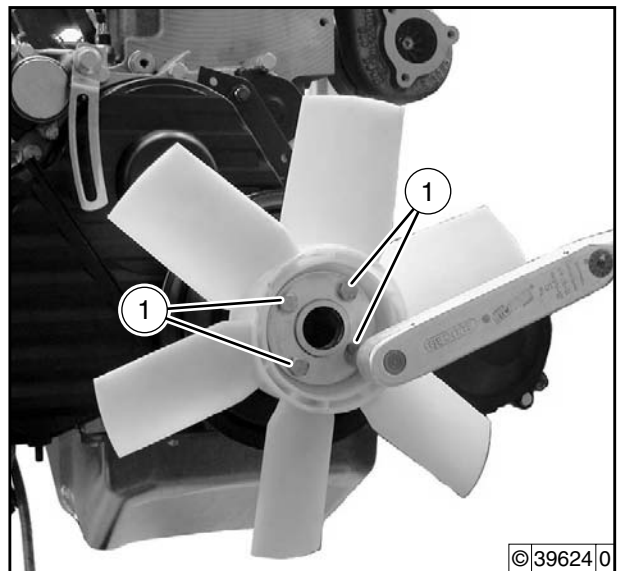
In FM, BFM engines

- If available, mount V-belt pulley and flange hub (1).
- Tighten (2) screws alternately.



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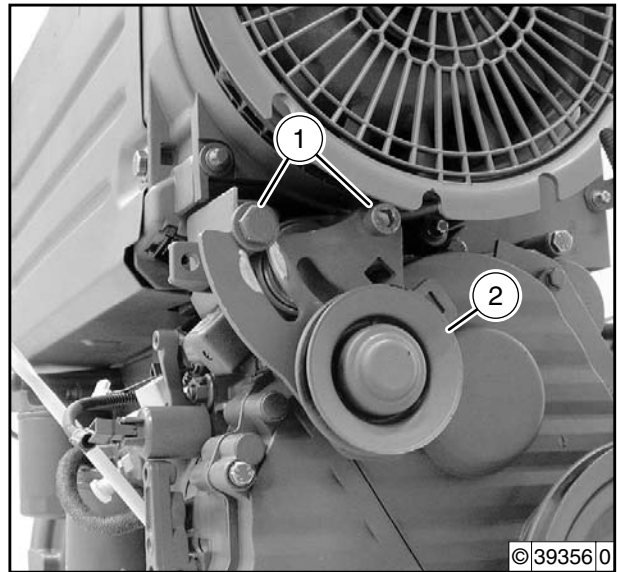
- Mount fan and disc, tighten screws (1).



©39624 0

In FL, BFL engines

- Fit V-belt clamping roller (2) and tighten screws (1).
- Install V-belt
 - Job card **W 12-02-01** (FL, BFL engines)
 - Job card **W 12-02-01** (FM, BFM engines).



Renew toothed belt and clamping roller (new version of the clamping roller)



Tools

- Commercial tools

- 8189 - Torx tool kit
- 9120 - Special bit, 70 mm long
- 9122 - Special bit, 25 mm long

- Special tools

- 100 700 - Setting bolt
- 144 130 - Holder



References

- W 12-02-01 (FL, BFL engines)
- W 12-02-01 (FM, BFM engines)
- W 12-08-03



Caution!

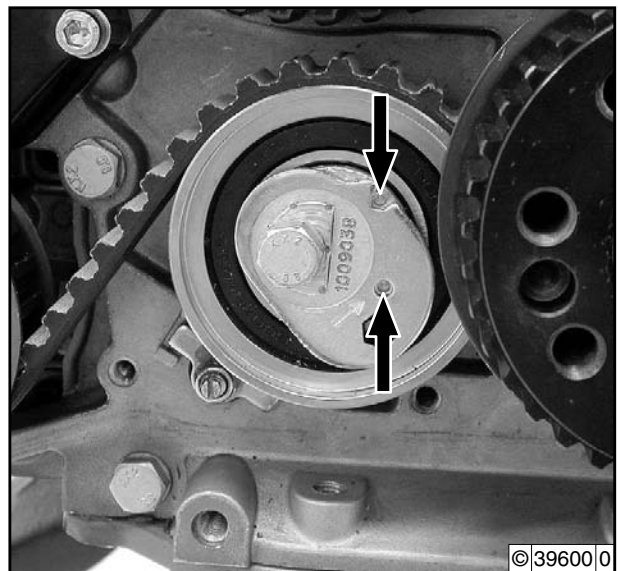
The toothed belt and the clamping roller must be renewed after every disassembly regardless of their time in operation.



Note

Distinguishing features of the new version of the clamping roller:

- The bores (arrows) serve for setting and inspecting the toothed belt tension.
- The clamping roller has no lock on the front cover.



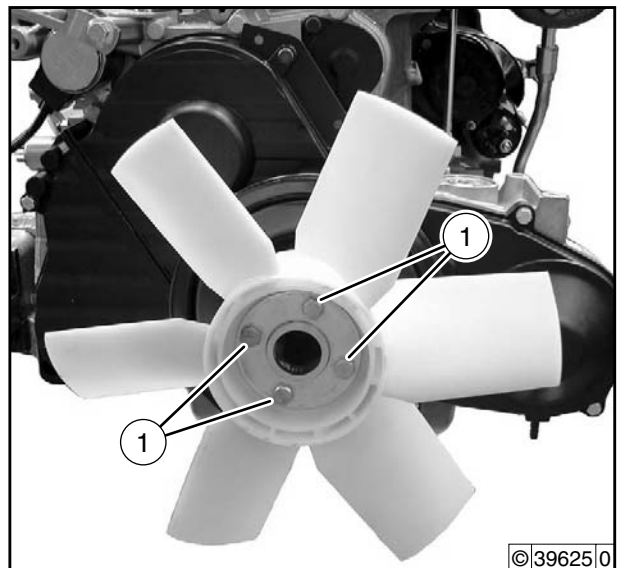
6

Renew toothed belt and clamping roller

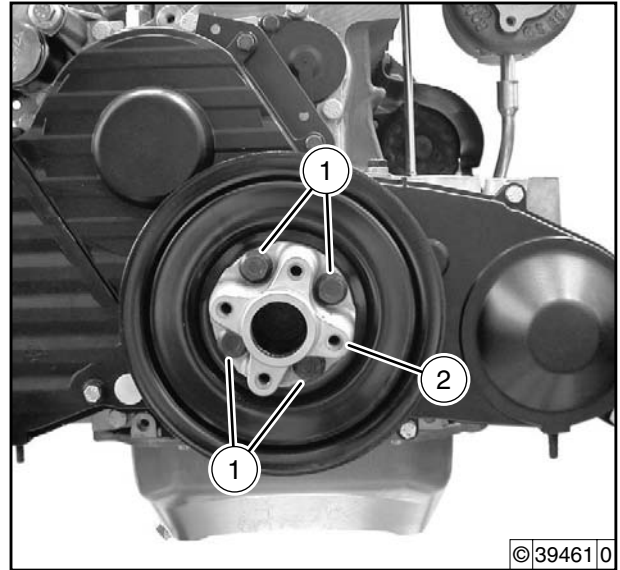
- Remove V-belt
 - ➔ Job card W 12-02-01 (FL, BFL engines)
 - ➔ Job card W 12-02-01 (FM, BFM engines)

In FM, BFM engines

- If available, unscrew screws (1) and remove fan.



- Unscrew screws (1) and remove flange hub (2) and V-belt pulley.



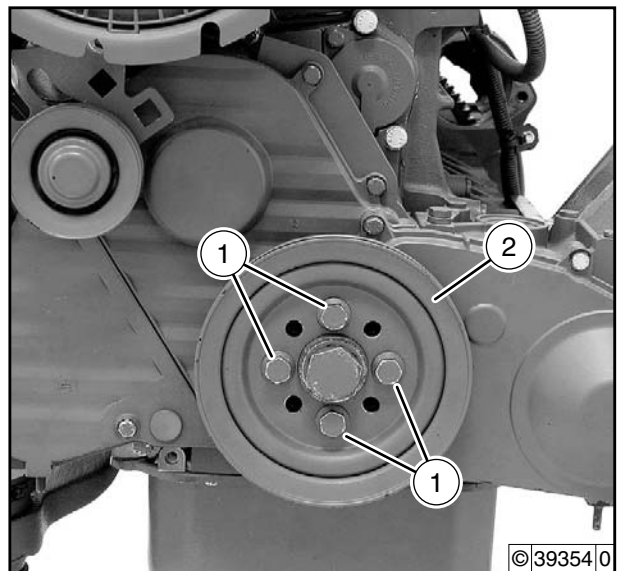
6

- Unscrew screws (1) and remove V-belt pulley (2).

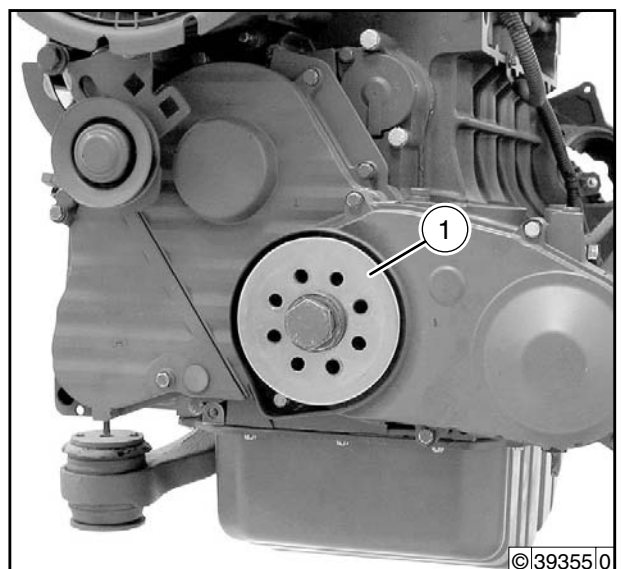


Note

Hold at the center screw.

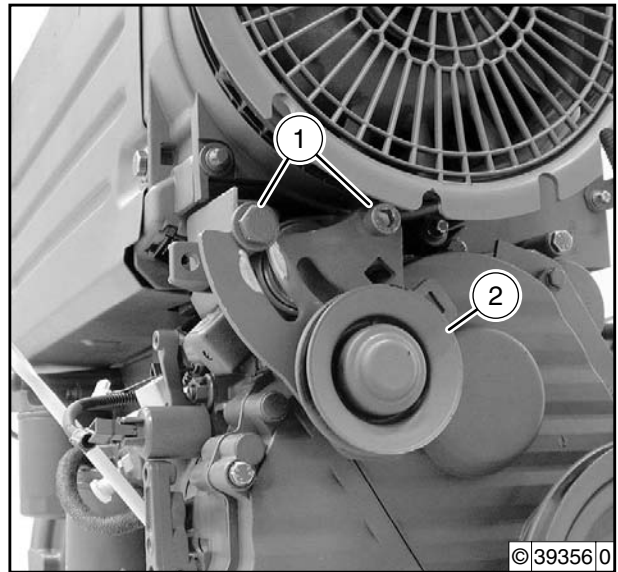


- Remove centrifugal disc (1).
- Remove toothed belt and clamping roller of the hydraulic pump
→ Job card W 12-08-03.



In FL, BFL engines

- Unscrew screws (1) and remove V-belt clamping roller (2).



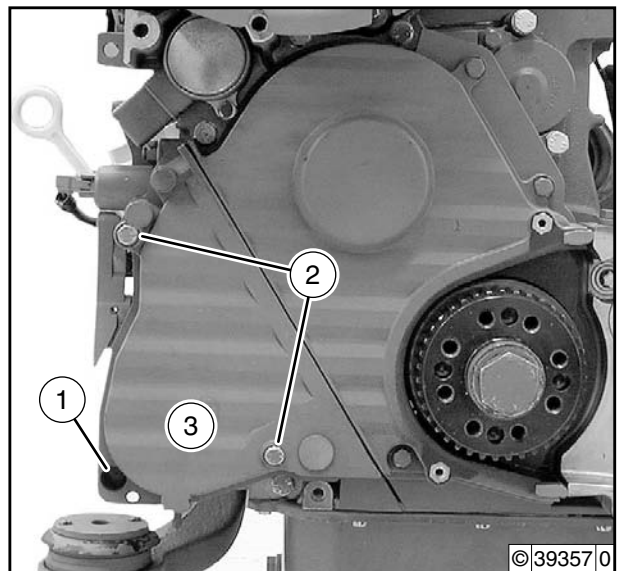
- Unscrew locking screw (1).



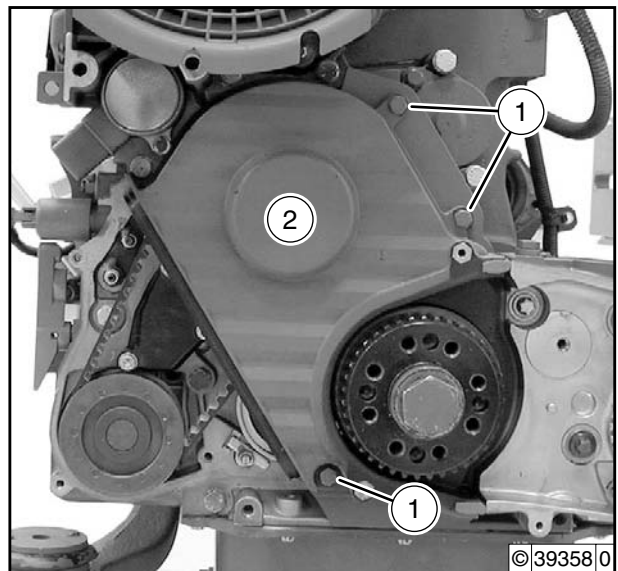
Note

Use a special bit, 70 mm long.

- Unscrew screws (2) and remove protective cover (1).

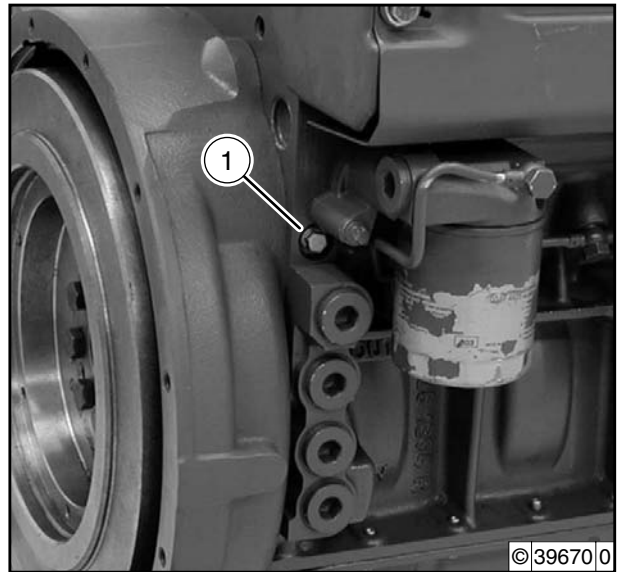


- Unscrew screws (1) and remove protective cover (2).



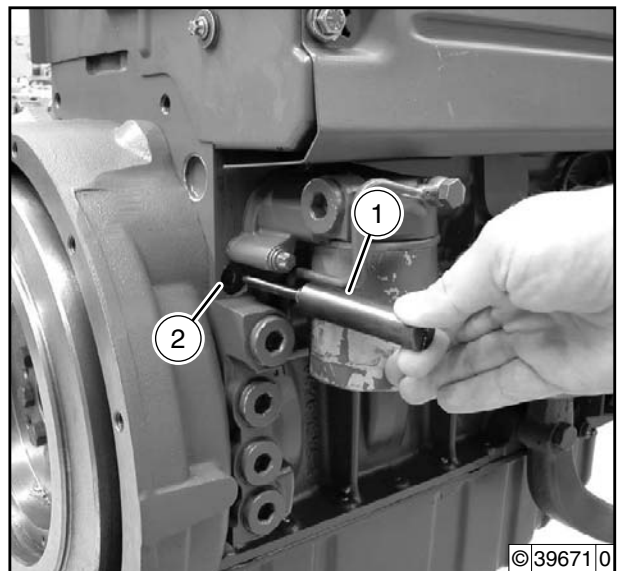
Lock camshaft

- Unscrew cap (1) and remove sealing ring.

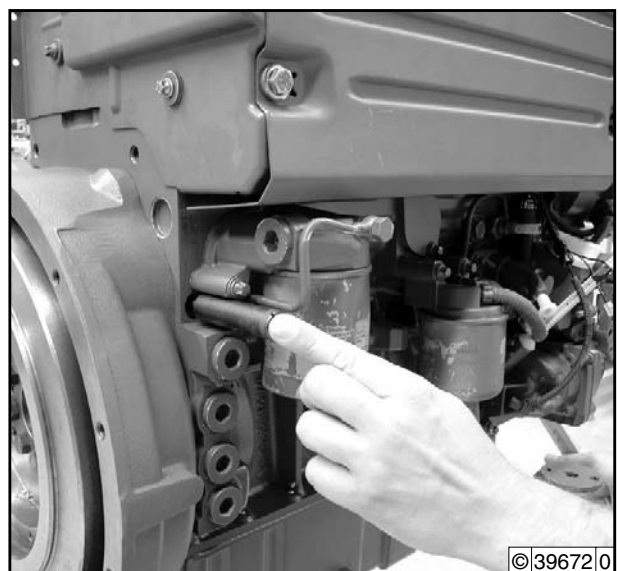


6

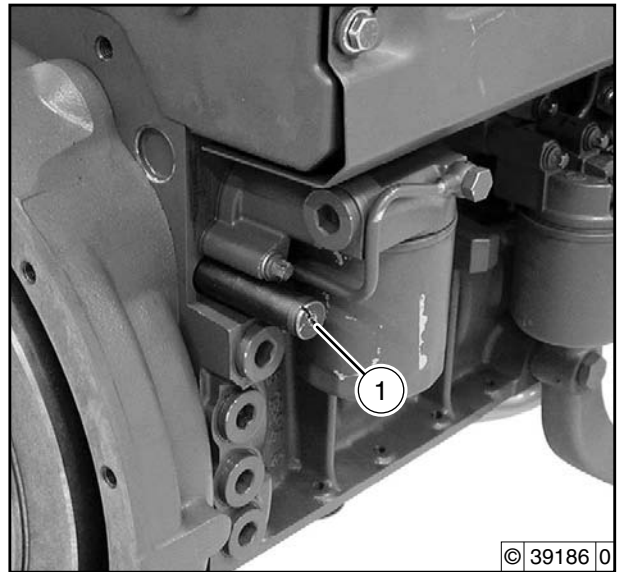
- Insert setting bolt (1) in the bore (2) to lock the camshaft.



- Hold the setting bolt lightly and turn the crankshaft in the direction of rotation of the engine (clockwise) until the setting bolt engages the bore of the camshaft.

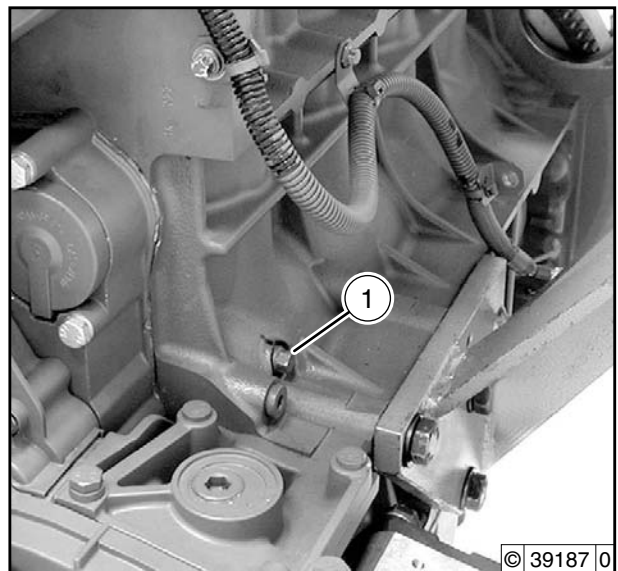


- Screw setting bolts (1) into the crankcase to the stop.

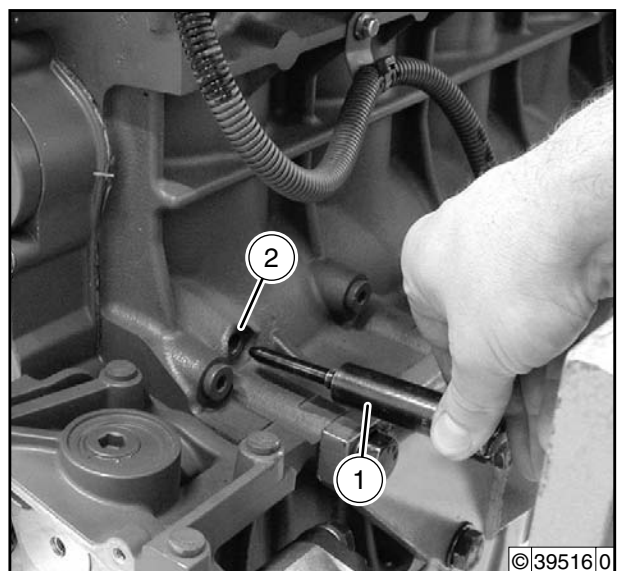


Lock the crankshaft

- Unscrew cap (1) and remove sealing ring.



- Insert setting bolt (1) in the bore (2) to lock the crankshaft.

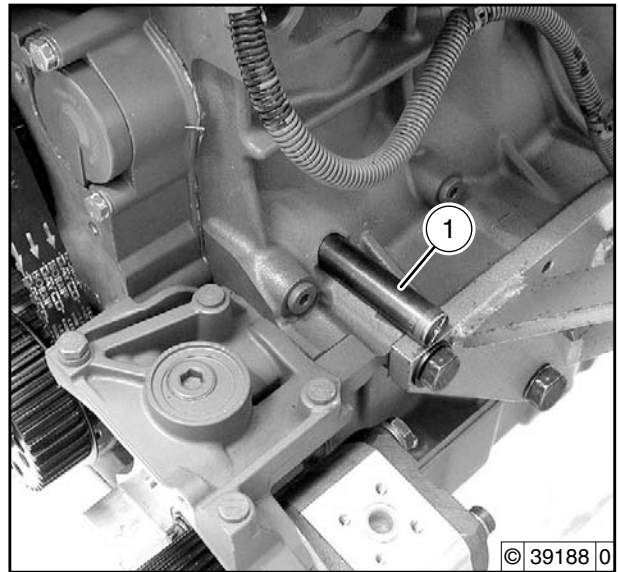


- Screw setting bolts (1) into the crankcase.



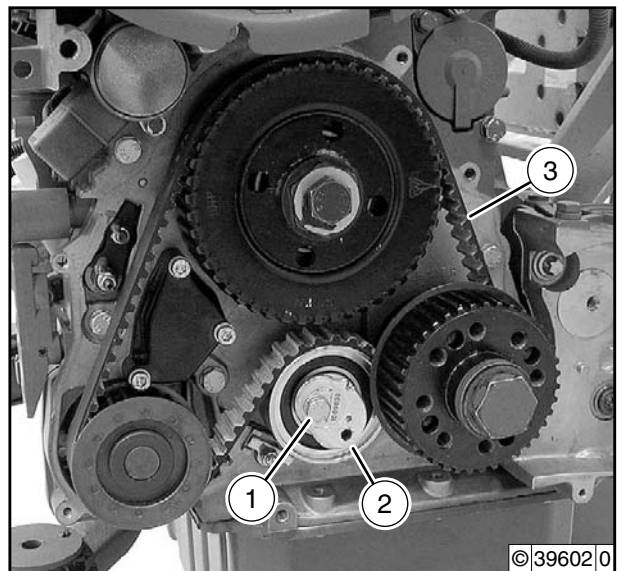
Note

The cylinder at the front cover is now in the ignition UT.



6

- Unscrew screw (1) and remove clamping roller (2).
- Remove toothed belt (3).



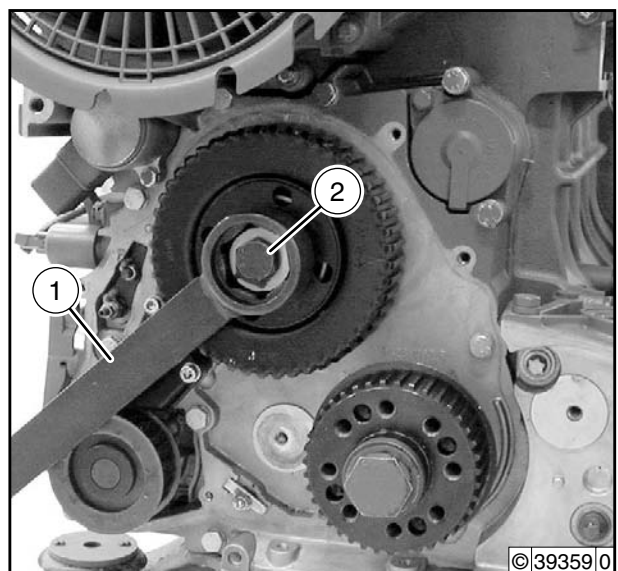
Loosen camshaft toothed belt wheel (without torsional vibration damper)

- Mount holder (1) and loosen center screw (2).



Note

Do not turn the camshaft.

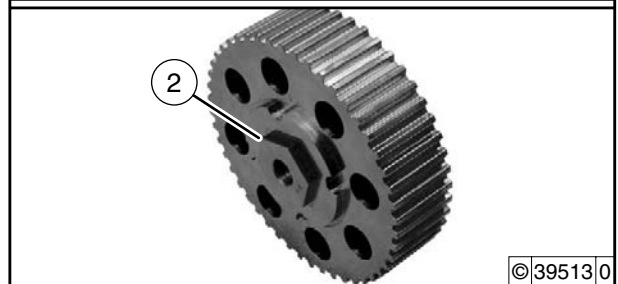
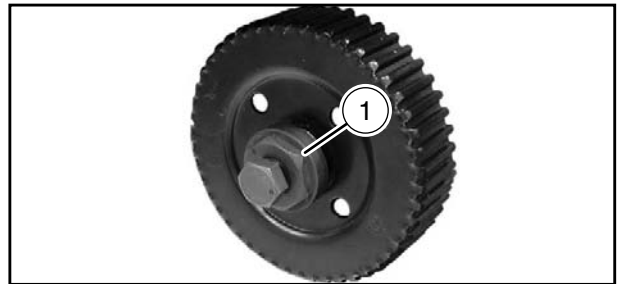


**Loosen camshaft toothed belt wheel
(with torsional vibration damper)**



Note

For camshaft toothed belt wheels with torsional vibration dampers, the hexagon is no longer on the toothed belt wheel (1) but directly on the camshaft toothed belt wheel (2).

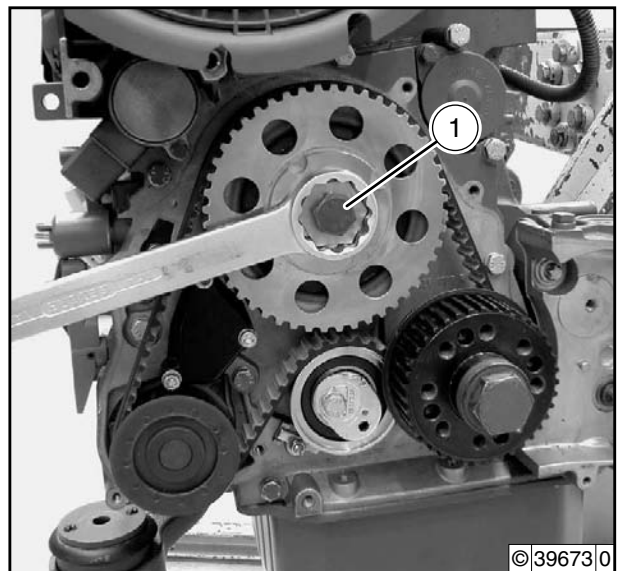


- Hold camshaft toothed belt wheel and loosen the center screw (1).



Note

Do not turn the camshaft.



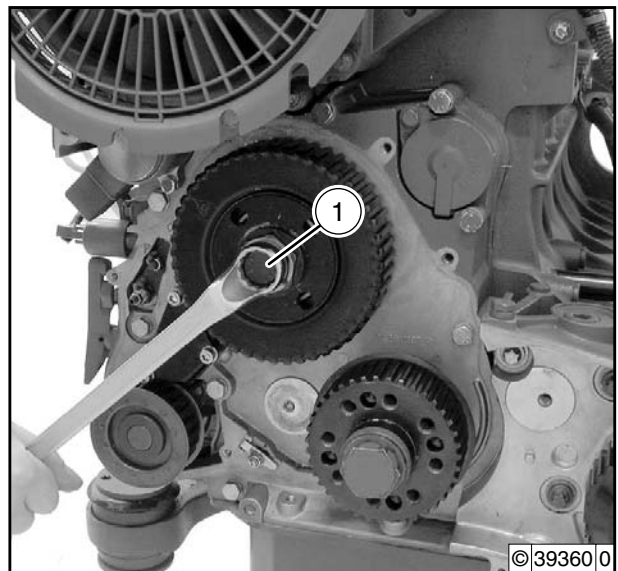
Install toothed belt and clamping roller

- Tighten the center screw (1) hand tight.

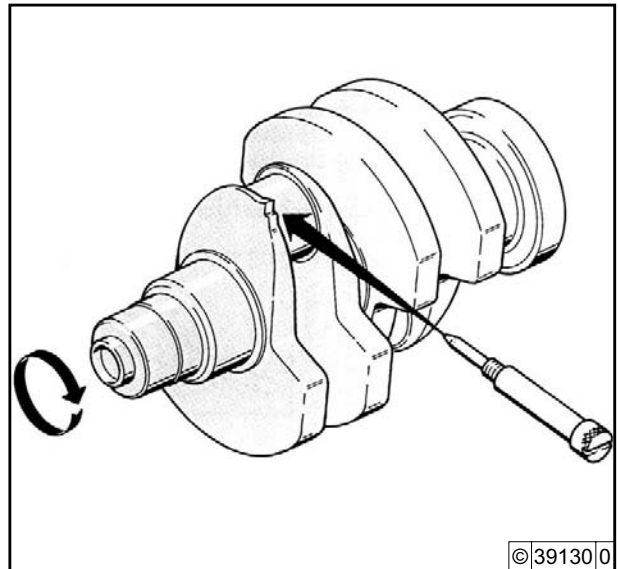


Note

- To guarantee the length compensation of the toothed belt, the camshaft toothed belt wheel must still be turnable.
- Use new center screw.



- Turn the crankshaft carefully in the direction of rotation of the engine (clockwise) until it touches the setting bolts.



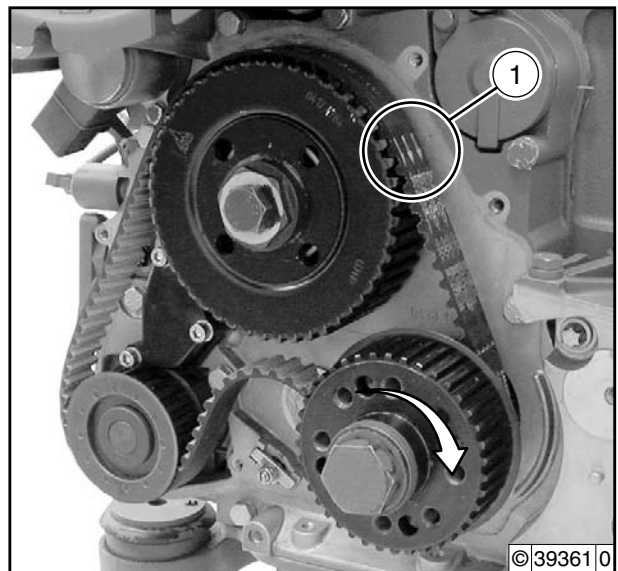
6

- Mount new toothed belt.



Note

Note the running direction of the toothed belt, the arrows (1) must point in the direction of rotation of the engine (arrow).



- Mount new clamping roller (1) and position setting eccentric (arrow) at 6.00 h position.



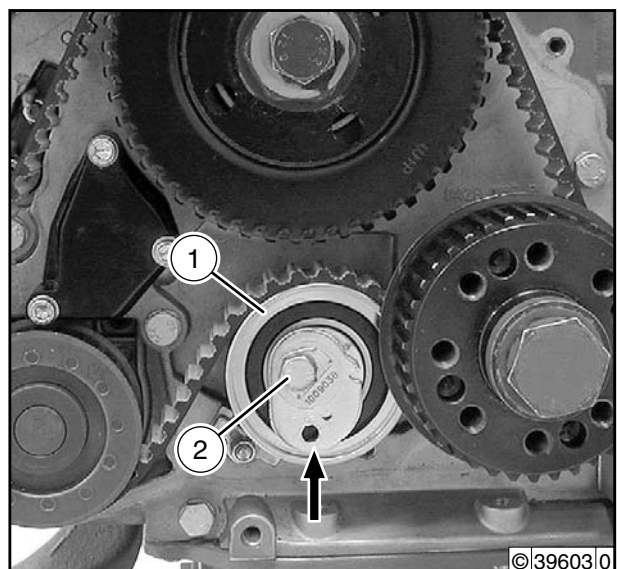
Note

When installing a hydraulic pump, watch out for different clamping rollers.

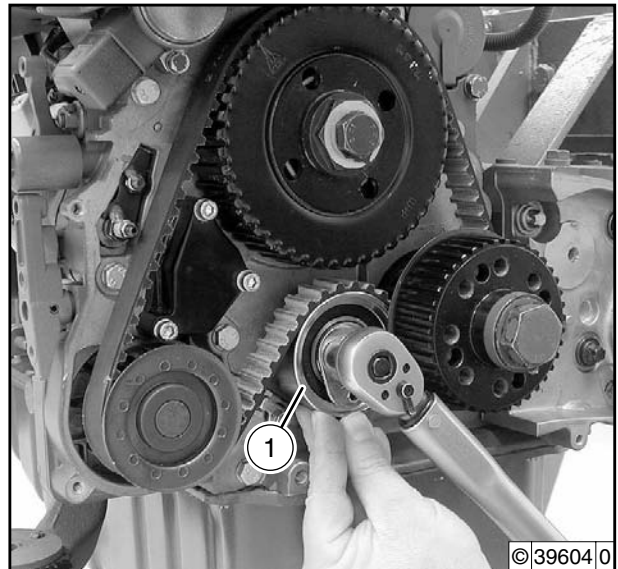
Width of clamping roller for:

- Camshaft drive 30 mm
- Hydraulic pump drive 35 mm

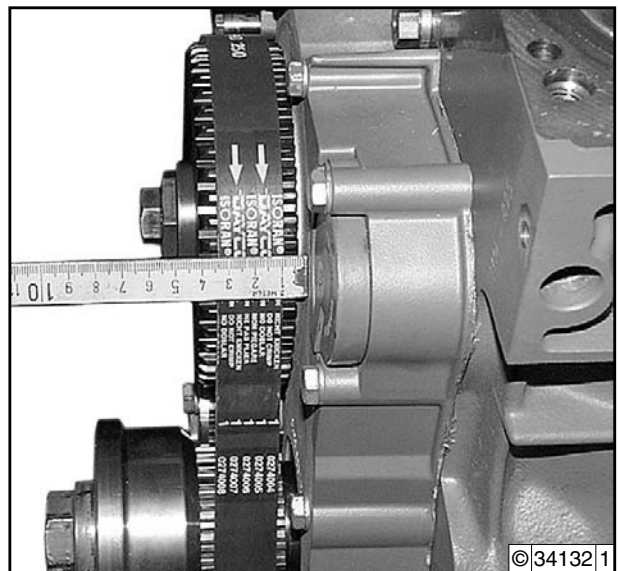
- Screw in screw (2).



- Press the clamping roller against the toothed belt and pre-tighten the screw.



- Align the toothed belt so that there is an even distance between the cover and the toothed belt of 8 to 9 mm.

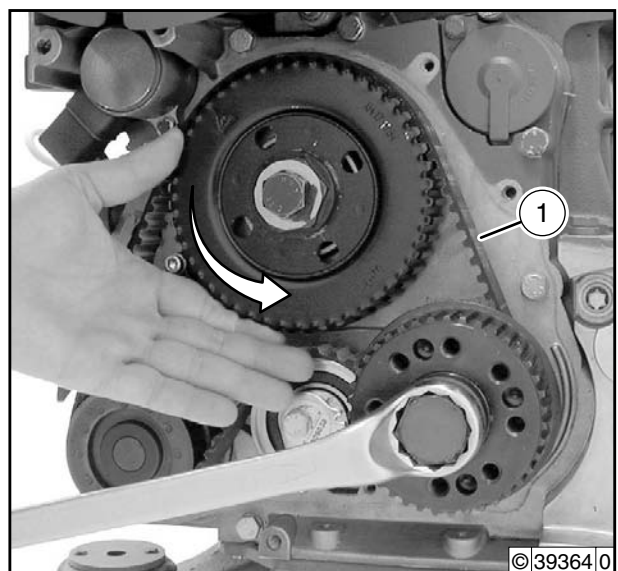


- Tighten the draw side (1) of the toothed belt by turning the camshaft toothed belt wheel in the direction of the arrow (clockwise).



Note

- Turn the camshaft toothed wheel by hand, not by the center screw.
- The crankshaft must be held against the stop whilst setting the toothed belt.



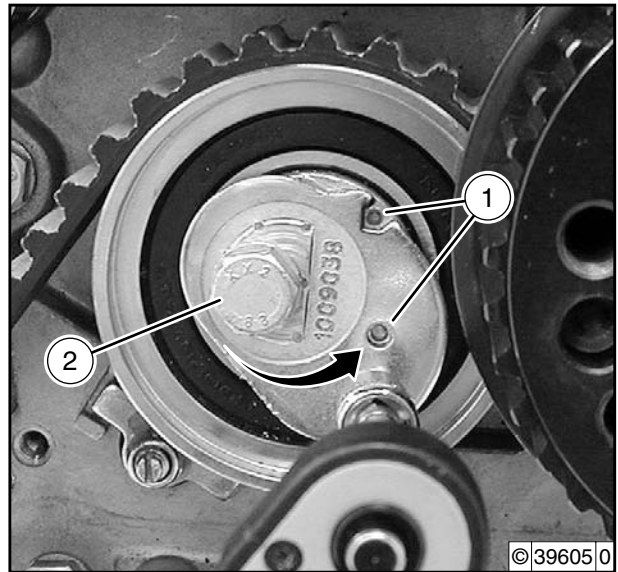
- Turn setting eccentric in direction of arrow (counterclockwise) until the bores (1) in the setting eccentric are in line.



Note

Turn the setting eccentric at the hexagon socket.

- Tighten screw (2).



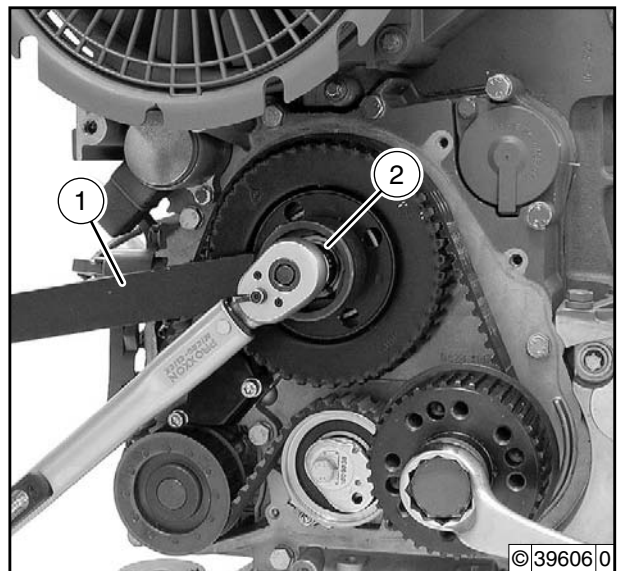
Fix the camshaft toothed belt wheel (without torsional vibration damper)

- Mount holder (1) and pre-tighten center screw (2).
- Tighten center screw (2).



Note

- Hold the toothed belt wheel.
- Hold the crankshaft against the stop.



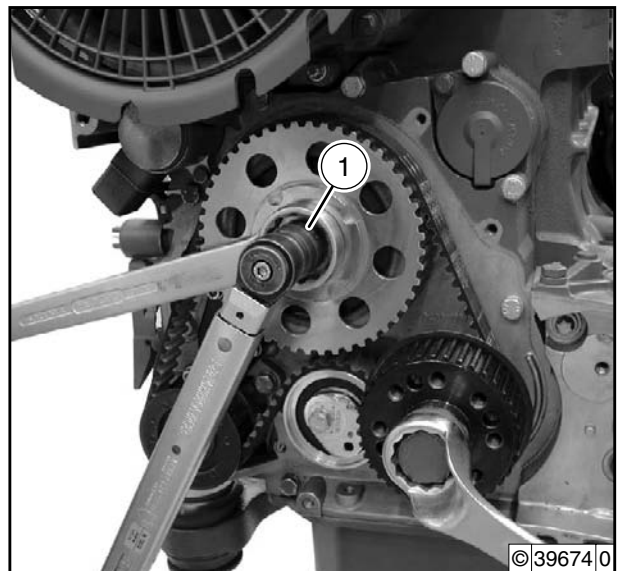
Fix the camshaft toothed belt wheel (with torsional vibration damper)

- Pre-tighten (1) and tighten center screw.



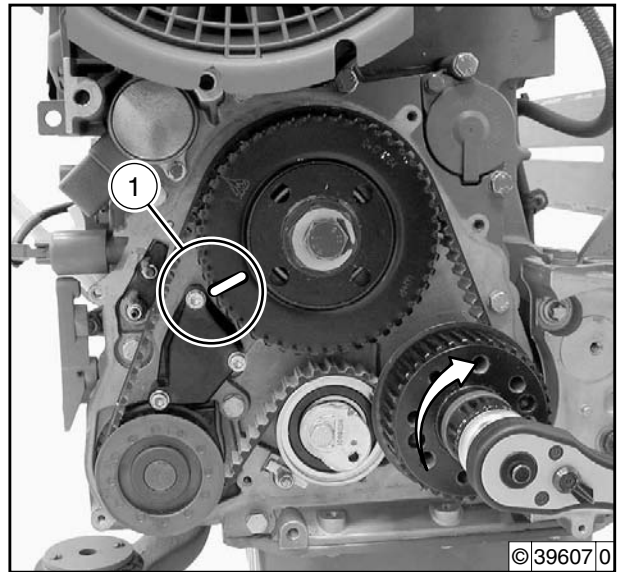
Note

- Hold the camshaft toothed belt wheel
- Hold the crankshaft against the stop.



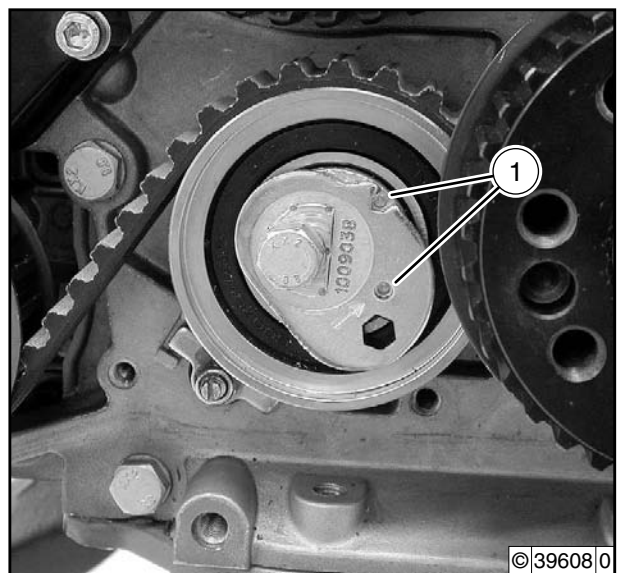
Check the toothed belt tension

- Unscrew the setting bolts for camshaft and crankshaft locking.
- Make help marks on the camshaft toothed belt wheel and insert the screw opposite (1).
- Turn the crankshaft 2 turns in the direction of rotation of the engine (clockwise) until the help marks are in line.



Note

- The bores (1) in the setting eccentric must be in line.
- If the marks are not in line, the toothed belt tension must be corrected.

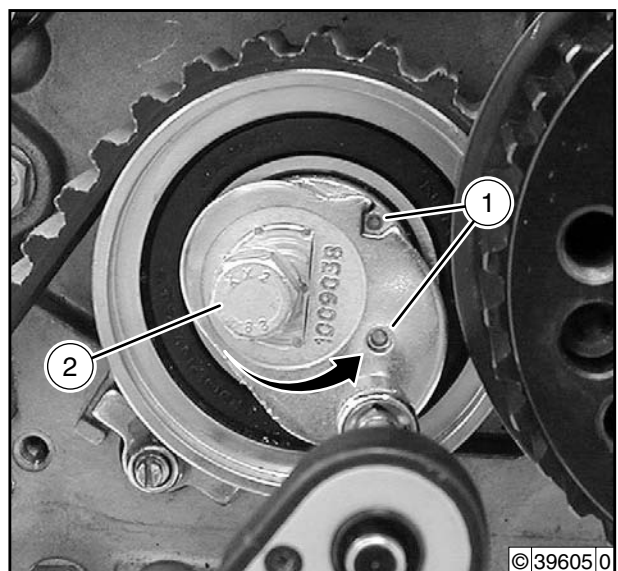


Correct the toothed belt tension

- Loosen screw (2) and re-tighten.



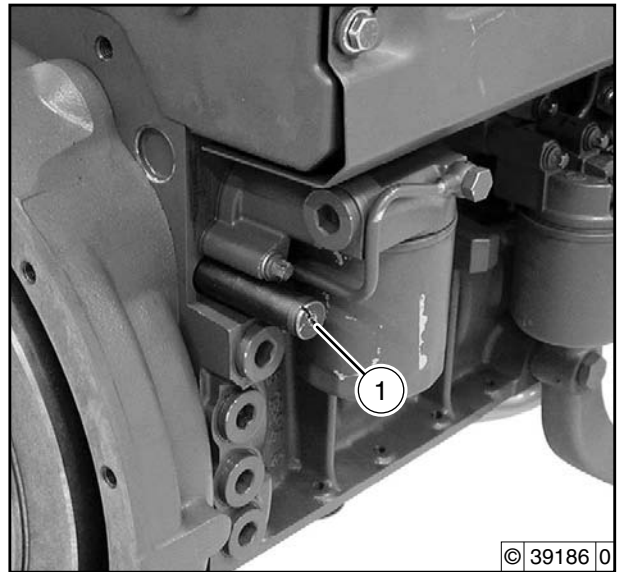
- Turn setting eccentric in direction of arrow (counterclockwise) until the bores (1) in the setting eccentric are in line.
- Tighten screw (2).



Check engine control times

Lock camshaft

- Insert setting bolt (1) for the camshaft lock in the bore and hold lightly.
- Turn the crankshaft in the direction of rotation of the engine (clockwise) until the setting bolt engages the bore of the camshaft.
- Screw setting bolt into the crankcase to the stop.

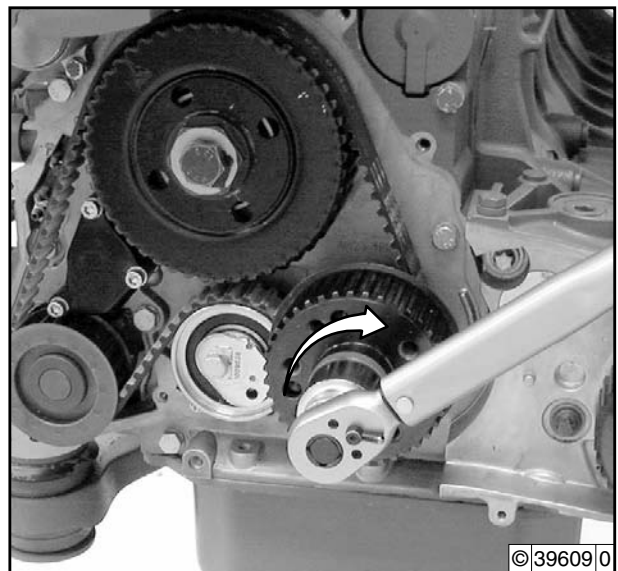


- Tighten center screw with the torque wrench in engine direction of rotation with **40 Nm**. Carefully relieve pressure on the torque wrench.



Note

Do not turn the crankshaft any more.



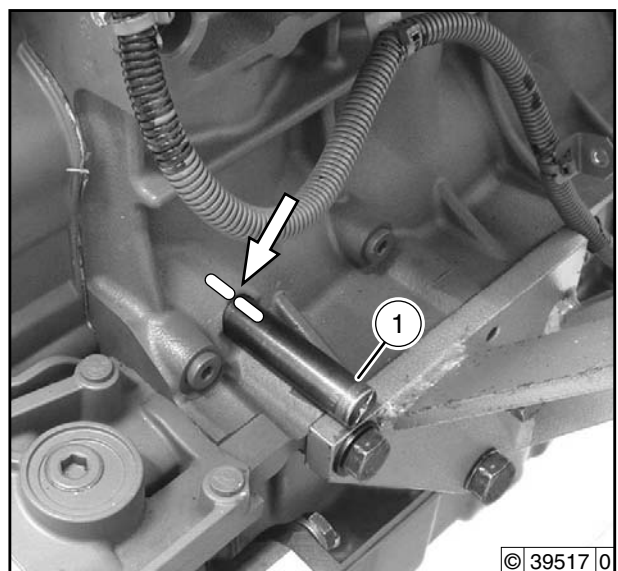
- Turn in the setting bolt (1) to the crankshaft lock until it is lightly touching the crankshaft.



Note

Do not turn the crankshaft when screwing in the setting bolt.

- Make help marks (arrow) on the crankcase and setting bolt.



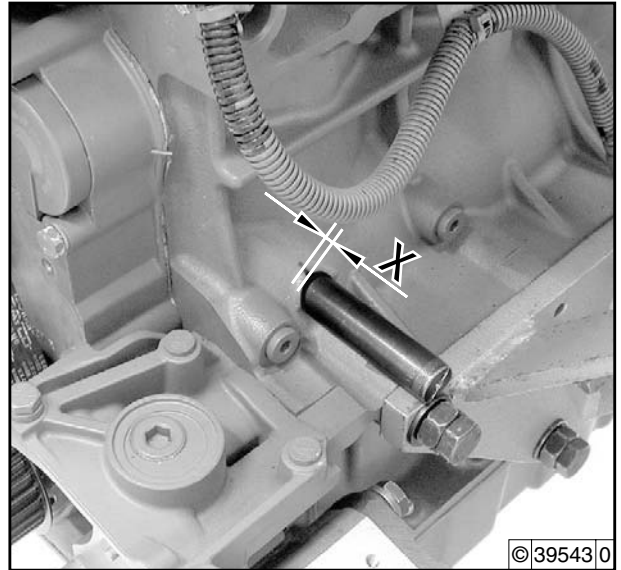
- The engine control times are set correctly when the setting bolt can be turned another **0.75** to **2.25** turns up to the stop in the crankcase.



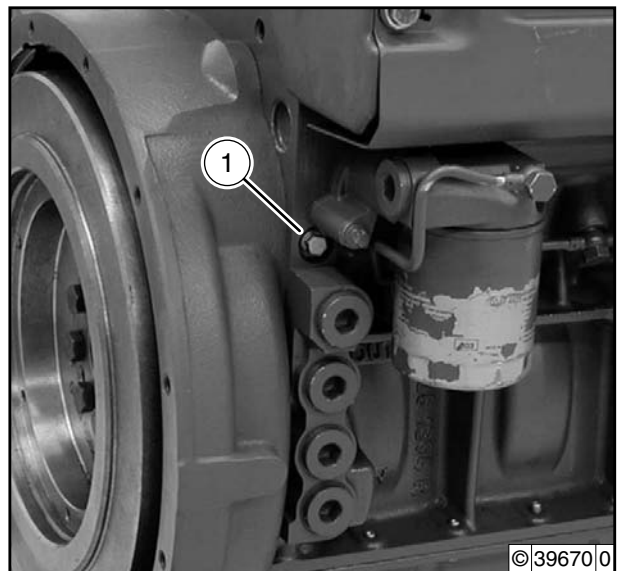
Note

If the screw-in depth (X) deviates from the specification, the toothed belt and the clamping roller must be changed.

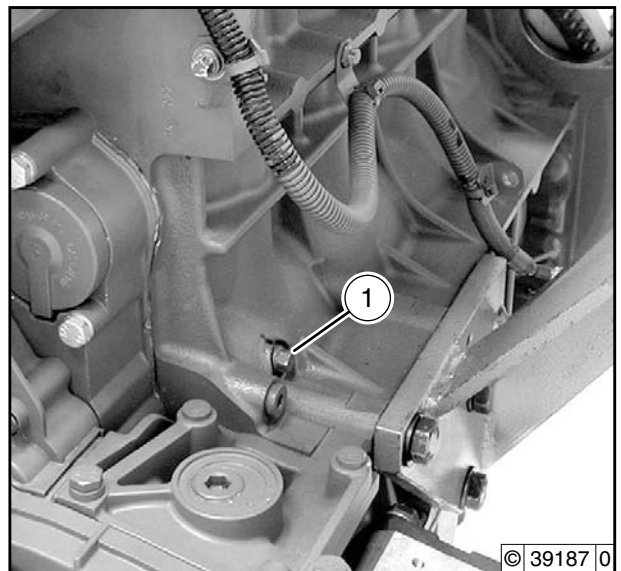
- Unscrew the setting bolts for camshaft and crankshaft locking.



- Tighten locking screw (1) with new CU sealing ring.



- Tighten locking screw (1) with new CU sealing ring.



- Inspect the protective covers visually, renew the sealing profile if necessary.



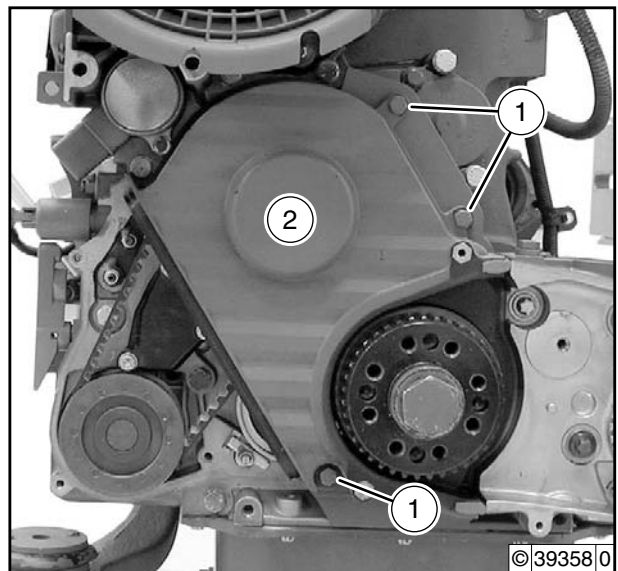
6

- Mount protective cover (2) and tighten screws (1).



Note

Pay attention to the correct fitting of the protective cover.



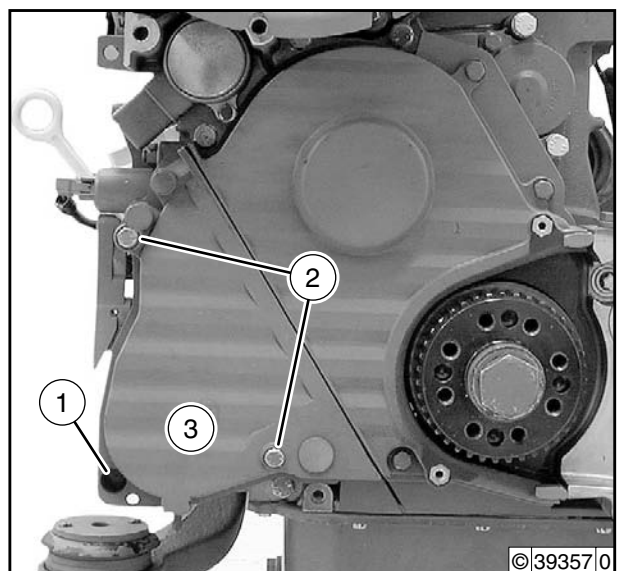
- Mount protective cover (3) and tighten screws (2).
- Screw in locking screw (1).



Note

Use a special bit, 70 mm long.

- Tighten screws.

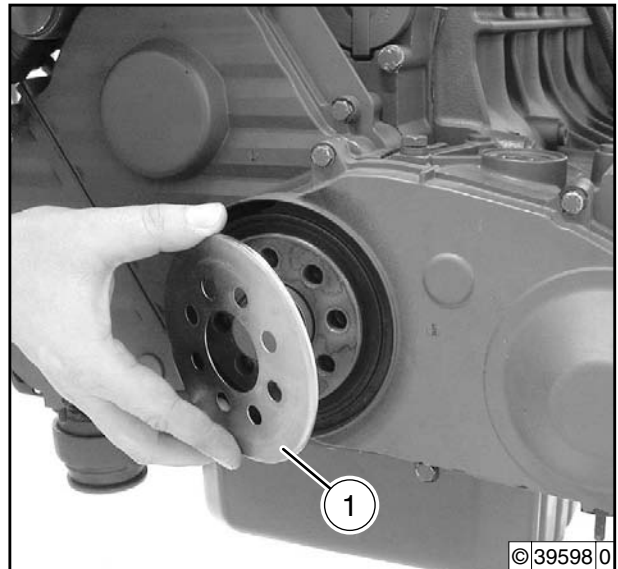


- Install toothed belt and clamping roller of the hydraulic pump
→ Job card W 12-08-03.
- Mount centrifugal disc (1).



Note

The hollow throat must face the adapter.

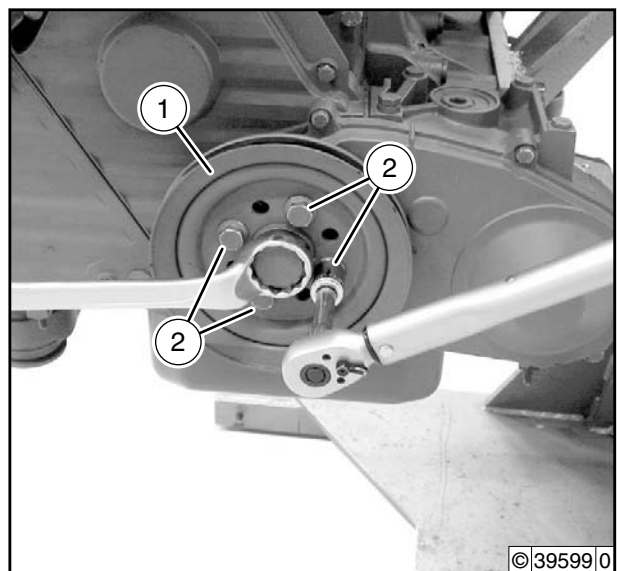


- Fit V-belt pulley (1) and tighten screws (2) alternately.



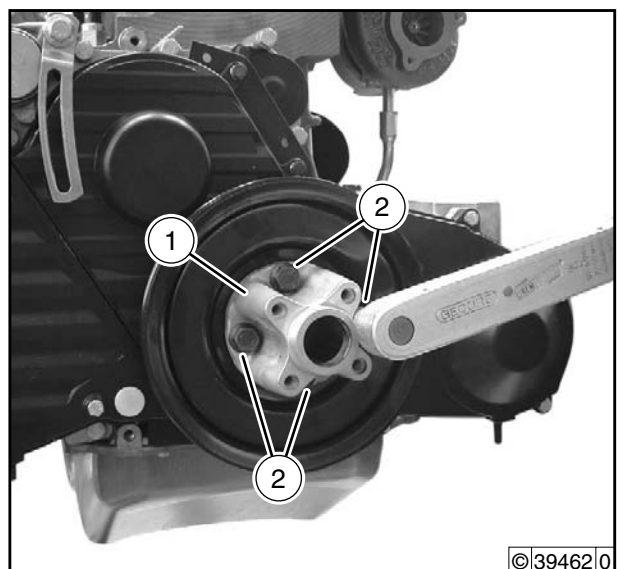
Note

Hold at the center screw.

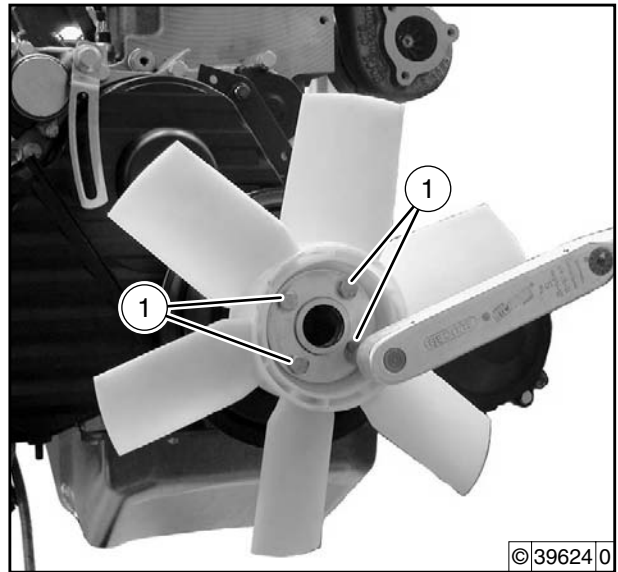


In FM, BFM engines (as an overview)

- If available, mount the V-belt pulley and flange hub (1).
- Tighten (2) screws alternately.



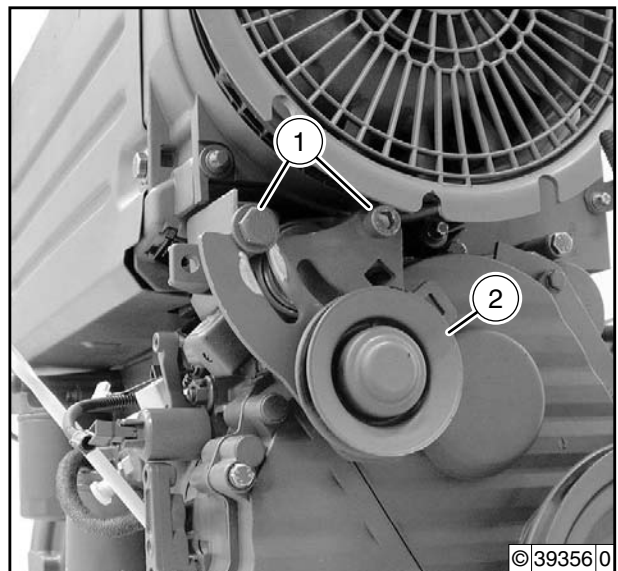
- Mount fan and disc, tighten screws (1).



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In FL, BFL engines

- Fit V-belt clamping roller (2) and tighten screws (1).
- Install V-belt
 - ➔ Job card **W 12-02-01** (FL, BFL engines)
 - ➔ Job card **W 12-02-01** (FM, BFM engines)



Remove and install camshaft



Tools

- Commercial tools
- Special tools
- 100 700 - Setting bolt



References

- W 01-02-02
- W 03-09-01
- W 04-04-12 (old version)
- W 04-04-12 (new version)
- W 07-04-01 (Motorpal)
- W 07-04-01 (Bosch)
- W 07-11-01

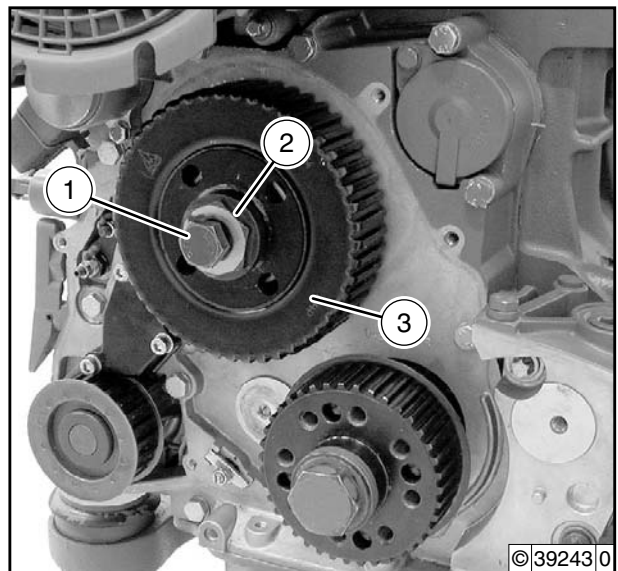
Remove camshaft

- Remove toothed belt and clamping roller and loosen camshaft toothed belt wheel
→ Job card **W 04-04-12** (old version)
→ Job card **W 04-04-12** (new version)
- Unscrew center screw (1) with washer (2) and remove the camshaft toothed belt wheel (3).

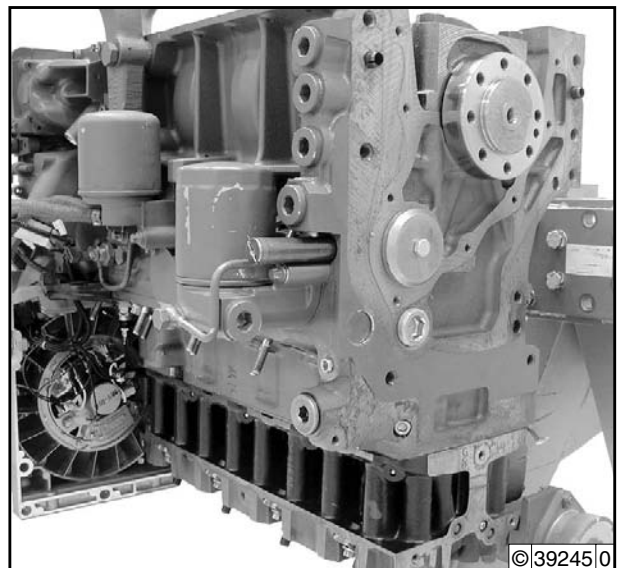


Note

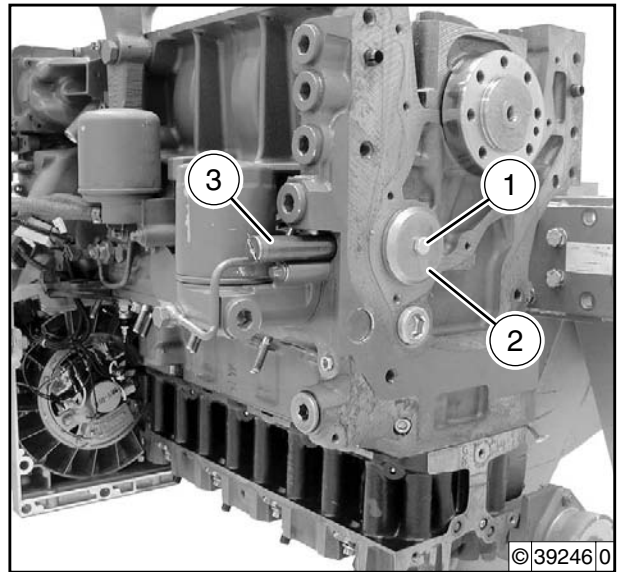
There is no washer (2) on the camshaft toothed belt wheel with torsional vibration damper.



- Remove toggle lever and toggle lever blocks
→ Job card **W 01-02-02**.
- Remove injection pumps
→ Job card **W 07-04-01** (Motorpal)
→ Job card **W 07-04-01** (Bosch)
- Remove fuel pump
→ Job card **W 07-11-01**.
- Remove rear cover (flywheel side)
→ Job card **W 03-09-01**.

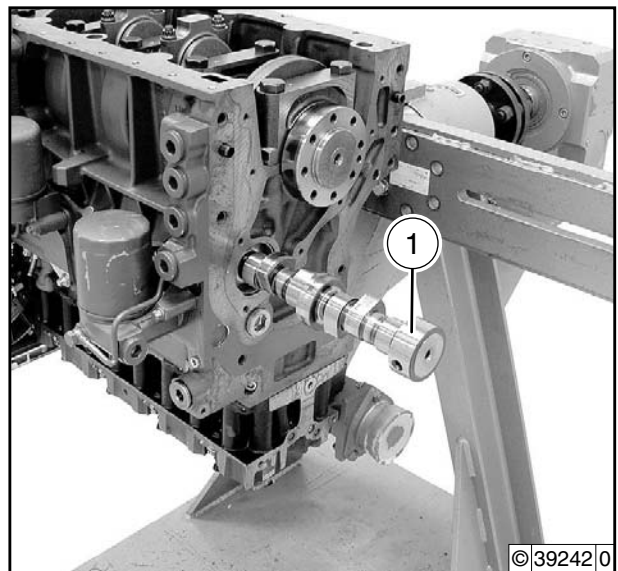


- Unscrew screw (1) and remove startup disc (2).
- Unscrew setting bolts (3).



6

- Press in all tappets.
- Pull out camshaft (1) carefully to the flywheel side.



Remove tappets.

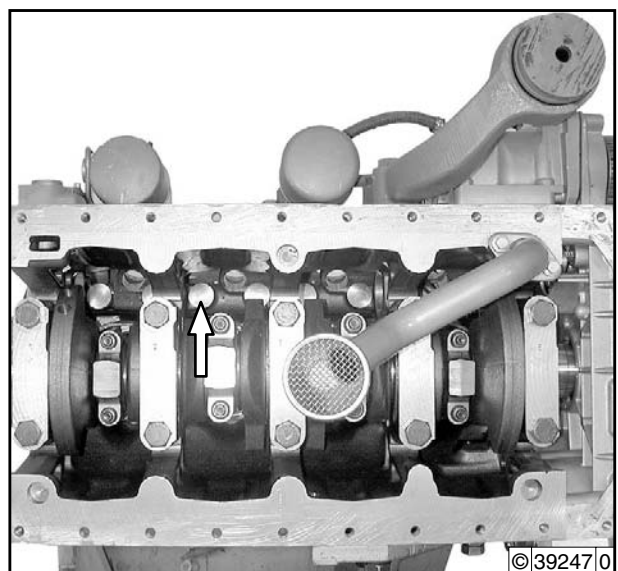
- Remove all tappets (arrow).



Note

Put down the components in the order of installation, note order of cylinders.

- Check the tappets for visible signs of wear.



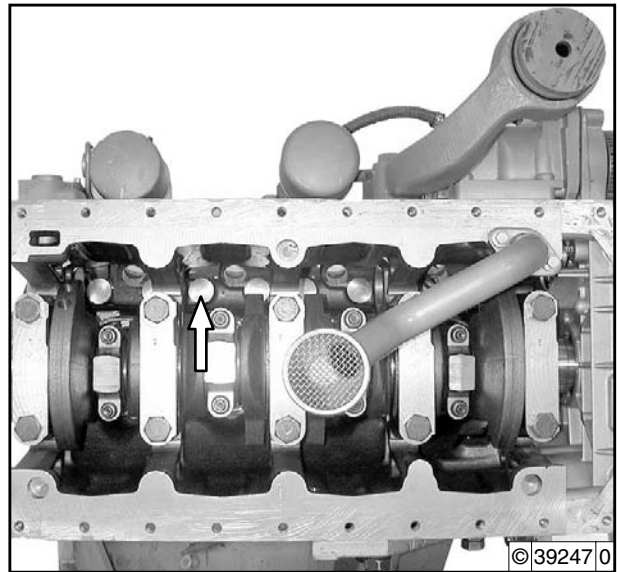
Install tappets

- Oil all tappets (arrow) lightly with engine oil and insert.



Note

Note assignment.



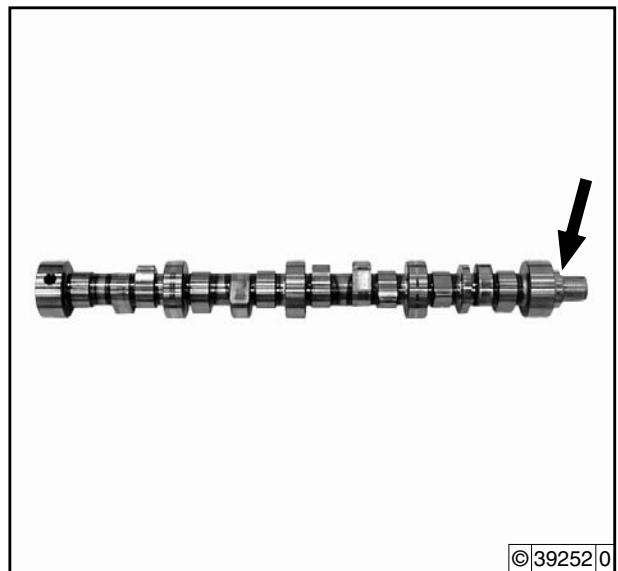
Install camshaft

- Oil camshaft bearing and camshaft journal lightly with engine oil.



Note

The connecting surface (arrow) with the muff of the measuring mechanism must be clean and oil free.

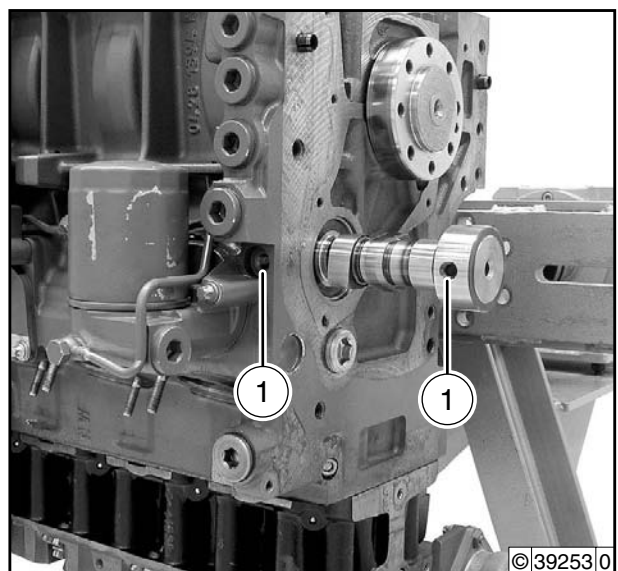


- Insert camshaft carefully.



Note

- The muff of the measuring mechanism must engage the front camshaft journal.
- Check that the bores (1) in the camshaft and the crankcase match up.

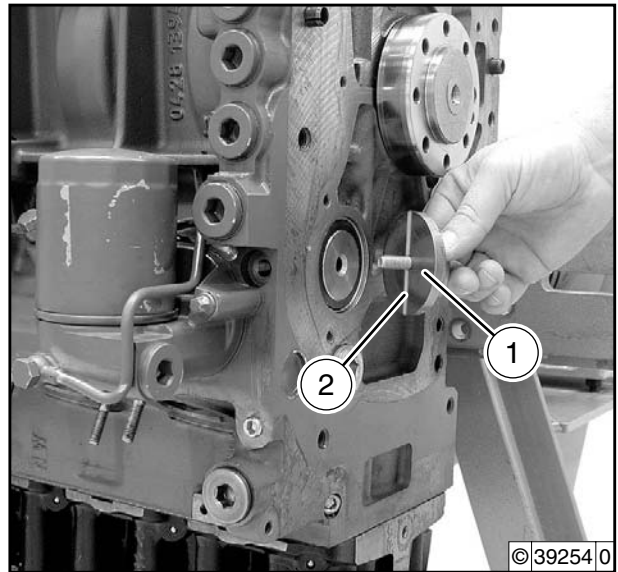


- Fit startup disc (1) and tighten screw.



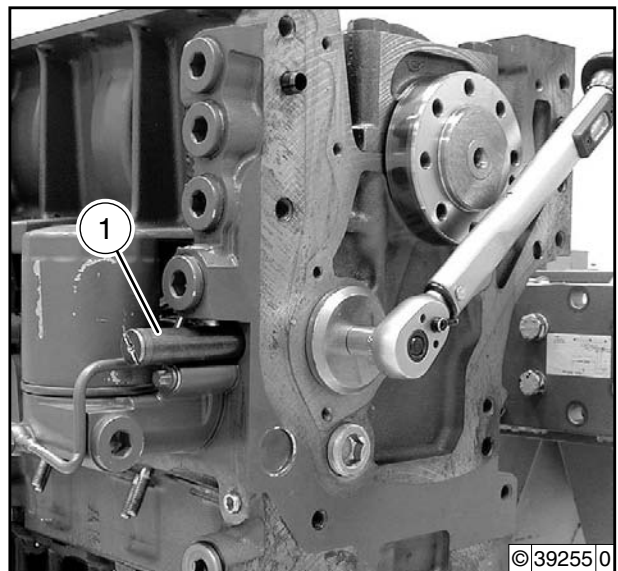
Note

The lubricating groove (2) of the startup disc must face the crankcase.



6

- Screw setting bolts (1) into the crankcase to the stop.
- Tighten screw.



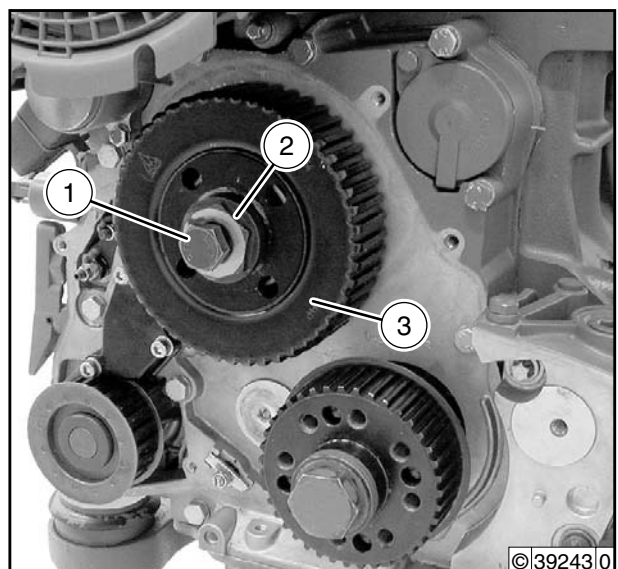
- Mount camshaft toothed belt wheel (3) and tighten new center screw (1) with washer (2).



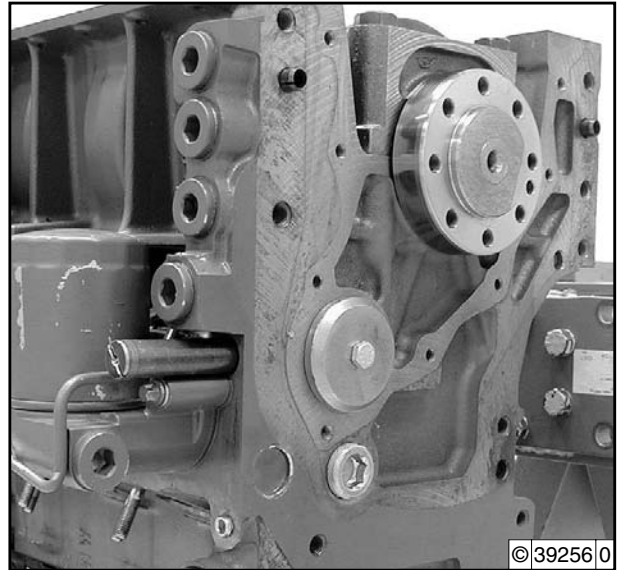
Note

- There is no washer (2) on the camshaft toothed belt wheel with torsional vibration damper.
- All connections must be clean and oil free.

- Install toothed belt and clamping roller, fix camshaft toothed belt wheel
 - ➔ Job card W 04-04-12 (old version)
 - ➔ Job card W 04-04-12 (new version)



- Install toggle lever and toggle lever blocks
→ Job card **W 01-02-02**.
- Install injection pumps.
→ Job card **W 07-04-01** (Motorpal)
→ Job card **W 07-04-01** (Bosch)
- Install fuel pump
→ Job card **W 07-11-01**.
- Install rear cover (flywheel side)
→ Job card **W 03-09-01**.





Notes

Check camshaft



Tools
- Commercial tools



References
- W 04-05-05

Check camshaft

- Remove camshaft
→ Job card **W 04-05-05**.
- Visually inspect cam and bearing pin for wear,
renew camshaft if necessary.
- Install camshaft
→ Job card **W 04-05-05**.





Notes

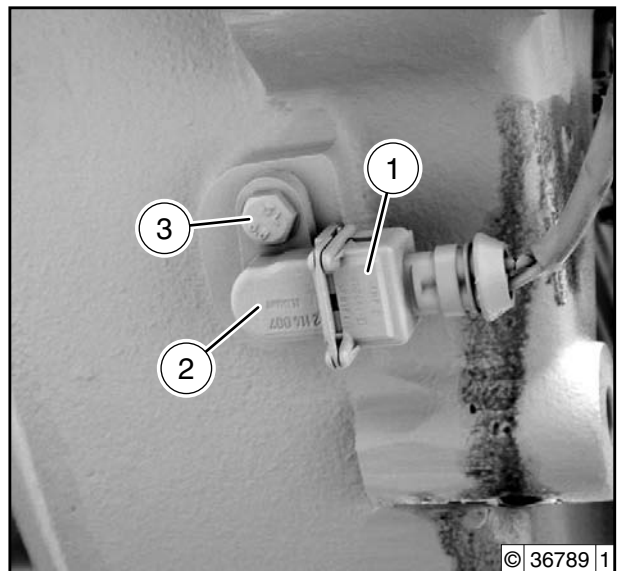
Remove and install speed governor



Tools
- Commercial tools

Remove speed governor

- Pull cable plug (1) out of speed governor (2).
- Unscrew screw (3) and remove speed governor.



Install speed governor

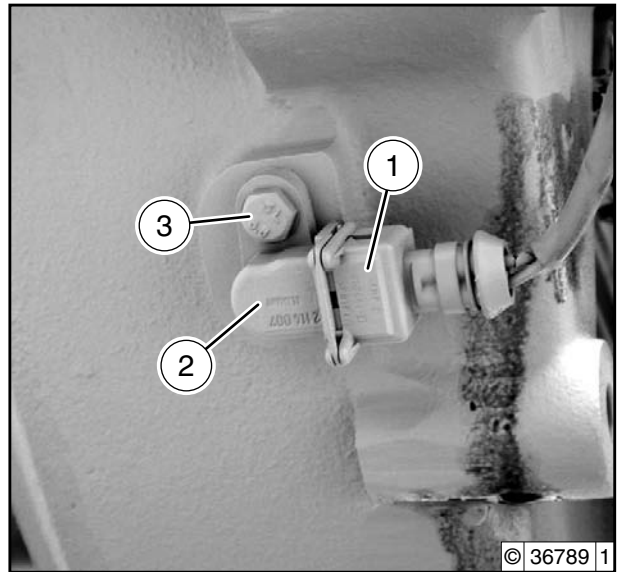
- Fit new round sealing ring (arrow) onto speed governor.



- Insert speed governor (2) and tighten screw (3).



- Plug cable plug (1) to speed governor.



Remove and install exhaust manifold



Tools

- Commercial tools
8189 - Torx tool kit



References

- W 06-06-04

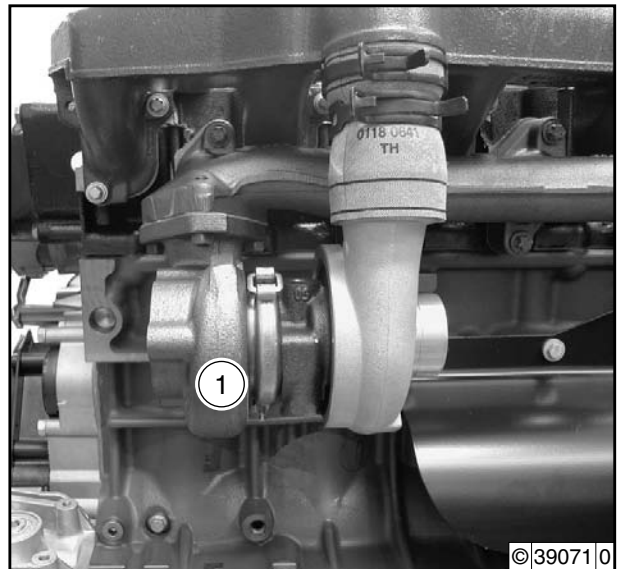


Auxiliary material

- DEUTZ S1

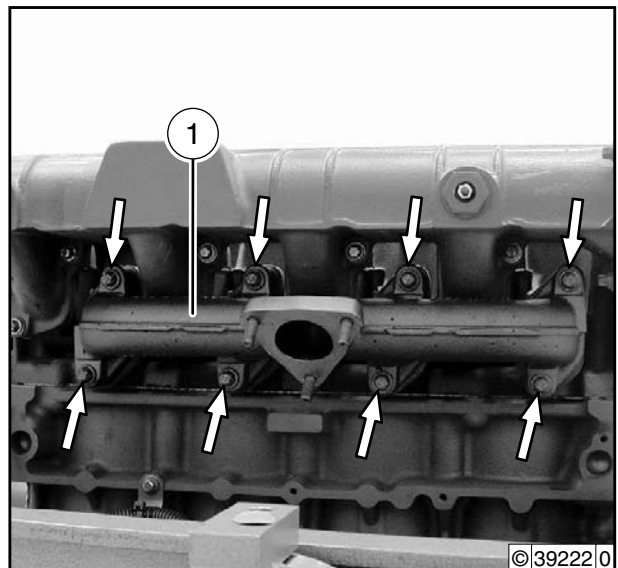
In BF engines

- Remove turbocharger (1).
→ Job card **W 06-06-04**.



Remove exhaust manifold

- Unscrew screws (arrows), remove exhaust manifold (1) and gaskets.
- Check components for visible signs of damage.



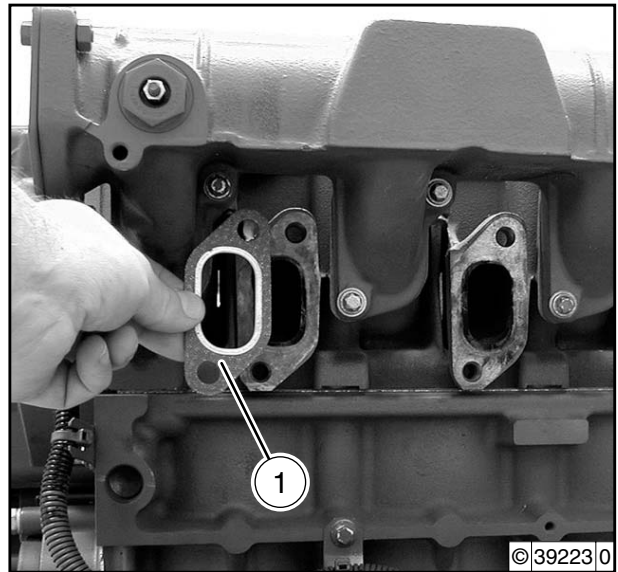
Install exhaust manifold

- Clean the sealing surface on the exhaust manifold and cylinder head.



Note

Note installation position of the gaskets (1).



6

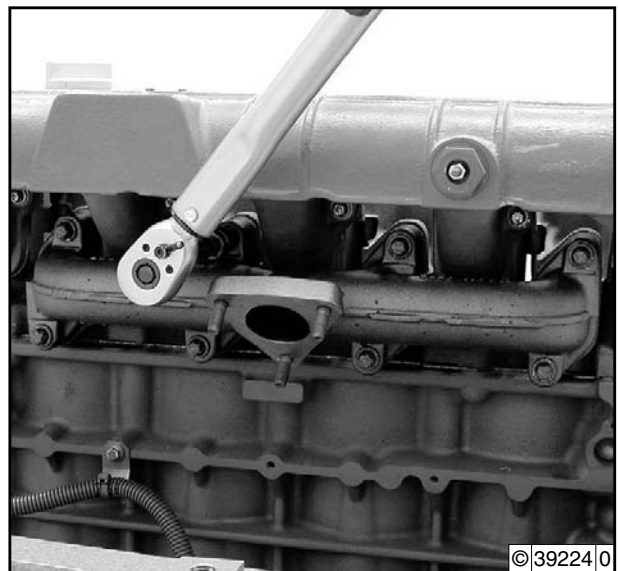
- Mount exhaust manifold with new gaskets and tighten screws.



Note

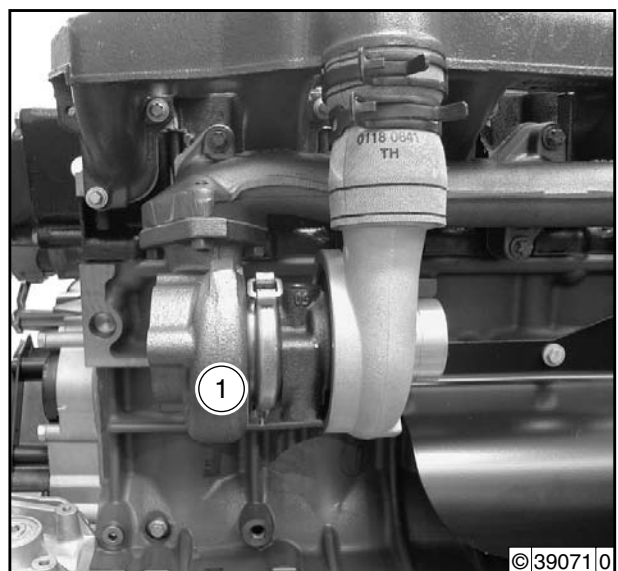
Coat screws with assembly aid **DEUTZ S1**.

- Tighten screws alternately from the center outwards.



In BF engines

- Install turbocharger (1).
→ Job card **W 06-06-04**.



Remove and install turbocharger



Tools

- Commercial tools
9090 - Clamping pliers



Auxiliary material

- DEUTZ S1

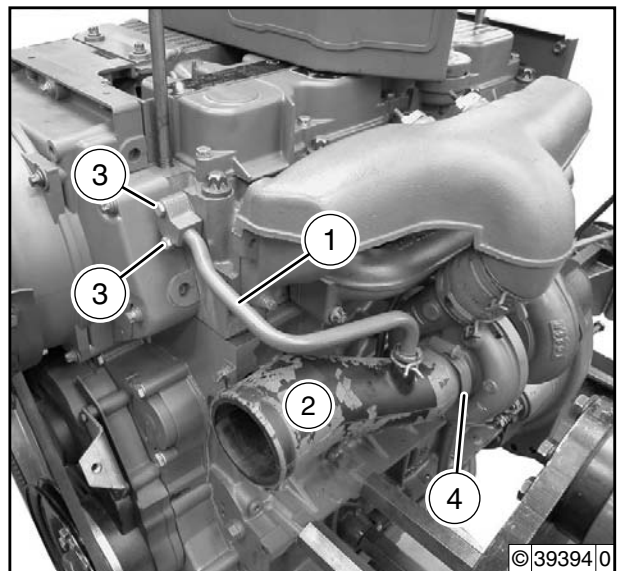


Note

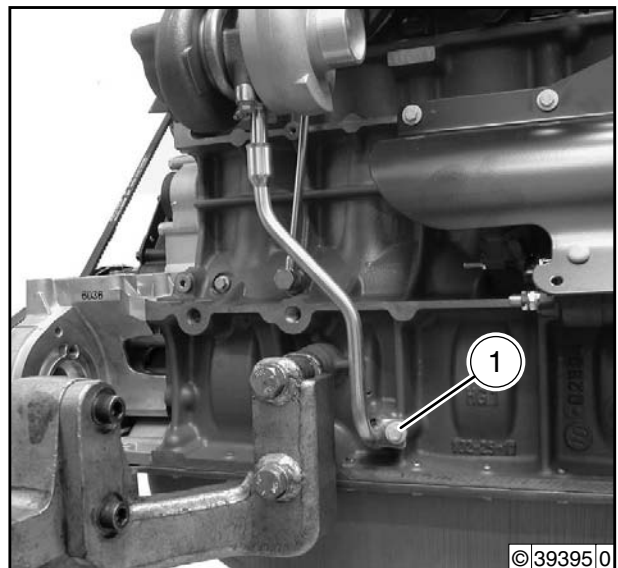
Collect drained operating materials in suitable vessels and dispose of according to regulations.

Remove turbocharger

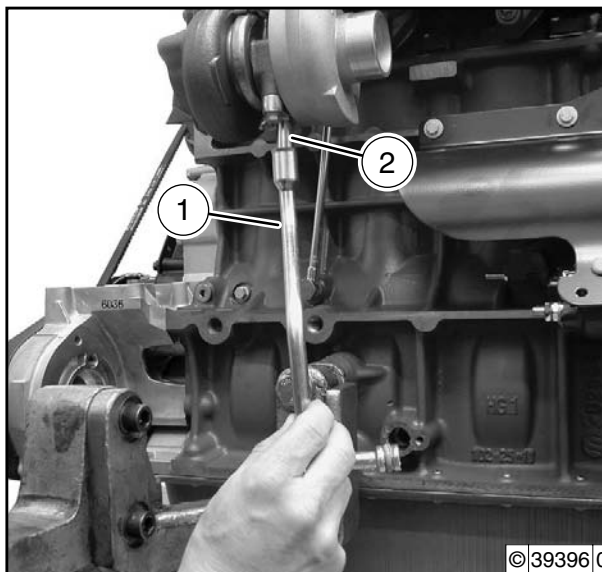
- If available, remove the bleed pipe (1) and reducer (2).
Unscrew screws (3).
- Loosen pipe clip (4), remove reducer with bleed pipe.



- Unscrew screw (1) and remove holder.

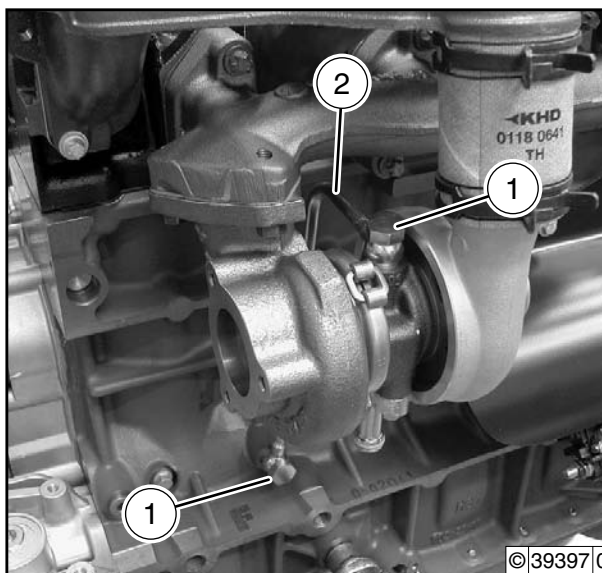


- Pull oil return line (1) out of the crankcase and pull off from oil return pipe flange support (2).

