

FENDT

Werkstatthandbuch

Workshopmanual

Manuel de réparation

Manuel d'atelier

Manuale per l'officina

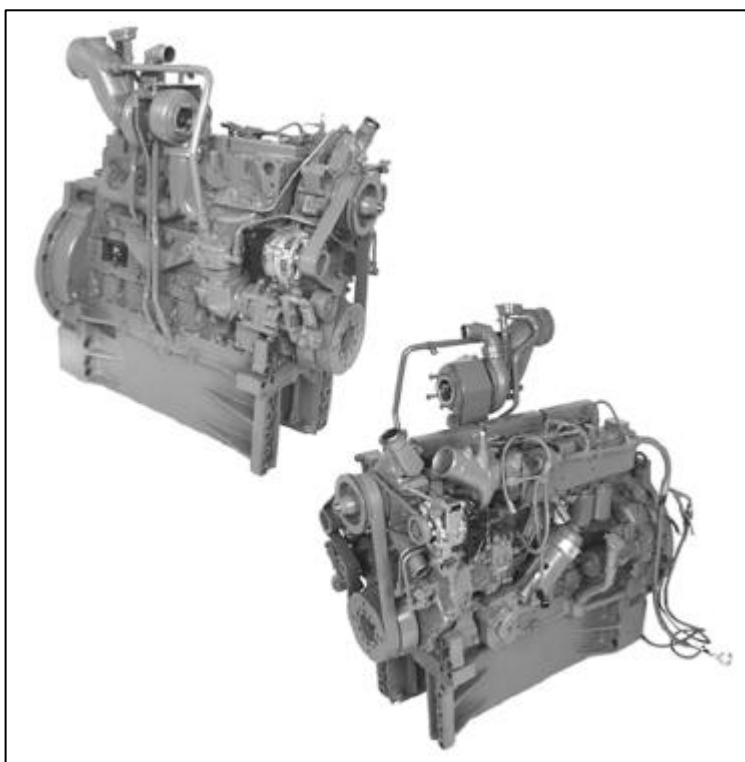
Motor

Engine

Moteur

Motore

MAN D 0836 LE (Mechanical part)



X990.005.039.010

MAN D 0836 LE

Favorit 916 916/./3001-
Favorit 920 920/./3001-
Favorit 924 924/./3001-
Favorit 926 926/./3001-

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FENDT

**WERKSTATTHANDBUCH
WORKSHOPMANUAL
MANUEL D'ATELIER
MANUAL DE TALLER
MANUALE PER L'OFFICINA**

MOTOR / ENGINE / MOTEUR / MOTORE

MAN D 0836 LE

(Mechanical part)

Ausgabe 05/2001

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Ein Unternehmen der AGCO-Corp.

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VORWORT

Das vorliegende Werkstatthandbuch wurde für die Reparaturwerkstätten unserer Vertretungen zusammengestellt und enthält alle Demontage- und Montagevorgänge, die im Zusammenhang mit Einstellarbeiten und der Auswechslung von Teilen erforderlich ist.

Sind Teile auszuwechseln, so dürfen nur Original-Ersatzteile verwendet werden. Teile-Bestellungen bitten wir unter Angabe der Fahrgestell-Nummer nach den jeweils gültigen Ersatzteilunterlagen aufzugeben.

Es wird vorausgesetzt, daß diese Arbeiten von Fachleuten ausgeführt werden; daher wurde auf die Beschreibung allgemein bekannter Reparaturen verzichtet.

Handelsübliche Werkzeuge und allgemeines Gerät, das zur Ausrüstung einer Werkstatt gehört, wird hierbei vorausgesetzt.

Spezialwerkzeuge sind auf das notwendige Maß beschränkt und am Schluß des Buches in einer Zusammenfassung gezeigt. Hinsichtlich der Pflege- und Wartungsarbeiten verweisen wir auf die Betriebsanleitungen.

Von den Werkstätten sind ie Technischen Daten zu beachten.

Die einschlägigen Unfallverhütungsvorschriften sowie die sonstigen allgemeinen anerkannten sicherheitstechnischen und arbeitsmedizinischen Regeln sind einzuhalten.

Dieses Werkstatthandbuch unterliegt keinem Änderungsdienst, wir weisen aus diesem Grunde auf die zusätzlich herauskommenden technischen Rundschreiben besonders hin. Bei Neuauflage eines Werkstatthandbuches werden alle Änderungen berücksichtigt und mit eingearbeitet.

Gegenüber Darstellungen und Angaben dieses Werkstatthandbuches sind technische Änderungen, die zur Verbesserung des Produktes notwendig werden, vorbehalten. Nachdruck und Vervielfältigung jeglicher Art, auch auszugsweise, bedarf unserer schriftlichen Genehmigung.

FOREWORD

This workshop manual was compiled for our agent's repair workshops and contains all the dismantling and assembly procedures necessary in connection with adjustments and replacement of parts.

If parts have to be renewed, only original replacement parts may be used. Orders für parts must state the chassis number and be in line with the latest parts documentation.

It is assumed that these repairs will be carried out by skilled mechanics; descriptions of routine repair work have, therefore, been omitted.

It is further assumed that the workshop concerned is equipped with standard tools and has the normal workshop facilities. The special tools are restricted to the essential minimum and are shown in a summary at the back of this manual.

Please refer to the Operating Instructions for details of general maintenance and care operations.

Workshops must observe the technical data.

The accident prevention regulations and all other generally recognized regulations on safety and occupational medicine are to be observed.

This workshop manual is not subject to an updating service. For this reason we draw your attention to the supplementary technical circulars which are published separately. New issues of a workshop manual incorporate all the latest changes.

In view of continuous desing improvements or changes, the technical specifications and the illustrations shown in this Workshop Manual are subject to alteration. Reprinting and reproduction, in part or in whole, are subject to our written approval.

AVANT PROPOS

Le présent Manuel de Réparation a été conçu pour les Ateliers de Réparation de nos dépositaires et il contient toutes les instructions de démontage et de montage nécessitées par les travaux de réglage et de remplacement des pièces.

Dès qu'il s'agit de remplacer des pièces, il faut utiliser uniquement des pièces de rechange originales. Pour commander les pièces de rechange, nous prions de nous indiquer le numéro du châssis et le numéro de référence de la pièce concernée.

On considère que ces travaux sont effectués par des spécialistes et c'est pourquoi les réparations courantes ne sont pas décrites.

On considère également que l'on dispose des outils classiques et de l'appareillage équipant normalement un atelier.

Les outils spéciaux ont été réduits au strict nécessaire et ils sont énumérés à la fin du manuel.

En ce qui concerne les travaux d'entretien, prière de consulter les Instructions de Service.

Les ateliers de réparation devront tenir compte des caractéristiques techniques.

Il convient de respecter les consignes générales de sécurité et de prévention des accidents en vigueur.

Le présent Manuel de Réparation n'est soumis à aucune modification, et c'est pourquoi il convient de consulter les Circulaires Techniques publiées par la suite. L'édition d'un nouveau Manuel de Réparation tient compte de toutes les modifications nécessaires.

Sous réserve de modifications techniques nécessaires à l'amélioration des produits présentés par des illustrations et des indications référencées dans ce Manuel d'Atelier.

Réimpression et reproduction même partielle, quelle qu'en soit la nature, interdites sans l'autorisation écrite de nos services.

PROLOGO

El presente Manual de Reparaciones ha sido elaborado para los talleres de nuestros servicios oficiales y comprende todos los trabajos de montaje y desmontaje que son necesarios para la sustitución de piezas o trabajos de ajuste.

Cuando se sustituyan piezas deberán utilizarse únicamente piezas de repuesto originales. Los pedidos de las piezas de repuesto, sirvanse hacerlos indicando el número de chasis y siguiendo el catálogo de repuestos que tenga validez.

Es una condición previa que los trabajos sean llevados a cabo por personal especializado. Por este motivo, hemos desistido de describir reparaciones comúnmente conocidas.

Naturalmente, damos por sobreentendido que los talleres deberán estar equipados con herramientas y utillaje adecuado. La cantidad de herramientas especiales a utilizar ha sido reducida a la medida necesaria y van relacionadas al final de este libro.

Los puntos referentes a trabajos de mantenimiento y de conservación sirvanse consultar el Manual de Instrucciones. Los talleres están obligados a tener en cuenta los datos técnicos.

Se cumplirán las normas aplicables para la prevención de accidentes así como todas las demás normas de seguridad y medicina laboral generalmente aceptadas.

Este Manual de Reparaciones no está sometido a modificaciones y, por lo tanto, les rogamos tengan especialmente en cuenta las técnicas que, adicionalmente, se irán publicando. Cuando un Manual de Reparaciones sea editado de nuevo se tendrán en cuenta y serán introducidas todas las modificaciones.

Nos reservamos el derecho de introducir modificaciones técnicas necesarias para el mejoramiento de las productas, aunque difieran de las ilustraciones y datos contenidos en este Manual de Taller. La reimpresión del presente libro o cualquiera forma de reproducción, aunque sea parcial, requiere nuestra autorización por escrito.

PREMESSA

Il presente manuale è stato redatto per le officine dei nostri concessionari e contiene tutte le indicazioni relative allo smontaggio ed al montaggio che si rendono necessari per la registrazione e la sostituzione di ricambi.

Se ci sono parti da sostituire devono essere utilizzati assolutamente ricambi originali. I ricambi devono venire ordinati indicando il numero di telaio, secondo la documentazione ricambistica in vigore.

E' necessario che questi lavori vengano effettuati da personale specializzato, perciò le riparazioni generalmente note non sono descritte in questo manuale.

Si presuppone la presenza degli attrezzi necessari e di dispositivi in generale che fanno parte della dotazione di un'officina.

Attrezzi speciali sono limitati al minimo indispensabile e vengono elencati alla fine di questo manuale. Per quanto riguarda la manutenzione si prega di consultare le istruzioni per l'uso.

Le officine devono osservare i dati tecnici.

Rispettare le norme antinfortunistiche nonché le generali norme tecniche sulla sicurezza e di medicina sul lavoro.

Questo manuale non è soggetto a nessun servizio di aggiornamento, per questo motivo rimandiamo ad ulteriori comunicazioni tecniche. In caso di aggiornamento di un manuale si tiene conto delle variazioni, che vengono poi incluse nella nuova versione.

Ci riserviamo il diritto di apportare modifiche rispetto ad illustrazioni ed indicazioni di questo manuale, che si rendono necessarie per il miglioramento del prodotto. Stampa e riproduzione di ogni genere, anche parziale, di questo manuale solo previa nostra autorizzazione scritta.

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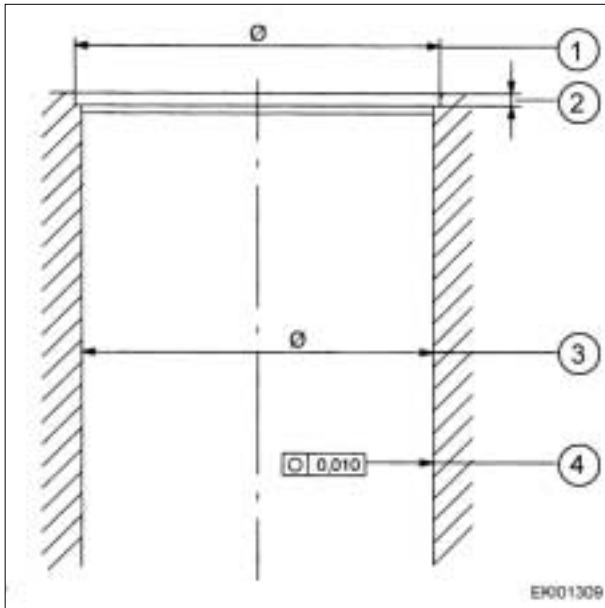
Fav 900	Engine / Generalities Specifications	A
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Engine	
Design	In-line vertical
Principle of operation	4- Stroke Diesel with turbocharger and inter-cooler
Method	Direct injection
Number of cylinders	6
Compression ratio	18 : 1
Bore	108 mm (4.25")
Stroke	125 mm (4.92")
Swept volume	6871 cm ³ (419.29 in ³)
Firing sequence	1-5-3-6-2-4
Emission category	MVEG 1
Max. output to ISO 1585 88/195 EWG	
D 0836 LE 501	210 kW (285 PS) at 2250 rpm (281HP)
D 0836 LE 502	186 kW (255 PS) at 2250 rpm (249HP)
D 0836 LE 503	162 kW (220 PS) at 2150 rpm (217 HP)
D 0836 LE 504	146 kW (200 PS) at 2150 rpm (196 HP)
Max. torque to ISO 1585 88/195 EWG	
D 0836 LE 501	1175 Nm at 1400 rpm
D 0836 LE 502	1070 Nm at 1400 rpm
D 0836 LE 503	970 Nm at 1400 rpm
D 0836 LE 504	880 Nm at 1400 rpm
Rotation in rpm	
D 0836 LE 501 / 502	Idling speed - Final speed 800±30 ; 2250; 2420-2480
D 0836 LE 503 / 504	800±30 ; 2150; 2320-2380
Start of delivery	
D 0836 LE 501 / 502 / 503 / 504	Crankshaft angle before TDP 0°±0,5°
Engine number D 0836 LE 50. 164 9790 ... and up	5°±0,5°
Lubrication	
method	Forced feed lubrication gear oil pump
Quantities	
Quantities in oil pan	min. 18 ltr. (19 qt.) max. 23 ltr. (24.3 qt.)
Oil change with filter	25,5 ltr. (27 qt.)
Cooling	
Method	Liquid cooling Impeller pump
Coolant temperature	
D 0836 LE 501 / 502	
normal	102°C (215°F)
momentary	max. 108°C (226°F)
D 0836 LE 503 / 504	
normal	105°C (221°F)
momentary	max. 113°C (235°F)

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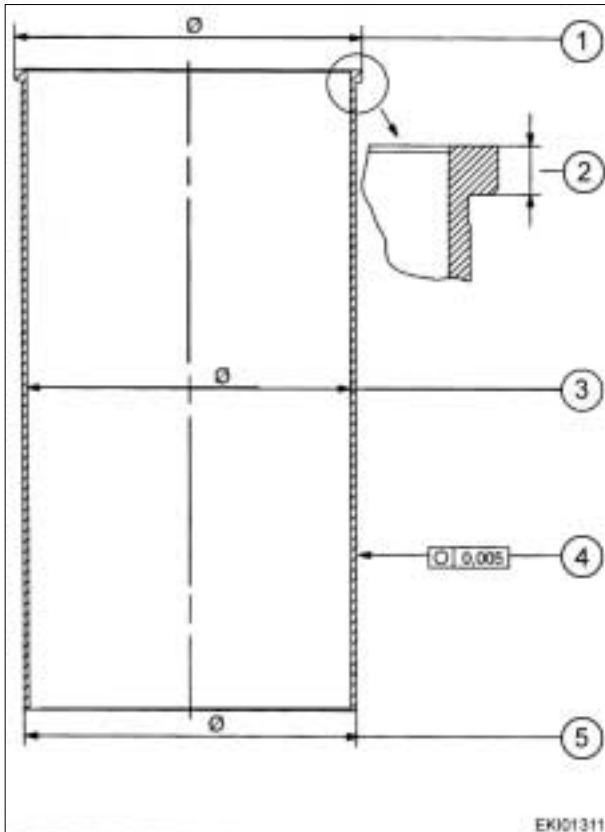
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Crankcase



- 1. 116,0-116,1 mm (4.4567 - 4.4570 ")
- 2. Standard size: 4,00-4,03 mm (.157 - .159")
Oversize: 4,20-4,23 mm (.165 - .167")
- 3. Standard size: 111,50-111,52 mm (4.389 - 4.390")
Oversize 0,5 mm: 112,00-112,02 mm (4.409 - 4.410")
- 4. Max. permissible taper over length of cylinder

Cylinder liner

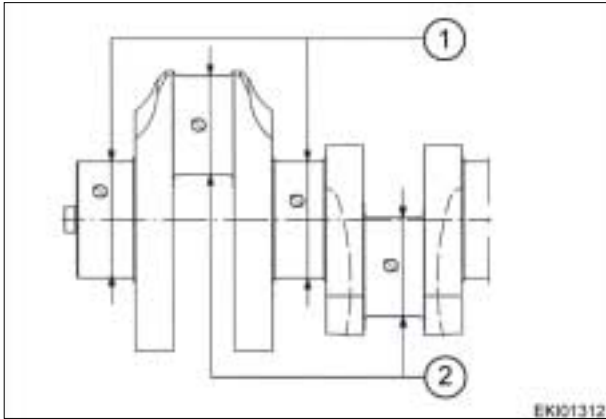


- 1. 115,74-115,88 mm (4.556 - 4.562")
- 2. Standard size 4,04-4,06 mm (.159 - .160")
Oversize: 4,24-4,26 mm (.167 - .168")
- 3. 108,00-108,22 mm (4.252 - 4.260")
max. wear limit: 0,1 (.039") above basic size
- 4. Max. permissible taper over length of cylinder
- 5. Standard size: 111,475-111,490 mm (4.388 - 4.389")
Oversize: 0,5 mm (.020"): 111,975-111,990 mm (4.408 - 4.409")

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Crankshaft



1. Dimensions:

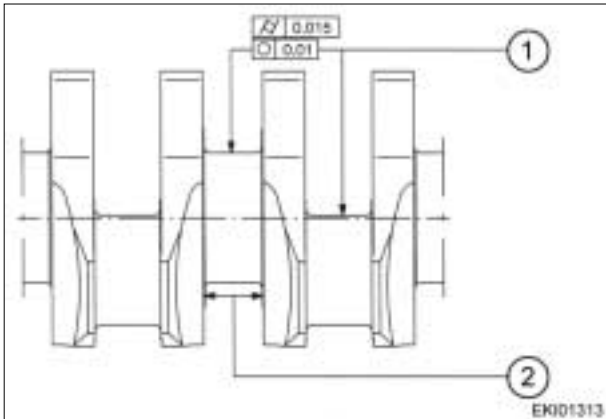
Standard: 76,981-77,000 mm (3.031 - 3.032")

Under size: 0,10 mm (.004"): 76,881-76,900 mm (3.027 - 3.028")

2. Con-rod bearing journal diameter:

Standard : 69,981-70,000 mm (2.755 - 2.756")

Under size: 0,10 mm (.004"): 69,881-69,900 mm (2.751 - 2.752")



1. For all crankshaft journals:

maximal permissible runout

maximal deviation from conical form

2. Thrust bearing journal width:

Standard size: 34,000-34,062 mm

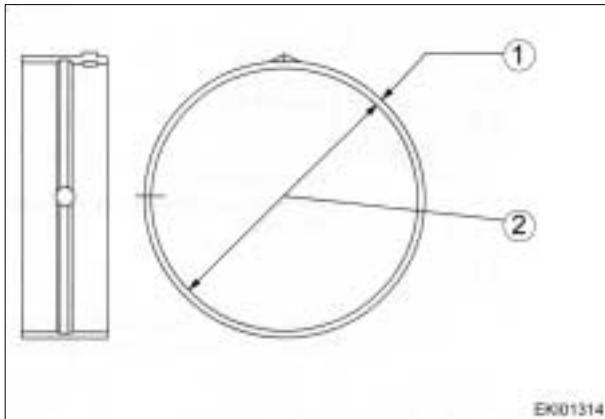
(1.339 - 1.341")

Repair sizes: 34,500-34,562 mm (1.358 - 1.361")

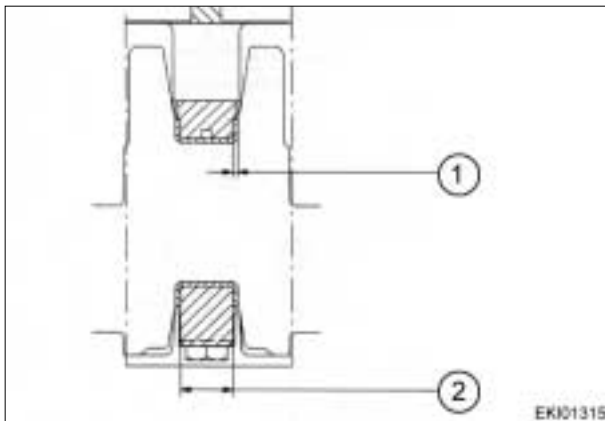
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Main bearing

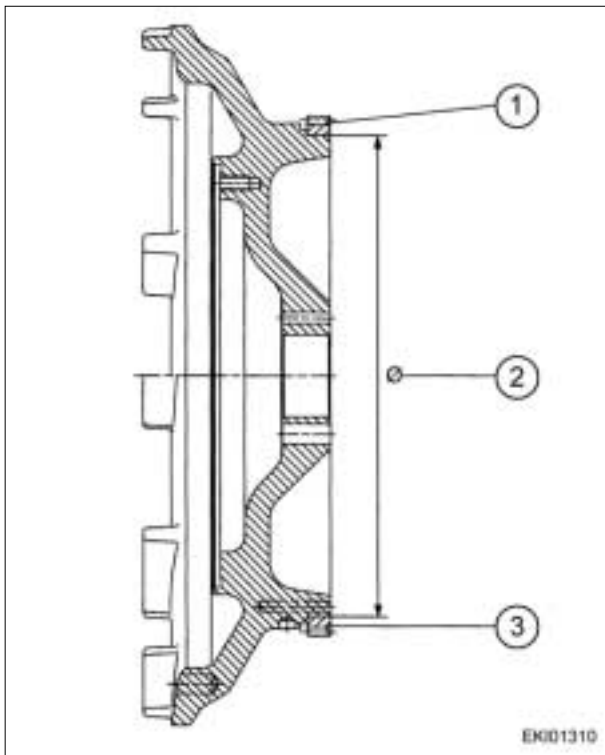


- 1. Standard size: 2,468-2,480 mm (.097 - .098")
Oversize 0,10 mm (.004"): 2,518-2,530 mm (.099 - .100")
- 2. Fitted bearing inner Ø for main bearing :
Standard size : 77,040-77,086 mm (3.033 - 3.035")
Undersize 0,10mm (.004"): 76,940-76,986 mm (3.029 - 3.031")
Housing bore for main bearing: 82,000-82,022 mm (3.228 - 3.229")
Axial play: 0,040-0,105 mm (.002 - .004")
Spread of main bearing shells: 0,5-1,5 mm (.020 - .059")



- max permissible crankshaft axial play: 0,200-0,395 mm (.008 - .016")
- 1. Thrust bearing journal width thrust washer:
Standard size: 2,850-2,900 mm (.112 - .114")
Repair size: 3,100-3,150 mm (.122 - .124")
- 2. 27,967-28,000 mm (1.101 - 1.102")

Flywheel

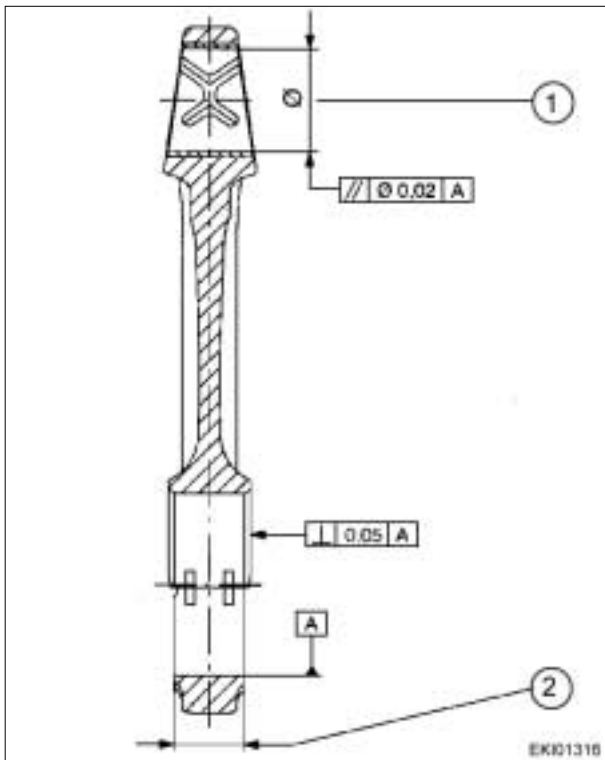


- 1. Watch position of chamfer!
Fitting temperature (Shrink-on temperature): 220-240°C (428-464°F)
- 2. Flywheel: 352,390-352,447 mm (13.874 - 13.876")
Ring gear (Internal): 351,671-351,760 mm (13.845 - 13.849")
m total. = 50,3 kg (110.89 lbs.)
J total = 1,65 kgm²
- 3. Number of teeth : Z=125, Module 3
Mating gear (Z=11)
Backlash : 0,4-0,7 mm (.016 - .020")

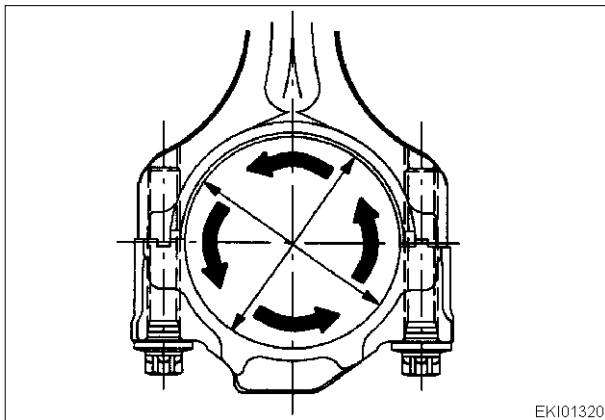
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Connecting rod

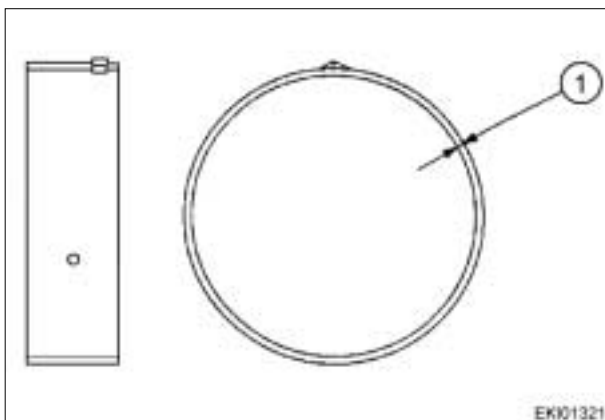


- 1. 42,050-42,066 mm (1.655 - 1.656")
 - 2. 32,78-32,88 mm (1.290 - 1.294")
- Con-rod journal width: 33,0-33,1mm (1.299 - 1.303")



Fit con-rod bearing caps (without shells). Measure basic bore with an internal micrometer.
74,000-74,019 mm (2.913 - 2.914")

Con-rod bearing

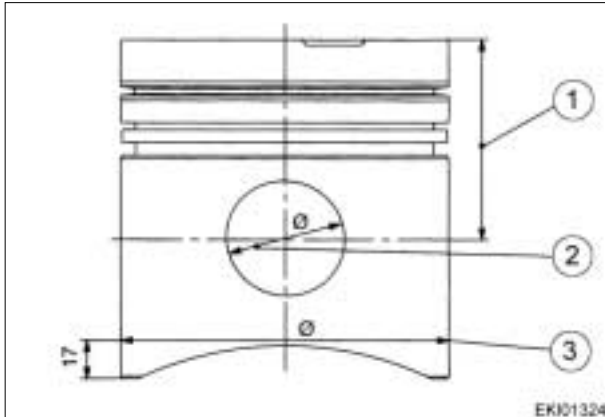


- 1. Standard size: 1,975-1,987 mm (.077 - .078")
- Oversize 0,10 mm (.004"): 2,025-2,037 mm (.079 - .080")
- Spread of new bearing shells : 0,5-2,0 mm (.020 - .079")

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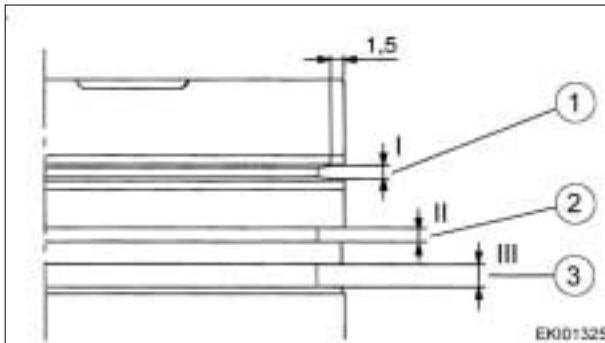
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Piston