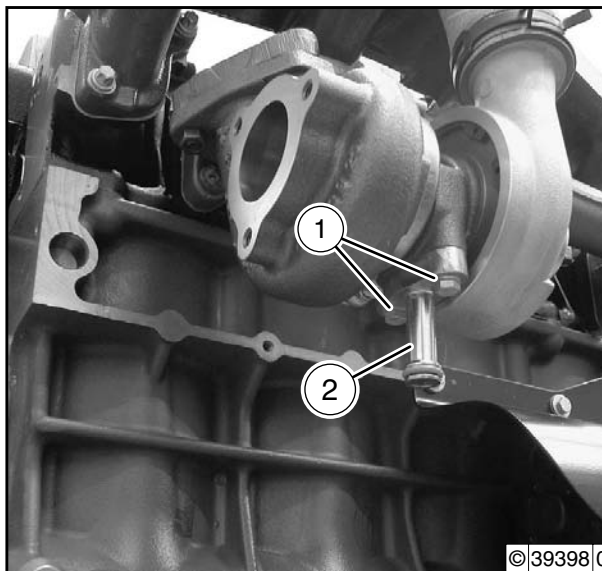


6

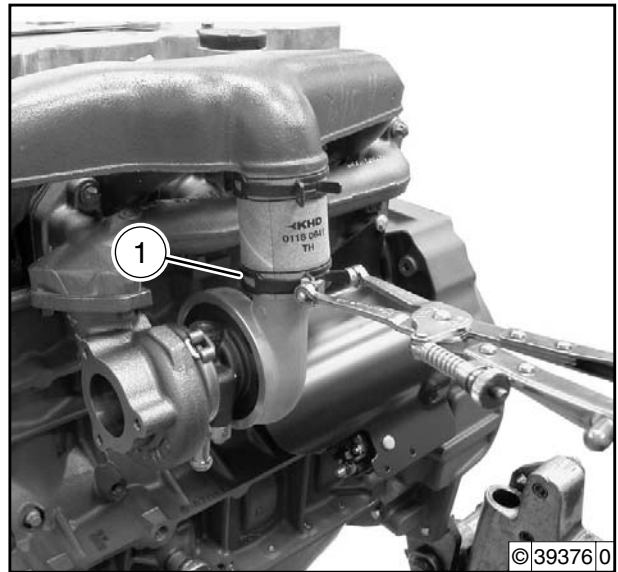
- Unscrew hollow screws (1), remove oil pressure line (2) and sealing rings.



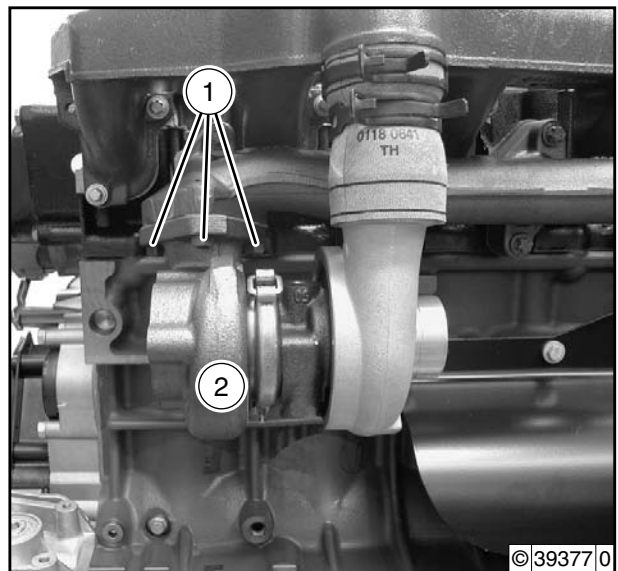
- Unscrew screws (1), remove oil return pipe flange support (2) and gasket.



- Loosen pipe clip (1) with clamping pliers.



- Unscrew nuts (1), remove turbocharger (2) and gasket.
- Check components for visible signs of damage.



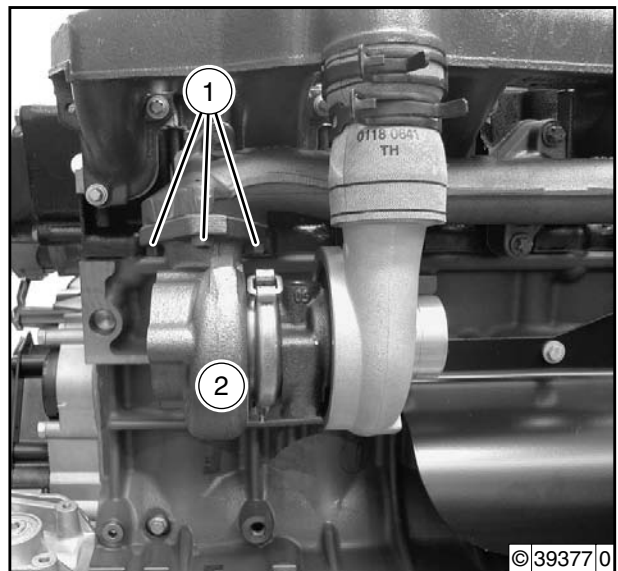
Install turbocharger

- Clean the sealing surface of the turbocharger and exhaust manifold.
- Mount turbocharger (2) with new gasket and tighten nuts (1).

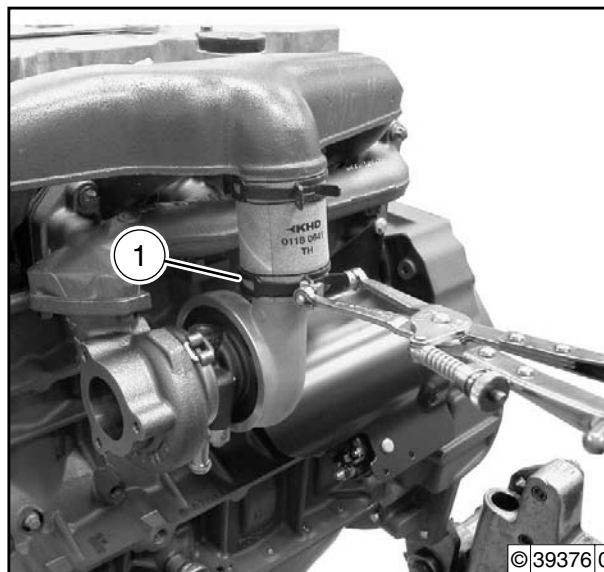


Note

Coat pin bolts with assembly aid **DEUTZ S1**.

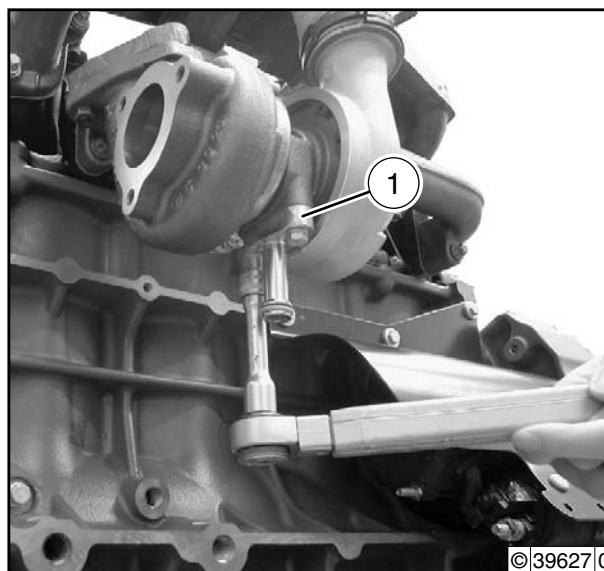


- Position pipe clip (1) with clamping pliers.

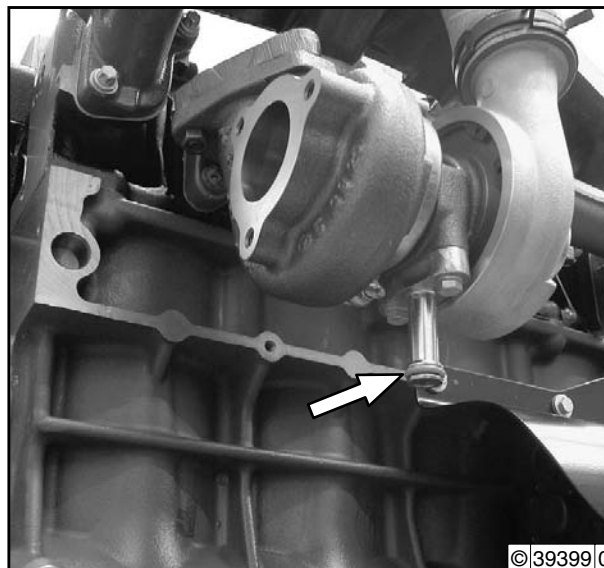


6

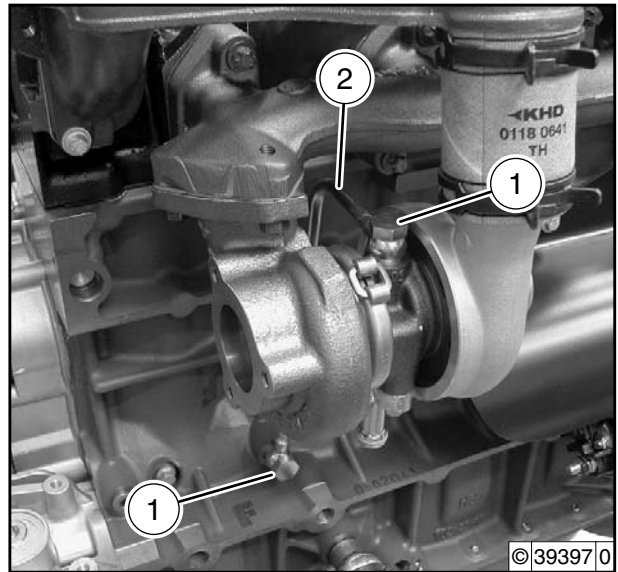
- Clean the sealing surface of the turbocharger and oil return pipe flange support.
- Mount oil return pipe flange support (1) with new gasket and tighten screws (2).



- Pull new round sealing ring (arrow) onto oil return pipe flange support.



- Mount oil pressure line (2), tighten hollow screws (1) with new CU sealing rings.



- Fit new round sealing ring (arrow) onto oil return pipe.

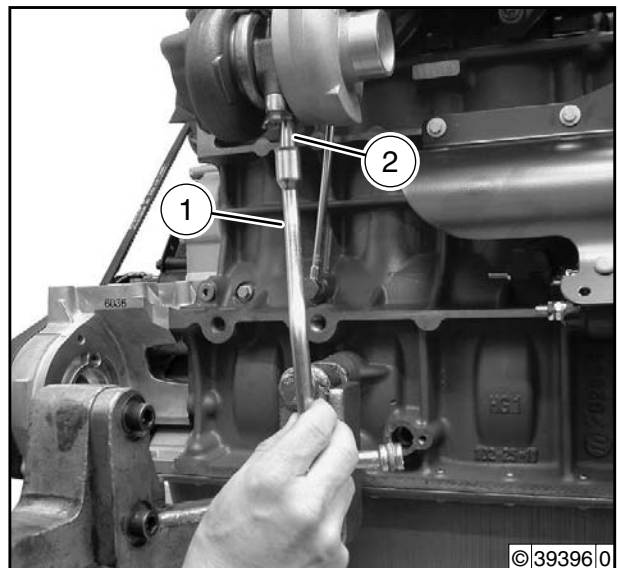


- Push oil return pipe (1) onto oil return pipe flange support (2) and insert in crankcase.

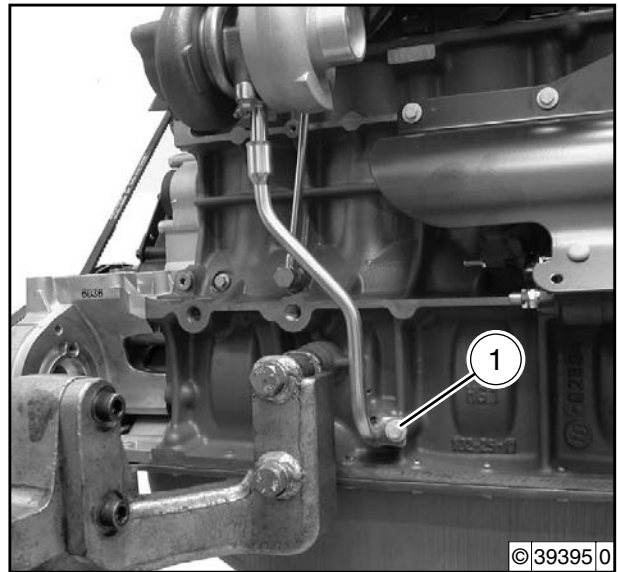


Note

Oil round sealing rings lightly.



- Mount holder and tighten screw (1).

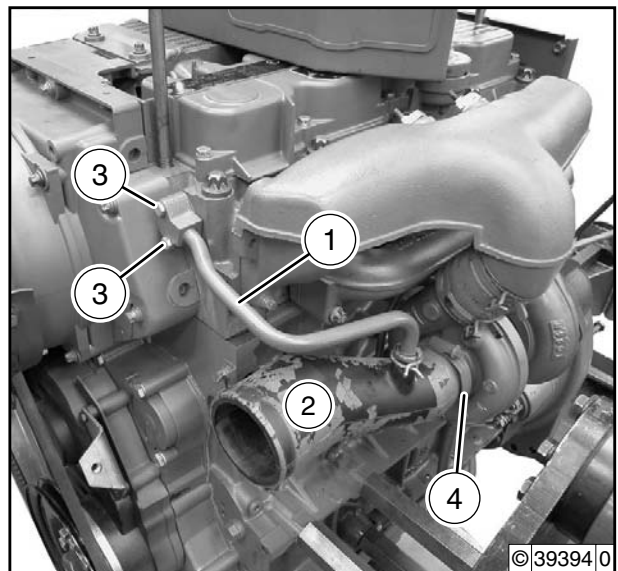


6

- Clean sealing surface on bleed pipe and cylinder head.
- If available, install the bleed pipe (1) and reducer (2).
- Mount reducer with bleed pipe and new gasket, tighten screws (3).



- Fix pipe clip (1).



Remove and install air intake pipe



Tools

- Commercial tools
- 8189 - Torx tool kit

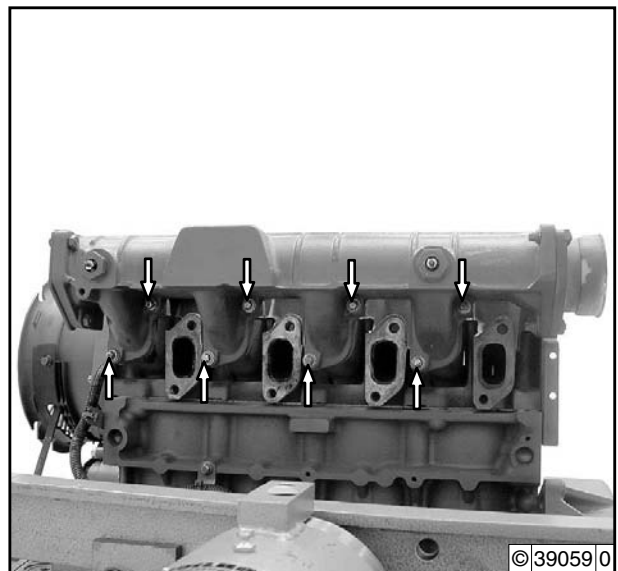


References

- W 06-01-05

Remove air intake pipe

- Remove exhaust manifold
→ Job card **W 06-01-05**.
- Unscrew screws (arrows), remove air intake pipe and gaskets.



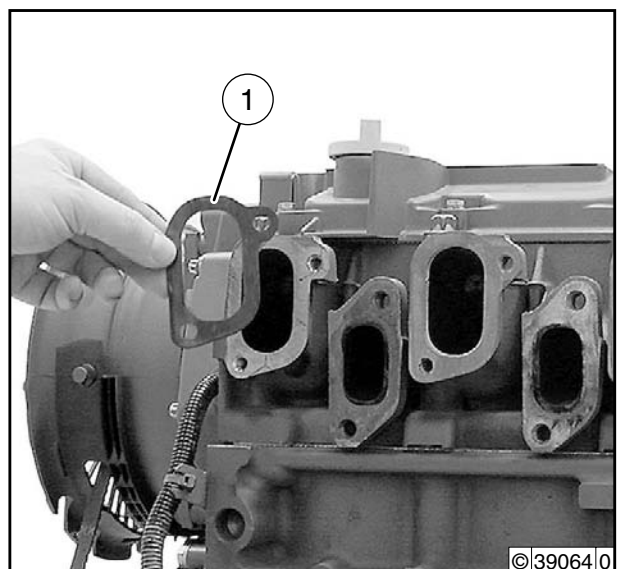
Install air intake pipe

- Clean sealing surfaces on air intake pipe and cylinder head.



Note

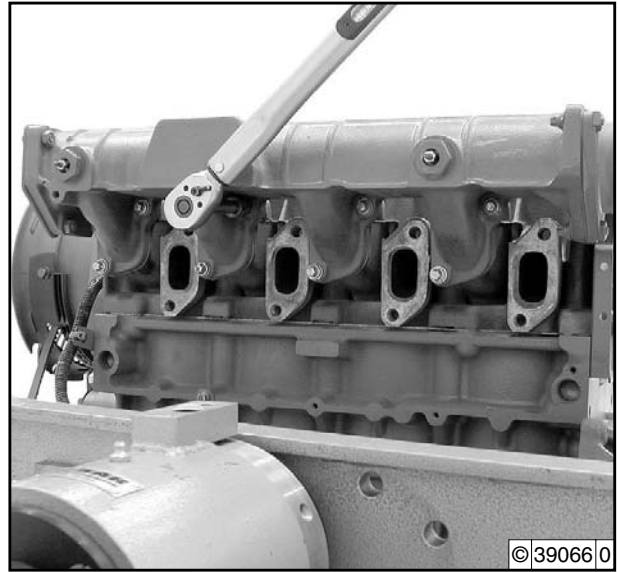
Note installation position of the gaskets (1).



- Mount air intake pipe with new gaskets and tighten screws.
- Tighten screws from the center outwards.



- Install exhaust manifold
→ Job card **W 06-01-05**.



Remove and install control linkage and guide bushes



Tools

- Commercial tools

- Special tools

110 140 - Assembly tool

150 140 - Extraction tool

150 150 - Assembly pin



Auxiliary material

- DEUTZ DW 72



References

- W 03-08-01

- W 03-09-04

- W 07-04-01 (Motorpal)

- W 07-04-01 (Bosch)

- W 07-08-02

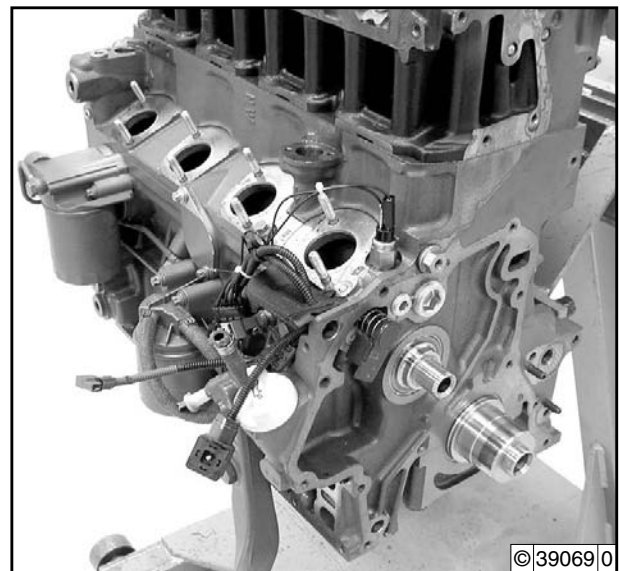
- W 08-11-12

- W 09-11-01

- W 13-02-03

Remove control linkage

- Remove front cover
→ Job card **W 03-08-01**.
- Remove injection pumps
→ Job card **W 07-04-01** (Motorpal)
→ Job card **W 07-04-01** (Bosch)
- Remove connection housing
→ Job card **W 03-09-04**.



In FL, BFL engines

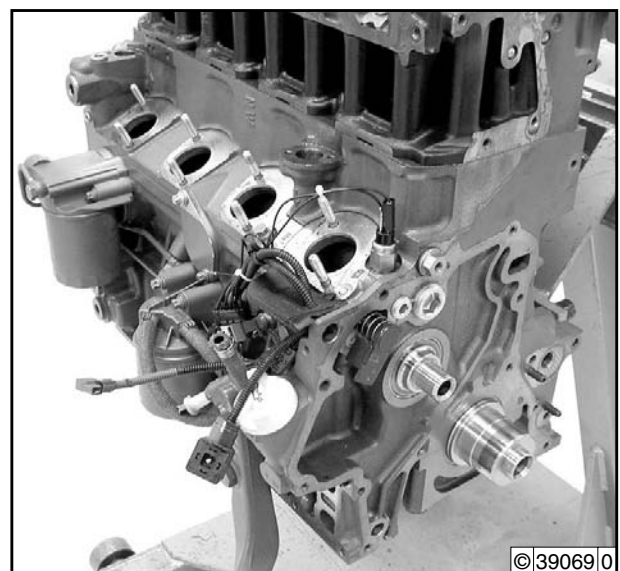
- Remove cooling blower
→ Job card **W 09-11-01**.

In FM, BFM engines

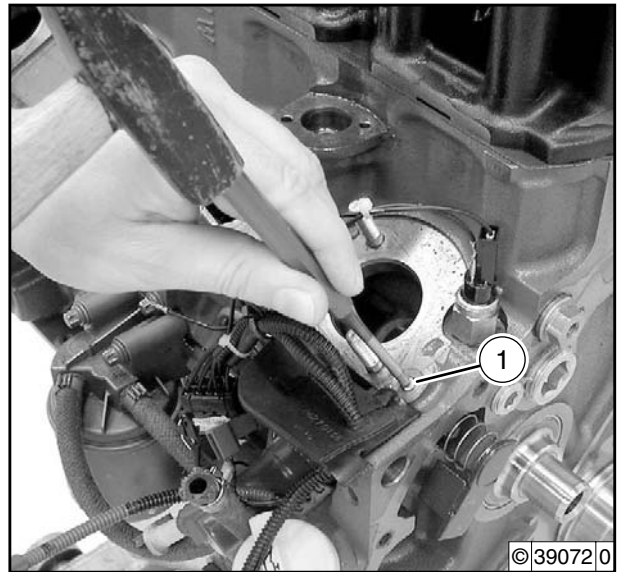
- Remove generator
→ Job card **W 13-02-03**.

In BFL, BFM engines

- Remove charging pressure dependent full load stop
→ Job card **W 07-08-02**.

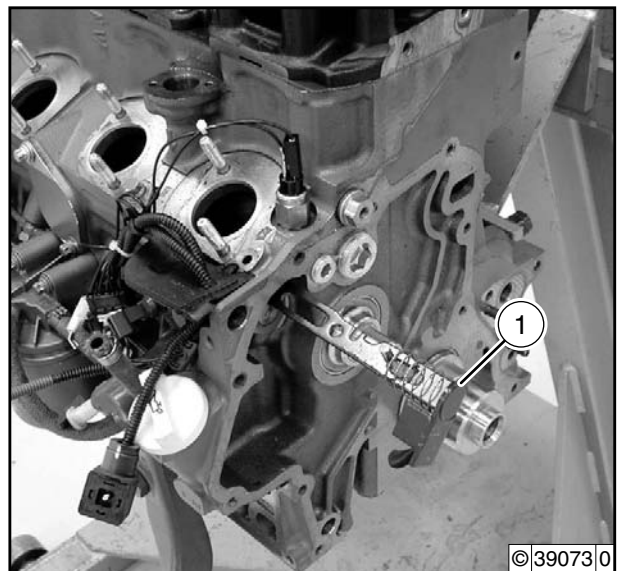


- Knock out cylindrical pin (1).



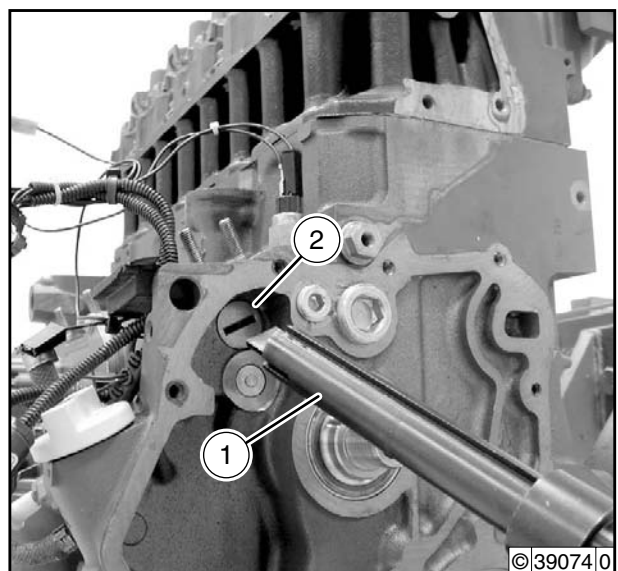
6

- Remove control linkage (1) with spring.

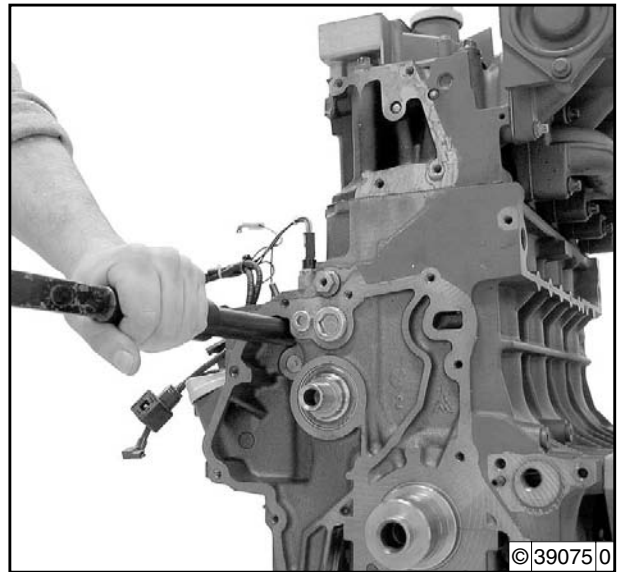


Remove guide bush (opposite side to flywheel)

- Insert assembly pin (1) in guide bush (2).

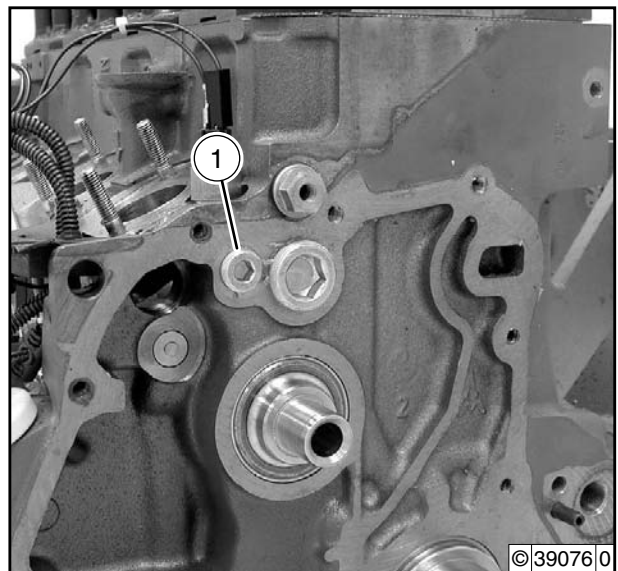


- Knock out guide bush.



Install guide bush (opposite side to flywheel)

- Unscrew locking screw (1).

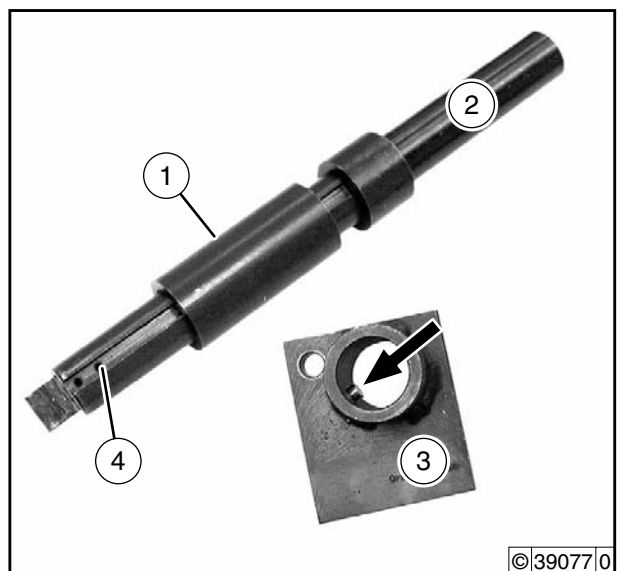


- Push spacer bush (1) onto assembly pin (2).
- Insert assembly pin in the centering (3).



Note

The guide pin (arrow) must engage in the groove (4).

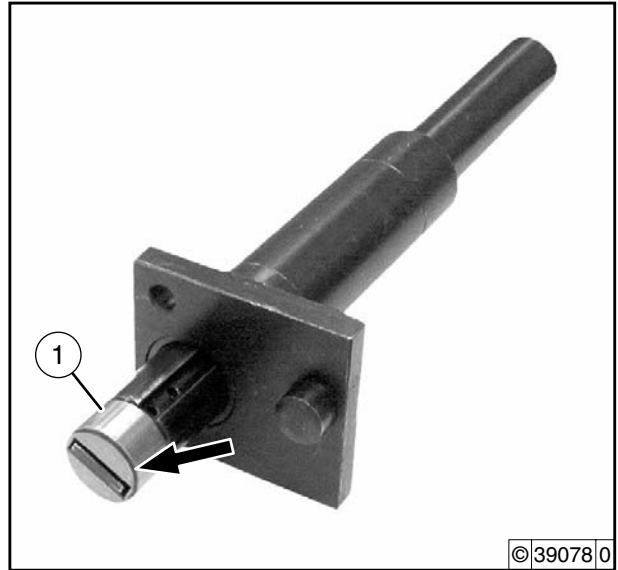


- Push guide bush (1) onto assembly pin.



Note

The chamfer (arrow) must face the crankcase in assembly.



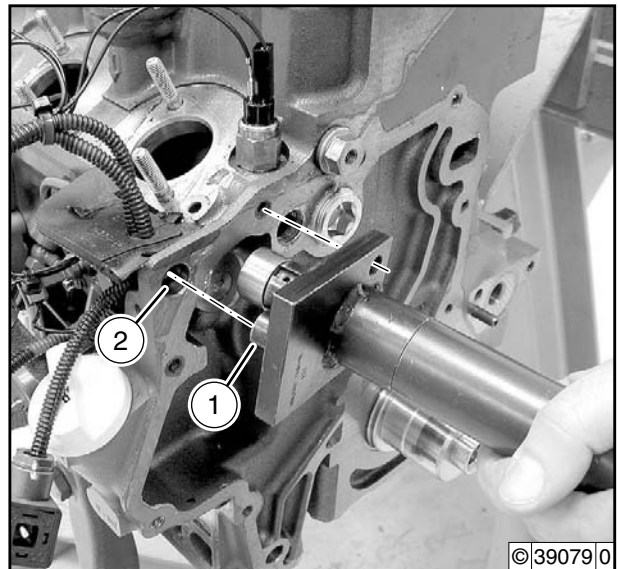
6

- Mount centering on crankcase.

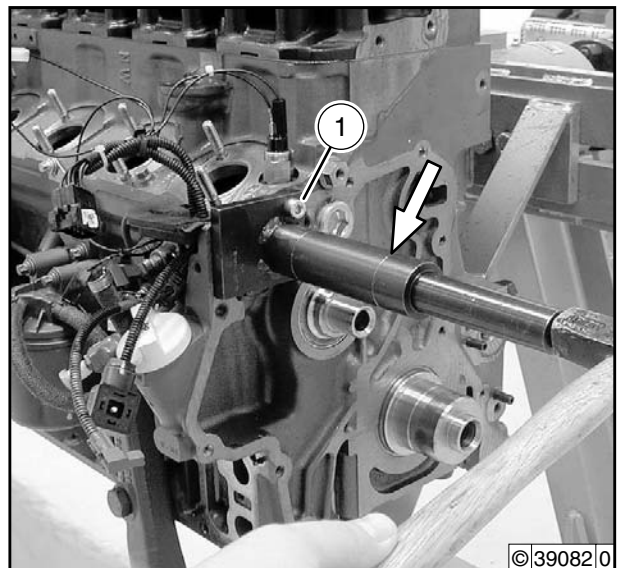


Note

- The crankcase contact surface must be clean.
- The fixing bolt (1) must engage the bore (2).



- Tighten screw (1).
- Knock in the guide sleeve until the assembly pin touches the spacer bush (arrow).
- Remove centering with assembly pin.



- Tighten new locking screw.

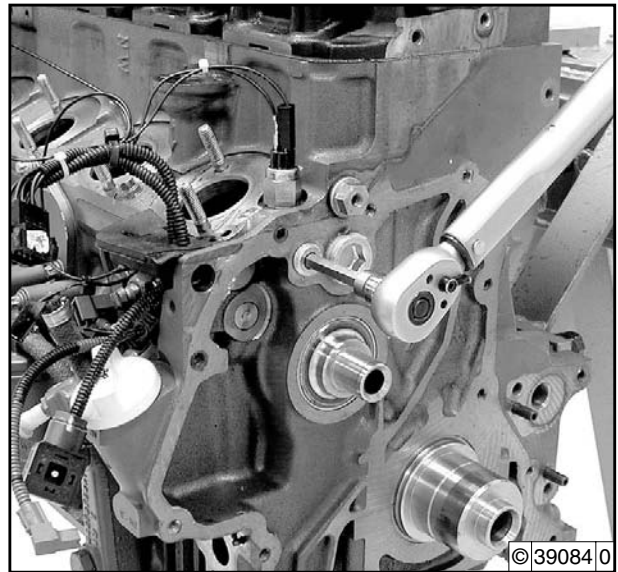


Note

The threaded bore for the locking screw must be free from oil, corrosion and dirt and be dry.

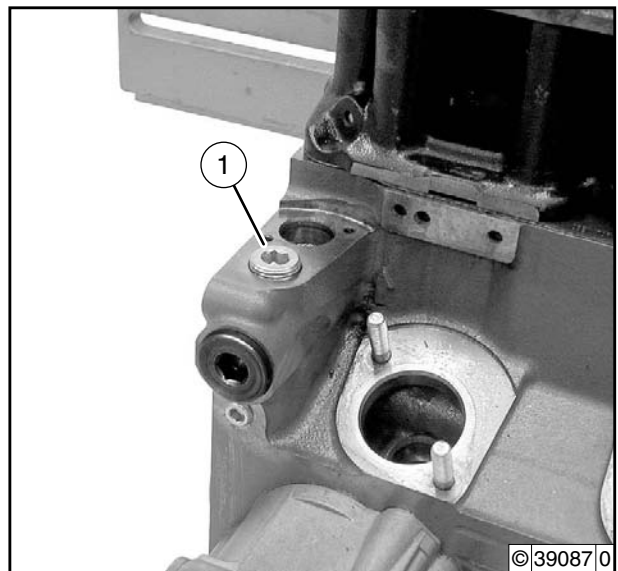


03007

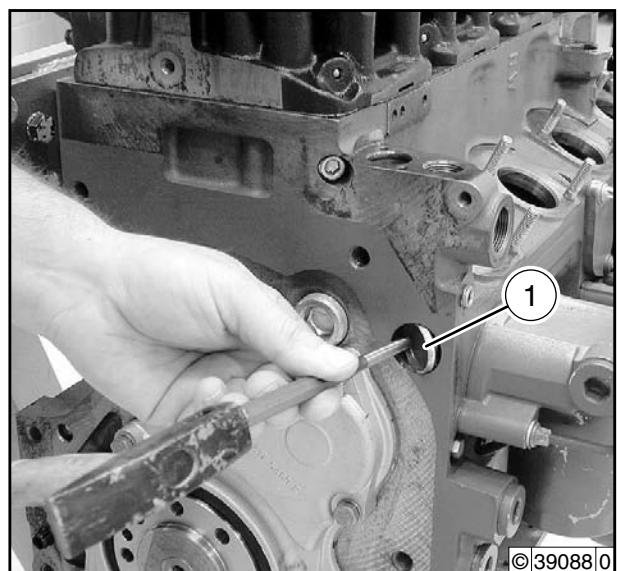


Remove oil rise pipe

- Unscrew locking screw (1).
- Remove oil thermostat
→ Job card **W 08-11-12**.



- Remove cap (1).

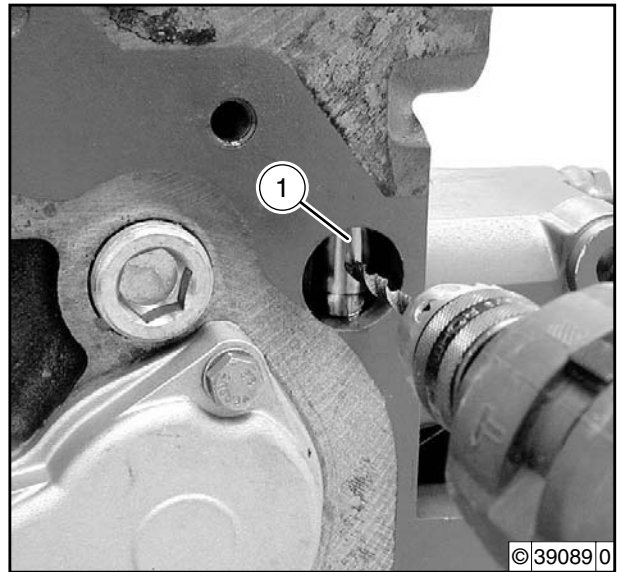


- Drill oil rise pipe (1) with a \varnothing 5.5 mm drill on one side.



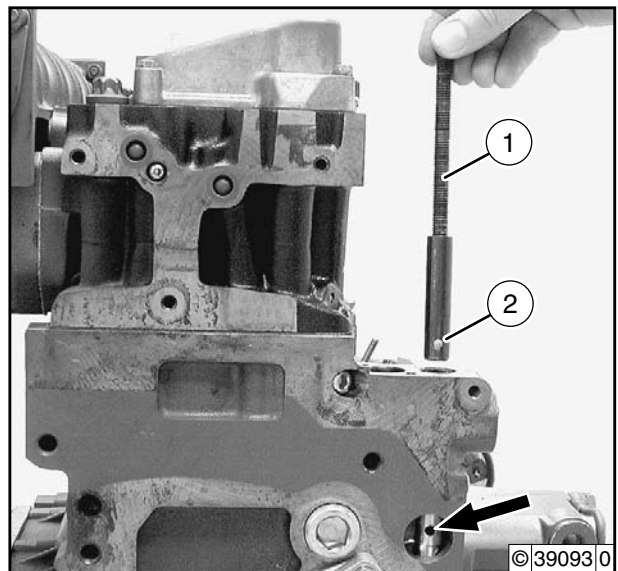
Note

- Coat the drill with grease so that no drill chips fall into the crankcase.
- Remove all drill chips.

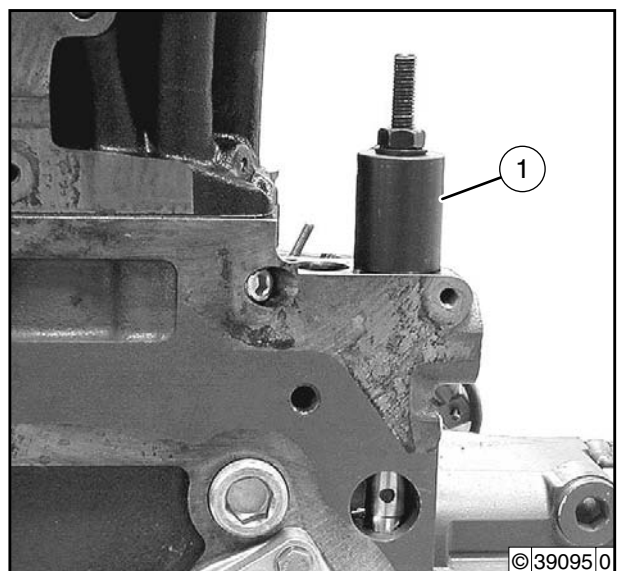


6

- Insert extraction tool (1) in the oil rise pipe until the bolt (2) snaps into the bore (arrow).



- Mount spacer bush (1) and disc, tighten nut.

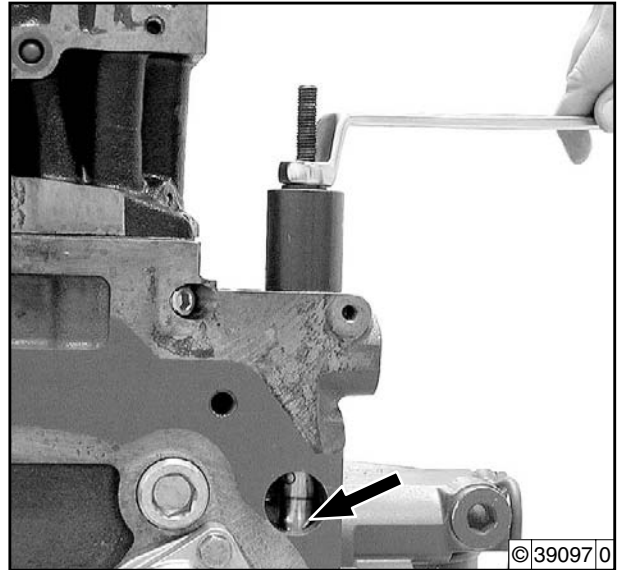


- Pull the oil rise pipe out of the lower press fit (arrow).

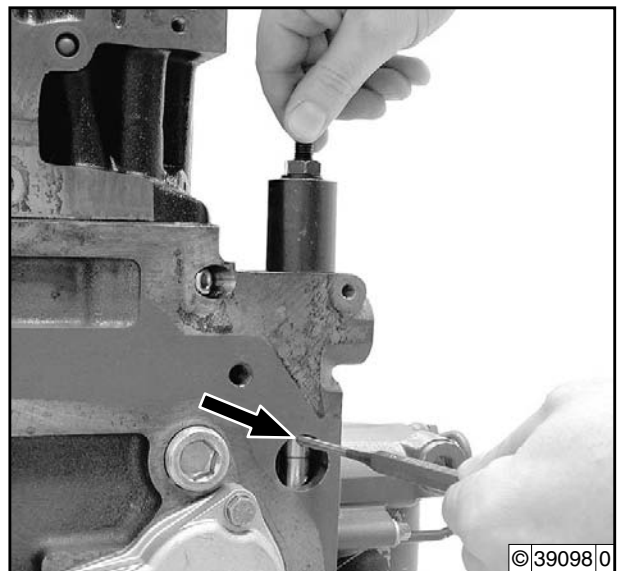


Note

Do not pull out the oil rise pipe completely.

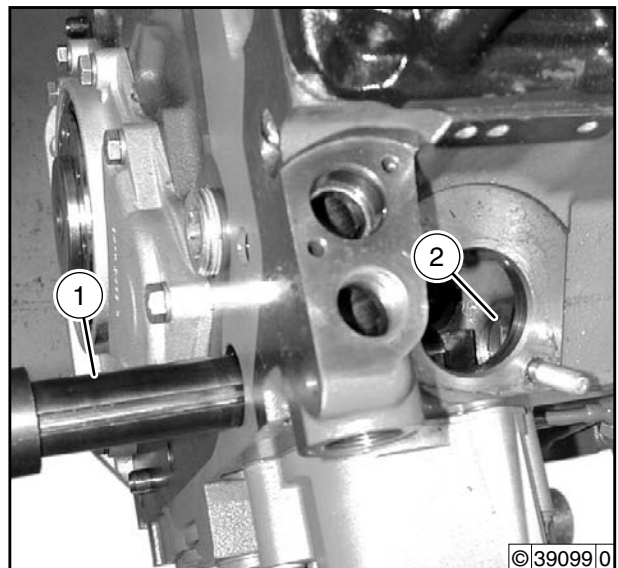


- Press in bolt (arrow) and remove oil rise pipe.



Remove guide bush (flywheel side)

- Insert assembly pin (1) in guide bush (2).



- Knock out guide bush.



6

Install guide bush (flywheel side)

- Insert assembly pin (1) in centering (2).



Note

The guide pin (arrow) must engage in the groove (3).

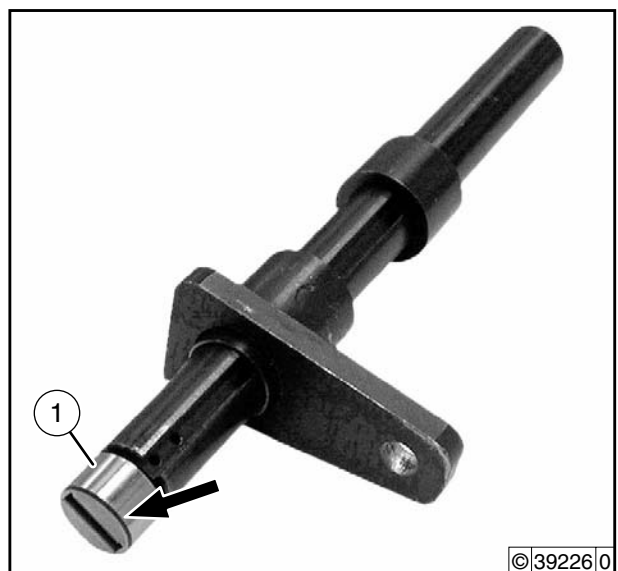


- Push guide bush (1) onto assembly pin.



Note

The chamfer (arrow) must face the crankcase in assembly.

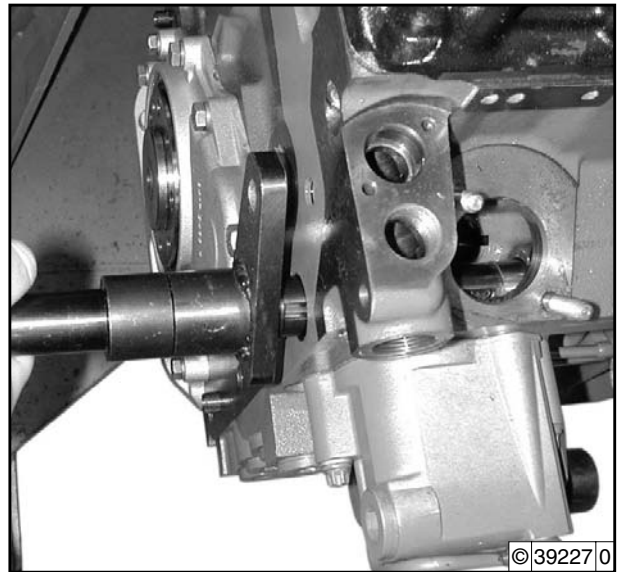


- Insert assembly pin with guide bush.

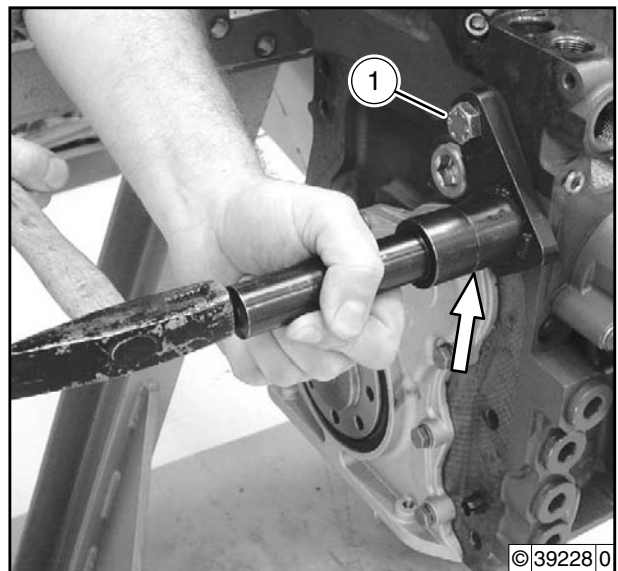


Note

The crankcase contact surface must be clean.



- Mount centering on crankcase and tighten screw (1).
- Knock in the guide sleeve until the assembly pin touches the centering (arrow).
- Remove centering with assembly pin.



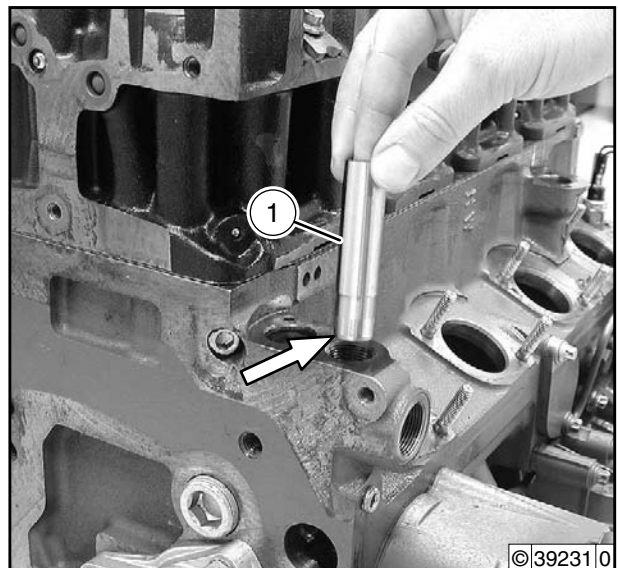
Install oil rise pipe

- Insert new oil rise pipe (1).

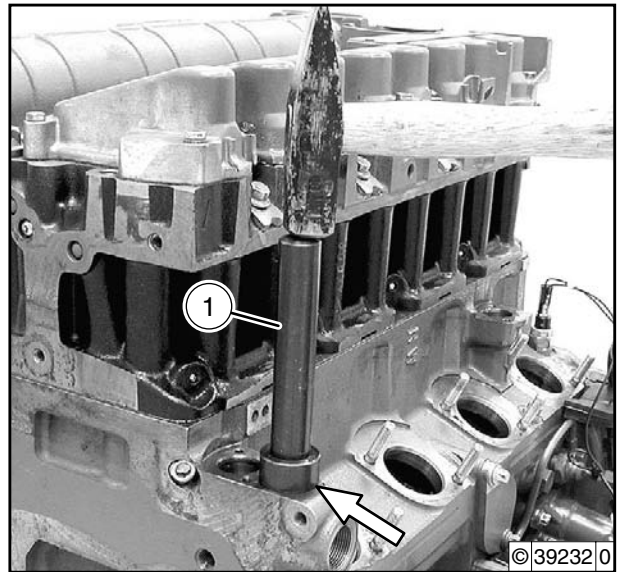


Note

The chamfer (arrow) must face the crankcase in assembly.

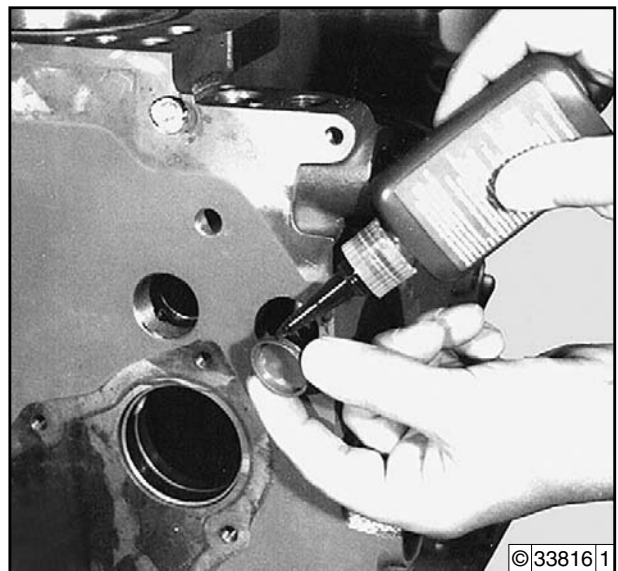


- Knock in the oil rise pipe until the assembly pin (1) touches the crankcase (arrow).

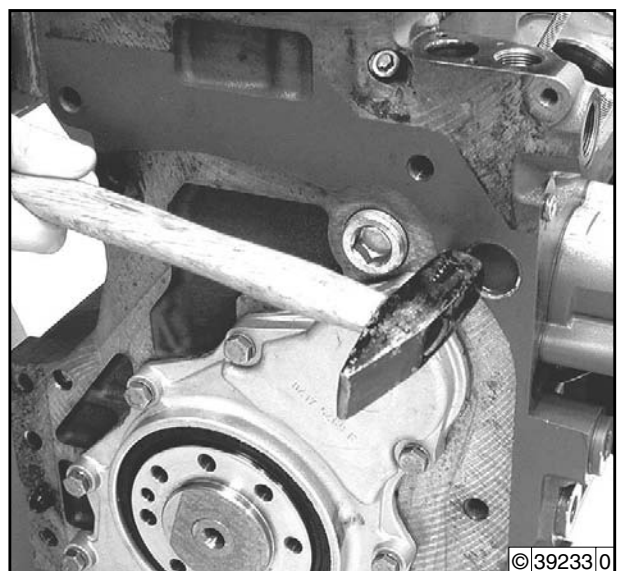


6

- Coat new cap with **DEUTZ DW 72** locking agent.



- Knock in cap flush with crankcase.
- Install oil thermostat
→ Job card **W 08-11-12**.

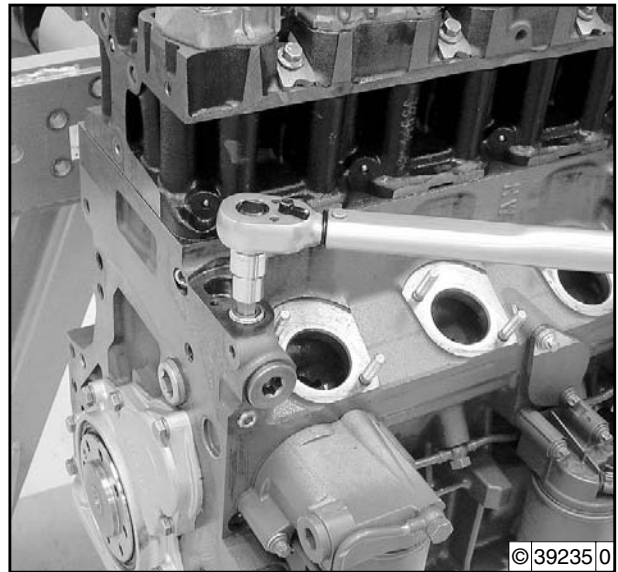


- Tighten new locking screw.



Note

The threaded bore for the locking screw must be free from oil, corrosion and dirt and be dry.



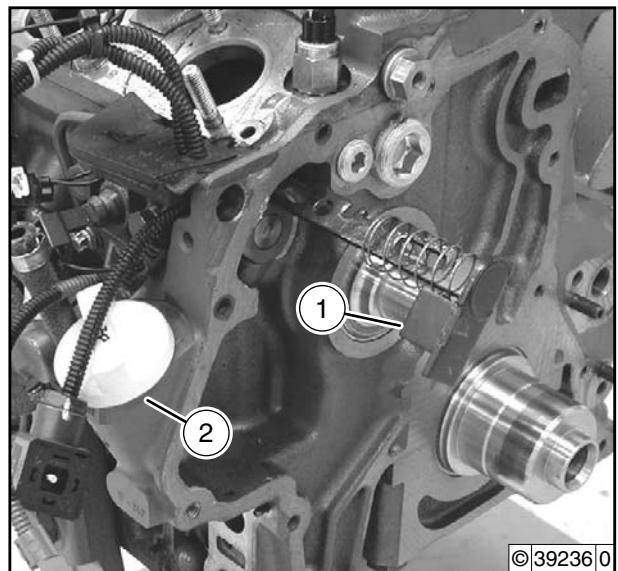
Install control linkage

- Insert control linkage with spring in the guide bushes.



Note

- Note installation position, the latch (1) must face the oil filling nozzle (2).
- Pay attention to easy action of the control linkage.

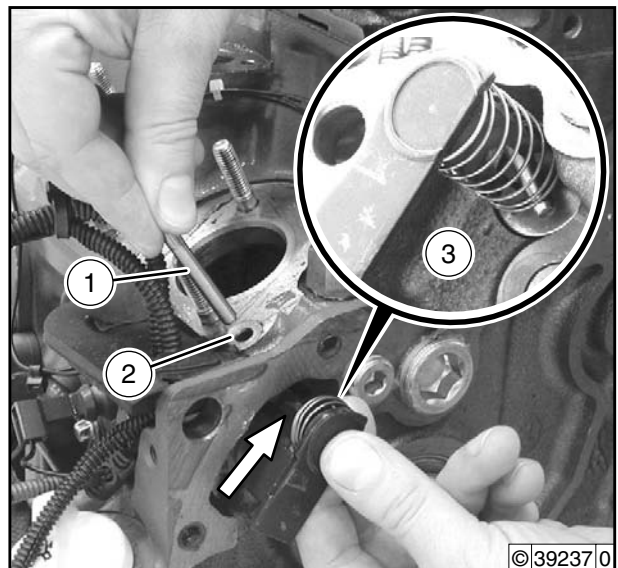


- Press together spring and insert cylindrical pin (1) in the bore (2).



Note

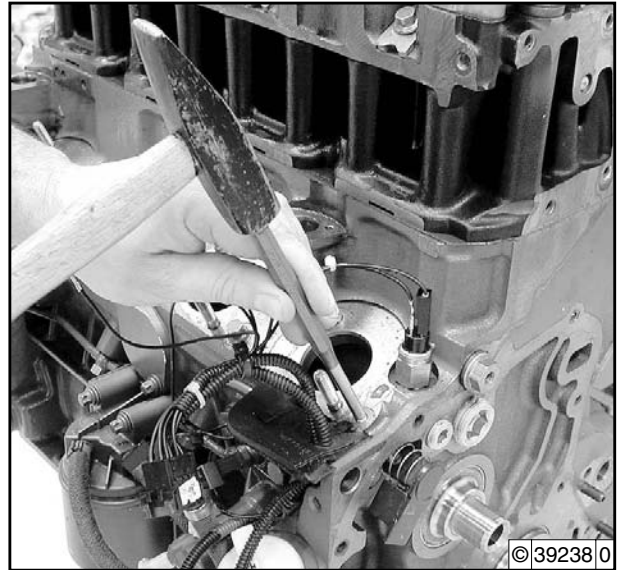
- The cylindrical pin must engage in the recess (arrow) for the control path limit.
- Make sure that the spring touches the cylindrical pin (3).



- Drive in the cylindrical pin flush with the crankcase.
- Install connection housing
→ Job card **W 03-09-04**.
- Install front cover
→ Job card **W 03-08-01**.
- Install injection pumps.
→ Job card **W 07-04-01** (Motorpal)
→ Job card **W 07-04-01** (Bosch)

In BFL, BFM engines

- Install charging pressure dependent full load stop
→ Job card **W 07-08-02**.



In FM, BFM engines

- Install generator
→ Job card **W 13-02-03**.

In FL, BFL engines

- Install cooling blower
→ Job card **W 09-11-01**.

Remove and install lifting magnet for start volume release

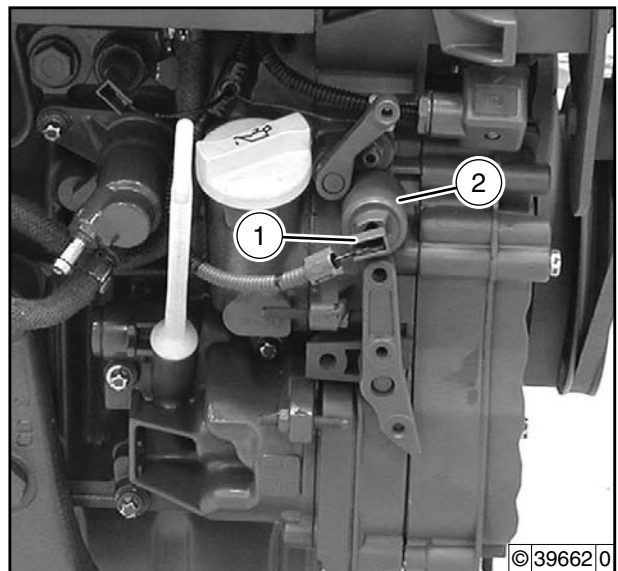


Tools

- Commercial tools
8027 - Pliers insert

Remove lifting magnet for start volume release

- Pull cable plug (1) out of lifting magnet (2).



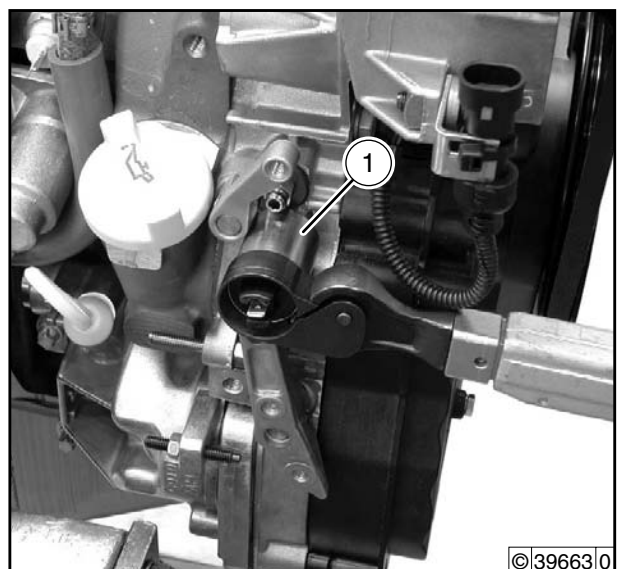
- Unscrew lifting magnet (1) with pliers insert and remove sealing ring.



Note

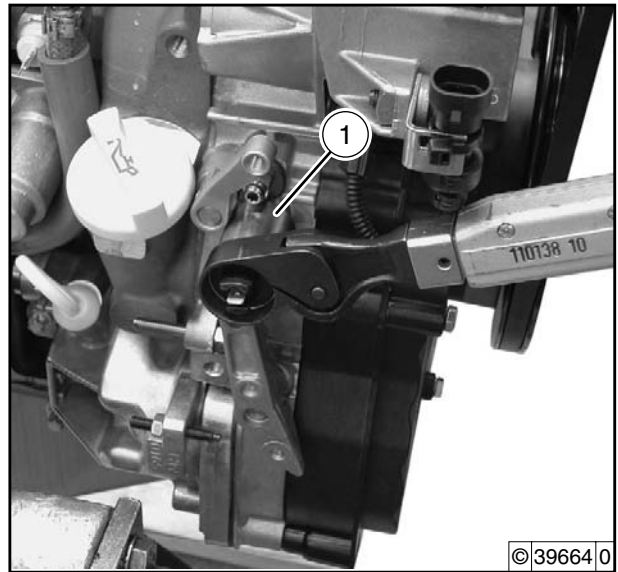
Note clamping direction of the pliers insert.

- Check components for visible signs of damage.



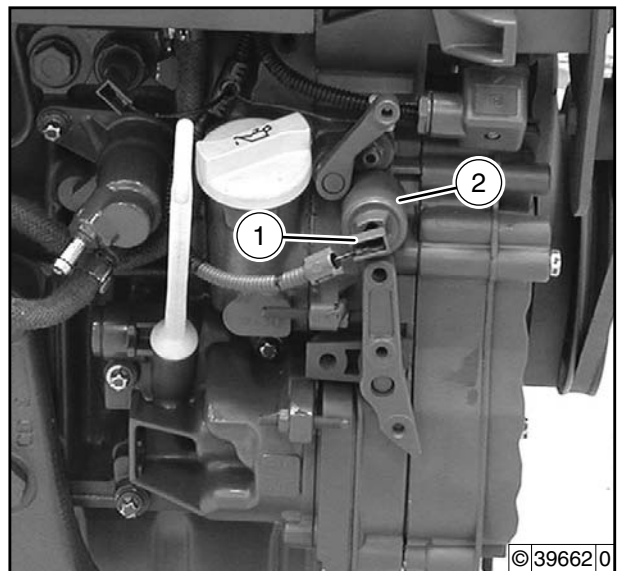
Install lifting magnet for start volume release

- Mount lifting magnet (1) with new CU sealing ring and tighten with pliers insert.



6

- Pull cable plug (1) out of lifting magnet (2).



Renew injection lines



Tools

- Commercial tools
- 8018 - Claw wrench
- 8189 - Torx tool kit



References

- W 08-08-02



Caution!

Observe the safety regulations and national specifications for handling fuels.



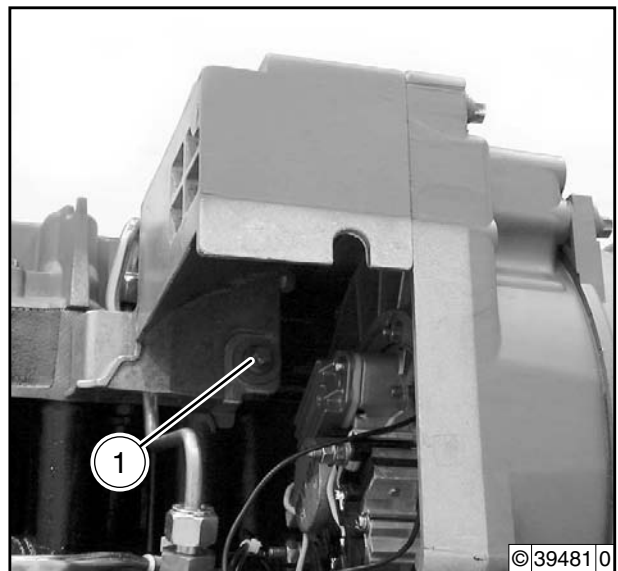
Note

- Cleanliness is extremely important when working on the injection equipment.
- Bending the injection lines is not permissible.
- Small tears may occur which lead to a reduction in the fatigue strength.
- Collect drained operating materials in suitable vessels and dispose of according to regulations.

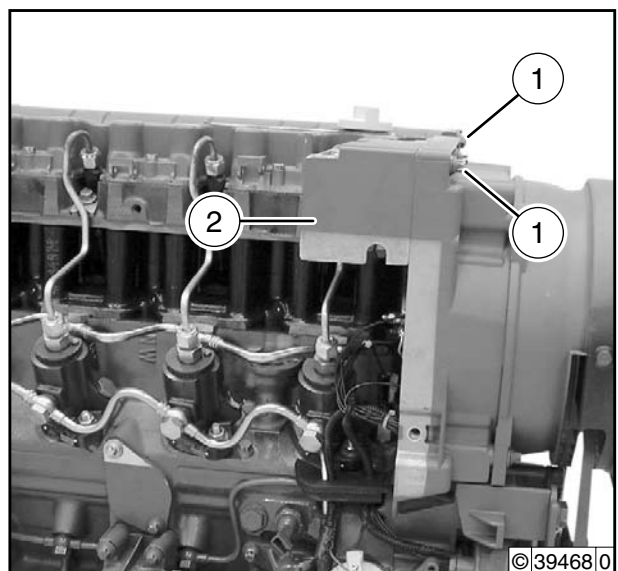
Remove injection lines

In FL, BFL engines

- Remove oil cooler
→ Job card W 08-08-02.
- Unscrew screw (1).



- Unscrew screws (1) and remove air feed (2).

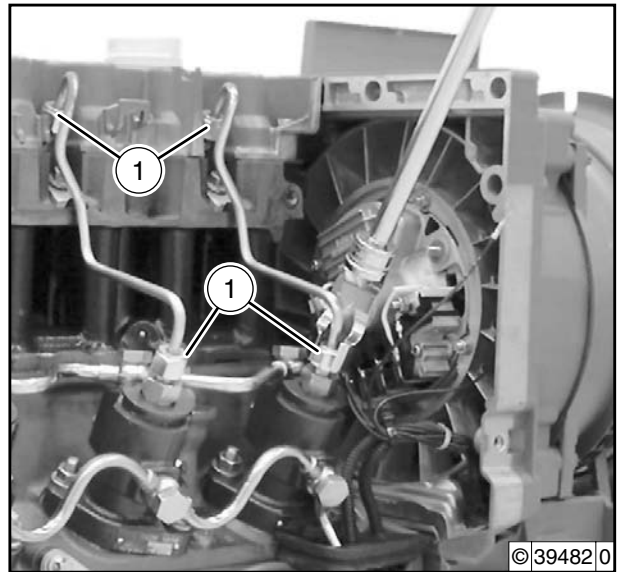


- Unscrew union nuts (1) from injection valve and injection pump with claw wrench.
- Remove injection line.



Note

- Put down the components in the order of installation, note order of cylinders.
- Seal openings on the injection valve and the injection pump.



6

Install injection lines

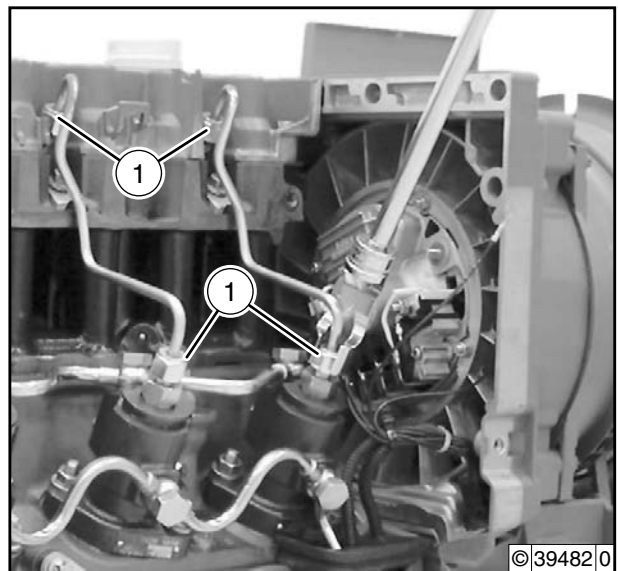
- Mount injection line on injection pump and injection valves and tighten union nuts (1).



Note

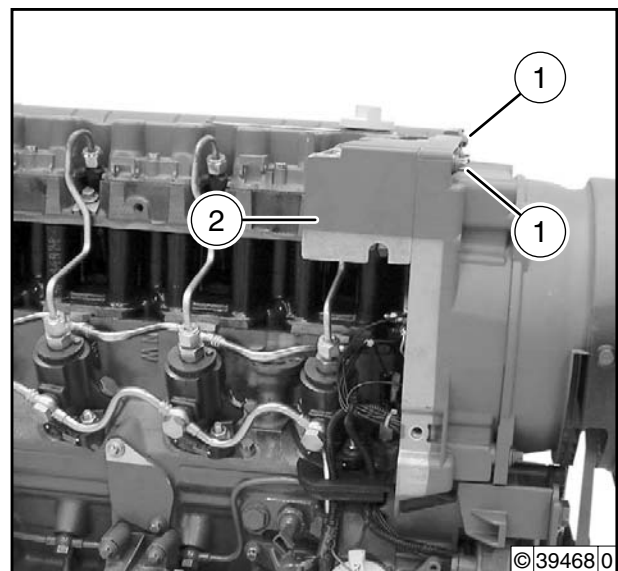
Mount the injection lines without tension.

- Tighten the union nuts of the injection line on the injection pump and injection valve.

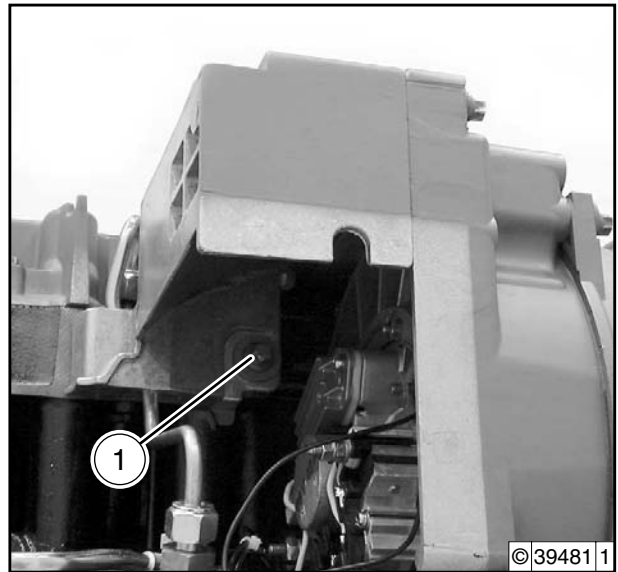


In FL, BFL engines

- Mount air feed (2) and tighten screws (1).



- Tighten screw (1).



- Pre-tighten screw (1) on cylinder head.



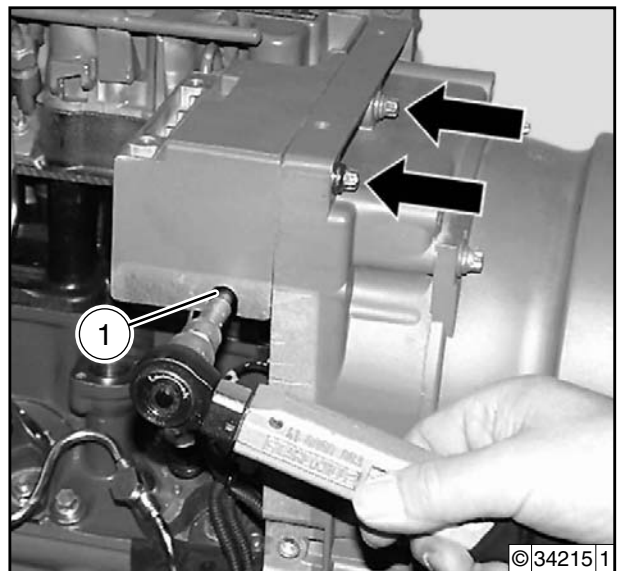
- Tighten screws (arrows).



- Tighten screw (1) on cylinder head.



- Install oil cooler
→ Job card **W 08-08-02**.





Notes

Remove and install injection pumps (Bosch)



Tools

- **Commercial tools**
Depth-measuring appliance

- Special tools

100.710 - Setting bolt
100 880 - Marking pin
103 030 - Test template



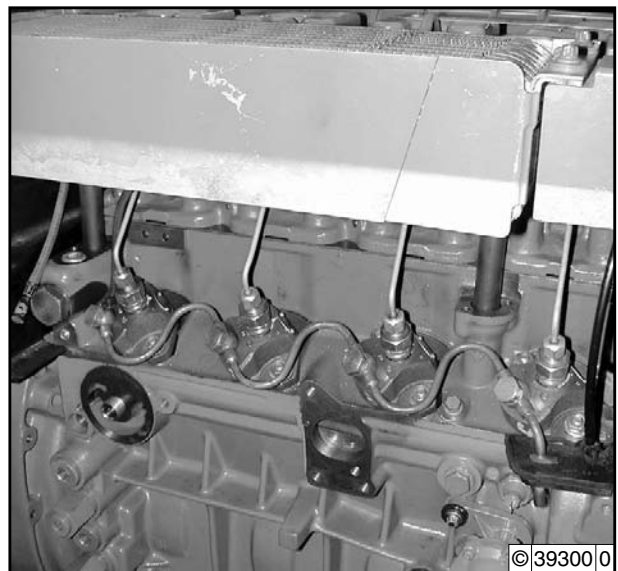
References

- W 07-03-01
- W 07-06-04
- W 07-10-06



Note

Distinguishing features for the Bosch injection pump:
- Short pump housing.



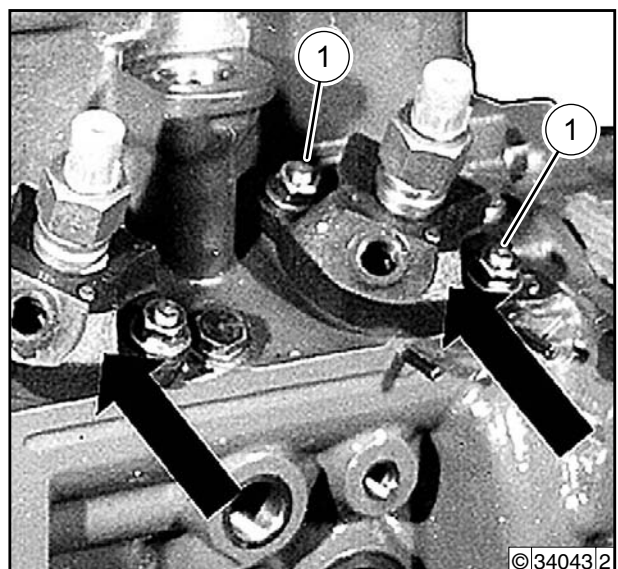
Remove injection pump

- Remove injection lines
→ Job card **W 07-03-01**.
- Remove fuel supply line
→ Job card **W 07-10-06**.
- Unscrew nuts (1), remove injection pump (arrows) and compensation gaskets.



Note

- Loosen nuts evenly to avoid jamming the injection pump.
- Put down the components in the order of installation, note order of cylinders.

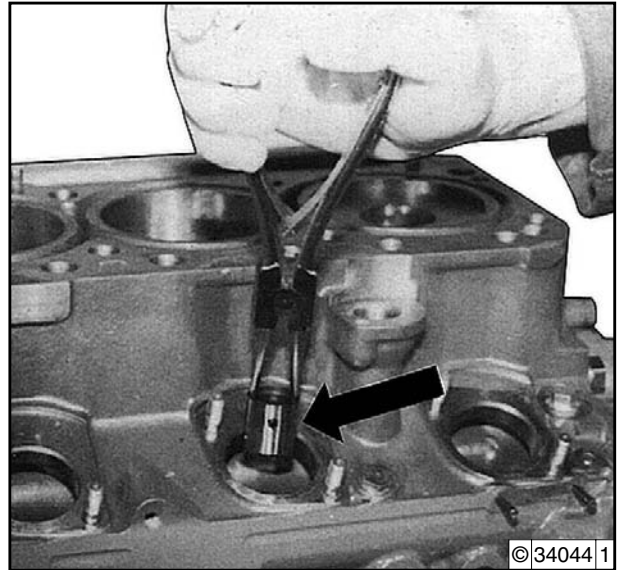


- Pull out roller tappet (arrow) using a suitable tool, e.g. outside locking pliers.



Note

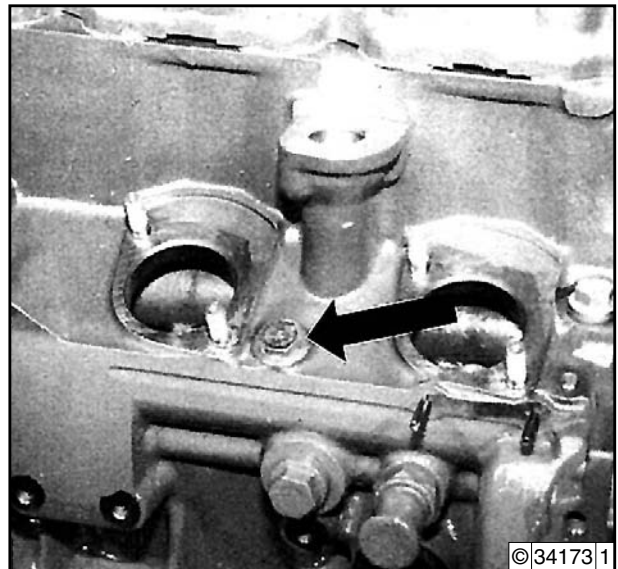
- Put down the components in the order of installation, note order of cylinders.
- Do not damage the roller tappet.



6

Install the injection pump

- Unscrew cap (arrow) and remove sealing ring.



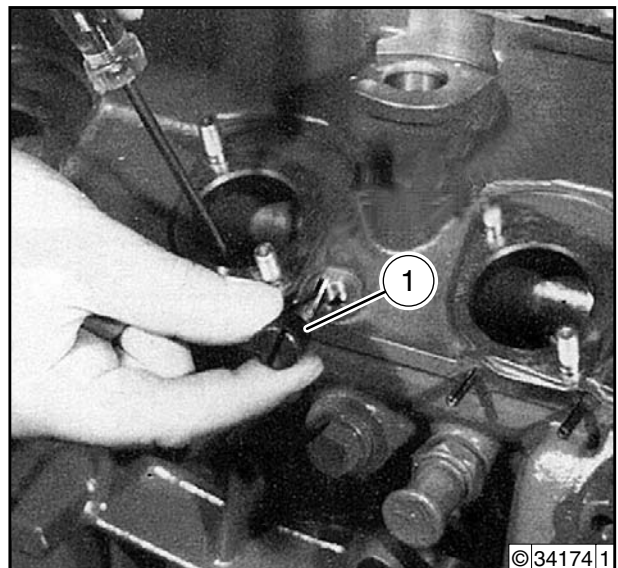
- Move control linkage to mid position.



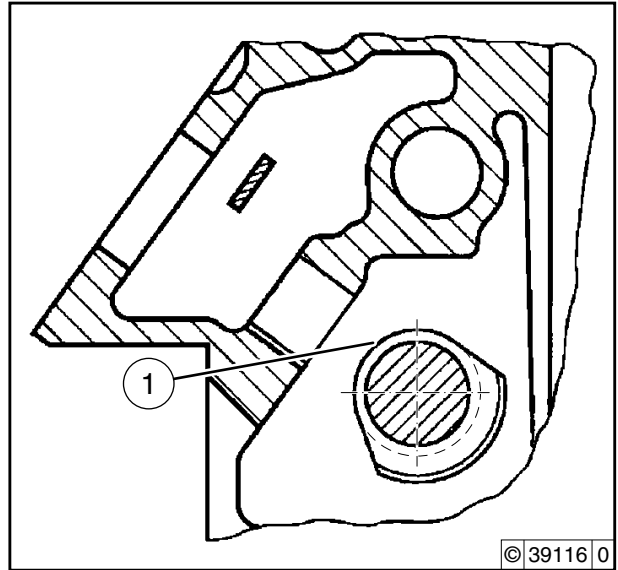
Note

Ignition off / stop magnet free.

- Turn in setting bolt (1) to stop.



- Turn crankshaft until the cam for the respective injection pump is standing on the cam basic circuit (1).

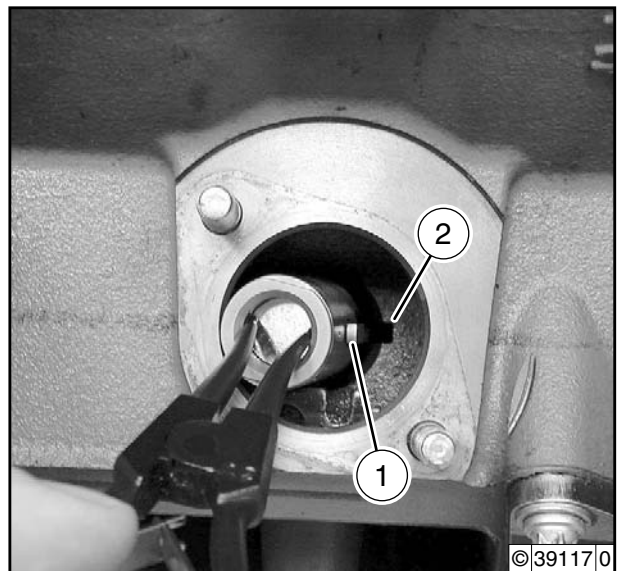


- Oil lightly and insert the roller tappet.



Note

- Note the assignment of the roller tappet.
- The guide pin (1) on the roller tappet must engage in the groove (2).

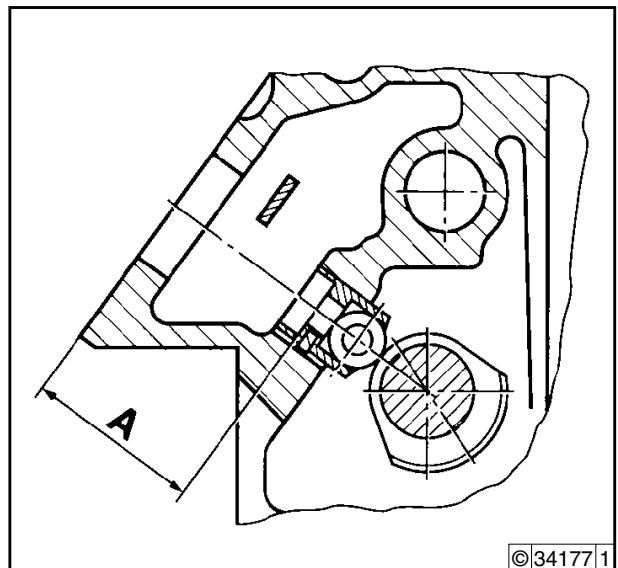


Determination of the compensation gasket



Note

- Schematic representation for determining the depth "A".



Determine depth dimension

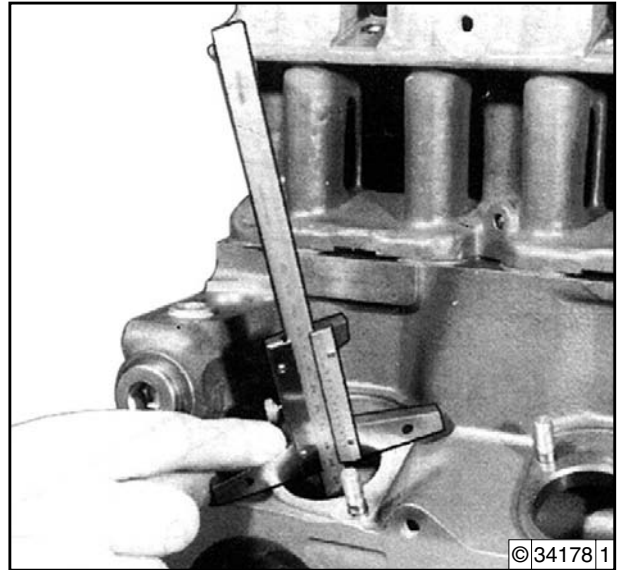
- Measure depth dimension "A" from the crankcase rest to the spring head rest of the roller tappet.



Note

The crankcase rest must be clean.

- Read and note measured value.



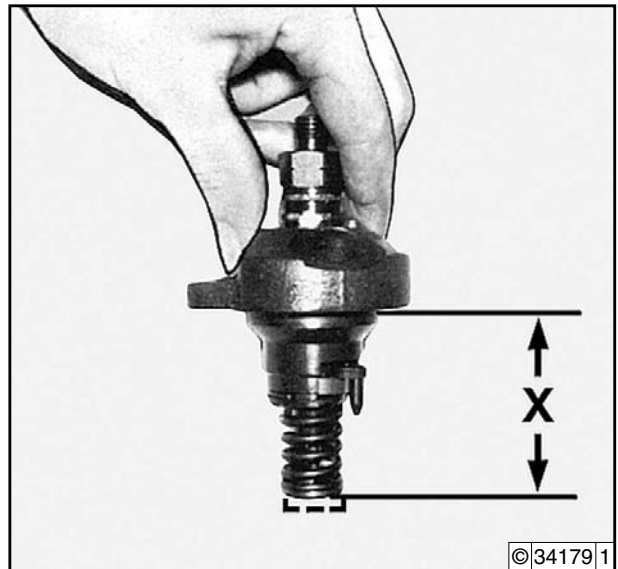
6

- Read and note installation dimension "X" from the rating plate of the respective injection pump.



Note

The installation dimension "X" serves exclusively to calculate the compensation gasket. Do not measure on the disassembled injection pump.

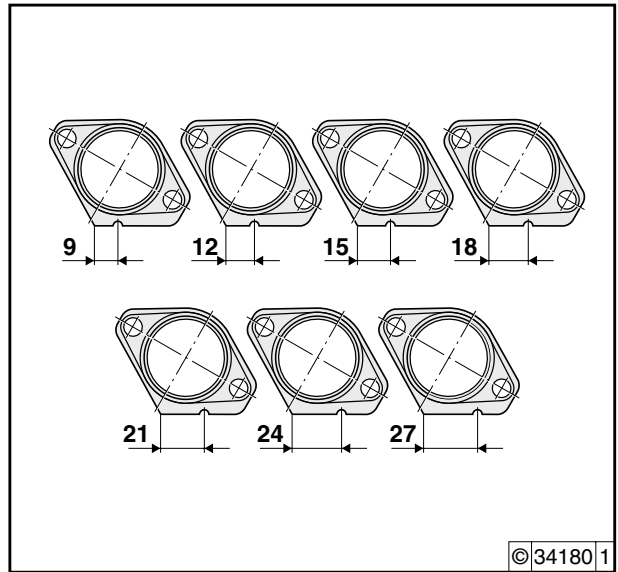


- Determine difference between installation dimension "X" and depth dimension "A".

Example:

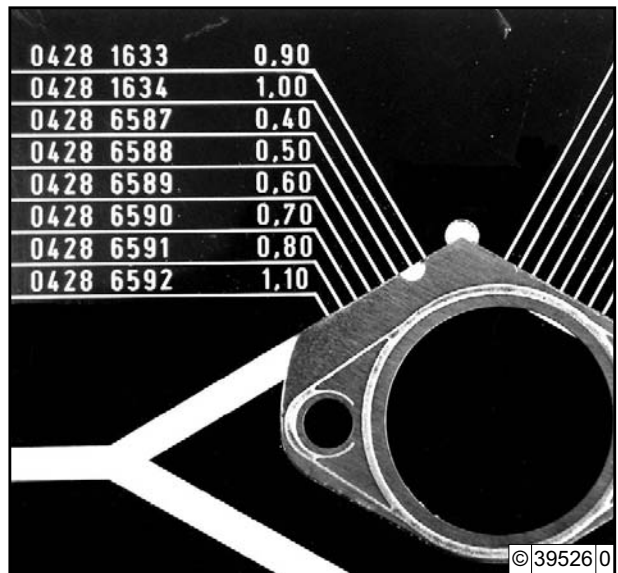
Installation dimension "X"	60.00 mm
Depth dimension "A"	59.35 mm
Difference	0.65 mm

- Select compensation gasket according to table.



Note

Since the part number and the gasket thickness are not specified on the compensation gasket, the gasket thickness can be checked with the test template.



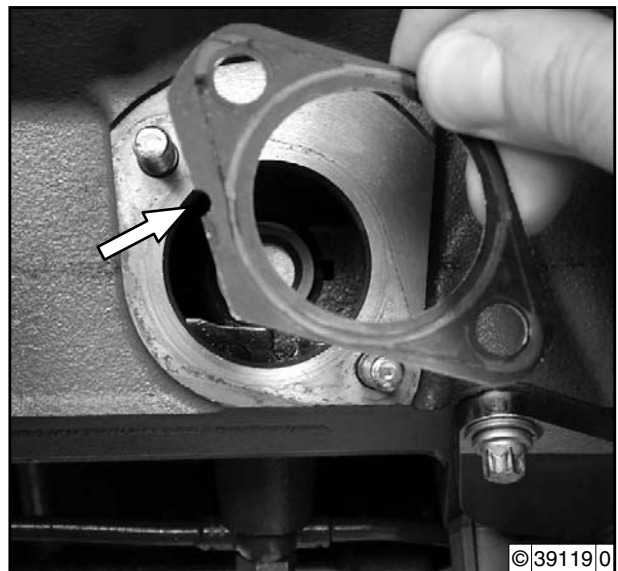
6

- Mount the appropriate compensation gasket.



Note

Note installation position, the recess (arrow) must face the flywheel.

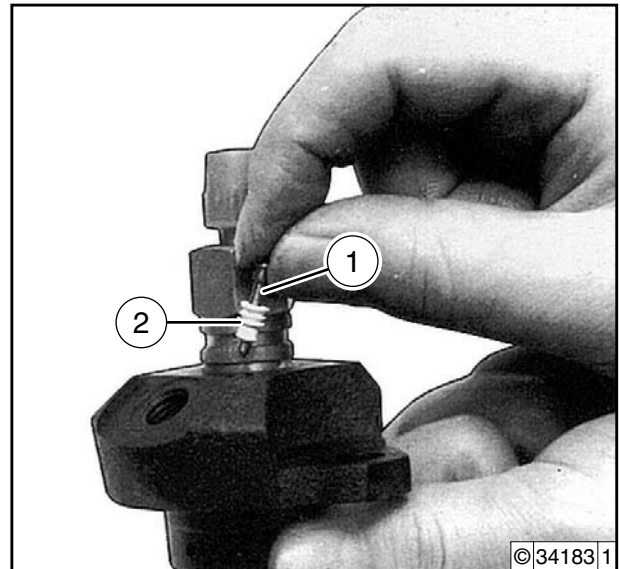


- Pull out locking pin (1).



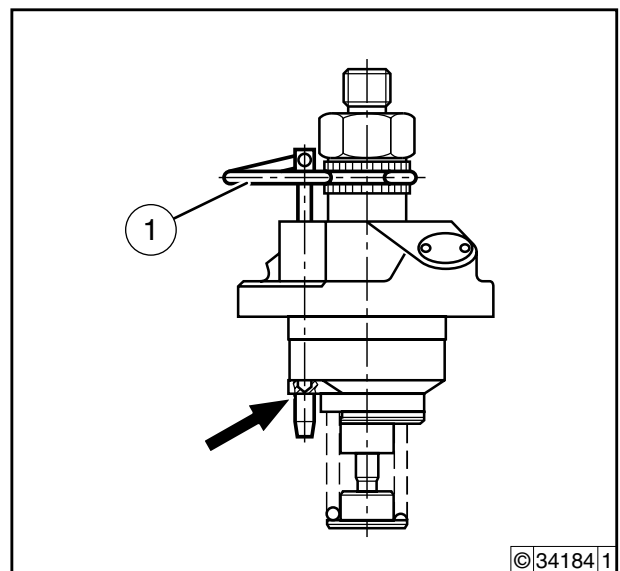
Note

Remove the gasket (2) together with the locking pin.