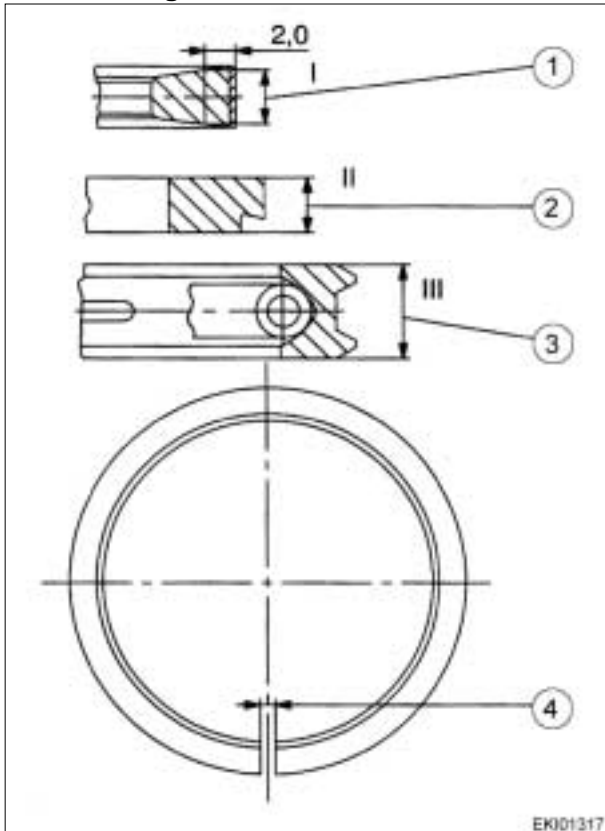
- 1. Compression height: 63,90-64,00 mm (2.516 - 2.519")
with undersizes 0,2 mm (.008"): 63,70-63,80 mm (2.508 - 2.511")
with undersizes 0,4 mm (.016"): 63,50-63,60 mm (2.500 - 2.503")
Piston projection above crankcase: 0,0093-0,391 mm (.004 - .015")
- 2. 42,003-42,009 mm (1.6537 - 1.6539")
- Piston pin diameter: 41,994-42,000 mm (1.6533 - 1.6535")
- 3. 107,891-107,900 mm (4.2477 - 4.2480")

Piston ring grooves



- 1. 2,685 mm (.106")
- 2. 2,54-2,56 mm (.100 - .101")
- 3. 4,02-4,04 mm (.158 - .159")

Piston rings

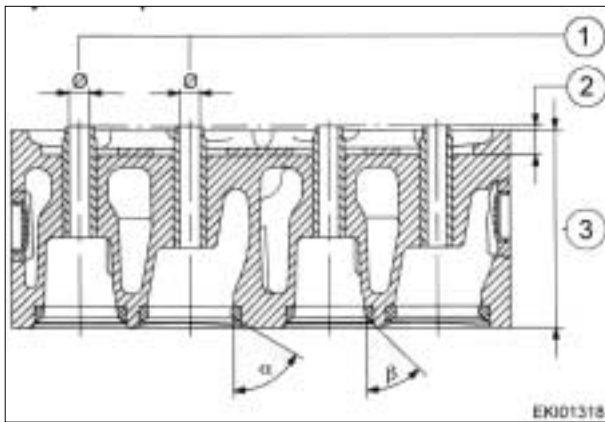


- 1. Ring - keystone ring:
Height: 2,429-2,463 mm (.096 - .097")
- 2. Ring - chamfered ring:
Height: 2,478-2,490 mm (.097 - .098")
Axial play: 0,050-0,082 mm (.002 - .003")
- 3. Ring - D-ring with spring:
Height: 3,975-3,990 mm (.156 - .157")
Axial play: 0,030-0,065 mm (.001 - .002")
- 4. End gap clearance:
 - 1. Ring: 0,35-0,55 mm (.001 - .002")
 - 2. Ring: 0,3-0,5 mm (.001 - .002")
 - 3. Ring: 0,3-0,6 mm (.001 - .002")

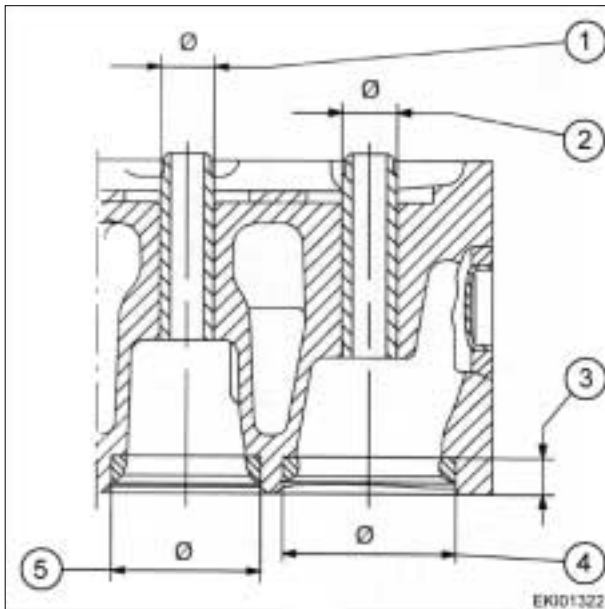
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Cylinder head



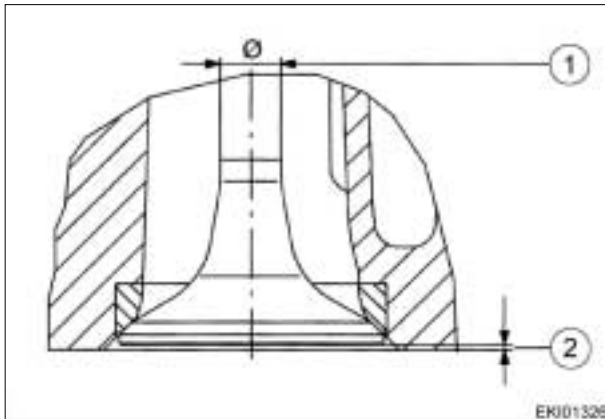
1. 10,000-10,015 mm (.3937 - .3942") at intake and exhaust valves
 2. 14,1-14,15 mm (.555 - .557")
 3. 97,8-98,0 mm (3.850 - 3.860")
Minimum: 96,8 mm (3.811")
- alpha = 60° Intake valve
beta = 45° Exhaust valve



1. Valve guide bore in cylinder head:
Standard size: 16,000-16,018 mm (.630 - .631")
Oversize: 16,250-16,268 mm (.640 - .641")
2. Valve guide outer diameter:
Standard size: 16,028-16,046 mm (.631 - .632")
Oversize: 16,278-16,296 mm (.641 - .642")
3. Standard size:
Intake valve: 10,8-10,9 mm (.425 - .429")
Exhaust valve: 11,0-11,1 mm (.433 - .437")
Oversize:
Intake valve: 11,0-11,1 mm (.433 - .437")
Exhaust valve: 11,2-11,3 mm (.441 - .445")
4. Cylinder head basic bore:
Standard size: 51,00-51,03 mm (2.008 - 2.009")
Oversize: 51,20-51,23 mm (2.016 - 2.017")
Valve seat insert outer diameter:
Standard size: 51,10-51,11 mm (2.011 - 2.012")
Oversize: 51,30-51,31 mm (2.019 - 2.020")
5. Cylinder head basic bore:
Standard size: 44,000-44,025 mm (1.732 - 1.733")
Oversize: 44,200-44,225 mm (1.740 - 1.741")
Valve seat insert outer diameter:
Standard size: 44,10-44,11 mm (1.736 - 1.737")
Oversize: 44,30-44,31 mm (1.744 - 1.745")

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Valves

1. Intake valve: 9,965-9,980 mm (.3923 - .3929")

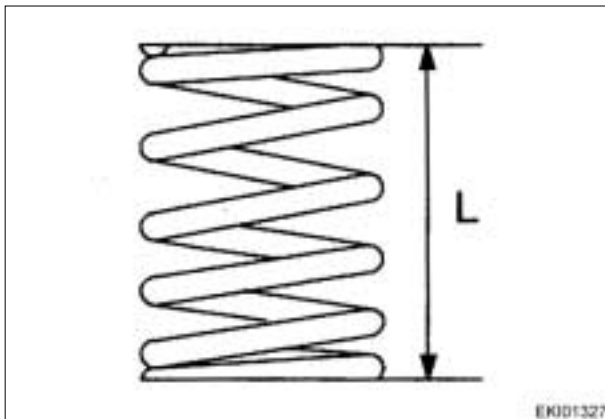
Exhaust valve: 9,950-9,965 mm (.3917 - .3923")

Wear limit: max. 0,1 mm (.0039")

2. Valve recess:

Intake valve : 0,25-0,71 mm (.010 - .028")

Exhaust valve: 0,45-1,05 mm (.018 - .041")



Valve springs:

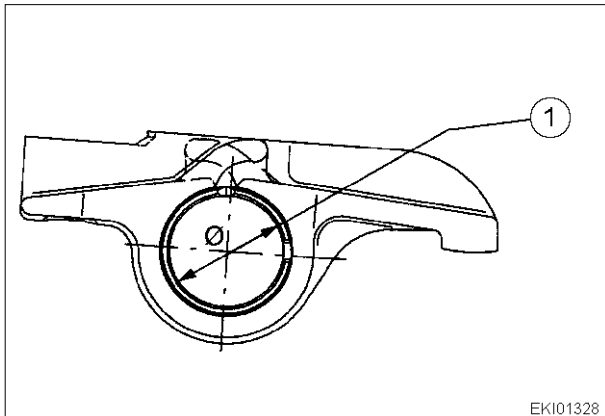
Untensioned approx.: 59,5-61,0 mm
(2.343 - 2.401")

Spring resistance L = 45 mm: 410-471 N
(92 - 106 lbs.)

Spring resistance L = 33,5 mm: 744-825 N
(167 - 185 lbs.)

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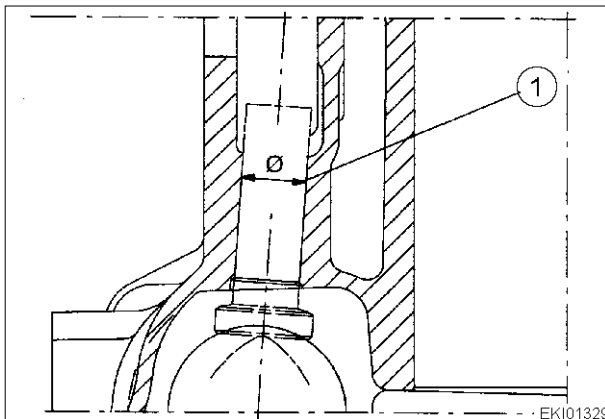
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Valve operation

EKI01328

Rocker arm

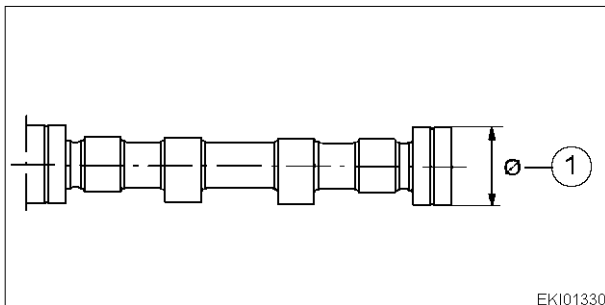
1. 20,000-20,001 mm (.78740 - .78744")
Diameter of rocker arm bearing: 19,957-19,970 mm (.7857 - .7862")
Wear limit: 0,08 mm (.003")



EKI01329

Valve tappets

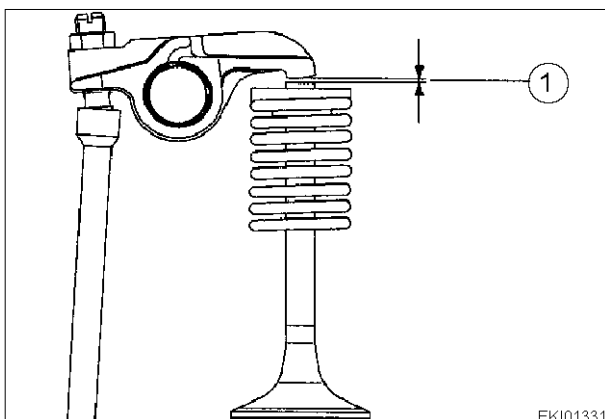
1. Tappet housing bore:
Standard size: 20,000-20,021 mm (.787 - .788")
Oversize: 20,250-20,271 mm (.797 - .798")
Tappet outer diameter:
Standard size: 19,944-19,965 mm (.785 - .786")
Oversize: 20,194-20,215 mm (.795 - .796")



EKI01330

Camshaft

- Camshaft bush inner diameter: 55,07-55,14 mm (2.168 - 2.170")
1. 54,91-54,94 mm (2.162 - 2.163")
Camshaft axial diameter: 0,14-0,27 mm (.0055 - .0106")
Wear limit: 1,5 mm (.059")



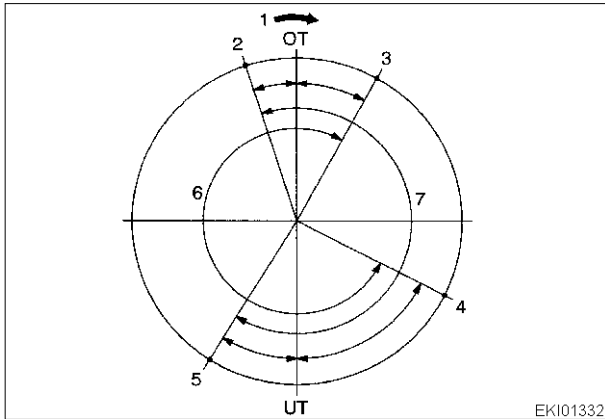
EKI01331

Valve clearance

1. Adjust when engine is cold.
Intake valve: 0,5 mm (.020")
Exhaust valve: 0,5 mm (.020")

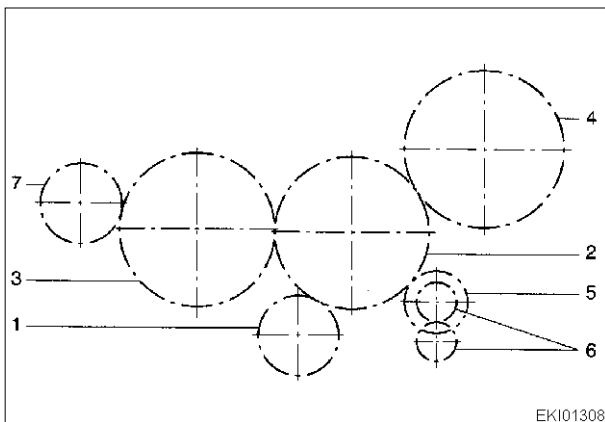
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Valve timing

1. Engine direction of rotation
 2. Intake valve opens 18° before TDC.
 3. Exhaust valve closes 29° after TDC.
 4. Exhaust valve opens 63° before TDC.
 5. Intake valve closes 32° after bottom dead point.
 6. Exhaust valve opening point 272°.
 7. Intake valve opening point 230°.
- Figures in degrees relate to the crankshaft angle.



Layout of engine timing

1. Crankshaft gear
2. Intermediate timing gear
3. Camshaft gear
4. Injection pump drive gear
5. Oil pump drive gear
6. Oil pump delivery gear
7. Power take off / air compression take off

Backlash between

Crankshaft gear and intermediate gear	0,000-0,465 mm (0 - .018")
Intermediate gear and crankshaft gear	0,062-0,324 mm (.002 - .013")
Intermediate gear and injection pump drive	0,10-0,27 mm (.004 - .010")
Intermediate gear and oil pump drive	0,100-0,266 mm (.004 - .010")
Oil pump delivery gears	0,10-0,22 mm (.004 - .009")
Camshaft gear and hydraulic pump gear	0,10-0,15 mm (.004 - .006")

Compression pressures

good	above 30 bar (435 PSI)
permissible	27 - 30 bar (391 - 435 PSI)
needs repairing	under 26 bar (377 PSI)
pressure difference	max. 4 bar (58 PSI)

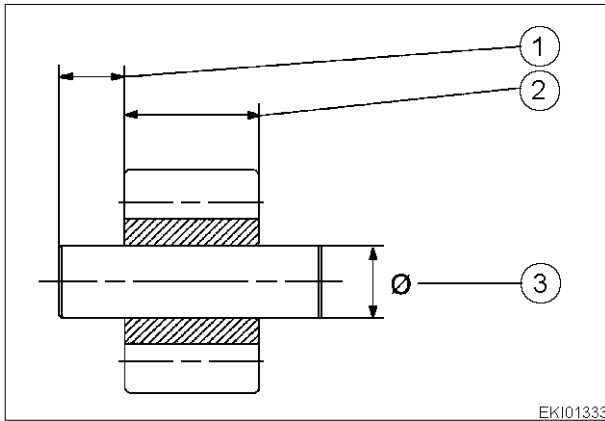
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Engine lubrication

Valve opening pressures	
Bypass valve for full flow oil filter	2-3 bar (29 - 44 PSI)
Oil pump pressure relief valve	5-6 bar (73 - 87 PSI)
Pressure valve of oil nozzles	
Opening pressure	1,9-2,1 bar (27.5 - 30.5 PSI)
Closing pressure	1,4-1,6 bar (20.3 - 23.2 PSI)
Oil splash nozzle orifice	1,75-1,85 mm (.069 - .073")

Oil pump



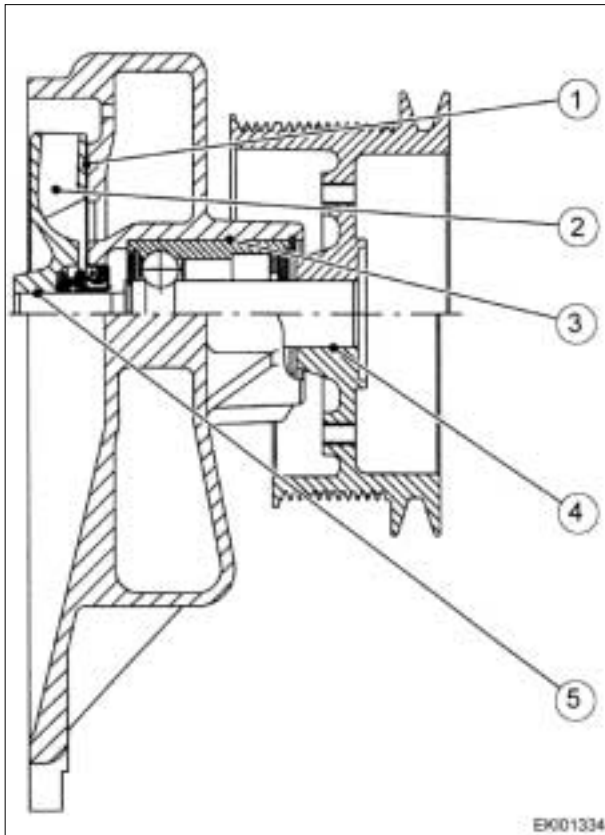
Oil pump drive gear

- 1. 16 mm (.630")
- 2. D 0836 LE 501/502: 31,925-31,950 mm (1.257 - 1.258")
- D 0836 LE 503/504: 31,920-31,950 mm (1.257 - 1.258")
- Housing depth: 32,000-32,039 mm (1.260 - 1.261")
- Housing bore: 10000 N
- 3. Shaft: 15,94-15,95 mm (.627 - .628")
- Housing bore: 16,000-16,018 mm (.630 - .631")

Oil pump delivery at pump speed (with SAE 20W/20 Oil, at 90°C (194°F) and p=6bar (87 PSI))	
Gear spread 32 mm (1.260")	
at n = 1008 1/min (rpm 800 1/min)	17 ltr./min (4.5 GPM)
at n = 2709 1/min (rpm 2150 1/min)	53,5 ltr./min (14 GPM)
at n = 2835 1/min (rpm 2250 1/min)	56,5 ltr./min (15 GPM)
at n = 2961 1/min (rpm 2350 1/min)	59 ltr./min (15.5 GPM)
at n = 3087 1/min (rpm 2450 1/min)	62,5 ltr./min (16.5 GPM)

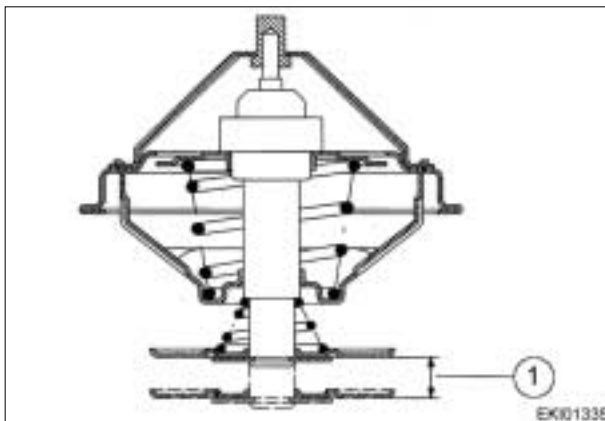
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Cooling system



Water pump (engine)

1. Gap between impeller and housing: 0,5-0,9 mm (.020 - .035")
2. Impeller diameter: 136 mm (5.354")
3. Bearing location in housing: 54,940-54,970 mm (2.163 - 2.164").
Bearing diameter: 54,981-54,994 mm (2.1646 - 2.1651")
4. Bore in hub: 25,000-25,013 mm (.984 - .985").
Bearing shaft diameter: 25,048-25,061 mm (.986 - .987").
5. Impeller bearing shaft bore: 16,000-16,018 mm (.630 - .631").
Bearing shaft diameter : 16,045-16,056 mm (.6316 - .6321).



Thermostat

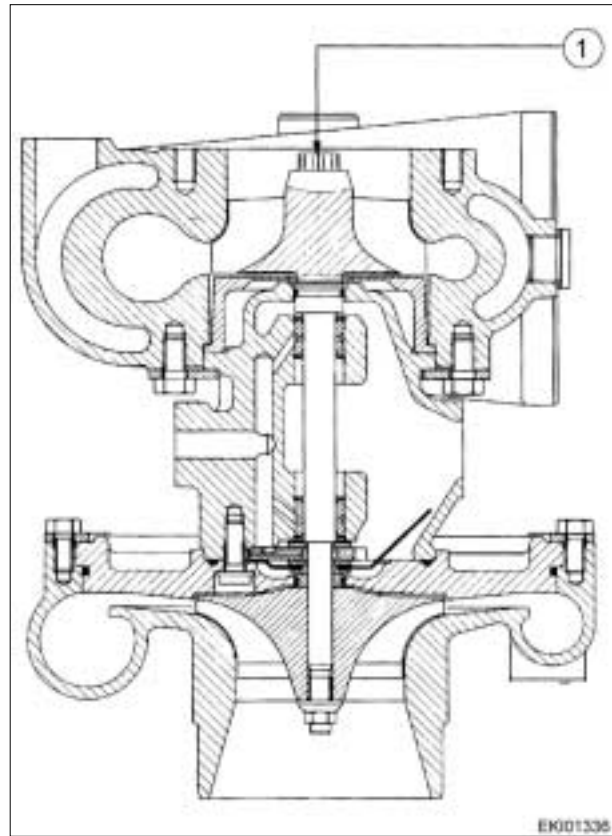
- Opening at 83°C (±2°) (181°F ±3.6°F).
Fully open: 95°C (203°F).
1. Stroke: min 8 mm at 95°C (.315" at 203°F).

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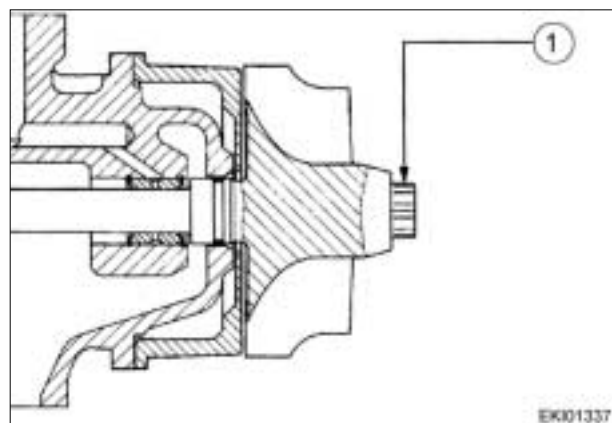
Turbocharger

Manufacturer D 0836 LE 501/502/503/504	KKK HX40-8274AW/H18WA8
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Axial play

- 1. 0,038-0,093 mm (.0015 - .0037")



Radial play

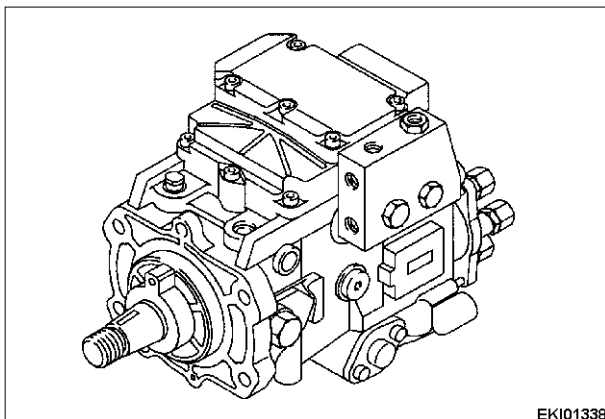
- 1. 0,329-0,501 mm (.0130 - .0197")

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Fuel system**Injection nozzles**

Manufacturer Type : N° of orifices Nozzle opening pressure : Nozzle holder new : Nozzle holder used : Nozzle injection pump with vane-cell feed pump and automatic pressure controlled injection timer Nozzle holder	Bosch DSLA 154 P 625 6 320 + 8 bar (4641 +116 PSI) 300 + 8 bar (4351 +116 PSI) 2,68-3,47 mm (.106 - .137") KDEL 82 P 55
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EKI01338

Injection pump

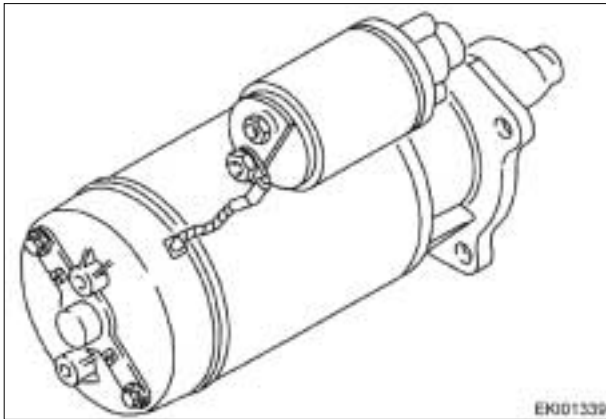
Nozzle injection pump with vane pump and automatic pressure controlled injection timer

Manufacturer : Bosch.

Type: VP 44.

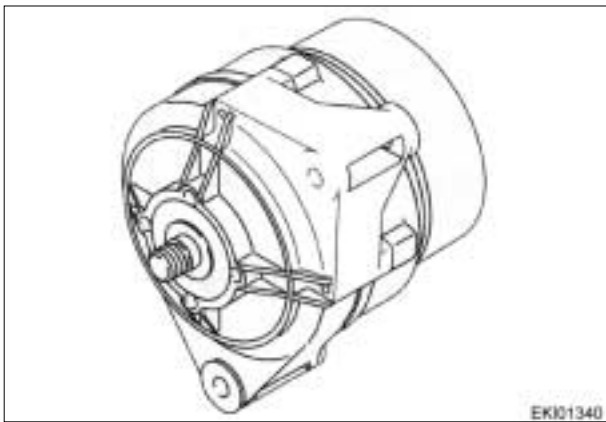
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Starter

Manufacturer : Bosch
 Type : EV
 operating method : pre-engaged drive
 Starter pinion gear
 Number of teeth: 11
 Module: 3
 Nominal voltage: 24 Volt
 Nominal output : 4 kW (5.36 HP)

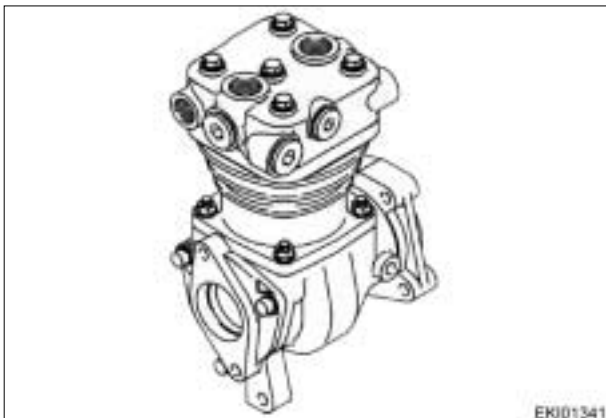


Generator

Manufactured : Bosch
 Type : KC
 Operating method : 3_PHASE
 Nominal voltage : 14 Volt
 Max. current : 45-90 Ampere

Power take-off for hydraulic pump / Air compressor

Speed	0,97 * engine speed
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Air compressor

Single cylinder air compressor
 Manufacturer: Knorr
 Lubrication: Circulatory system with pressure compression
 Cooling: air-cooled
 Displacement: 213 cm³ (129 in³)
 Op speed: max. 3000 1/min
 Op pressure: max 12,5 bar (181 PSI)

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Fav 900	Engine / Generalities Tightening Torque values	A
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Note:

All threaded unions not specified in this table must be tightened according to our works standard M 3059. Bolts and screws must be lightly oiled before tightening !