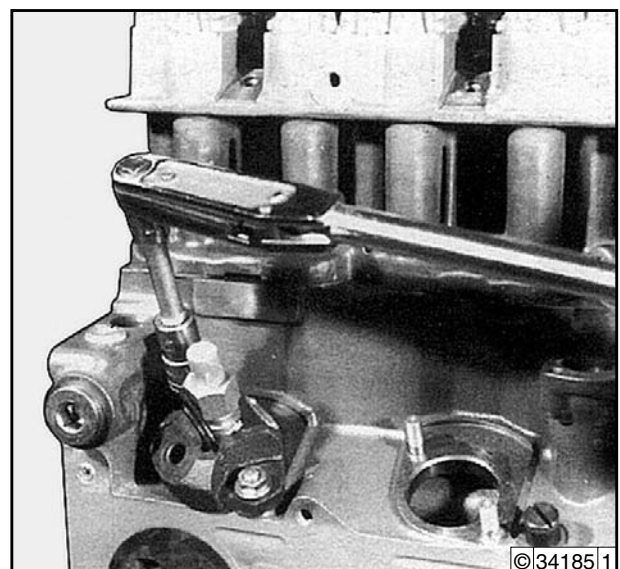


6

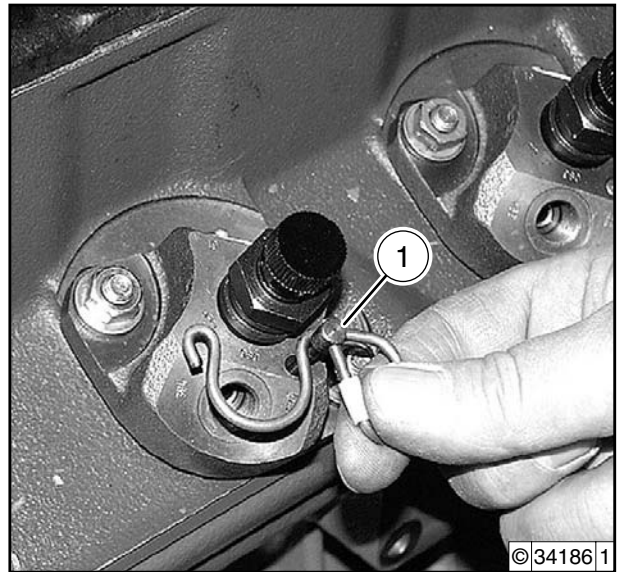
- Insert the marking pin (1) in the bore of the injection pump and snap into the deflection lever (arrow).
- Clamp the bracket of the marking pin.



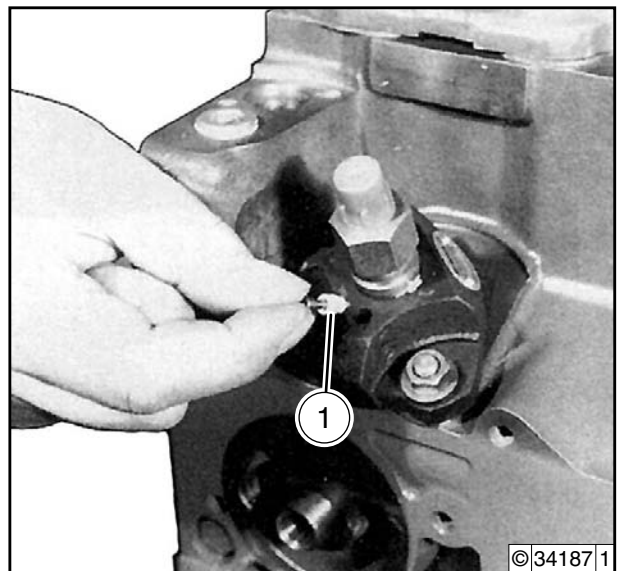
- Insert the injection pump centrally to the long holes.
- Press in injection pump to stop and tighten nuts.
- Tighten nuts.



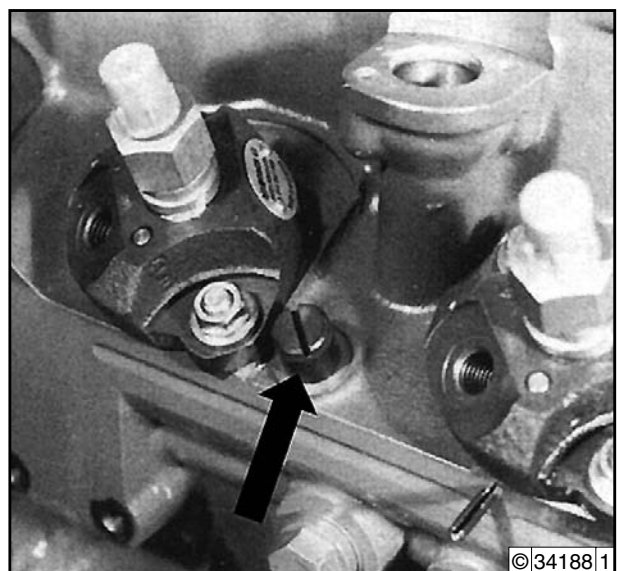
- Loosen clamping bracket and pull out marking pin (1).



- Press in locking pin (1) with gasket to stop.



- Unscrew setting bolt (arrow).



- Tighten cap with new CU sealing ring.



- Check beginning of pumping if necessary
→ Job card **W 07-06-04**.
- Install fuel supply line
→ Job card **W 07-10-06**.
- Install injection lines
→ Job card **W 07-03-01**.



Remove and install injection pumps (Motorpal)



Tools

- Commercial tools
- Special tools
 - 100 710 - Setting bolt
 - 103 030 - Test template
 - 101 100 - Marking pin



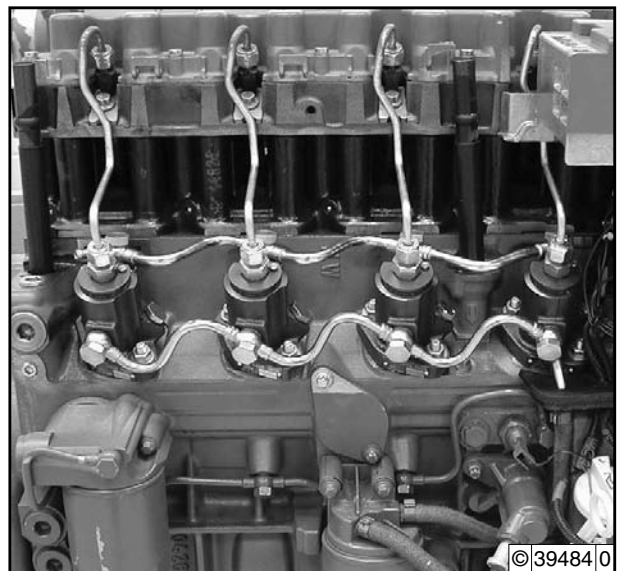
References

- W 07-03-01
- W 07-06-03
- W 07-06-04
- W 07-10-06



Note

- Distinguishing features for the Motorpal injection pump:
- Long injection pump housing.
 - Overflow line on the injection pump.



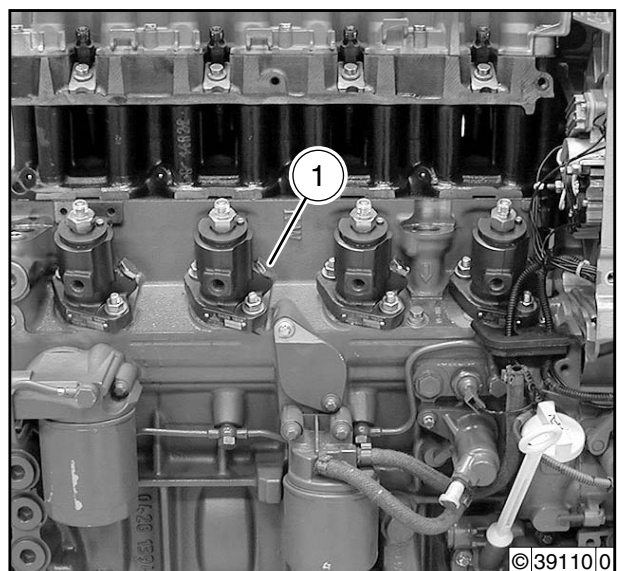
Remove injection pump

- Remove injection lines
→ Job card **W 07-03-01**.
- Remove fuel lines
→ Job card **W 07-10-06**.
- Loosen locking screw (1).



Note

- The locking screw must be unscrewed for later locking of the injection pump.

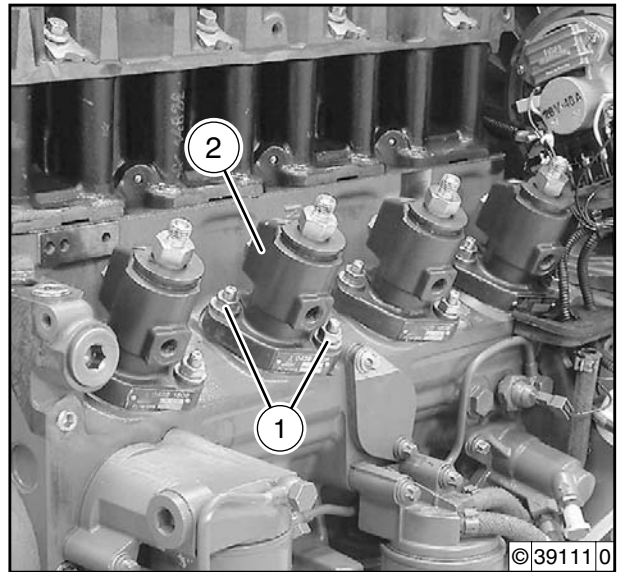


- Unscrew nuts (1), remove injection pump (2) and compensation gaskets.



Note

- Loosen nuts evenly to avoid jamming the injection pump.
- Put down the components in the order of installation, note order of cylinders.



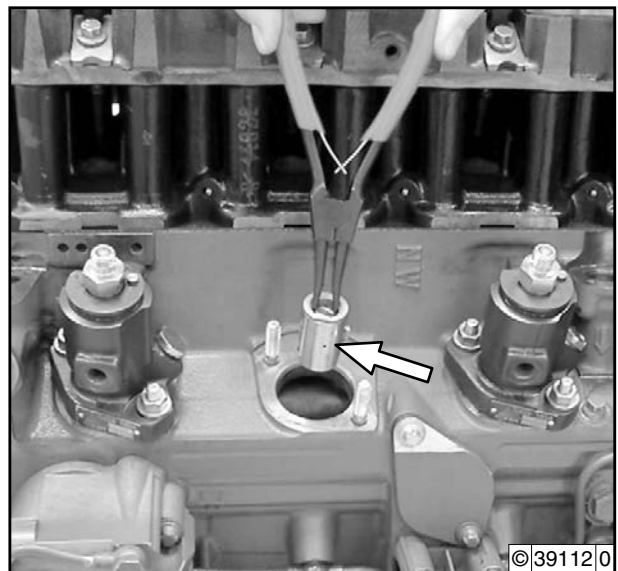
6

- Pull out roller tappet (arrow) using a suitable tool, e.g. outside locking pliers.

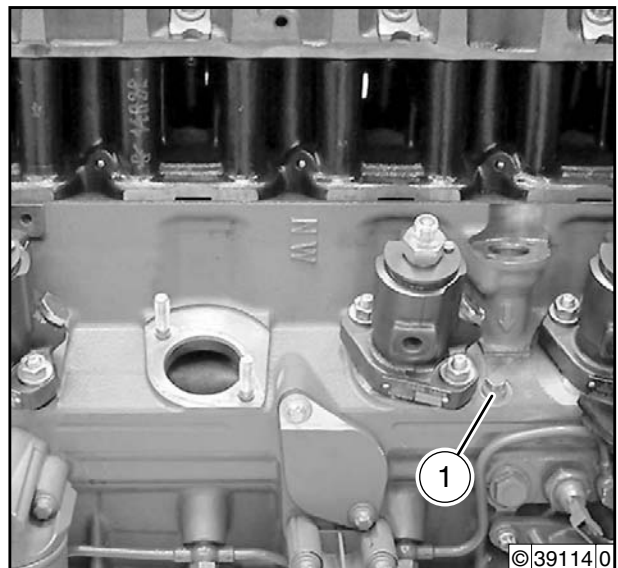


Note

- Put down the components in the order of installation, note order of cylinders.
- Do not damage the roller tappet.



- Unscrew cap (1) and remove sealing ring.



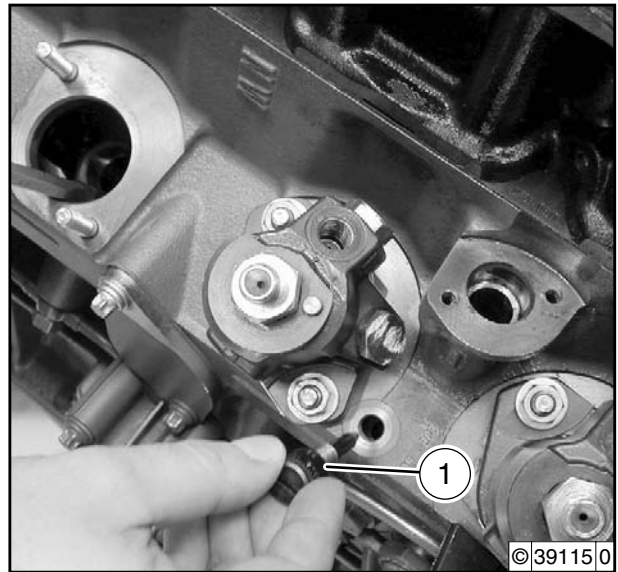
- Move control linkage to mid position.



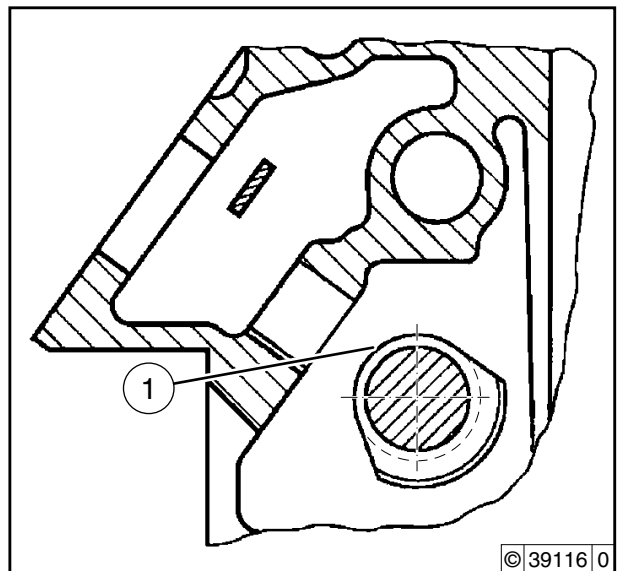
Note

Ignition off / stop magnet free.

- Turn in setting bolt (1) to stop.



- Turn crankshaft until the cam for the respective injection pump is standing on the cam basic circuit (1).



- Oil lightly and insert the roller tappet.



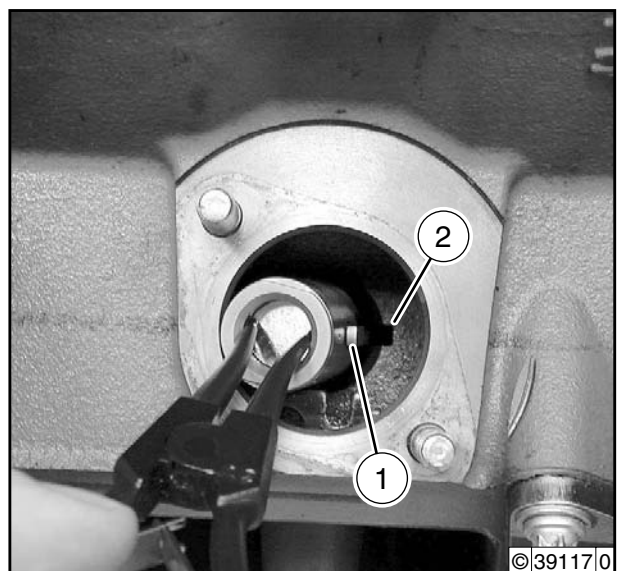
Note

- Note the assignment of the roller tappet.
- The guide pin (1) on the roller tappet must engage in the groove (2).

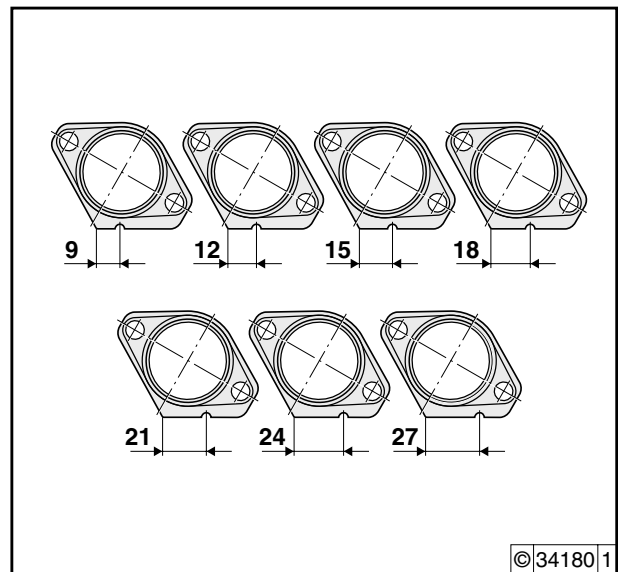


Note

When replacing the roller tappet, the assignment of the injection pump to the roller tappet must be observed.



- Determine the thickness of the shim gasket
→ Job card W 07-06-03.
- Select compensation gasket according to table.



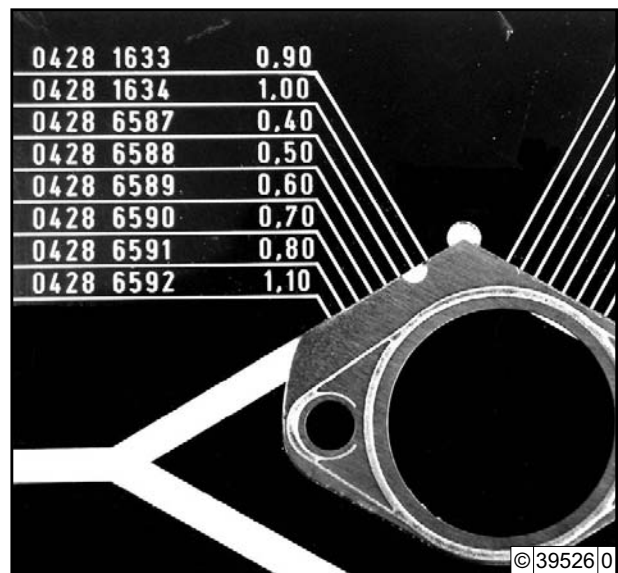
©34180 1

6



Note

Since the part number and the gasket thickness are not specified on the compensation gasket, the gasket thickness can be checked with the test template.



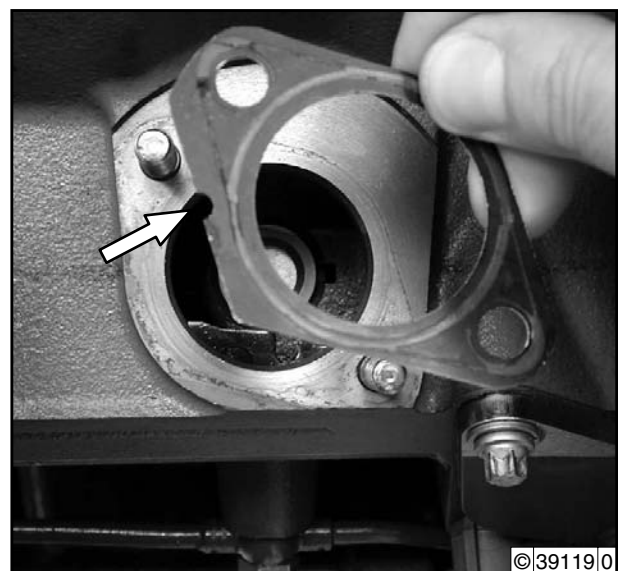
©39526 0

- Mount the appropriate compensation gasket.



Note

Note installation position, the recess (arrow) must face the flywheel.



©39119 0

Install the injection pump



Note

When replacing the injection pump the assignment of the injection pump to the roller tappet must be observed.



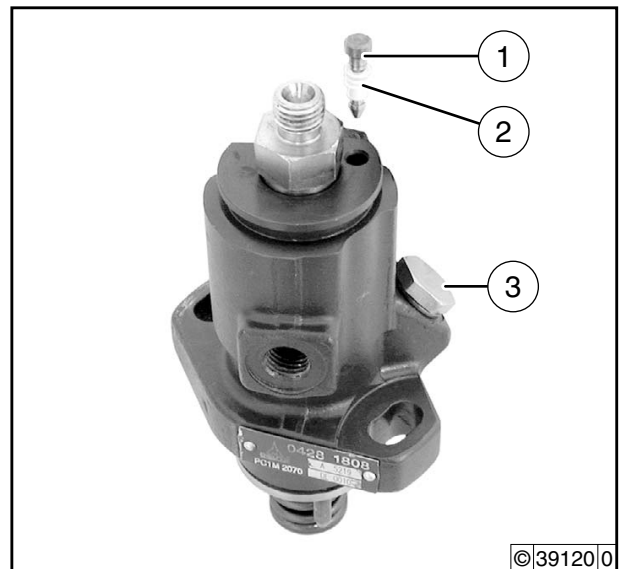
- Pull out locking pin (1).



Note

Remove the gasket (2) together with the locking pin.

- Unscrew cap (3) and remove sealing ring.

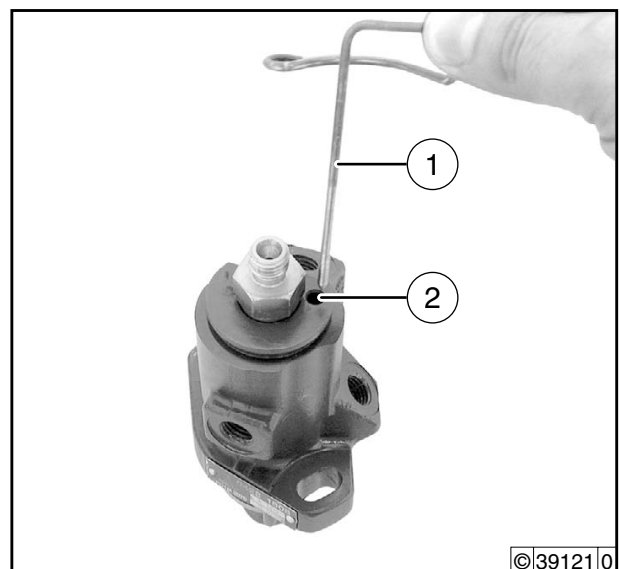


- Insert marking pin (1) in the bore (2) of the injection pump.



Note

Do not press in the marking pin completely.

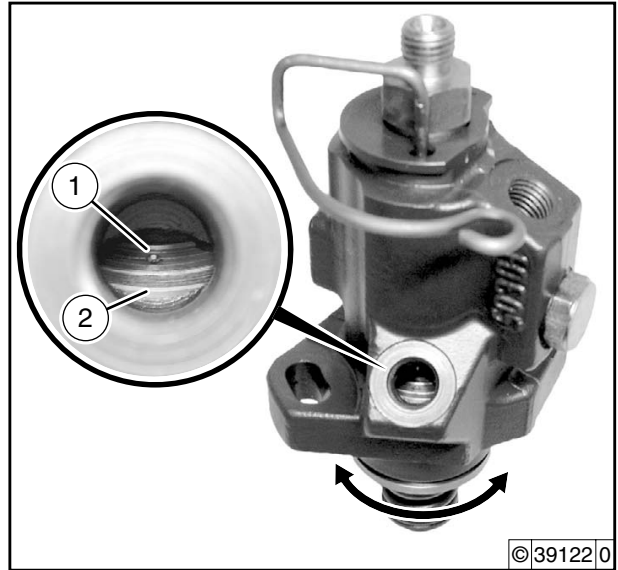


- Position the center punch point (1) on the regulating sleeve (2) (arrow) so that it is underneath the tip of the marking pin.



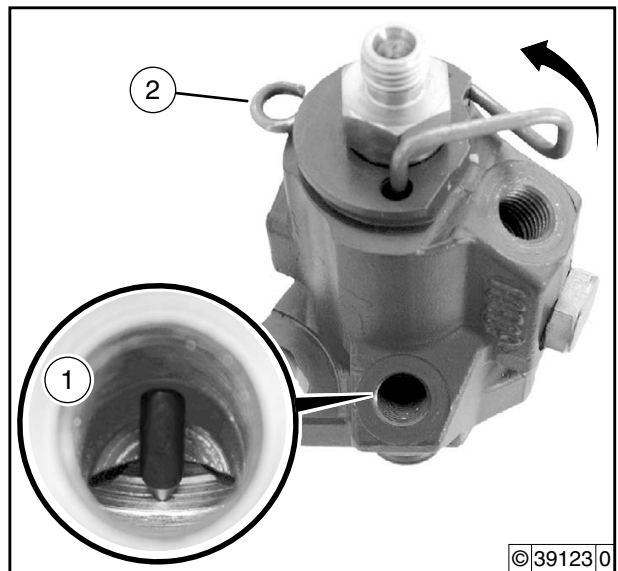
Note

The center punch point is visible through the bore for the locking screw.

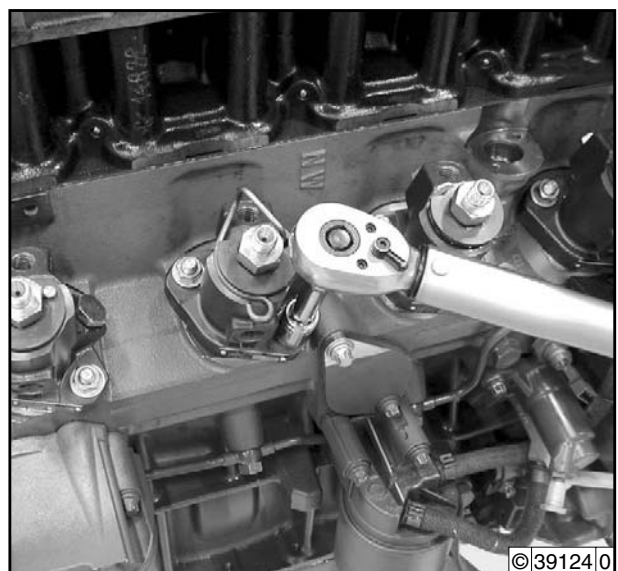


6

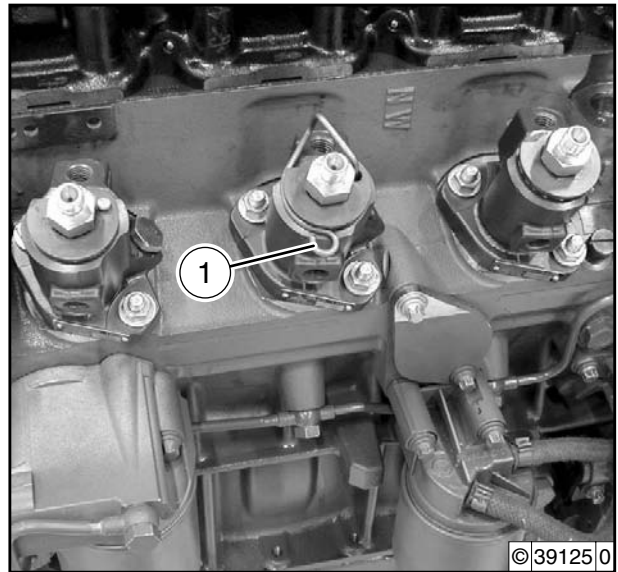
- Position the tip of the marking pin (1) in the center punch point.
- Clamp the clamping bracket (2) of the marking pin.



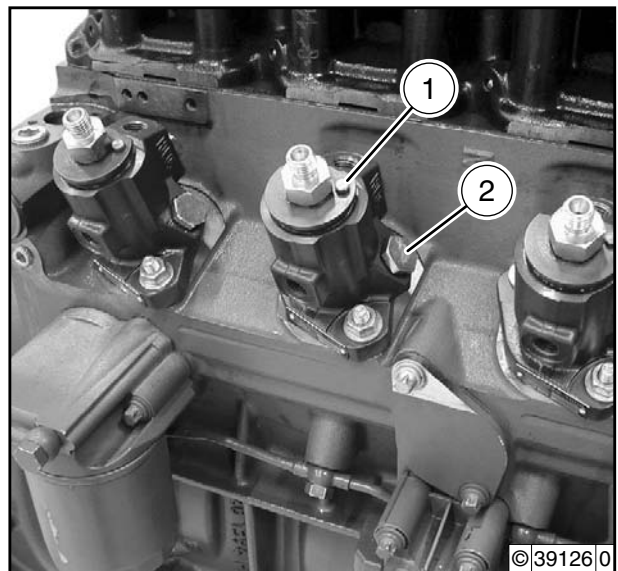
- Insert the injection pump centrally to the long holes.
- Press in injection pump to stop and tighten nuts.
- Tighten nuts.



- Loosen clamping bracket and pull out marking pin (1).



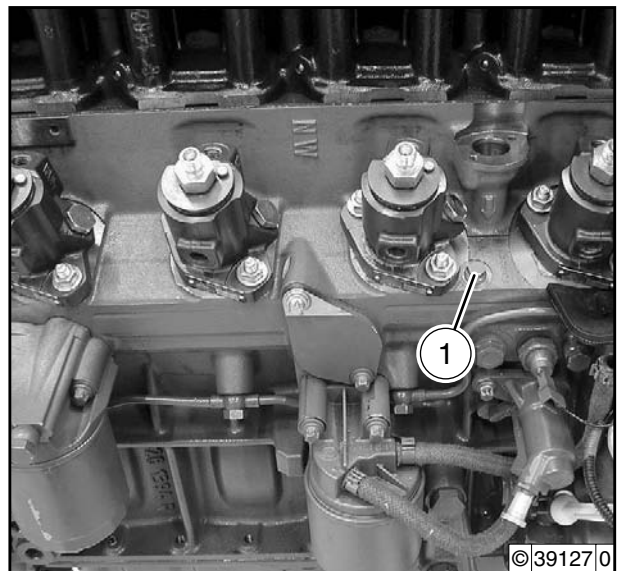
- Press in locking pin (1) with gasket to stop.
- Tighten cap (2) with new CU sealing ring.



- Unscrew setting bolt.
- Tighten locking screw (1) with new CU sealing ring.



- Check beginning of pumping if necessary
→ Job card W 07-06-04.
- Install fuel lines
→ Job card W 07-10-06.
- Install injection lines
→ Job card W 07-03-01.





Notes

Determine the thickness of the shim gasket



Tools

- **Commercial tools**
8170 - Depth measuring appliance



References

- W 07-04-01 (Motorpal)



Note

- All contact and measuring surfaces must be absolutely clean to rule out measuring errors!
- The following work procedure must be performed for every injection pump if necessary.

- Remove injection pump and compensation gasket.
- Removal and installation of roller tappet, visual inspection.
→ Job card **W 07-04-01**(Motorpal)



- Mount probe for measuring range 50 to 75 mm on depth measuring screw.

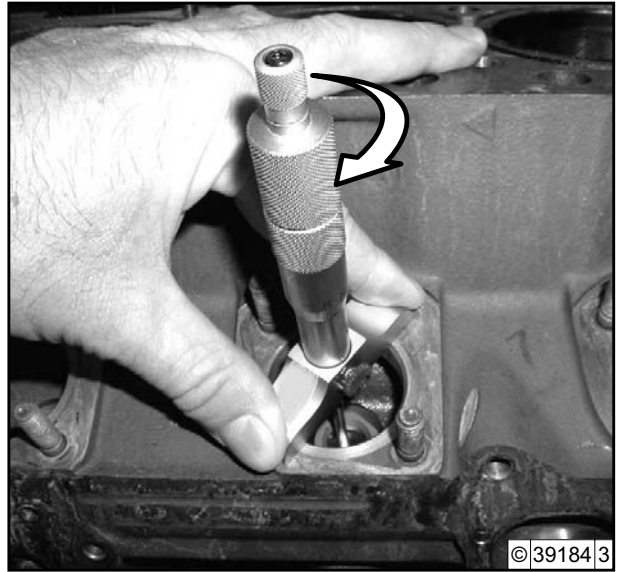


Note

- Presetting of the measuring range approx. 52 mm.

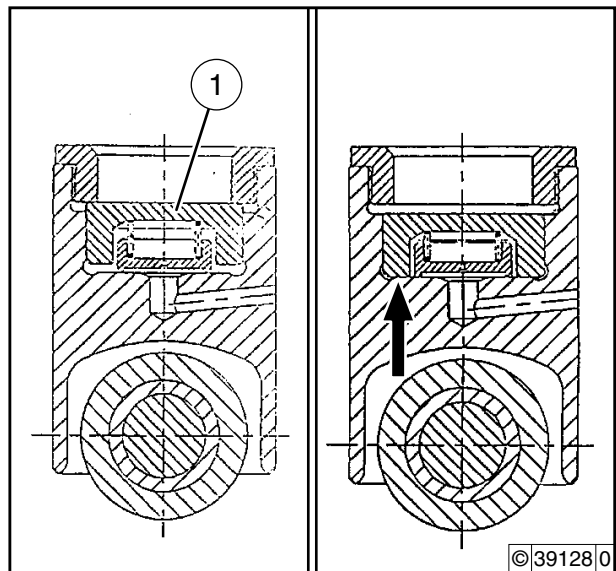


- Place the depth measuring screw on the contact surface of the crankcase and keep it pressed against the stop.
Turn the depth measuring screw until the probe is touching the roller tappet.



6

- In hydro-roller tappets, the working piston in the roller tappet (1) must be pressed down (approx. 1 mm) to determine the total depth dimension by turning on the depth measuring screw to the stop (arrow).



- Measure, read and note the depth dimension "A" from the crankcase rest to the plate spring rest of the roller tappet.



Note

- The crankcase rest must be clean.
- Example: 60.25 mm

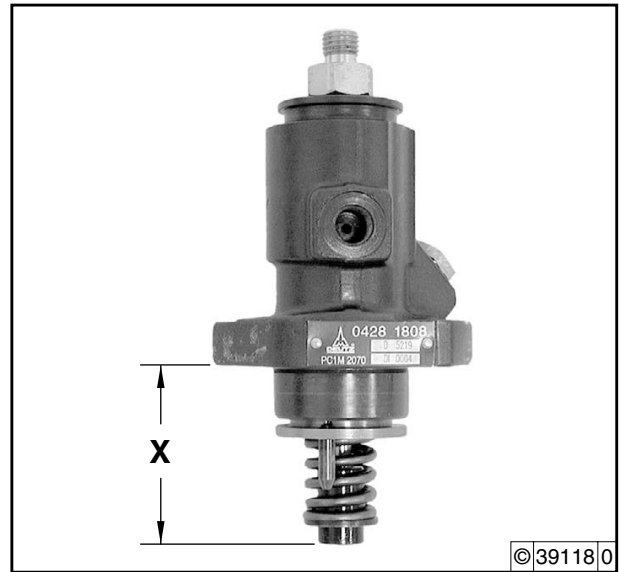


- Read and note installation dimension "X" of the rating plate of the respective injection pump.



Note

- The installation dimension "X" serves to calculate the compensation gasket.
- Do not measure on the disassembled injection pump.
- The exact installation dimension "X" is specified on the rating plate of the injection pump.
- Example: 6088
Installation dimension "X" = 60.88 mm



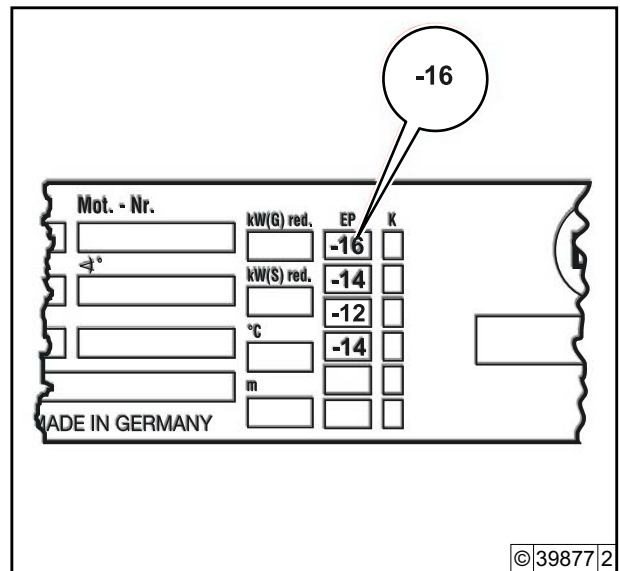
©39118|0

- Read and note value of the pre-stroke correction from the company rating plate.



Note

- The value of the pre-stroke correction is specified with a minus (-) or plus sign.
- Example: -16



©39877|2

- Calculate compensation gasket thickness "S_s".

Calculation example:

- Searching for:
- Compensation gasket thickness S_s
 - Compensation gasket thickness without pre-stroke correction S_o

- Given:
- installation dimension of the injection pump X
 - Pre-stroke correction V_k

- Measured:
- depth dimension A

Calculation:

$$S_o = X - A$$

$$= 60.88 \text{ mm} - 60.25 \text{ mm}$$

$$= 0.63 \text{ mm}$$

$$S_s = S_o + V_k$$

$$= 0.63 \text{ mm} + (-0.16 \text{ mm})$$

$$= 0.47 \text{ mm}$$

- Select compensation gasket.



Notes

Check start of pumping



Tools

- Commercial tools

- Special tools

- 100 120 - Connecting piece
- 101 300 - Pointer for degree scales
- 101 500 - Hand pump
- 101 510 - Tank
- 100 910 - Scale dial



References

- W 07-03-01
- W 07-10-06 (Bosch)
- W 07-10-06 (Motorpal)
- W 11-00-03



Note

- The description refers to the cylinder at the front cover. The respective ignition UT must be determined by the scale dial when testing on other cylinders.

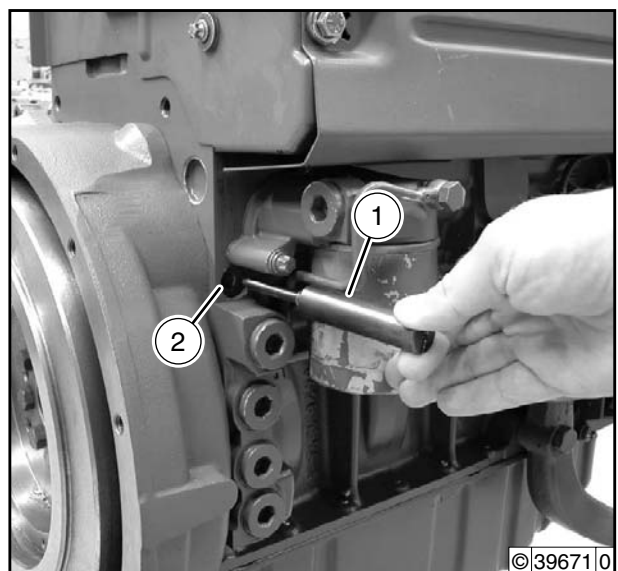
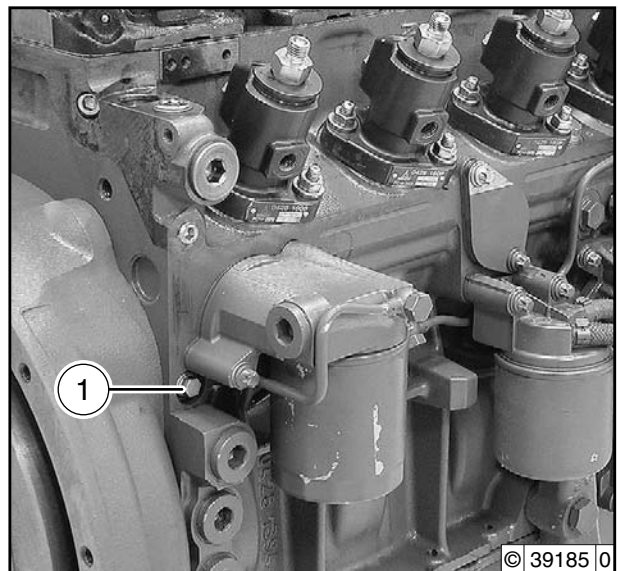
Check start of pumping

- Remove injection lines
→ Job card W 07-03-01.
- Remove fuel lines
→ Job card W 07-10-06 (Bosch)
→ Job card W 07-10-06 (Motorpal)
- Remove lifting magnet (shutdown magnet)
→ Job card W 11-00-03.

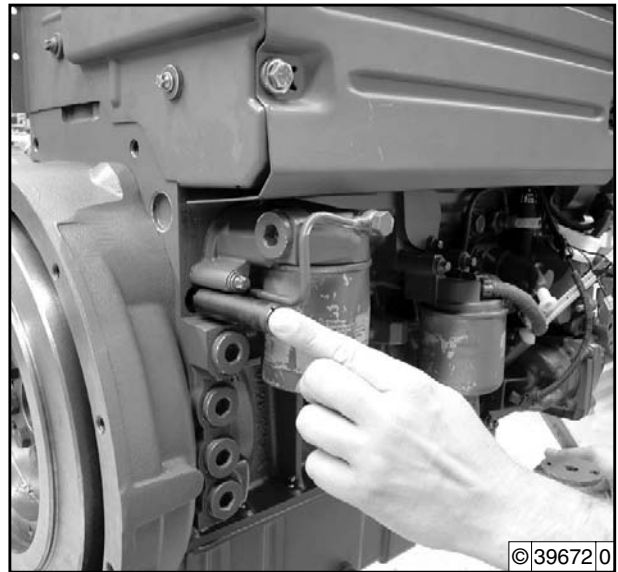
Lock camshaft

- Unscrew cap (1) and remove sealing ring.

- Insert setting bolt (1) in the bore (2) to lock the camshaft.

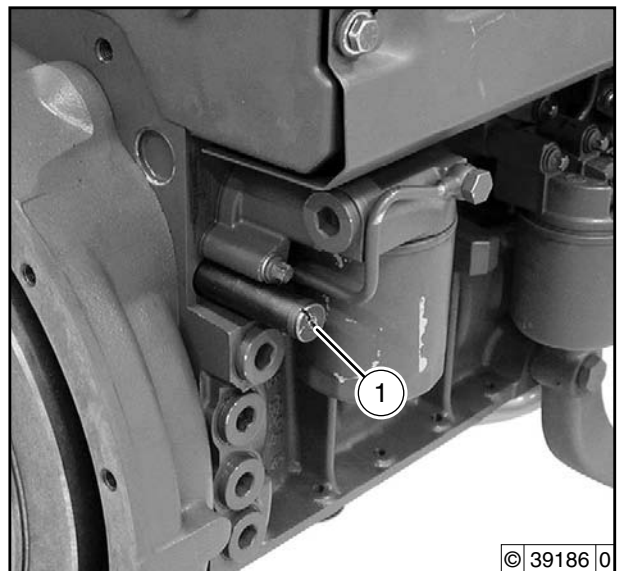


- Hold the setting bolt lightly and turn the crankshaft in the direction of rotation of the engine (clockwise) until the setting bolt engages the bore of the camshaft.



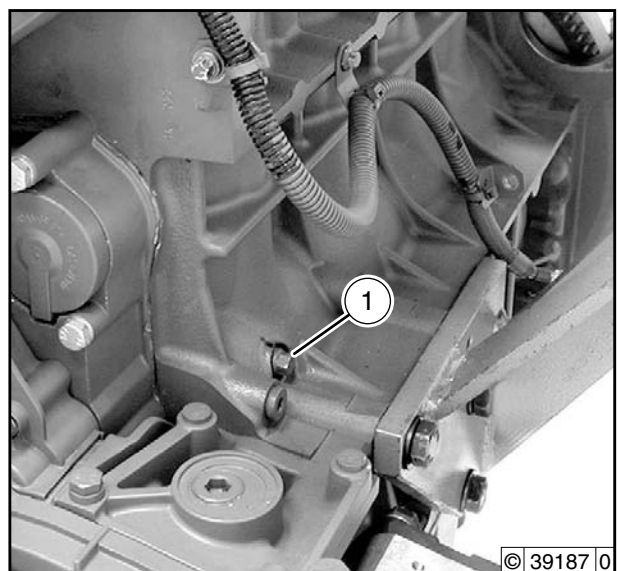
6

- Screw setting bolt (1) into the crankcase to the stop.

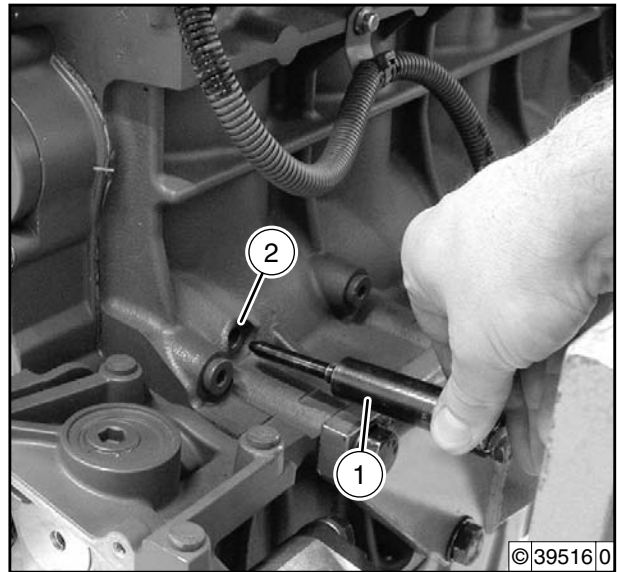


Lock the crankshaft

- Unscrew cap (1) and remove sealing ring.



- Insert setting bolt (1) in the bore (2) to lock the crankshaft.

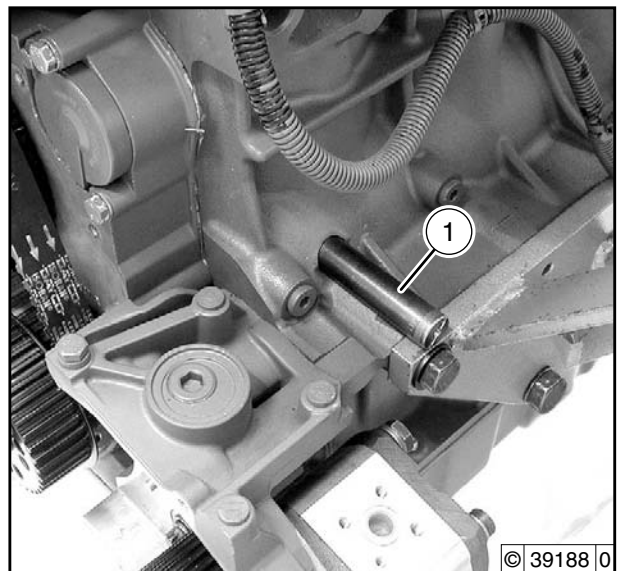


- Screw setting bolt (1) into the crankcase to the stop.

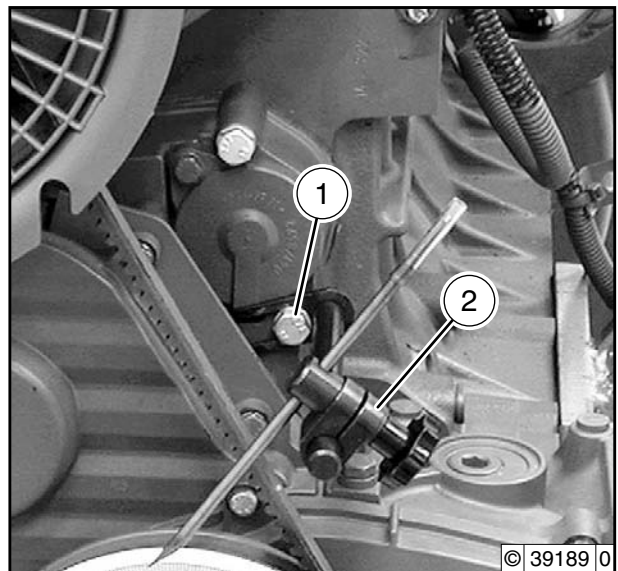


Note

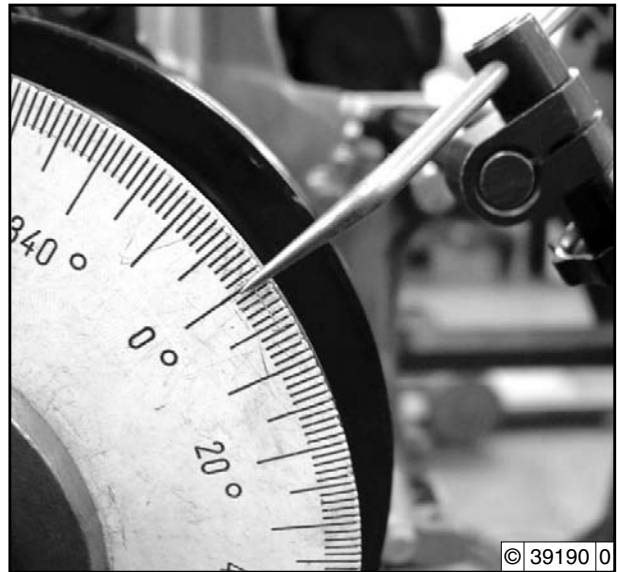
The cylinder at the front cover is now in the ignition UT.



- Loosen screw (1) and mount pointer with stop device (2).
- Tighten screw.



- Mount scale dial on V-belt pulley.
- Set pointer in line with "0°".



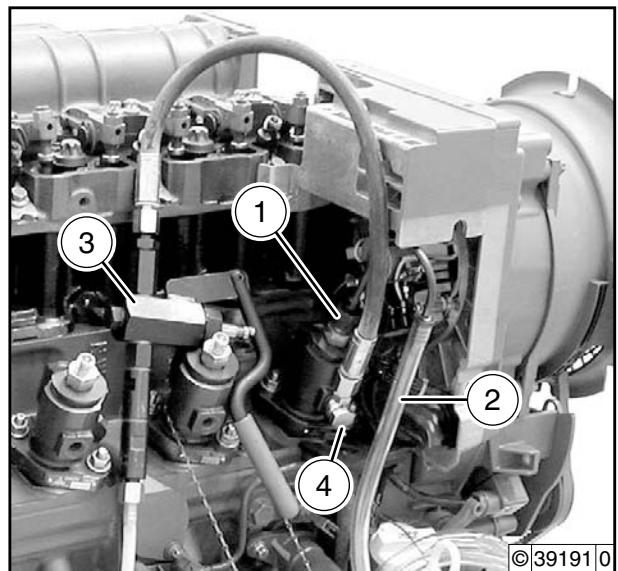
6

- Install overflow pipe (1) on pressure valve holder of the injection pump.
- Install hose (2) on overflow pipe and supply tank.
- Install high pressure hand pump (3) to injection pump (4) and supply tank.



Note

Make sure that there is enough fuel in the supply tank.

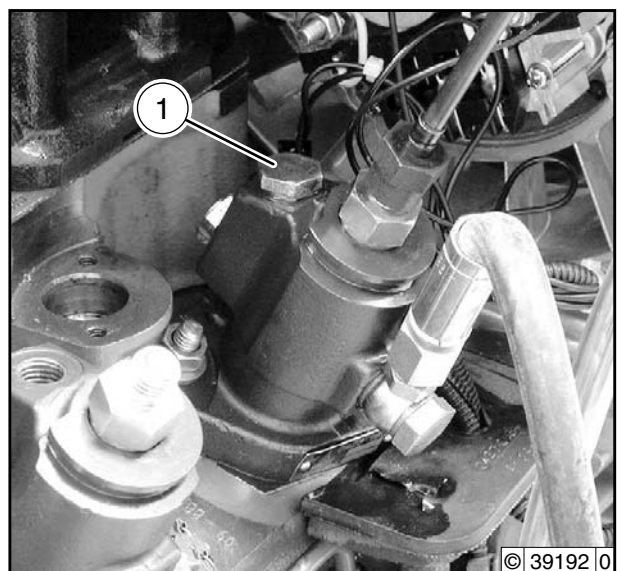


- Screw locking screw (1) into injection pump.



Note

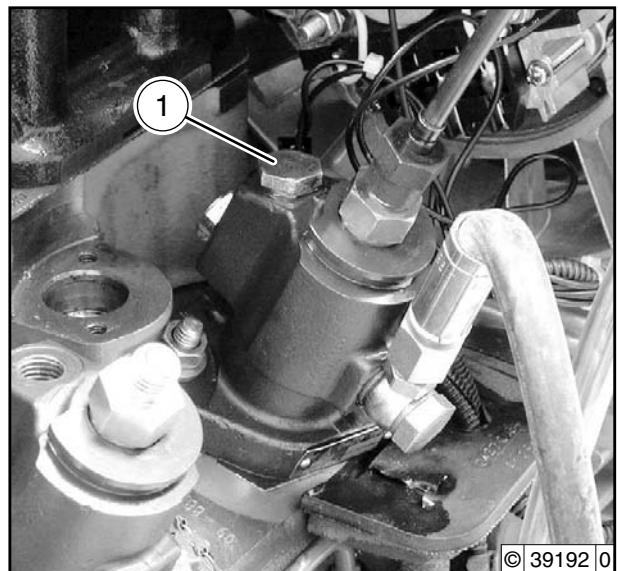
Do not tighten locking screw.



- Unscrew setting bolt for camshaft and crankshaft locking.
- Turn crankshaft approx. 90° against the engine's direction of rotation (arrow).



- Bleed the suction chamber of the injection pump. Actuate the high pressure hand pump until fuel emerges at the locking screw (1).
- Tighten the locking screw.



- Actuate the high pressure hand pump constantly.



Note

The fuel must flow evenly out of the overflow pipe.

- Turn the crankshaft slowly and evenly in the direction of rotation of the engine (arrow) until the fuel flow becomes just a dripping.



Note

As soon as the fuel flow becomes a dripping, the beginning of pumping is reached.



- Read beginning of pumping from the dial.



6



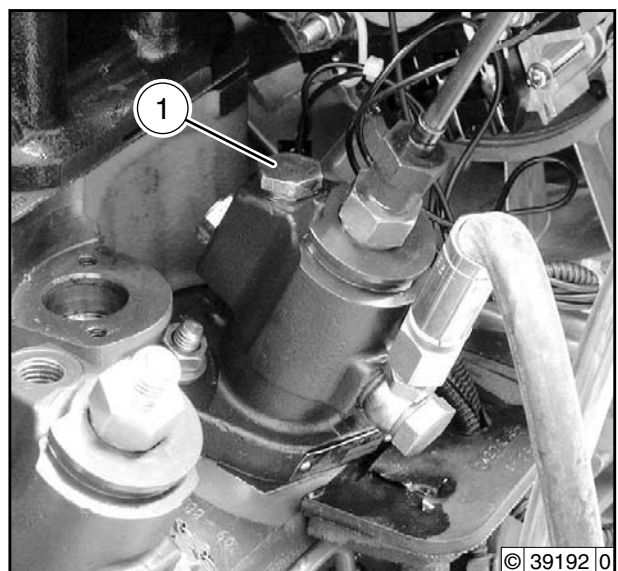
Note

- The beginning of pumping of other injection pumps must be checked by this method.
- Determine the ignition UT of the respective cylinder with the dial.
Observe the ignition distance.

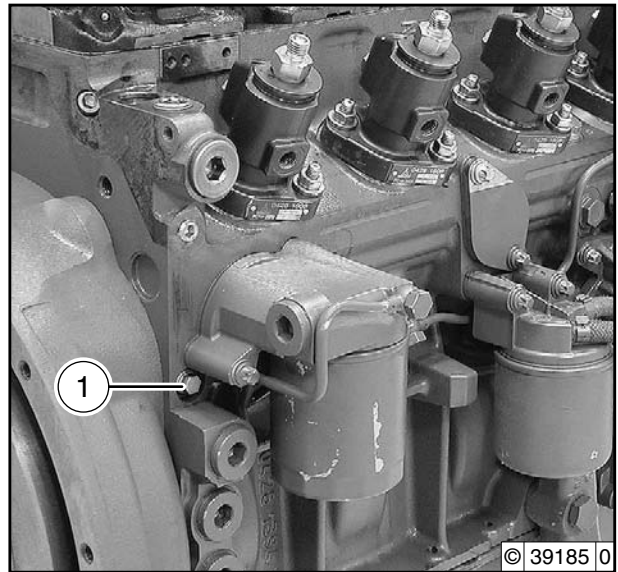
Ignition distance:

2 cylinder engine	180°
3 cylinder engine	120°
4 cylinder engine	180°

- Remove dial and pointer, tighten screw.
- Remove high pressure hand pump and overflow pipe.
- Unscrew cap (1) and remove sealing ring.



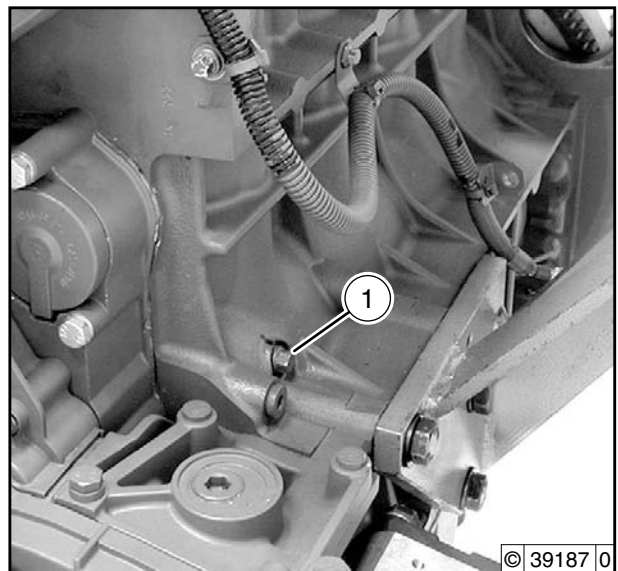
- Tighten locking screw (1) with new CU sealing ring.



- Tighten locking screw (1) with new CU sealing ring.



- Install fuel lines
 - Job card **W 07-10-06** (Bosch)
 - Job card **W 07-10-06** (Motorpal)
- Install injection lines
 - Job card **W 07-03-01**.
- Install lifting magnet (shutdown magnet)
 - Job card **W 11-00-03**.





Notes

Remove and install injection valves (in engines with leak fuel line)



Tools

- **Commercial tools**
8011 - Clamping pliers

- **Special tools**

110 030 - Extractor
150 800 - Extraction tool



References

- W 07-03-01



Note

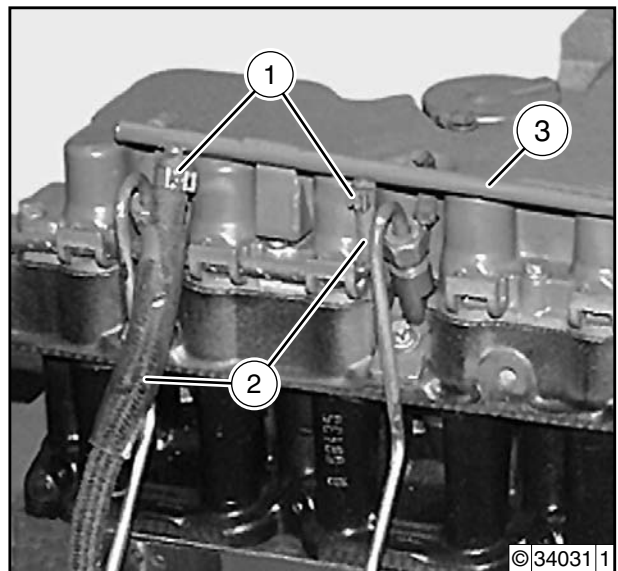
- Cleanliness is extremely important when working on the injection equipment.
- Collect drained operating materials in suitable vessels and dispose of according to regulations.

Remove injection valve

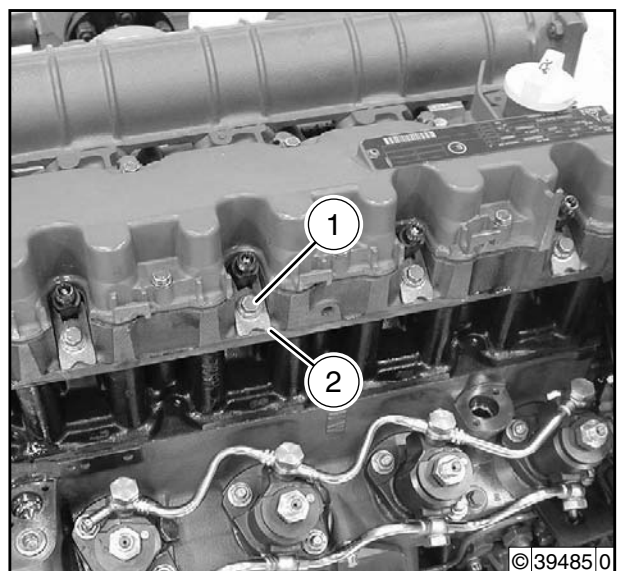
- Remove injection lines
→ Job card W 07-03-01.

In engines with leak fuel line

- Loosen pipe clips (1) and pull off return pipes (2).
- Unscrew screws and remove overflow pipe (3).



- Unscrew screw (1) and remove clamping claw (2).

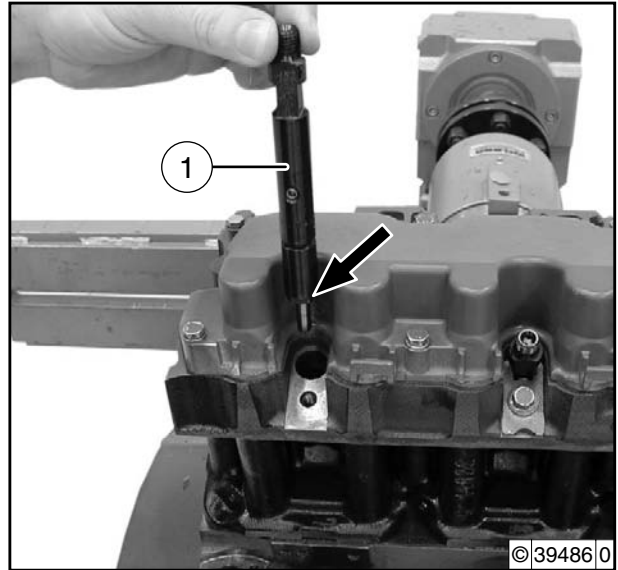


- Pull out injection valve (1) and sealing ring (arrow).



Note

- Put down the components in the order of installation, note order of cylinders.
- Pull off gaskets burned tight to the cylinder head with extractor and extraction device.



6

Install injection valve

- Mount new sealing ring (arrow) on injection valve.

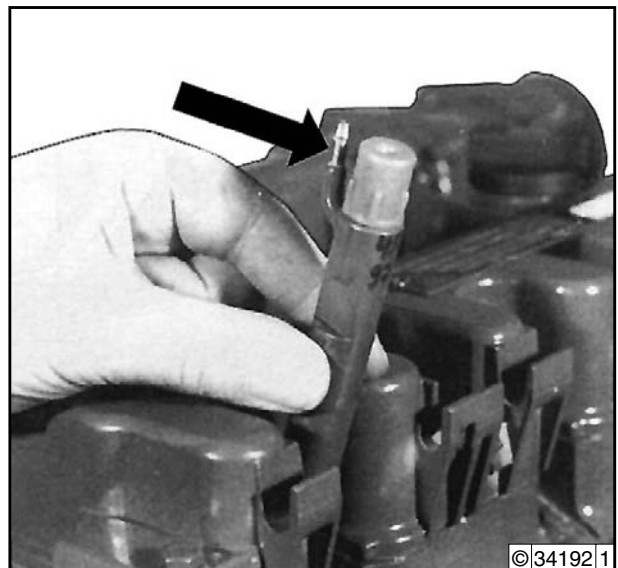


- Insert injection valve.



Note

- The leak fuel connection (arrow) must face the Manifold side.

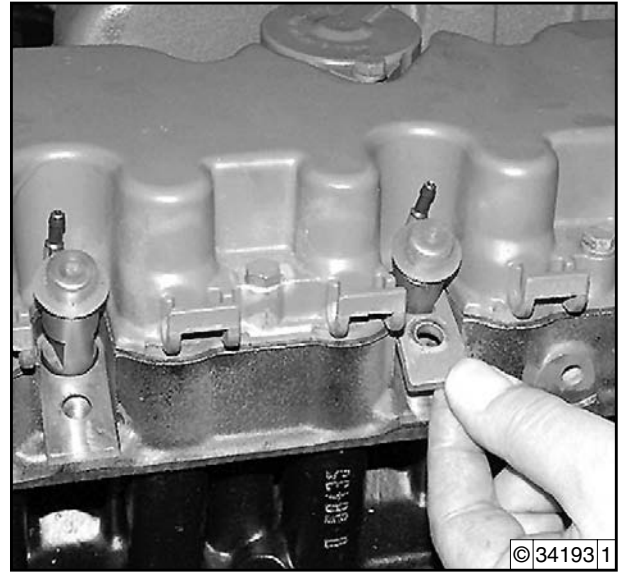


- Mount the clamping claw and tighten the screw.

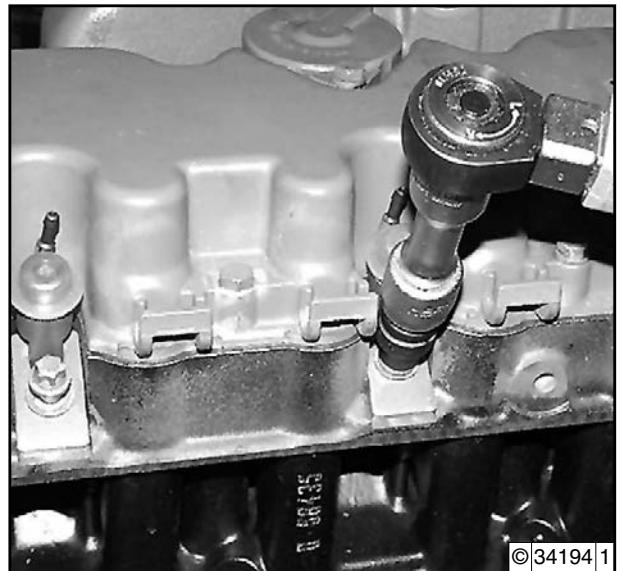


Note

Note installation position of the clamping claw.



- Tighten screw.



- Mount overflow pipe (1), attach hoses and tighten screws.

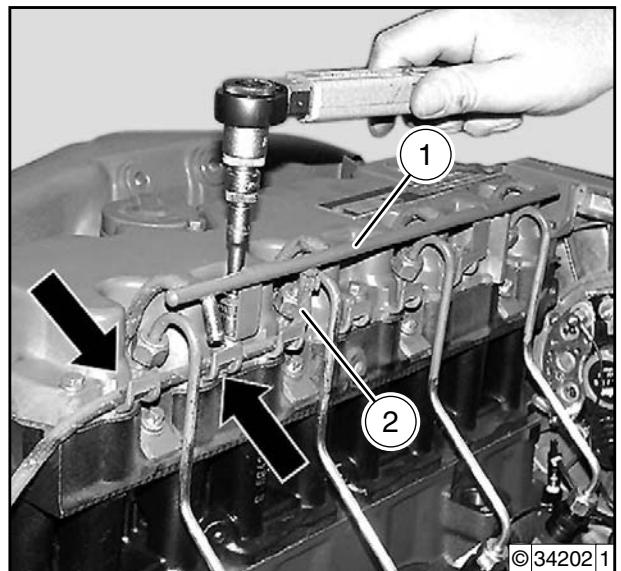


- Attach return hose (2) and fix hose clip with clamping pliers.
- Insert return hose in holder (arrows).



Note

The rubber hoses must always be renewed.



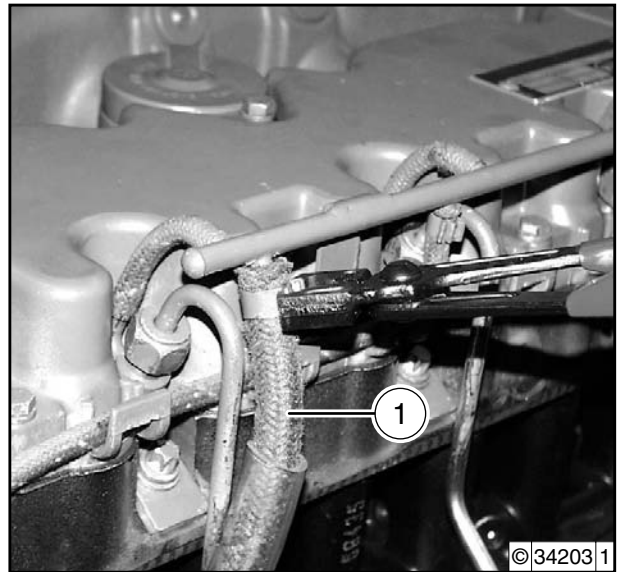
- Attach return hose (1) and fix hose clip with clamping pliers.



Note

Check return pipe, renew if necessary.

- Install injection lines
→ Job card W 07-03-01.



6

Install injection valve (leak fuel-less)

- Mount new sealing ring (1) on injection valve.

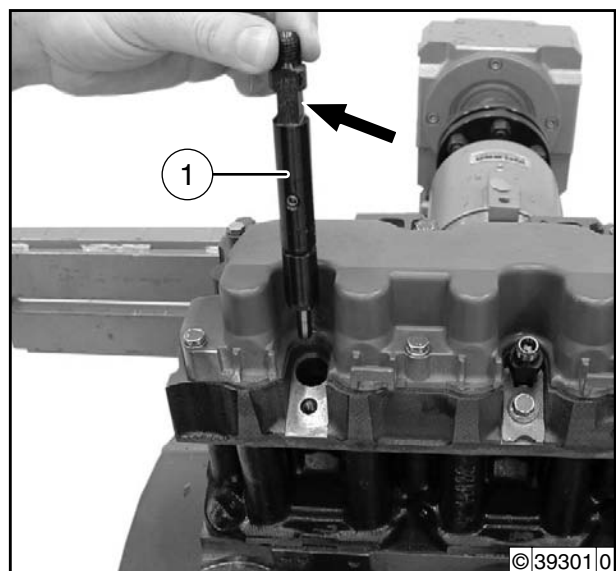


- Insert injection valve (1).



Note

The flattened side (arrow) must face the Operating side.

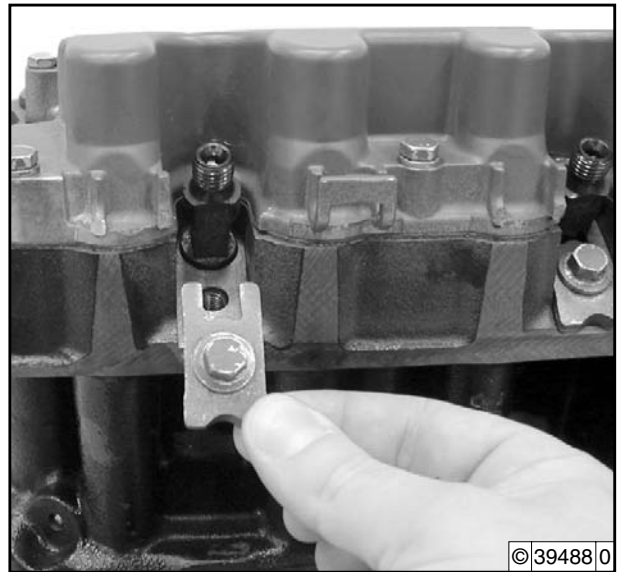


- Mount the clamping claw and tighten the screw.



Note

Note installation position of the clamping claw.

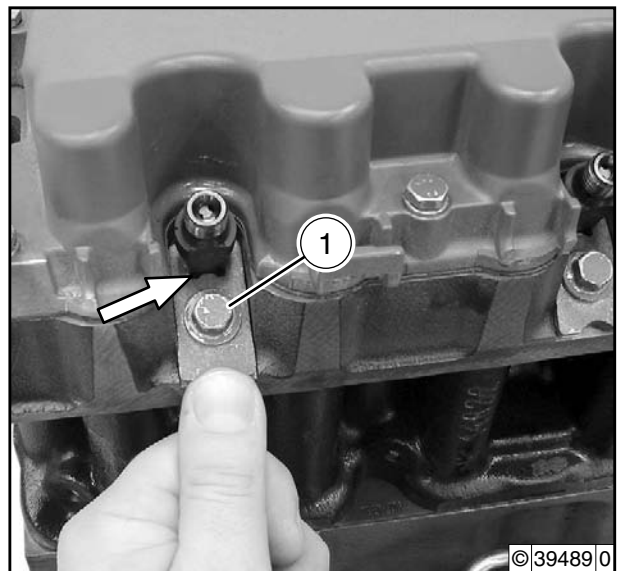


- Press the clamping claw to touch the gate (arrow) on the injection valve (arrow) and tighten screw (1).



07001

- Install injection lines
→ Job card W 07-03-01.





Notes

Check and repair injection valve



Tools

- **Commercial tools**
8021 - Socket size 15

- **Special tools**

- 110 110 - Holder



References

- W 07-07-05
- W 07-07-01

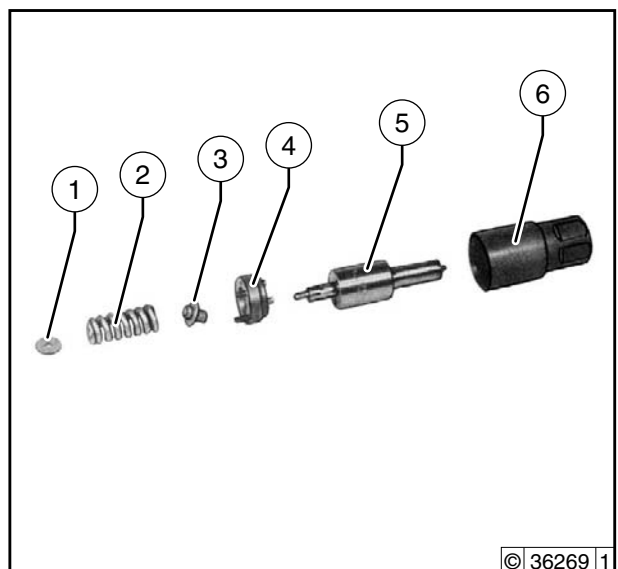
Dismantle injection valve

- Remove injection valves
→ Job card **W 07-07-01**.
- Insert injection valve in holder.
- Unscrew nozzle clamping nut with long socket.



Order of individual disassembly

- 1 shim disc
 - 2 pressure spring
 - 3 pressure bolt
 - 4 adapter
 - 5 Injection nozzle
 - 6 nozzle lock nut
- Clean parts in clean diesel fuel and blow dry with air.



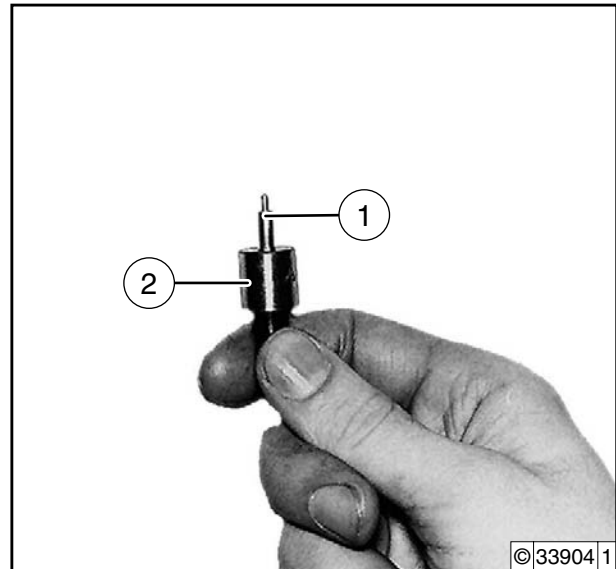
Check injection nozzle

- The nozzle needle (1) must slide back to its seat slowly and jolt-free by its own weight when the nozzle body (2) is held vertically.



Note

- Do not touch the nozzle needle with your fingers.
- The nozzle needle and nozzle body are lapped together and may not be switched round or changed individually.
- If the nozzle needle slides back with a jolt, clean the injection nozzle in diesel fuel again, renew if necessary.
- Also clean the new injection nozzle in clean diesel fuel.



6

- Inspect the seat surfaces of the adapter for wear.



Note

- Make sure the centering pins (arrows) are in place.



Complete injection valve

- Insert shim disc.



Note

- The opening pressure depends on the strength of the shim disc.



- Insert compression spring.

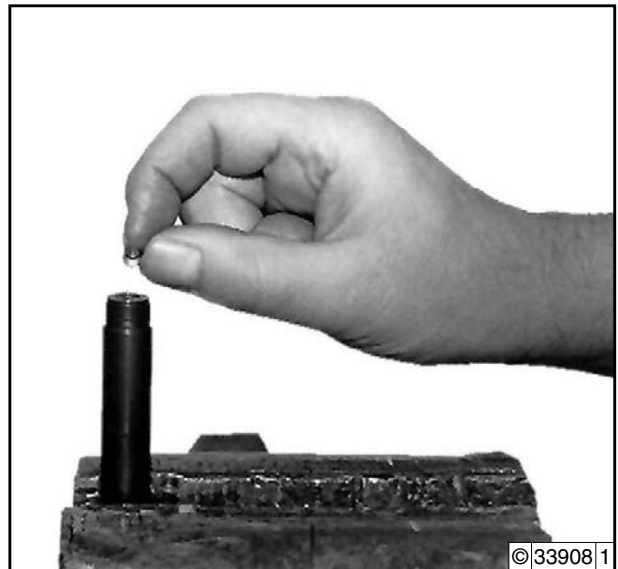


- Insert compression bolt.



Note

The center joint must face the compression spring.



- Insert adapter with the centering pins in the bores in the nozzle holder.



Note

The countersink must face the compression bolt.

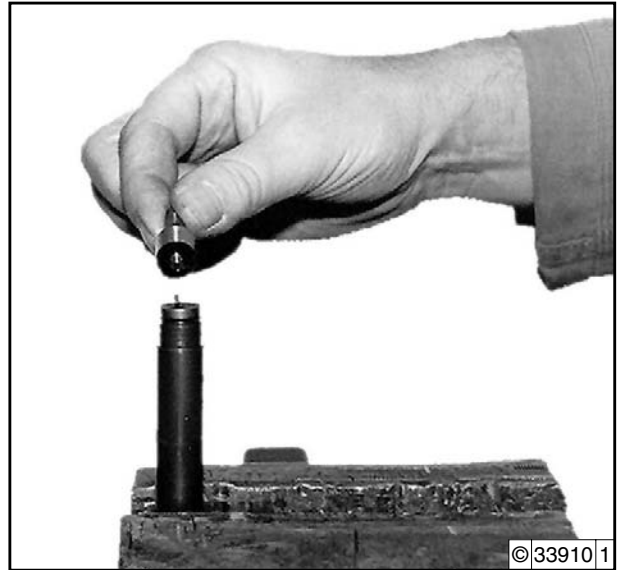


- Mount the injection nozzle with the centering bores on the centering pins of the adapter.



Note

The nozzle needle may not fall out of the nozzle body.



6

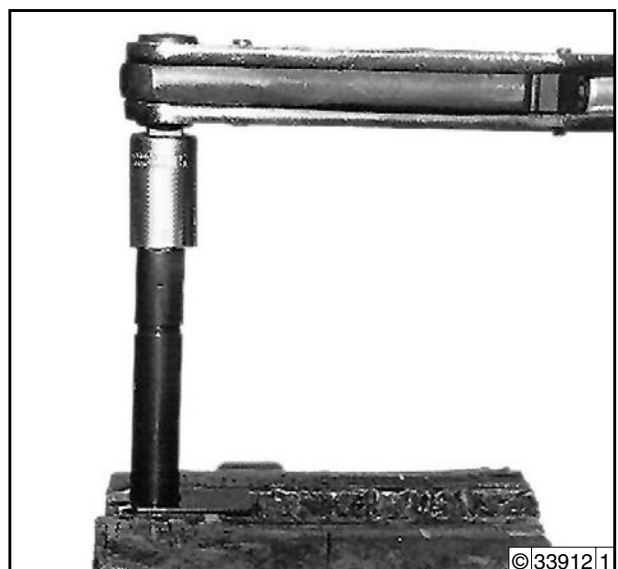
- Screw on the nozzle clamping nut.



- Tighten the nozzle clamping nut.



- Remove the injection valve from the holder.
- Check and set injection valves
→ Job card **W 07-07-05**
- Install injection valves
→ Job card **W 07-07-01**.



Check and set injection valves (leak fuel-less)



Tools

- **Commercial tools**
- 8008 - Nozzle tester
- 8021 - Socket size 15

- **Special tools**

- 110 110 - Holder



Note

- Cleanliness is extremely important when working on the injection equipment.
- Only use pure test oil according to ISO 4113 or clean diesel fuel to test the injection valves.



Caution!

After about three or four actuations of the hand lever, the spring space above the nozzle needle in the injection valve fills up with diesel fuel/test oil. Then it is no longer possible to actuate the hand lever. The nozzle lock nut must be loosened carefully before every test procedure to release pressure from the spring space.



References

- W 07-07-01

Check the injection valve.

- Remove injection valves
→ Job card **W 07-07-01**.
- Insert injection valve in holder.
- Loosen the nozzle clamping nut with the long socket approx. 180° (relieve pressure) and re-tighten.



Caution!

Risk of injury! The fuel penetrates deep into the flesh through the nozzle jet.
Risk of blood poisoning!

- Install injection valve in the nozzle tester.



Testing the opening pressure

- Press down the lever of the nozzle tester slowly, with **connected** pressure gauge. The pressure at which the pointer stands still or suddenly drops is the opening pressure.



6



Note

- When the hand lever of the nozzle tester has been actuated three or four times, the pressure in the spring space has built back up.
- The nozzle clamping nut must be loosened again and re-tightened.
- The test must be repeated.
- If the measured values of three tests are identical, these can be considered valid.



- Remove the injection valve from the nozzle tester.



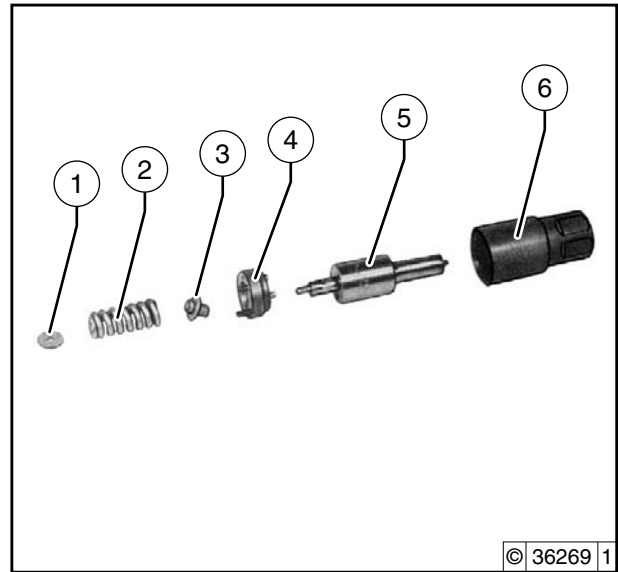
Setting the opening pressure on the injection valve

- Insert the injection valve in the holder, unscrew the nozzle clamping nut and remove all parts.



Order of single part assembly

- 1 - Shim disc
- 2 - Compression spring
- 3 - Compression bolt
- 4 - Adapter
- 5 - Injection nozzle
- 6 - Nozzle clamping nut



- Select shim disc, for correcting the opening pressure according to the spare parts list.



Note

A thicker disc gives a higher opening pressure.

- Assemble injection valve and tighten nozzle clamping nut.



- Check the injection valve on the nozzle tester again.



Tightness test

- Blow the injection nozzle and nozzle holder dry with air.
- Press the hand lever of the tester down **slowly** until approx. **20 bar below** the previously read opening pressure are reached.





Note

Injection nozzle is tight if it does not drip within 10 seconds.



6



Note

- If the injection nozzle drips, the injection valve must be dismantled and cleaned, the injection nozzle may have to be changed.
- Repairs are not permitted.



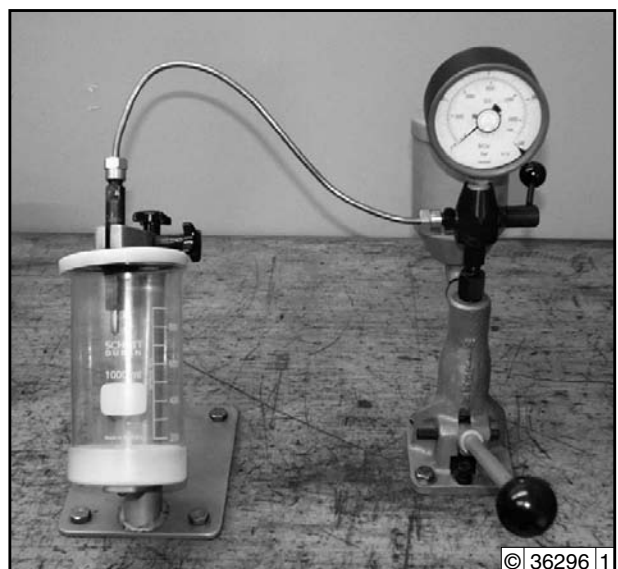
Buzz and jet test

- Switch off the tester's pressure gauge.



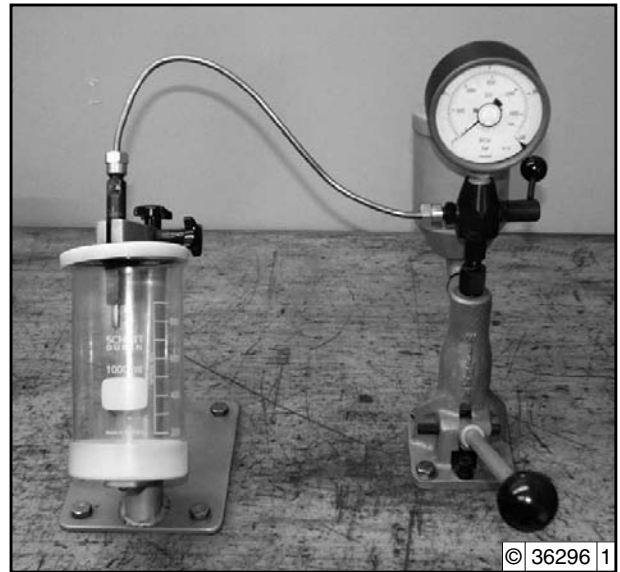
Note

The easy action of the nozzle needle in the nozzle body is checked by the acoustic buzz test. Increasing wear in the needle seat of the injection valves changes their buzz behavior.



**Note**

After cleaning, a used injection valve must buzz audibly and atomize the fuel finely when the lever is actuated **quickly**. The injection nozzle must be changed if it does not buzz after cleaning. The jet profile may deviate considerably from that of a new injection valve.

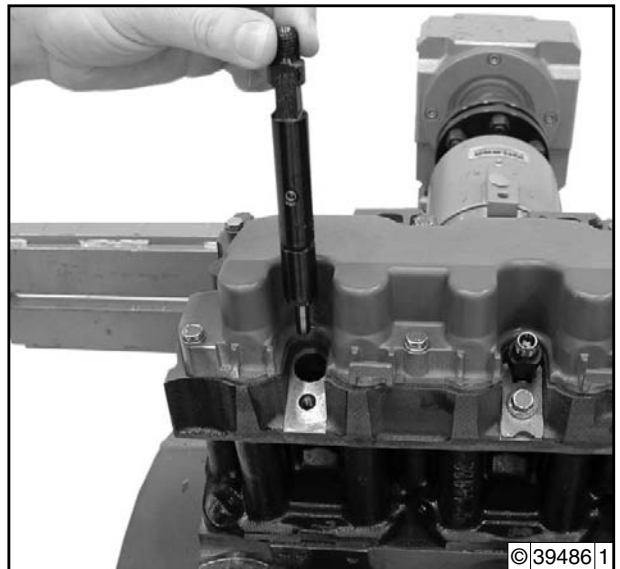
**Caution!**

The pressure in the spring space must be relieved in any case before installing the injection valves.

- Loosen the nozzle clamping nut with the long socket approx. 180° (relieve pressure) and re-tighten.



- Install injection valves
→ Job card **W 07-07-01**.





Notes

Remove and install solenoid valve (LDA)



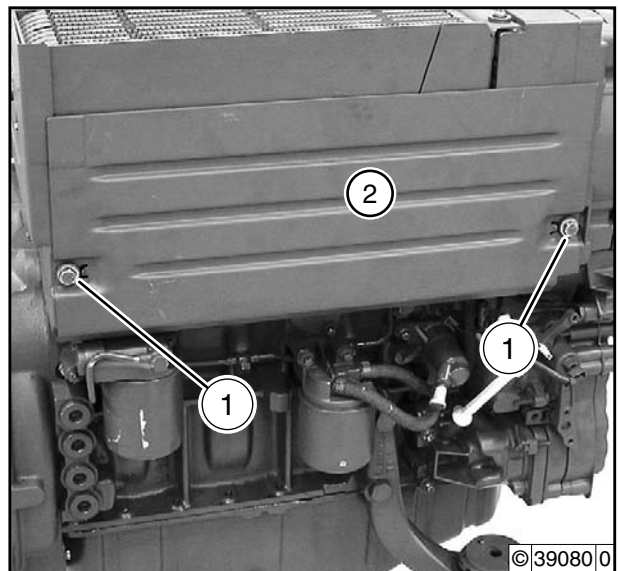
Tools

- Commercial tools
- 8027 - Pliers insert

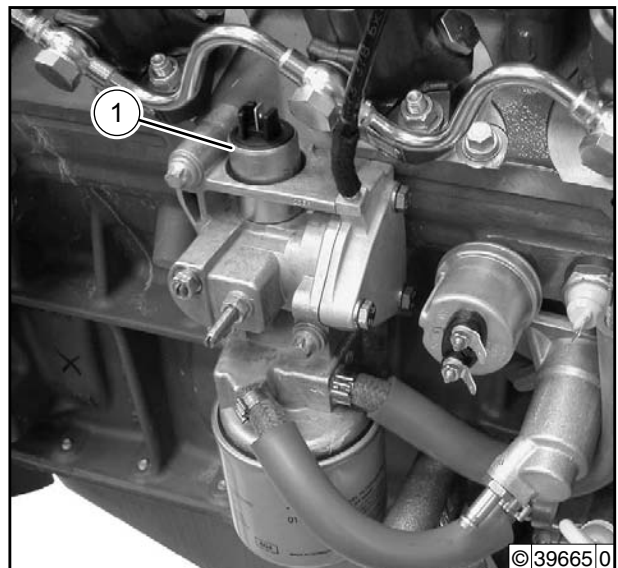
Remove solenoid valve

In BFL engines

- Unscrew screws (1) and remove air duct cover (2).



- Pull off cable plug from solenoid valve (1) if available.



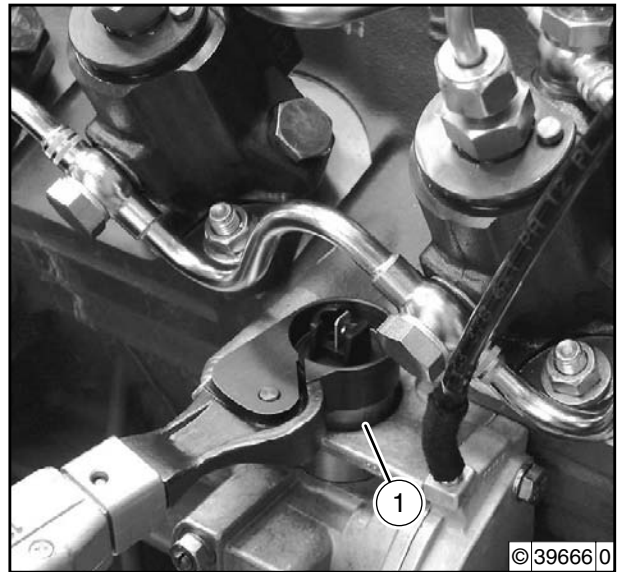
- Unscrew solenoid valve (1) with pliers insert and remove sealing ring.



Note

Note clamping direction of the pliers insert.

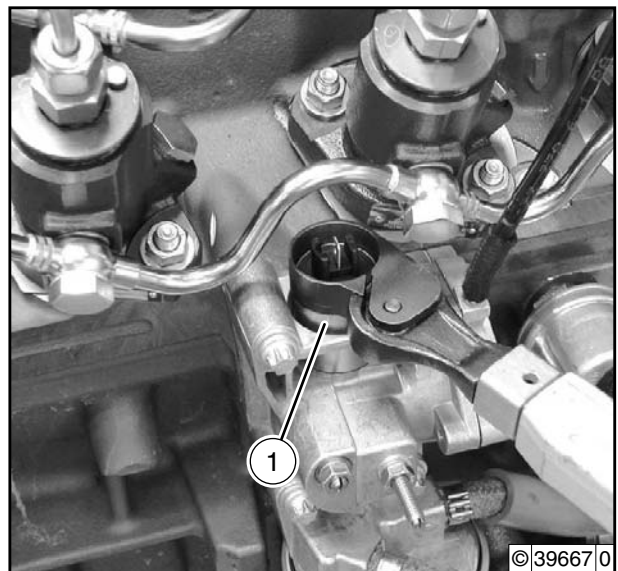
- Check components for visible signs of damage.



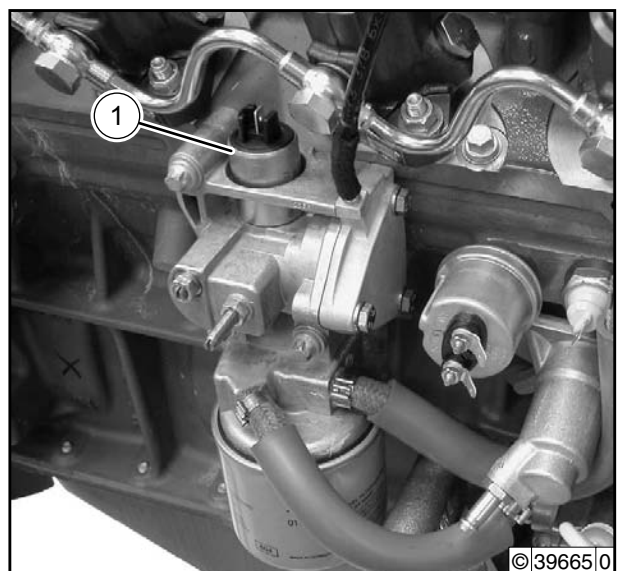
6

Install solenoid valve

- Mount solenoid valve (1) with new CU sealing ring and tighten with pliers insert.