Plugs

DIN 908	
M 14*1,5; M16*1,5	80 Nm (59,00 lbf-ft)
M 18*1,5; M22*1,5	100 Nm (73,76 lbf-ft)
M 24*1,5; M26*1,5	120 Nm (88,51 lbf-ft)
M 30*1,5	150 Nm (110,63 lbf-ft)
DIN 7604	
AM 10*1; M12*1,5	50 Nm (36,88 lbf-ft)
AM 14*1,5	80 Nm (59,00 lbf-ft)

Crankcase, crank gear

Crankshaft bearing cap on and crankcase	
Initial torque	115 Nm (84,82 lbf-ft)
Angular torque	90-100°
Damper on crankshaft M14*1,5 10,9	
Initial torque	150 Nm (110,63 lbf-ft)
Angular torque	90-100°
Damper on crankshaft M14*1,5 12,9	
Initial torque	150 Nm (110,63 lbf-ft)
Angular torque	90-100°
Angular torque	90-100°
Flywheel on crankshaft	
Initial torque	100 Nm (73,76 lbf-ft)
Angular torque	90-100°
Con-rod bearing caps	
Initial torque	50-60 Nm (36,88-44,25 lbf-ft)
Angular torque	90-100°

Cylinder head

For tightening and retightening of cylinder head bolts see following page	
Lock nut for valve adjusting screw	40 Nm (29,50 lbf-ft)
Cheese-head screws with hexagonal socket for bolts of intermediate gear	115 Nm (84,82 lbf-ft)
Collar screw for crankshaft	65 Nm (47,94 lbf-ft)
Rocker socket (Torx E12)	65 Nm (47,94 lbf-ft)

Lubrication

Oil pressure valve for piston spray nozzle	38-42 Nm (28,03-30,98 lbf-ft)
Oil pump drive gear on shaft	30 Nm (22,13 lbf-ft)
Screw plug for pressure relief valve in crankcase	60 Nm (44,25 lbf-ft)
Oil pan drain plug	60 Nm (44,25 lbf-ft)
Screw plug for oil filter head (M 10*1)	20 Nm (14,75 lbf-ft)
Threaded coupling for oil filter	40 Nm (29,50 lbf-ft)
Screw plug in oil filter (M 18*1,5)	30 Nm (22,13 lbf-ft)
Screw plug in oil filter (M 24*1,5)	30 Nm (22,13 lbf-ft)
Screw plug in oil filter (M 30*1,5)	40 Nm (29,50 lbf-ft)
Oil change filter	25 Nm (18,44 lbf-ft)

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Cooling system

Screw plug in coolant pipe (M14*1,5)	20 Nm (14,75 lbf-ft)
Hose clips :	
Clamping range 12 to 31 mm, 9 mm wide	3,6 Nm (2,66 lbf-ft)
over 32 mm, 13 mm wide	5 Nm (3,69 lbf-ft)

Exhaust / Intake manifolds

Exhaust manifold on cylinder head	
Initial torque	50-55 Nm (36,88-40,75 lbf-ft)
Angular torque	90-100°
Banjo bolt of solenoid valve	10-15 Nm (7,38-11,06 lbf-ft)
Knuckle pin clap of turbocharger	12 Nm (8,85 lbf-ft)

Fuel system

Nozzle holder in cylinder head	70 Nm (51,63 lbf-ft)
Nozzle adjusting nut	45 Nm (33,19 lbf-ft)
Banjo bolt for leak oil	10-12 Nm (7,38-8,86 lbf-ft)
Pressure line at nozzle	
Initial torque	10 Nm (7,38 lbf-ft)
Angular torque	60°
Banjo bolt on oil filter	20-30 Nm (14,75-22,13 lbf-ft)
Fuel filter	10-15 Nm (7,38-11,06 lbf-ft)
Purge plug on fuel filter	8-10 Nm (5,90-7,38 lbf-ft)

Starter / Alternator / Compressor

Alternator pulley	75-85 Nm (55,32-62,69 lbf-ft)
Compressor drive gear	200-250 Nm (147,51-184,39 lbf-ft)

Sensors

Oil pressure sensor	80 Nm (59,00 lbf-ft)
Temperature sensor switch	15 Nm (11,06 lbf-ft)
Coolant Temperature sensor (EDC)	35 Nm (25,82 lbf-ft)

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Assembly tightening torques to works standard M 3059

External or internal hexagon nuts and bolts, heads without collar or flange.

Tread size * Pitch	Property class / Tightening torque in Nm (lbf-ft)		
	at 8,8/8	at 10,9/10	at 12,9/12
M4	2,5 (1,84)	4,0 (2,95)	4,5 (3,32)
M5	5,0 (3,69)	7,5 (5,53)	9,0 (6,64)
M6	9,0 (6,64)	13,0 (9,59)	15,0 (11,06)
M7	14,0 (10,33)	20,0 (14,75)	25,0 (18,44)
M8	22,0 (16,23)	30,0 (22,13)	35,0 (25,81)
M8*1	23,0 (16,96)	35,0 (25,81)	40,0 (29,50)
M10	45,0 (33,19)	65,0 (47,94)	75,0 (55,32)
M10*1,25	45,0 (33,19)	65,0 (47,94)	75,0 (55,32)
M10*1	50,0 (36,88)	70,0 (51,63)	85,0 (62,62)
M12	75,0 (55,32)	105,0 (77,44)	125,0 (92,20)
M12*1,5	75,0 (55,32)	110,0 (81,13)	130,0 (95,88)
M12*1,25	80,0 (59,00)	115,0 (84,20)	135,0 (99,57)
M14	115,0 (84,20)	170,0 (125,39)	200,0 (147,51)
M14*1,5	125,0 (92,20)	185,0 (136,45)	215,0 (158,58)
M16	180,0 (132,76)	260,0 (191,77)	310,0 (228,64)
M16*1,5	190,0 (140,14)	280,0 (206,52)	330,0 (243,40)
M18	260,0 (191,77)	370,0 (272,90)	430,0 (317,15)
M18*2	270,0 (199,14)	290,0 (213,89)	450,0 (331,90)
M18*1,5	290,0 (213,89)	410,0 (302,40)	480,0 (354,03)
M20	360,0 (265,52)	520,0 (383,53)	600,0 (442,54)
M20*2	380,0 (280,27)	540,0 (398,28)	630,0 (464,66)
M20*1,5	400,0 (295,02)	570,0 (420,41)	670,0 (494,17)
M22	490,0 (361,40)	700,0 (516,29)	820,0 (604,80)
M22*2	510,0 (376,16)	730,0 (538,42)	860,0 (634,30)
M22*1,5	540,0 (398,28)	770,0 (567,92)	900,0 (663,80)
M24	620,0 (457,29)	890,0 (656,43)	1040,0 (767,06)
M24*2	680,0 (501,54)	960,0 (708,06)	1130,0 (833,44)
M24*1,5	740,0 (545,8)	1030,0 (759,69)	1220,0 (899,82)

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Cylinder head bolts

Tightening cylinder head bolts following repair work (new engine)

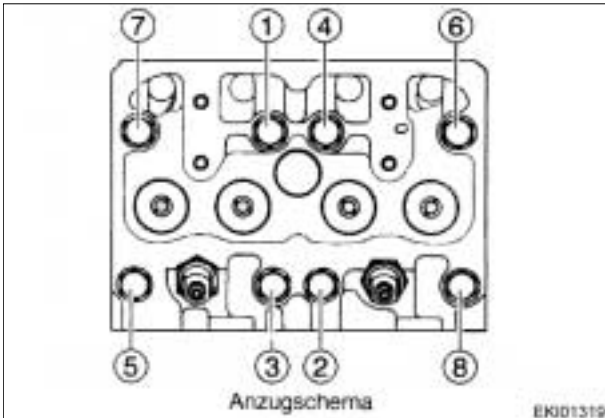
Only for Torx-head screws.

No tightening for Torx-head screws.

Tightening cylinder head bolts following repair work

(cold engine)

Only for Torx-head screws.



Note:

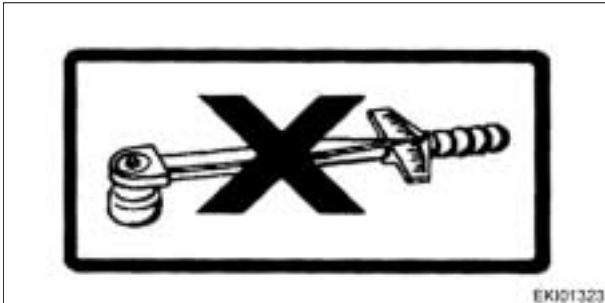
Only use new cylinder head bolts. do not re-use.

before inserting bolts, lubricate threads (not the tapped bores) and the bolt heads with "Optimoly White T" paste. Do not use oils or additives containing MoS₂-h. Tighten bolts by the torque angle method following the diagram :

- 1.st initial stage = 10 Nm (7,38 lbf-ft).
- 2.nd initial stage = 80 Nm (59,00 lbf-ft).
- 3.rd initial stage = 150 Nm (110,63 lbf-ft).
- 4.tth initial stage = 90°.
- 5.th initial stage = 90°.
- Final stage = 90°.

Adjust valve play

Put on sticker number 51.97801-0150.



Tightening cylinder head bolts following repair work

Only for Torx-heads.

No tightening for Torx-head screws.

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Fav 900	Engine / General system Turbocharger, troubleshooting	B
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Before replacing the turbocharger, check the following:

Excessive engine oil consumption, lack of power and abnormal intake or exhaust noises are a frequent cause of unnecessary turbocharger replacement.

Examination of the allegedly defective parts by the manufacturer often shows the turbocharger to be in perfectly good working order.

To avoid this situation, the following checks must be performed :

Excessive oil consumption

- Check air filter contamination
- Check intake pipe for restricted cross section (e.g. damage, dirt)

Either are possible causes for increased oil consumption due to the higher pressure.

- Check turbocharger for external traces of oil

Excessive oil consumption of the turbocharger is due to bearing wear, quickly resulting in mechanical damage.

Lack of power

For satisfactory power, observe correct settings for:

- start of fuel delivery
- valves clearance
- engine control (at full load)
- exhaust brake (must open fully).

Also check:

- Cylinder compression
- air filter contamination
- intake system for restricted cross sections and leaks
- exhaust system for damage and leaks.

If none of these checks reveal the cause of poor performance, the turbocharger has to be also checked for:

- Coking of turbine impedes easy rotation. (Axial movement may release coking.)
- Dirt within compressor
- Damage by foreign objects
- Turbine wheel in contact with housing

Remove visible contamination of compressor side and check bearing clearance.

Note:

Do not damage the compressor fan wheel.

Abnormal intake and exhaust noises

- Check intake and exhaust system adjacent to the turbocharger assembly. Damaged gaskets must be replaced (can mislead to failure diagnostic of turbocharger).
- If this does not eliminate the abnormal noises, the turbocharger is to be replaced. (A turbocharger in good condition does not generate noise!)

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Fav 900	Engine / General system Turbocharger, troubleshooting	B
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Oil in intake pipes and intercooler

Oilspray within the intake system is necessary. It lubricates inlet valve seats.

If too much oil is encountered to such an extent that puddles can be found within the air box of the intercooler, there is a serious risk of engine "runaway", an uncontrolled increase of engine speed .

Leaks must immediately be removed.

Possible origins:

- Engine oil level too high - Check whether proper dipstick is used -
- Inadequate engine oil, check "Lubricants " schedule.
- Operation on not allowed high slanting angles
- High pressure within crankcase, e. g. Oil release valve failure (Crank case venting) or worn piston rings

Turbocharger compressor coking

Can occur by excessive intake air temperature, e.g. during constant full load operation.

Coking may result in reduced intake air pressure, there will not be a noticeable power reduction or a diminished acceleration behavior. Coking may result in exhaust turbidity.

If Turbocharger compressor coking occurs:

- Disassemble compressor housing. Avoid compressor fan wheel damage which could result in balancing problems and strong vibrations until complete destruction of the turbocharger.
- Use a solvent to remove coking from the compressor housing



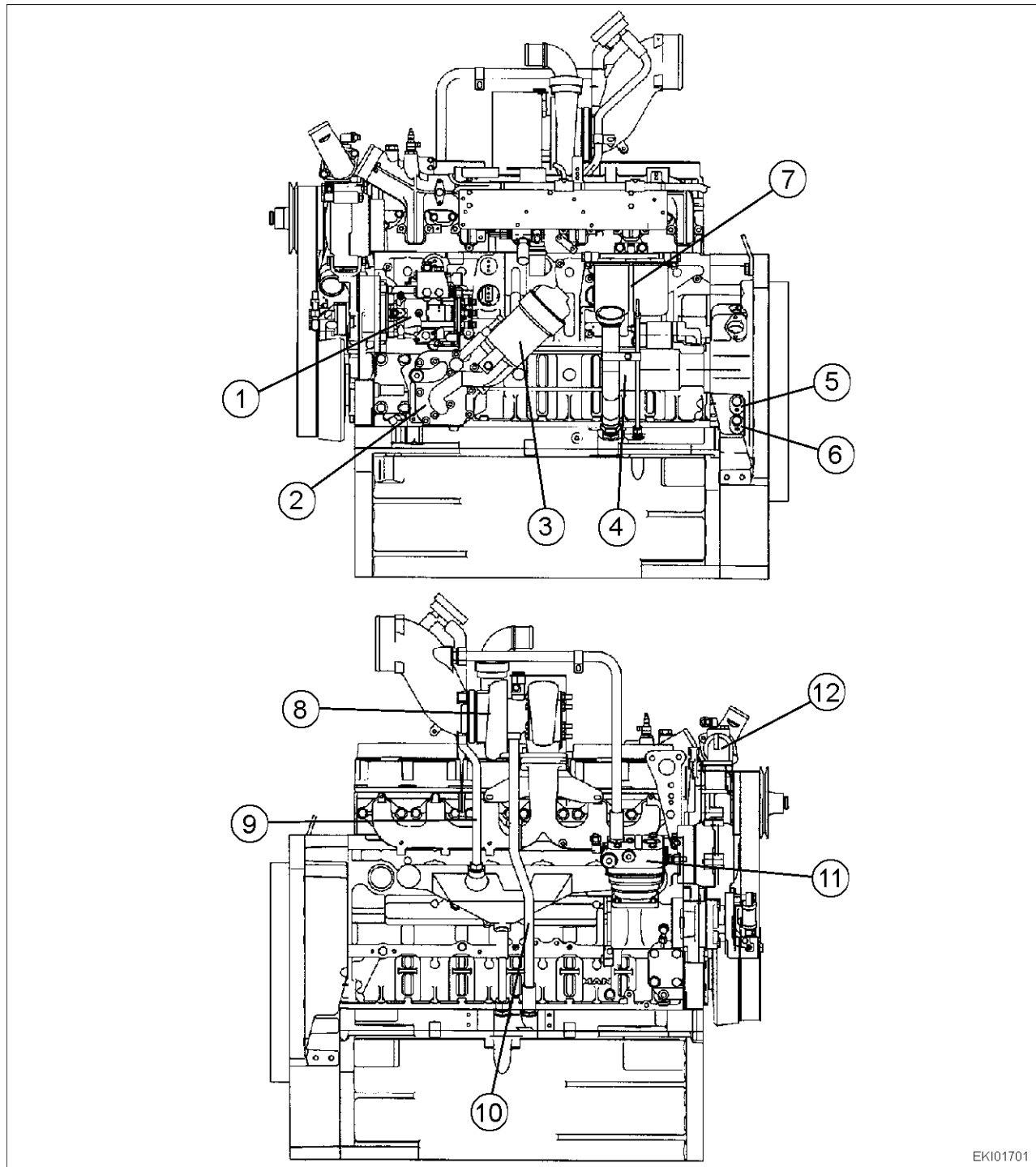
Warning:

Never inject solvent spray while the engine is running - Accident Hazard !!! -

- In severe cases, use special oil with low coking risk.