- Plug cable plug to solenoid valve (1) if available.



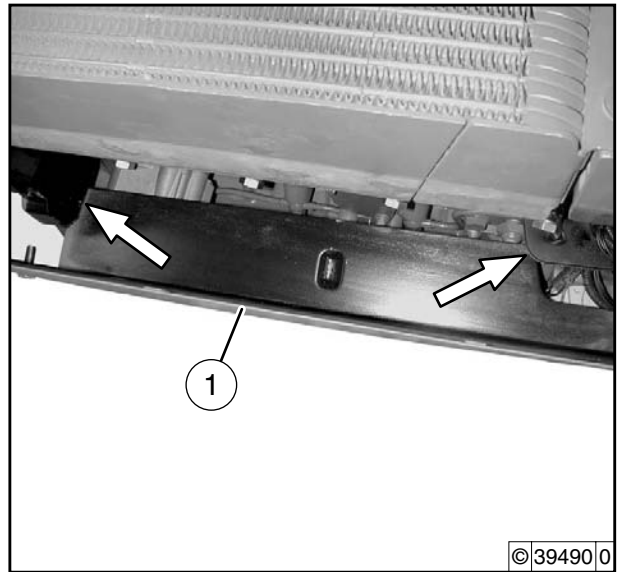
In BFL engines

- Mount air duct cover (1).

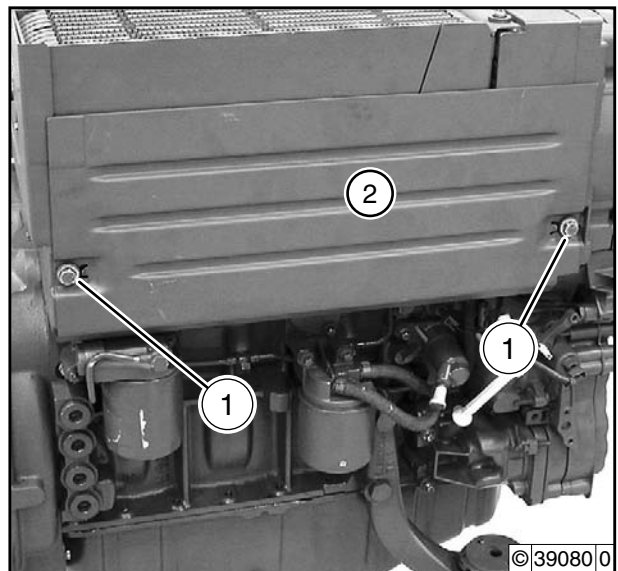


Note

The air duct cover must be under the stand plate and the profile rubber (arrows).



- Fix air duct cover (2).
Tighten screws (1).





Notes

Remove and install charge pressure full load stop (LDA)



Tools

- **Commercial tools**
8011 - Clamping pliers
8027 - Pliers insert

- **Special tools**
170 050 - Special wrench



Note

- Collect drained operating materials in suitable vessels and dispose of according to regulations.
- A test stand run is necessary to set the charging pressure-dependent full load stop.



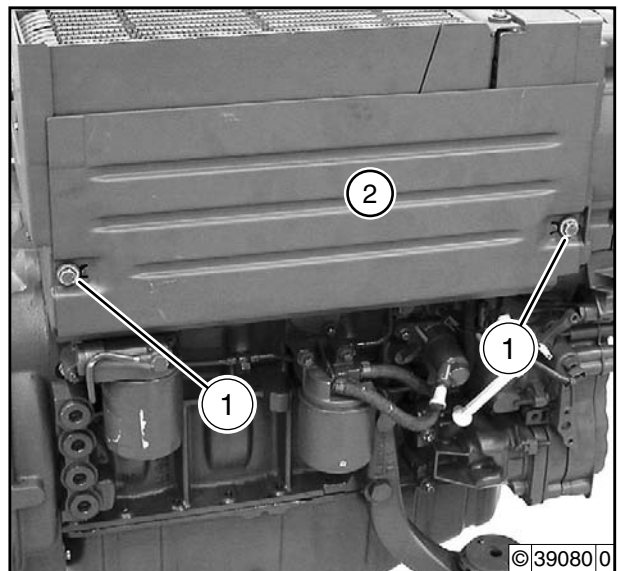
Caution!

Observe the safety regulations and national specifications for handling fuels!

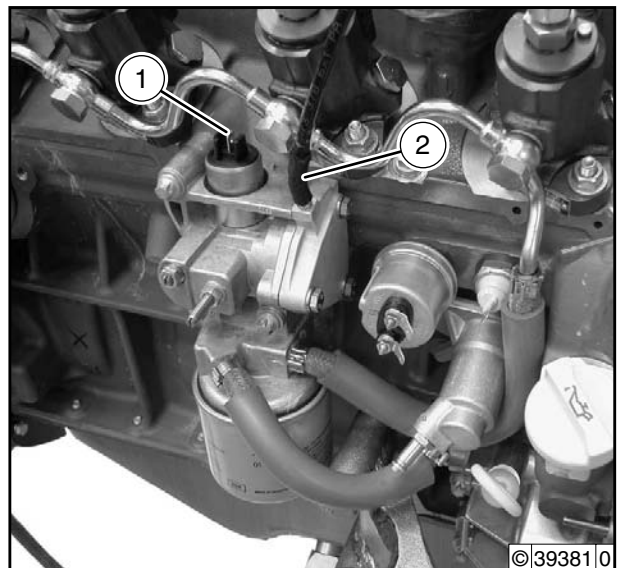
Remove charging pressure full load stop

In FL, BFL engines

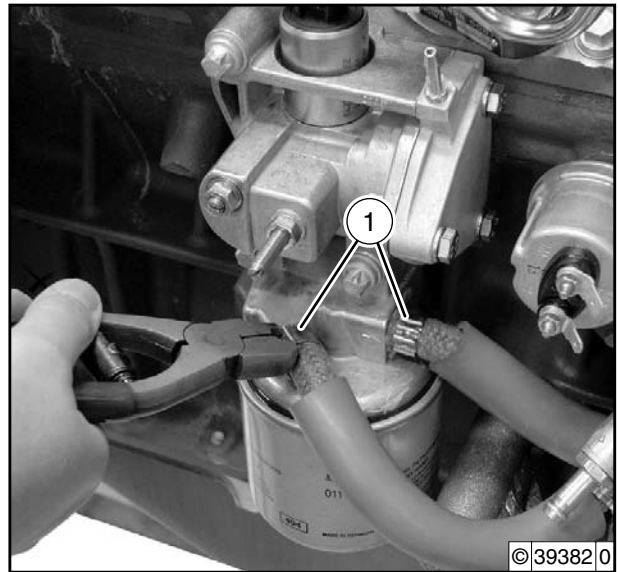
- Unscrew screws (1) and remove the air duct cover (2).



- Pull the cable plug out of the solenoid valve (1) if available.
- Pull out the underpressure line (2).

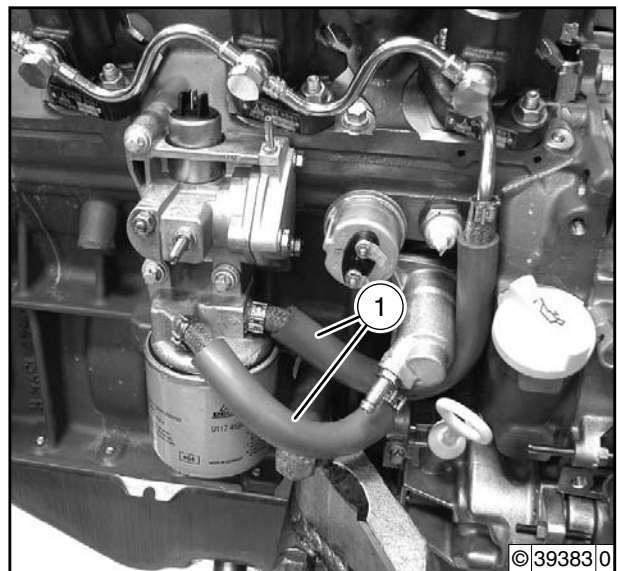


- Loosen the hose clips (1) with clamping pliers.

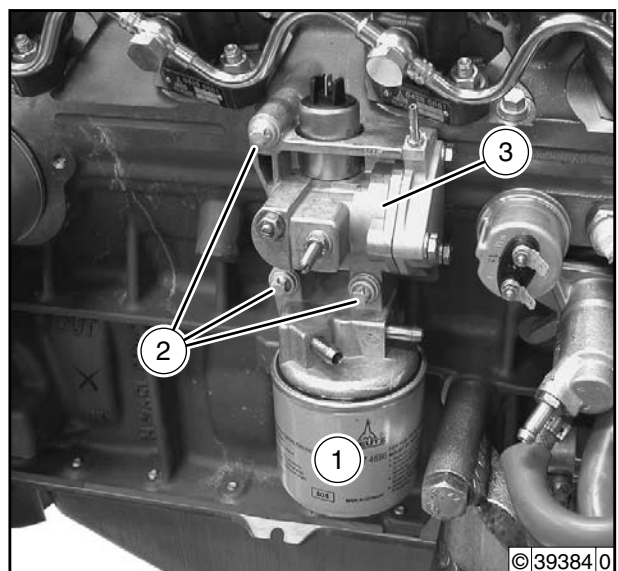


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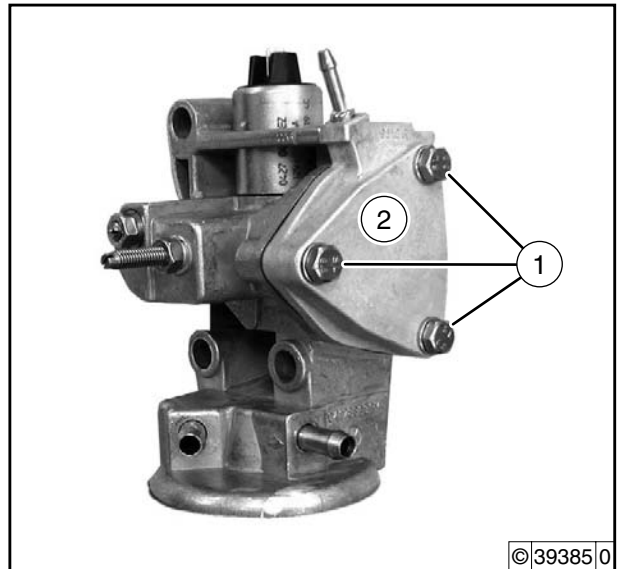
- Pull off the fuel pipes (1).



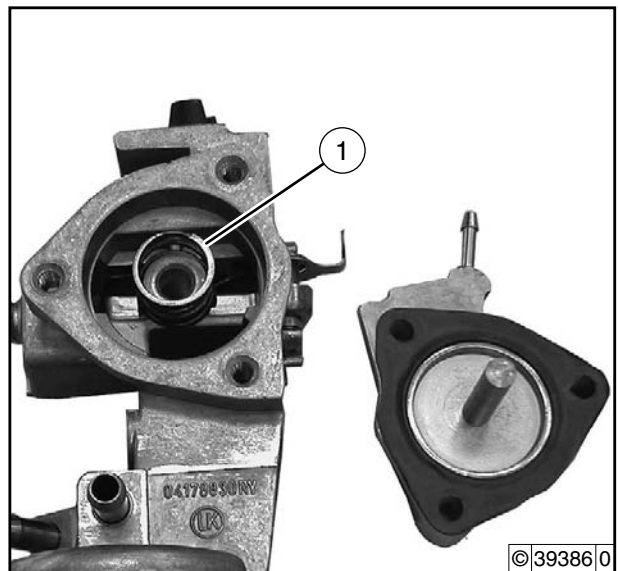
- Unscrew fuel filter (1) with special wrench.
- Unscrew screws (2) and remove fuel filter console (3) with LDA.



- Unscrew screws (1), remove cover (2) with diaphragm.



- Remove spring (1).



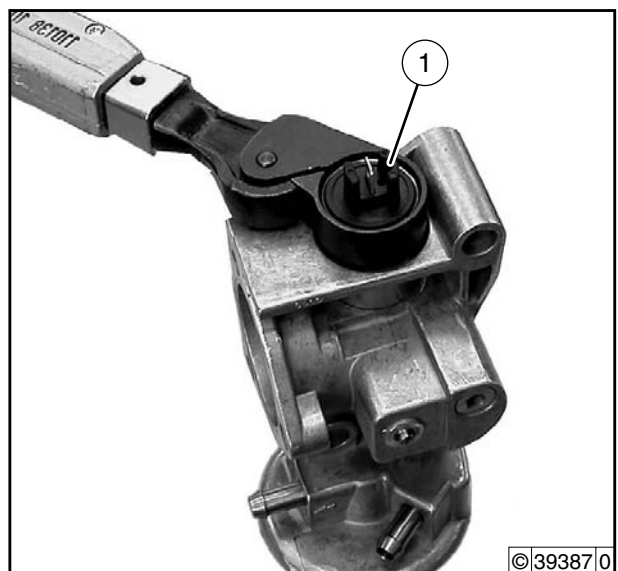
- Unscrew solenoid valve (1) with pliers insert and remove sealing ring.



Note

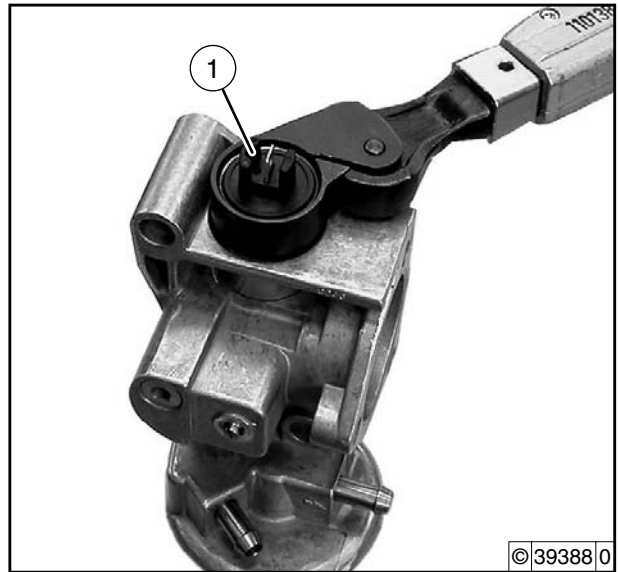
- Note clamping direction of the pliers insert.

- Check components for visible signs of damage.



Install charging pressure dependent full load stop

- Mount solenoid valve (1) with new CU sealing ring and tighten with pliers insert.



6

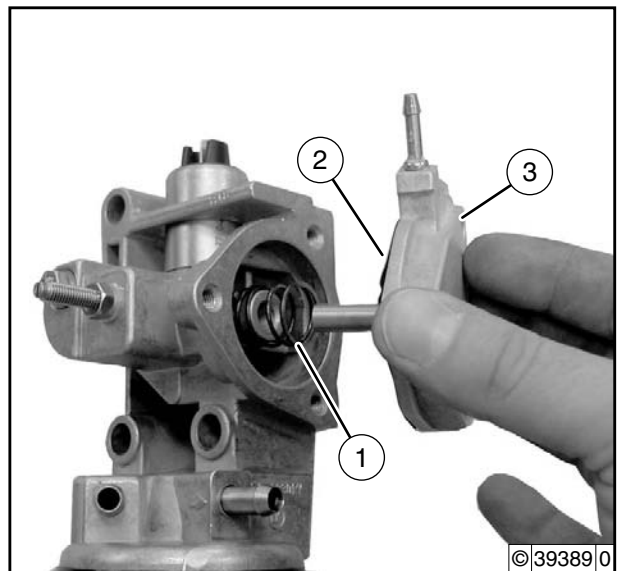
- Mount spring (1), diaphragms (2) and cover (3).



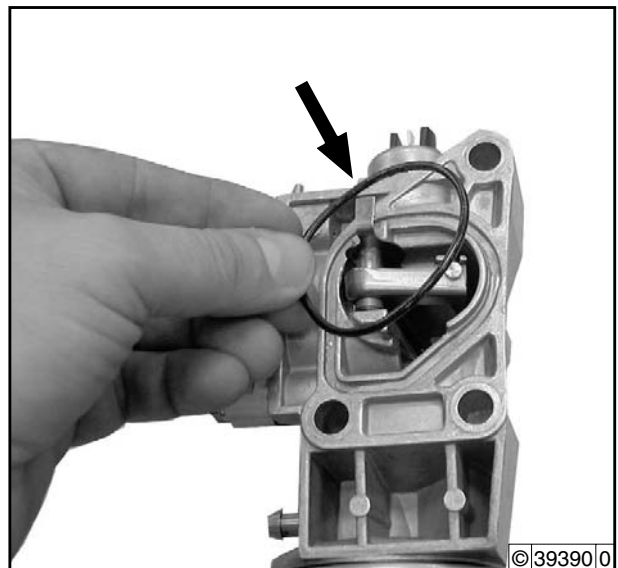
Note

Note the installation position of the cover, the underpressure connection must face upwards.

- Tighten screws.



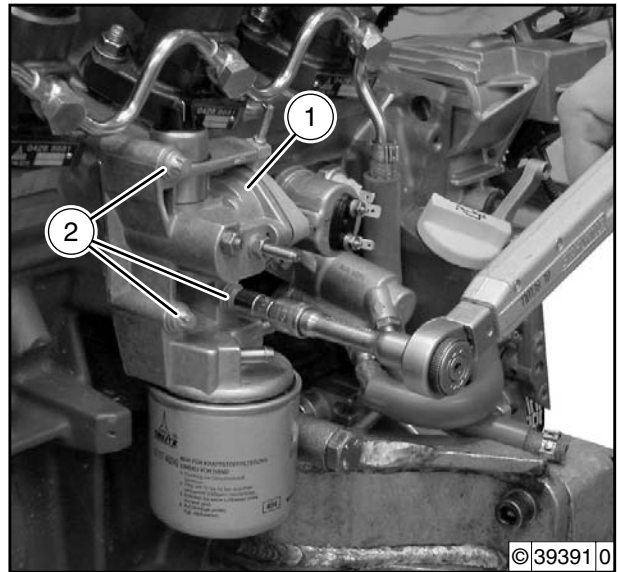
- Clean the sealing surface on the fuel filter console and crankcase.
- Renew the gasket (arrow).



- Mount fuel filter console (1) with LDA and tighten screws (2).



- Oil sealing ring on fuel filter lightly.
- Tighten fuel filter hand tight.



- Plug fuel pipes and fix pipe clips (1) with clamping pliers.

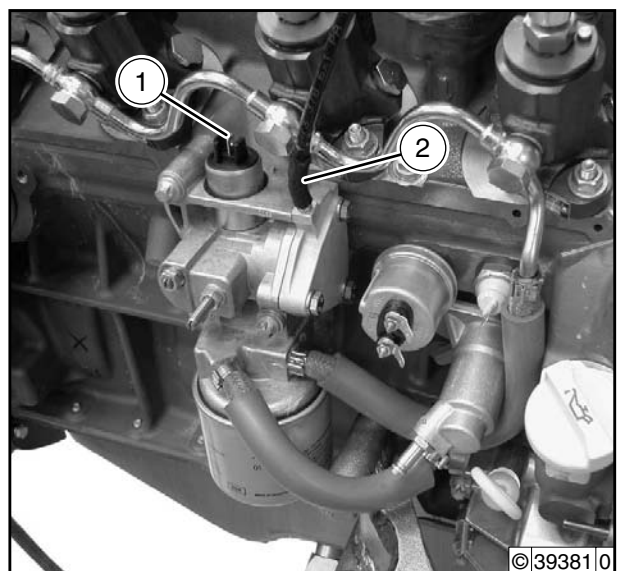


Note

- Check fuel pipes and renew if necessary.
- Observe assignment of the fuel pipes.



- Plug cable plug to solenoid valve (1) if available.
- Plug on the underpressure line (2).



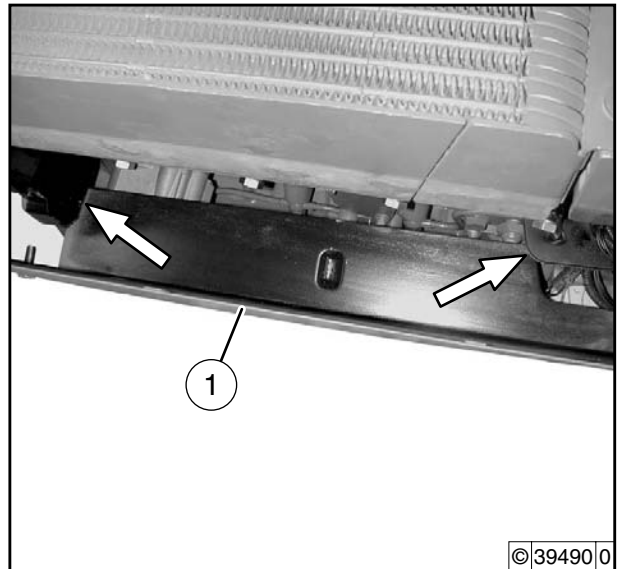
In FL, BFL engines

- Mount air duct cover (1).



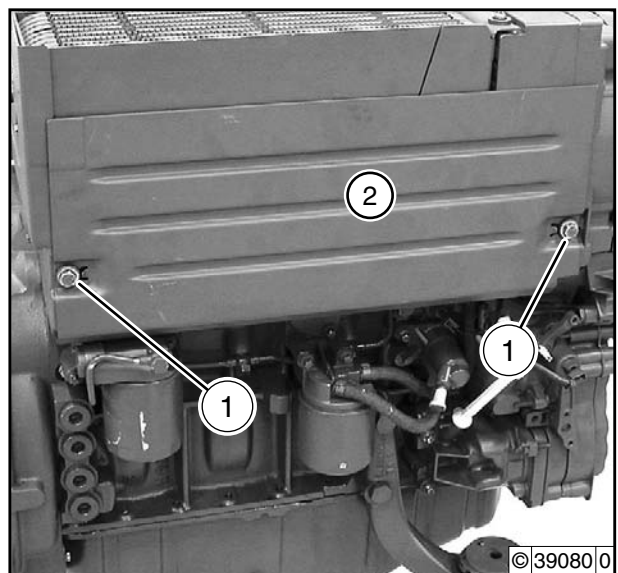
Note

The air duct cover must be under the stand plate and the profile rubber (arrows).



6

- Fix air duct cover (2).
Tighten screws (1).



Remove and install fuel lines (with Bosch injection pumps)



Tools

- Commercial tools
8011 - Clamping pliers



Note

Collect drained operating materials in suitable vessels and dispose of according to regulations.



References

- W 08-08-02



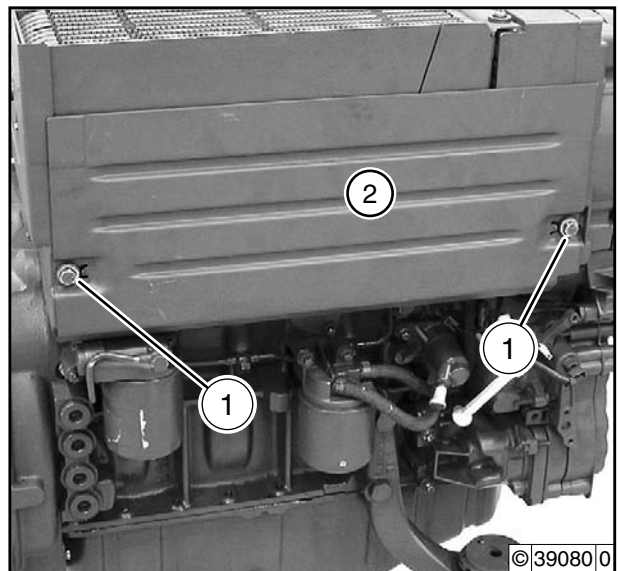
Caution!

Observe the safety regulations and national specifications for handling fuels!

Remove fuel lines

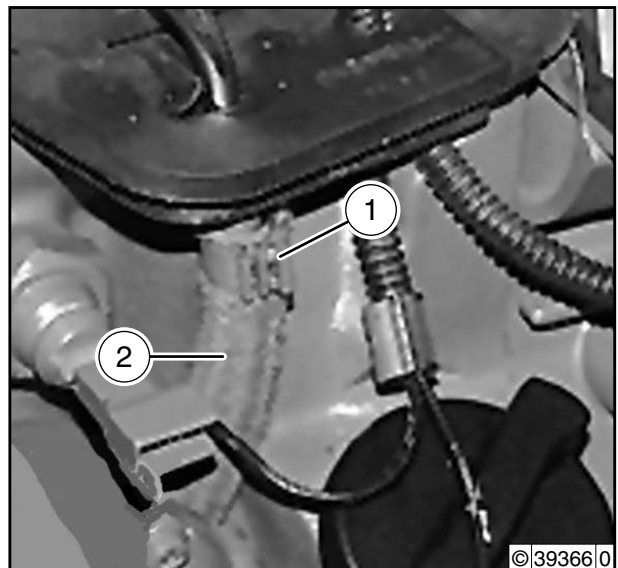
In FL, BFL engines

- Unscrew screws (1) and remove air duct cover (2).

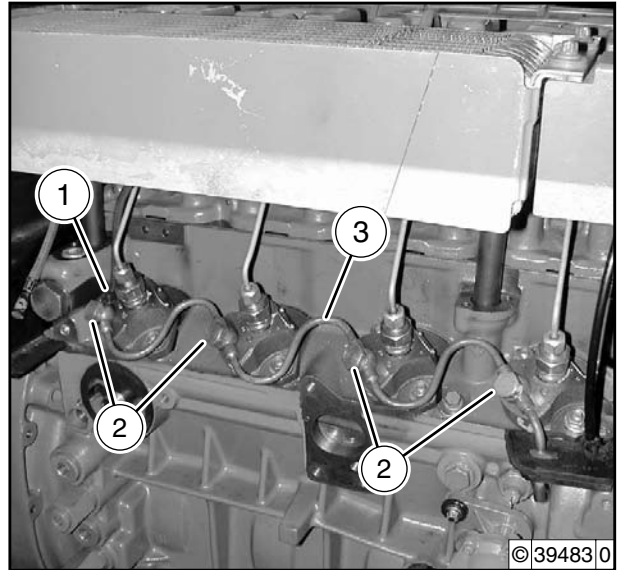


Remove fuel supply line

- Loosen pipe clip (1) and pull off fuel pipe (2).



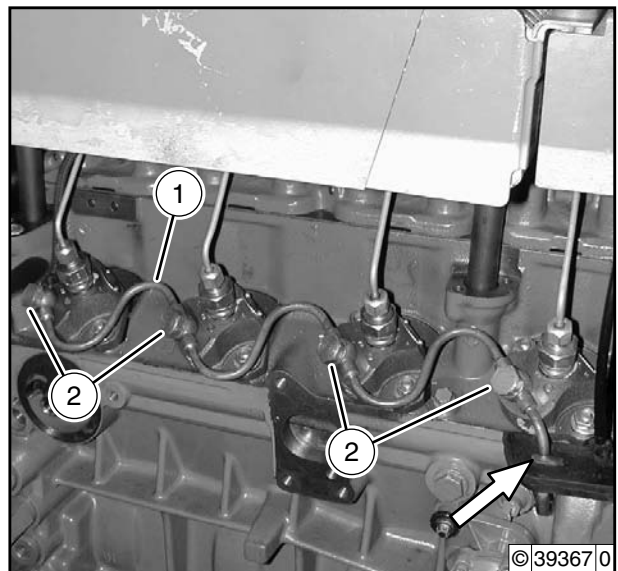
- Loosen hose clip and pull off return pipe (1).
- Unscrew hollow screws (2), remove fuel supply line (3) and sealing rings.
- Check components for visible signs of damage.



6

Install fuel supply line

- Push fuel supply line (1) through the profile rubber (arrow) and position.
- Tighten hollow screws (2) with new CU sealing rings.

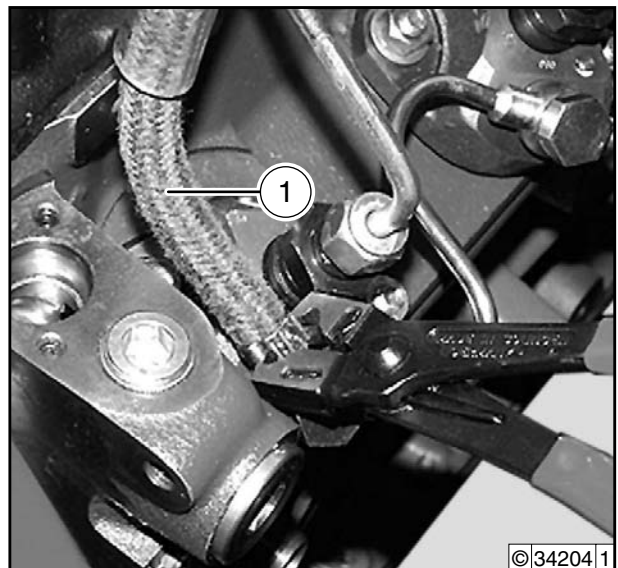


- Attach return hose (1) and fix hose clip with clamping pliers.



Note

Check return pipe, renew if necessary.

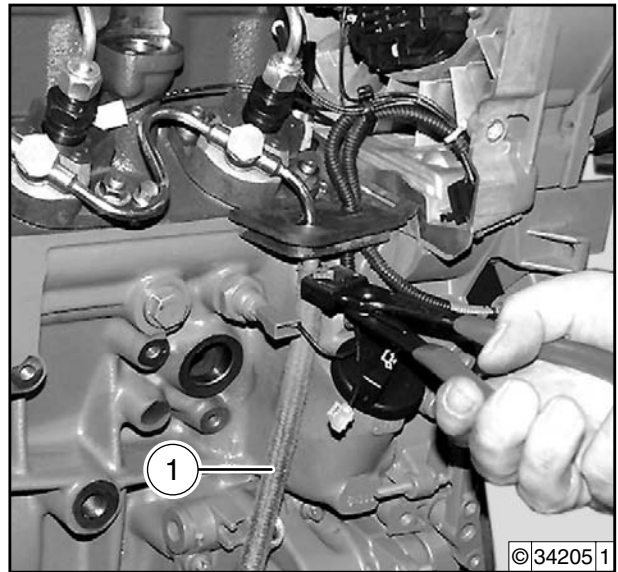


- Attach fuel hose (1) and fix hose clip with clamping pliers.



Note

Check fuel pipe and renew if necessary.



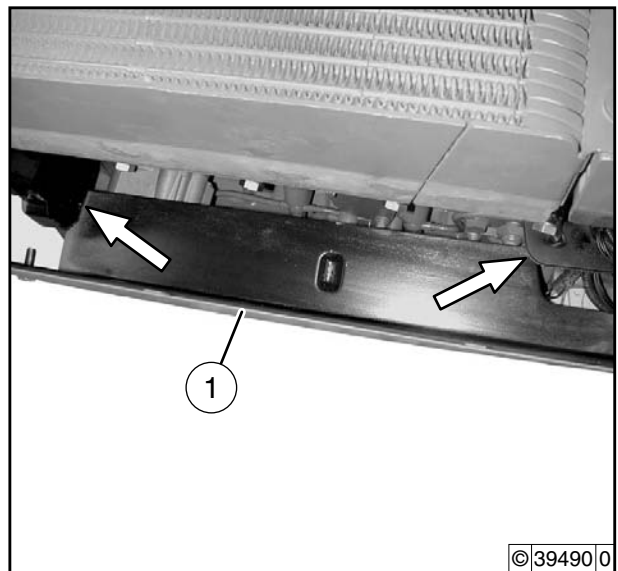
In FL, BFL engines

- Mount air duct cover (1).

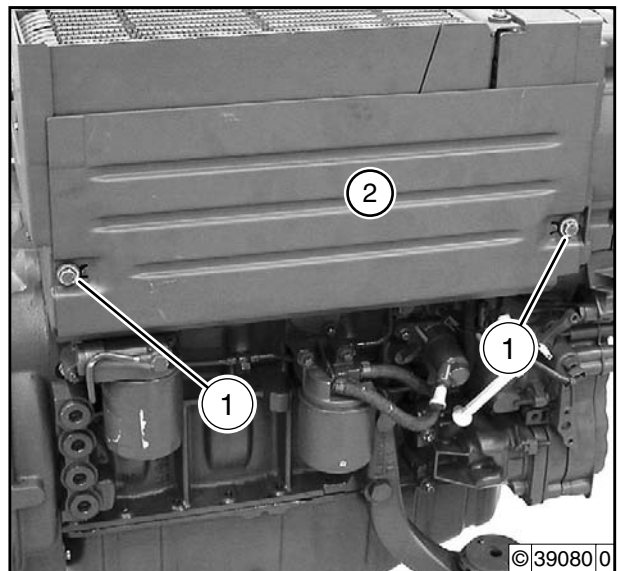


Note

The air supply cover must be under the stand plate and the profile rubber (arrows).



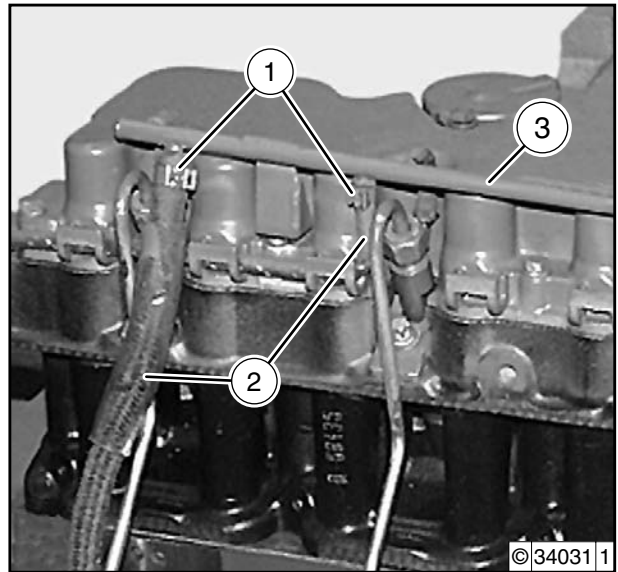
- Fix air duct cover (2).
Tighten screws (1).



Remove overflow pipe

In FL, BFL engines

- Remove oil cooler
→ Job card **W 08-08-02**.
- Loosen pipe clips (1) and pull off return pipes (2).
- Unscrew screws and remove overflow pipe (3).
- Check components for visible signs of damage.



6

Install overflow pipe

- Mount overflow pipe (1), attach hoses and tighten screws.

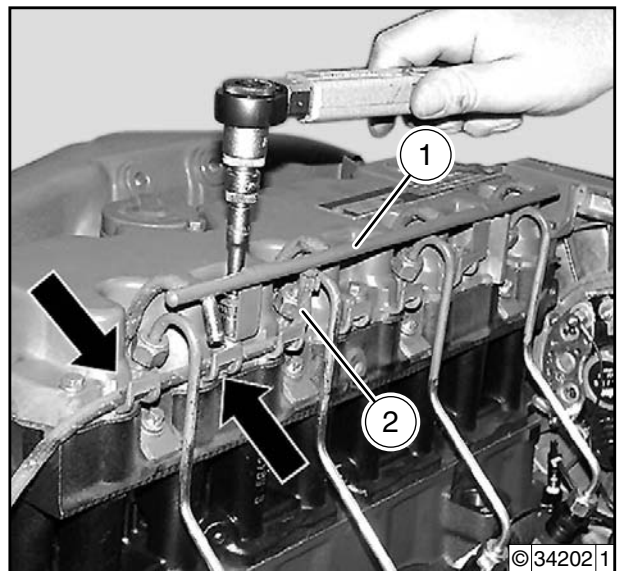


- Attach return hose (2) and fix hose clip with clamping pliers.
- Insert return hose in holder (arrows).



Note

The rubber hoses must always be renewed.



- Attach return hose (1) and fix hose clip with clamping pliers.

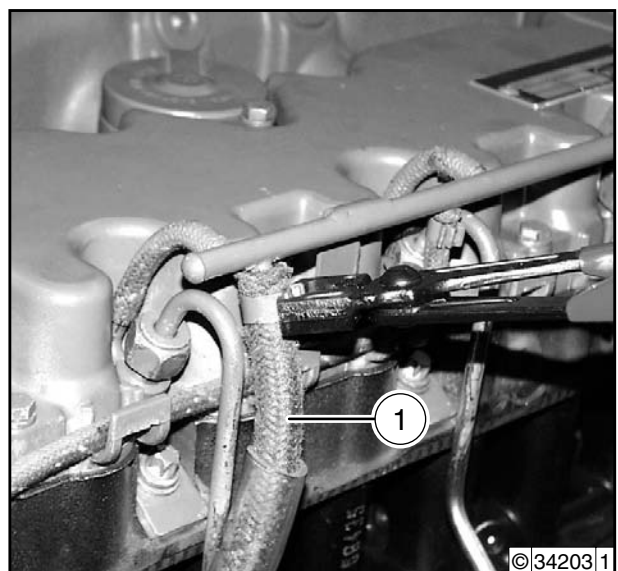


Note

Check return pipe, renew if necessary.

In FL, BFL engines

- Install oil cooler
→ Job card **W 08-08-02**.



Remove and install fuel lines (with Motorpal injection pumps)



Tools

- Commercial tools
8011 - Clamping pliers



Note

Collect drained operating materials in suitable vessels and dispose of according to regulations.



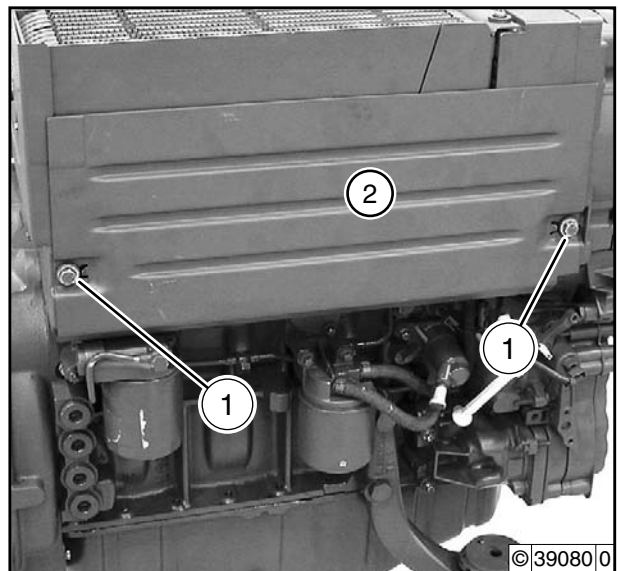
Caution!

Observe the safety regulations and national specifications for handling fuels!

Remove fuel lines

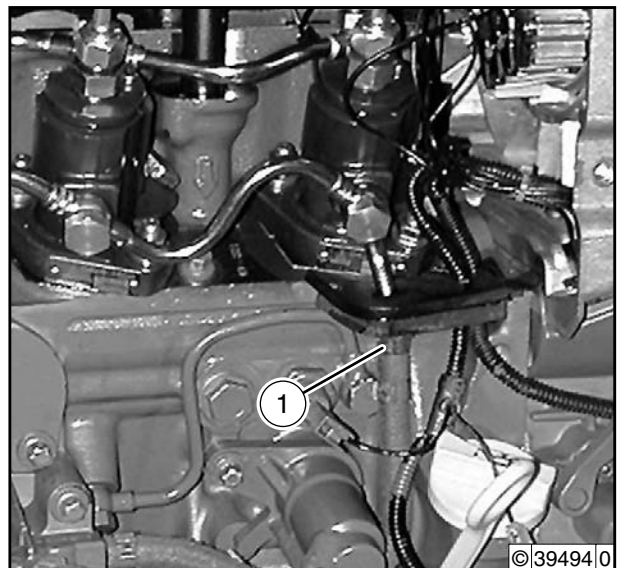
In FL, BFL engines

- Unscrew screws (1) and remove air duct cover (2).

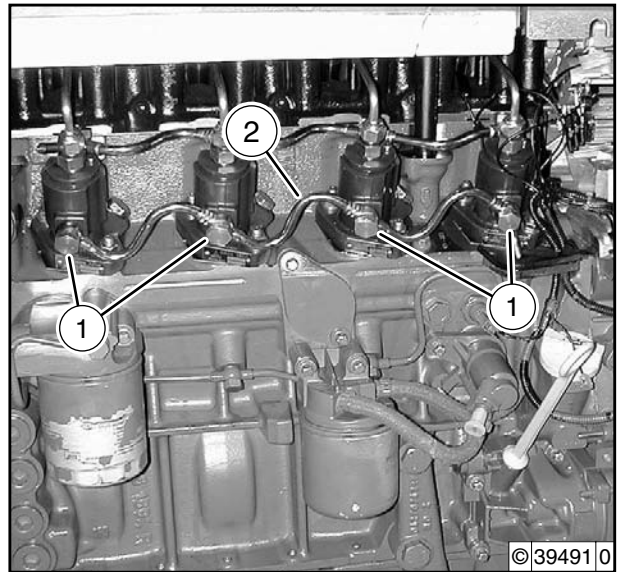


Remove fuel supply line

- Loosen pipe clip (1) and pull off fuel pipe.



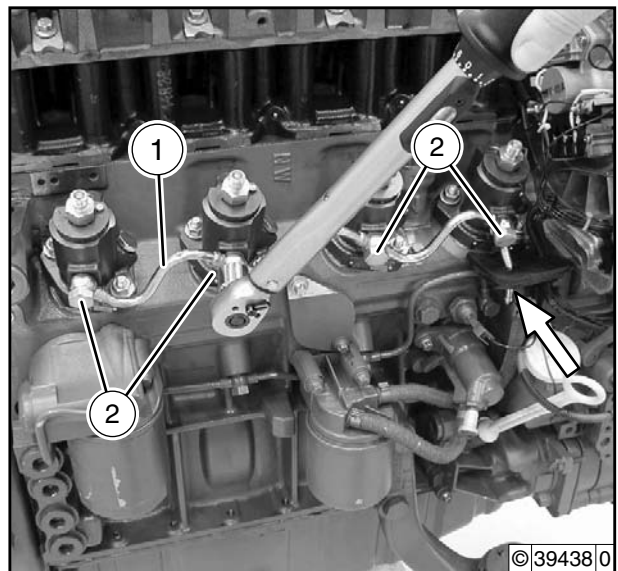
- Unscrew hollow screws (1), remove fuel supply line (2) and sealing rings.
- Check components for visible signs of damage.



6

Install fuel supply line

- Push fuel supply line (1) through the profile rubber (arrow) and position.
- Tighten hollow screws (2) with new CU sealing rings.

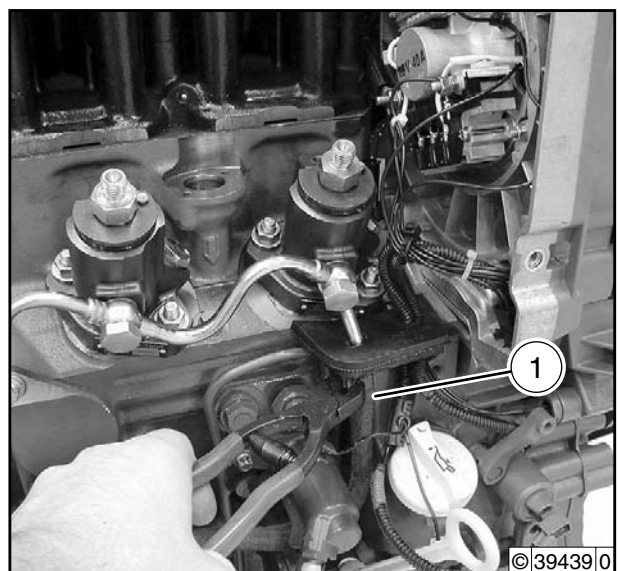


- Attach fuel hose (1) and fix hose clip with clamping pliers.



Note

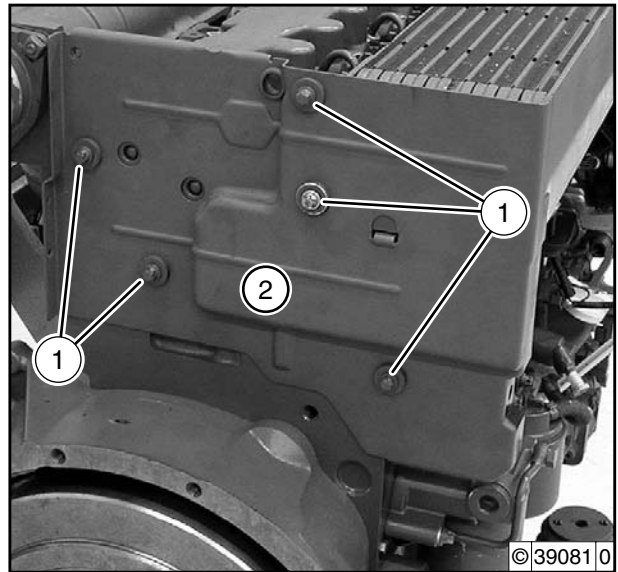
Check fuel pipe and renew if necessary.



Remove overflow pipe

In FL, BFL engines

- Unscrew screws (1) and remove standing plate (2).



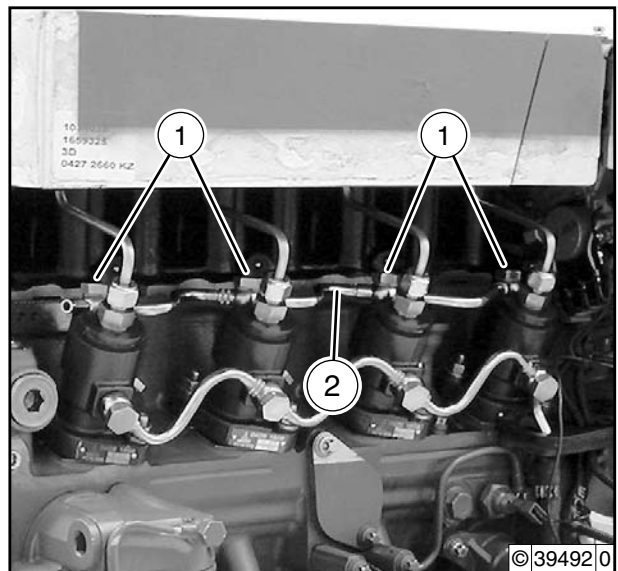
- Unscrew hollow screws (1), remove overflow pipe (2) and sealing rings.



Note

Remove overflow pipe to flywheel side.

- Check components for visible signs of damage.

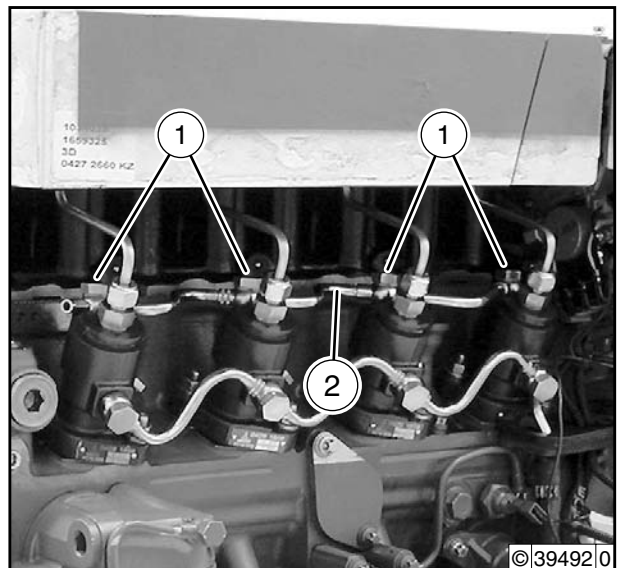


Install overflow pipe

- Mount overflow pipe (2), tighten hollow screws (1) with new CU sealing rings.



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In FL, BFL engines

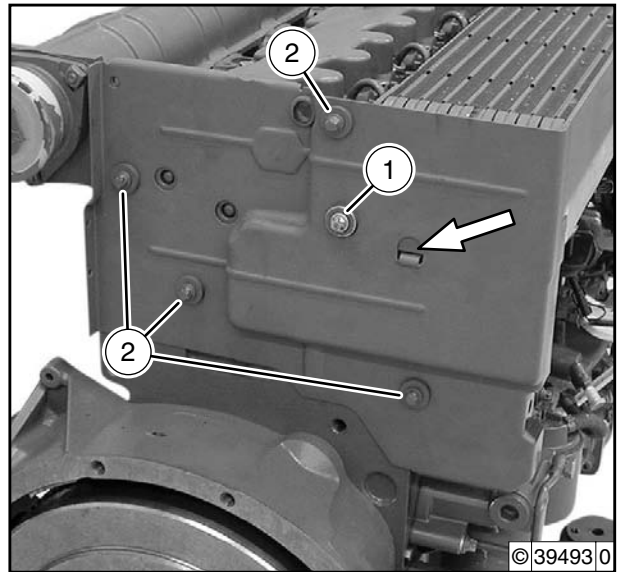
- Mount the standing plate and tighten the screws.



Note

- Note different screw length (1 and 2).
- The oil cooler must be on the latch (arrow).

- Tighten screws (1 and 2).



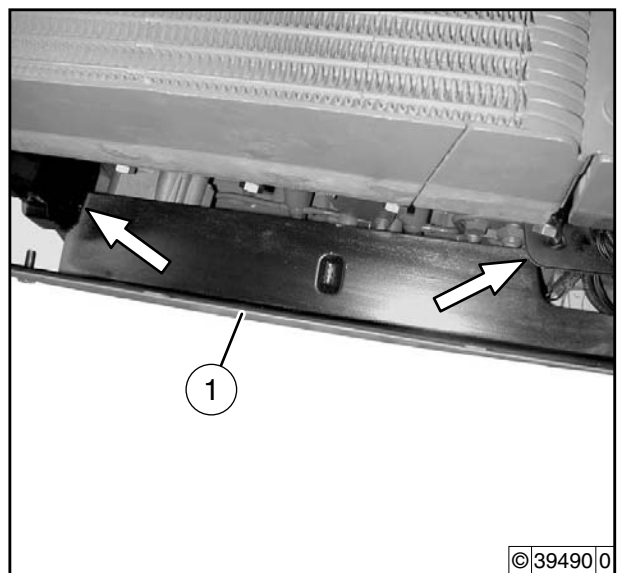
6

- Mount air duct cover (1).

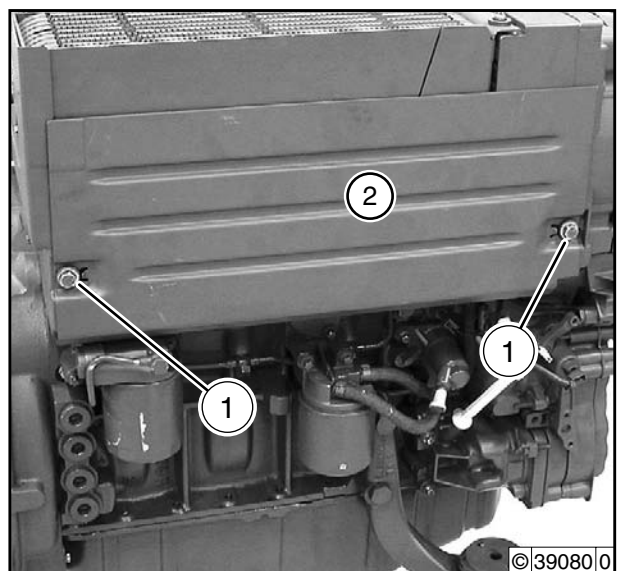


Note

- The air supply cover must be under the stand plate and the profile rubber (arrows).



- Fix air duct cover (2).
Tighten screws (1).



Remove and install fuel filter console



Tools

- **Commercial tools**
8011 - Clamping pliers

- **Special tools**
170 050 - Special wrench



Caution!

Observe the safety regulations and national specifications for handling fuels!



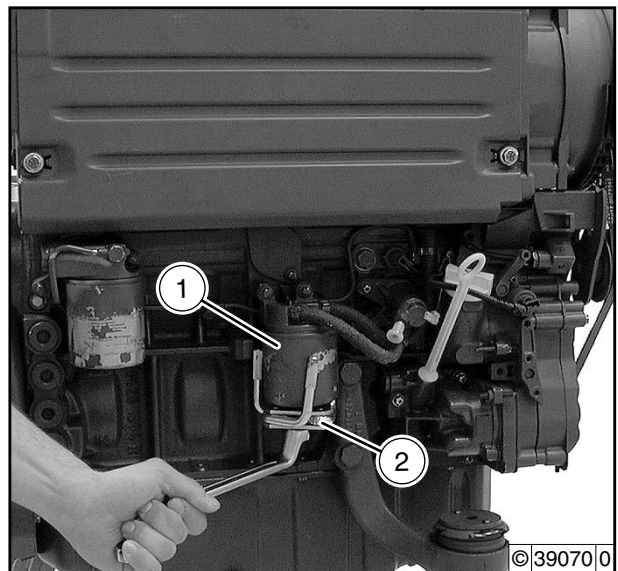
Note

Collect drained operating materials in suitable vessels and dispose of according to regulations.

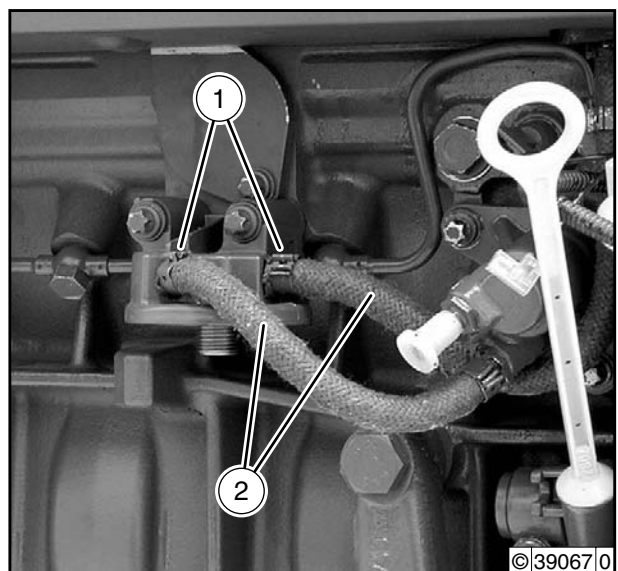
Remove fuel filter console

Remove fuel filter

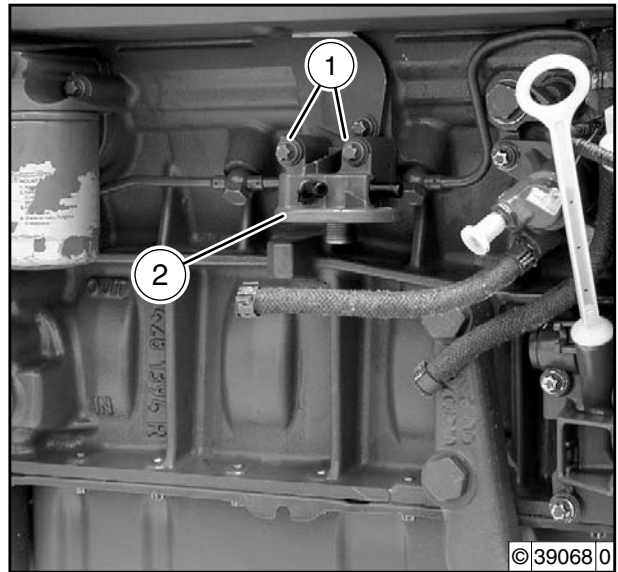
- Unscrew fuel filter (1) with special wrench.



- Loosen pipe clips (1) with clamping pliers and pull off fuel pipes (2).



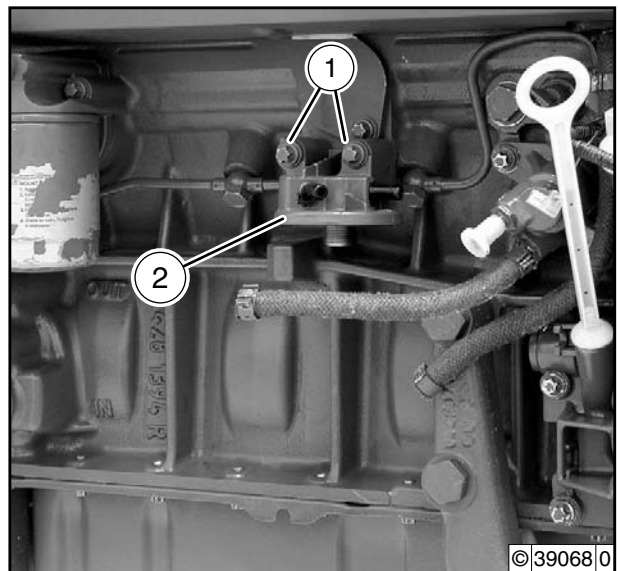
- Unscrew screws (1) and remove fuel filter console (2).
- Check components for visible signs of damage.



6

Install fuel filter console

- Mount fuel filter console (2) and tighten screws (1).

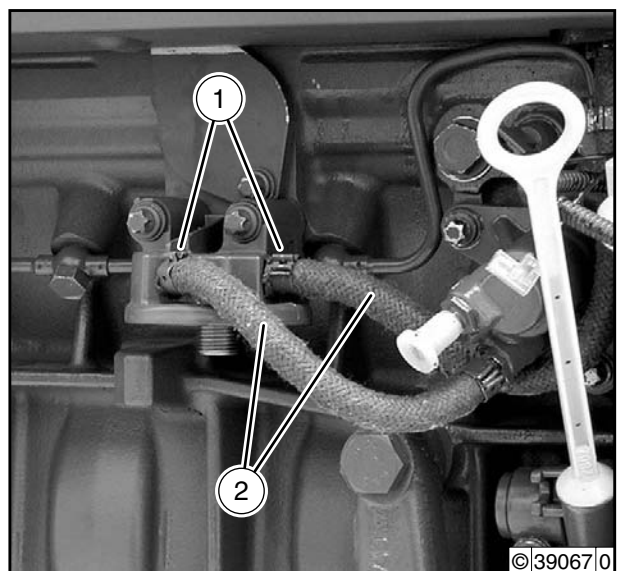


- Attach fuel pipes (2) and fix pipe clips (1) with clamping pliers.



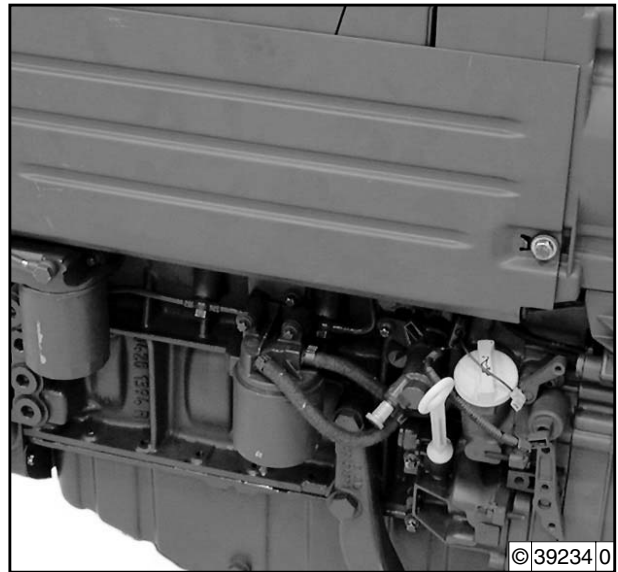
Note

- Check fuel pipes and renew if necessary.
- Observe assignment of the fuel pipes.



Install fuel filter

- Oil sealing ring on fuel filter lightly.
- Tighten new fuel filter hand tight.





Notes

Remove and install fuel pump

**Tools**

- Commercial tools
- 8011 - Clamping pliers

**Note**

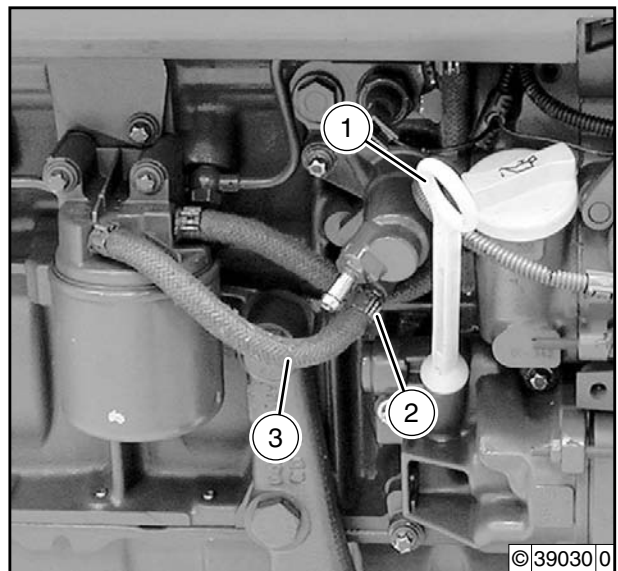
Collect drained operating materials in suitable vessels and dispose of according to regulations.

**Caution!**

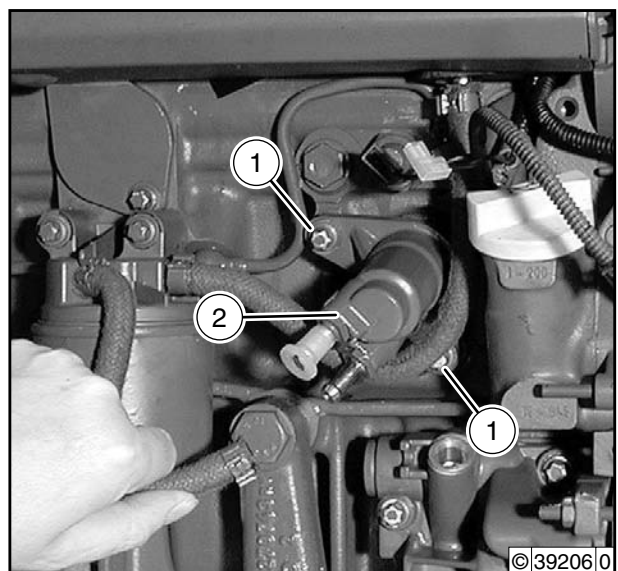
Observe the safety regulations and observe national specifications for handling fuels.

Remove fuel pump

- Pull out oil dipstick (1).
- Loosen pipe clip (2) with clamping pliers and pull off fuel pipe (3).

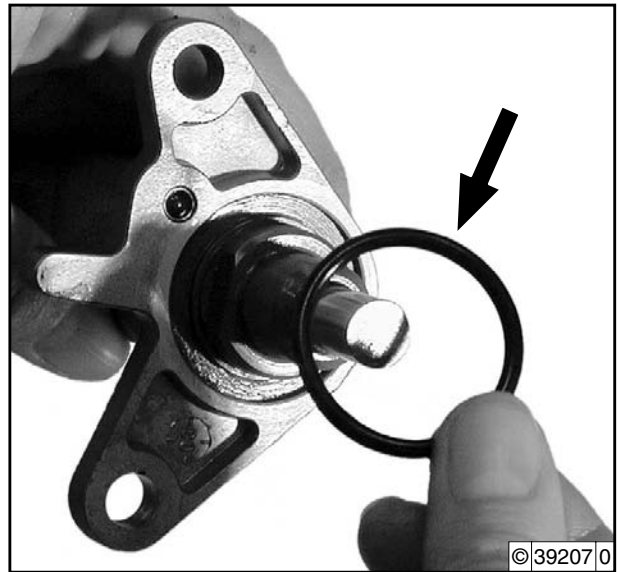


- Unscrew screws (1).
Remove fuel pump (2) and gasket.
- Check components for visible signs of damage.



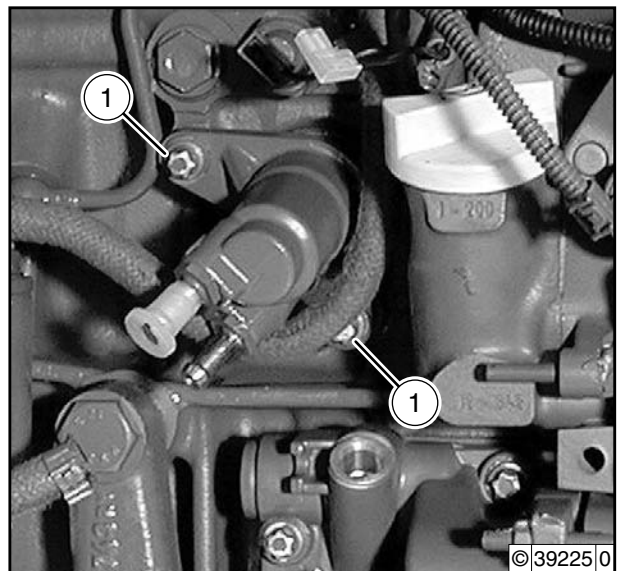
Install fuel pump

- Clean the sealing surface on the fuel pump and crankcase.
- Pull new round sealing ring (arrow) onto fuel pump.



6

- Mount fuel pump.
- Press in fuel pump to stop and tighten screws (1).
- Tighten screws.



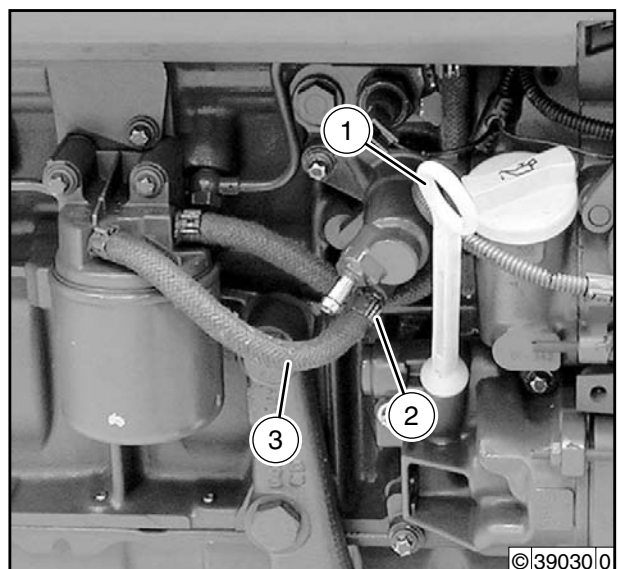
- Attach fuel hose (3) and fix hose clip (2) with clamping pliers.



Note

Check fuel pipe and renew if necessary.

- Insert oil dipstick (1).



Remove and install lube oil pump



Tools

- Commercial tools



References

- W 04-04-12 (old version)
- W 04-04-12 (new version)

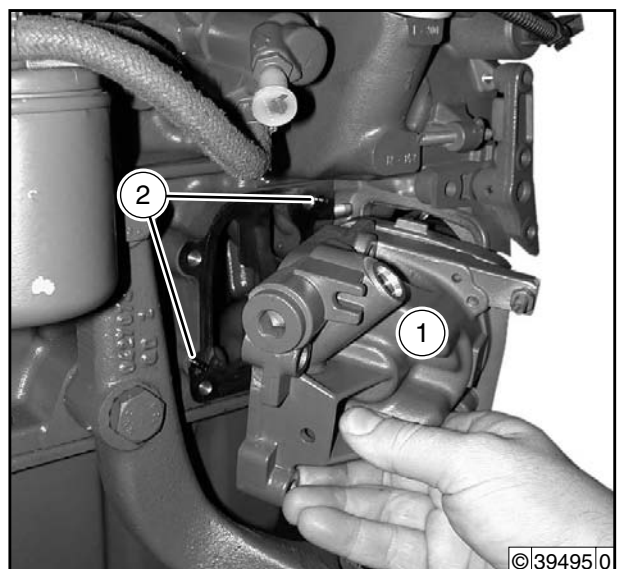
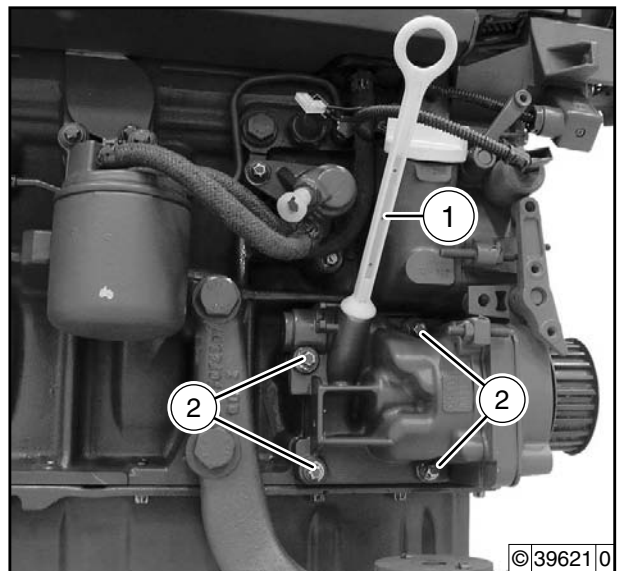


Note

Collect drained operating materials in suitable vessels and dispose of according to regulations.

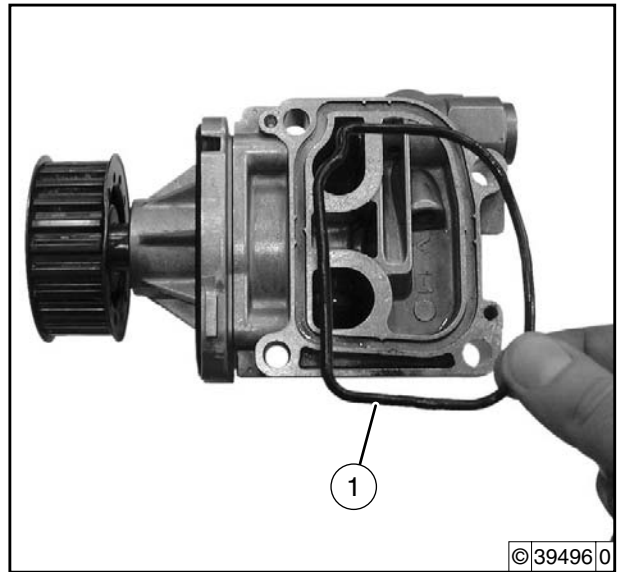
Remove lube oil pump

- Remove toothed belt and clamping roller
 - Job card W 04-04-12 (old version)
 - Job card W 04-04-12 (new version)
 - Pull out oil dipstick (1).
 - Unscrew screws (2).
-
- Press lube oil pump (1) off the clamping sleeves (2) and remove.
 - Check components for visible signs of damage.



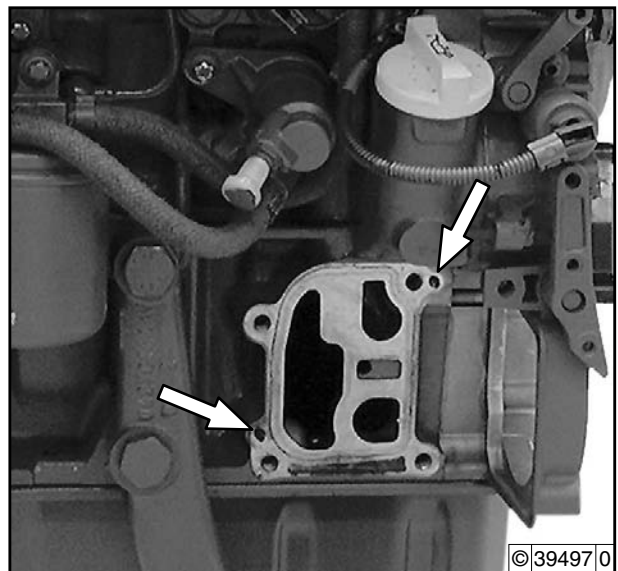
Install lube oil pump

- Clean the sealing surface on the lube oil pump and crankcase.
- Renew the gasket (1).

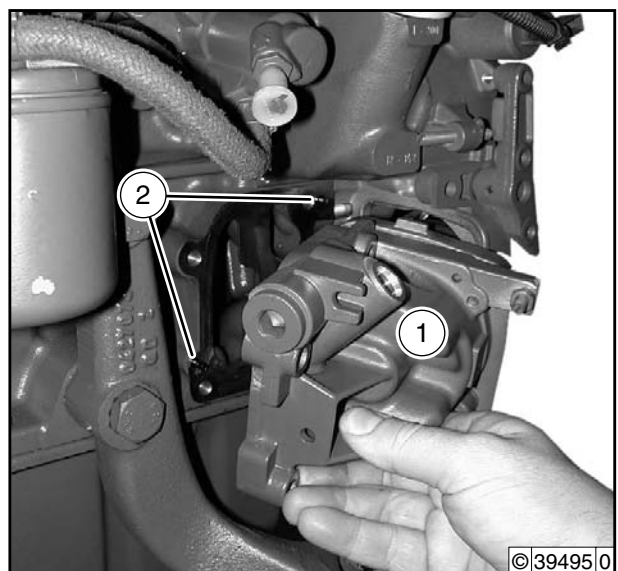


6

- Check all clamping sleeves are in place (arrows).



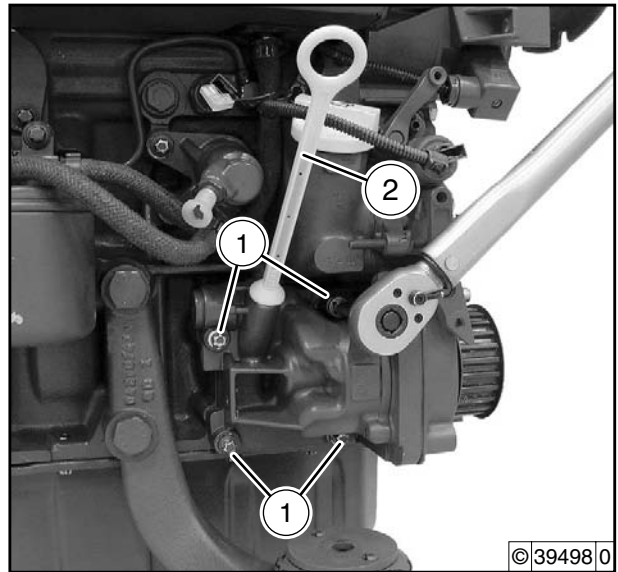
- Insert lube oil pump (1) and attach to clamping sleeves (2).



- Tighten screws (1).



- Insert oil dipstick (2).
- Install toothed belt and clamping roller
 - Job card **W 04-04-12** (old version)
 - Job card **W 04-04-12** (new version).





Notes

Remove and install oil intake pipe



Tools

- Commercial tools



References

- W 08-04-07

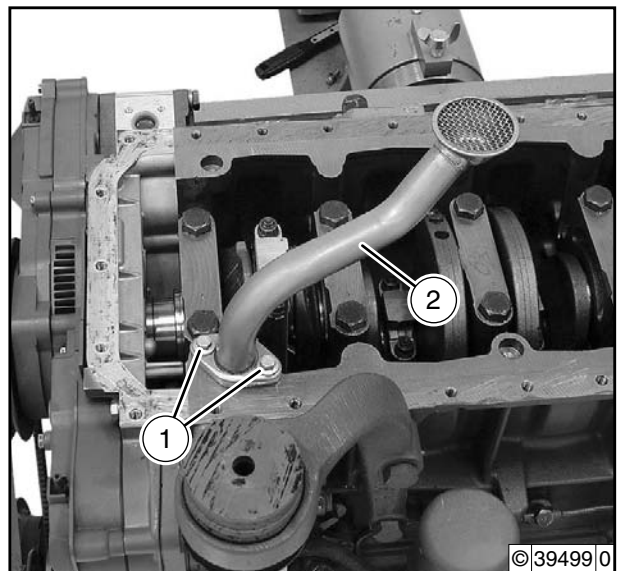


Auxiliary material

- DEUTZ DW 74

Remove oil intake pipe

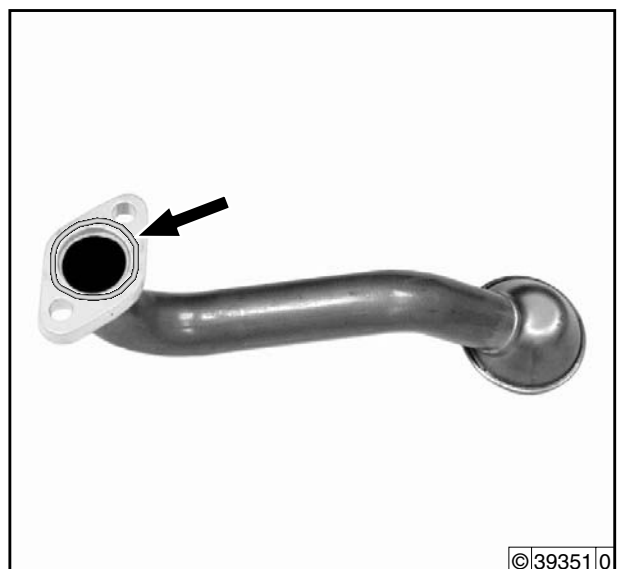
- Remove lube oil tray
→ Job card **W 08-04-07**
- Unscrew screws (1) and remove oil intake pipe (2).



6

Install oil intake pipe

- Clean the sealing surface on the oil intake pipe and crankcase.
- Apply sealant **DEUTZ DW 74** to the oil intake pipe (arrow).



- Mount oil intake pipe (1) and tighten screws (2).



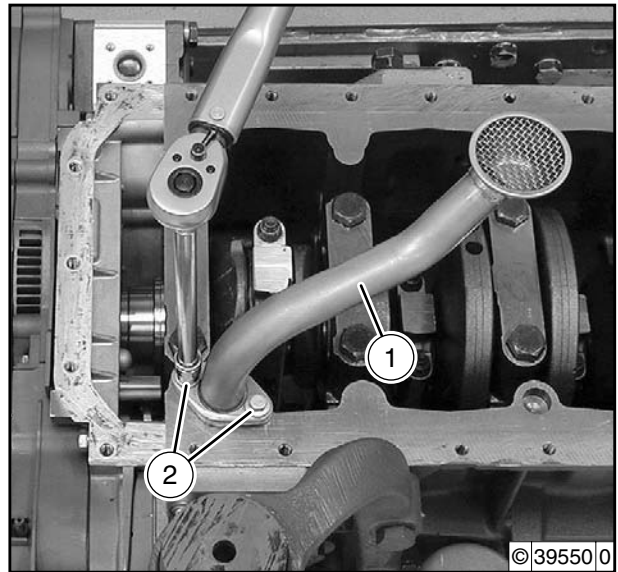
Note

Do not move the sealant when mounting the oil intake pipe.



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- Install lube oil tray
→ Job card **W 08-04-07**.



Remove and install lube oil tray



Tools

- Commercial tools
8189 - Torx tool kit



Auxiliary material

- DEUTZ DW 74

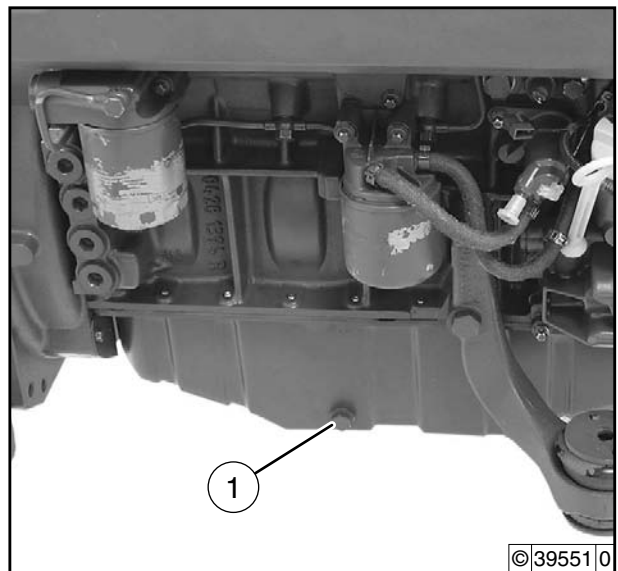


Note

Collect drained operating materials in suitable vessels and dispose of according to regulations.

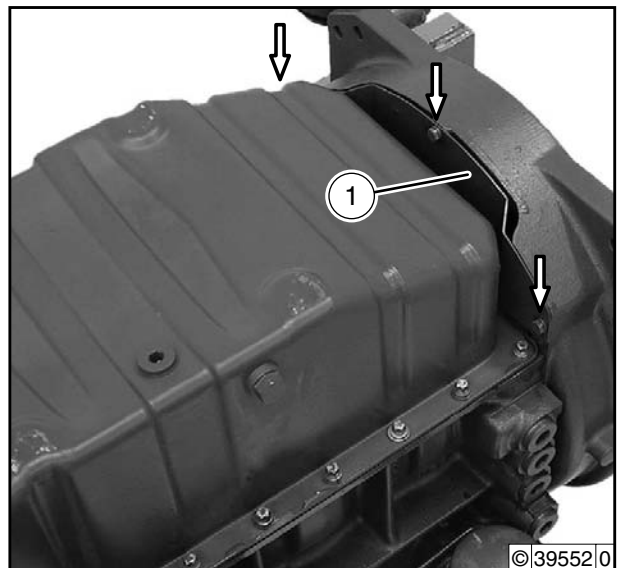
Remove lube oil tray

- Unscrew locking screw (1) and drain engine oil.
- Tighten locking screw with new sealing ring.

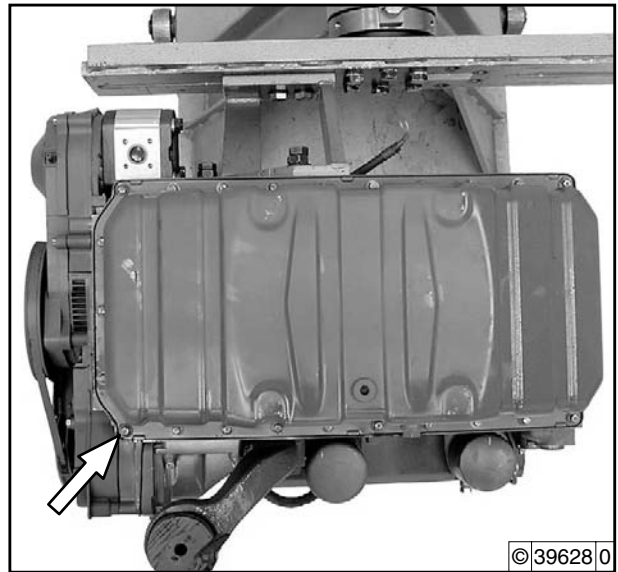


In engines with connection housing

- Unscrew screws (arrows) and remove cover plate (1).



- Unscrew all screws (arrow) and remove lube oil tray.



6

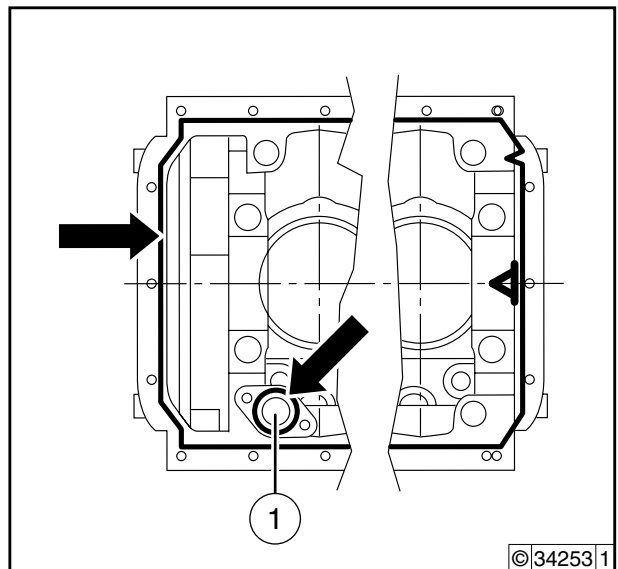
Install lube oil tray

- Clean the sealing surface on the lube oil tray and crankcase.
- Apply sealant **DEUTZ DW 74** (arrows).



Note

Make sure no sealant gets into the oil channel (1).



- Mount lube oil tray.



Note

Do not move the sealant when mounting the lube oil tray.

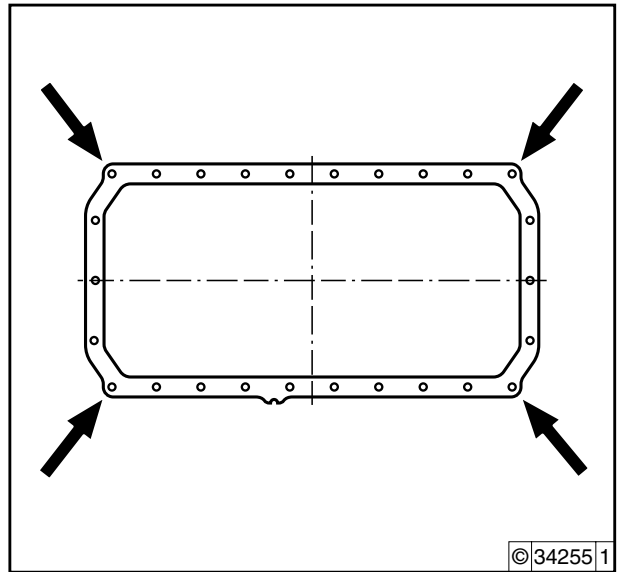


- Pre-tighten screws at the corners (arrows).



Note

Pre-tighten the screws of the lube oil tray at the corners (arrows) first then tighten all the screws in order.



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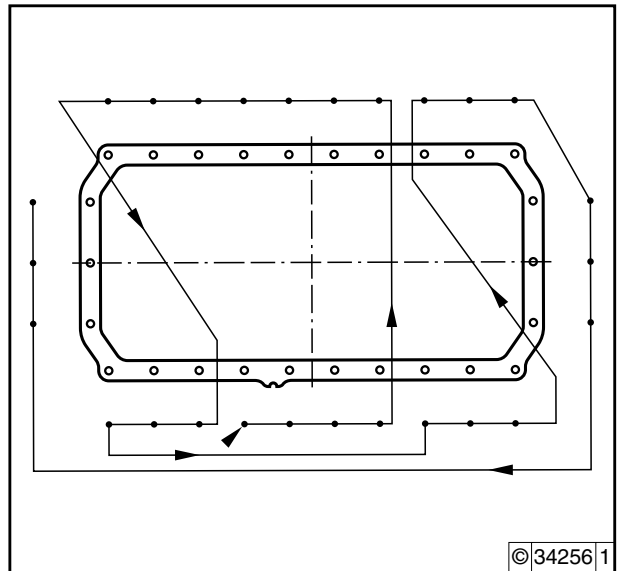
Tightening order 4-cylinder

- Tighten all bolts in the right order.



Note

Pay attention to different screw length for cast oil tray.



©34256 1

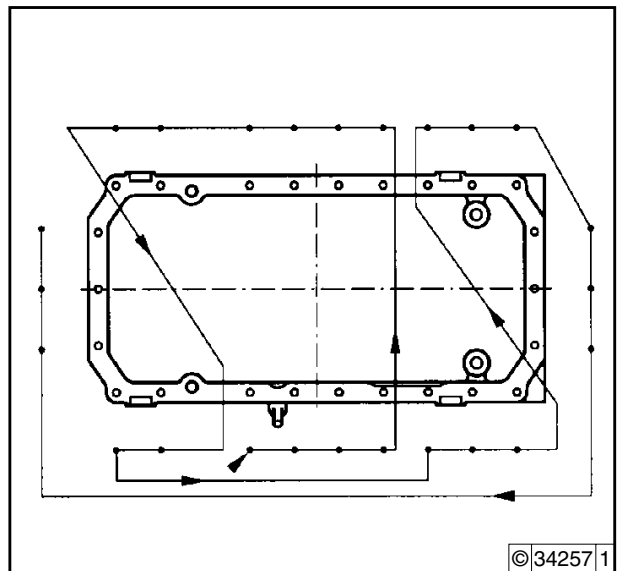
**Tightening order 4-cylinder
(cast oil tray with cylinder head screws)**

- Tighten all screws in the right order.



Note

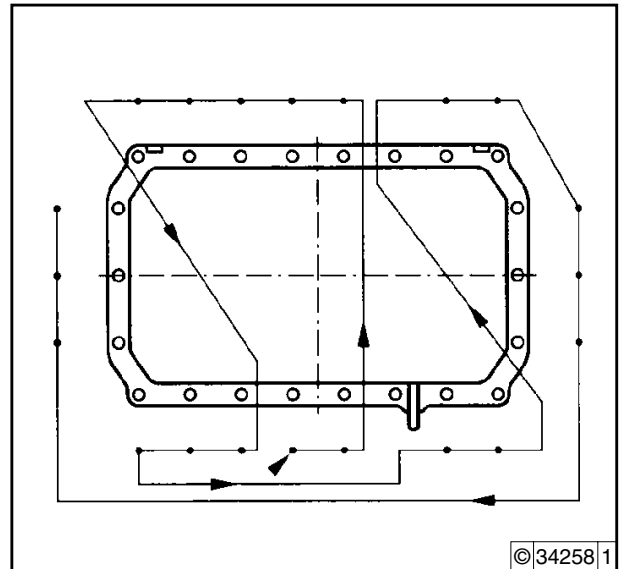
Note different screw length.



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Tightening order 3-cylinder

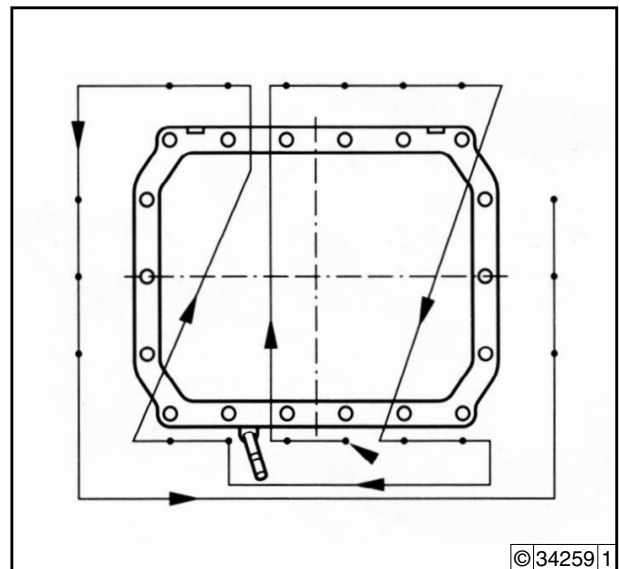
- Tighten all screws in the right order.



6

Tightening order 2-cylinder

- Tighten all screws in the right order.

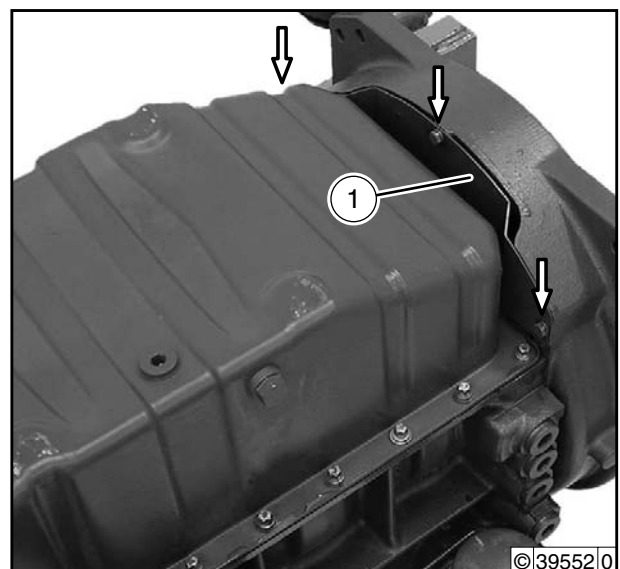


In engines with connection housing

- Fit cover plate (1) and tighten screws (arrows).



- Fill in prescribed engine oil.



Remove and install oil cooler



Tools

- Commercial tools
8189 - Torx tool kit

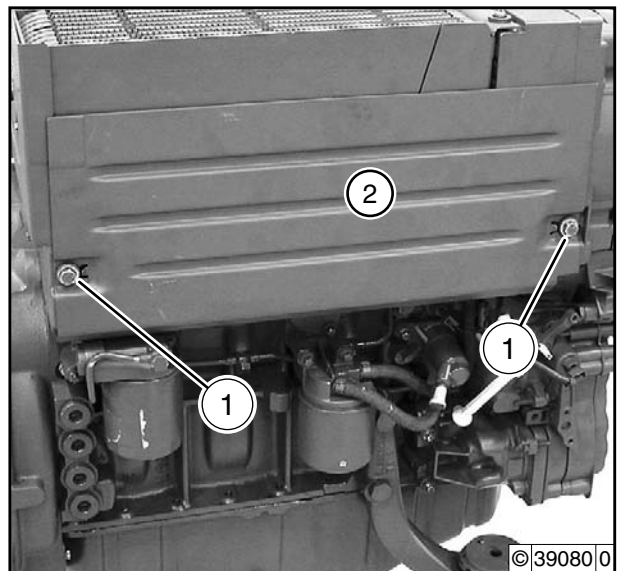


Note

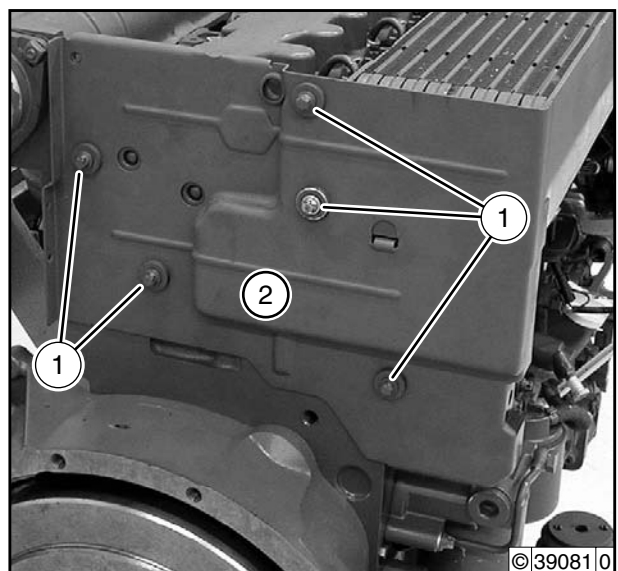
Collect drained operating materials in suitable vessels and dispose of according to regulations.

Remove oil cooler

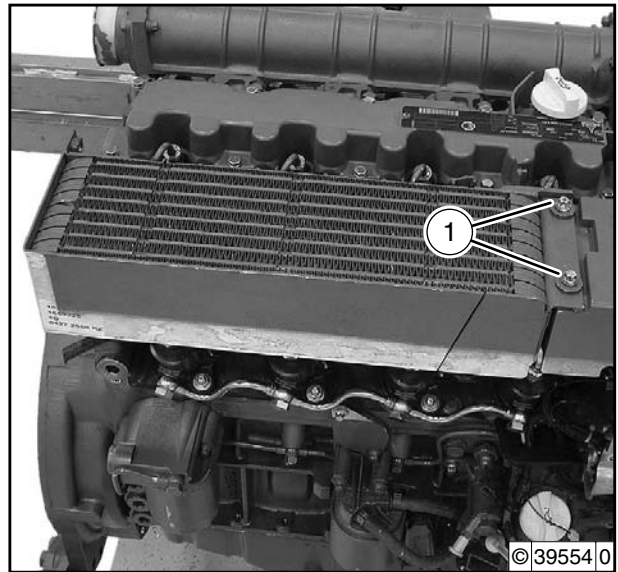
- Unscrew screws (1) and remove air duct cover.



- Unscrew screws (1) and remove standing plate (2).

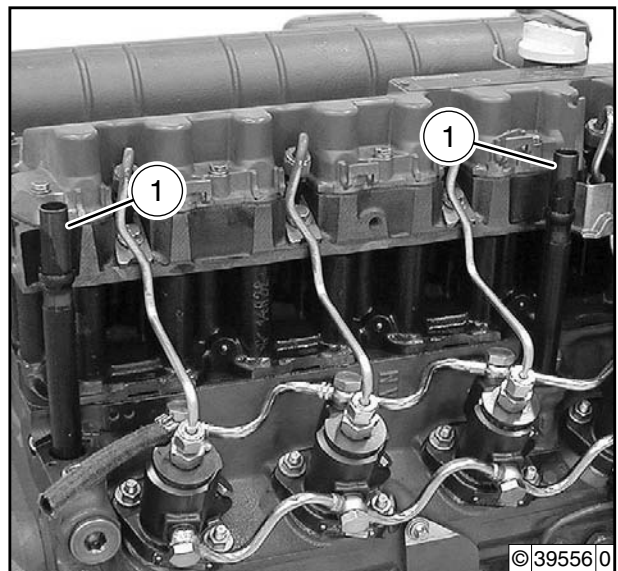


- Unscrew screws (1) and pull oil cooler up.



6

- Pull connections (1) out of crankcase.



Install oil cooler

- Check connections for visible signs of damage.

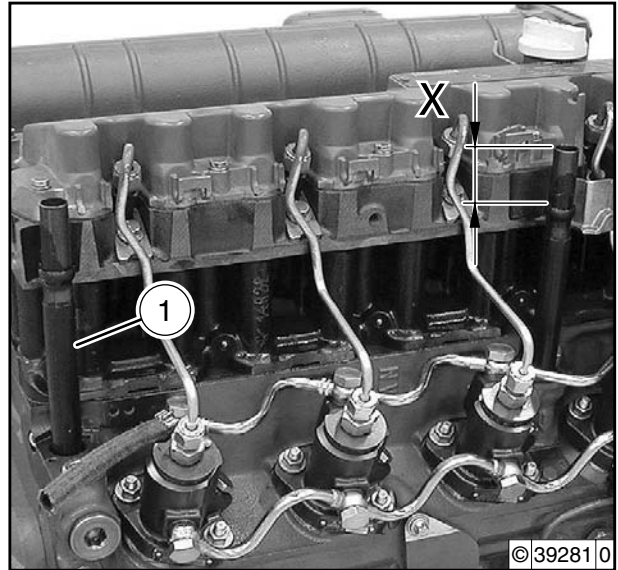


- Press connections (1) into the crankcase to the stop.



Note

The side with the long joint "X" must face upwards.

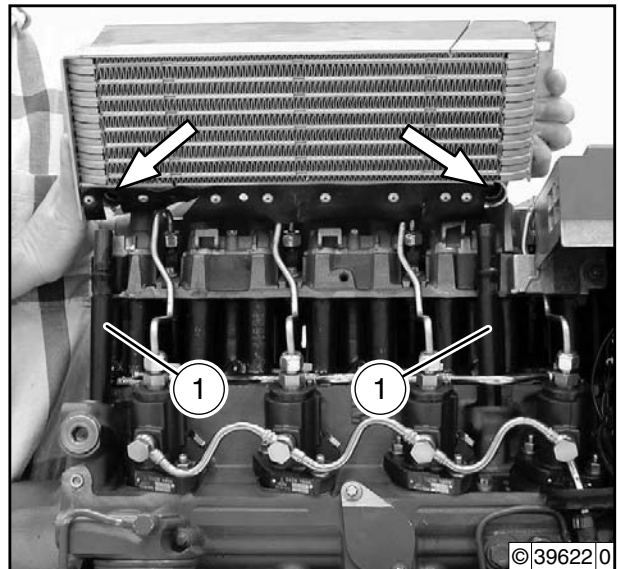


- Press the oil cooler onto the connections to the stop.



Note

Insert connections (1) in the bores (arrows).

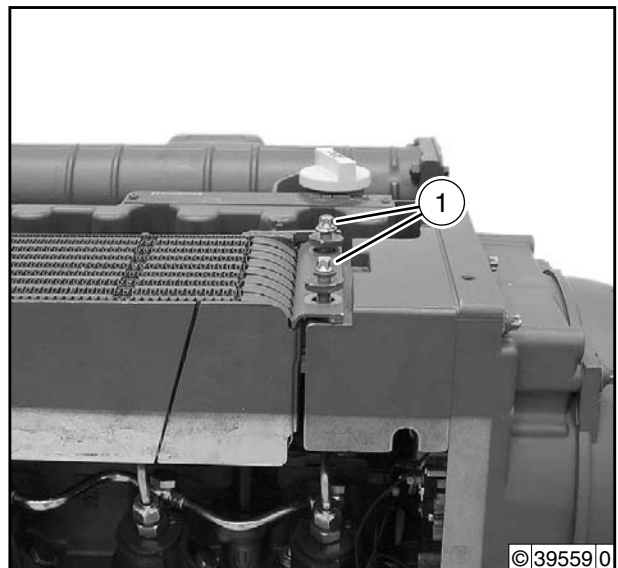


- Turn on screws (1).



Note

Do not tighten screws.

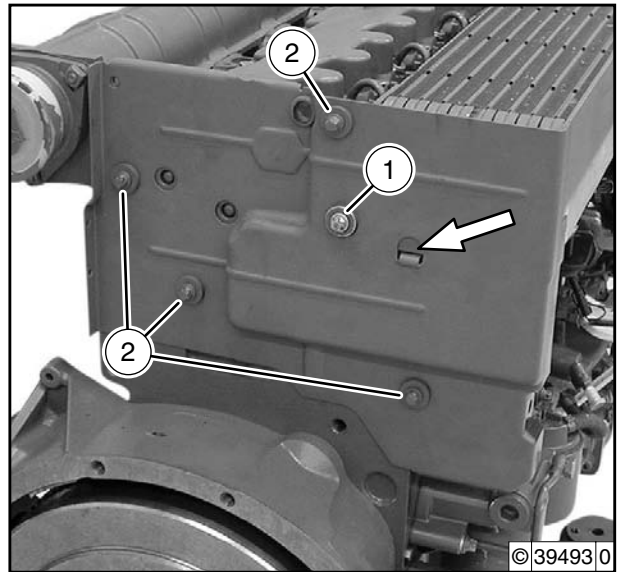


- Mount the standing plate and turn on the screws.



Note

- Note different screw length (1 and 2).
- The oil cooler must be on the latch (arrow).

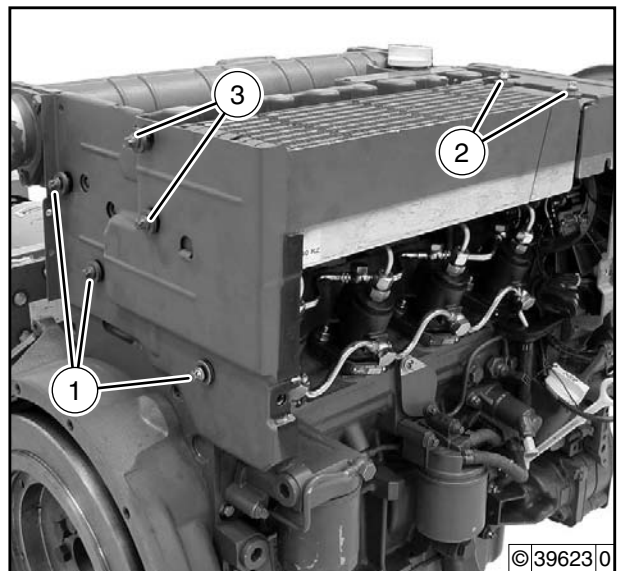


6

- Tighten screws (1 and 3).



- Tighten screws (2).

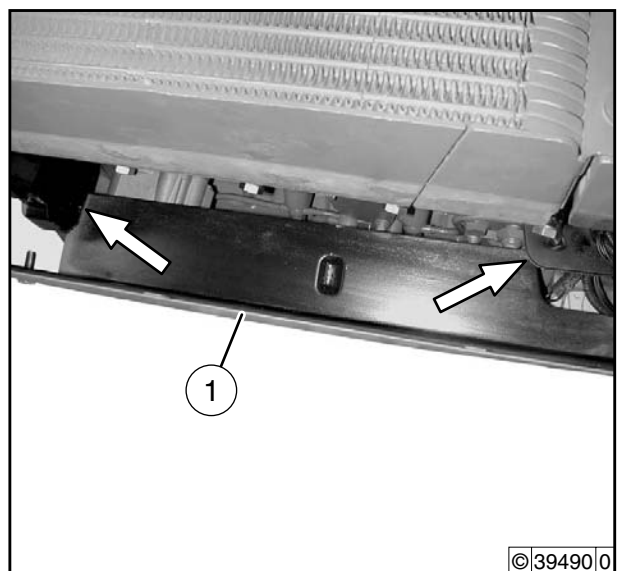


- Mount air duct cover (1).

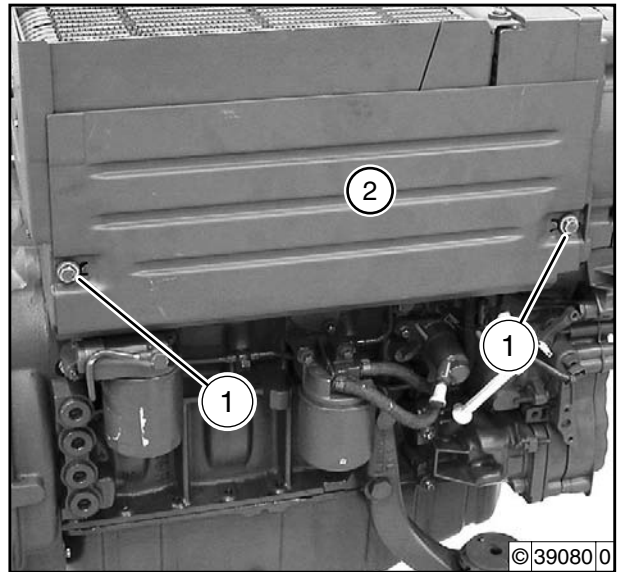


Note

- The air duct cover must be under the stand plate and the profile rubber (arrows).



- Fix air duct cover (2).
Tighten screws (1).





Notes

Remove and install oil filter cartridge



Tools

- Commercial tools

- Special tools

170 050 - Special wrench

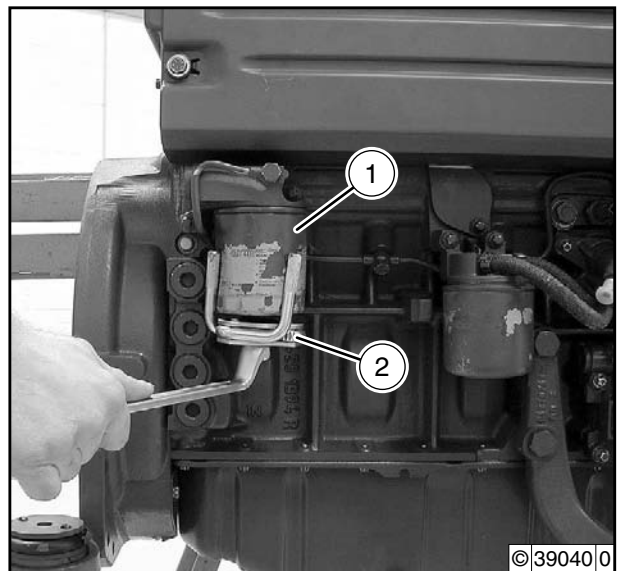


Note

Collect drained operating materials in suitable vessels and dispose of according to regulations.

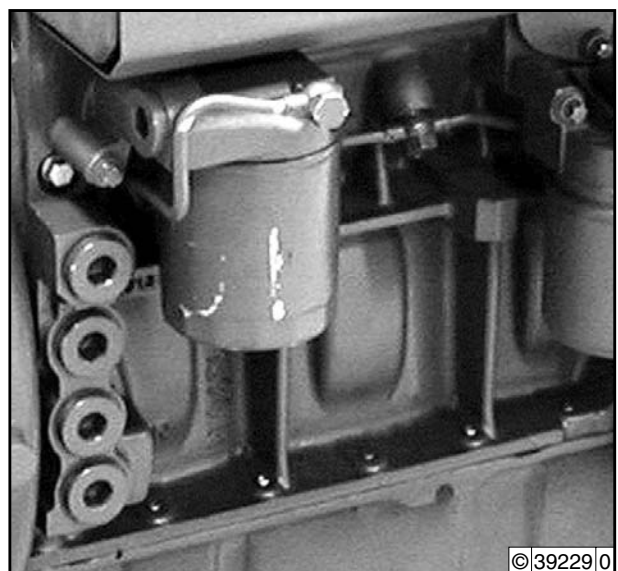
Remove oil filter cartridge

- Unscrew oil filter cartridge (1) with special device (2).



Install oil filter cartridge

- Oil the sealing ring of the new oil filter cartridge lightly and screw on hand tight.





Notes

Remove and install oil pressure regulating valve, check



Tools

- Commercial tools
- Caliper gauge



Note

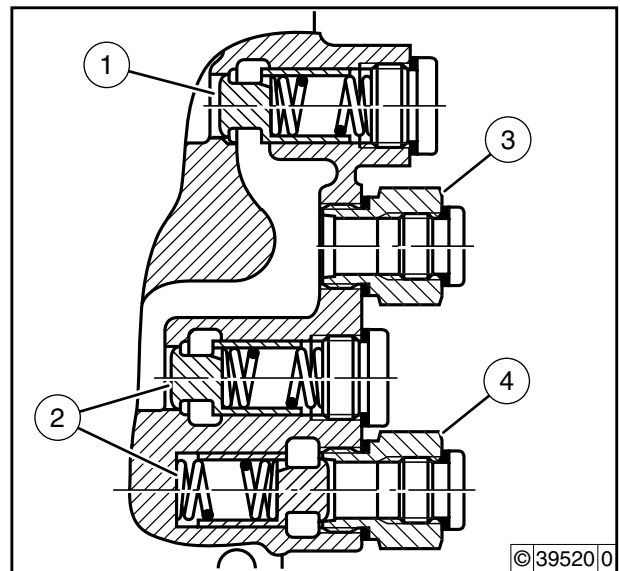
Collect drained operating materials in suitable vessels and dispose of according to regulations.



Note

Overview of valve row assignment

- An oil pressure regulating valve (1) is installed as standard in the upper oil channel. The lower oil channels are empty and sealed.
- In engines with a heater connection, additional oil pressure regulating valves (2) are available in the lower two oil channels as well as a transfer nipple for supply (3) and return (4).



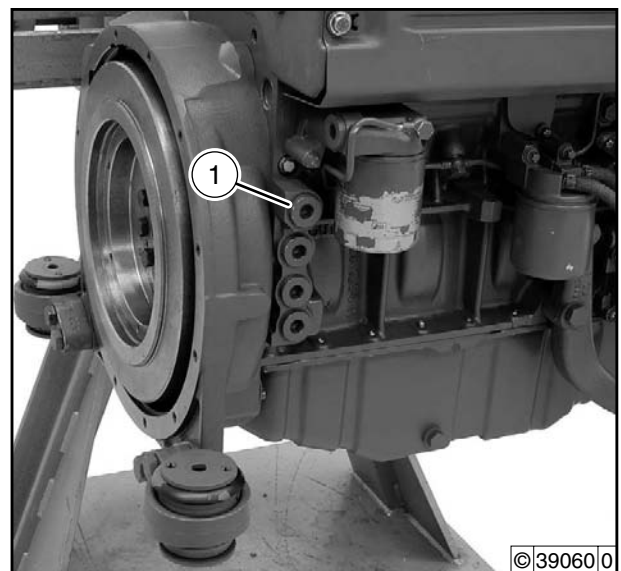
Remove oil pressure regulating valve (without heater connection)

- Unscrew cap (1), remove compression spring and valve piston.

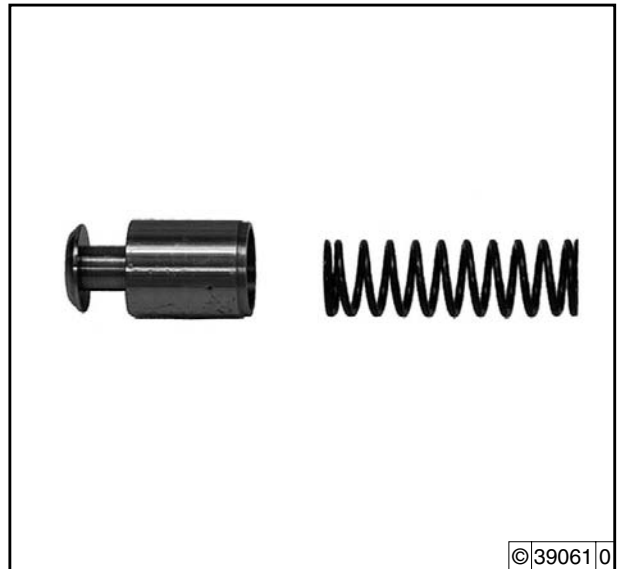


Note

When removing the cap the following parts may jump out under the pressure of the compression spring.



- Check components for visible signs of wear.



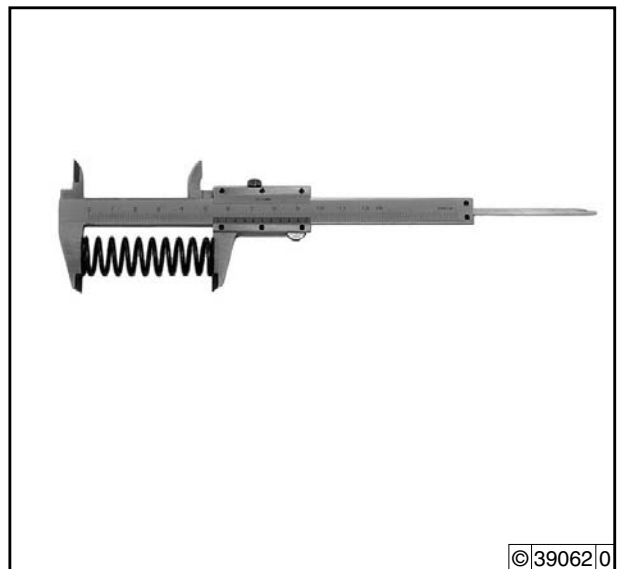
6

- Measure length of the compression spring with caliper gauge.



Note

If the wear limit is reached, the compression spring has to be changed.



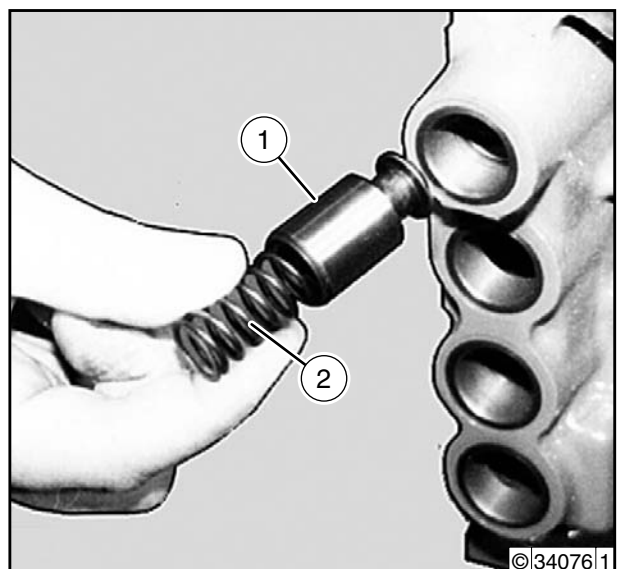
Install oil pressure regulating valve (without heater connection)

- Insert valve piston (1) and compression spring (2).

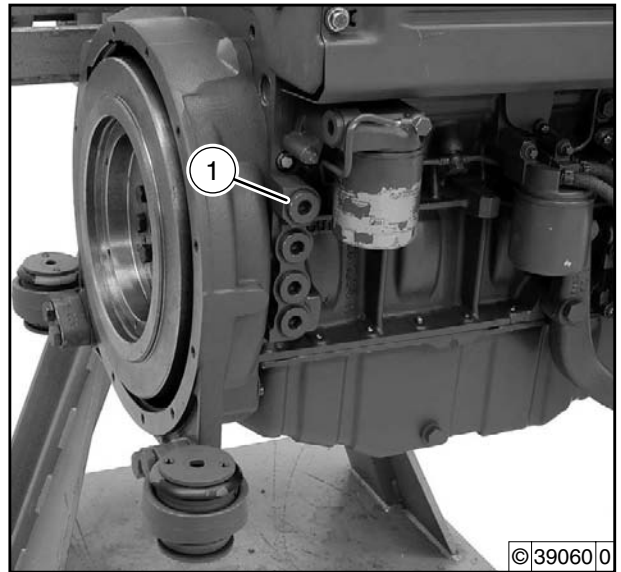


Note

- Use compression spring with green mark (3 bar opening pressure).
- Oil the valve piston lightly.
- Note installation order.

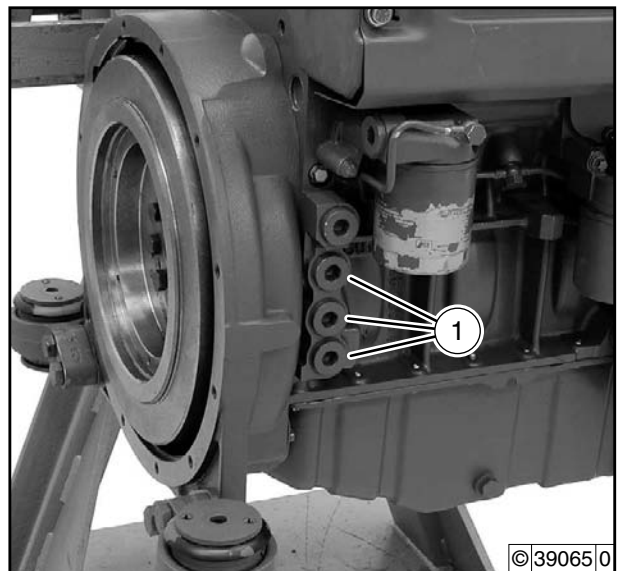


- Tighten cap (1) with new CU sealing ring.



Note

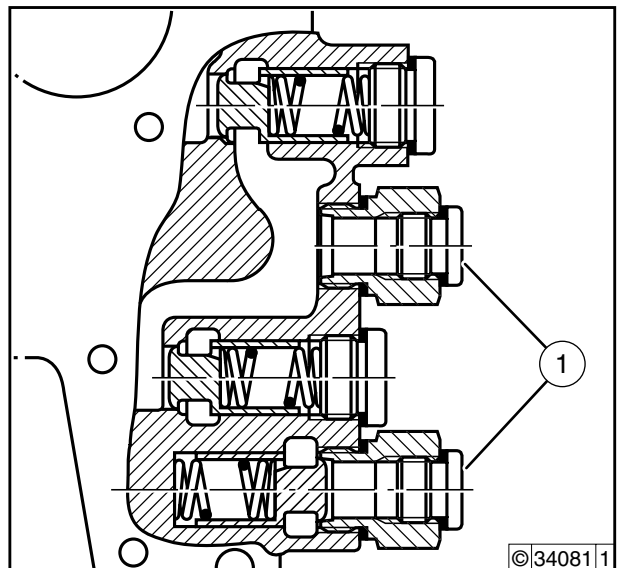
In engines without heater connection no oil pressure regulating valves are available in the valve row and the oil channels are fitted with a cap (1).



6

Remove oil pressure regulating valves (with heater connection)

- Unscrew caps (1) and remove sealing rings.

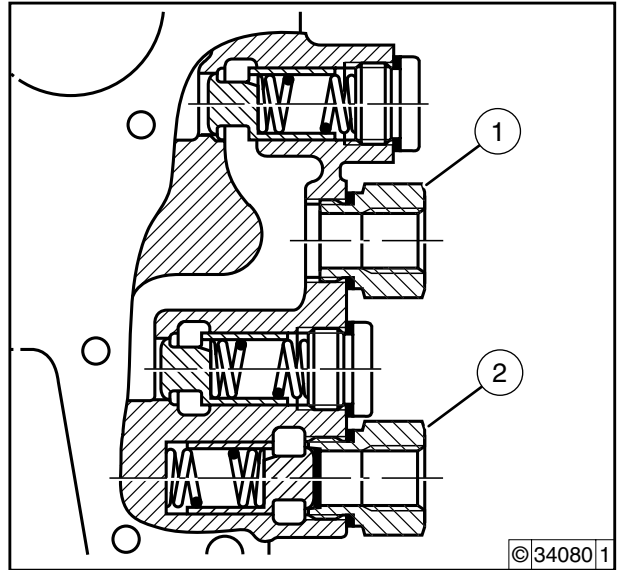


- Unscrew transfer nipple (1) for heater supply and remove sealing ring.
- Unscrew transfer nipple (2) for heater return and remove sealing ring.



Note

When removing the transfer nipple (2) the following parts may jump out under the pressure of the compression spring.



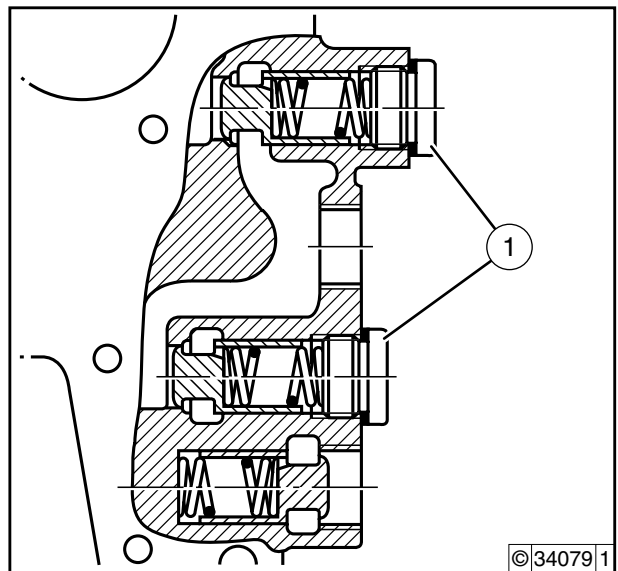
6

- Unscrew caps (1) and remove sealing ring.



Note

When removing the cap the following parts may jump out under the pressure of the compression spring.

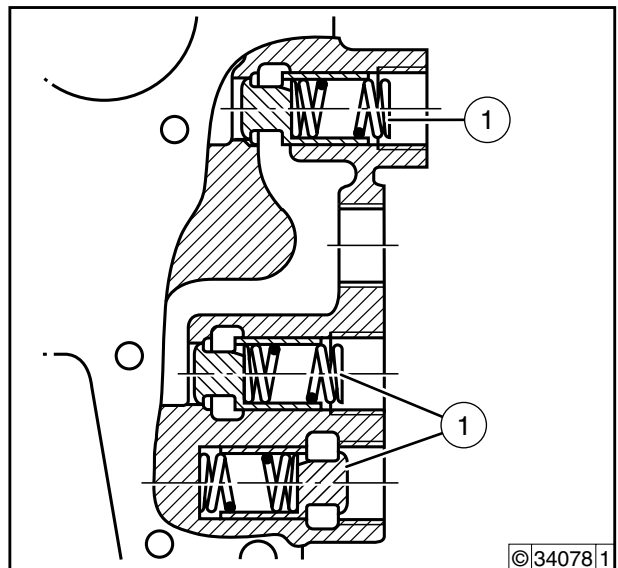


- Remove compression springs and valve piston (1).

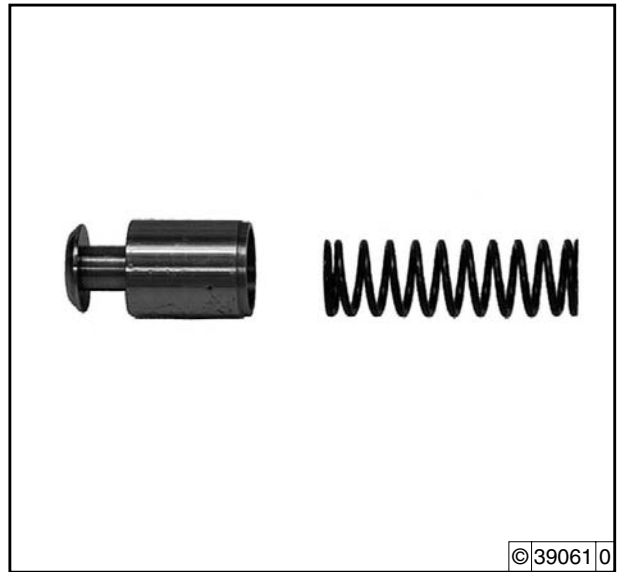


Note

Set down the components in the order of installation.



- Check components for visible signs of wear.



©390610

- Measure length of the compression springs with caliper gauge.



Note

If the wear limit is reached, the compression spring has to be changed.



©390620

Install oil pressure regulating valves (with heater connection)

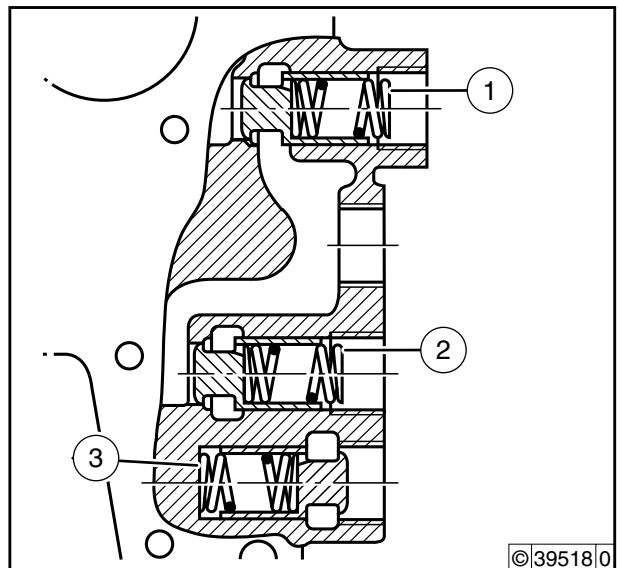
- Insert valve piston and compression springs (1, 2 and 3).



Note

- Note the assignment of the compression springs

Item	Opening pressure	Color marking
1	1.0 bar	yellow
2	1.7 bar	red
3	0.3 bar	blue

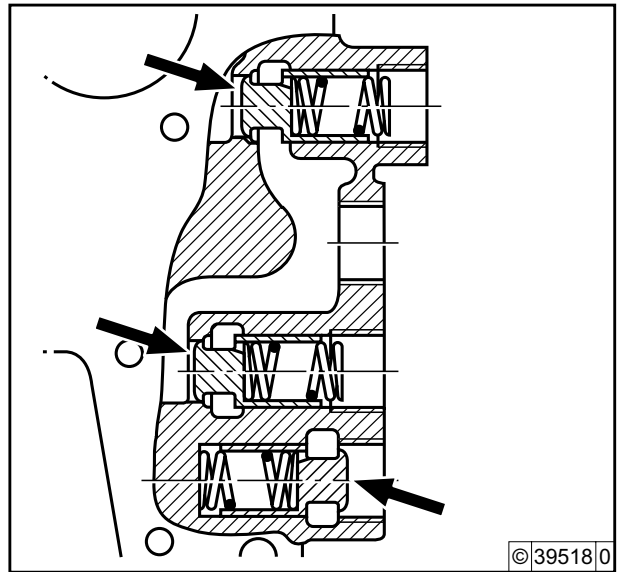


©395180



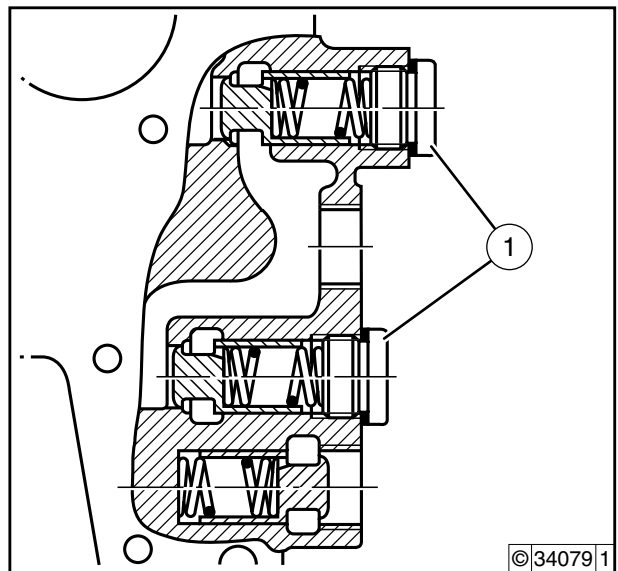
Note

- Note installation position of the valve pistons (arrows).
- Oil the valve piston lightly.



6

- Tighten caps (1) with new CU sealing rings.

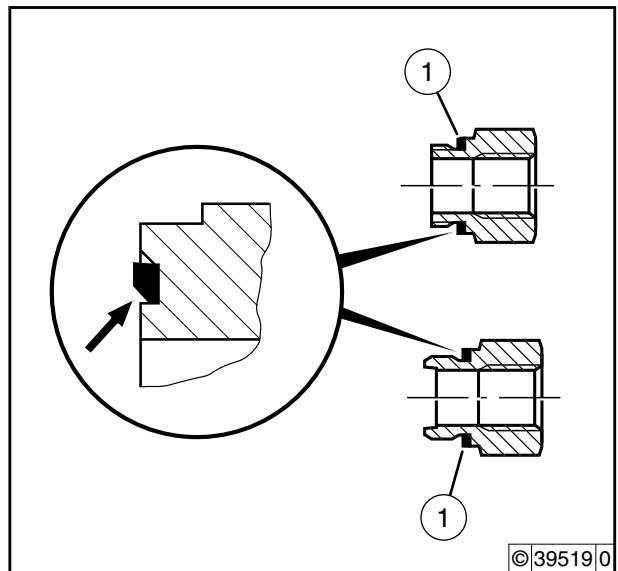


- Install new sealing rings (1) at the transfer nipple.

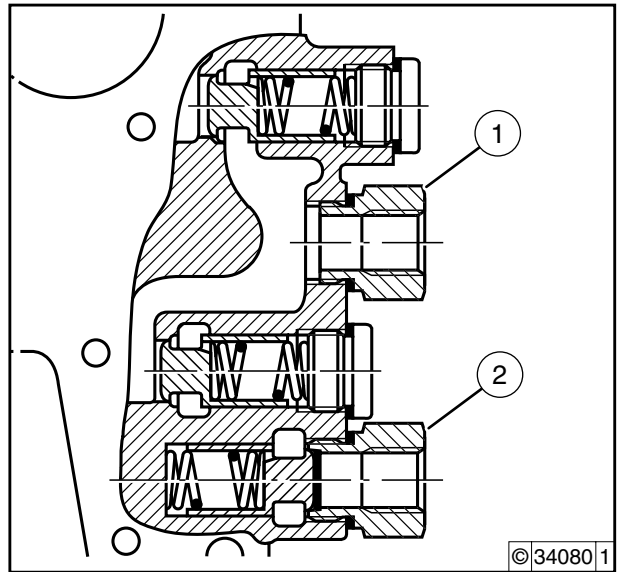


Note

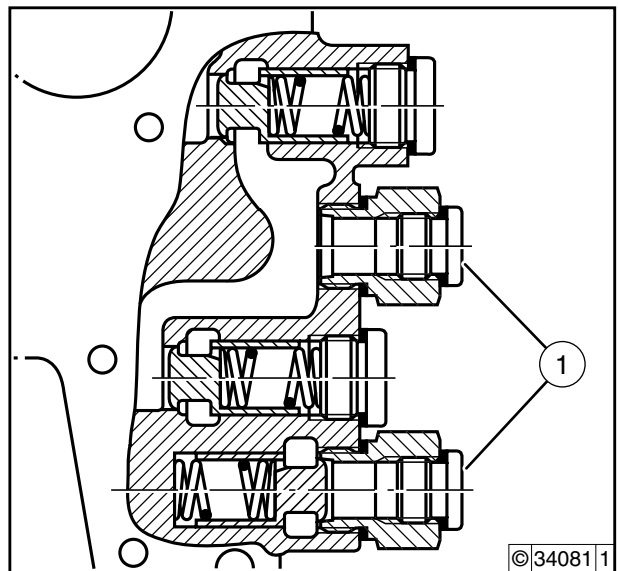
The countersink on the sealing rings (arrow) must face the crankcase.



- Tighten the transfer nipple (1) for the heater supply.
- Tighten transfer nipple (2), with valve seat, for heater return.



- Tighten caps (1) with new CU sealing rings.





Notes

Remove and install oil filter console



Tools
- Commercial tools



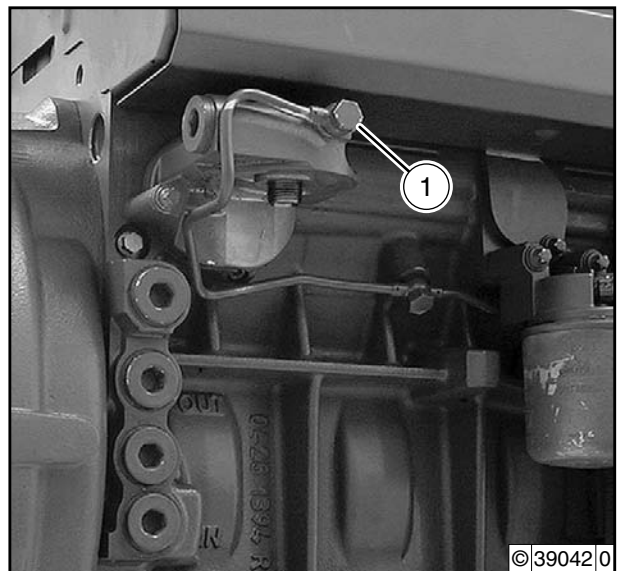
References
- W 08-10-06



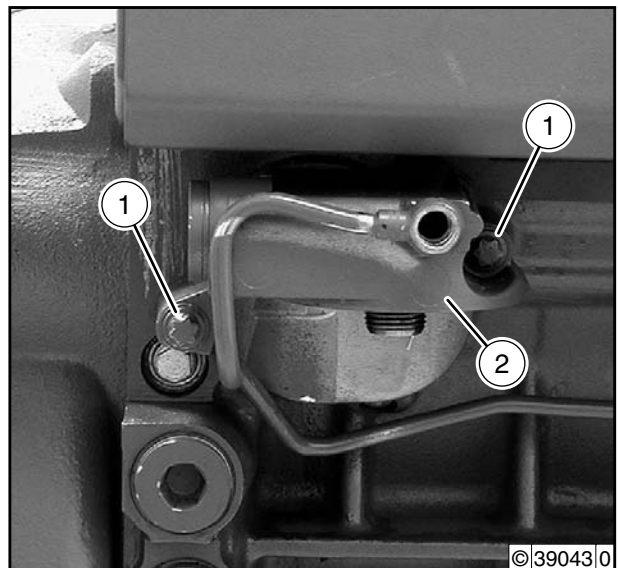
Note
Collect drained operating materials in suitable vessels and dispose of according to regulations.

Remove oil filter console

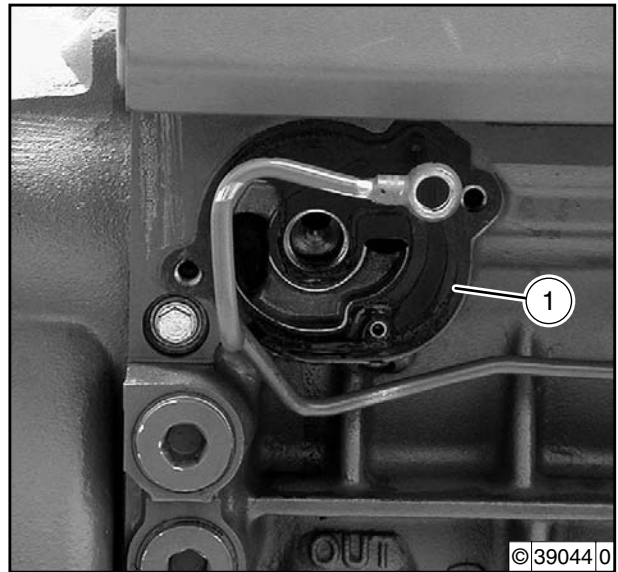
- Remove oil filter cartridge
→ Job card W 08-10-06.
- Unscrew hollow screw (1) and remove sealing rings.



- Unscrew screws (1) and remove oil filter console (2).



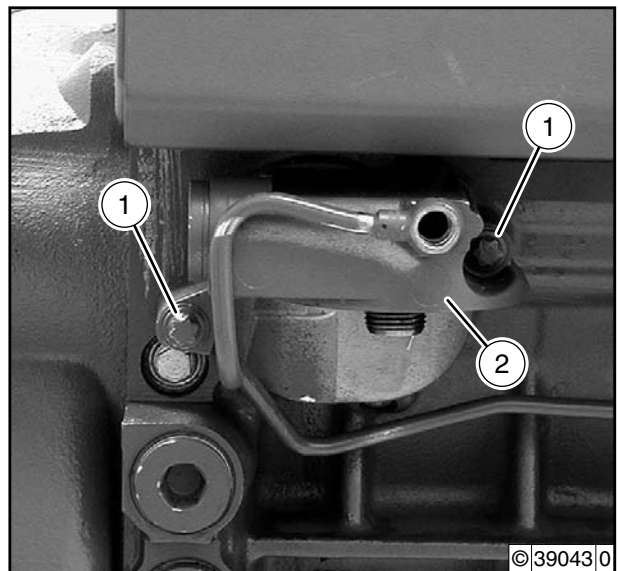
- Remove gasket (1).
- Check components for visible signs of damage.



6

Install oil filter console

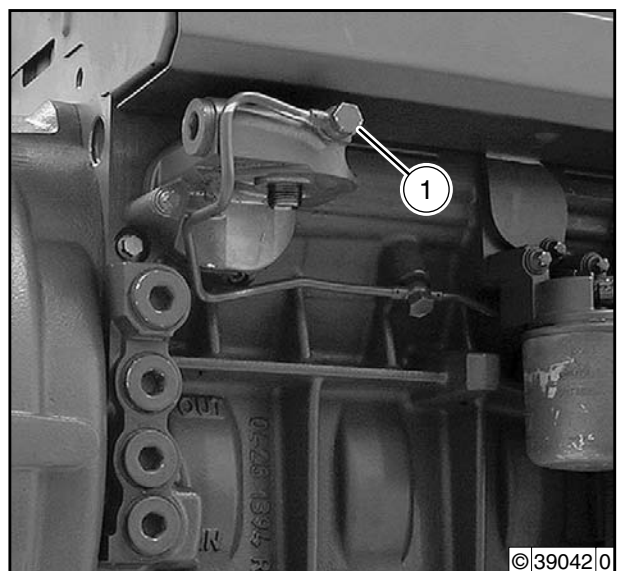
- Clean the sealing surface of the oil filter console and crankcase.
- Mount oil filter console (2) with new gasket and tighten screws (1).



- Tighten hollow screw (1) with new CU sealing rings.



- Install oil filter cartridge
→ Job card W 08-10-06.



Remove and install oil pressure switch



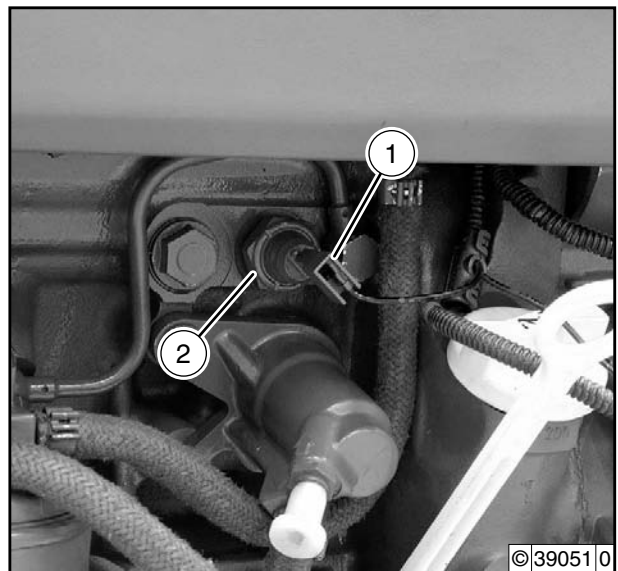
Tools
- Commercial tools



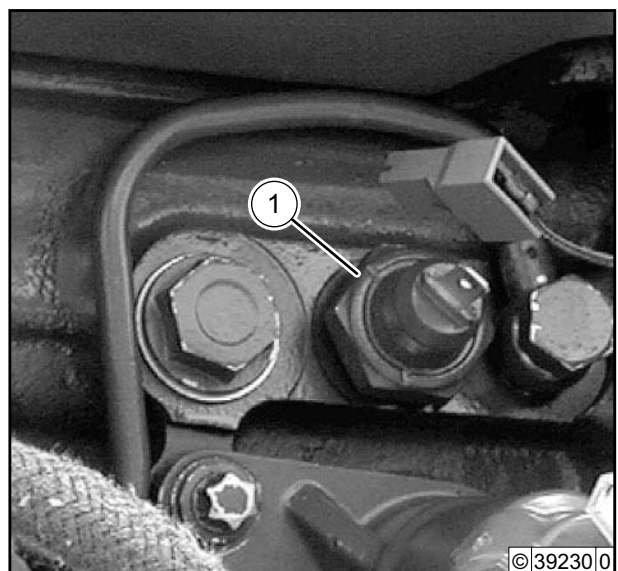
Note
Collect drained operating materials in suitable vessels and dispose of according to regulations.

Remove oil pressure switch

- Pull cable plug (1) out of oil pressure switch (2).



- Unscrew oil pressure switch (1) with sealing ring.
- Check component for visible signs of damage.

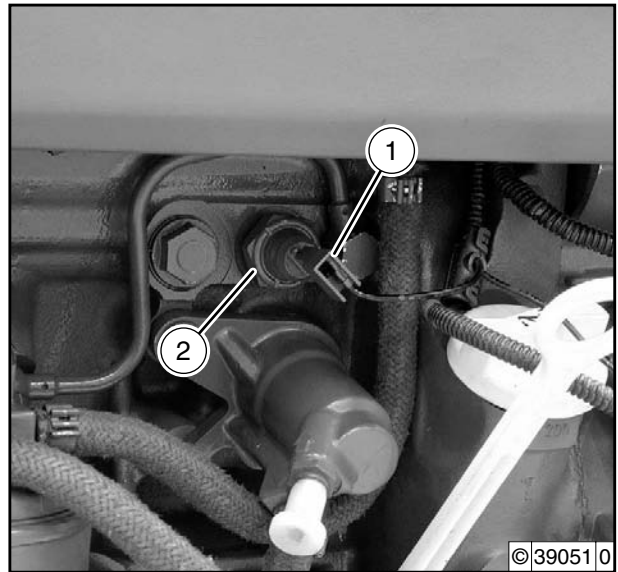


Install oil pressure switch

- Tighten oil pressure switch (2) with sealing ring.



- Plug cable plug (1) to oil pressure switch.



Remove and install oil pressure sensor



Tools

- Commercial tools

- Special tools

170 110 - Special wrench

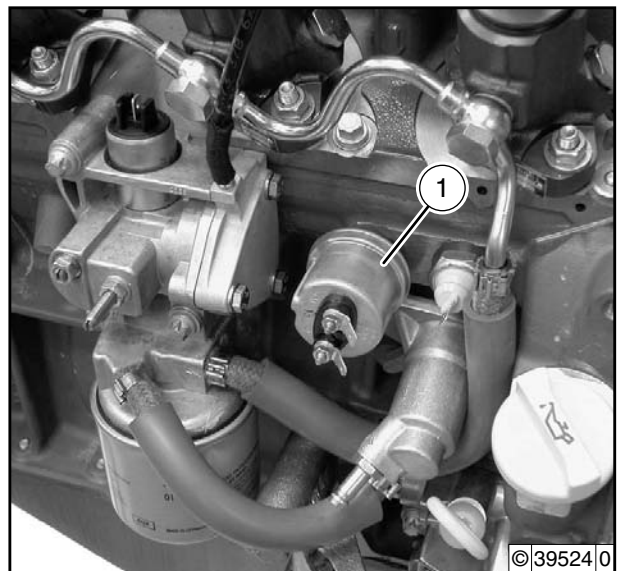


Note

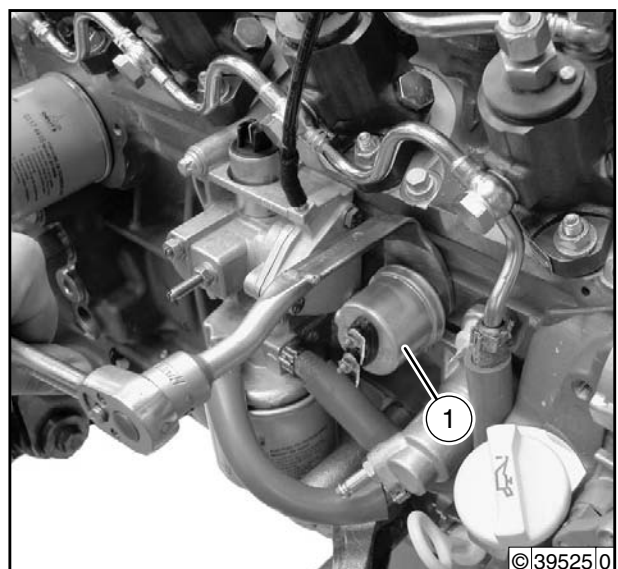
Collect drained operating materials in suitable vessels and dispose of according to regulations.

Remove oil pressure sensor

- Pull off cable plug from oil pressure sensor (1) if available.



- Unscrew oil pressure sensor (1) with special wrench and remove sealing ring.
- Check components for visible signs of damage.



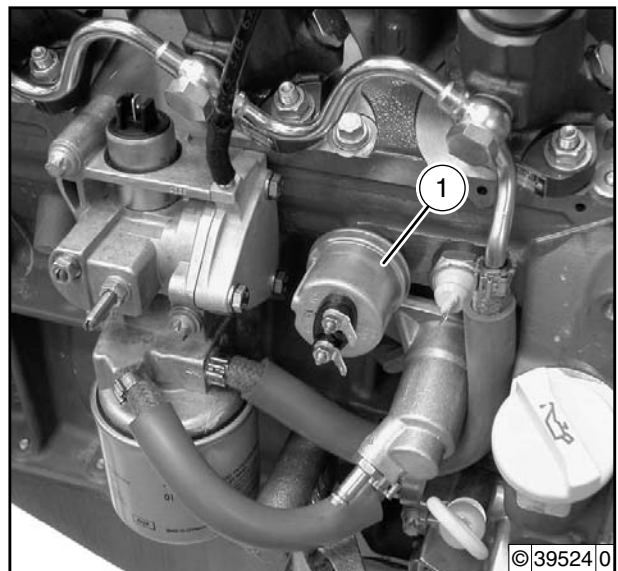
Install oil pressure sensor

- Mount oil pressure sensor (1) with new CU sealing ring and tighten with special wrench.



6

- Plug cable plug to oil pressure sensor (1) if available.



Remove and install oil thermostat (oil cooler)



Tools

- Commercial tools
Caliper gauge



Auxiliary material

- Assembly sleeve



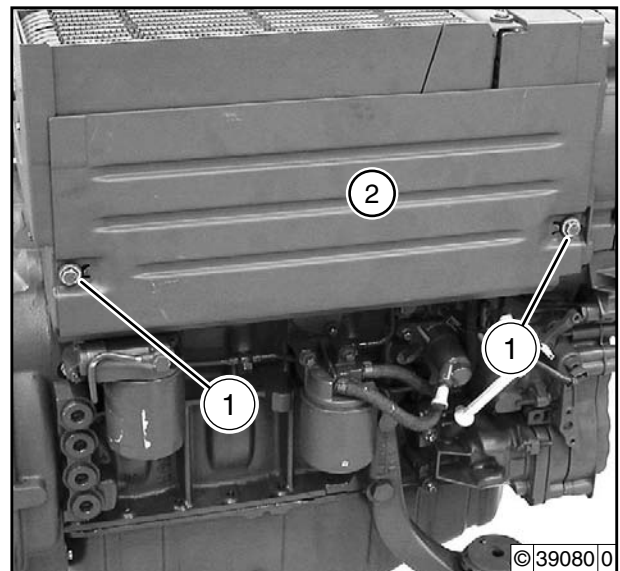
Note

Collect drained operating materials in suitable vessels and dispose of according to regulations.

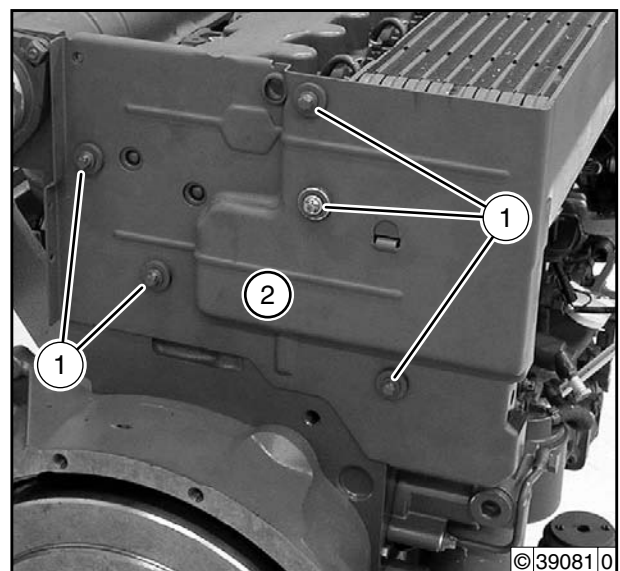
Remove oil thermostat (oil cooler)

In FL, BFL engines

- Unscrew screws (1) and remove air duct cover (2).



- Unscrew screws (1) and remove standing plate (1).

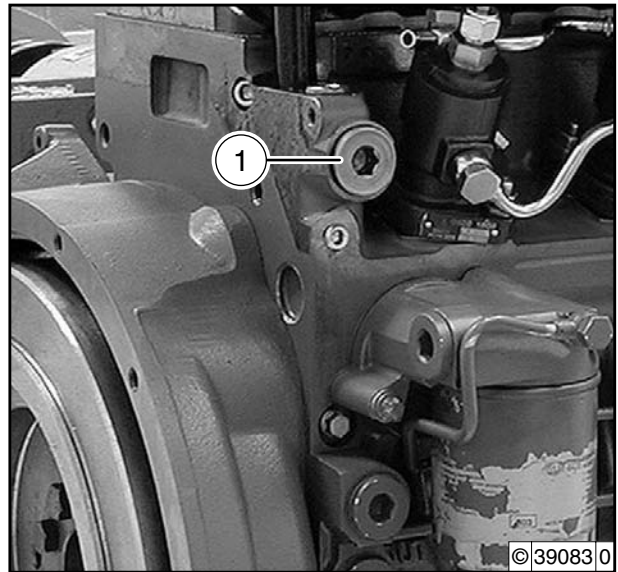


- Unscrew cap (1), remove oil thermostat with compression spring.



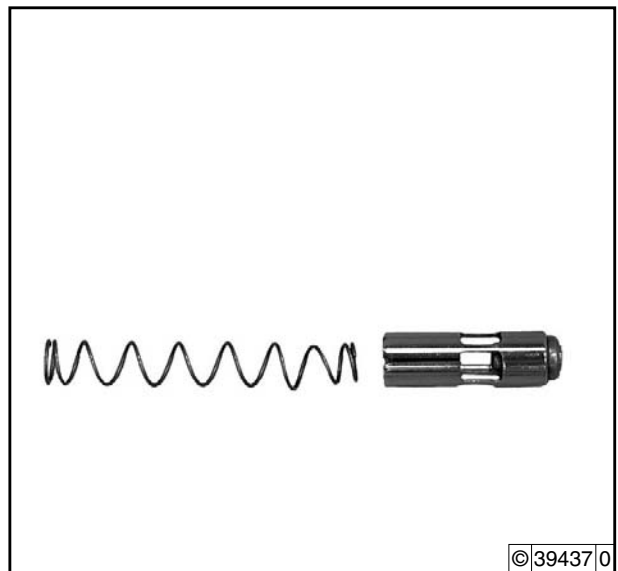
Note

When removing, the following parts may jump out under the pressure of the compression spring.



6

- Check components for visible signs of wear.



- Measure length of the compression spring with caliper gauge.



Note

If the wear limit is reached, the compression spring has to be changed.



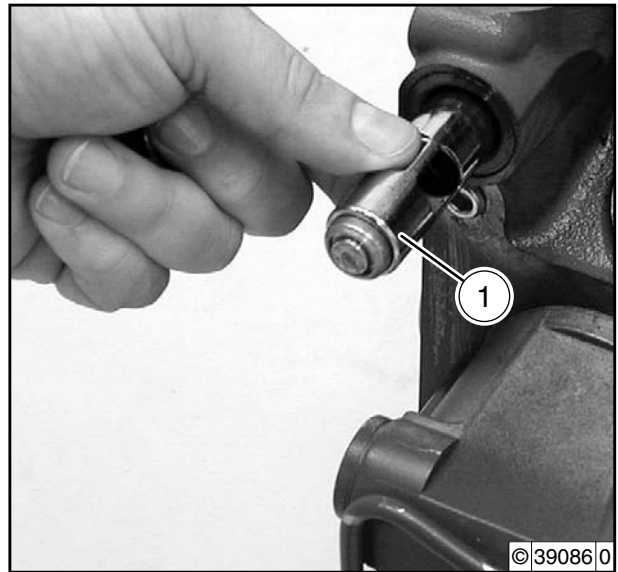
Install oil thermostat (oil cooler)

- Insert oil thermostat (1) with compression spring.



Note

- Oil the oil thermostat lightly.
- Note installation order.



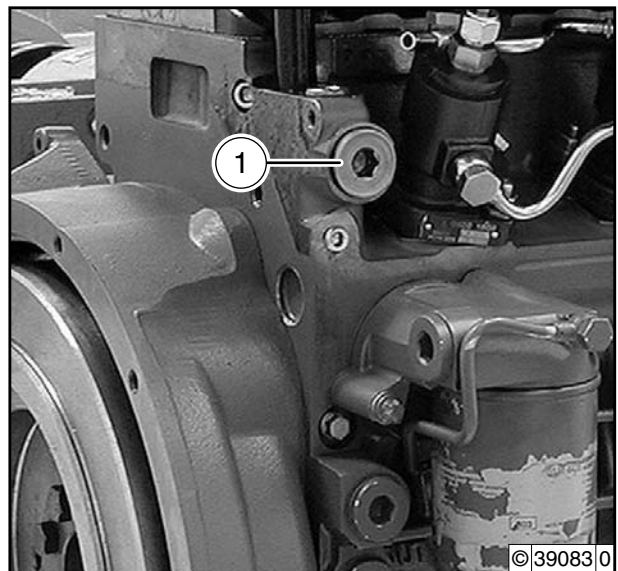
- Pull the new round sealing ring onto the cap.



Note

- Use the assembly sleeve.

- Tighten locking screw (1).



In FL, BFL engines

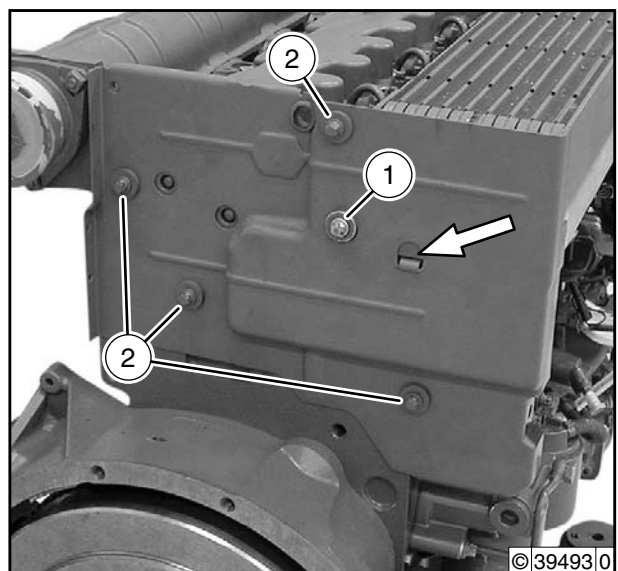
- Mount the standing plate and turn on the screws.



Note

- Note different screw length (1 and 2).
- The oil cooler must be on the latch (arrow).

- Tighten screws (1 and 2).

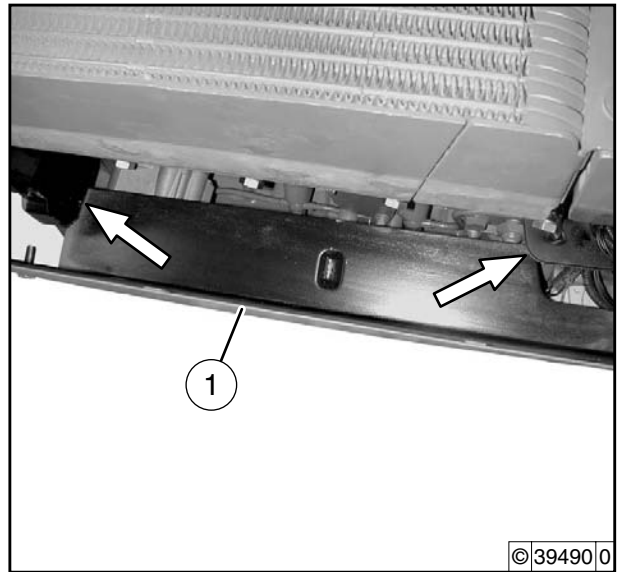


- Mount air duct cover (1).



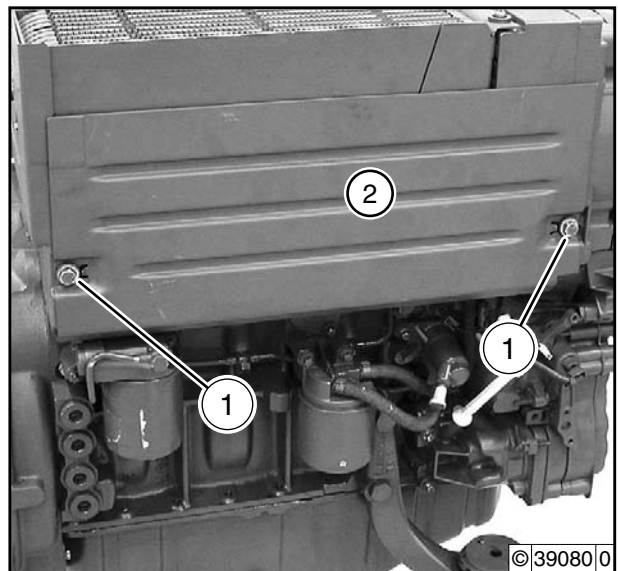
Note

The air duct cover must be under the stand plate and the profile rubber (arrows).



6

- Fix air duct cover (2).
Tighten screws (1).



Remove and install oil pressure line (turbocharger)



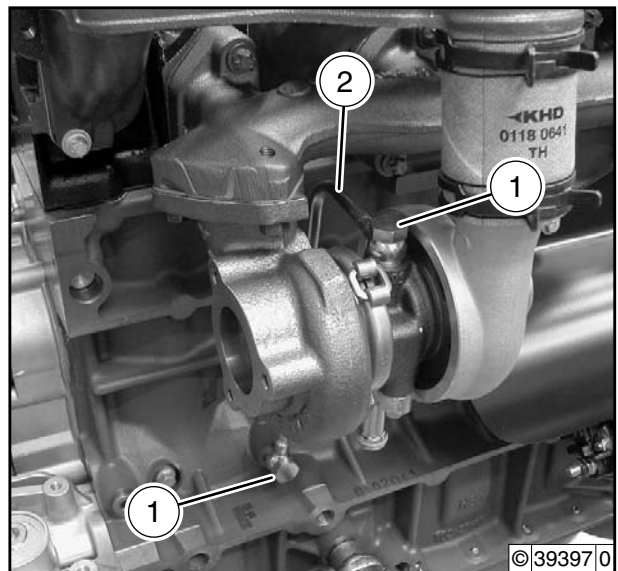
Tools
- Commercial tools



Note
Collect drained operating materials in suitable vessels and dispose of according to regulations.

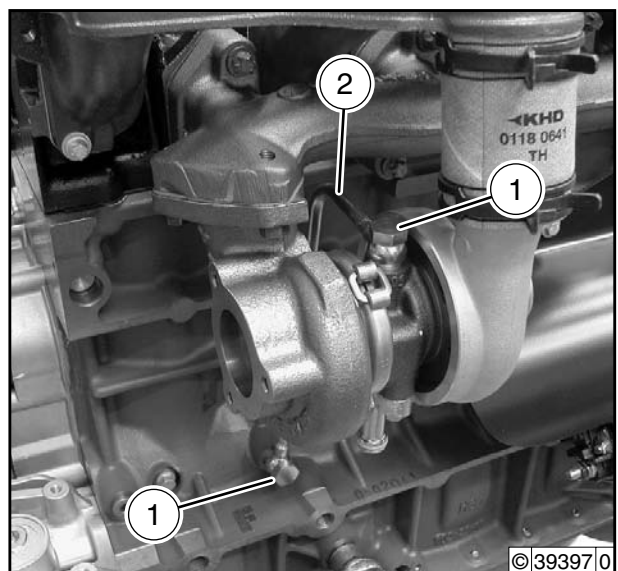
Remove oil pressure I-line

- Unscrew hollow screws (1), remove oil pressure line (2) and sealing rings.
- Check components for visible signs of damage.



Install oil pressure line

- Mount oil pressure line (2), tighten hollow screws (1) with new CU sealing rings.





Notes

Remove and install oil return line (turbocharger)



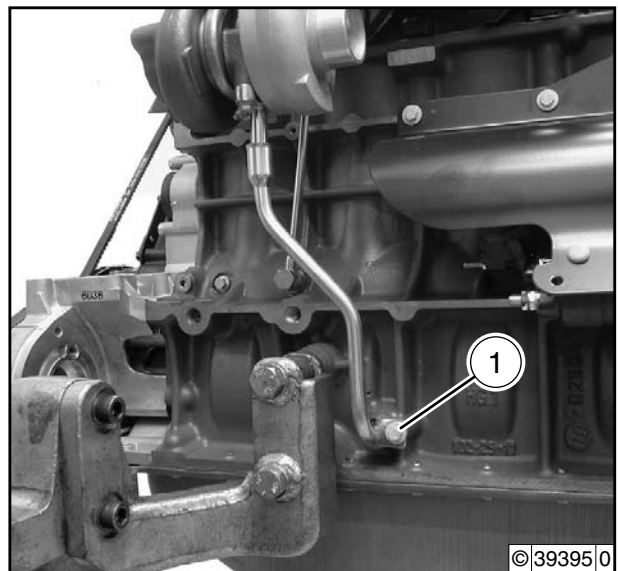
Tools
- Commercial tools



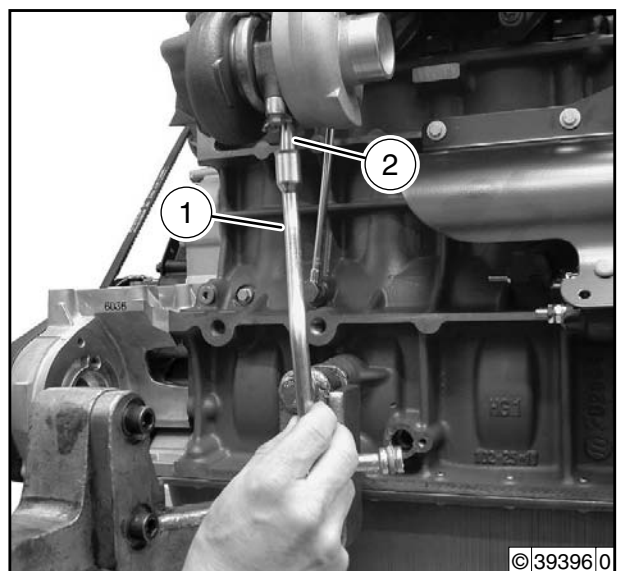
Note
Collect drained operating materials in suitable vessels and dispose of according to regulations.

Remove oil return line

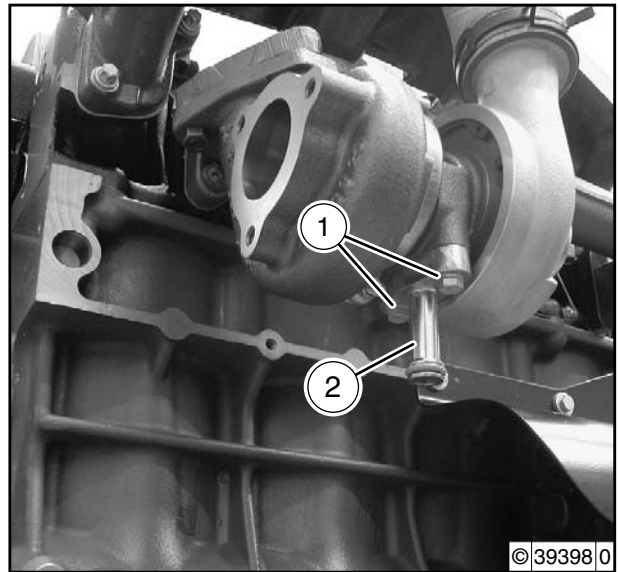
- Unscrew screw (1) and remove holder.



- Pull oil return line (1) out of the crankcase and pull off from oil return pipe flange support (2).



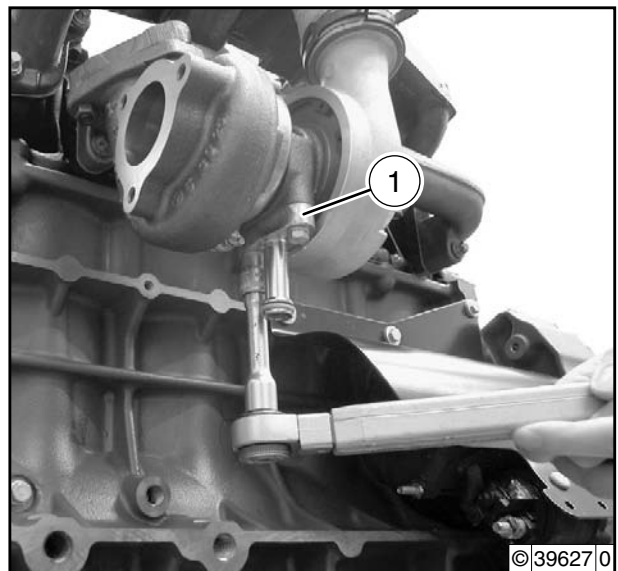
- Unscrew screws (1), remove oil return pipe flange support (2) and gasket.
- Check components for visible signs of damage.



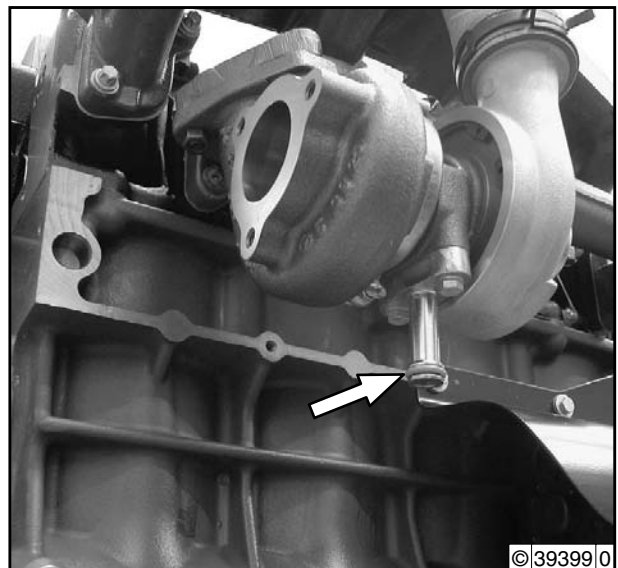
6

Install oil return line

- Clean the sealing surface of the turbocharger and oil return pipe flange support.
- Mount oil return pipe flange support (1) with new gasket and tighten screws (2).



- Pull new round sealing ring (arrow) onto oil return pipe flange support.



- Pull new round sealing ring (arrow) onto oil return line.

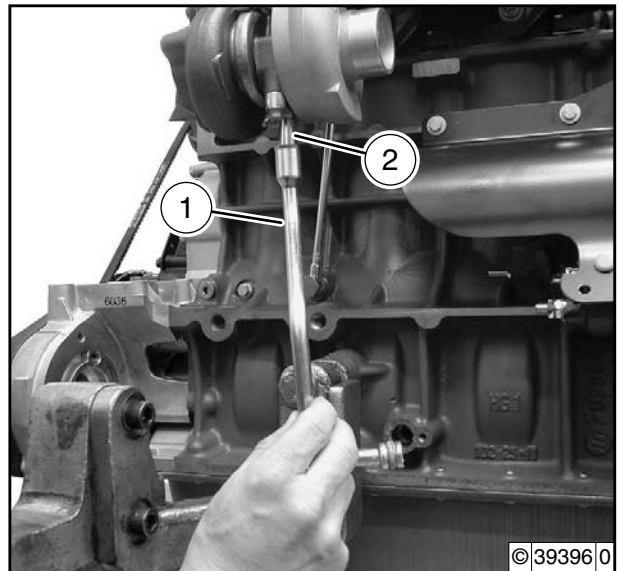


- Push oil return line (1) onto oil return line flange support (2) and insert in crankcase.

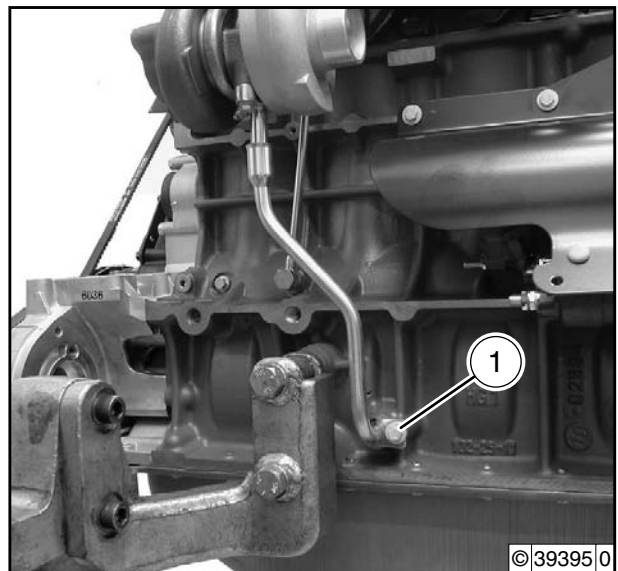


Note

Oil round sealing rings lightly.



- Mount holder and tighten screw (1).





Notes

Remove and install oil line for injection adjuster supply



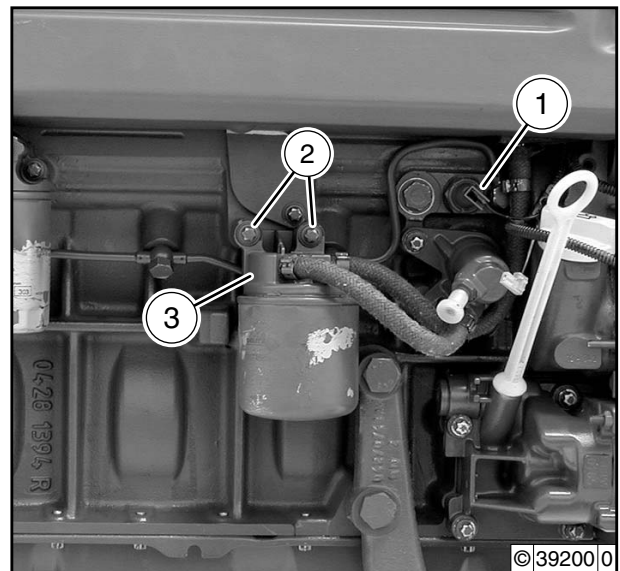
Tools
- Commercial tools



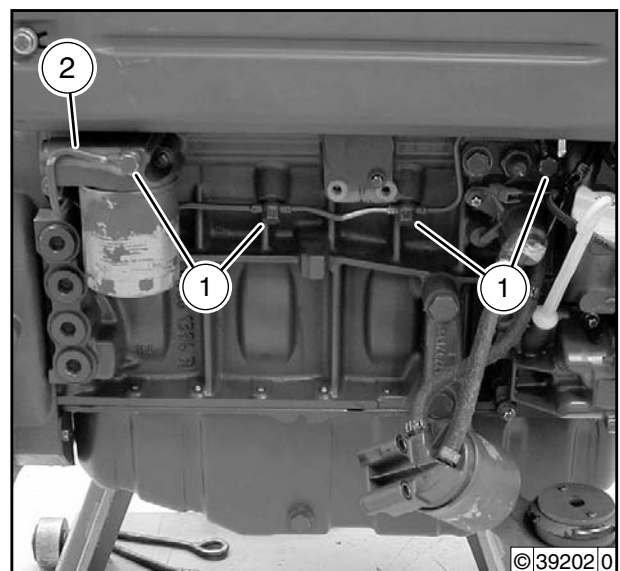
Note
Collect drained operating materials in suitable vessels and dispose of according to regulations.

Remove oil line

- Pull cable plug (1) out oil pressure switch.
- Unscrew screws (2), remove fuel filter console (3) and hang aside.

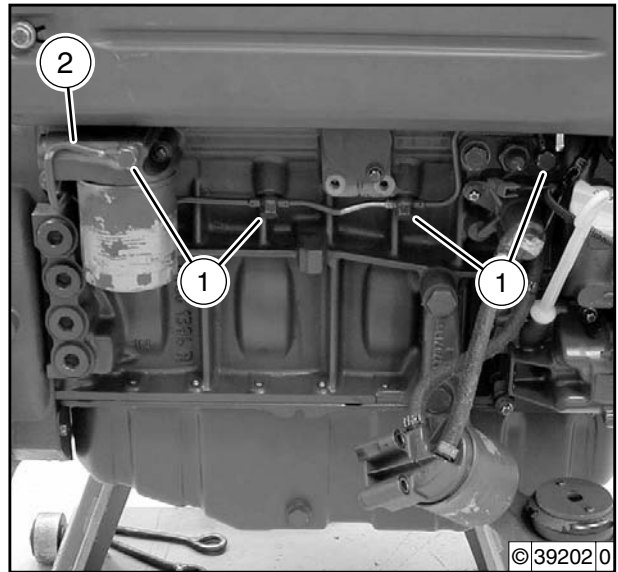


- Unscrew hollow screws (1), remove oil line (2) and sealing rings.
- Check components for visible signs of damage.



Install oil line

- Mount oil line (2), tighten hollow screws (1) with new CU sealing rings.

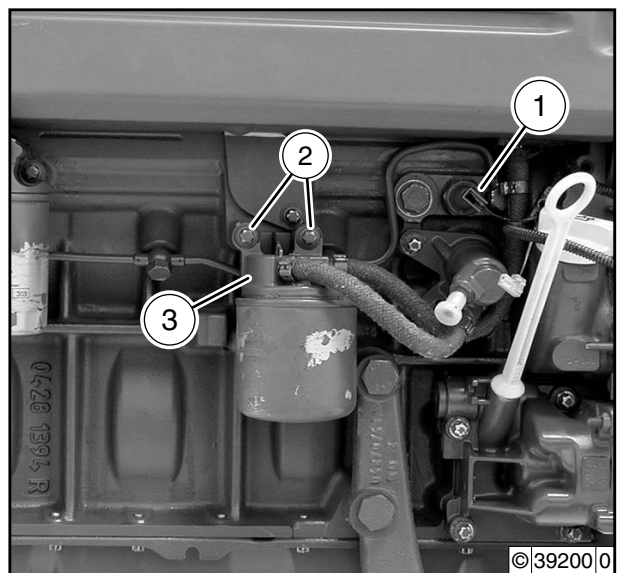


6

- Fit fuel filter console (3) and tighten screws (2).



- Plug cable plug (1) to oil pressure switch.



Remove and install oil temperature sensor (in engines with injection adjustment)



Tools

- Commercial tools
- Caliper gauge



Note

Collect drained operating materials in suitable vessels and dispose of according to regulations.

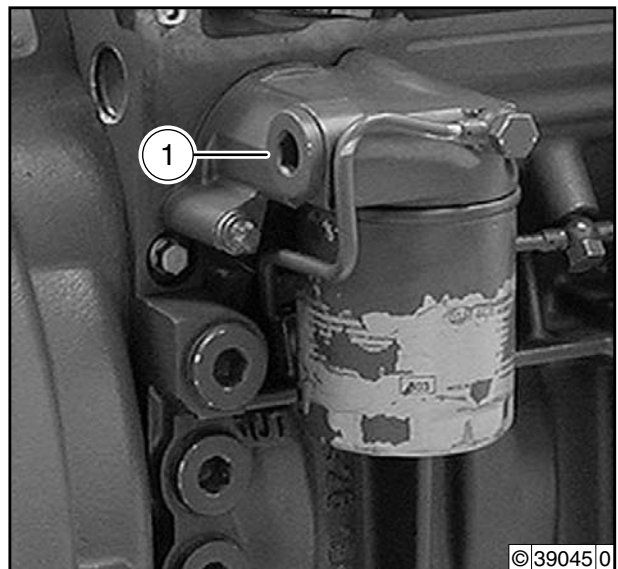
Remove oil temperature sensor (injection adjustment)

- Unscrew cap (1), remove oil temperature sensor with compression spring and remove slide regulator.

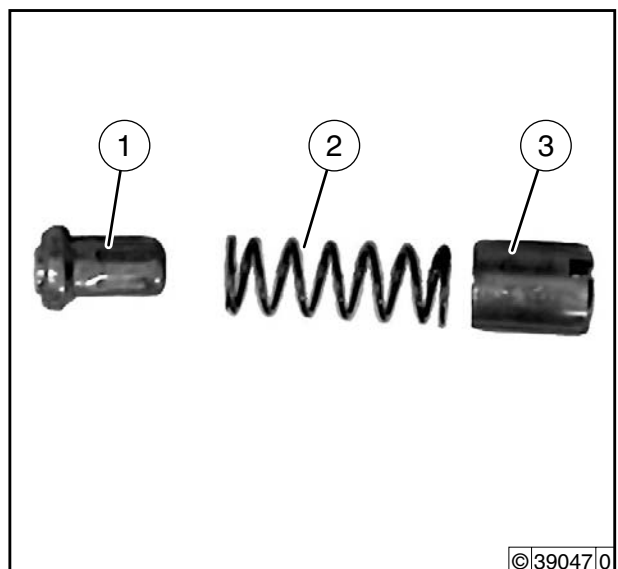


Note

When removing, the following parts may jump out under the pressure of the compression spring.



- Check components for visible signs of wear.
 - 1 temperature sensor
 - 2 pressure spring
 - 3 slide regulator



- Measure length of the compression spring with caliper gauge.



Note

If the wear limit is reached, the compression spring has to be changed.



6

Install oil temperature sensor (injection adjustment)

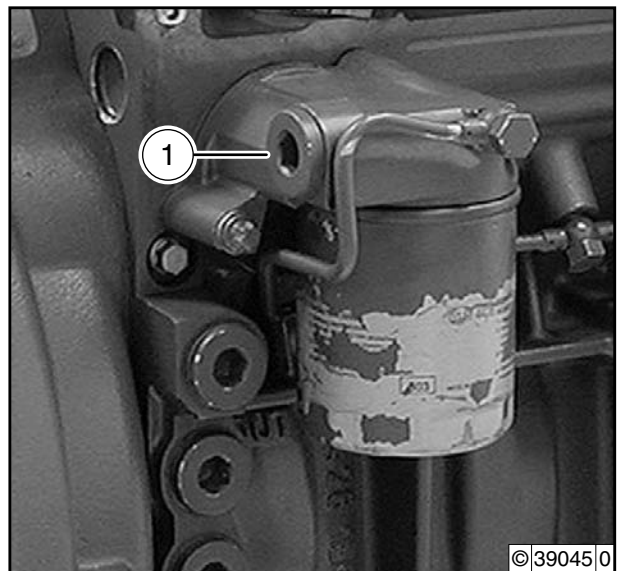
- Insert temperature sensor, compression spring and slide regulator.



Note

- Oil temperature sensor lightly.
- Note installation order.

- Tighten locking screw (1) with new CU sealing ring.



Remove and install oil temperature sensor



Tools
- Commercial tools



References
- W 08-08-02

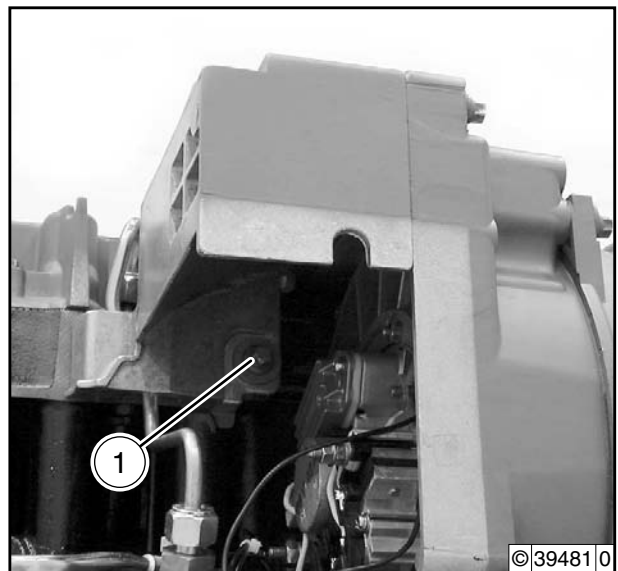


Note
Collect drained operating materials in suitable vessels and dispose of according to regulations.

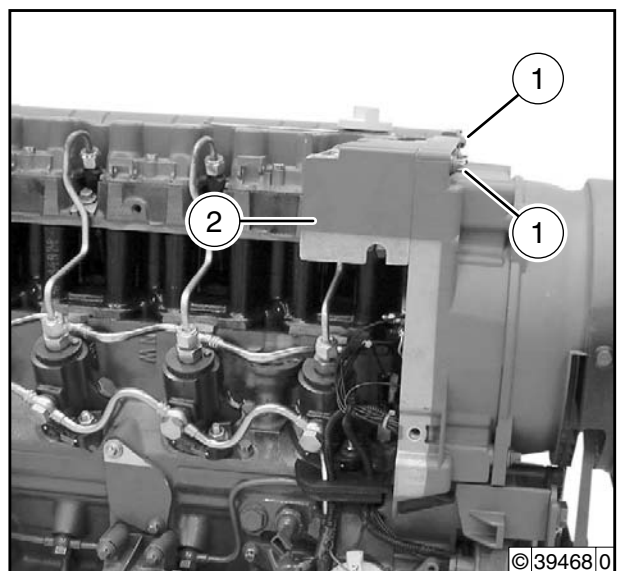
Remove oil temperature sensor

In FL, BFL engines

- Remove oil cooler
→ Job card **W 08-08-02**.
- Unscrew screw (1).



- Unscrew screws (1) and remove air duct (2).

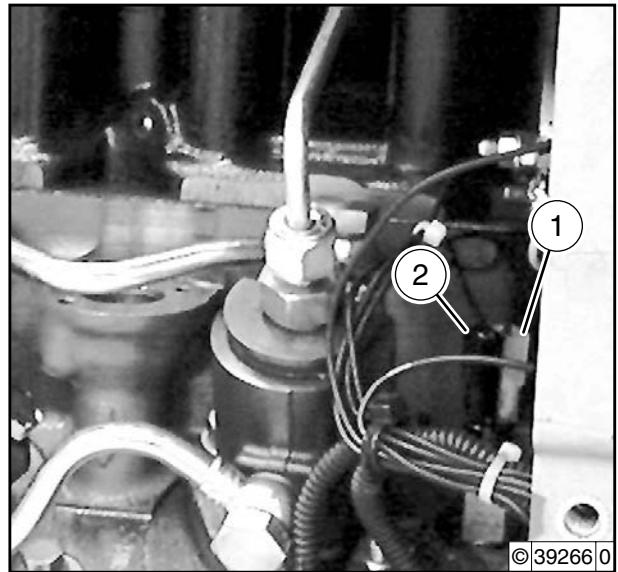


- Pull cable plugs (1 and 2) from the oil temperature sensor.



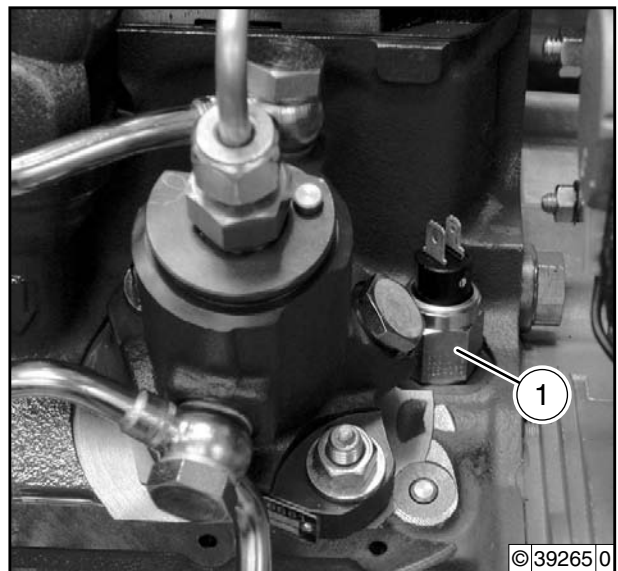
Note

Note the assignment of the cable plugs.



6

- Unscrew oil temperature sensor (1) and remove sealing ring.

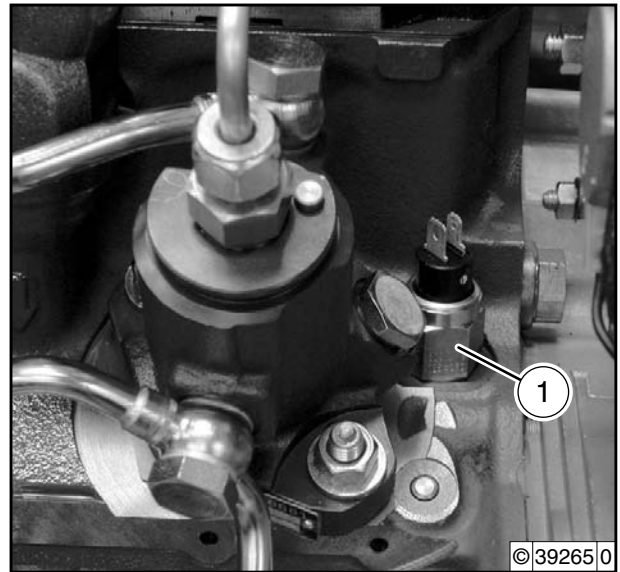


- Check components for visible signs of damage.



Install oil temperature sensor

- Tighten oil temperature sensor (1) with new sealing ring.

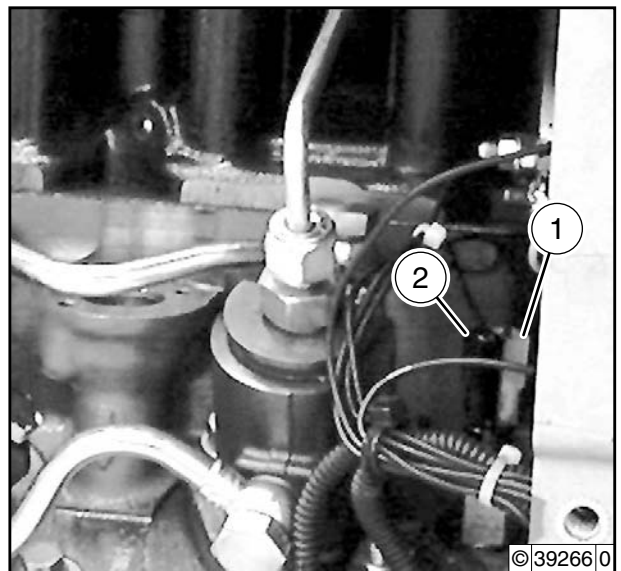


- Plug cable plugs (1 and 2) into oil temperature sensor (2).