Date	Version	Page	Capitel	Index	Docu-No.	
15.2.2001	a	2/2	Turbocharger, troubleshooting	2000	B	000003

Fav 900	Engine / Generalities View of engine D 0836 LE 501	D
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EKI01701

1 Fuel injection pump (VP44)	7 Fuel filters
2 Lubricant cooler	8 Turbocharger
3 Lubricant filter	9 Lubrication oil turbocharger (pressure)
4 Oil filling socket, Oil level indicator	10 Lubrication oil return from turbocharger
5 B10 - Sensor, Engine 1	11 Air compressor
6 B11 - Sensor, Engine 2	12 Thermostat

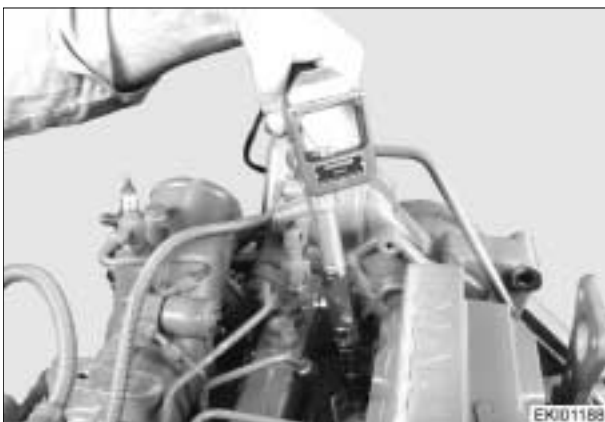
Date	Version	Page	View of engine D 0836 LE 501	Capitel	Index	Docu-No.
09/03/2001	a	1/1		2000	D	000003

Fav 900	Engine / Cylinder head Checking compression	E
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- Warm up engine until coolant temperature reaches 60 to 80°C (140 - 176°F).
- Check valves clearance and adjust.
- Remove all injectors and injector holders.
- See values of compression in chapter "Service Data".

Starting with the 1st cylinder, fit new seal and tighten. Install test adaptor of compression recorder with threaded union and tighten.



Screw compression recorder onto test adaptor and insert test sheet.

Using the starter motor, turn engine until the indicator no longer deflects.

Connect compression recorder with test adapter to the other cylinders and proceed as above.



Depending on the design of the compression recorder, the engine can also be cranked directly from the compression recorder.

To do this, the starter has to be connected to the appropriate electrical leads.



Compare data and remove compression recorder and test adapter. Apply "Never Seeze" to contact faces of injector holders.

Fit injector holder and injectors using a new seal. Screw on union nut and tighten to specified torque.

Re-connect injection and leak-oil lines.

Note:

The union nut can be tightened with an open end wrench without removing the injection pipe.

Date	Version	Page	Checking compression	Capitel	Index	Docu-No.
20.2.2001	a	1/1		2010	E	000001

Fav 900	Engine / Cylinder head Checking valve timing	F
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Checking valve timing

Shifting of the camshaft drive gear can result in severe engine damage.

It is therefore necessary to ensure a correct fit by checking the valve timing after repair.

The above takes into consideration that tappet push rods are not distorted!

Proceed as follows:

- Fit engine actuation device to flywheel housing.
- Remove crankcase venting pipe.
- Accurately set valve play of 1st cylinder.
- Actuate engine against rotating direction to approx. 40°C before TDP.
- Set dial gauge onto intake valve spring retainer of 1st cylinder and set at "0".
- Slowly turn crankshaft in rotating direction and watch the pointer:
- Immediately when the pointer moves, the intake valve opens.
- Take reading from graded scale on flywheel and compare with valve timing.

Note:

By fitting a dial gauge to both intake and exhaust valve spring retainers of the 1st cylinder, it is possible to check all valve timings and the valve stroke by continued turning of the engine. Valve stroke desired value: 5,0 to 5,7 mm (.197 - .224").

Date	Version	Page	Capitel	Index	Docu-No.	
20.2.2001	a	1/1	Checking valve timing	2010	F	000002

Fav 900	Engine / Cylinder head Setting valve clearance	F
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Engine must be cold for adjusting valve clearance.
(max. coolant temperature 50° C (122°F))
Setting valve clearance.

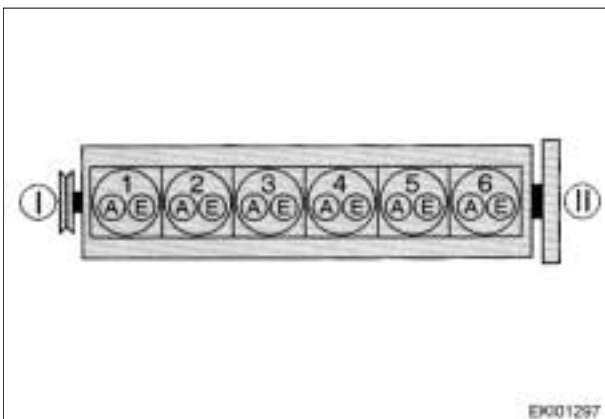


Rotate crankshaft using turning device until the piston of the cylinder to be set is at top dead centre (TDC) and the rocker arms are not loaded.
The valves of the synchronous cylinder are now overlapping.

Setting valves clearance:

1	5	3	6	2	4
6	2	4	1	5	3

Valves overlap on cylinder:



Layout of cylinder sequence and position of valves
I Fan end
II Flywheel end
A Exhaust valve
E Intake valve

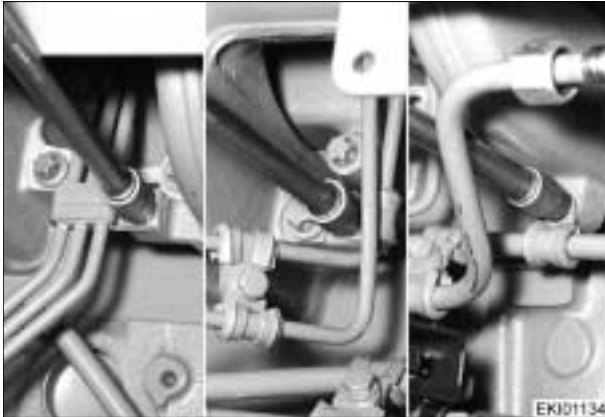
Fav 900	Engine / Cylinder head Setting valve clearance	F
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- Insert gauge between valve shaft and rocker .
- With valve setting tool loosen lock nut and turn setting screw until gauge can be moved with a slight resistance.
- Tighten lock nut.
- Check clearance again.
- Refit cylinder head covers.
- Tighten screws and bolts to adequate torque.

Date	Version	Page	Setting valve clearance	Capitel	Index	Docu-No.
15.2.2001	a	2/2		2010	F	000003

Fav 900	Engine / Cylinder head Reassembling and refitting intake pipe	G
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Removing intake pipe

Note:

To avoid engine damage, always ensure clean conditions when working on intake system.

- Disconnect pressure sensor for intercooler
- Disconnect wiring to flame booster plug, to solenoid switch and to the temperature sensors.
- Remove fuel lines to flame booster plug and to solenoid valve.
- Remove wiring harness.
- Remove fuel filter.
- Remove fuel pre filter with manual lifting pump
- Remove collars of the injection lines and of the fuel lines which are fitted onto the intake manifold.

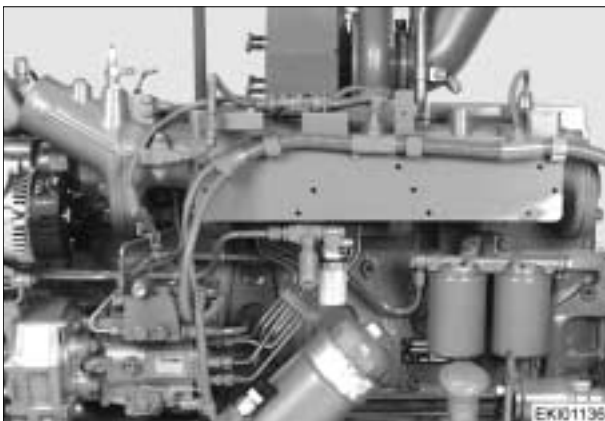


Loose and remove intake pipe fixing bolts on the cylinder head.

Detach intake pipe, remove traces of gasket residue from sealing faces of intake pipe and cylinder head.

Note:

Do not allow dirt particles to enter the inlet ports.



Refitting intake pipe

Position intake pipe using new gaskets.

Insert fixing bolts.

Watch proper positioning of the gasket.

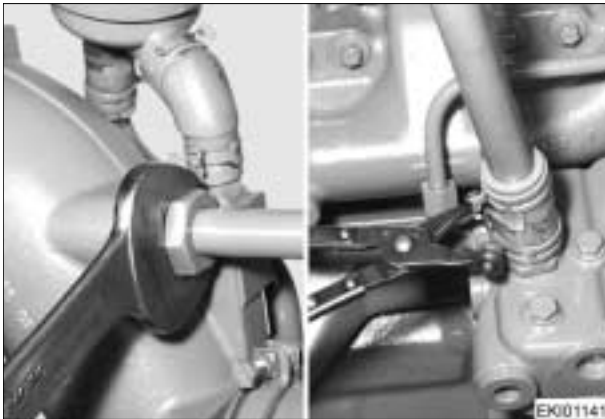
Tighten to specified torque.

replace all parts which have been removed before

Purge fuel system.

Date	Version	Page	Reassembling and refitting intake pipe	Capitel	Index	Docu-No.
15.2.2001	a	1/1		2010	G	000002

<p>Fav 900</p>	<p align="center">Engine / Cylinder head Removing and refitting turbocharger</p>	<p align="center">G</p>
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Removing turbocharger

Remove crankcase venting (pressure control valve).

Remove air intake pipe from compressor to intake manifold.

Remove air intake manifold.



Remove oil return line and feed line.



Remove heat protection panel



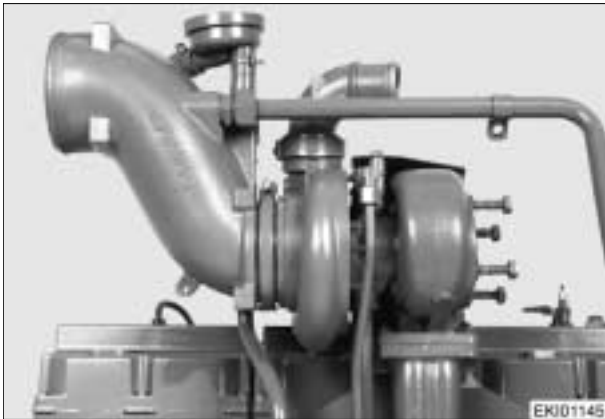
Unscrew the turbocharger.

Remove turbocharger.

Note:
Shut all inlet and outlet ports in order to prevent particle contamination.

Date	Version	Page	Removing and refitting turbocharger	Capitel	Index	Docu-No.
15.02.2001	a	1/2		2010	G	000004

Fav 900	Engine / Cylinder head Removing and refitting turbocharger	G
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Refitting the turbocharger

Check intake pipe and exhaust manifold for eventual foreign objects.

Examine oil feed and return lines for eventual damage, jamming and leaks.

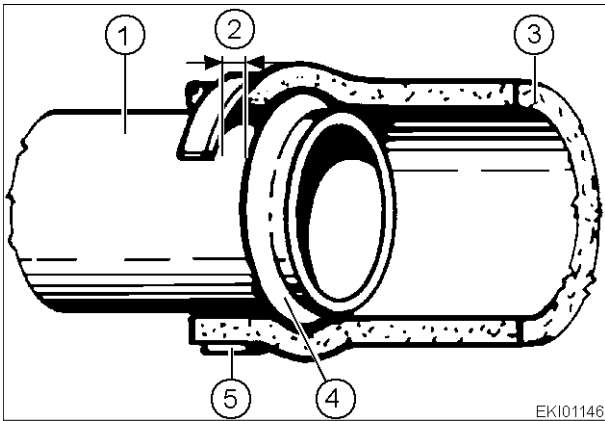
Replace all gaskets.

Refitting the turbocharger occurs in the inversed sequence as the removing

For refitting use new gaskets and new locking nuts.

Before connecting oil feed line, fill bearing case with clean engine oil.

Check all connection for tightness and absence of mechanical stress.



Note:

The clamped section of the hose must always be behind the collar of the hose.

- 1. Pipe
- 2. Gap
- 3. Hose
- 4. Collar
- 5. Hose clip

Note:

Use only clean water as a lubricant.

Date	Version	Page	Removing and refitting turbocharger	Capitel	Index	Docu-No.
15.02.2001	a	2/2		2010	G	000004

Fav 900	Engine / Cylinder head Removing and refitting exhaust manifold	G
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Removing the exhaust manifold

Remove turbocharger.

Note:

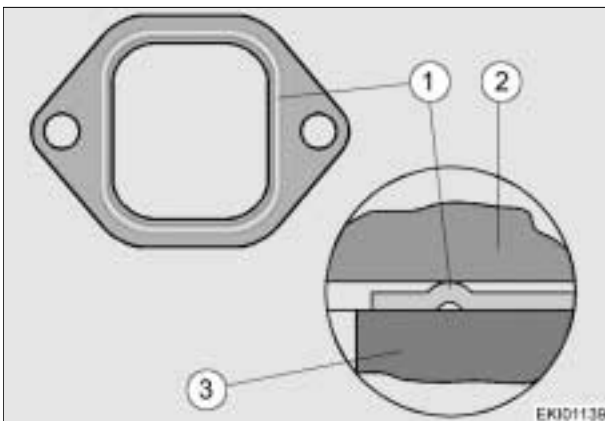
Protect exhaust port on turbocharger from contamination.

Unscrew and remove nuts from exhaust manifold.



Guidance pins (visible on photograph) may be used.

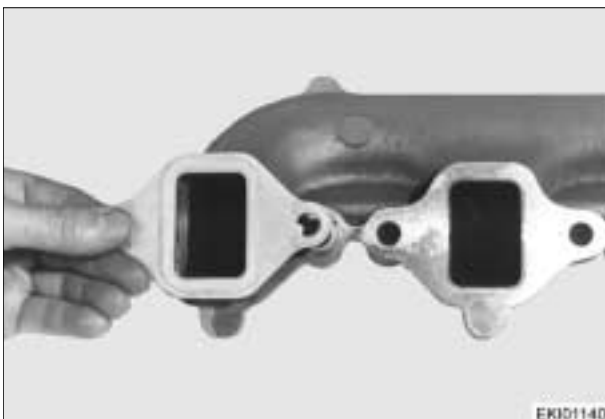
Remove manifold.



Refitting the exhaust manifold

Clean sealing faces of both, cylinder head and manifold.

Bumped side (1) of gasket facing the cylinderhead (2), depression facing the manifold (3).



Insert screws and tighten to adequate torque.

Refit the turbocharger.

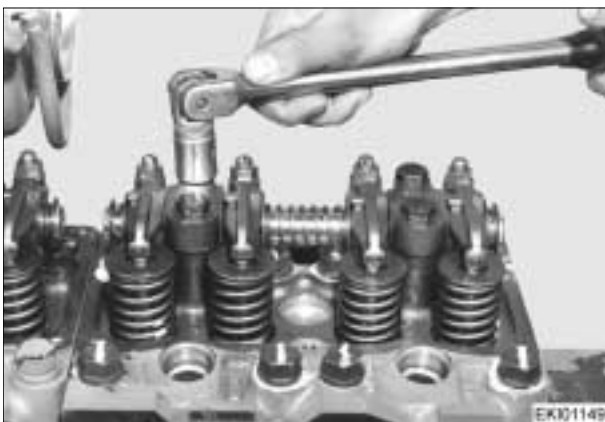
Date	Version	Page	Removing and refitting exhaust manifold	Capitel	Index	Docu-No.
15.02.2001	a	1/1		2010	G	000003

<p>Fav 900</p>	<p align="center">Engine / Cylinder head Removing and refitting cylinder head</p>	<p align="center">G</p>
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Removing the rocker

Remove cylinder head cover.



Loosen clamping bolts and remove rocker arm. Dismantling, overhauling and reassembling rocker assembly.

Removing the cylinder head

- Drain coolant,
- remove lines from injection nozzles,
- Remove intake pipe,
- Remove exhaust manifold,
- Remove coolant pipe.



Remove push rods.



Loosen cylinder head bolts in reverse sequence of tightening (for tightening torque values refer to chap 2000 Reg A).

Note:

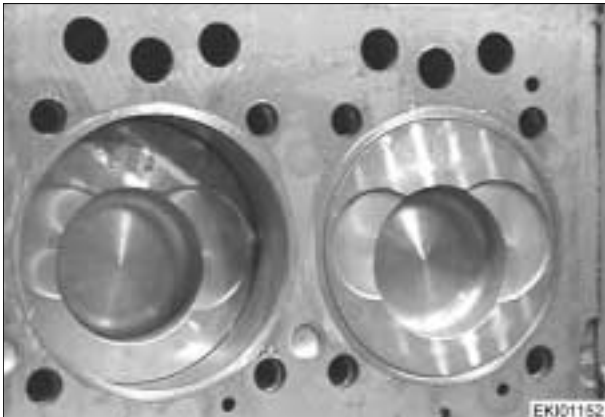
Cylinder head bolts must not be re-used.

Remove cylinder head and lay down in such way to prevent damage.

Remove cylinder head gasket.

Date	Version	Page	Removing and refitting cylinder head	Capitel	Index	Docu-No.
16.02.2001	a	1/4		2010	G	000006

<p>Fav 900</p>	<p align="center">Engine / Cylinder head Removing and refitting cylinder head</p>	<p align="center">G</p>
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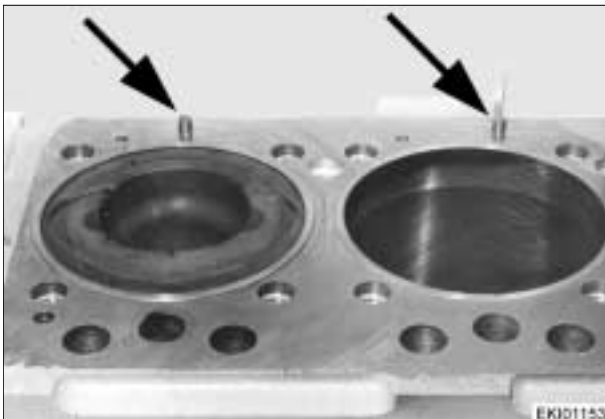


Before refitting the cylinder head :

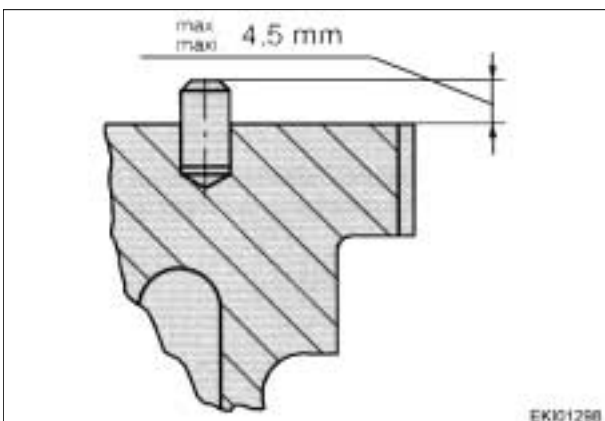
- Clean all the parts which have been removed.
- Clean sealing faces of cylinder head and crankcase, and blow out tapped holes in crankcase.
- In the event of repeated leaking, use the straight edge to check the sealing faces of crankcase and cylinder head for distortion.
- Uneven cylinder heads can be surface ground by up to 1 mm.
- Remachined sealing surfaces are measured in relation to the bore centre of the crankshaft bearing.

Note:

Sealing surface of the cylinder head and crankcase may only be cleaned manually by scraper and slight sandpaper on a polishing block.



Insert two 6h 8x10 DIN 7 straight pins per head into the leading surface of the crankshaft housing to locate the cylinder heads



If these straight pins need replacing, observe the max. projection of 4,5mm.

Date	Version	Page	Removing and refitting cylinder head	Capitel	Index	Docu-No.
16.02.2001	a	2/4		2010	G	000006

<p>Fav 900</p>	<p align="center">Engine / Cylinder head Removing and refitting cylinder head</p>	<p align="center">G</p>
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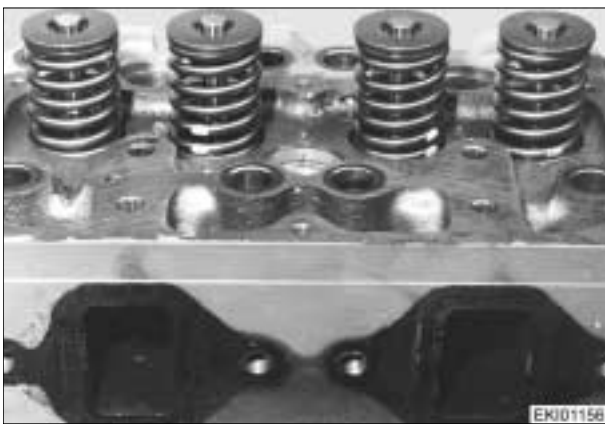


Refitting the cylinder head

Note:

Cylinder head gasket must always be replaced.

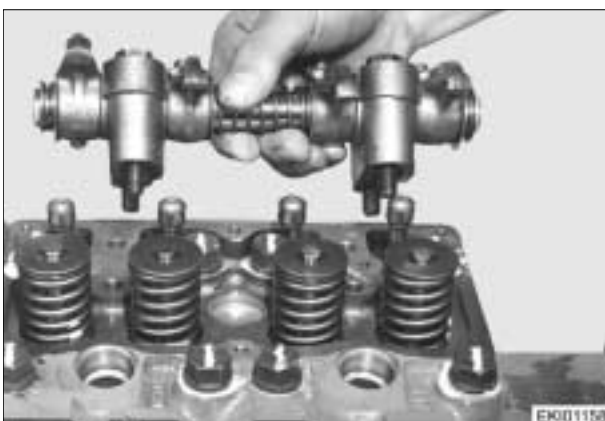
Install a dry new gasket carefully positioned according to the hole pattern . Fit cylinder head.



Note:

To prevent distortion between cylinder heads and manifolds, we recommend the following steps :

- Refit cylinder heads using guidance bolts.
- Oil the new cylinder head bolts and their rest surface with "Optimoly Withe T" paste.
- Hand tighten new cylinder head bolts.
- Mount rectified ruler (Special tool) onto the exhaust side. Tighten screws at 20 Nm. If no ruler is available, fit exhaust pipe and tighten at 20 Nm.
- Tighten progressively cylinder head bolts in the indicated sequence at the prescribed torque.
- Remove the rectified ruler.



Refitting the rocker assembly

Check push rods for distortion and wear in the ball sockets.

When inserting the push rods ensure correct fit in the socket of the valve tappets.

Fit rocker arm bracket.

Date	Version	Page	Removing and refitting cylinder head	Capitel	Index	Docu-No.
16.02.2001	a	3/4		2010	G	000006

Fav 900

**Engine / Cylinder head
Removing and refitting cylinder head**

G

Tighten bolts slightly and align rocker arms with valves.

Subsequently tighten bolts to specified torque.



- Set valve clearance, chap 2010 Reg F
- Refit coolant pipe,
- Refit exhaust manifold,
- Refit intake pipe,
- Refit the injectors lines.



Refit cylinder head cover with a dry new gasket. Insert screws and tighten.

Fill up with coolant.

Tighten cylinder head bolts once more.

Date	Version	Page	Capitel	Index	Docu-No.
16.02.2001	a	4/4	2010	G	000006

Fav 900	<p align="center">Engine / Cylinder head</p> <p align="center">Dismantling and reassembling the rocker arm assembly</p>	<p>G</p>
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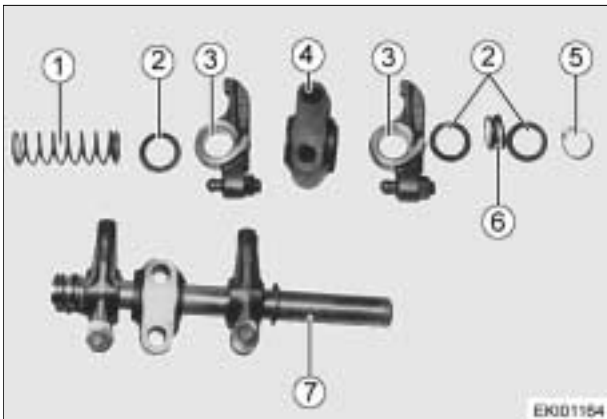


Dismantling the rocker arm assembly

Remove rocker arm assembly
 Clamp rocker bearing bracket in a vise (use non-metallic jaws).



Remove circlip.



Remove parts separately from the rocker shaft.

- 1 Central spring
- 2 Stop washer
- 3 Rocker arm
- 4 Rocker bearing bracket
- 5 Circlip
- 6 Outside spring
- 7 Rocker shaft



Note:
 If the rocker bearing bushes need replacing, use new or reconditioned ready-to-install rocker arms.

Date	Version	Page	Capitel	Index	Docu-No.	
19.02.2001	a	1/2	Dismantling and reassembling the rocker arm assembly	2010	G	000007

Fav 900	Engine / Cylinder head Dismantling and reassembling the rocker arm assembly	G
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Reassembling the rocker arm assembly

Coat rocker bushes with "Optimol White T"paste.

Refit circlip on the rocker shaft.

Coat rockershaft and bearing bracket bore with "Optimol White T" paste.

Slide stop washer, outer spring, stop washer, rocker arm (end flush with bushing facing the bearing bracket) and bearing bracket into the rocker shaft.

When clamping the assembled rocker shaft into the bearing bracket, ensure that the shaft end is supported. (Use non-metallic jaws).



Fit parts in the sequence shown, compressing springs, and insert circlip.

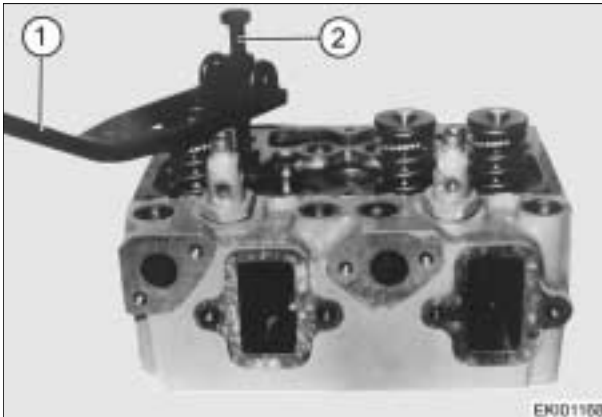
Refit rocker arm assembly, see chapter 2010 Reg G - Cylinder head removing and refitting.

Date	Version	Page	Capitel	Index	Docu-No.
19.02.2001	a	2/2	2010	G	000007

Fav 900

Engine / Cylinder head Removing and refitting valves

G



Removing valves

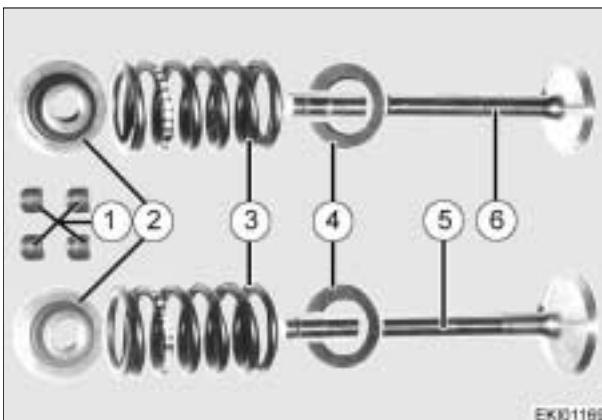
Remove rocker arm assembly and cylinder head (Chapter 2010 Reg G).

Note:

Valve springs and spring plates can be replaced without removing the cylinder head. This requires the appropriate piston to be at TDC.

The use of a valve fitting tool is necessary.

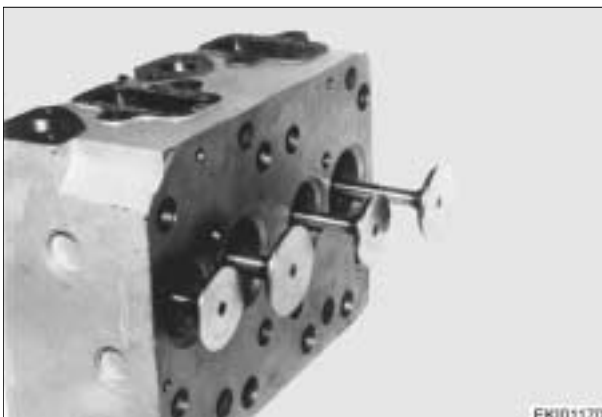
- Place fitting lever to cylinder head.
- Turn screw (1) until the lever (2) is slightly raised.



Note:

If a valve bench is available, this can be used for the above operations.