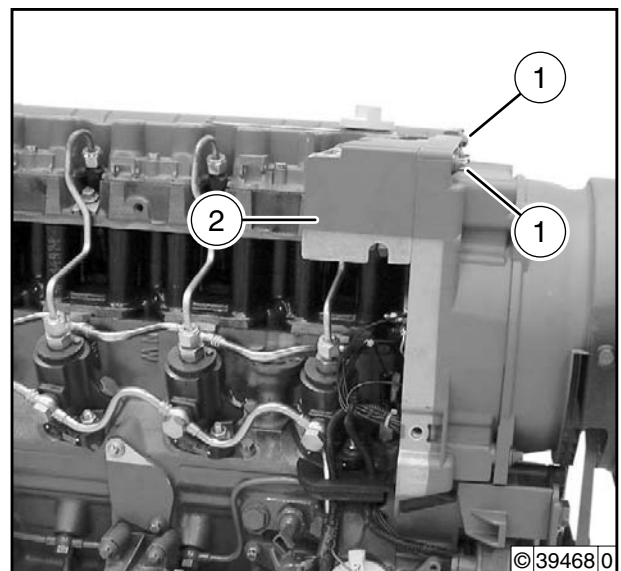
Note

Note the assignment of the cable plugs.

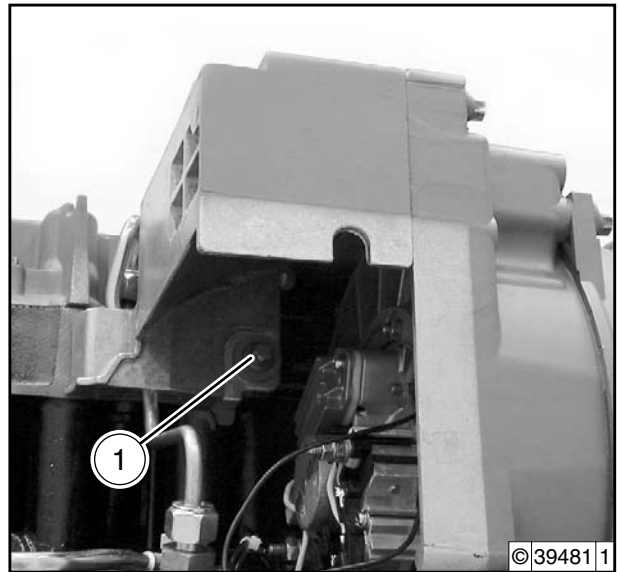


In FL, BFL engines

- Mount air duct (2) and tighten screws (1).



- Tighten screw (1).



6

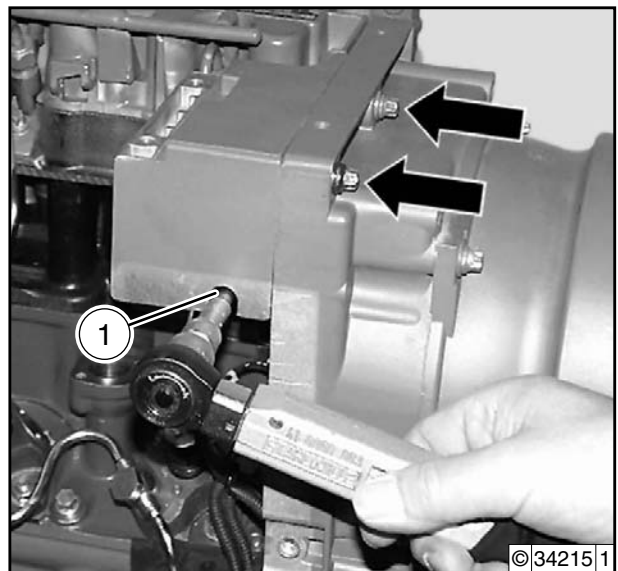
- Pre-tighten screw (1) on cylinder head and tighten screws (arrows).



- Tighten screw (1) on cylinder head.



- Install oil cooler
→ Job card **W 08-08-02**.



Remove and install cooling blower



Tools

- Commercial tools
8189 - Torx tool kit

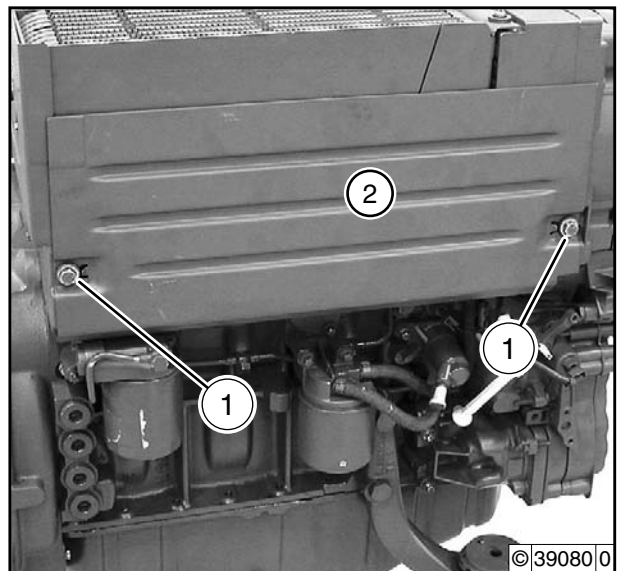


References

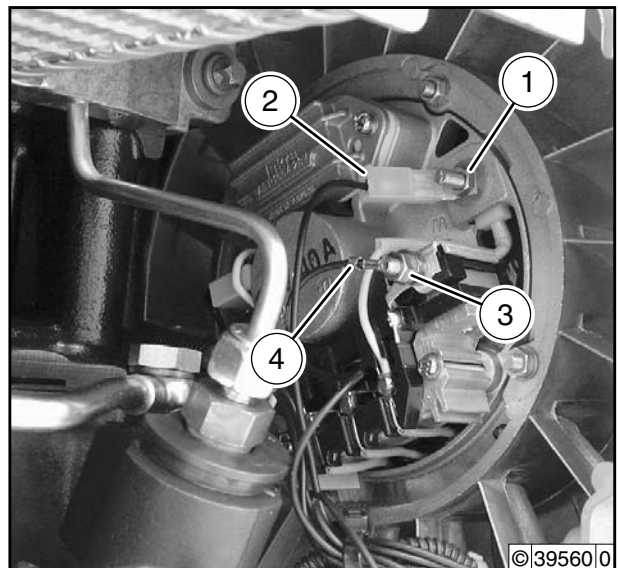
- W 12-02-01 (FL, BFL engines)

Remove cooling blower

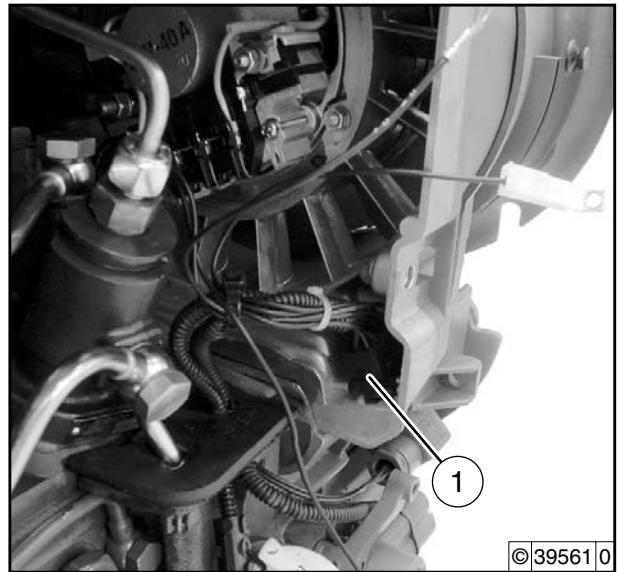
- Remove V-belt
→ Job card W 12-02-01.
- Unscrew screws (1) and remove air duct cover (2).



- Remove cable from generator.
Unscrew nut (1) and remove cable "G1.W" (2).
- Unscrew nut (3) and remove cable "G1.D+" (4).

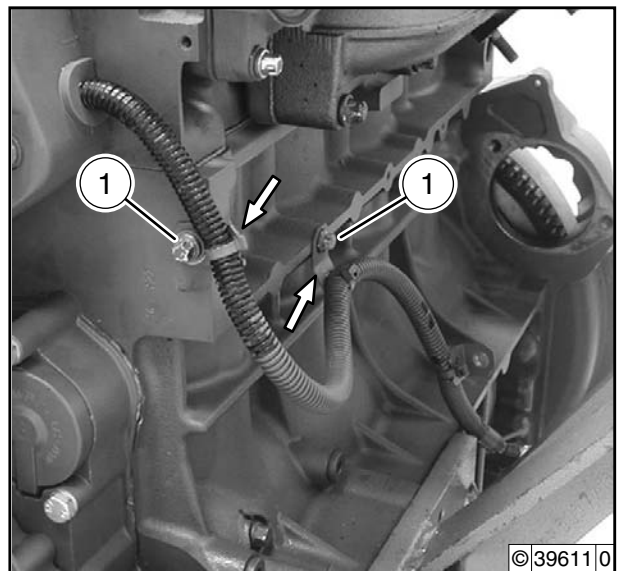


- Unclip cable plug (1).

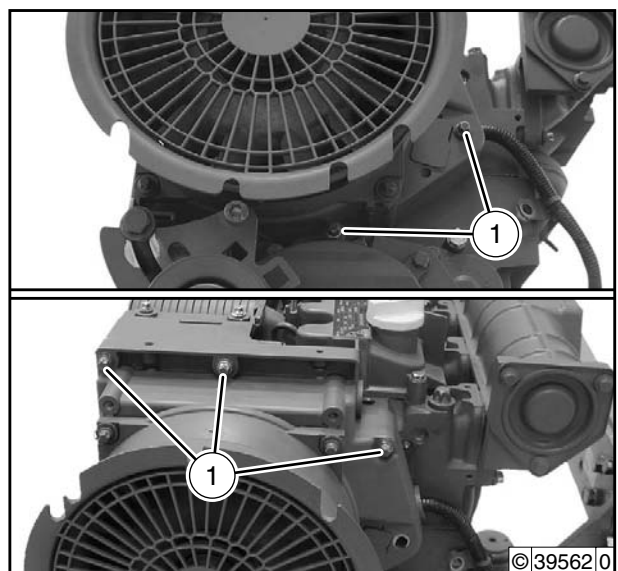


6

- Unscrew screws (1) and remove cable holders (arrows).

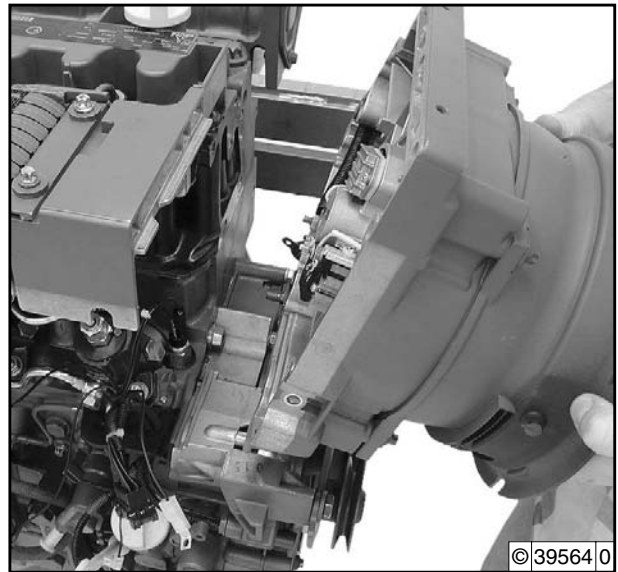


- Unscrew screws (1) and remove cooler blower with generator.
- Check components for visible signs of damage.



Install cooling blower

- Mount cooler blower with generator and tighten screws.



© 39564 0

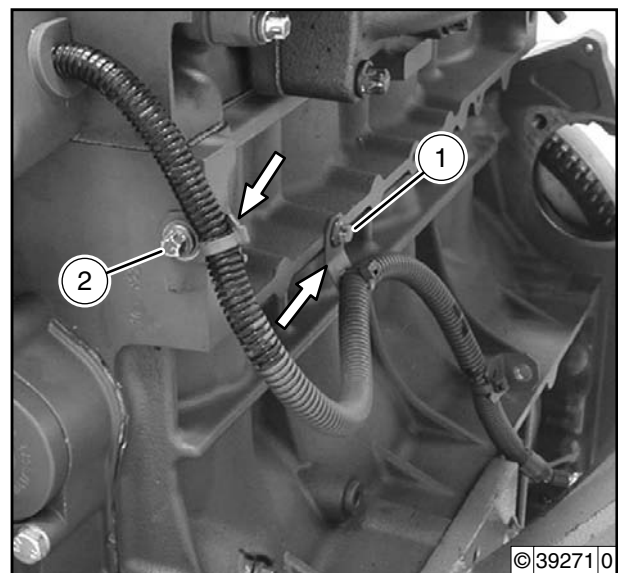
- Position cable holders (arrows) and tighten screws.



Note

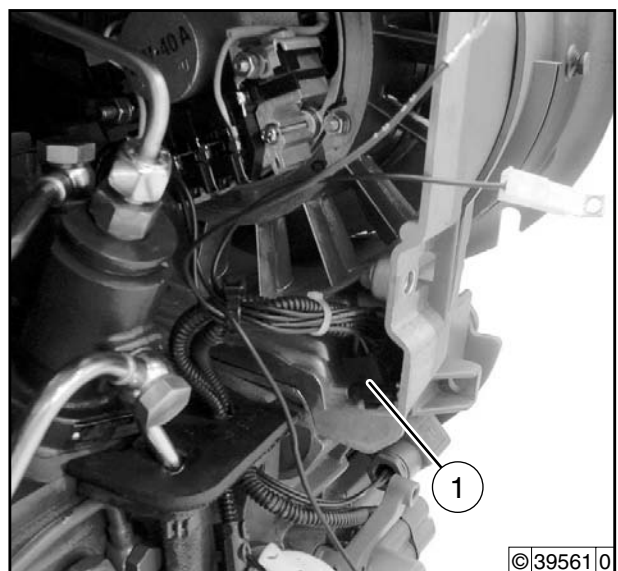
Note different screw length:
Screw M6 x 12 mm (1)
Screw M8 x 20 mm (2)

- Tighten screw (1 and 2).



© 39271 0

- Clip in cable plug (1).



© 39561 0

- Plug cable to generator.
Attach cable "G1.D+" (4) and tighten nut (3).

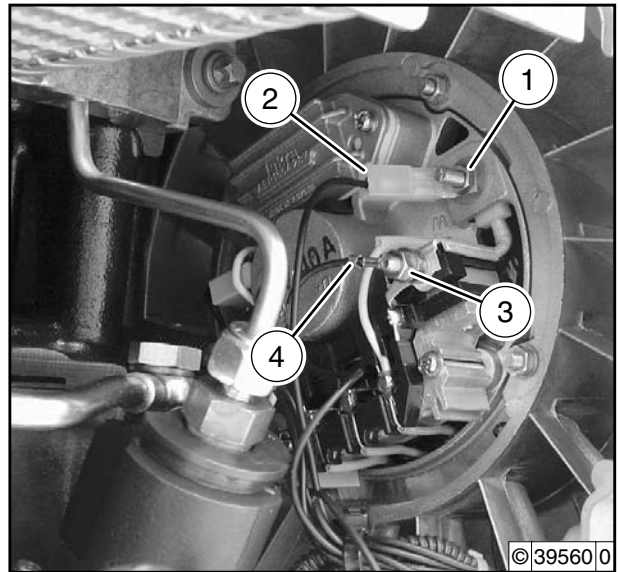


13082

- Attach cable "G1.W" (2) and tighten nut (1).



13083



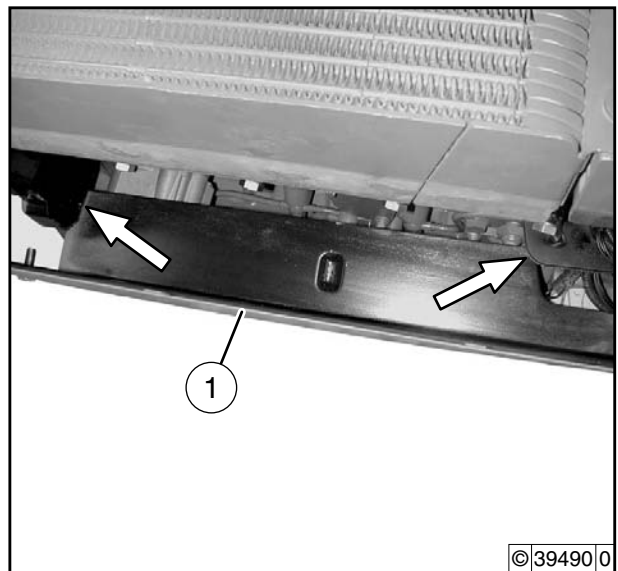
6

- Mount air duct cover (1).



Note

The air duct cover must be under the stand plate and the profile rubber (arrows).

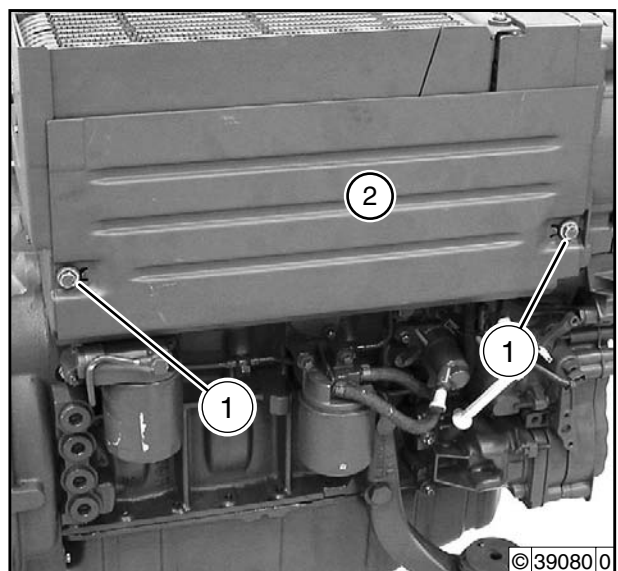


- Fix air duct cover (2).
Tighten screws (1).



09087

- Install V-belt.
→ Job card W 12-02-01.



Dismantle and complete cooling blower, check



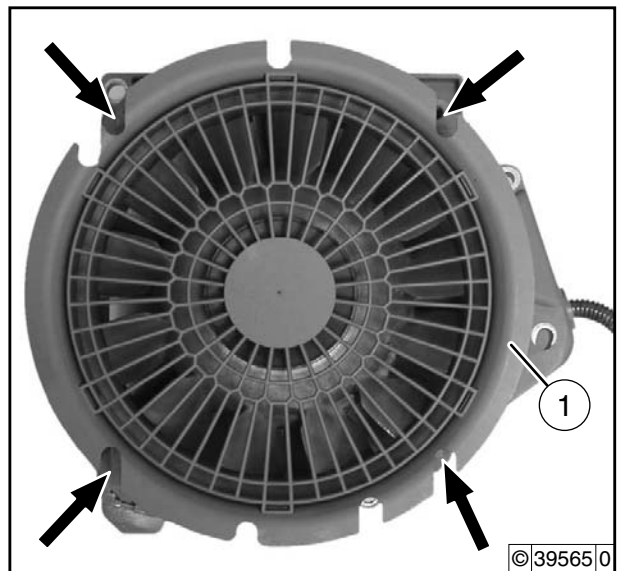
Tools
- Commercial tools
8189 - Torx tool kit



References
- W 09-11-01

Dismantle cooling blower

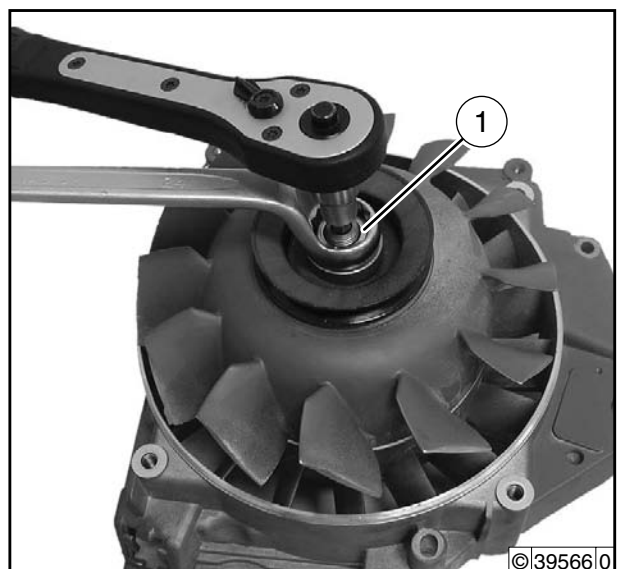
- Remove cooling blower
→ Job card W 09-11-01.
- Unscrew screws (arrows) and remove blower jacket inlet (1).



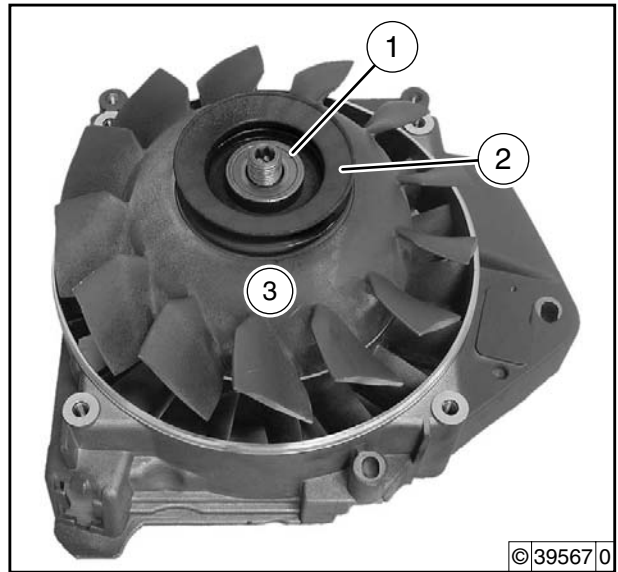
- Unscrew nut (1).



Note
Hold shaft.

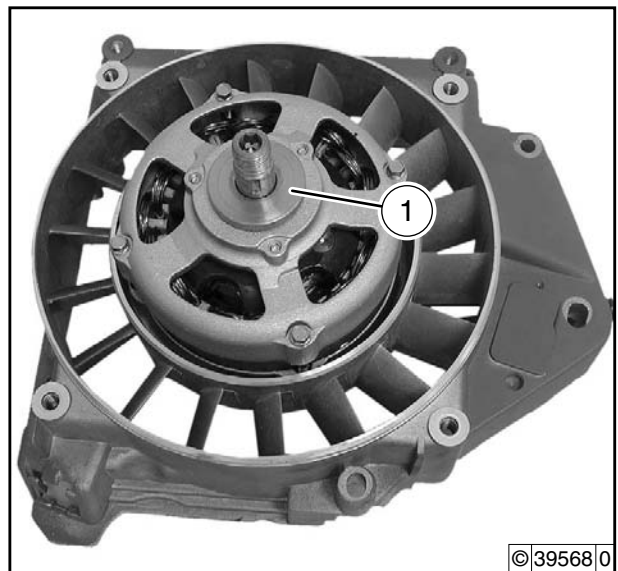


- Remove disc (1), V-belt pulley (2) and running wheel (3).



6

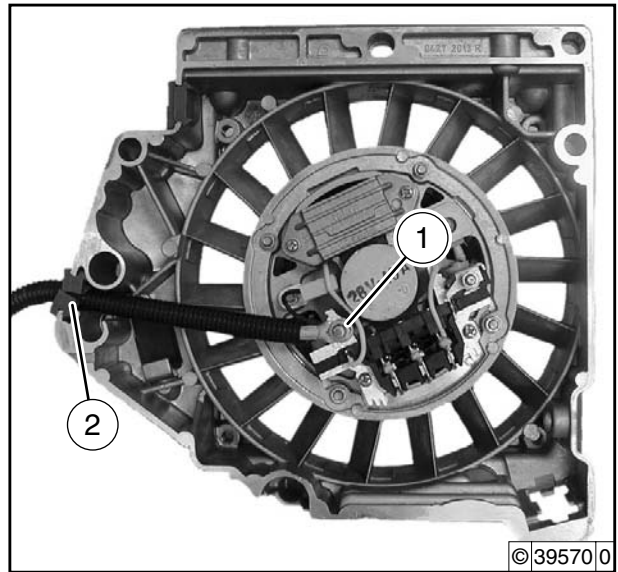
- Remove spacer disc (1).



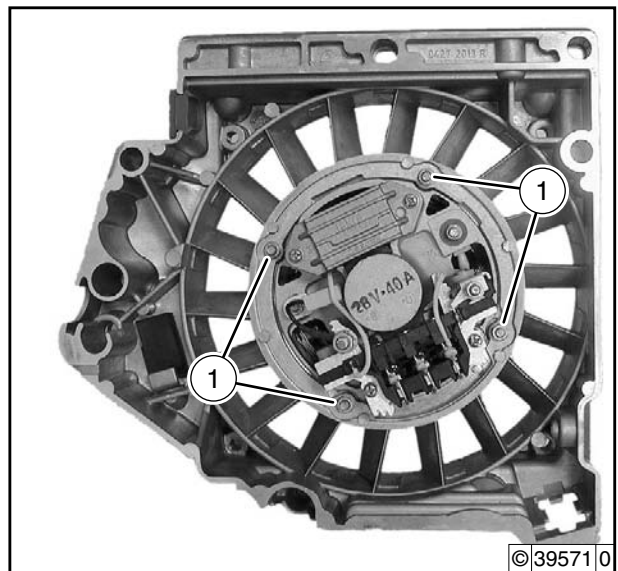
- Remove guide disc (1).



- Unscrew nut (1) and press out rubber muff (1).



- Unscrew nuts (1) and press out generator.
- Visually inspect components and renew if necessary.

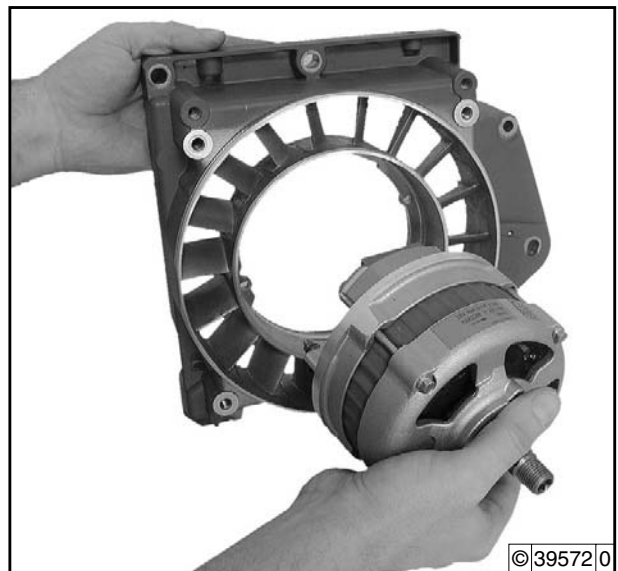


Complete cooler blower

- Insert generator and press in to stop.



Note
Note installation position of the generator.



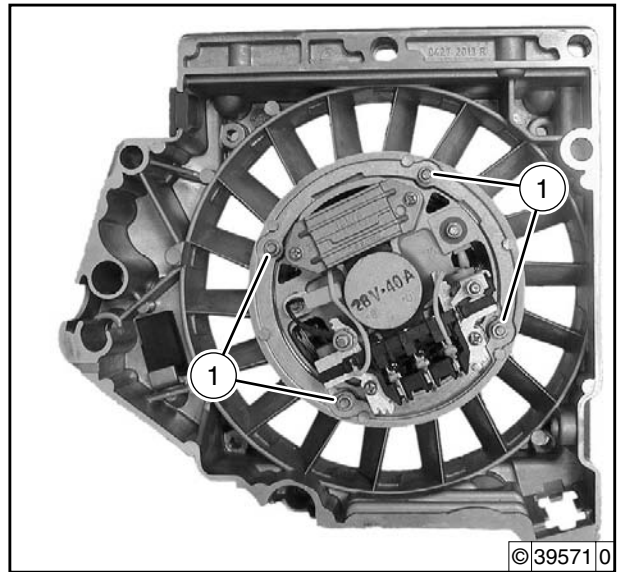
- Mount washers and tighten nuts (1) alternately.



Note

Check the installation position again.

09065



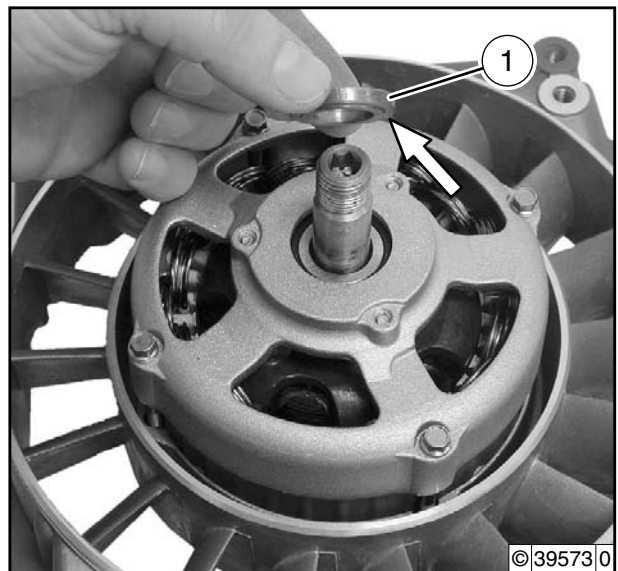
6

- Mount guide disc (1).

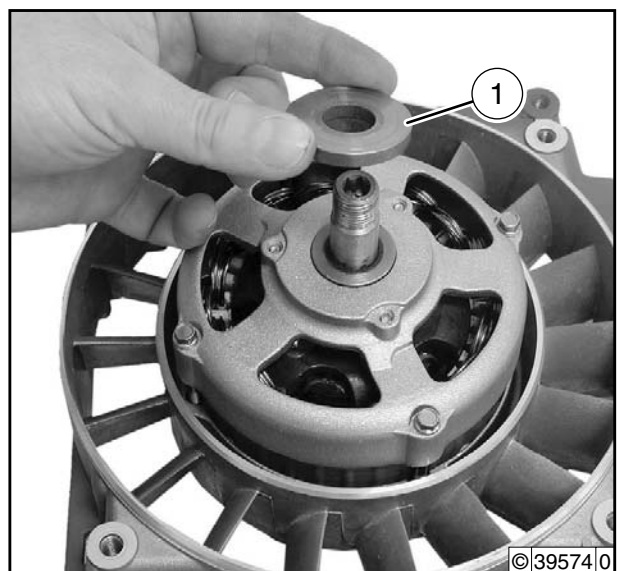


Note

The stepped side (arrow) must face the generator.



- Mount spacer disc (1).

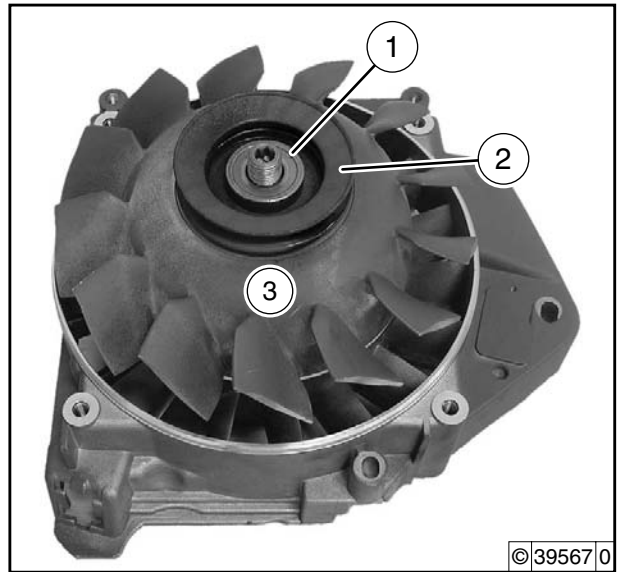


- Mount running wheel (3), V-belt pulley (2) and disc.



Note

Note installation position.



- Tighten nut.



13021



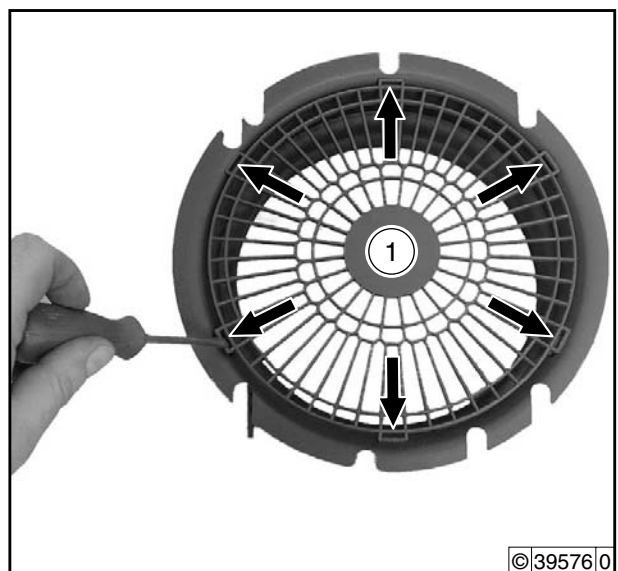
Check gap dimension

- Press out the protective grille (1) carefully from the blower jacket inlet at the fastening points (arrows).



Note

Do not damage the protective grille.



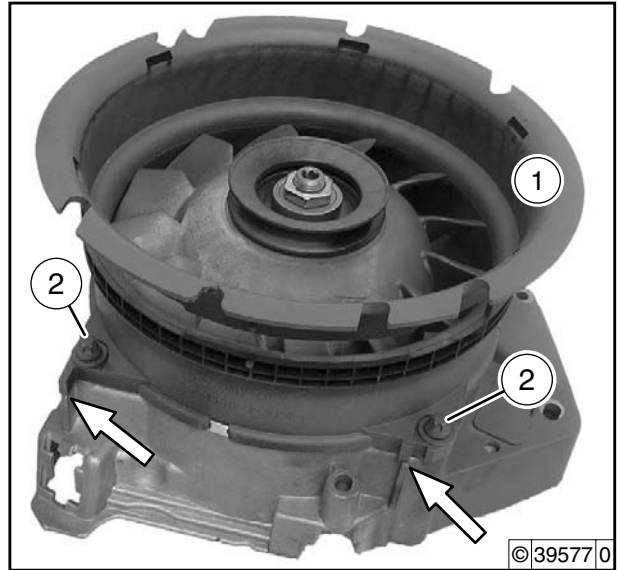
- Mount blower jacket inlet (1) and tighten screws (2).



Note

Note the installation position, the gates (arrows) must be in line.

09067



6

- Measure the gap dimension with a feeler gauge between the running wheel and the blower jacket inlet.

09 91

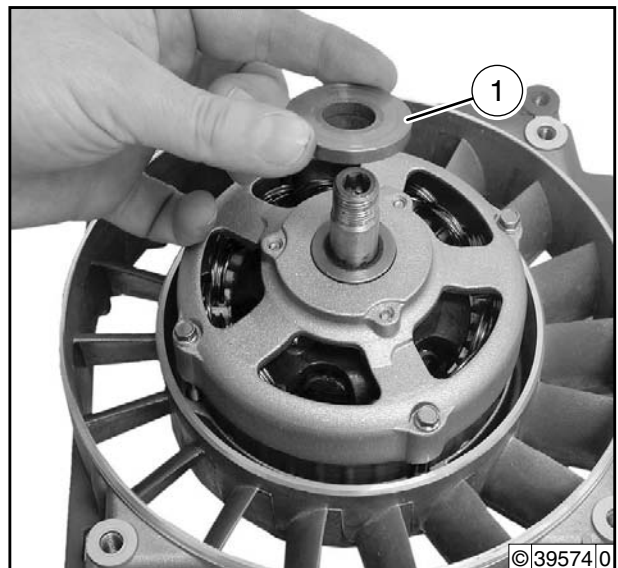


- Compensate gap dimension with the appropriate spacer disc (1).



Note

Spacer discs of 5 to 7 mm are available.

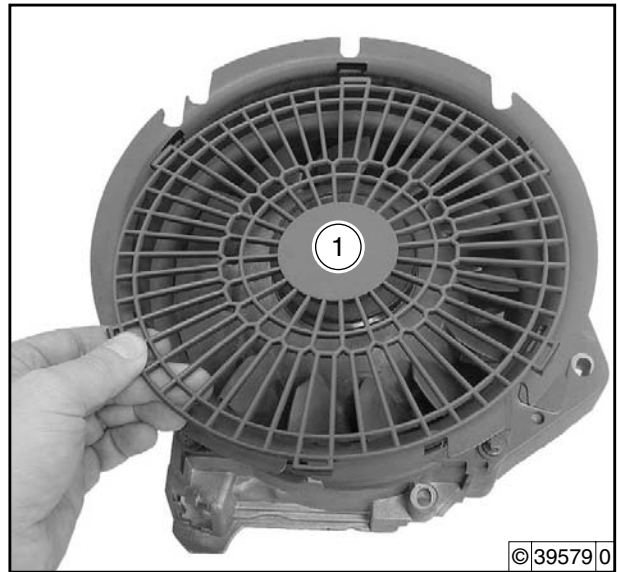


- Press the protective grille (1) carefully into the blower jacket inlet.



Note

Observe the fastening points.

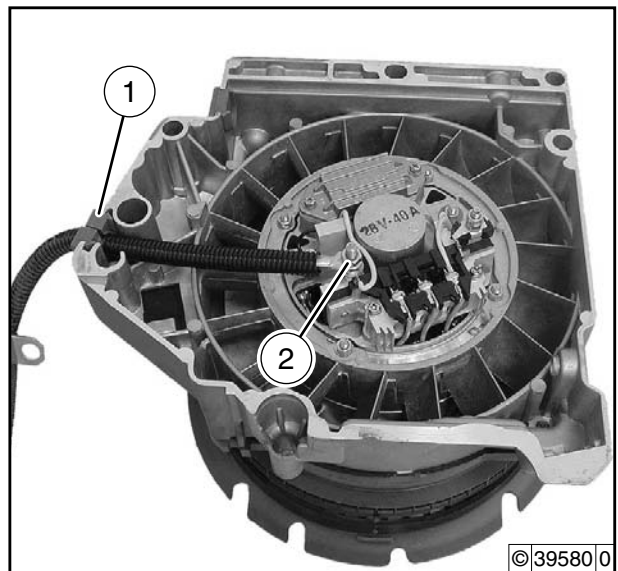


- Insert rubber muff (1) and tighten nut (2).



13081

- Install cooler blower
→ Job card W 09-11-01.





Notes

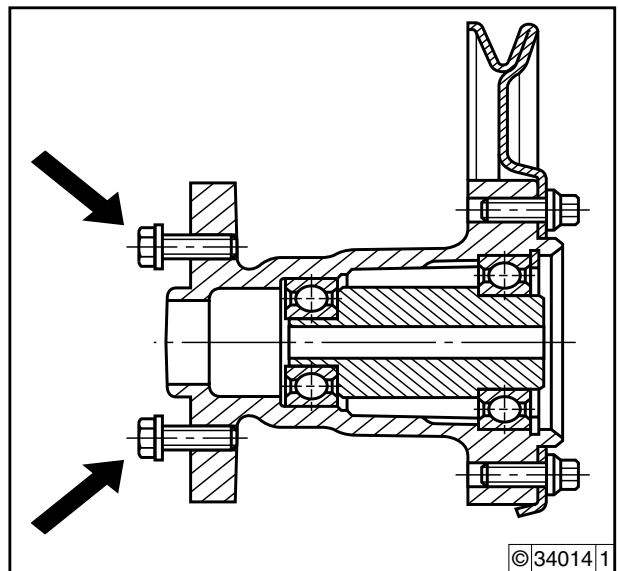
Dismantle and complete fan drive



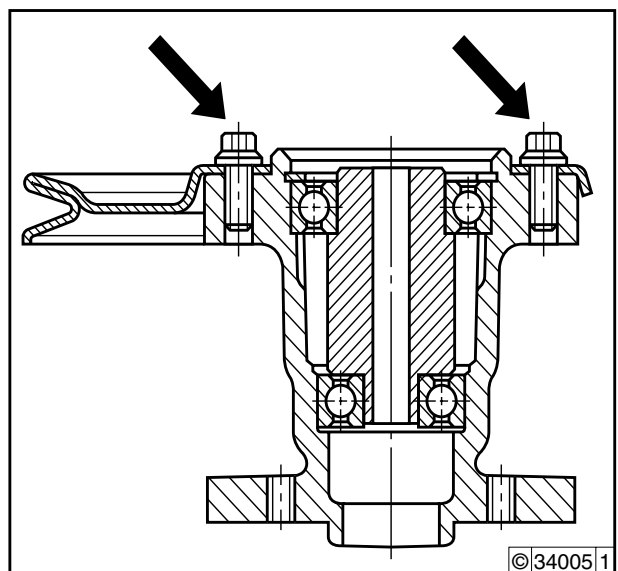
Tools
- Commercial tools

Dismantle fan drive

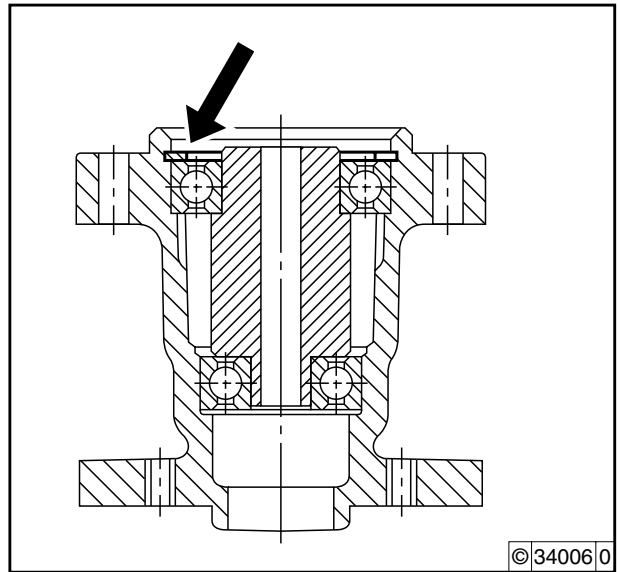
- If available, unscrew screws (arrows) and remove fan.



- Unscrew screws (arrows) and remove V-belt pulley.

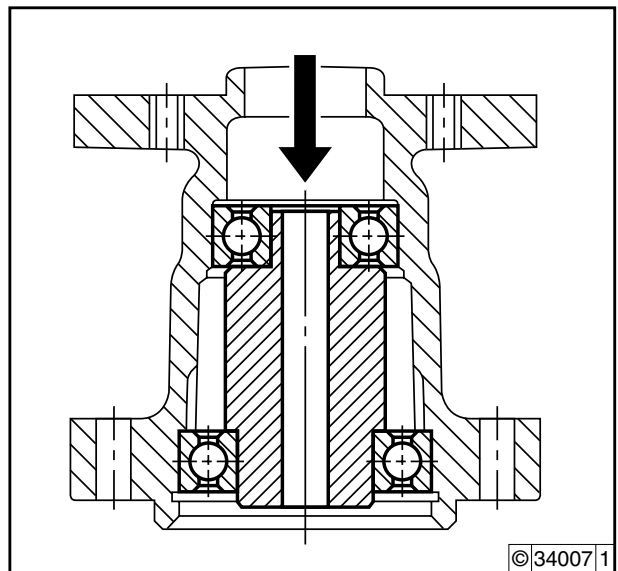


- Remove locking ring (arrow).



6

- Press out ball bearing with shaft (arrow).

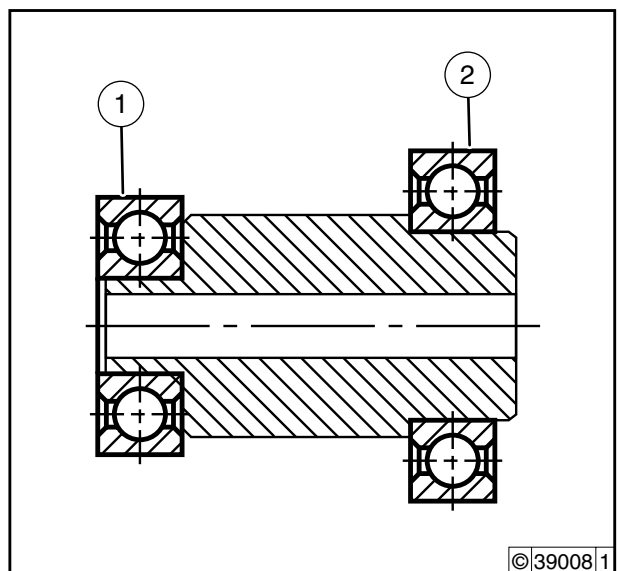


- Pull the inner (1) and outer (2) ball bearing from the shaft.
- Check components for visible signs of damage.



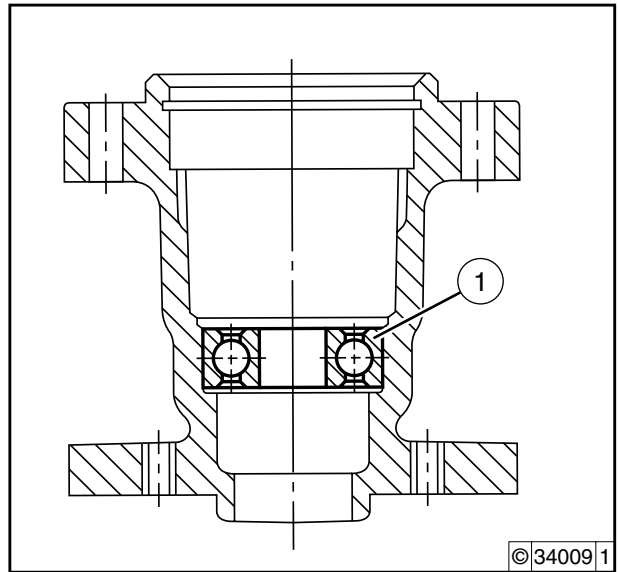
Note

The ball bearings must always be renewed.



Complete fan drive

- Press the inner ball bearing (1) over the outer ring up to the stop.

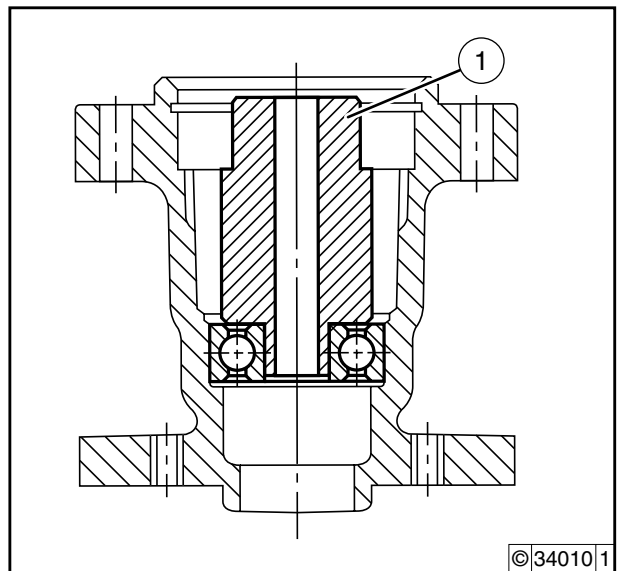


- Press in the shaft (1) to the stop in the inner ball bearing.

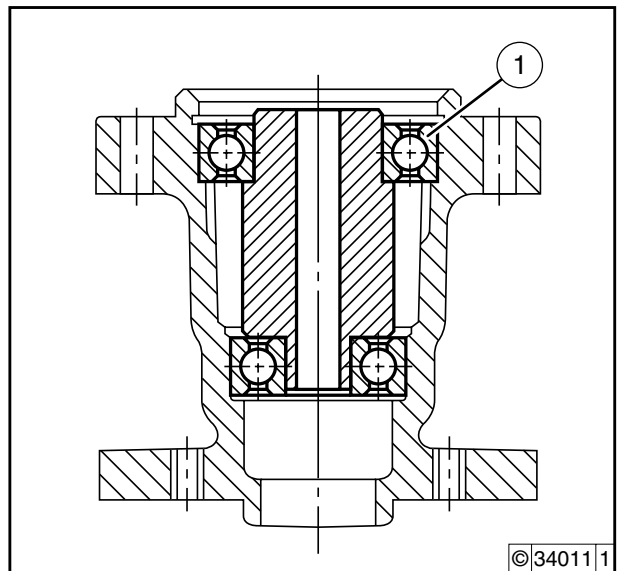


Note

- Note installation position of the shaft.
- Support the inner ring of the ball bearing when pressing in.



- Press in the outer ball bearing (1) over the outer and inner ring up to the stop.

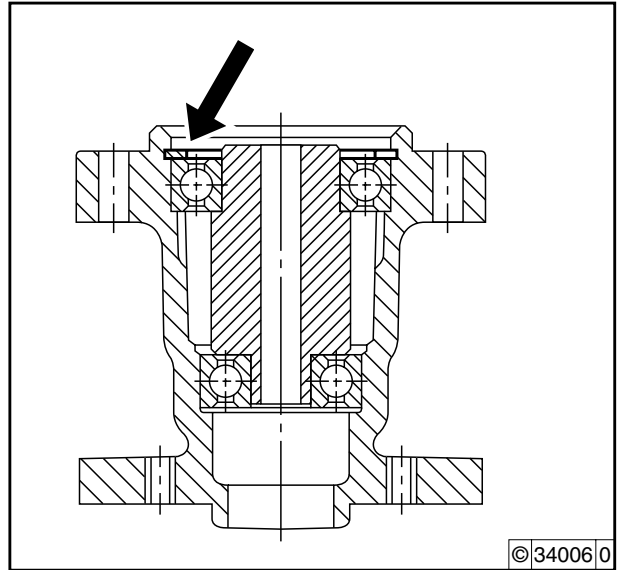


- Insert locking ring (arrow).



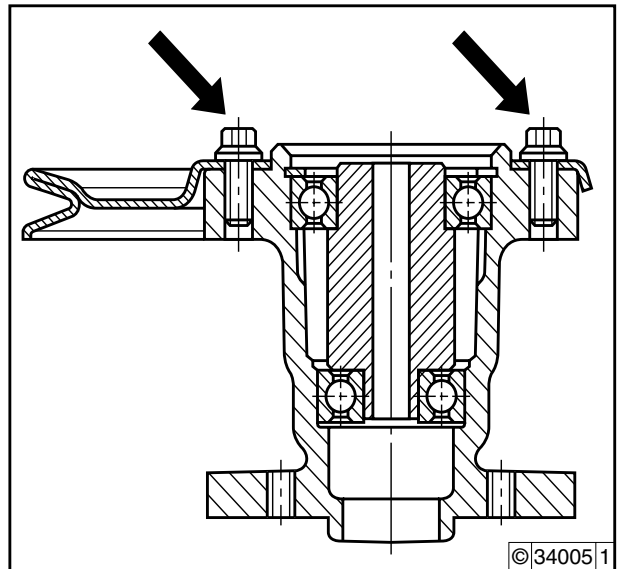
Note

Pay attention to correct fit of the locking ring in the groove.



6

- Mount V-belt pulley and tighten screws (arrows).

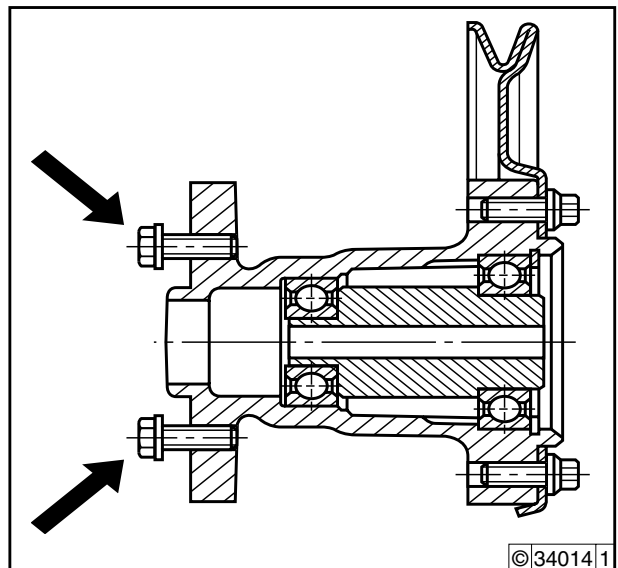


- Mount fan if available and tighten screws (arrows).



Note

Note different strength classes of the screws.



Remove and install lifting magnet (shutoff magnet)



Tools
- Commercial tools



References
- W 12-02-06
- W 13-02-03 (FM, BFM engines)

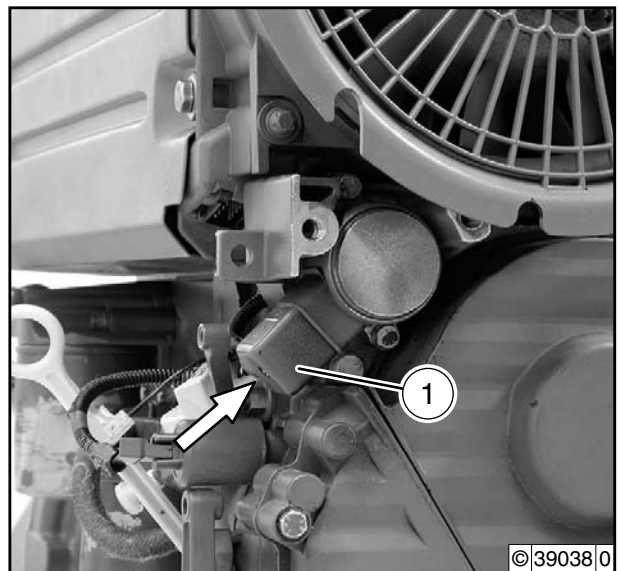
Remove lifting magnet (shutdown magnet)

In FM, BFM engines

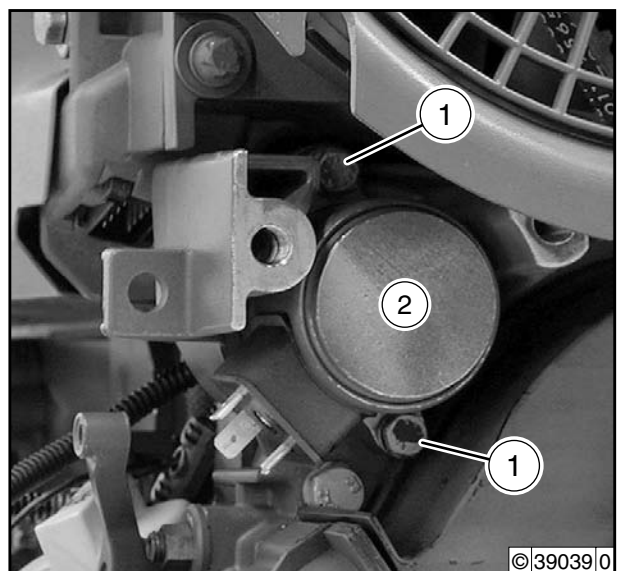
- Remove generator
→ Job card W 13-02-03.

In FL, BFL engines

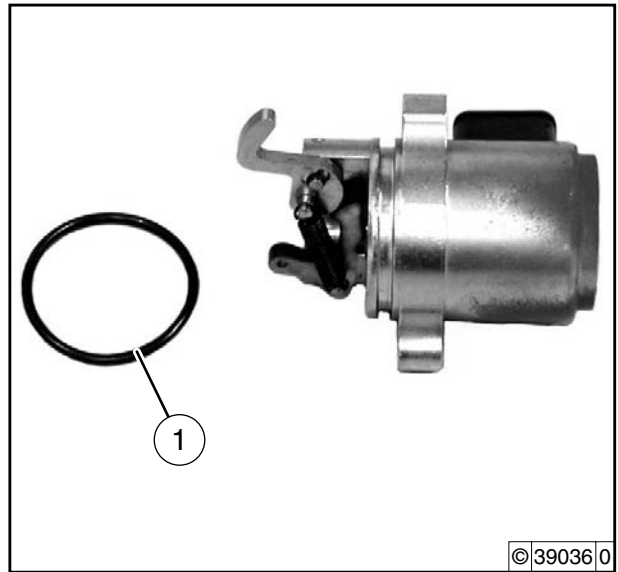
- Remove V-belt clamping roller
→ Job card W 12-02-06.
- Unscrew screw (arrow) and pull off cable plug (1).



- Unscrew screws (1) and remove lifting magnet (2).
- Check components for visible signs of damage.



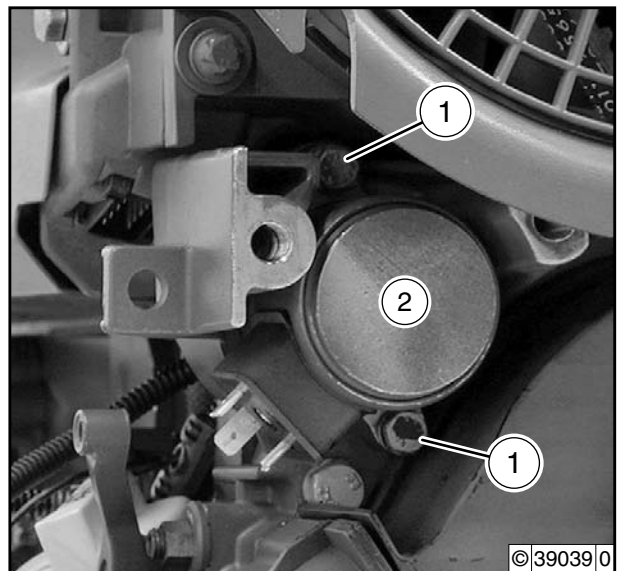
- Pull new round sealing ring (1) onto lifting magnet.



6

Install lifting magnet

- Insert lifting magnet (2) and tighten screws (1).



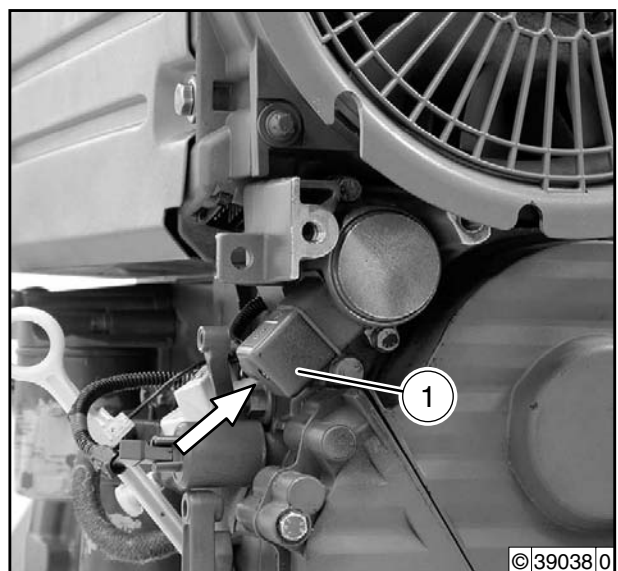
- Plug cable plug (1) and tighten screw (arrow).

In FL, BFL engines

- Install V-belt clamping roller
→ Job card W 12-02-06.

In FM, BFM engines

- Install generator
→ Job card W 13-02-03.



Check V-belt, renew (in FL and BFL engines)



Tools

- Commercial tools

8115 - V-belt pulley tension measuring appliance



Caution!

Only test / tighten / renew V-belts with the engine at a standstill.

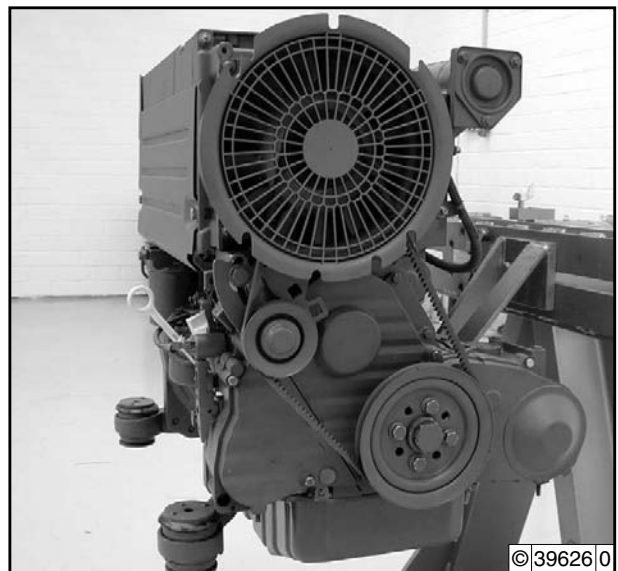


Note

The V-belt tension of new V-belts must be checked after they have been running for 15 minutes.

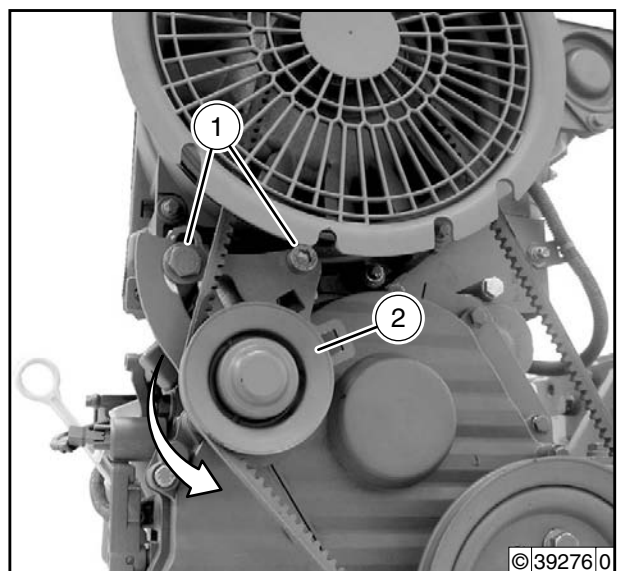
Test V-belt

- Inspect the V-belt visually for wear all round.

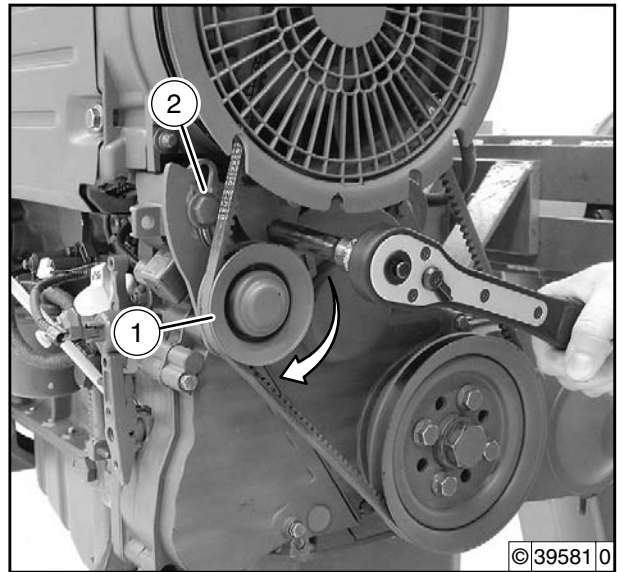


Renew V-belt

- Loosen screws (1).
- Swing V-belt clamping roller (2) to the side (arrow).
- Remove V-belt.



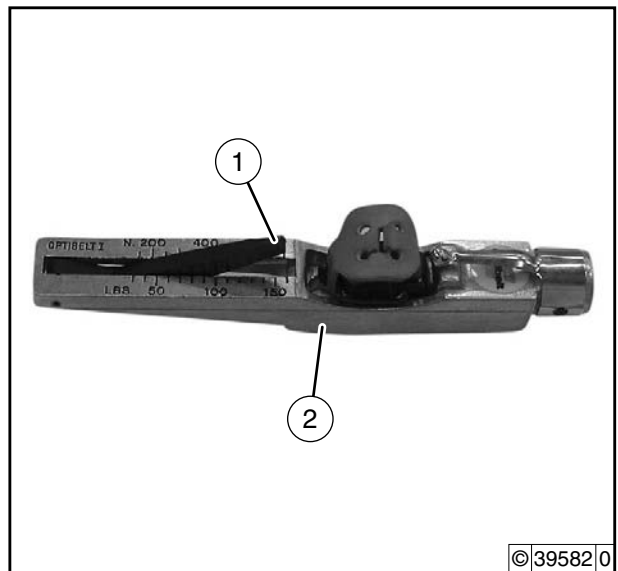
- Fit V-belt.
- Tighten V-belt.
Press the V-belt clamping roller (1) in the direction of the arrow with a suitable tool and tighten the screw (2).



6

Check the V-belt tension with the V-belt tension measuring appliance.

- Lower indicator arm (1) into V-belt tension measuring appliance (2).

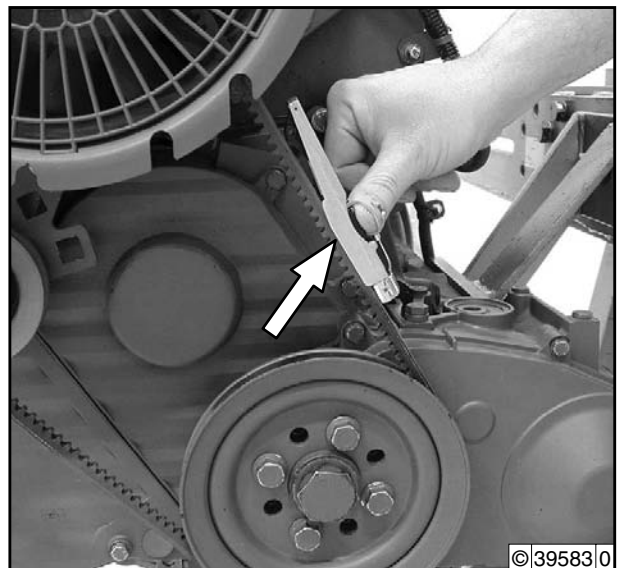


- Mount V-belt tension measuring appliance on the V-belt.



Note

The V-belt must be between the guides (arrow).



- Press the V-belt measuring appliance against the V-belt with the button (1) until you hear it click.
- Read the measured value at the point of intersection of the indicator arm and the scale (arrow).

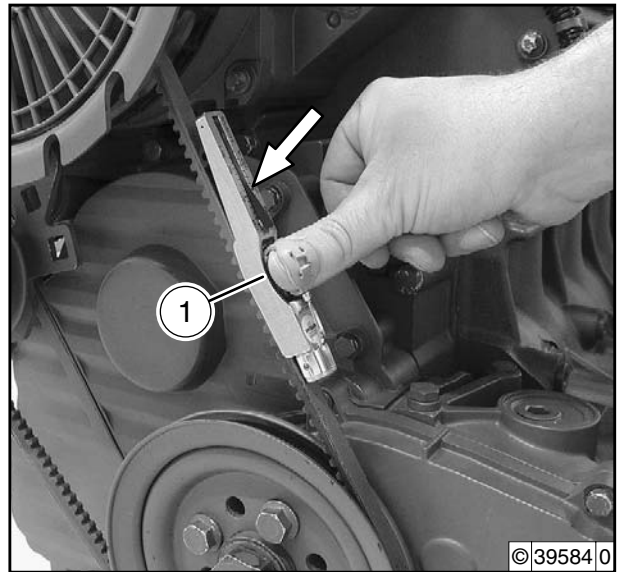


Note

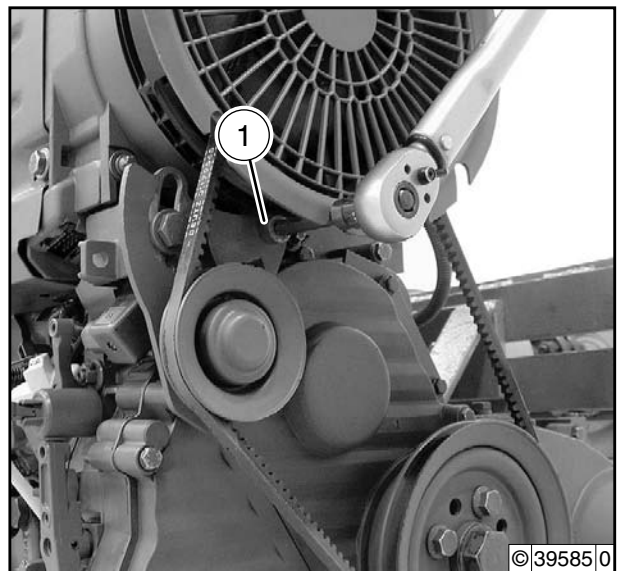
Note different unit on the scale.



- If the setpoint is not reached, the clamping procedure must be repeated.



- Tighten screw (1).





Notes

Check, renew V-belt (in FM, BFM engines)



Tools

- Commercial tools

8115 - V-belt pulley tension measuring appliance



Note

- The V-belt tension of new V-belts must be checked after they have been running for 15 minutes.
- One variant has been described. The procedure is the same accordingly for other variants.

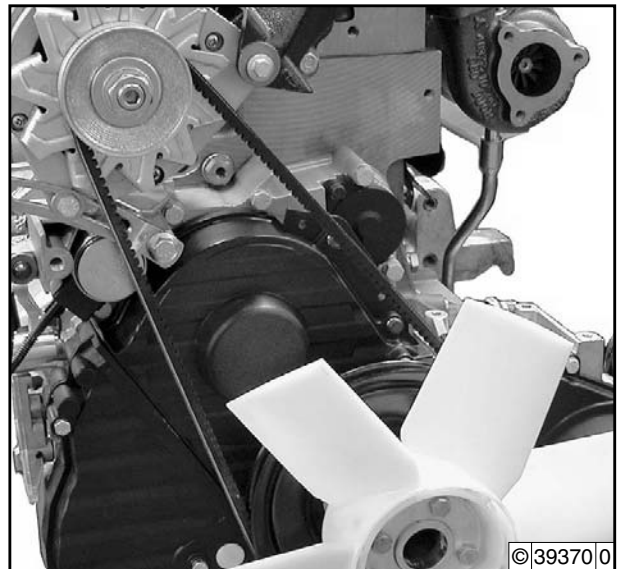


Caution!

Only test / tighten / renew V-belts with the engine at a standstill.

Test V-belt

- Inspect the V-belt visually for wear all round.



6

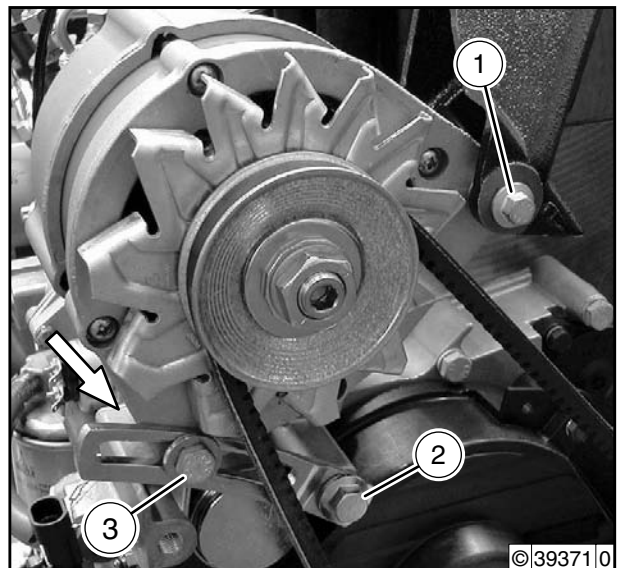
Renew V-belt

- Loosen screws (1).
- Loosen screw (2).

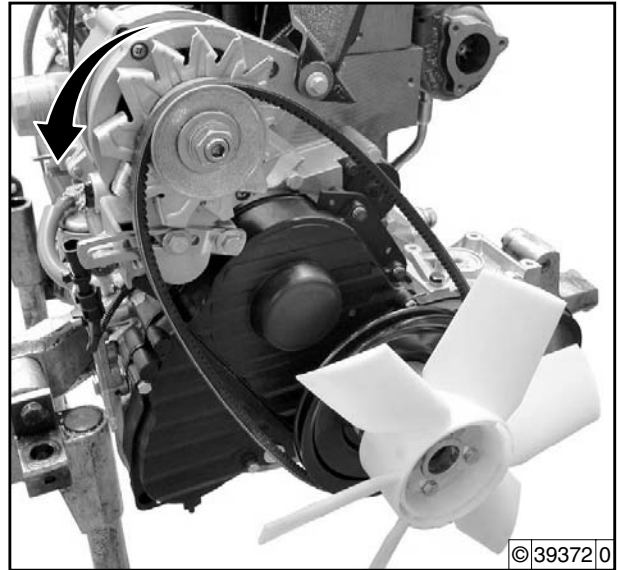


Note

Hold nuts (arrow).



- Swing generator aside (arrow).
- Remove V-belt.

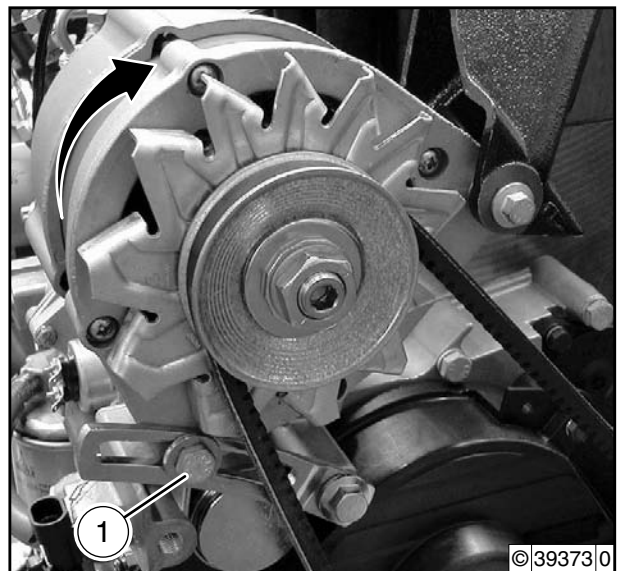


6

- Fit V-belt.
- Tighten V-belt.
Push back generator with suitable tool (arrow) and tighten screw (1).

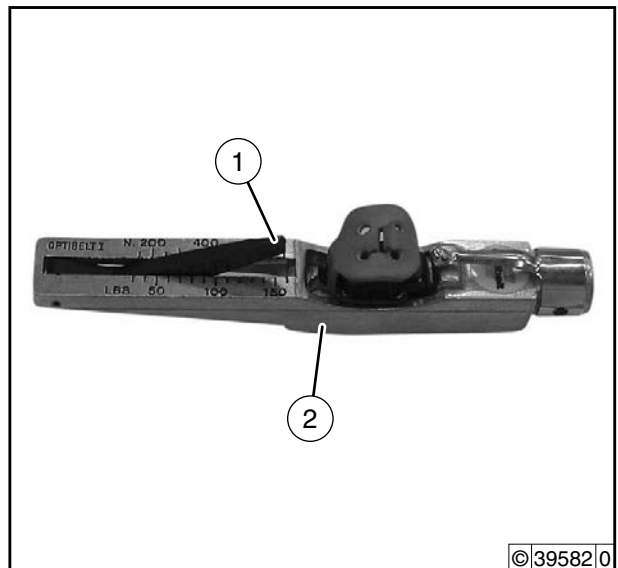


Note
Hold nuts.



Check the V-belt tension with the V-belt tension measuring appliance.

- Lower indicator arm (1) into V-belt tension measuring appliance (2).

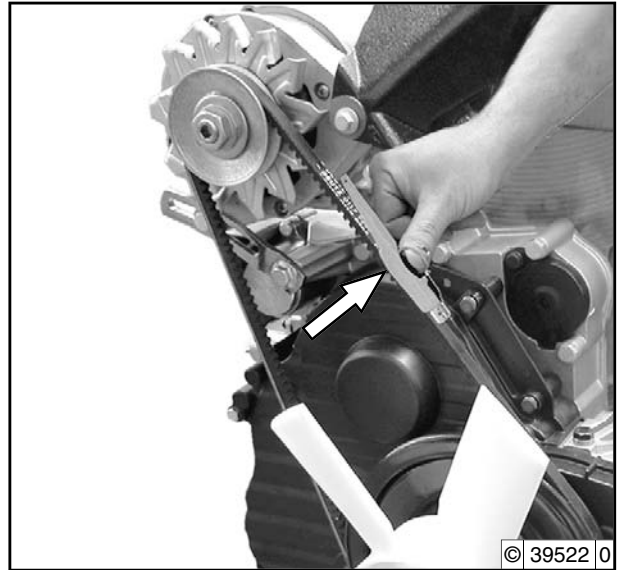


- Mount V-belt tension measuring appliance on the V-belt.



Note

The V-belt must be between the guides (arrow).



- Press the V-belt measuring appliance against the V-belt with the button (1) until you hear it click.
- Read the measured value at the point of intersection of the indicator arm and the scale (arrow).

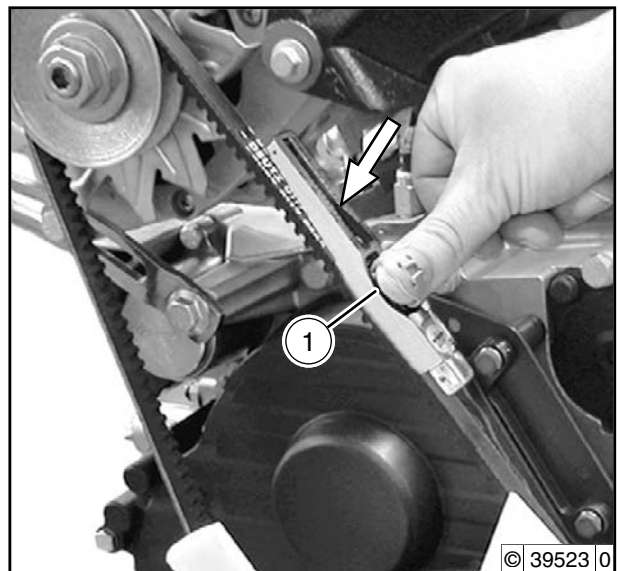


Note

Note different unit on the scale.



- If the setpoint is not reached, the clamping procedure must be repeated.



- Tighten screw (1).



- Tighten screws (2).

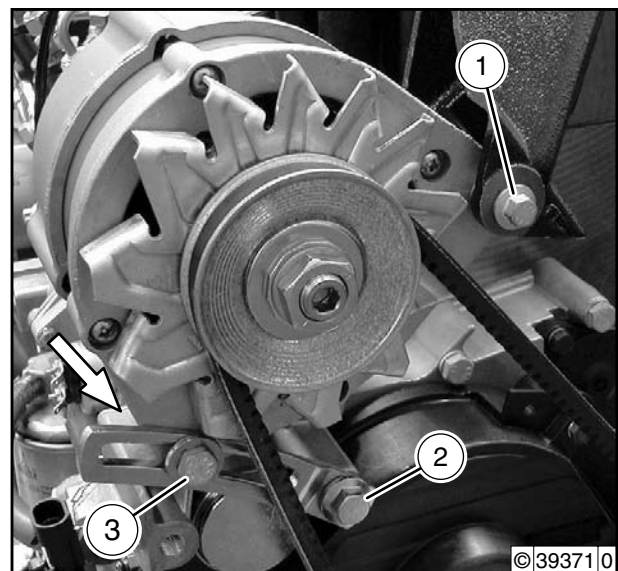


- Tighten screw (3).



Note

Hold nuts (arrow).



Generator fastening with built-up fan drive (unit design)

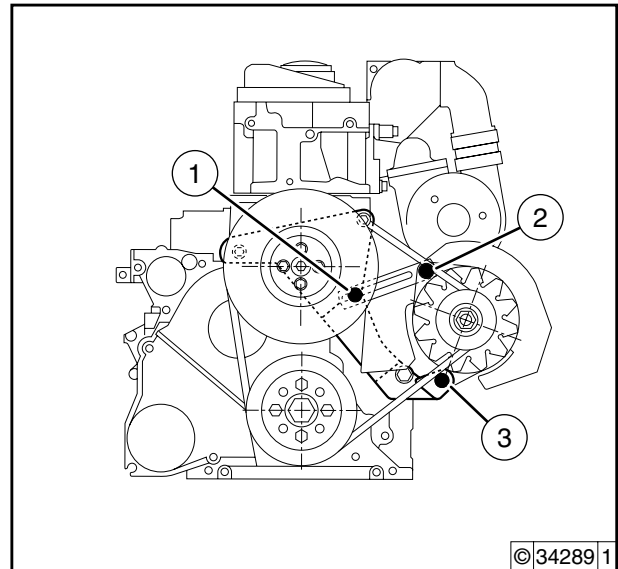
- Tighten screw (1).



- Tighten screw (2).



- Tighten screw (3).



Generator fastening with built-up fan drive (building machine design)

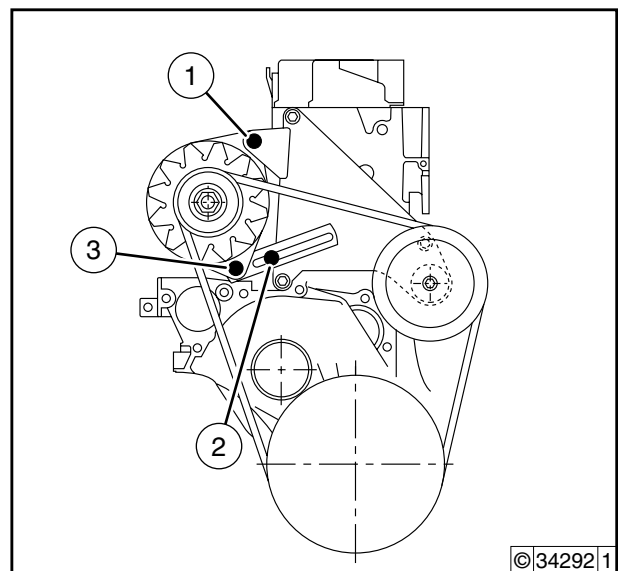
- Tighten screw (1).



- Tighten screw (2).



- Tighten screw (3).



Remove and install V-belt clamping roller



Tools

- Commercial tools



References

- W 12-02-01 FL and BFL engines
- W 12-02-01 FM and BFM engines

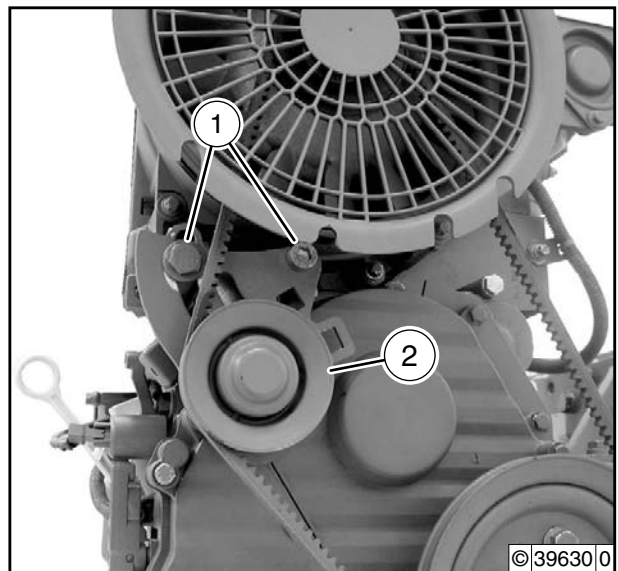


Note

- Only the old version of the clamping roller has been described.
- The procedure is the same accordingly for other versions.

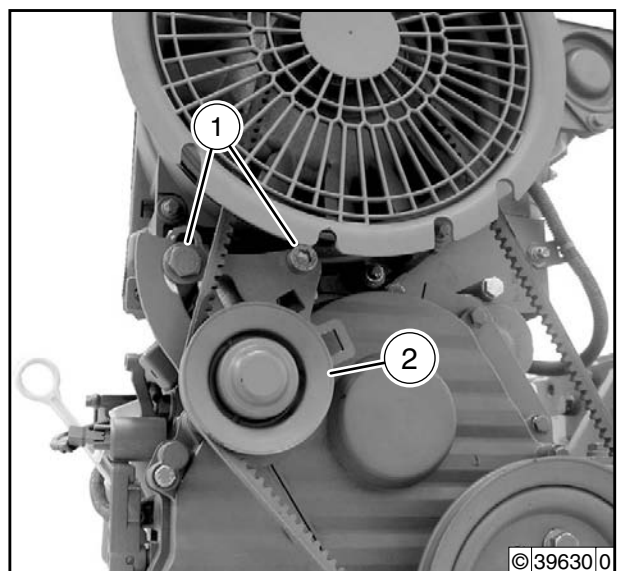
Remove V-belt clamping roller

- Unscrew screws (1) and remove V-belt clamping roller (2).
- Check component for visible signs of damage.



Install V-belt clamping roller

- Fit V-belt clamping roller (2) and tighten screws (1).
- Tighten V-belt.
 - Job card **W 12-02-01** (FL and BFL engines)
 - Job card **W 12-02-01** (FM and BFM engines).





Notes

Remove and install flywheel



Tools

- Commercial tools

- Special tools

Guide pin (self made)

143 100 - Pressing device

Remove flywheel

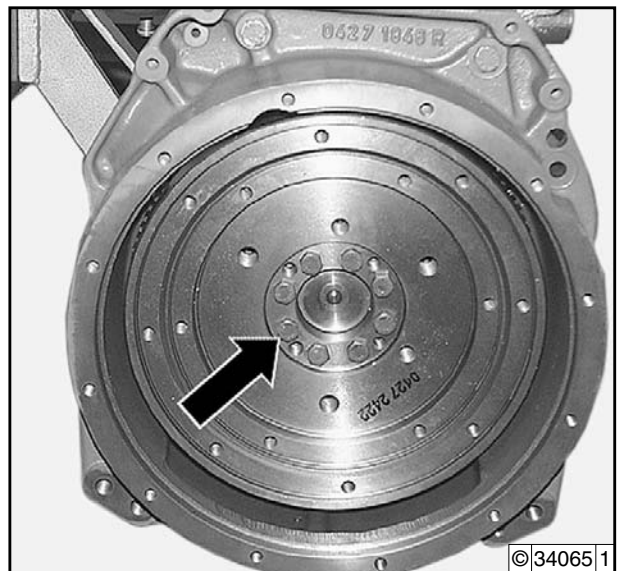
- Unscrew all screws (arrow).



Note

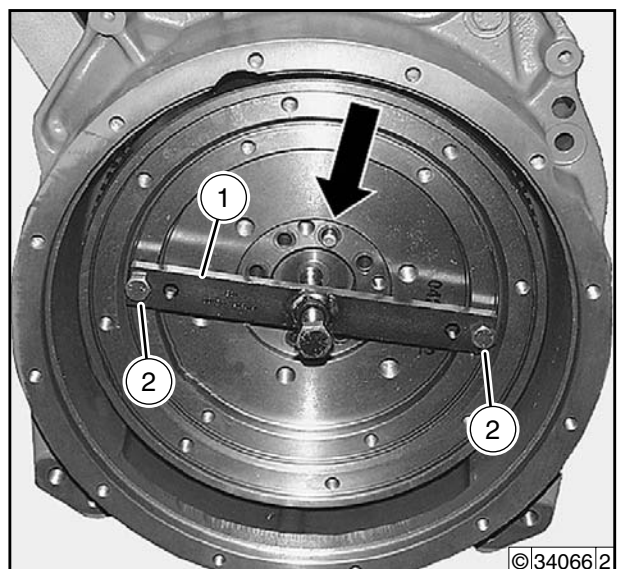
Block flywheel with suitable tool.

- Remove flywheel.

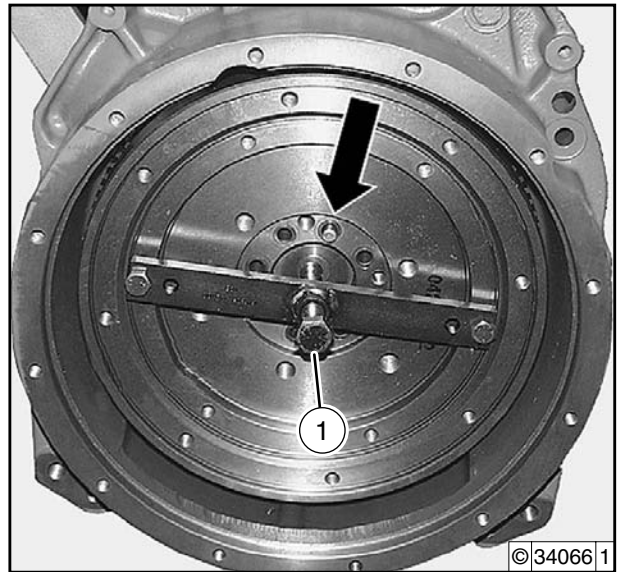


Remove stuck flywheel

- Turn in self-made guide pin (arrow).
- Apply pressing tool (1) and tighten screws (2).



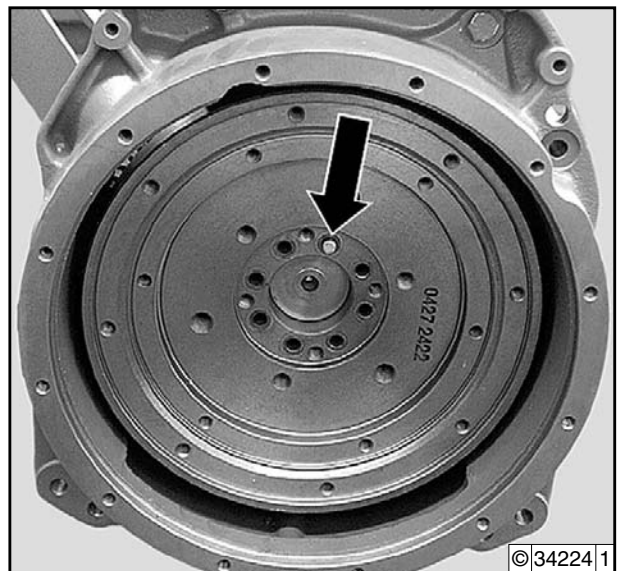
- Press down flywheel by turning in the center screw (1).
- Remove pressing tool.
- Unscrew self-made guide pin (arrow).
- Visually inspect the flywheel and toothed starter ring for damage.



6

Install flywheel

- Mount flywheel using a self-made guide pin (arrow).

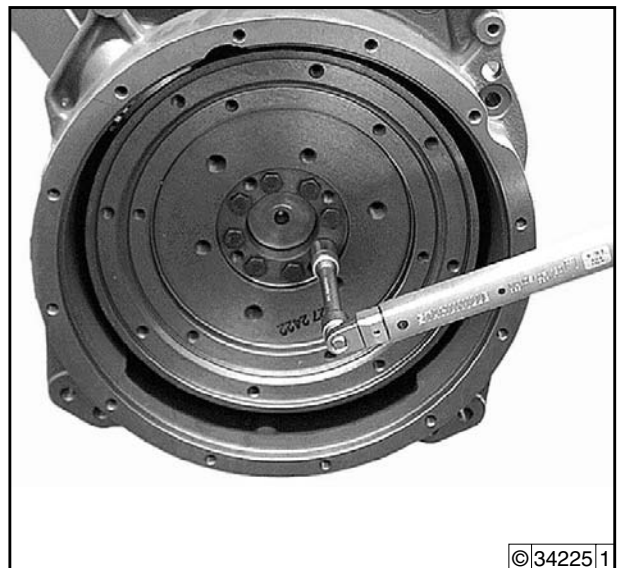


- Tighten all screw with angled wrench alternately.



Note

- Use new screws.
- Block flywheel with suitable tool.



Renew toothed starter at flywheel ring



Tools
- Commercial tools



Caution!
Risk of injury!
From hot parts.



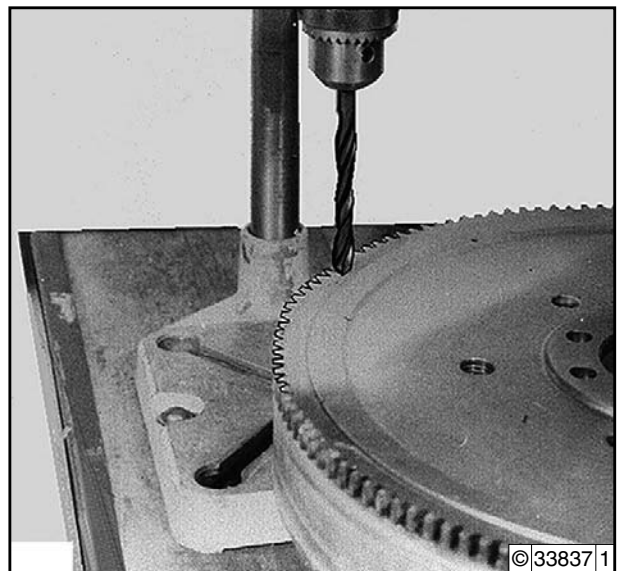
References
- W 12-06-01

Remove toothed starter ring

- Remove flywheel
→ Job card W 12-06-01.
- Drill toothed starter ring.



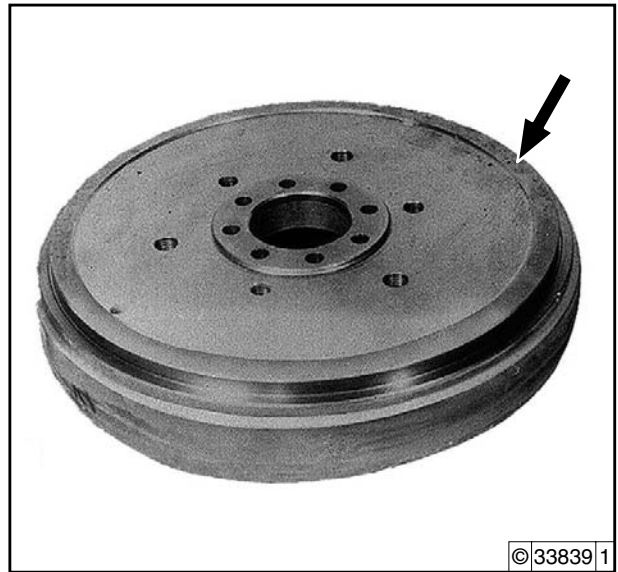
Note
Do not damage the flywheel.



- Remove toothed starter ring with suitable tool.



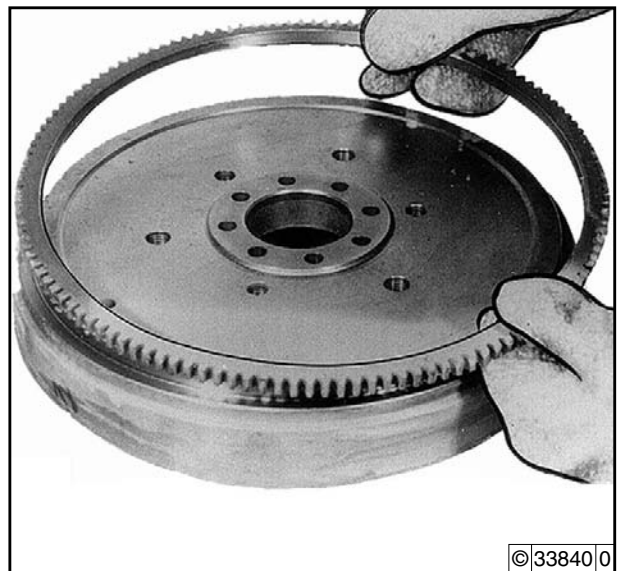
- Clean the flywheel and inspect visually at the joint (arrow).



6

Install toothed starter ring

- Heat up toothed starter ring to max. 220 °C. Mount toothed starter ring and contact at collar.
- Install flywheel.
→ Job card **W 12-06-01**.



Remove and install hydraulic pump



Tools

- Commercial tools

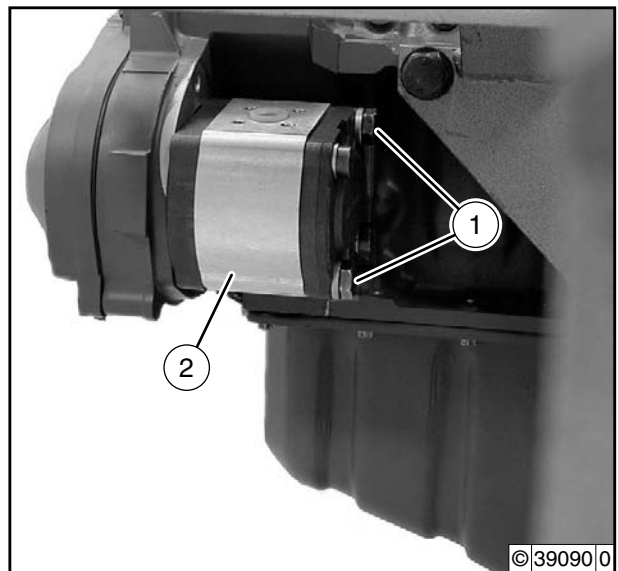


Auxiliary material

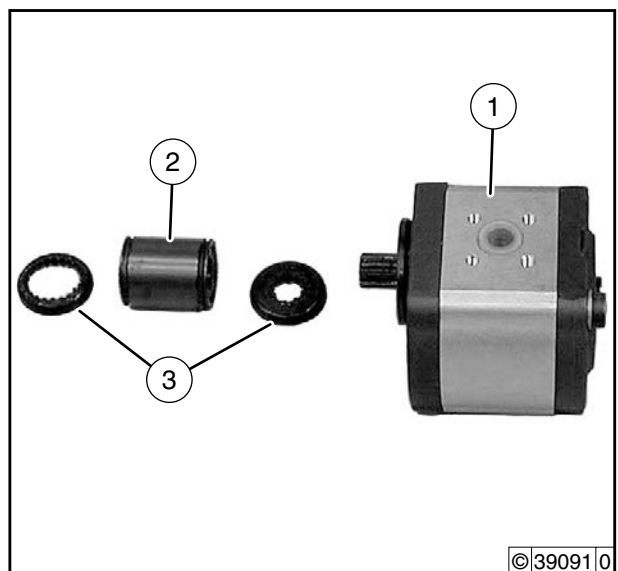
- Graphite grease G 500, 20g tube

Remove hydraulic pump

- Unscrew hexagon bolts (1), remove hydraulic pump (2) and coupling sleeve.



- Visually inspect hydraulic pump (1), coupling sleeve (2) and jackets (3) for damage, change if necessary.



Install hydraulic pump

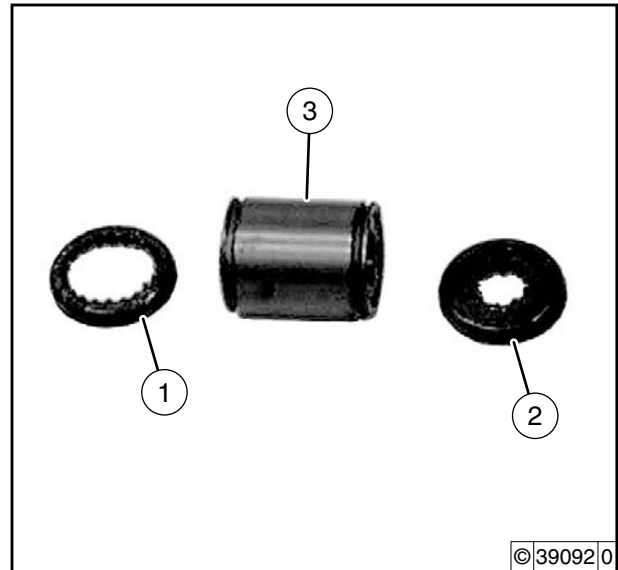
- Pull jackets (1 and 2) onto coupling sleeve (3).



Note

The punch-out of the jackets must be aligned to the teeth of the coupling sleeve.

- Grease the inside teeth of the coupling sleeve with graphite grease **G 500**.



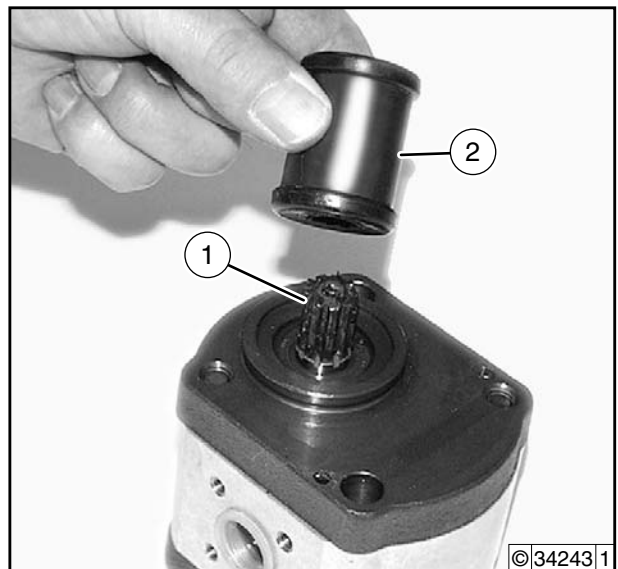
6

- Grease the toothed shaft with graphite grease **G 500**.
- Plug the coupling sleeve (2) to the toothed shaft.



Note

- Note installation position.
- The teeth of the coupling sleeve must engage the toothed shaft.

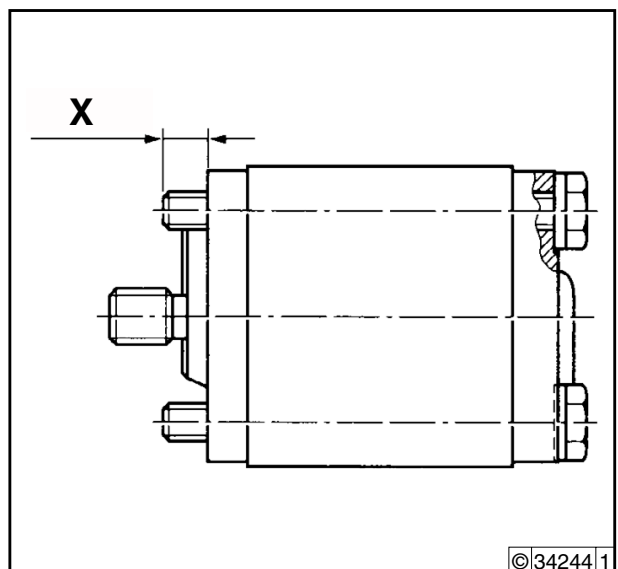


- Insert hexagon bolts in the hydraulic pump.
- Check the protrusion of the bolts.



Note

The maximum protrusion "X" may not be greater than 18 mm, renew bolts if necessary or place additional washers under the bolt head.

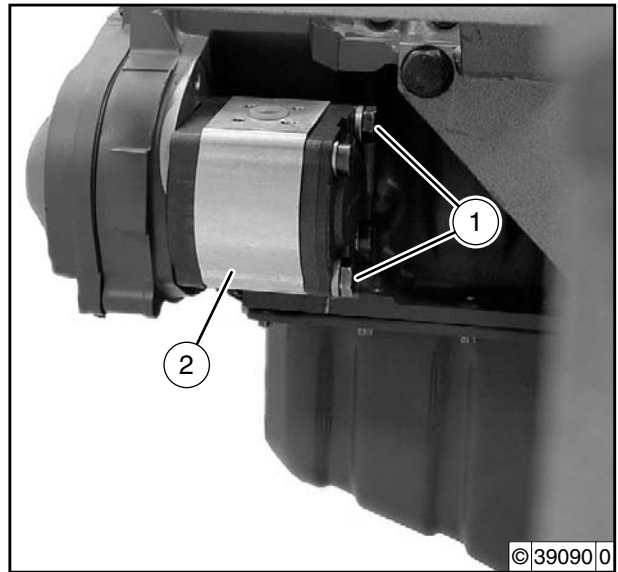


- Grease the toothed shaft of the hydraulic pump drive with graphite grease **G 500**.
- Insert hydraulic pump (2) with coupling sleeve and tighten hexagon bolts (1).



Note

The teeth of the coupling sleeve must engage the hydraulic pump drive.





Notes

Remove and install toothed belt and clamping roller of the hydraulic pump



Tools
- Commercial tools



Caution!

The toothed belt and the clamping roller must be renewed after every disassembly regardless of their time in operation.



References

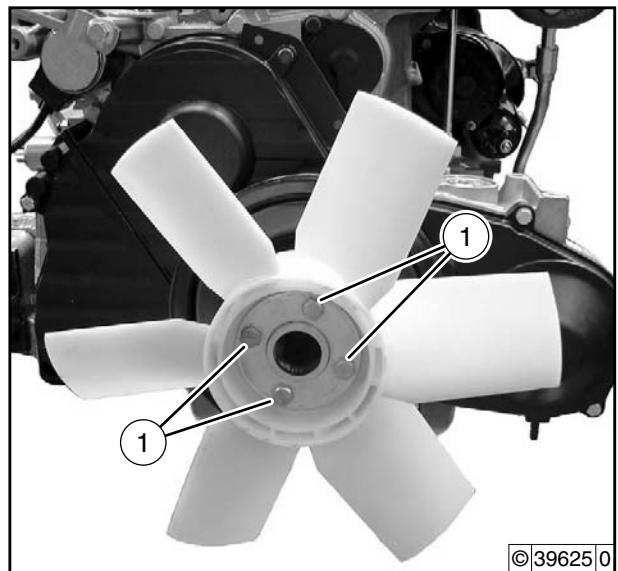
- W 12-02-01 (FL, BFL engines)
- W 12-02-01 (FM, BFM engines)

Remove toothed belt and clamping roller

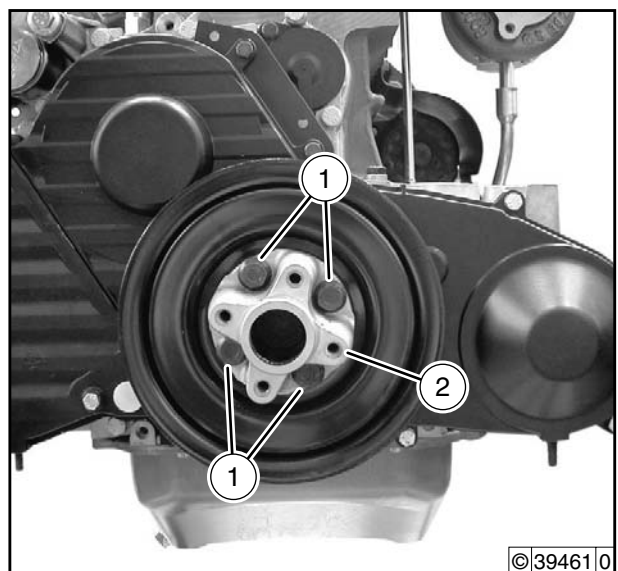
- Remove V-belt
 - Job card W 12-02-01 (FL, BFL engines)
 - Job card W 12-02-01 (FM, BFM engines)

In FM, BFM engines

- If available, unscrew screws (1) and remove fan.



- Unscrew screws (1), flange hub (2) and remove V-belt pulley.

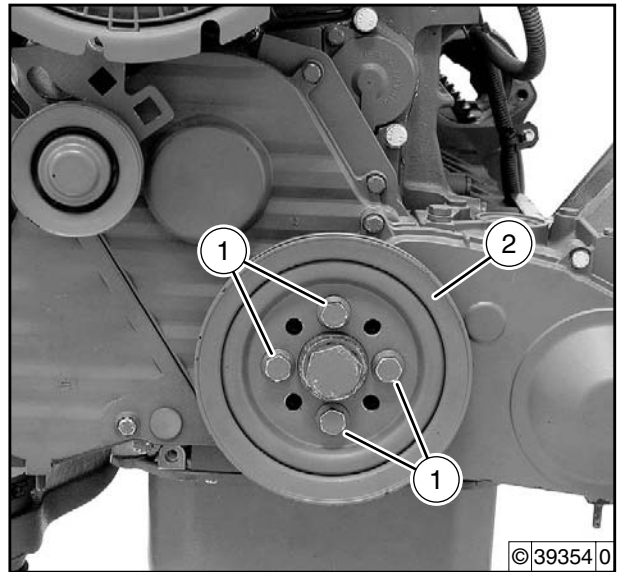


- Unscrew screws (1) and remove V-belt pulley (2).



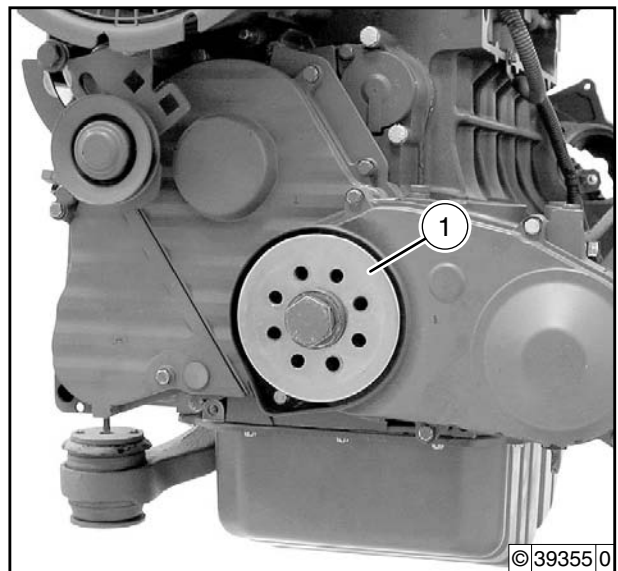
Note

Hold at the center screw.

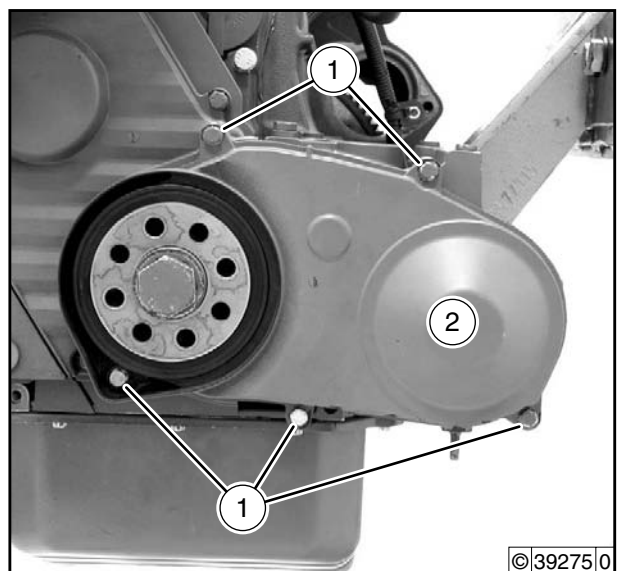


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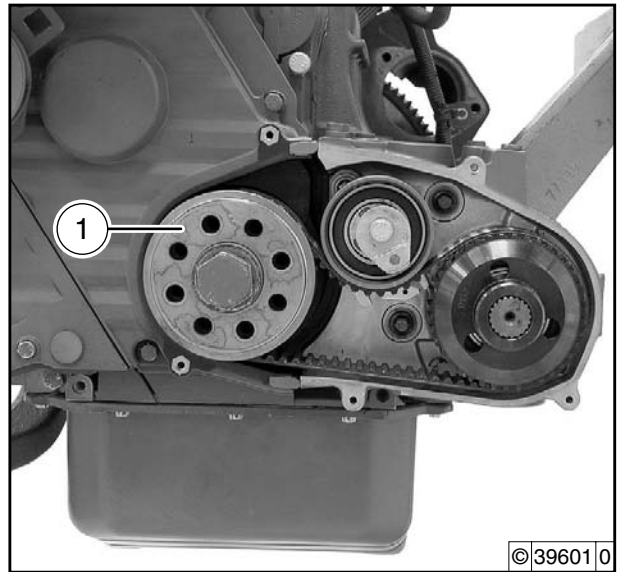
- Remove centrifugal disc (1).



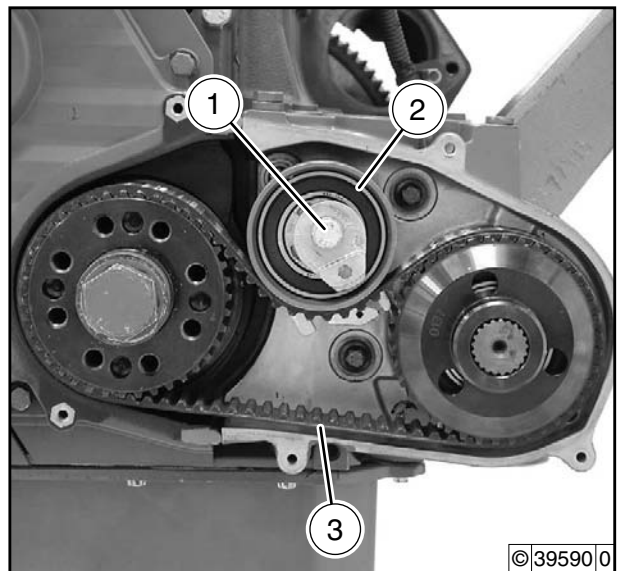
- Unscrew screws (1) and remove protective cover (2).



- Remove adapter (1).

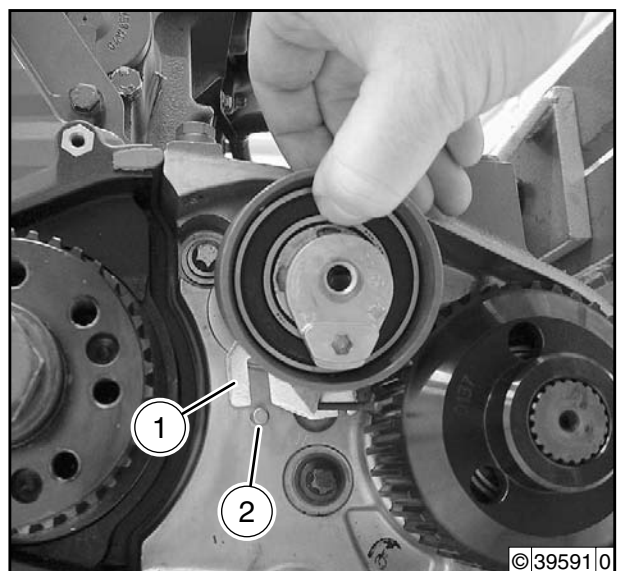


- Unscrew screw (1) and remove clamping roller (2).
- Remove toothed belt (3).
- Check components for visible signs of damage.

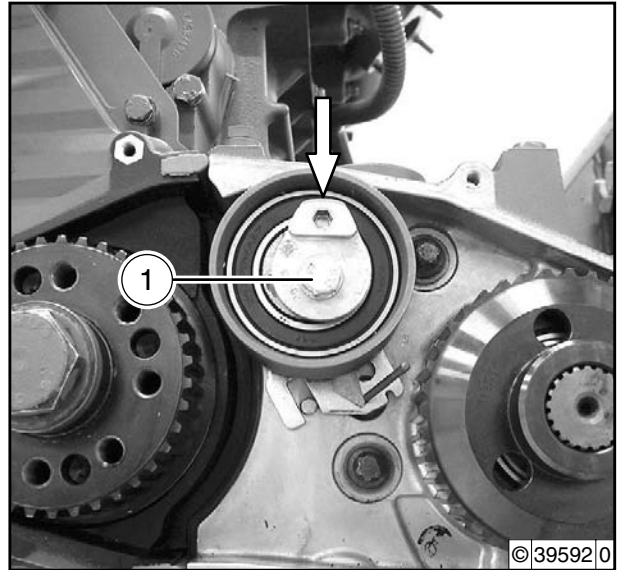


Install toothed belt and clamping roller

- Insert new clamping roller with the guide fork (1) of the base plate in the guide pin (2) of the hydraulic pump console.



- Screw in screw (1) and position setting eccentric (arrow) at 12.00 h position.
- Pre-tighten screw.

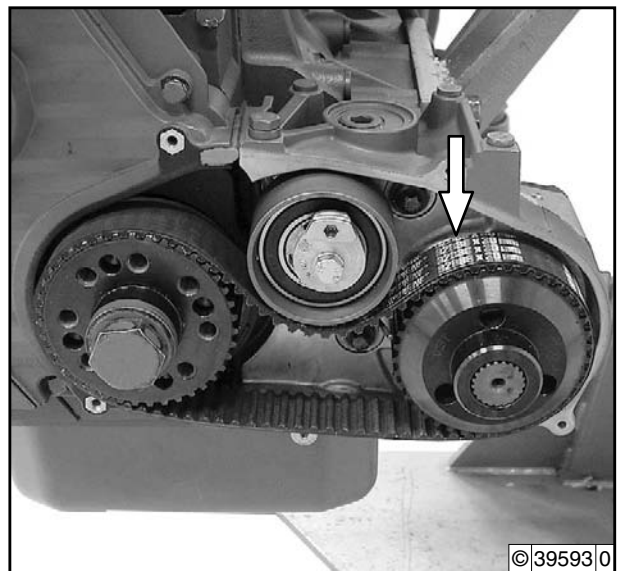


- Mount new toothed belt.

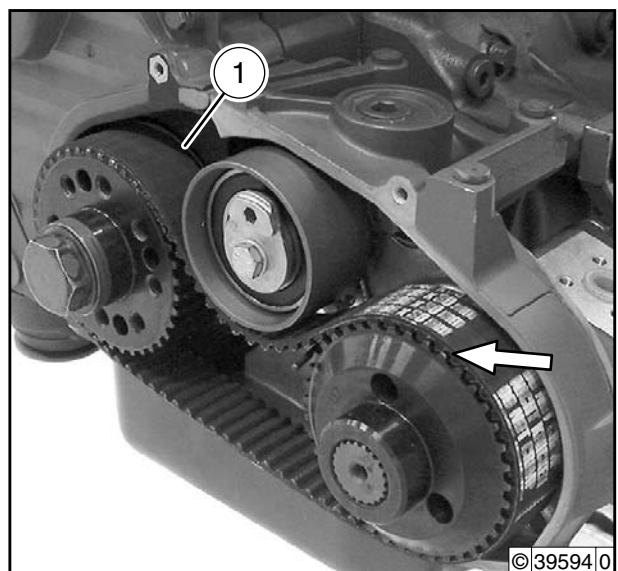


Note

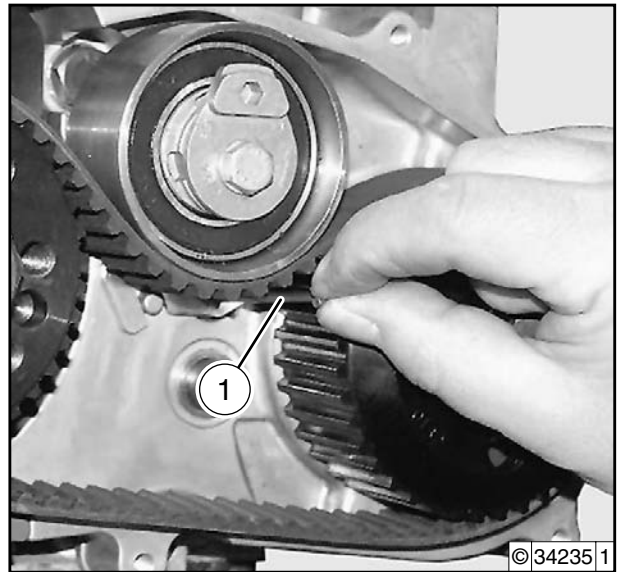
Note running direction of the toothed belt. The labeling (arrow) on the toothed belt must be legible from the front.



- Align the toothed belt so that it is touching the crankshaft gear wheel at the guide joint (1) and the hydraulic pump gear about 4 mm behind the front edge (arrow).



- Remove locking pin (1).



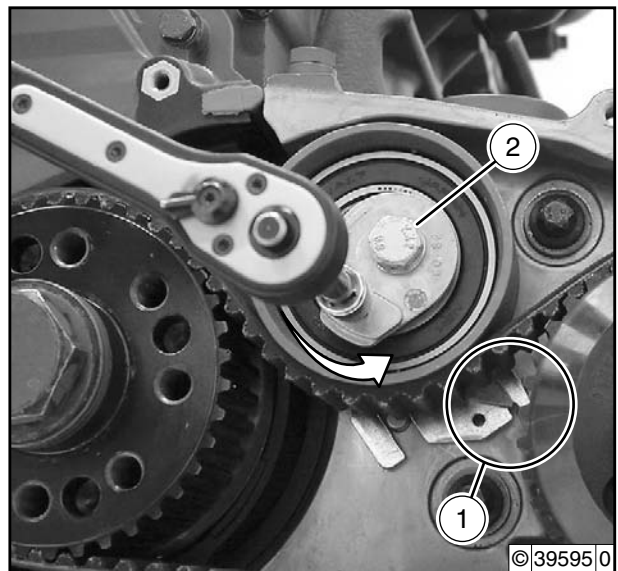
- Turn the setting eccentric in the direction of the arrow (counterclockwise) until the pointer of the clamping roller is in line with the notch (1).



Note

Turn the setting eccentric at the hexagon socket.

- Tighten screw (2).

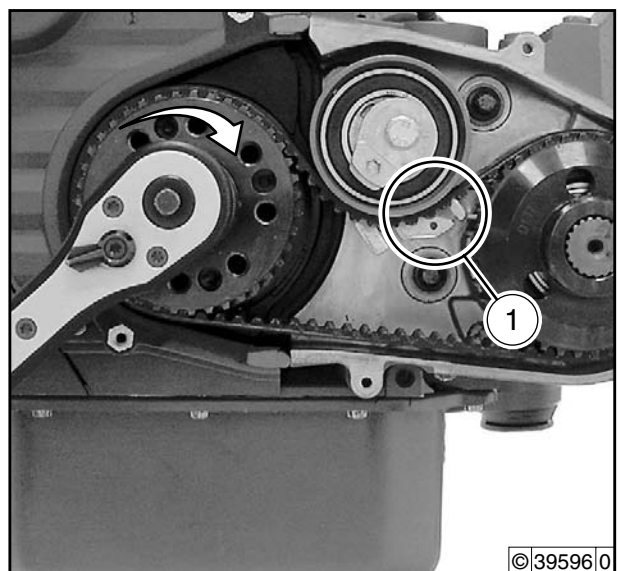


- Turn the crankshaft 2 turns in the engine's direction of rotation (arrow).
- Check the toothed belt tension.



Note

- The pointer of the clamping roller must be in line with the notch (1).
- If the marks are not in line, the toothed belt tension must be corrected.

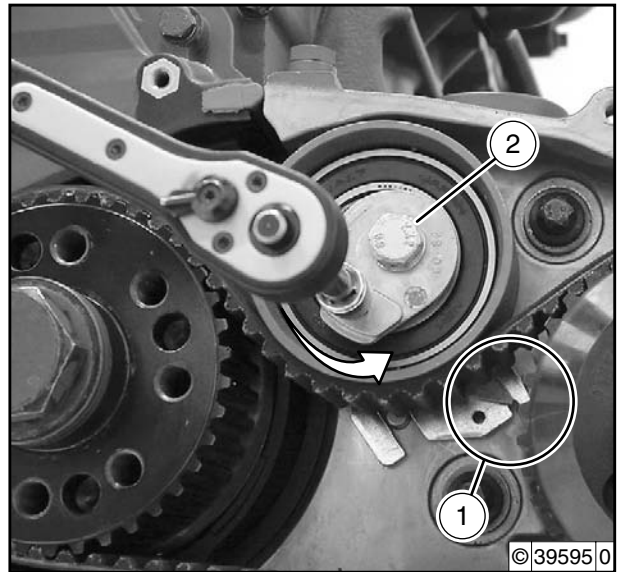


Correct the toothed belt tension

- Loosen screw (2) and pre-tighten again.



- Turn the setting eccentric in the direction of the arrow (counterclockwise) until the pointer of the clamping roller is in line with the notch (1).
- Tighten screw (2).



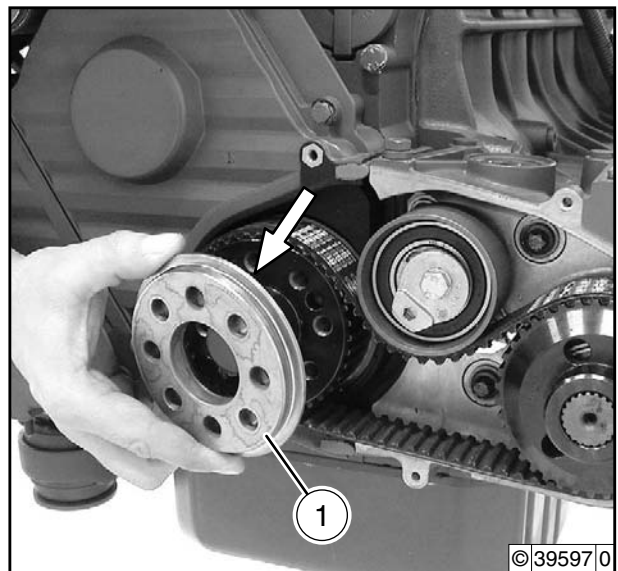
6

- Mount adapter (1).



Note

The flattened side (arrow) must face the toothed belt.

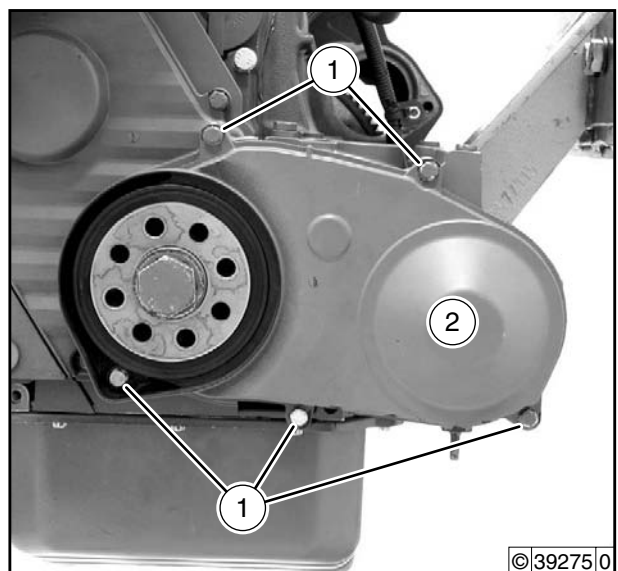


- Mount protective cover (2) and tighten screws (1).



Note

Pay attention to the correct fitting of the protective cover.

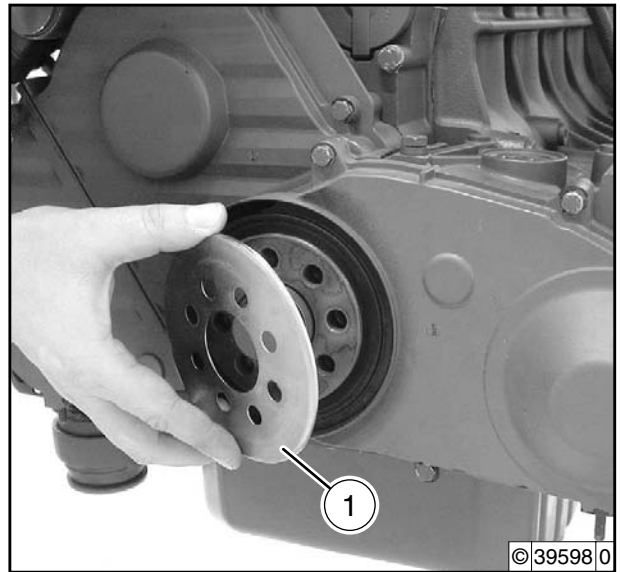


- Mount centrifugal disc (1).



Note

The hollow gorge must face the adapter.

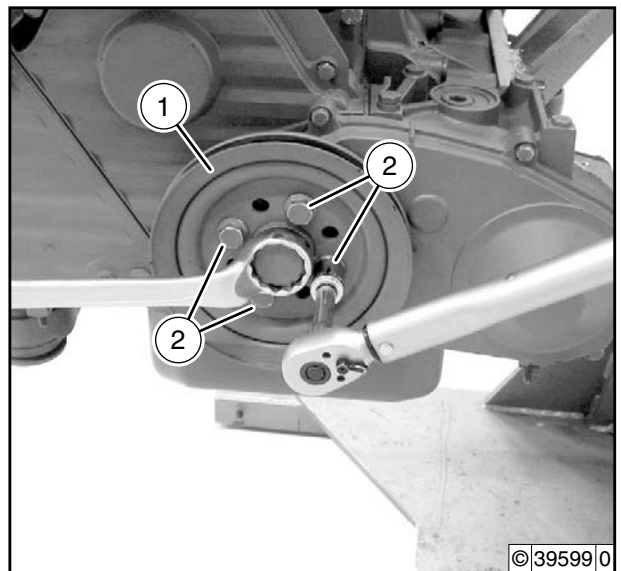


- Fit V-belt pulley (1) and tighten screws (2) alternately.



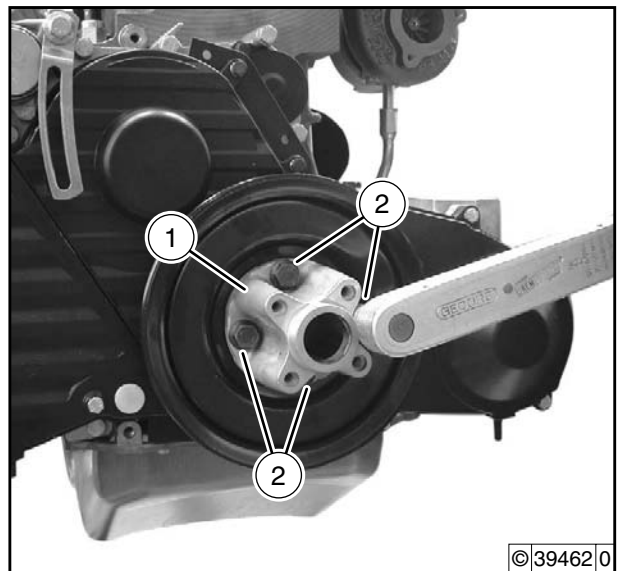
Note

Hold at the center screw.



In FM, BFM engines

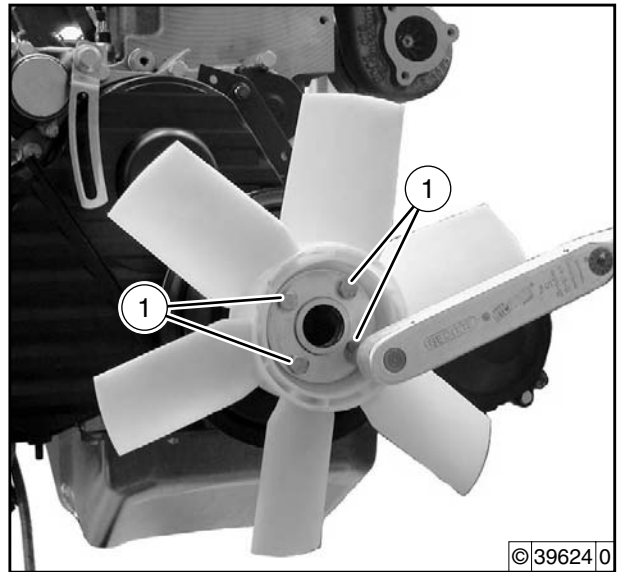
- If available, mount V-belt pulley and flange hub (1).
- Tighten (2) screws alternately.



- Mount fan and disc, tighten screws (1).



- Install V-belt.
 - Job card W 12-02-01 (FL, BFL engines)
 - Job card W 12-02-01 (FM, BFM engines)



Remove and install cable harness

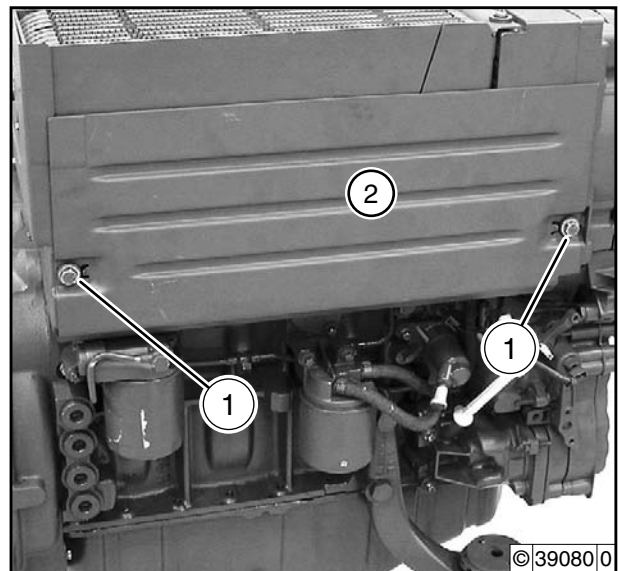


Tools
- Commercial tools



Note
The repair procedure refers to FL, BFL engines.
In FM, BFM engines the repair procedure must be performed accordingly.

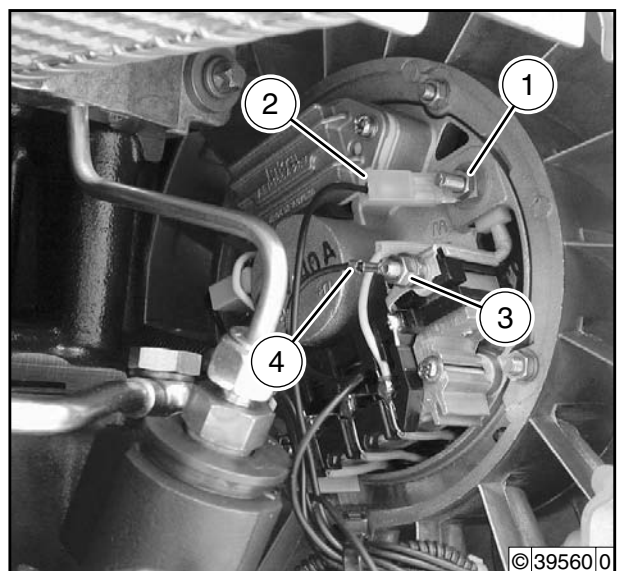
- Unscrew screws (1) and remove air duct cover (2).



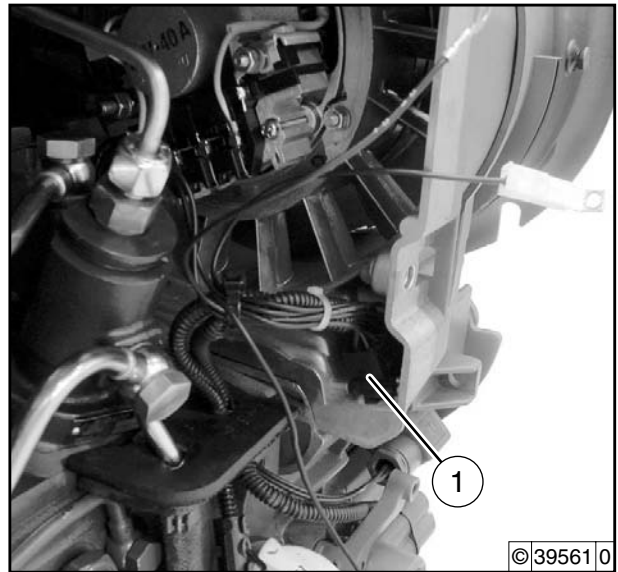
6

Remove cable harness

- Remove cable from generator.
Unscrew nut (1) and remove cable "G1.W" (2).
- Unscrew nut (3) and remove cable "G1.D+" (4).

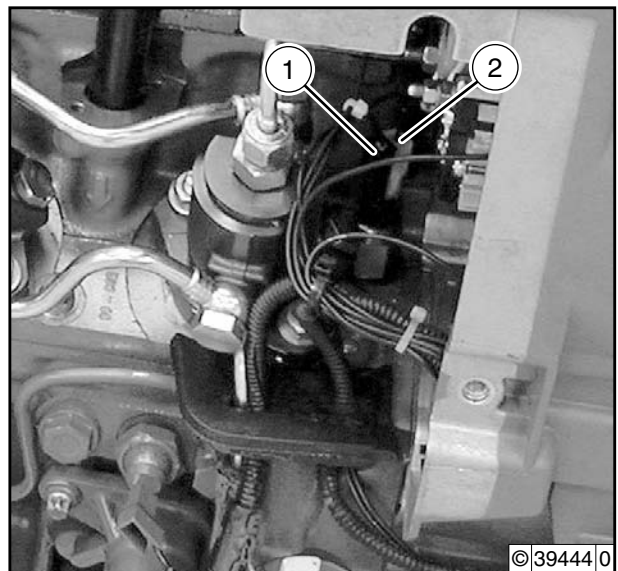


- Unclip cable plug (1).



6

- Pull out cable plug (1), with black housing, with cable "B3.WK" from the oil temperature sensor.
- Pull out the cable plug (2), without housing, with cable "B3.G" from the oil temperature sensor.



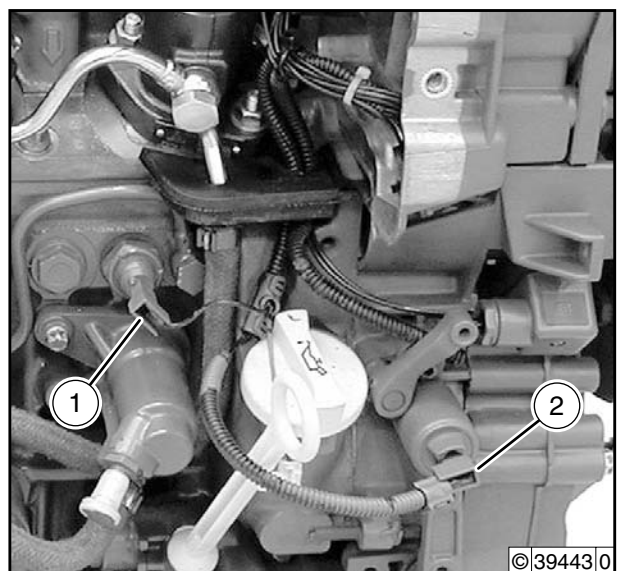
- Pull out the cable plug (1) with cable "F1/B6.WK" from the oil pressure switch.



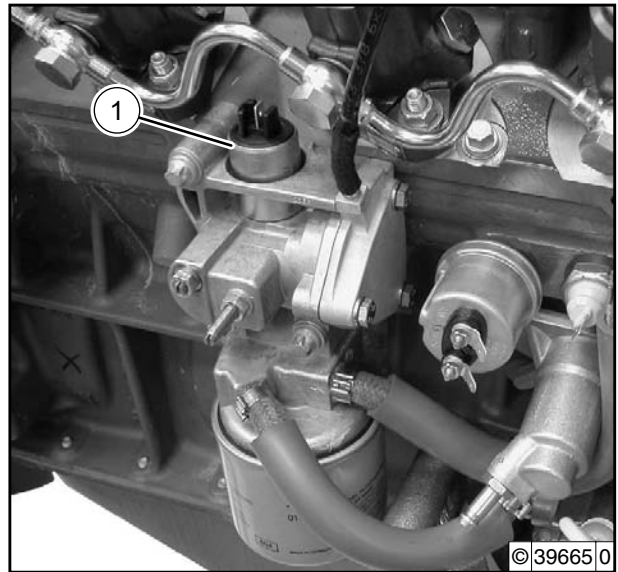
Note

If available, pull out the cable plug with cable "F1/B6.WK" and cable plug with cable "B6.G" from the oil pressure sensor.

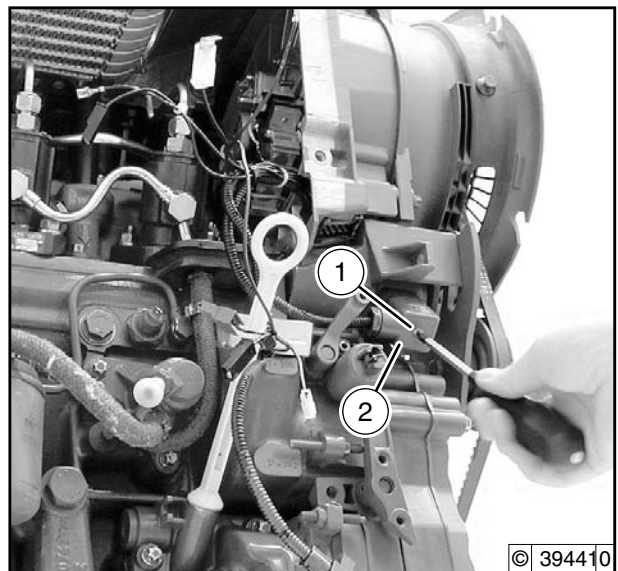
- Pull out the cable plug (2) from the release magnet.



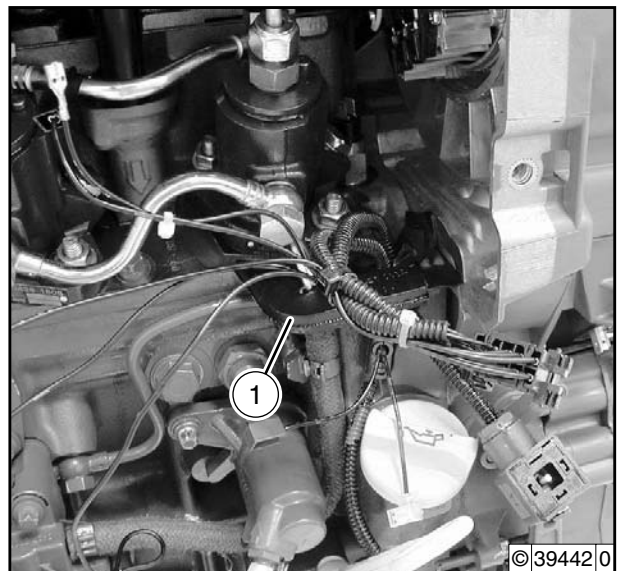
- Pull off cable plug from solenoid valve (1) if available.



- Unscrew screw (1) and remove cable plug (2) from engine shutdown.



- Pull off profile rubber (1) from the clamping pins and remove the cable harness.

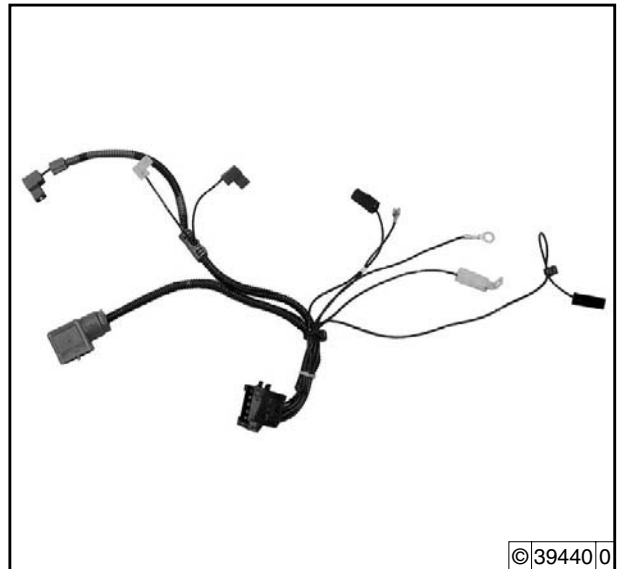


- Visually inspect the cable harness.



Note

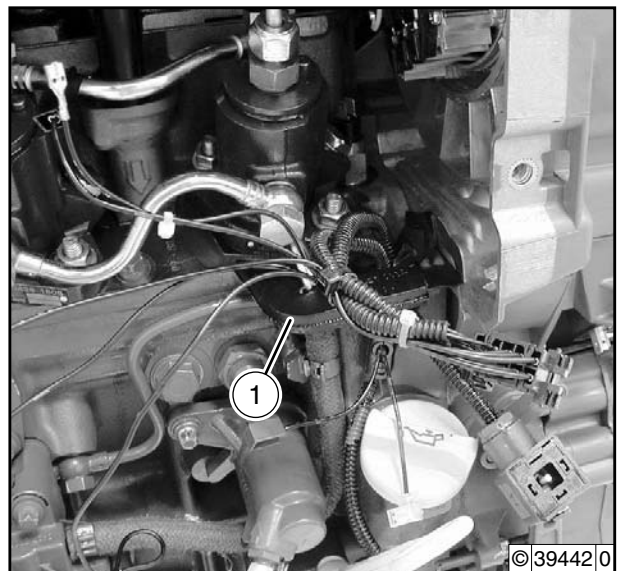
The connections to the cable harness depend on the engine requirements.



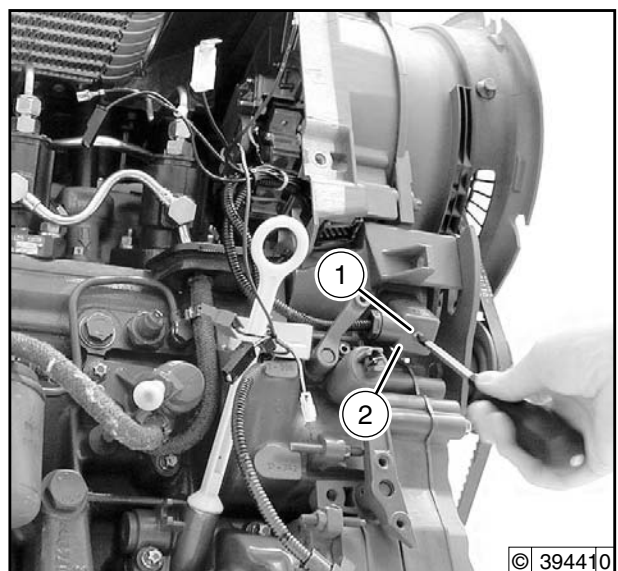
6

Install cable harness

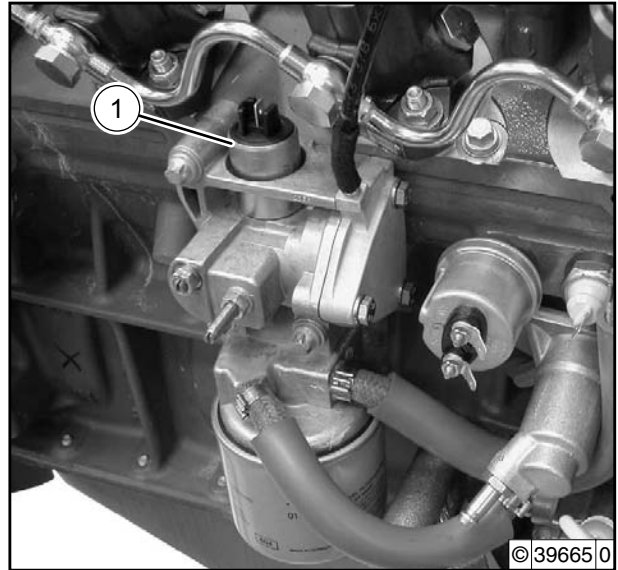
- Insert the cable harness in the profile rubber (1) and plug the profile rubber to the clamping pins.



- Plug the cable plug (2) to the engine shutdown and tighten the screw (1).



- Plug cable plug to solenoid valve (1) if available.



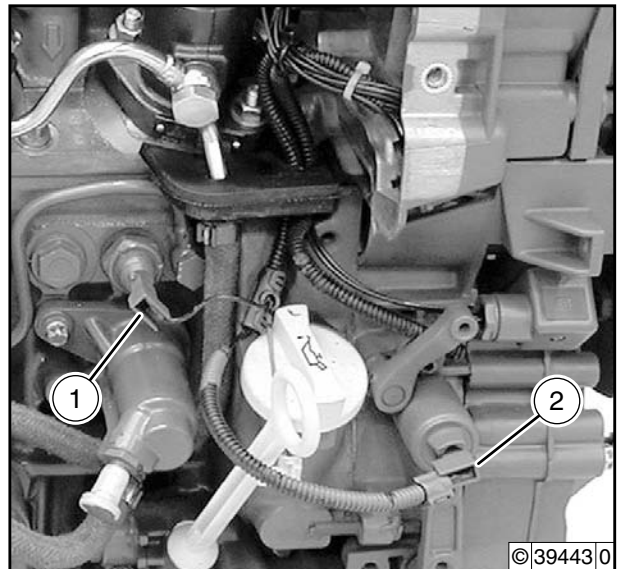
- Plug the cable plug (1) with cable "F1/B6.WK" to the oil pressure switch.



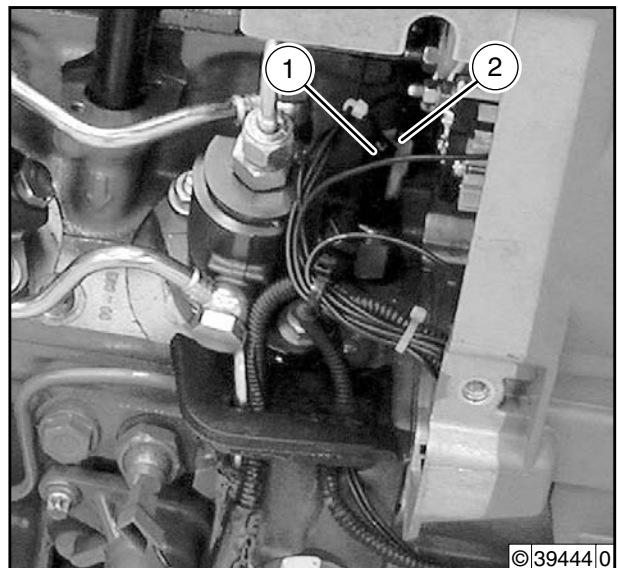
Note

If available, plug the cable plug with cable "F1/B6.WK" and cable plug with cable "B6.G" to the oil pressure sensor.

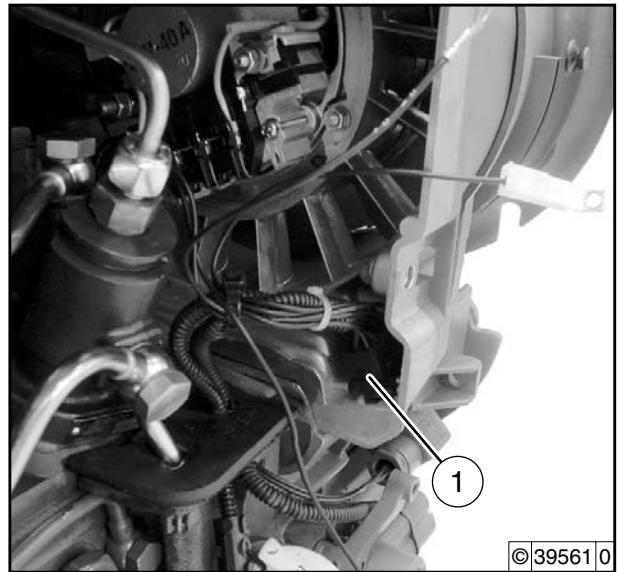
- Plug the cable plug (2) with cable to the release magnet.



- Plug cable plug (1), with black housing, with cable "B3.WK" to the oil temperature sensor.
- Plug the cable plug (2), without housing, with cable "B3.G" to the oil temperature sensor.



- Clip in cable plug (1).

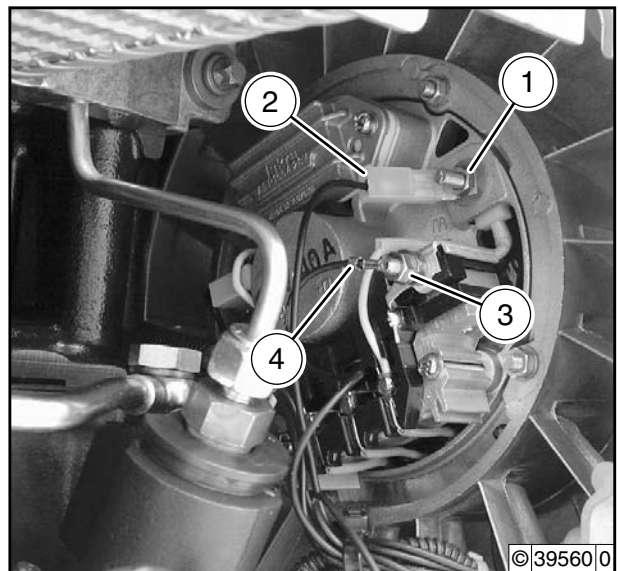


6

- Connect cable to generator.
- Attach cable "G1.W" (4) and tighten nut (3)



- Attach cable "G1.D+" (2) and tighten nut (1).

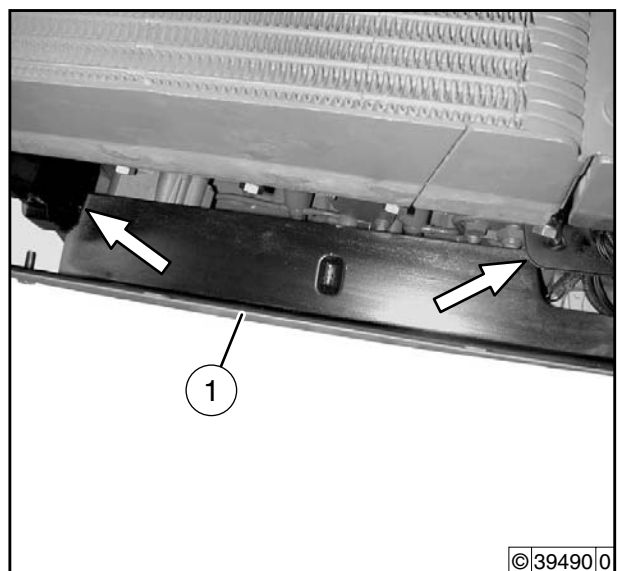


- Mount air duct cover (1).

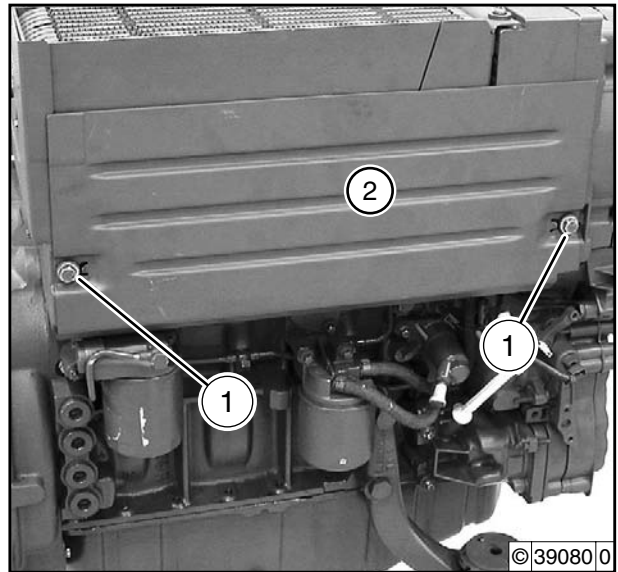


Note

The air duct cover must be under the stand plate and the profile rubber (arrows).



- Fix air duct cover (2).
Tighten screws (1).





Notes

Remove and install generator (in FL and BFL engines)



Tools

- Commercial tools
8189 - Torx tool kit

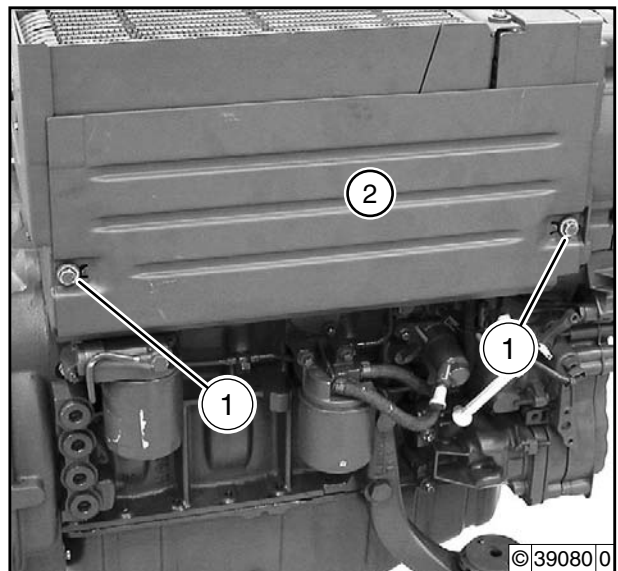


References

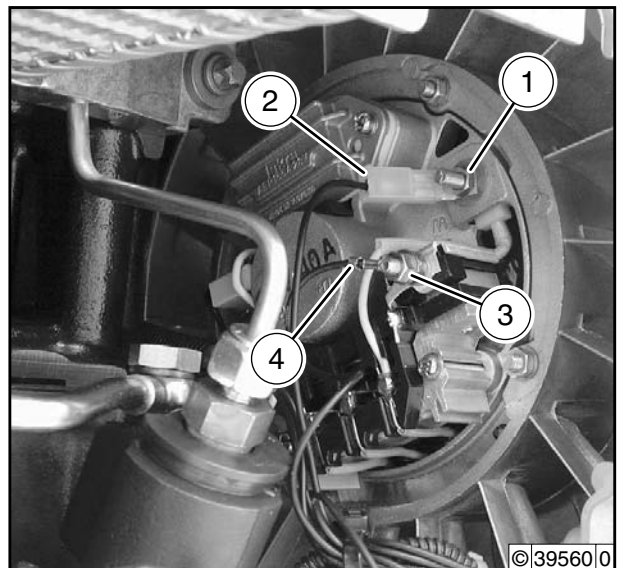
- W 12-02-01

Remove generator

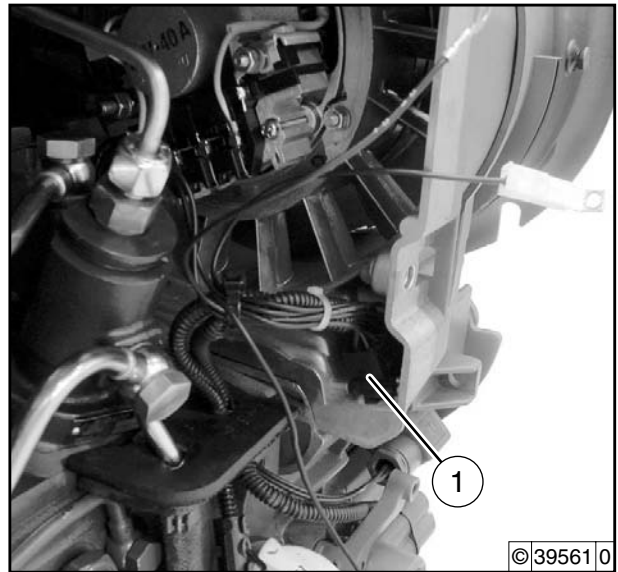
- Remove V-belt
→ Job card W 12-02-01.
- Unscrew screws (1) and remove air duct cover (2).



- Remove cable from generator.
Unscrew nut (1) and remove cable "G1.W" (2).
- Unscrew nut (3) and remove cable "G1.D+" (4).

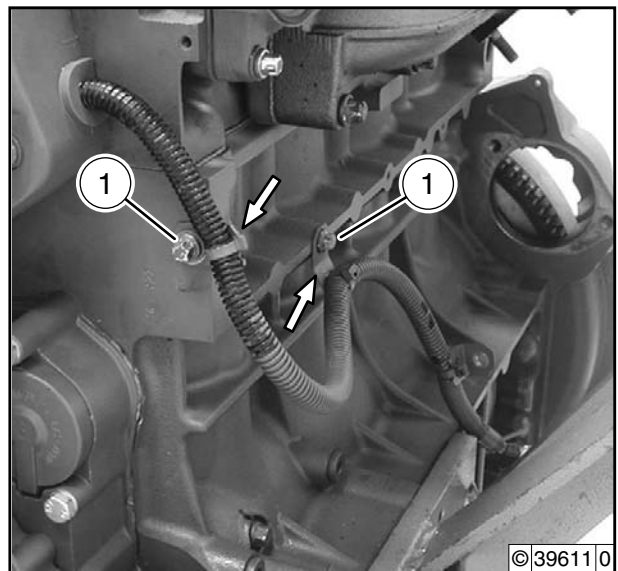


- Unclip cable plug (1).

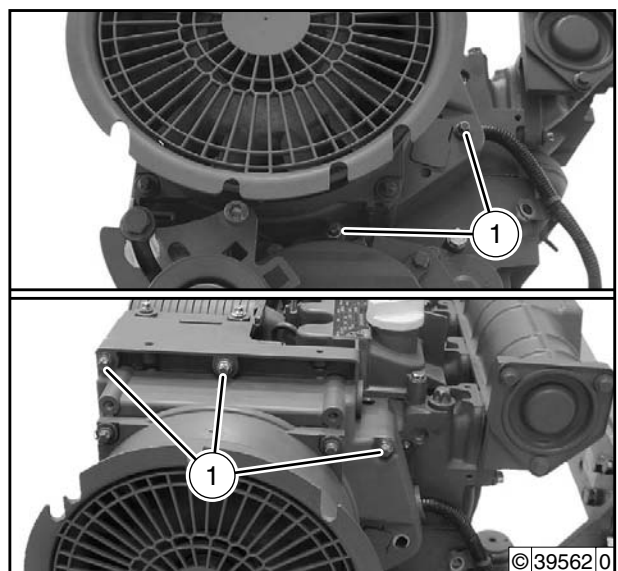


6

- Unscrew screws (1) and remove cable holders (arrows).

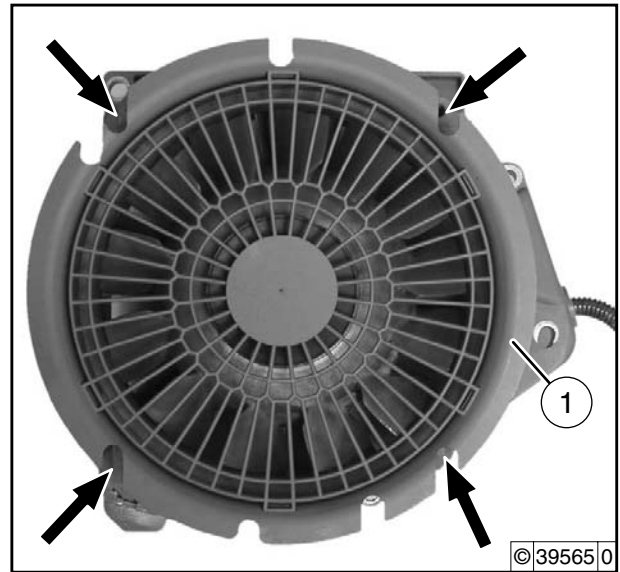


- Unscrew screws (1) and remove cooler blower with generator.



Remove generator from cooling blower

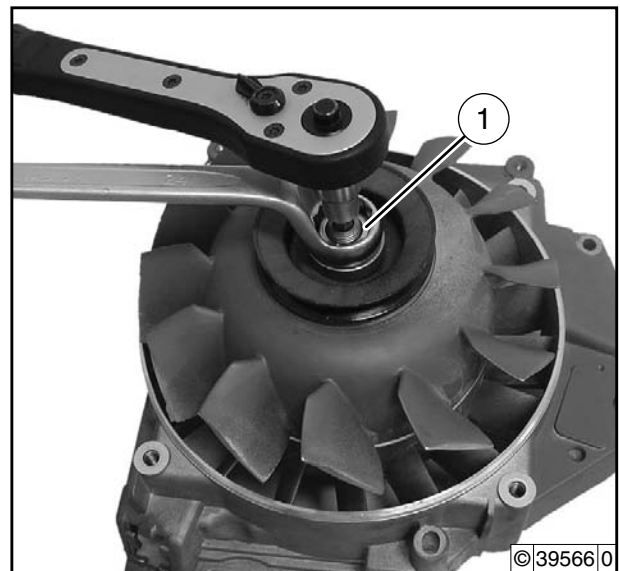
- Unscrew screws (arrows) and remove blower jacket inlet (1).



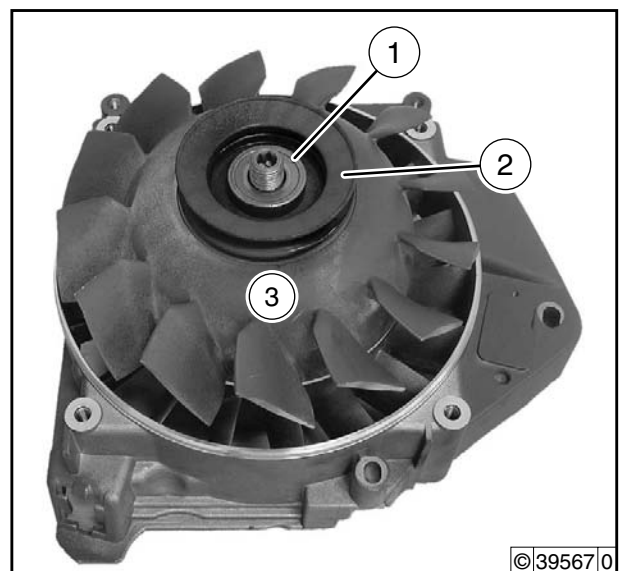
- Unscrew nut (1).



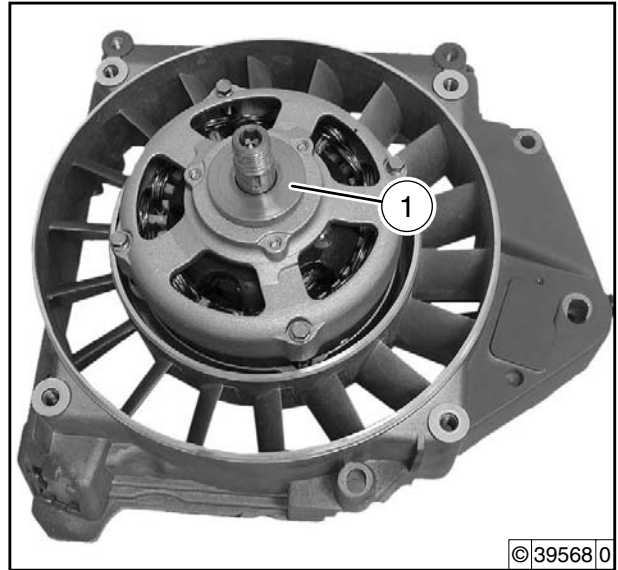
Note
Hold shaft.



- Remove disc (1), V-belt pulley (2) and running wheel (3).



- Remove spacer disc (1).

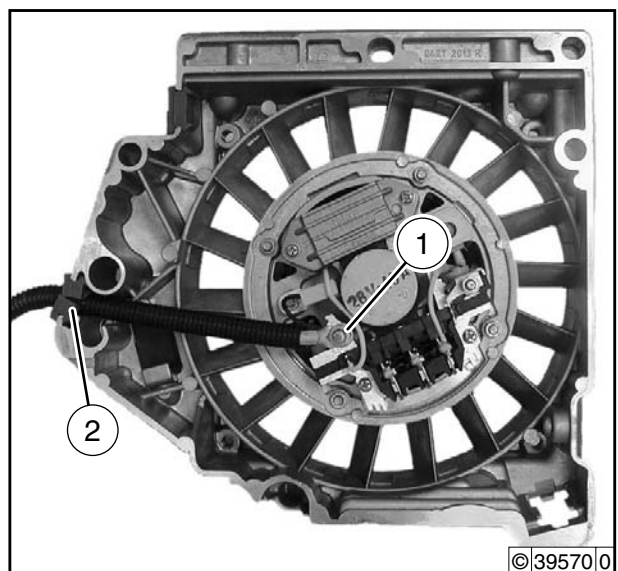


6

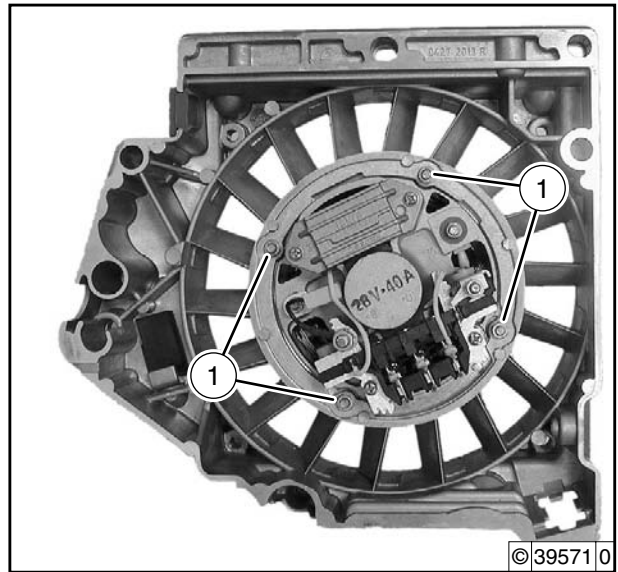
- Remove guide disc (1).



- Unscrew nut (2) and press out rubber muff (1).



- Unscrew nuts (1) and press out generator.
- Visually inspect components and renew if necessary.



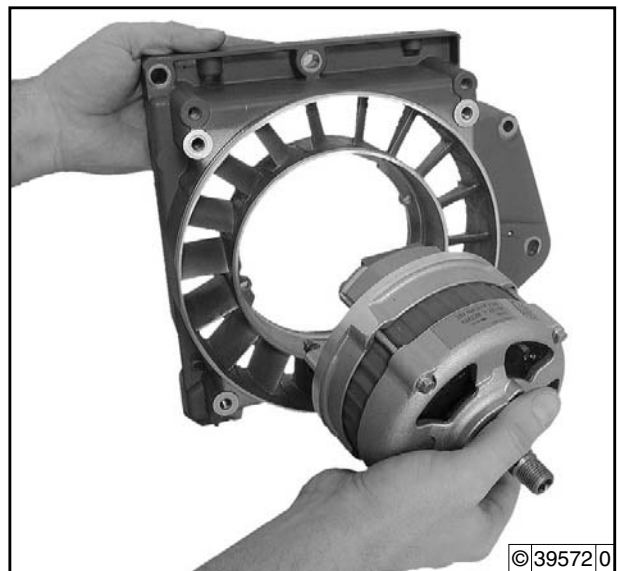
Install generator in cooling blower

- Insert generator and press in to stop.



Note

Note installation position of the generator.

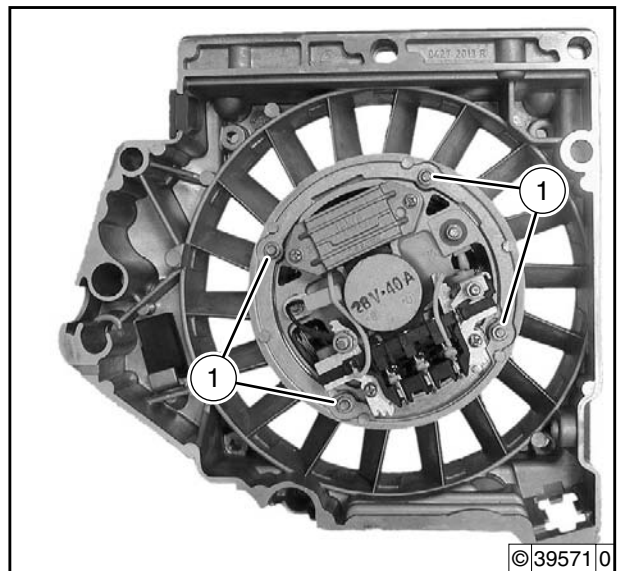


- Mount washers and tighten nuts (1) alternately.



Note

Check the installation position again.

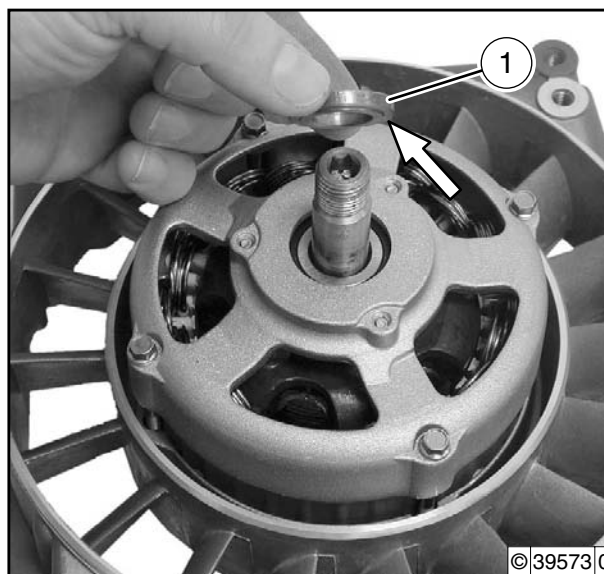


- Mount guide disc (1).



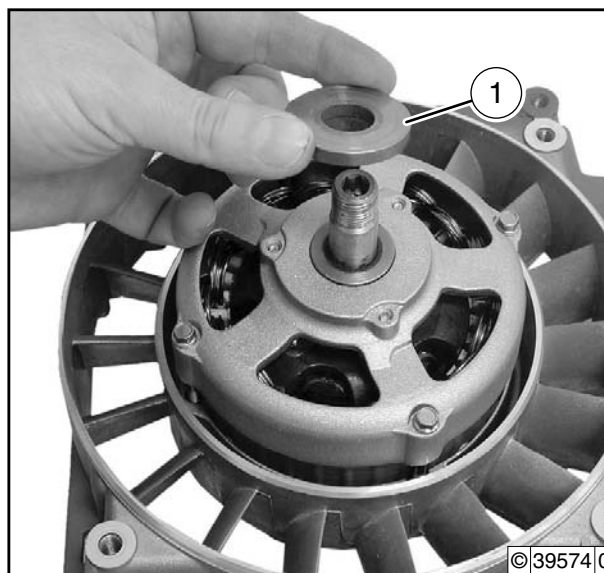
Note

The stepped side (arrow) must face the generator.



6

- Mount spacer disc (1).

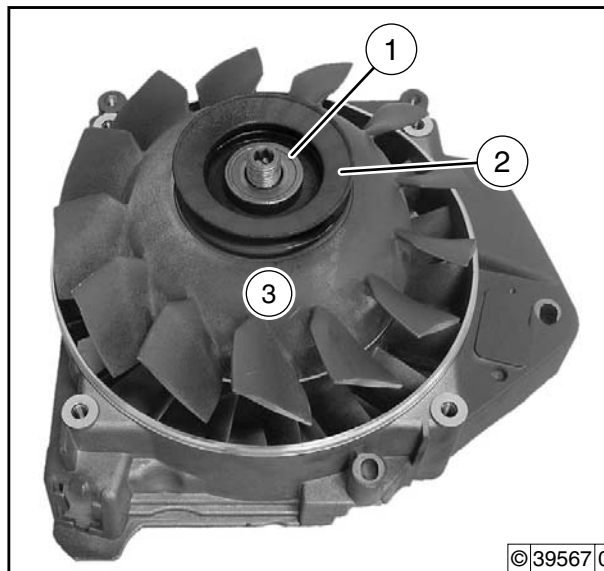


- Mount running wheel (3), V-belt pulley (2) and disc.



Note

Note installation position.



- Tighten nut.

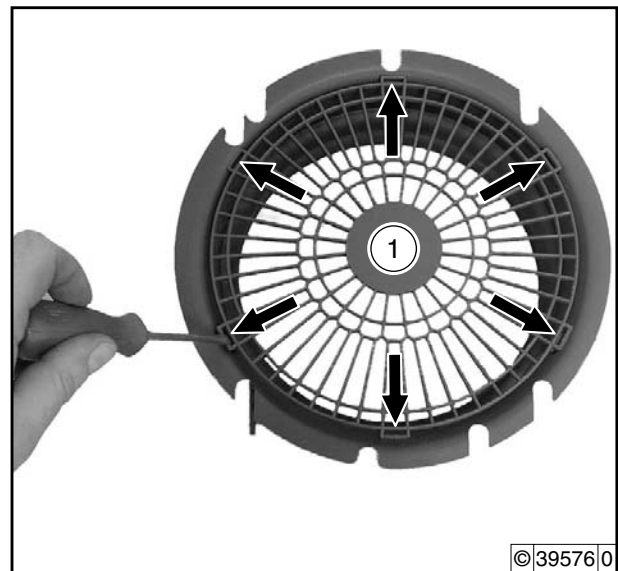


Check gap dimension

- Press out the protective grille (1) carefully from the blower jacket inlet at the fastening points (arrows).



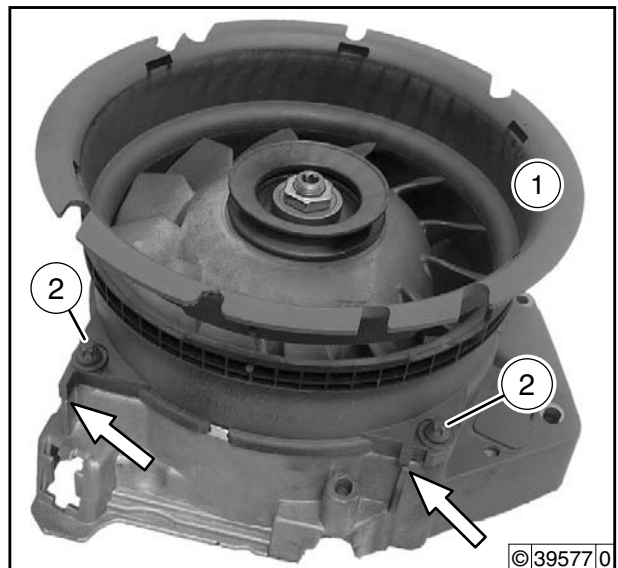
Note
Do not damage the protective grille!



- Mount blower jacket inlet (1) and tighten screws (2).



Note
Note the installation position, the gates (arrows) must be in line.



- Measure the gap dimension with a feeler gauge between the running wheel and the blower jacket inlet.



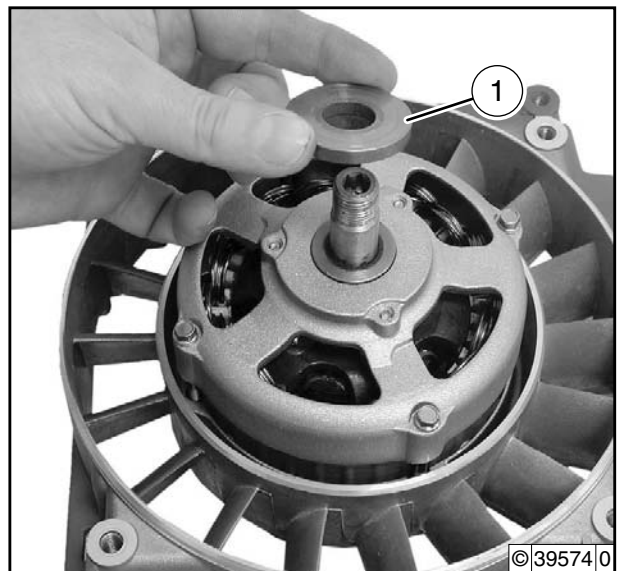
6

- Compensate gap dimension with the appropriate spacer disc (1).



Note

Spacer discs of 5 to 7 mm are available.

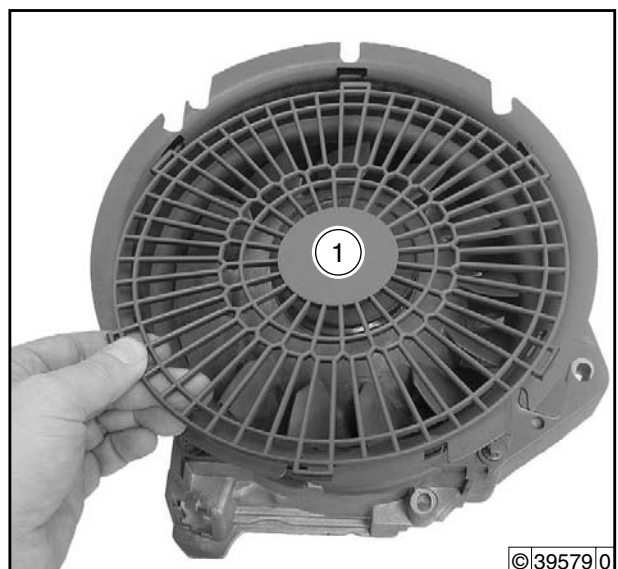


- Press the protective grille (1) carefully into the blower jacket inlet.

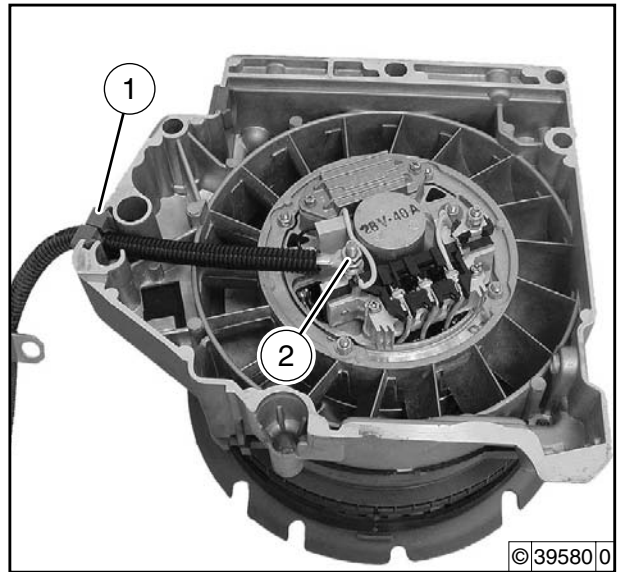


Note

Observe the fastening points.

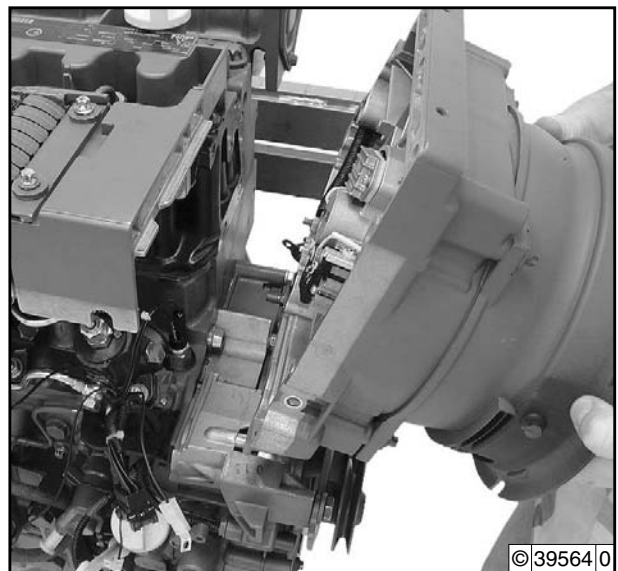


- Insert rubber muff (1) and tighten nut (2).



Install generator

- Mount cooler blower with generator and tighten screws.



- Position cable holders (arrows) and tighten screws.



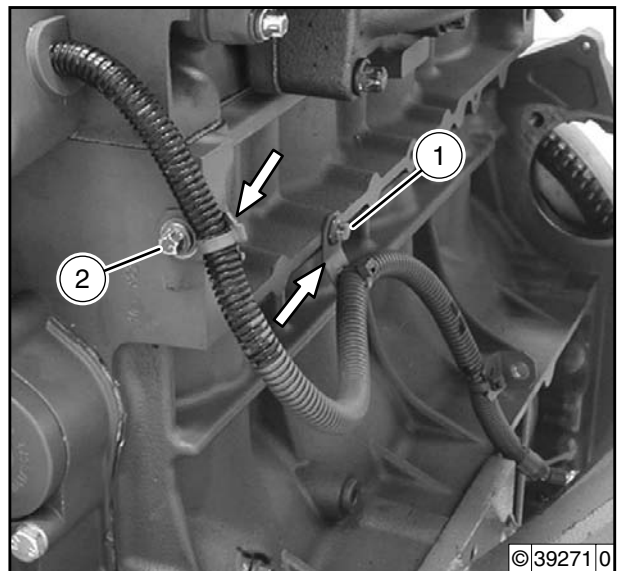
Note

Note different screw length:
Screw M6 x 12 mm (1)
Screw M8 x 20 mm (2)

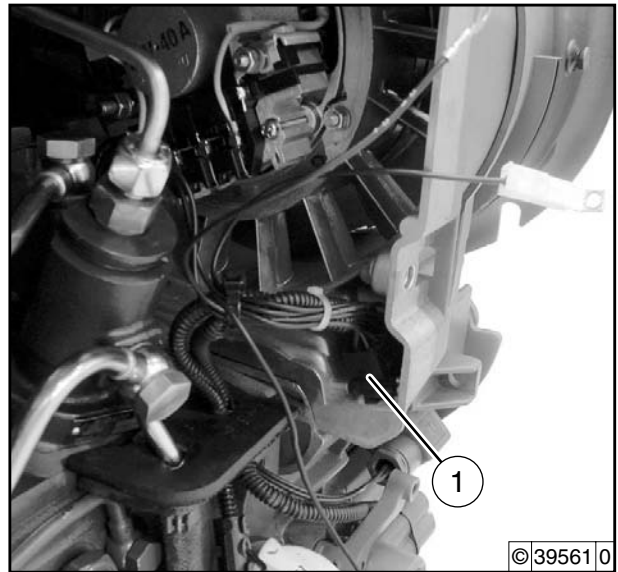
- Tighten screw (1).



- Tighten screw (2).



- Clip in cable plug (1).

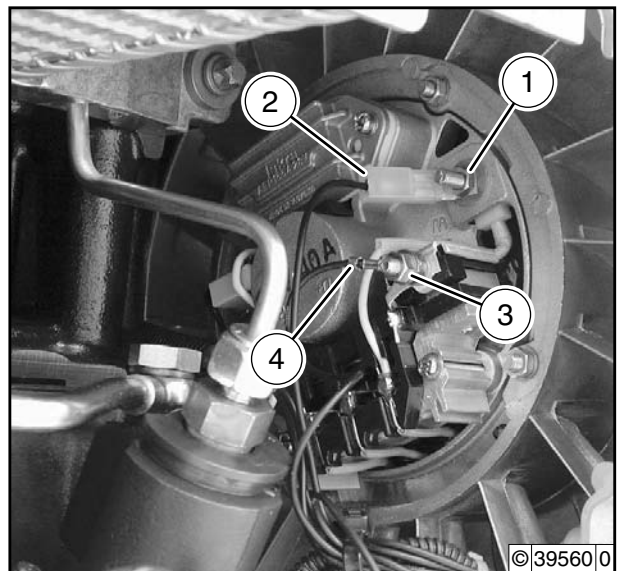


6

- Plug cable to generator.
Attach cable "G1.D+" (4) and tighten nut (3).



- Attach cable "G1.W" (2) and tighten nut (1).

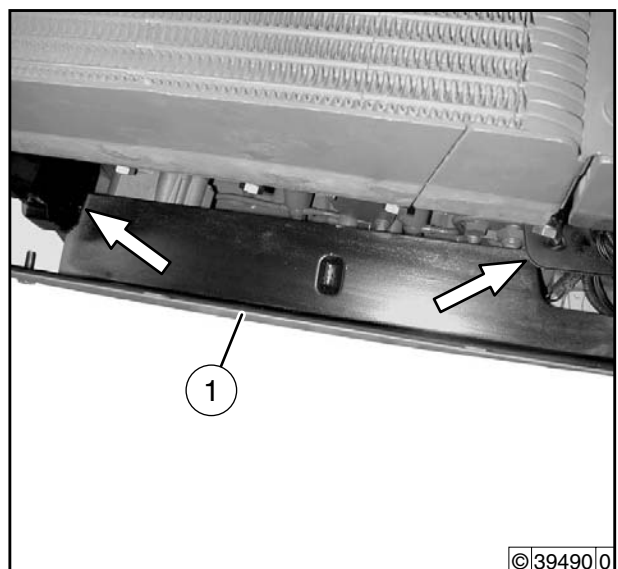


- Mount air duct cover (1).



Note

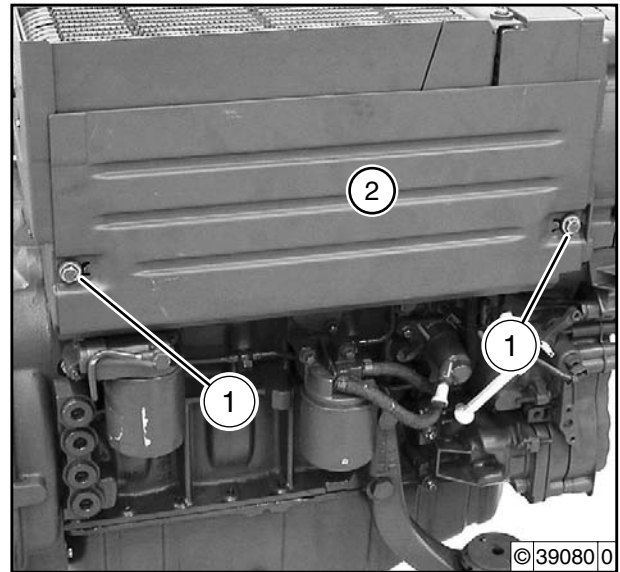
The air duct cover must be under the stand plate and the profile rubber (arrows).



- Fix air duct cover (2).
Tighten screws (1).



- Install V-belt.
→ Job card W 12-02-01.





Notes

Remove and install generator and holder (in FM, BFM engines)



Tools

- Commercial tools
8189 - Torx tool kit



References

- W 12-02-01



Note

One variant has been described. The procedure is the same accordingly for other variants.

Remove generator

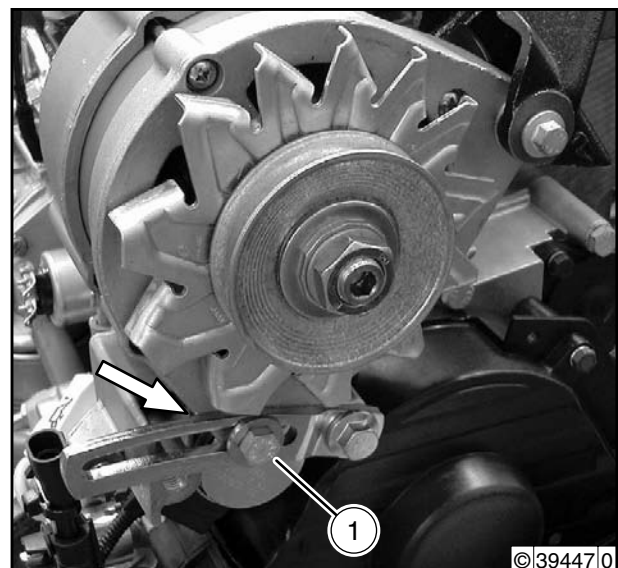
- Remove cable from generator if available.

Item	(1)	D+
Item	(2)	B+
Item	(3)	W

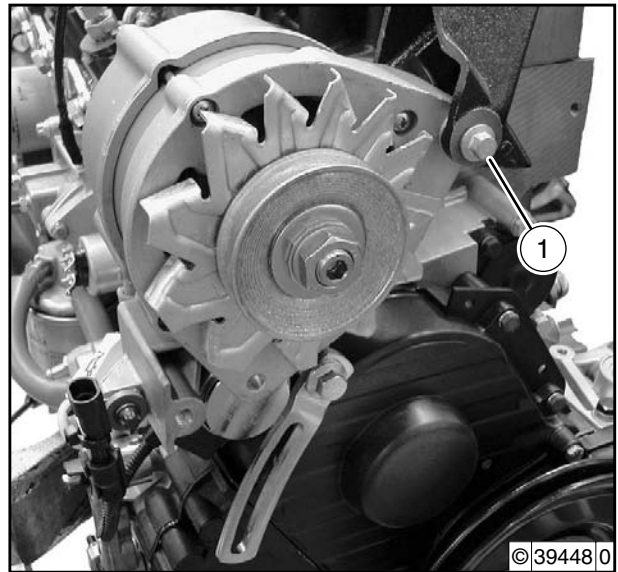
- Remove V-belt
→ Job card W 12-02-01.



- Unscrew nut (arrow), remove screw (1) and washers.

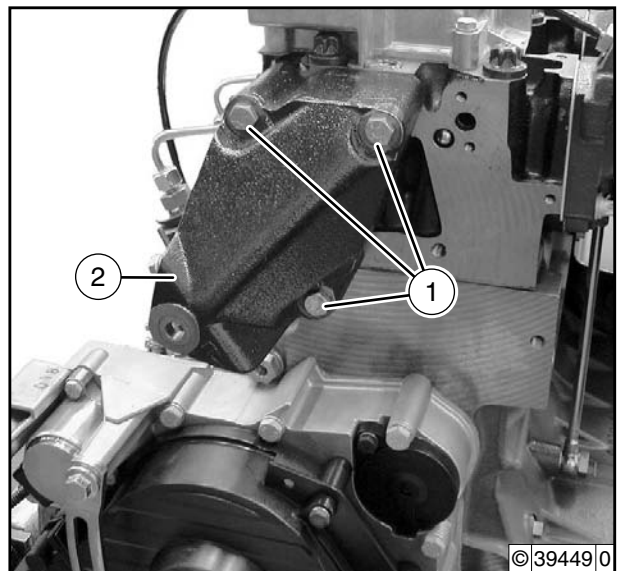


- Unscrew screw (1) and remove generator.

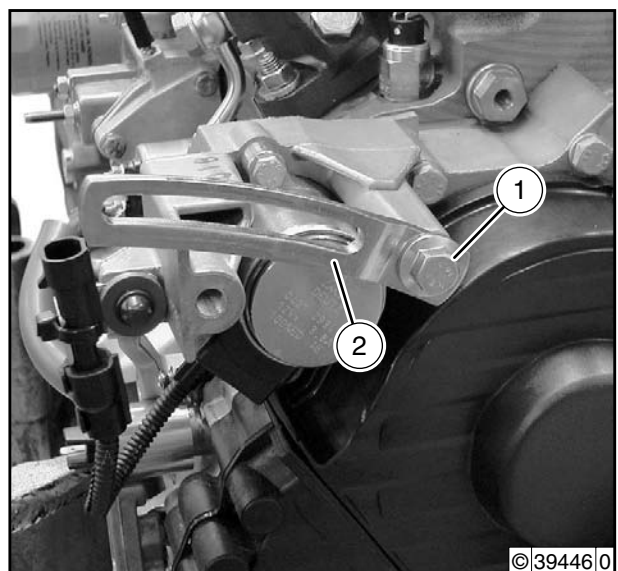


6

- Unscrew screws (1) and remove console (2).



- Unscrew screw (1) and remove clamping bracket (2).
- Check components for visible signs of damage.



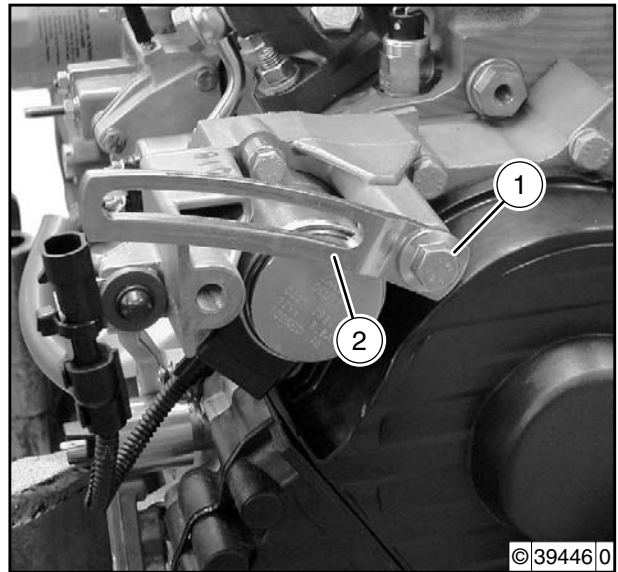
Install generator

- Mount clamping bracket (2) and tighten screw (1).

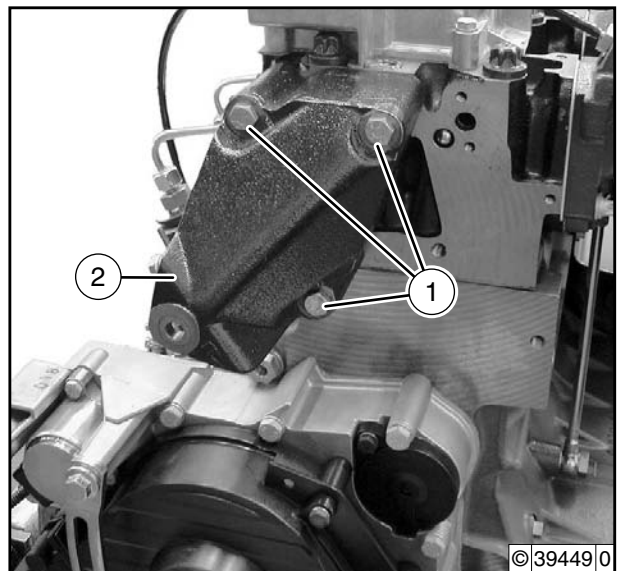


Note

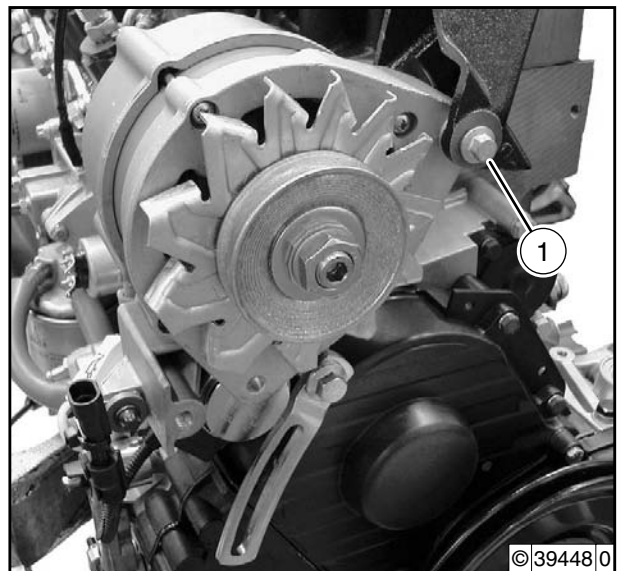
Note installation position of the clamping bracket.



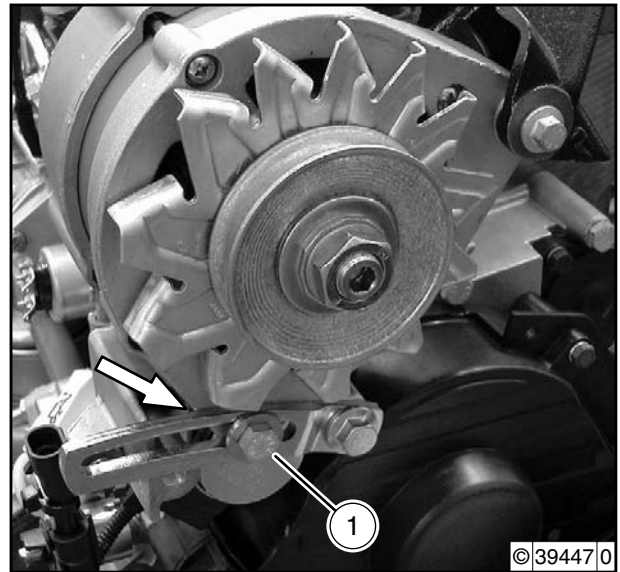
- Mount console (2) and tighten screws (1).



- Insert generator and tighten screw (1).



- Insert screw (1) and washers, tighten nut (arrow).
- Install V-belt.
→ Job card W 12-02-01.



6

- Plug cable into generator if available.

Item	(1)	D+
Item	(2)	B+
Item	(3)	W

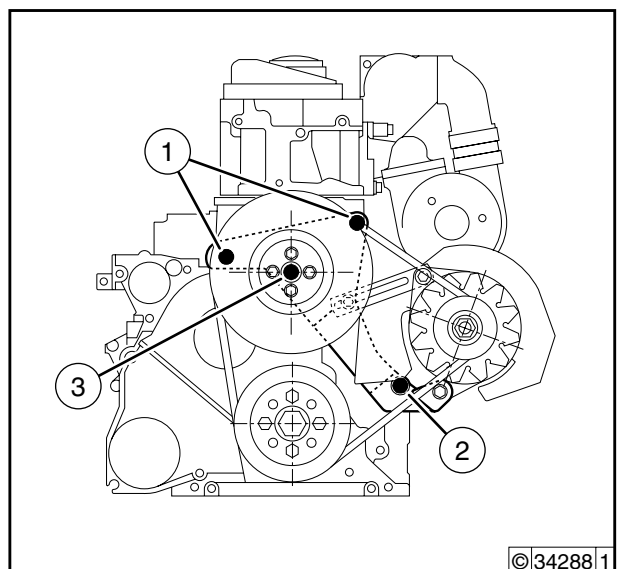


Console fastening with built-up fan drive (unit design)

- Tighten screws (1 and 2).



- Tighten screw (3).

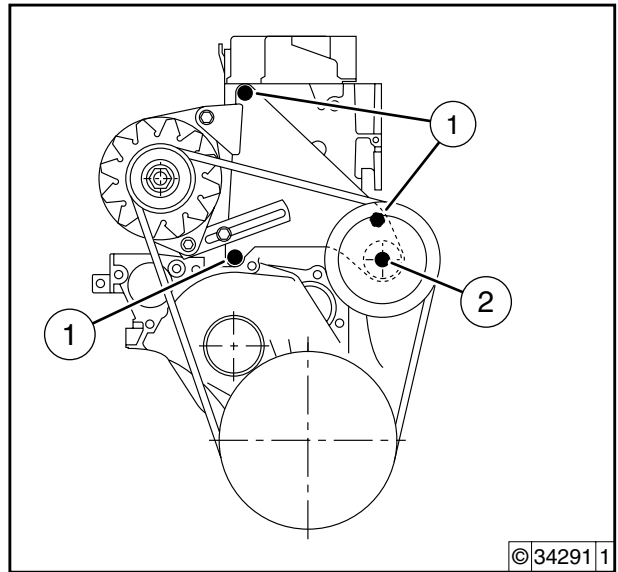


**Console fastening with built-up fan drive
(building machine design)**

- Tighten screws (1).



- Tighten screw (2).





Notes

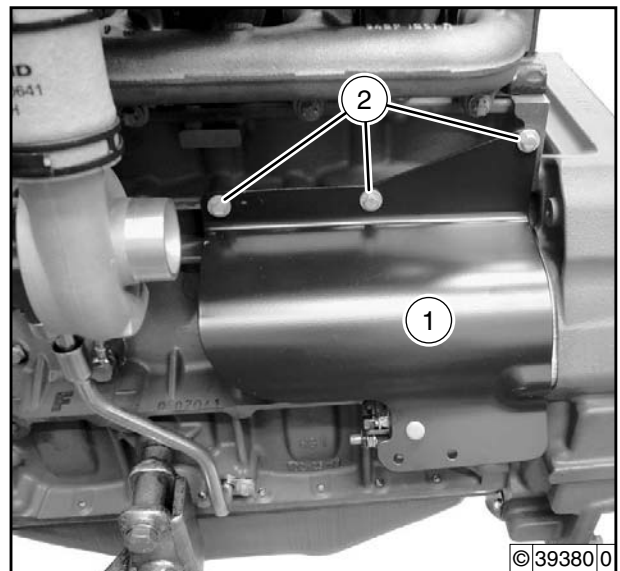
Remove and install starter



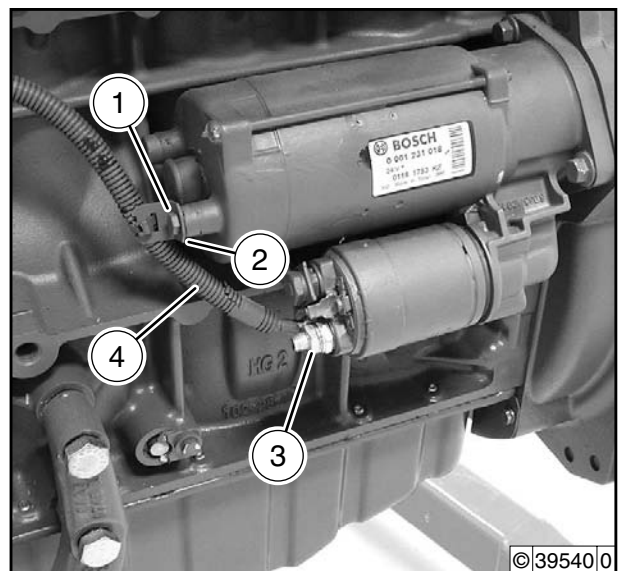
Tools
- Commercial tools

Remove starter

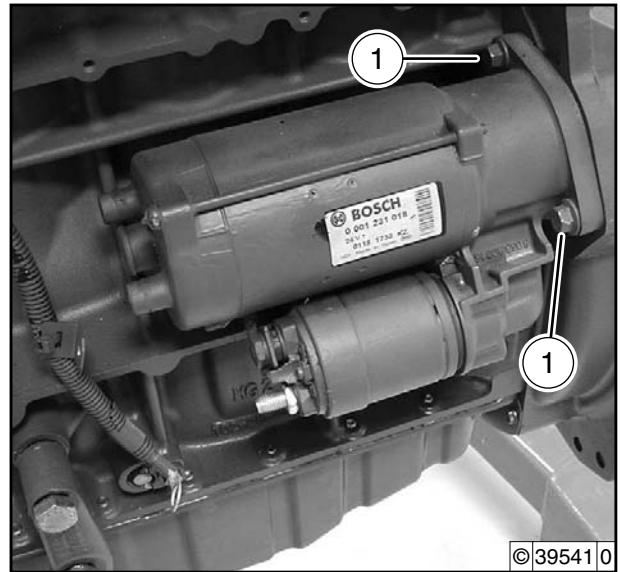
- If available, remove the heat shield (1).
Unscrew screws (2).



- Unscrew screw (1) and remove cable holder (2).
- Unscrew nut (3) and remove charging current cable (4).

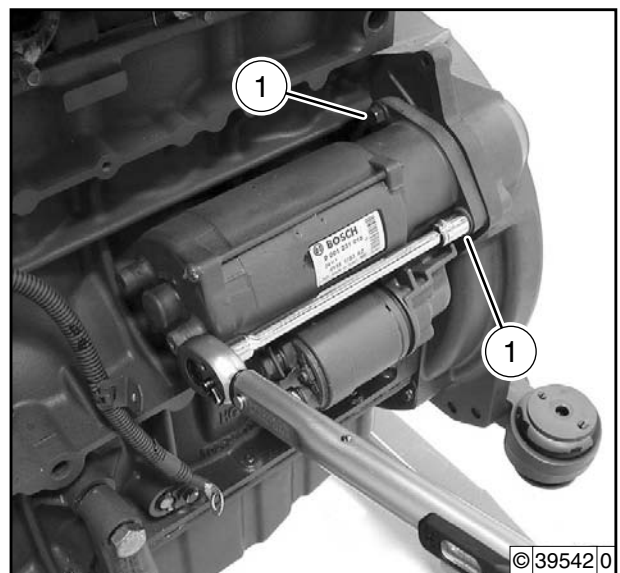


- Unscrew screws (1) and remove starter.



6

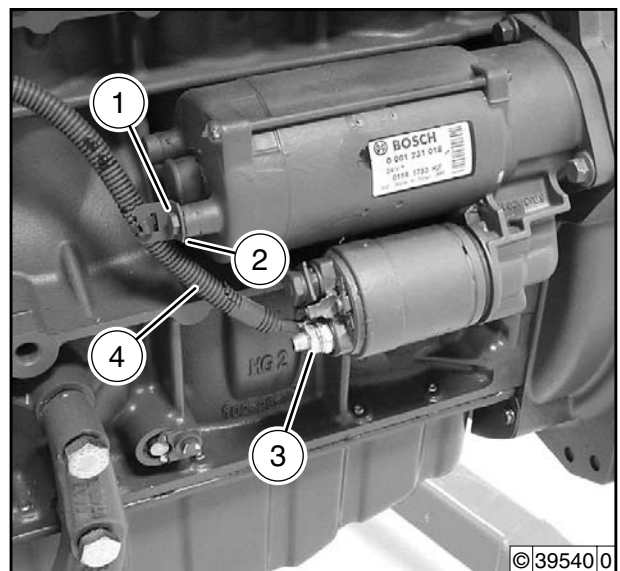
- Insert starter and tighten screws (1).



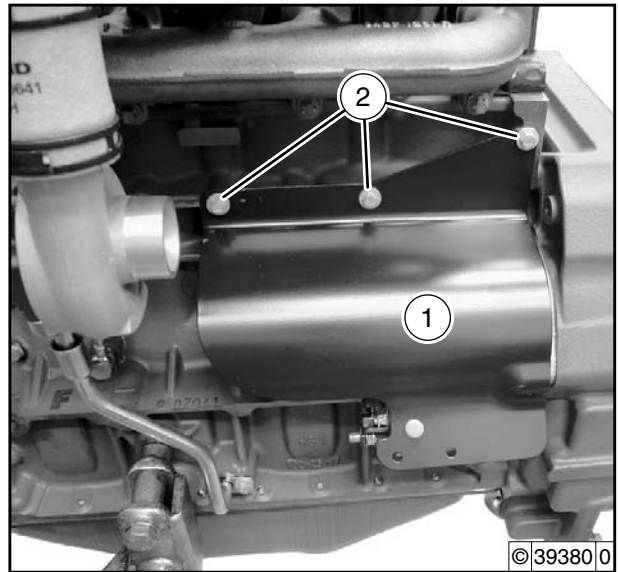
- Connect charging current cable (4) and tighten nut (3).



- Position cable holder (2) and tighten screw (1).



- If available, install the heat shield (1).
Tighten screws (2).





Notes

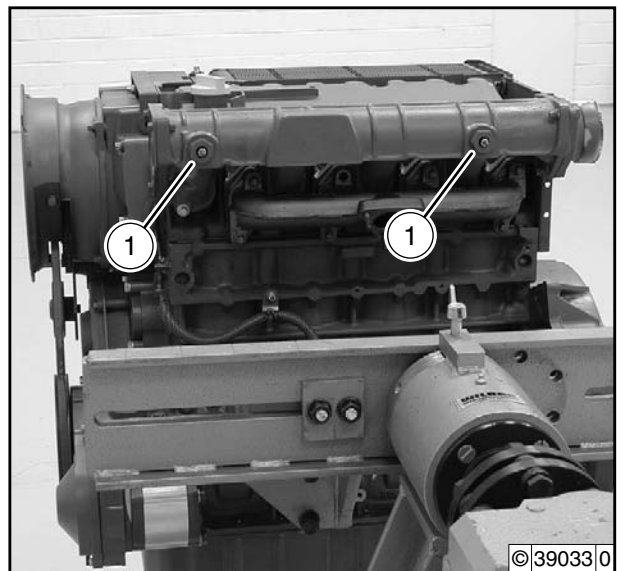
Remove and install helical heater plug



Tools
- Commercial tools

Remove helical heater plugs

- Unscrew helical heater plugs (1) and remove sealing rings.
- Check components for visible signs of damage.



Install helical heater plugs

- Tighten helical heater plug (1) with new CU sealing ring.





Notes

7 Commercial tools

Please send all tool orders directly to:

WILBÄR

Wilhelm Bäcker GmbH & Co. KG

Postfach 14 05 80

D -42826 Remscheid

Fax: ++49 (0) 02191 - 8 10 92

Tel.: ++49 (0) 21191 - 9882-860

E-mail address for orders from

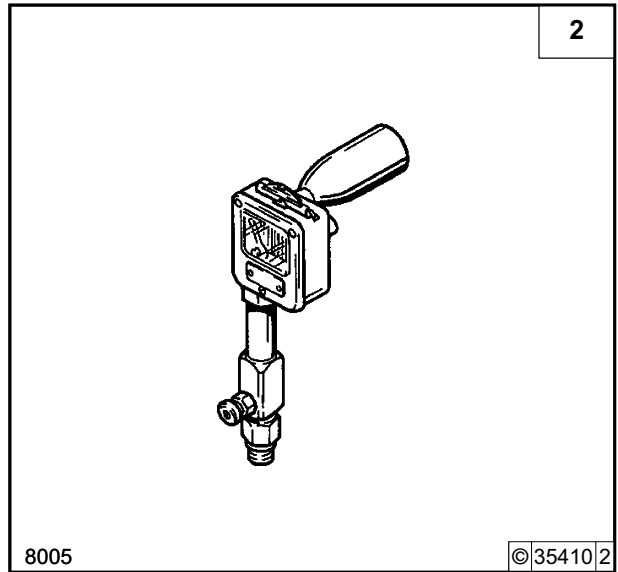
Germany: a.zarrath@wilbaer.de (Ms. Zarrath)

other countries: a.karsten@wilbaer.de (Ms. Karsten)

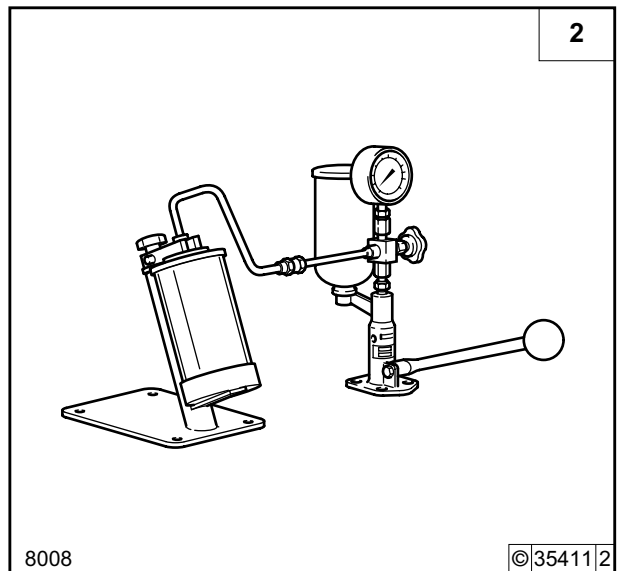


Notes

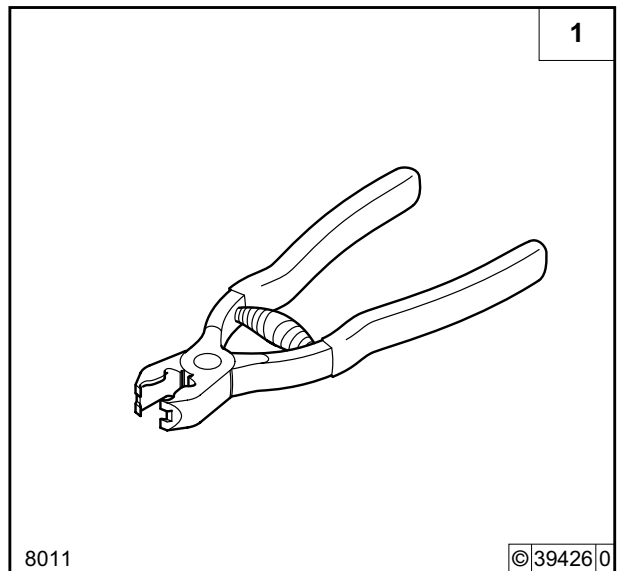
8005 - **Compression tester**
for diesel engines 10-40 bar
Set



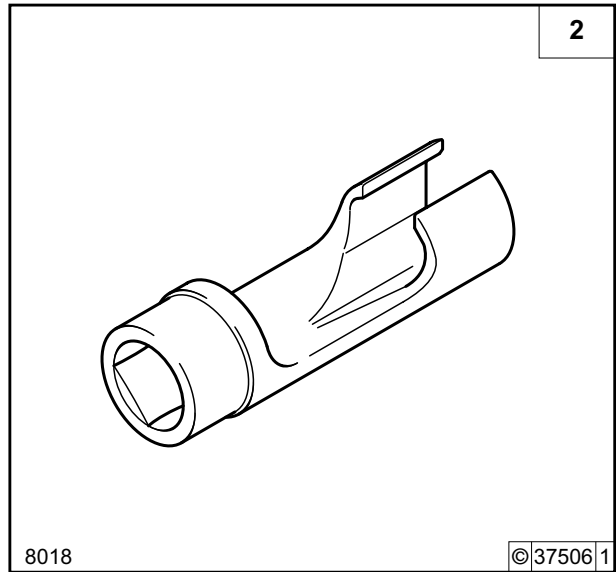
8008 - **Nozzle tester**
with spray mist collector



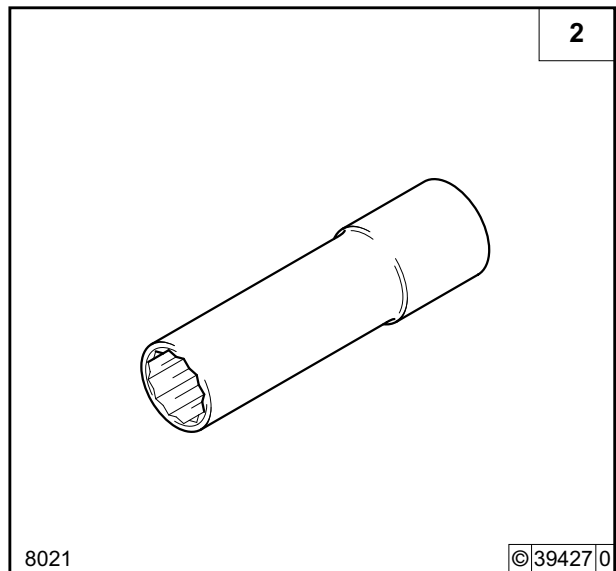
8011 - **Clamping pliers**
for leak fuel lines



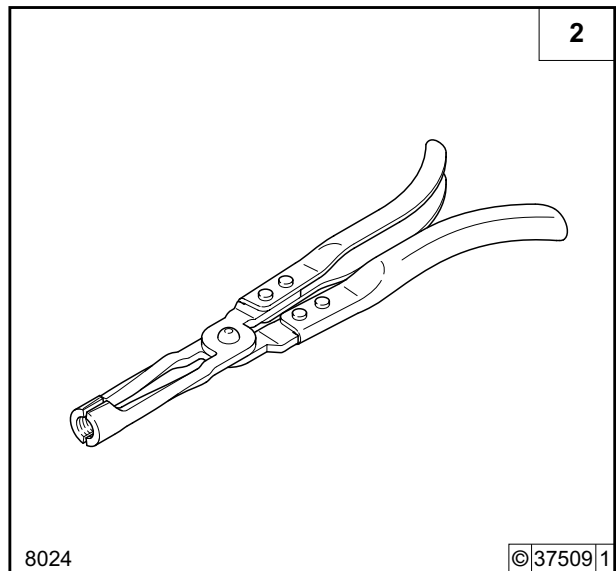
8018 - **Claw wrench**
Size 17 for union nuts of the injection lines, reinforced



8021 - **Socket size 15**
long, hexagonal $\frac{1}{2}$, for union nut injection valve



8024 - **Assembly pliers**
for valve shaft sealing, for removing the valve shaft seal

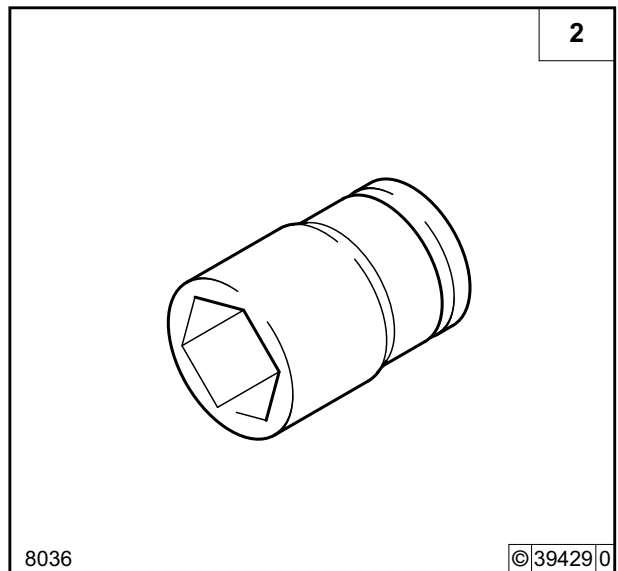


7

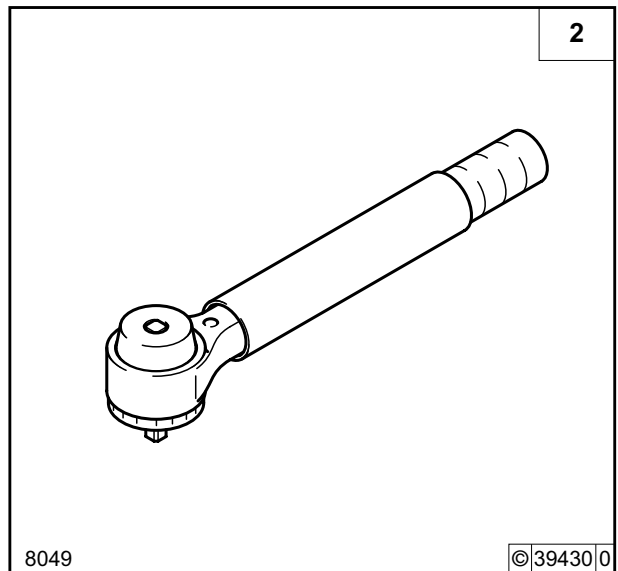
8027 - Pliers insert
for solenoid valve



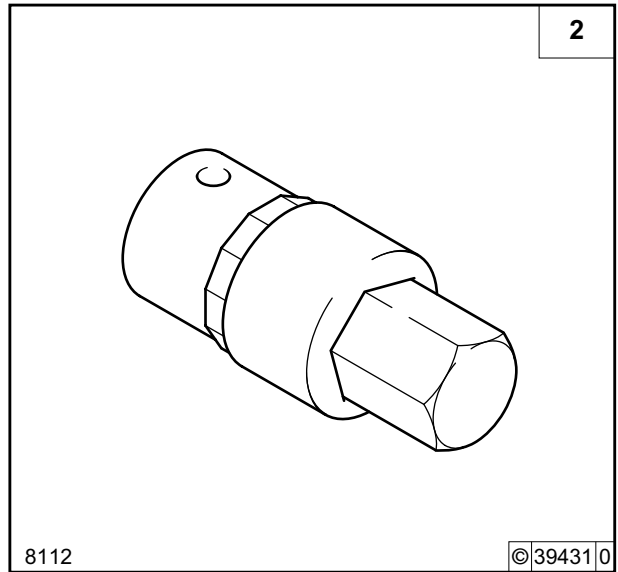
8036 - Socket
size 32, set with 8049



8049 - Force multiplier
for center screw on the crankshaft, set
with 8036

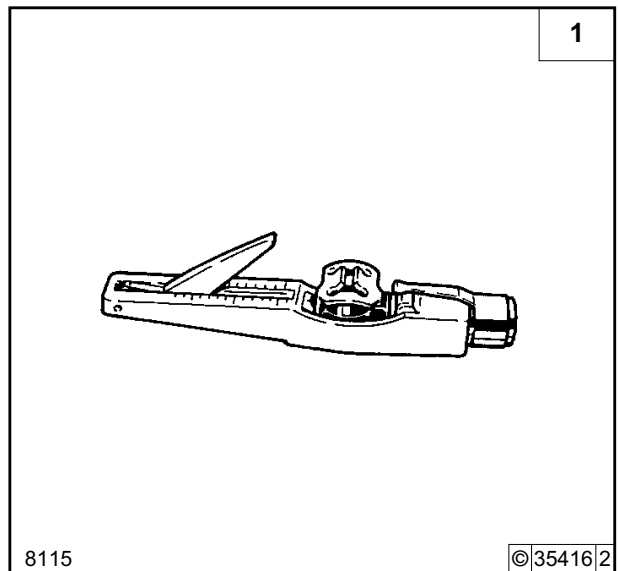


8112 - Insert
for screwdriver, 1/2" size 17

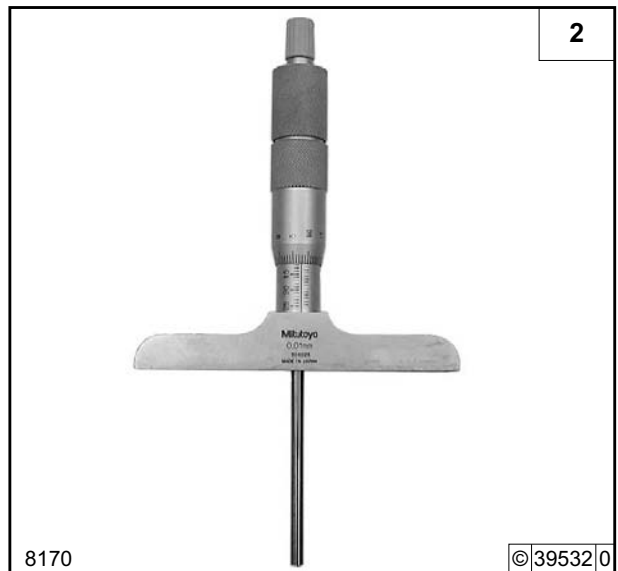


7

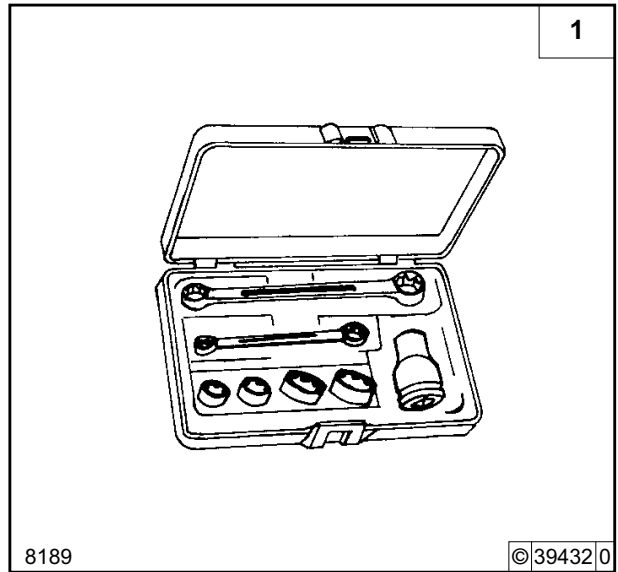
8115 - V-belt pulley tension measuring appliance
150 to 600 N, test the V-belt pulley tension



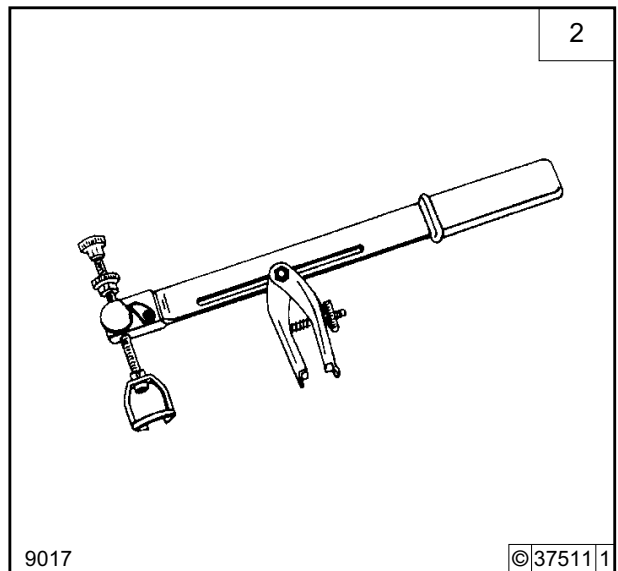
8170 - Depth measuring appliance



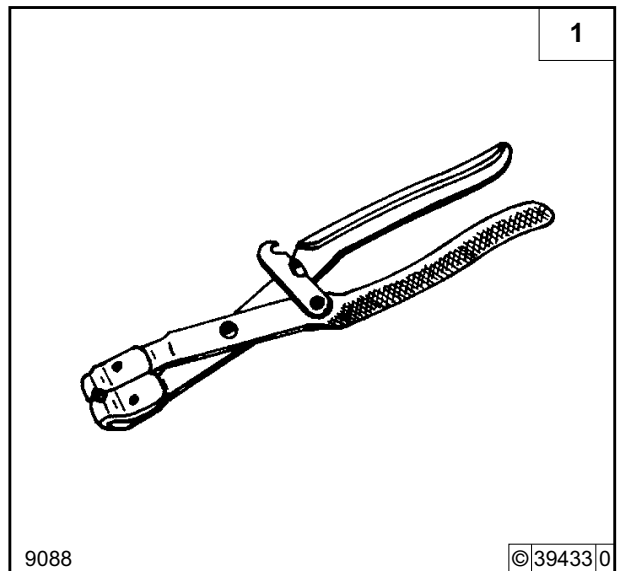
8189 - Torx tool kit



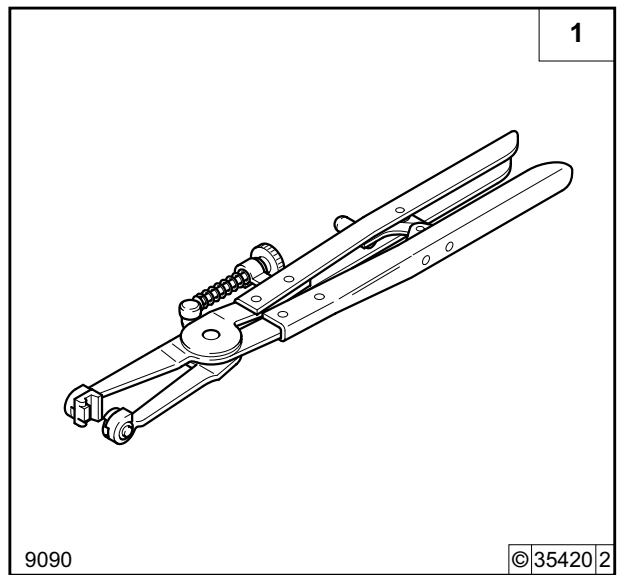
9017 - Assembly lever
for valve spring



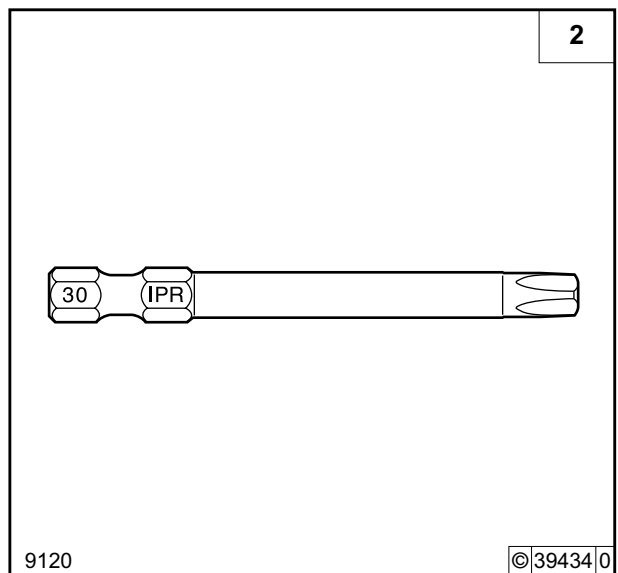
9088 - Clamping pliers
for hose clips, 220 mm, spring clamps



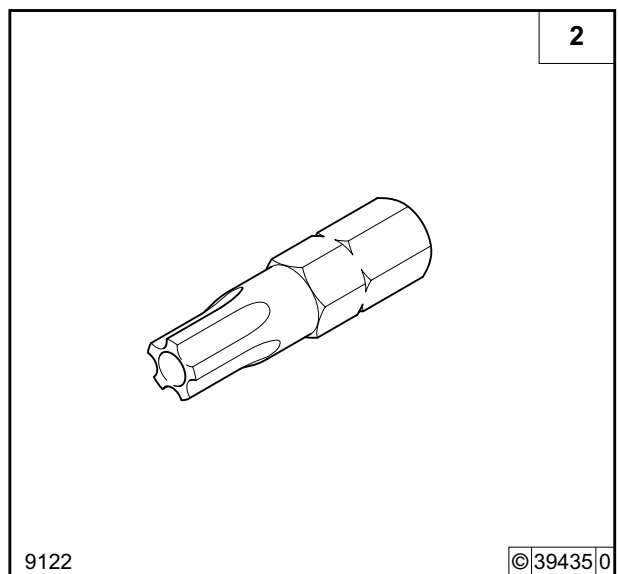
- 9090 - Clamping pliers**
for hose clips, 320 mm, clamping spring clamps



- 9120 - Special bit, 70 mm long**
IPR 30, 70 mm long, for secure screwing on regulator



- 9122 - Special bit, 25 mm long**
IPR 30, 25mm long, for secure screwing on regulator



8 Special tools

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WILBÄR

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Postfach 14 05 80

D -42826 Remscheid

Fax: ++49 (0) 02191 - 8 10 92

Tel.: ++49 (0) 21191 - 9882-860

E-mail address for orders from

Germany: a.zarrath@wilbaer.de (Ms. Zarrath)

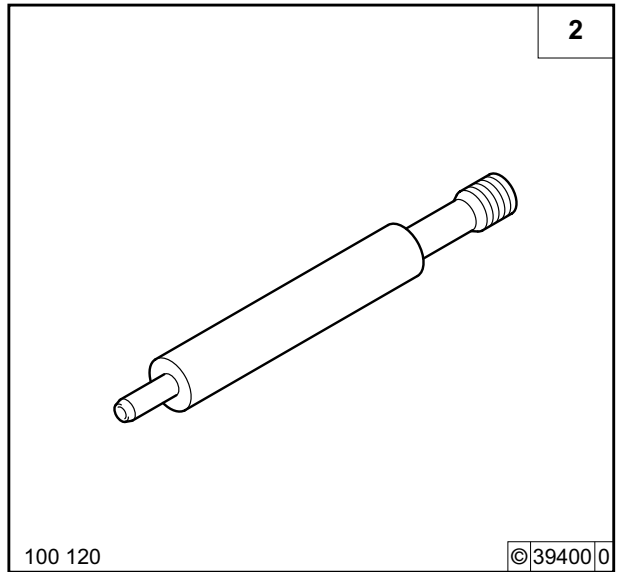
other countries: a.karsten@wilbaer.de (Ms. Karsten)



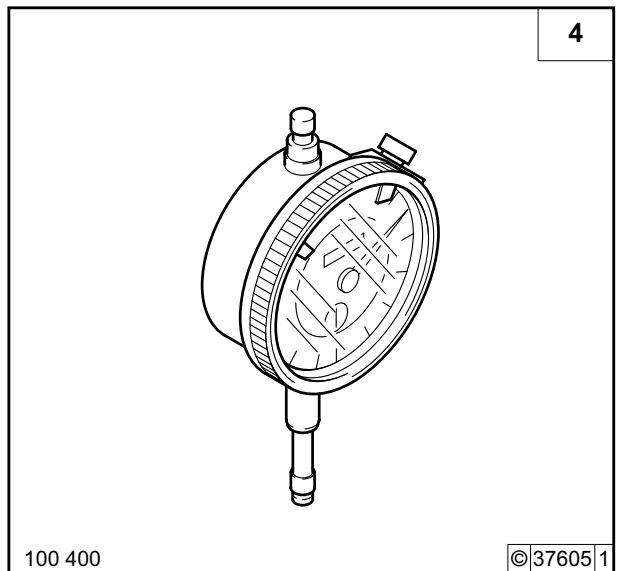
Notes

8

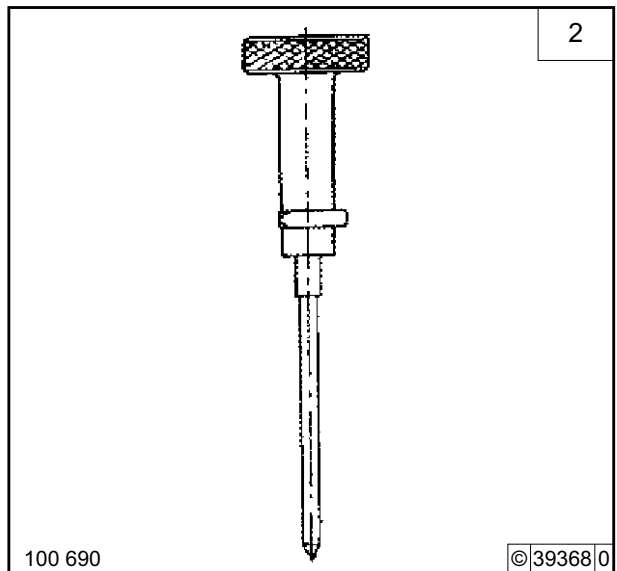
100 120 - Connecting piece
for compression tester



100 400 - Meter
in connection with 100 750



100 690 - Marking pin
for Bosch injection pump

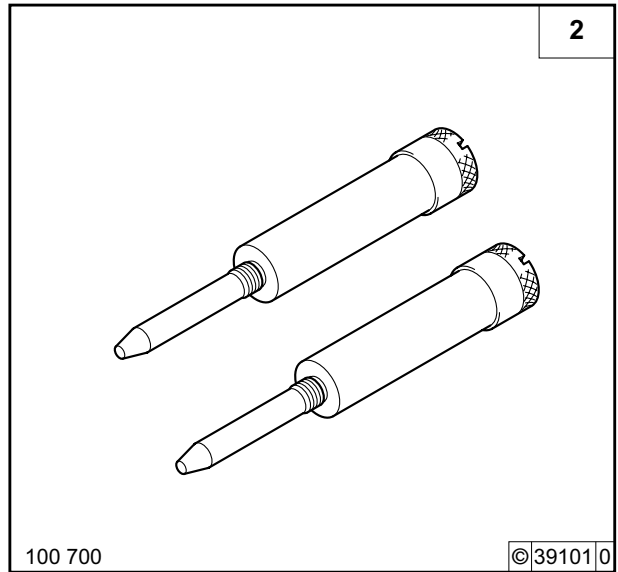


8 Special tools

2011

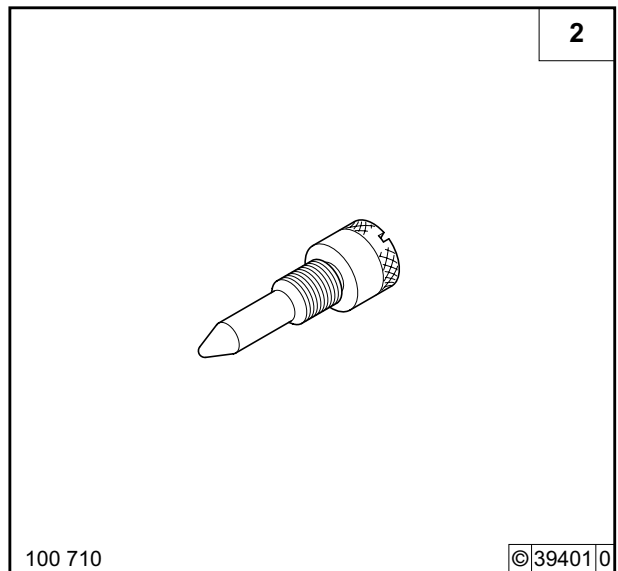


100 700 - **Setting bolt**
for toothed belt assembly
Crankshaft and camshaft

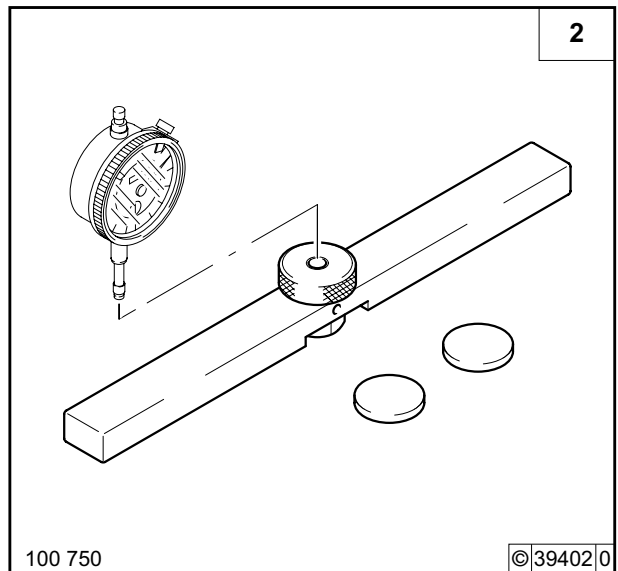


8

100.710 - **Setting bolt**
for control linkage



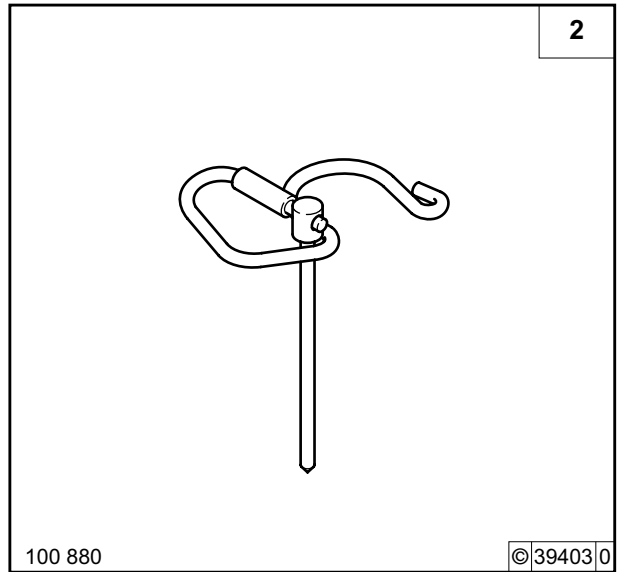
100 750 - **Measuring device**
with shim discs for piston overhang and
front cover
in connection with 100 400



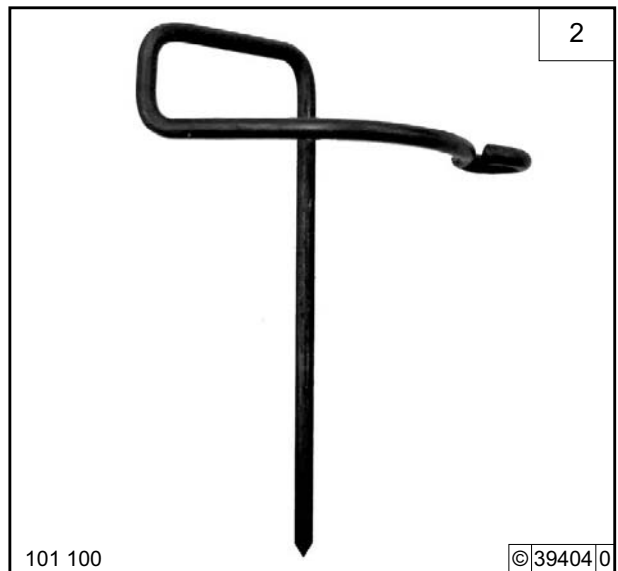
100 880 - **Marking pin**
for Bosch injection pumps
Wire length 64mm



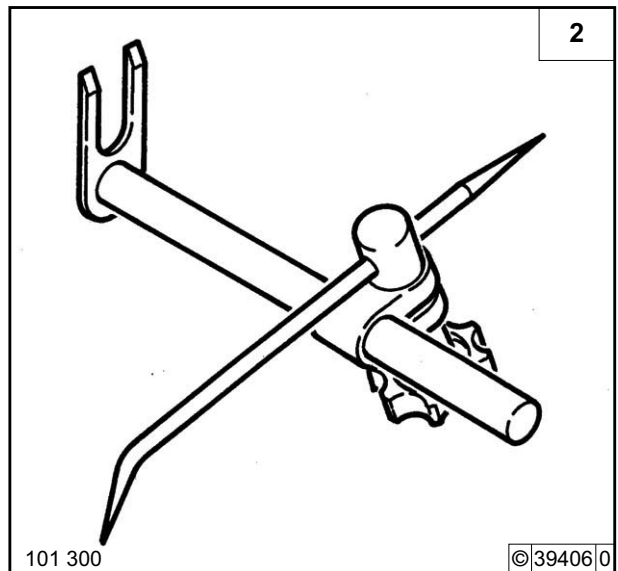
Note
No longer available.
Replaced by marking pin 100 690.



101 100 - **Marking pin**
for Motorpal



101 300 - **Pointer for degree scales**



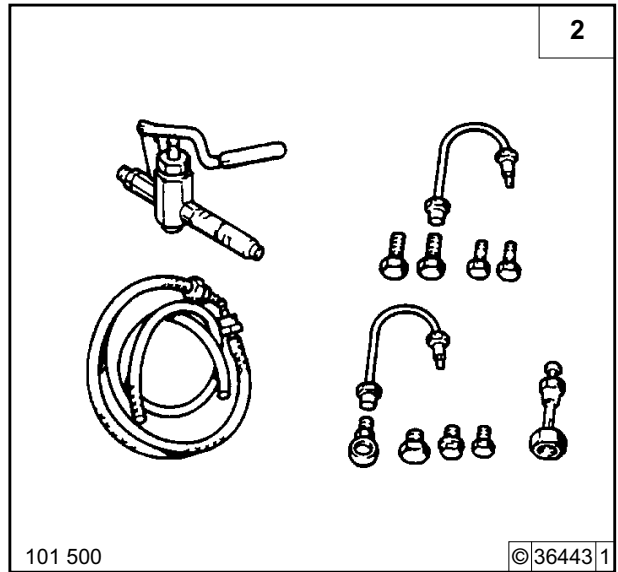
8 Special tools

2011



101 500 - Hand pump

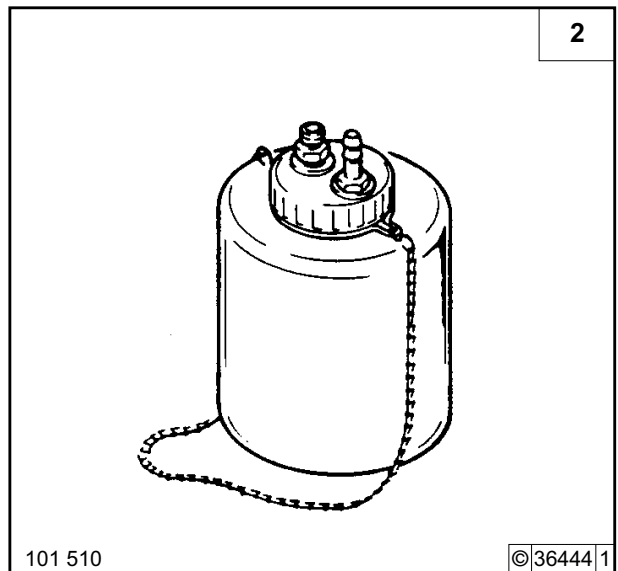
High pressure hand pump for testing and setting the static beginning of pumping



8

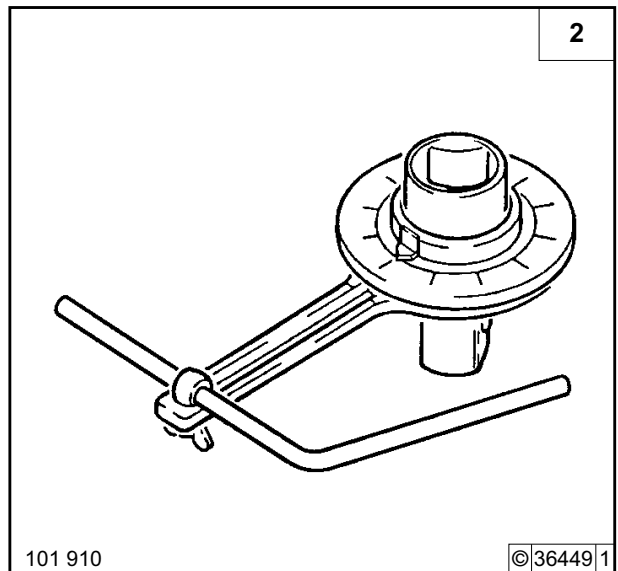
101 510 - Tank

Supply tank for high pressure hand pump

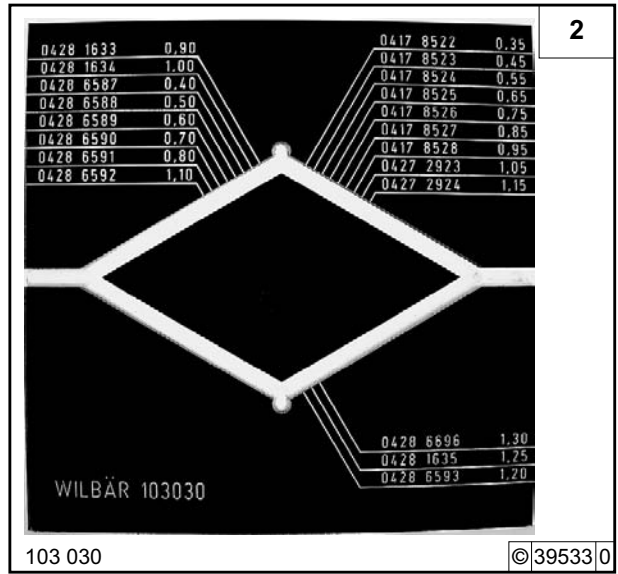


101 910 - Device

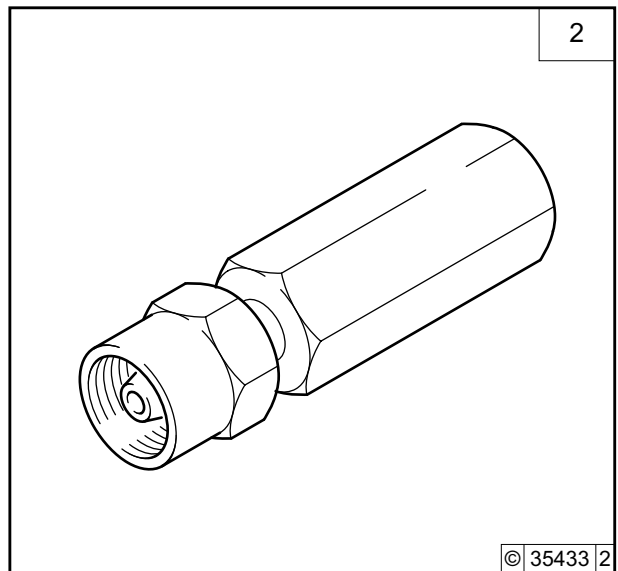
for reading the angle degrees



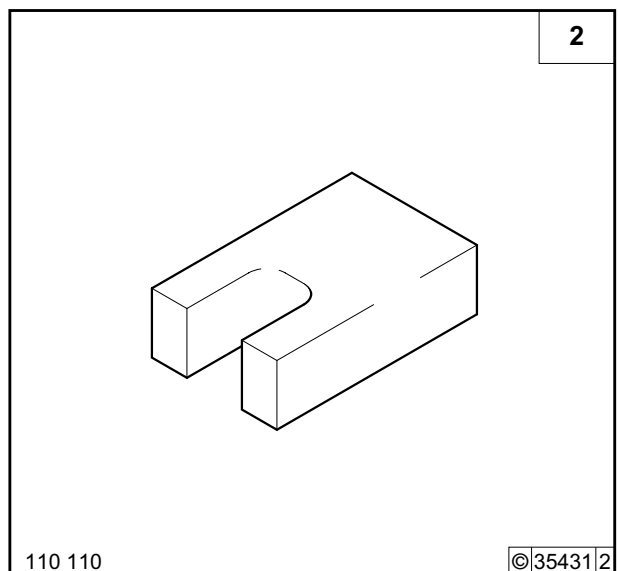
- 103 030** - **Test template**
for compensation gasket of the injection pump



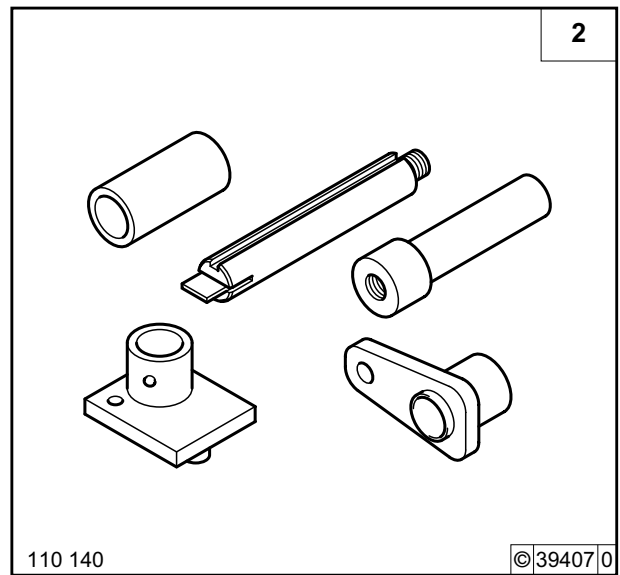
- 110 030** - **Extractor**
for injection valve
in connection with 150 800



- 110 110** - **Holder**
for injection valve SW11 to
accommodate the injection valve in the
vice

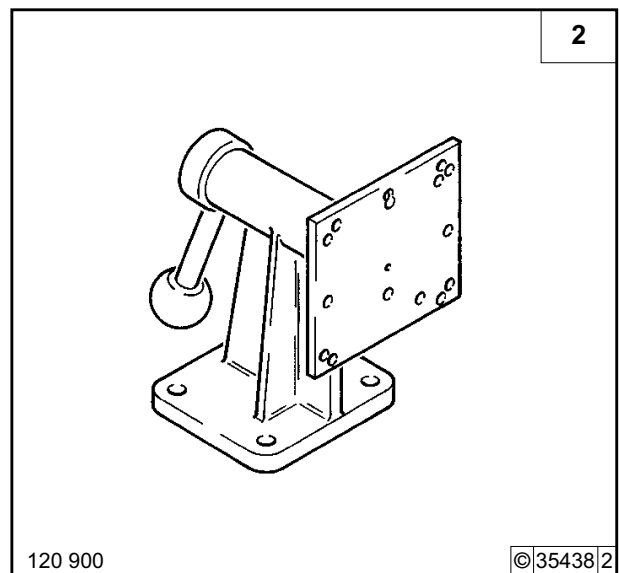


110 140 - **Assembly tool**
for control linkage bushes

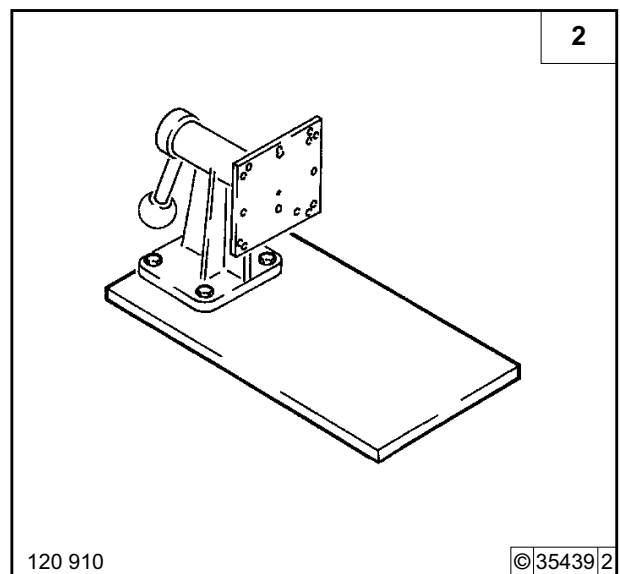


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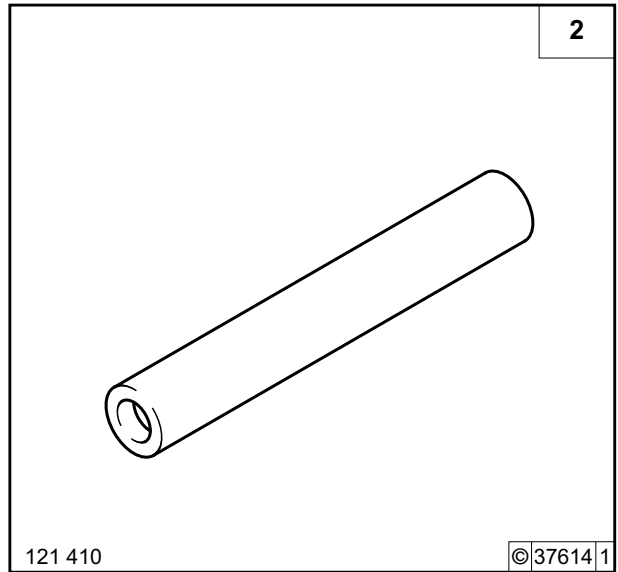
120 900 - **Clamping block**
for cylinder head, swivelling



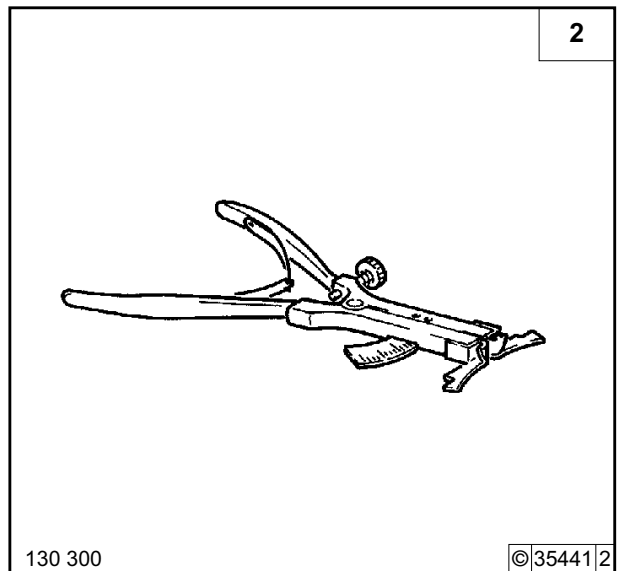
120 910 - **Clamping plate**
for clamping plate 120 900 if this is not
screwed tight



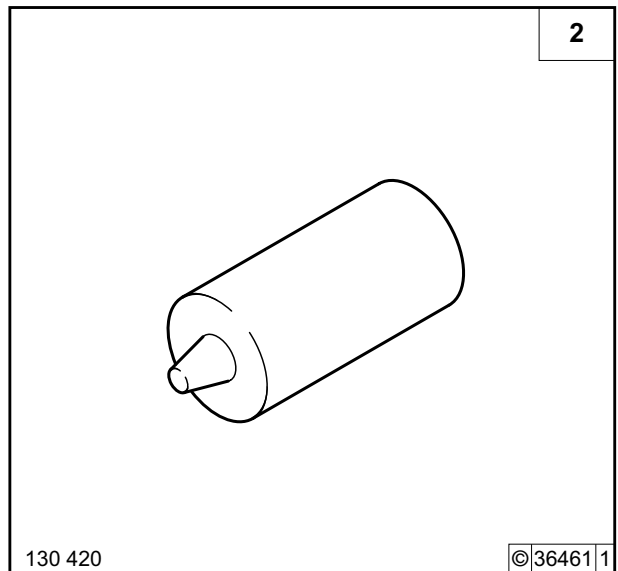
121 410 - **Assembly tool**
for valve shaft seals



130 300 - **Universal piston ring pliers**
Disassemble and assemble piston rings



130 420 - **Trapezoidal wear gauge**

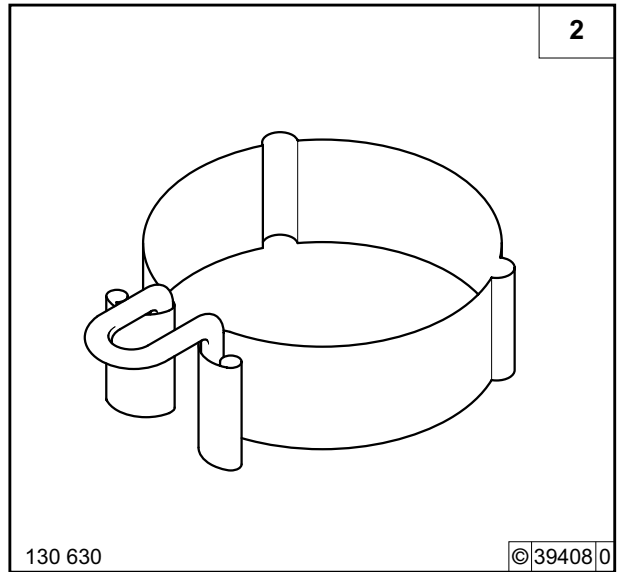


8 Special tools

2011

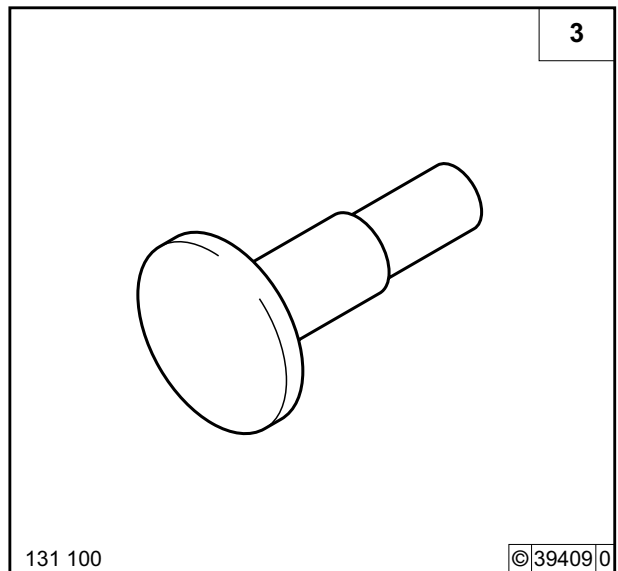


130 630 - Piston ring tensioning band

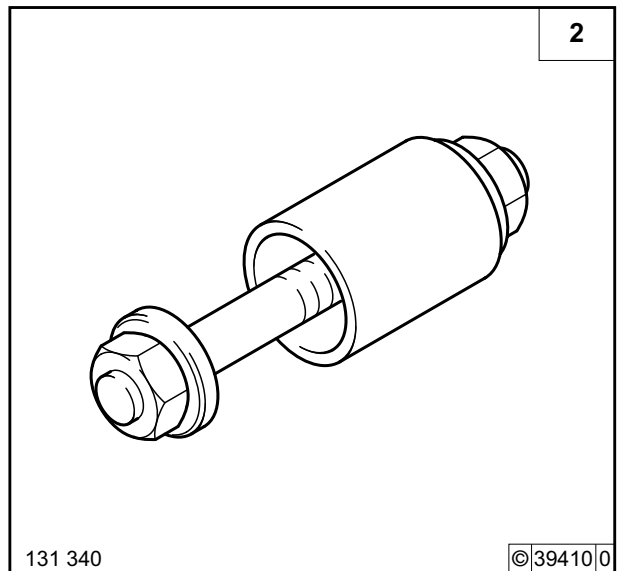


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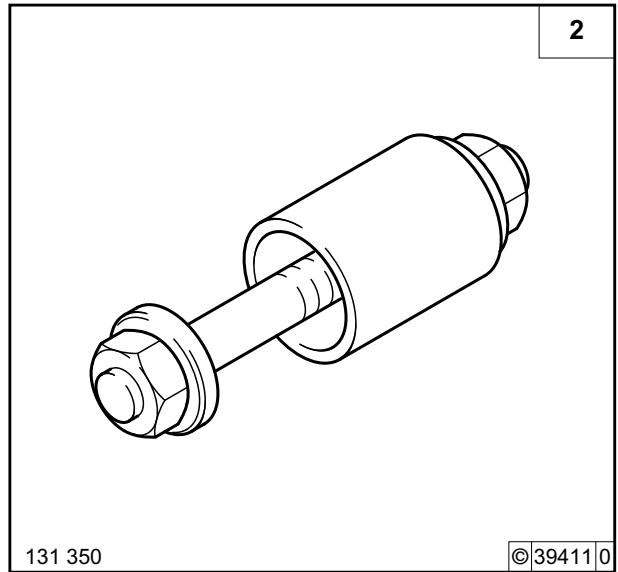
131 100 - Disassembly tool
for piston bolt lock



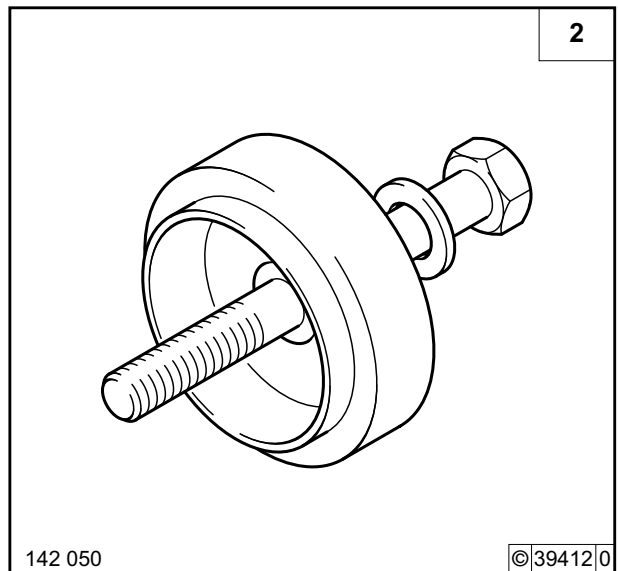
131 340 - Assembly tool for FL/M engines
for piston bolt bush of FL/M engines



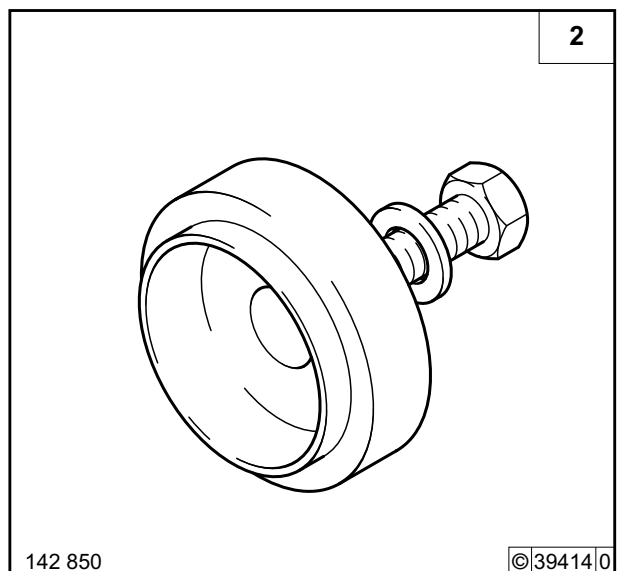
- 131 350 - **Assembly tool for BF/M engines**
for piston bolt bush of BF/M engines



- 142 050 - **Press-in device**
for camshaft sealing ring



- 142 850 - **Assembly tool**
for camshaft sealing ring without
running ring, opposite side to flywheel

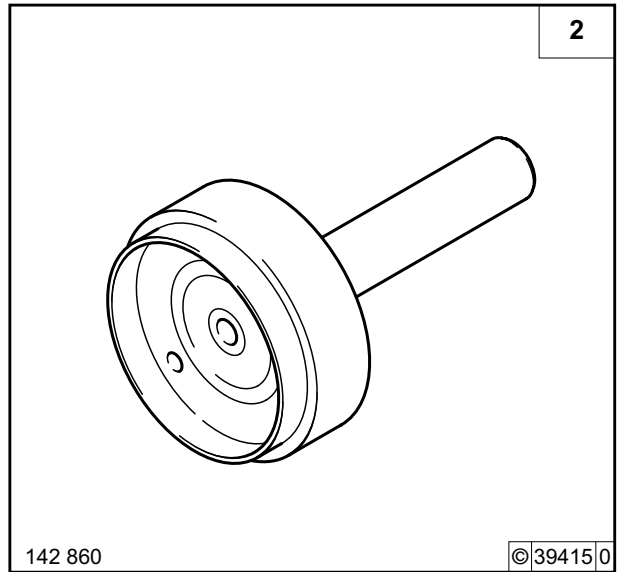


8 Special tools

2011

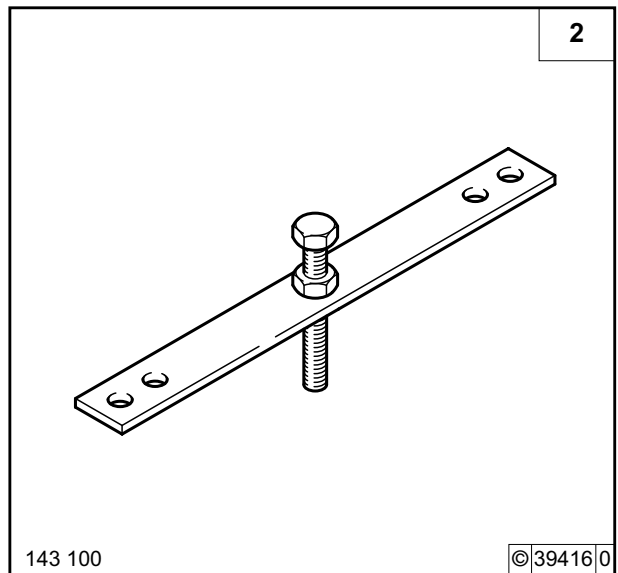


142 860 - **Assembly tool**
for camshaft sealing ring without
running ring, flywheel side

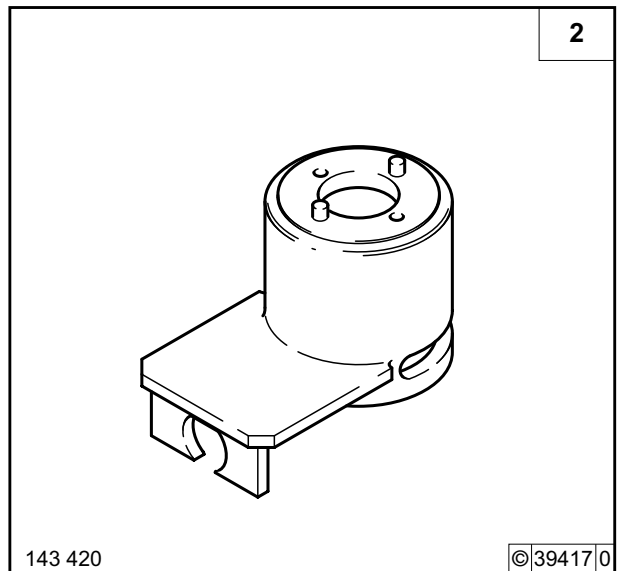


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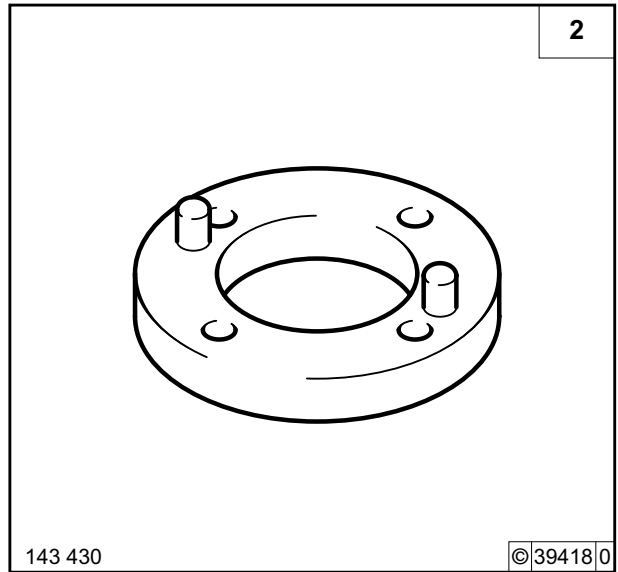
143 100 - **Pressing device**
for flywheel



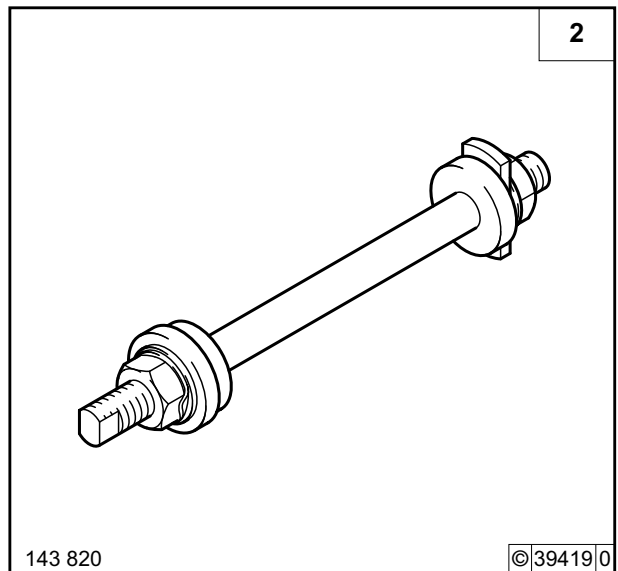
143 420 - **Holder**
for force multiplier



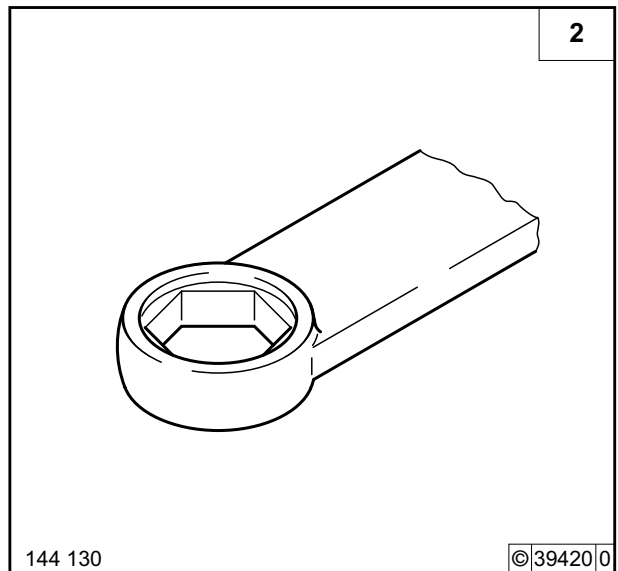
143 430 - Intermediate disc
for holder 143 420



143 820 - Assembly tool
for camshaft bearing



144 130 - Holder
for camshaft wheel

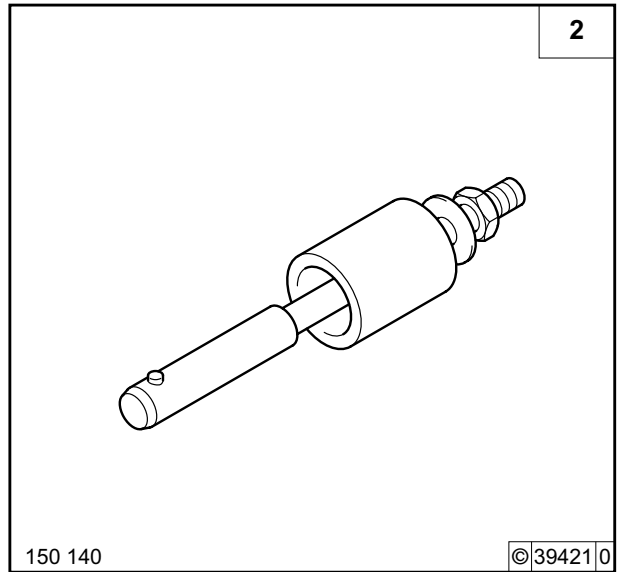


8 Special tools

2011

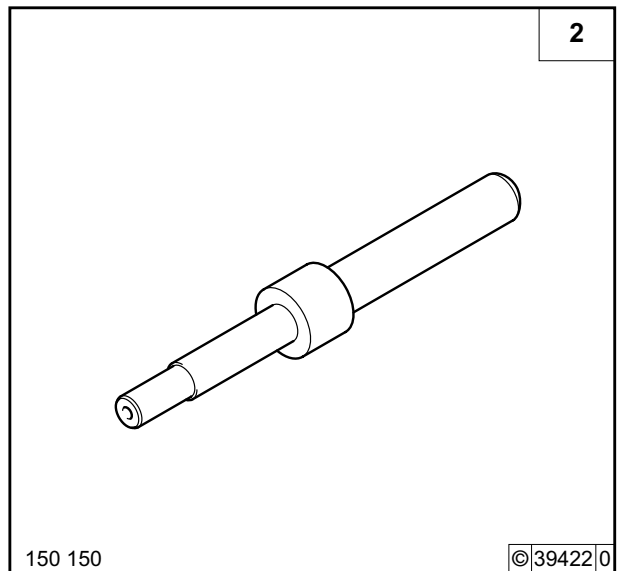


150 140 - Extraction tool
for oil pipe in crankcase

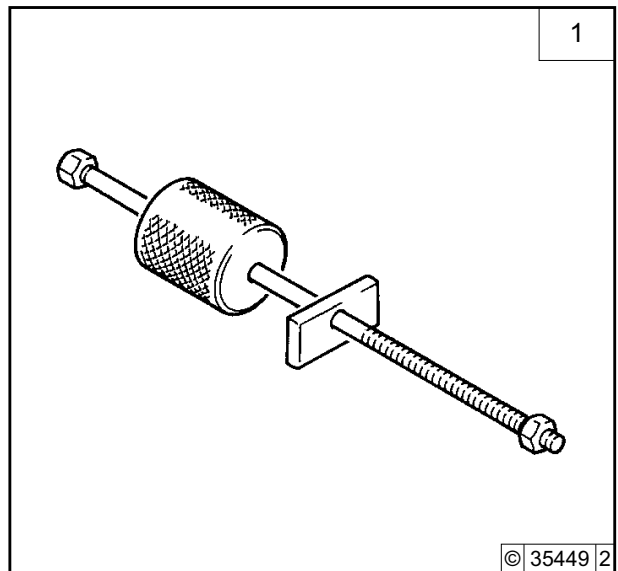


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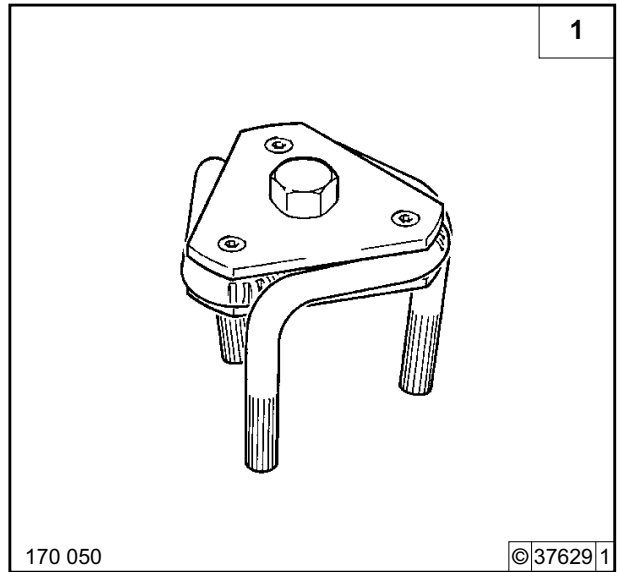
150 150 - Assembly pin
for oil pipe in crankcase



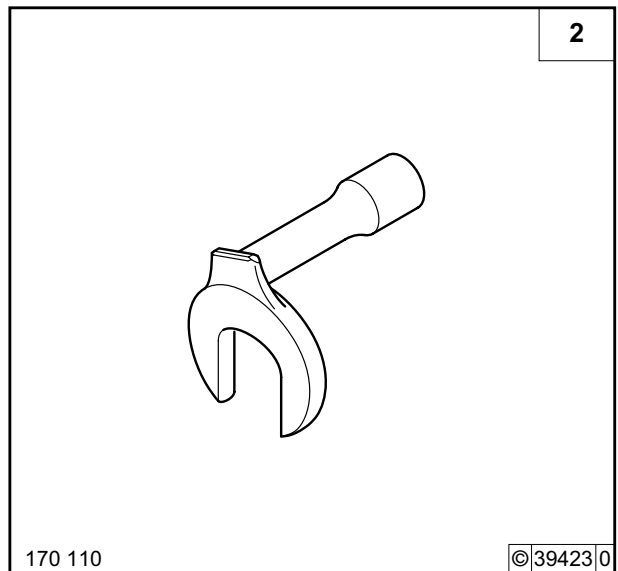
150 800 - Extraction tool
e.g. for injection valves



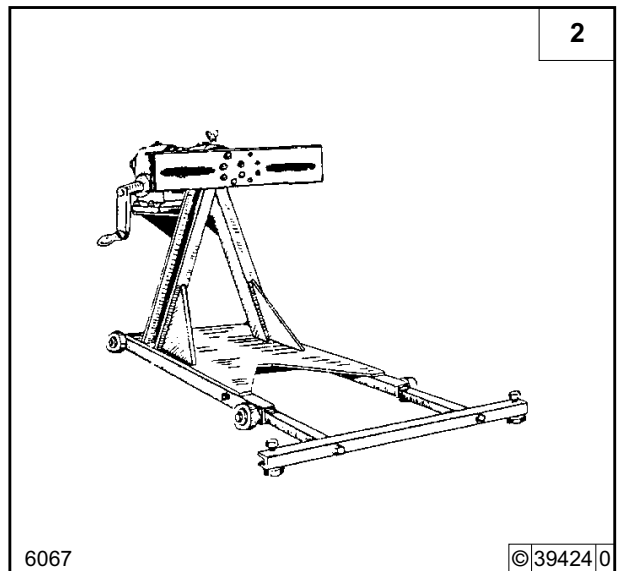
- 170 050 - **Special wrench**
for filter cartridge, for unscrewing the filter cartridge



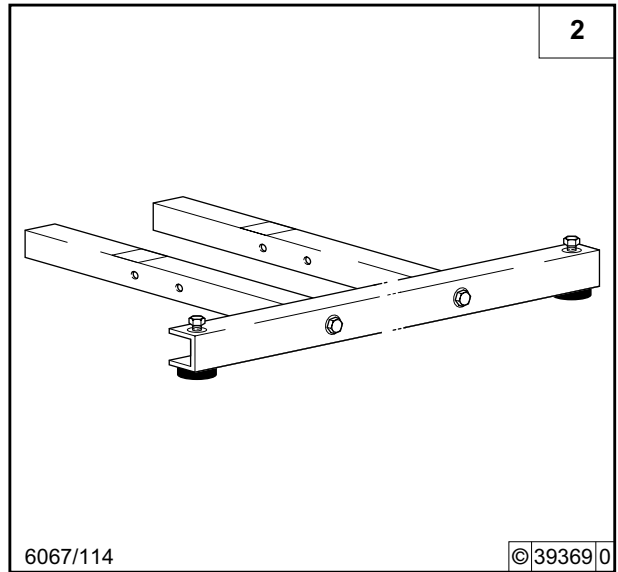
- 170 110 - **Special wrench**
for oil pressure sensor



- 6067 - **Engine assembly stand**



6067/114 - Support arm



8

6067/115 - Clamping holder