- Push valve fitting lever down and remove valve collets.
- Lift lever and swing to one side **Caution: Beware of spring tension. Danger of injury !**
- Remove upper spring plate (2), valve spring (3) and washer (4).
- Turn cylinder head over and extract intake (5) exhaust (6) valve.
- Check valves for damage and replace weak springs.
- Measure valve spring and replace weak springs.
- Check valve stem and guides for scoring and wear; if necessary, measure guides with a plug gauge.
- Check valve seats for severe wear and signs of burning, if necessary reseal valves or replace the insert.
- Remachine valve seat (following grinding machine manufacturer's instructions), or replace.



Refitting valves

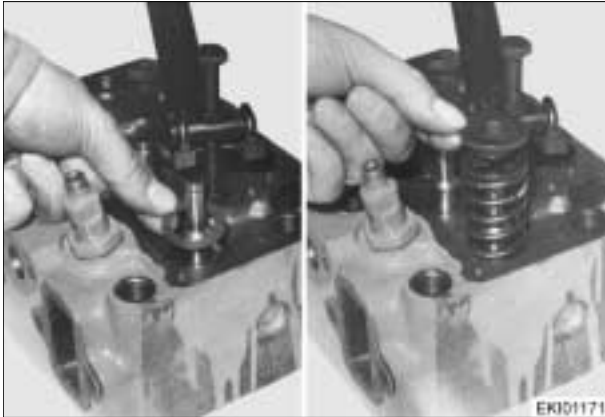
Lubricate valve stems and insert into valve guides.

Note:

Minor valve seating damage can be removed by reseating using a valve grinding paste. When fitting new valves these must be reseated so that uniform seating is attained, if necessary machine the valve seat insert.

Date	Version	Page	Capitel	Index	Docu-No.
19.02.2001	a	1/3	2010	G	000008

Fav 900	<p align="center">Engine / Cylinder head Removing and refitting valves</p>	<p align="center">G</p>
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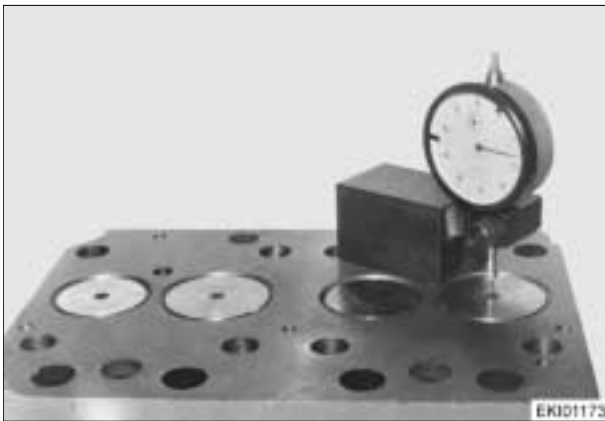


Turn cylinder head over.
 Place valve fitting lever.
 Fit washer, valve spring and upper spring plate.



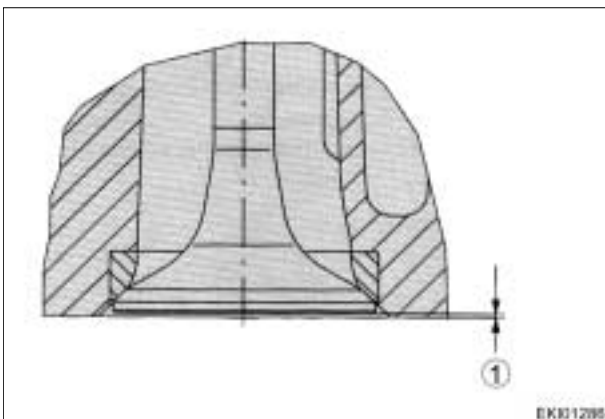
Compress spring with fitting lever and insert collets.

Note:
Make sure collets fit properly: they can cause severe damage by springing out.



Measuring valve recess

- Position gauge holder with dial gauge at the cylinder head.
- Press tip of gauge onto cylinder head.
- Set dial gauge at "0".
- Swing gauge towards valve head and read recess.



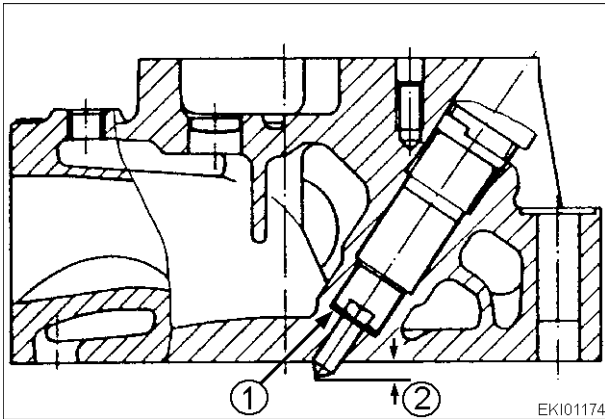
If after skimming the cylinder head faces, valve recess is inadequate or valve projection is excessive, the valve seat insert must be re-ground.

1 Valve recess

Note:
 - When skimming the cylinder head sealing face, the max. dimension must not exceed 1 mm (0.039").
 - After skimming, observe injection nozzle projection. Replace standard - copper sealing ring with a thicker one.

Date	Version	Page	Removing and refitting valves	Capitel	Index	Docu-No.
19.02.2001	a	2/3		2010	G	000008

Fav 900	Engine / Cylinder head Removing and refitting valves	G
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1= Copper - Sealing ring

2 = Injection nozzle projection (2,68 - 3,47mm).

Available sealing ring thicknesses : 0,5 / 1,0 / 1,5 / 2,0 / 2,5 / 3,0 mm (.020 / .039 / .059 / .079 / .098 / .118")

Date 19.02.2001	Version a	Page 3/3	Removing and refitting valves	Capitel 2010	Index G	Docu-No. 000008

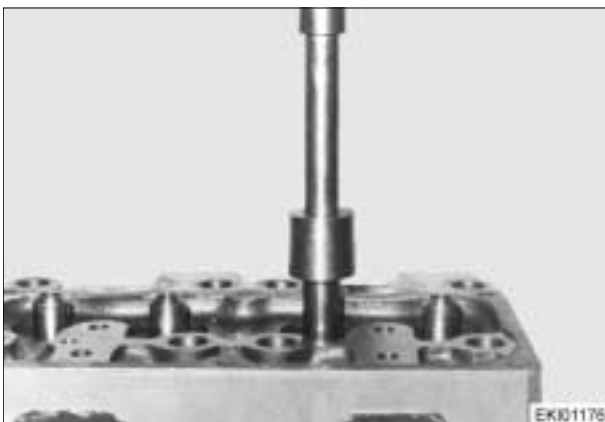
Fav 900	Engine / Cylinder head Removing and refitting valve guides.	G
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Removing the valve guide

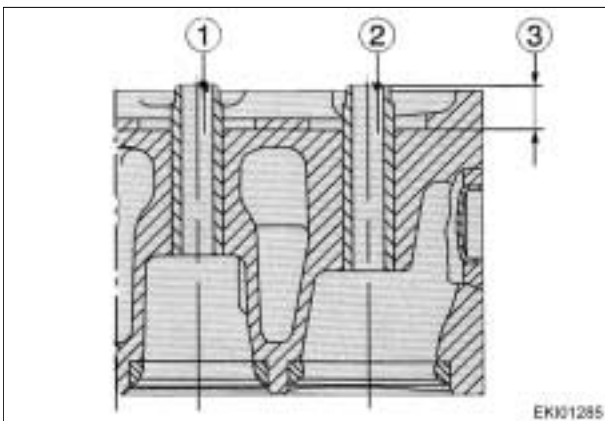
Removing and refitting the cylinder head.
Removing and refitting the valves.

Position cylinder head on a press with the combustion chamber side facing upwards. Use a mandrel to press out the valve guide.



Refitting the valve guide

Lubricate new valve guides and using a mandrel and spacer sleeve, press in from the rocker arm side.



Valve guides differ in length only.

1 Exhaust = shorter guide

2 Intake = longer guide

3 Press-in depth (see Servicing Data)

Press-in depth is governed by the spacer sleeve.

Note:

After replacing the valve guides it is necessary to re-grind the valve seats (see Servicing Data and instructions by the manufacturer of the valve lathe used in your workshop).

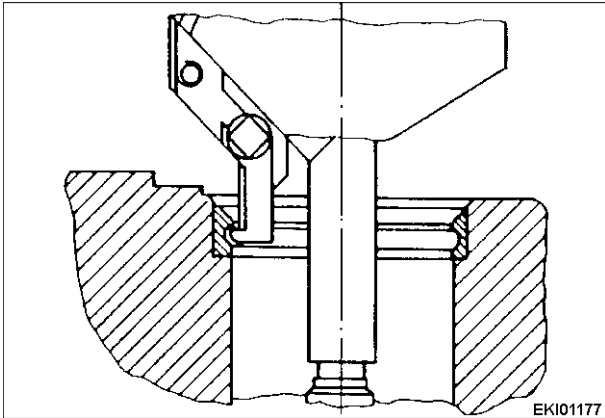
Fav 900	Engine / Cylinder head Replacing valve seat insert	G
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Remove valve seat insert

Note:

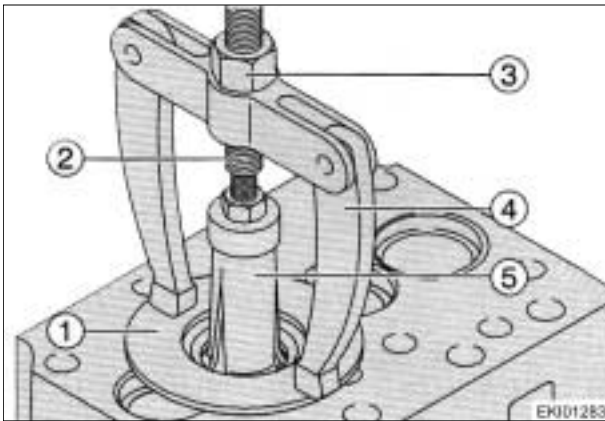
When replacing valve seat inserts, it is advisable to replace valve guides, since this is the only way to guarantee precise reseating of the new inserts.

A tool was therefore designed with which valve guidance and valve seat inserts can only be replaced together, or alternately the valve guides alone.



Using a valve lathe machine a 3 - 4 mm (.118-.157") wide groove in the valve valve seat inserts.

Insert internal extractor claw in the machined groove and tighten.

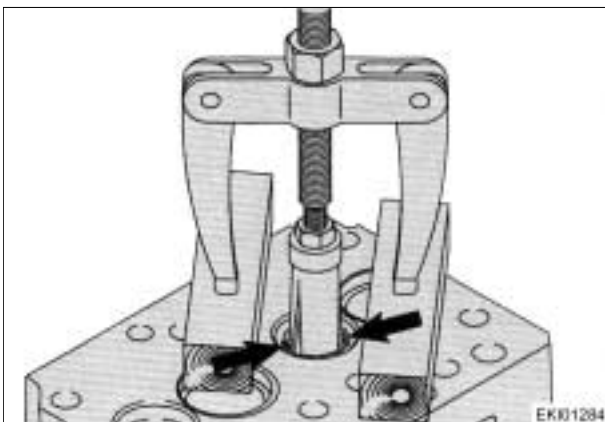


Note:

To prevent damage to the cylinder head face, insert a washer (1) or other suitable object underneath the feet (4) of the support legs.

Screw spindle (2) into extractor (5), align support legs (4) and extract valve seat insert by turning the nut (3).

Clean contact surface of insert in the cylinder head.

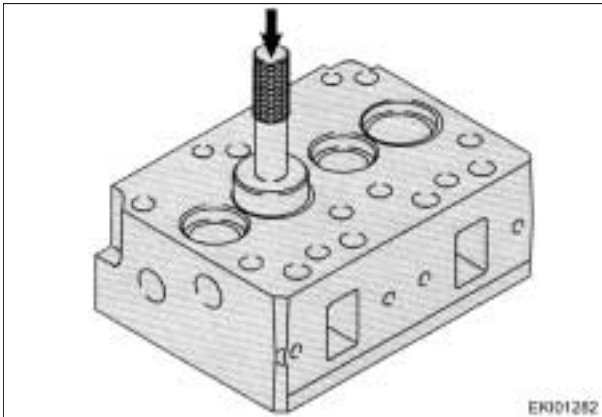


If a valve lathe is not available, proceed as follows:

- Using an arc-welder, apply two welding beads to the valve seat (arrowed).
- Extract valve seat insert.
- Clean insert contact surface in the cylinder head.

Date	Version	Page	Replacing valve seat insert	Capitel	Index	Docu-No.
19.02.2001	a	1/2		2010	G	000010

Fav 900	Engine / Cylinder head Replacing valve seat insert	G
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**Replacing valve seat insert**

Immerse cylinder head in a hot water bath and heat up to approx. 80°C (176°F).

Supercool new insert to approx -200°C (-328°F) and insert into the cylinder head.

When the temperature has equalized, check by pressing in a mandrel to the end position.

Refit valve guides.

Note:

When replacing the valve seat inserts, it is necessary to re-machine valve seats.

Note:

After cooling down: re-machine valve seats.

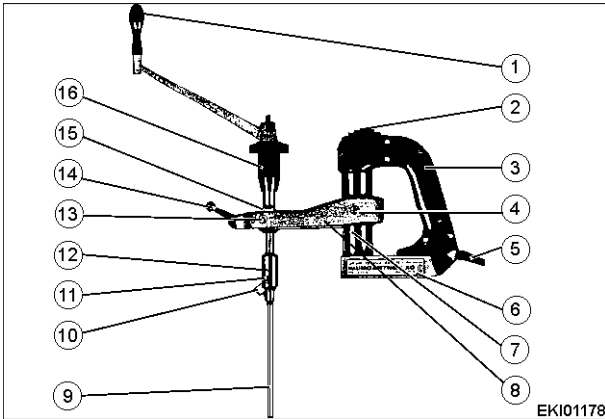
After re-machining: clean cylinder head and check for leaks with a cylinder detector.

Overheating of the cylinder head (above +200°C / 392°F) causes the core plugs to become loose, and they must be replaced.

To do this, clean core holes, blow out ducts and press in new core plugs using a mandrel and "LOCTITE 270".

Date	Version	Page	Capitel	Index	Docu-No.
19.02.2001	a	2/2	2010	G	000010

Fav 900	Engine / Cylinder head Re-machining the valve seats	G
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Re-machining the valve seat

(with Mira-Precision valve seat re-machining tool)

1. Crank
2. Rocker switch
3. Hand grip
4. Lubricating nipple
5. Mains supply
6. Solenoid valve with coil
7. Guide tube
8. Swivel arm
9. Guide mandrel
10. Cutter
11. Allen screw
12. Chuck
13. Lubricating nipple
14. Clamping lever
15. Guide ball
16. Thrust nut with mm-dial

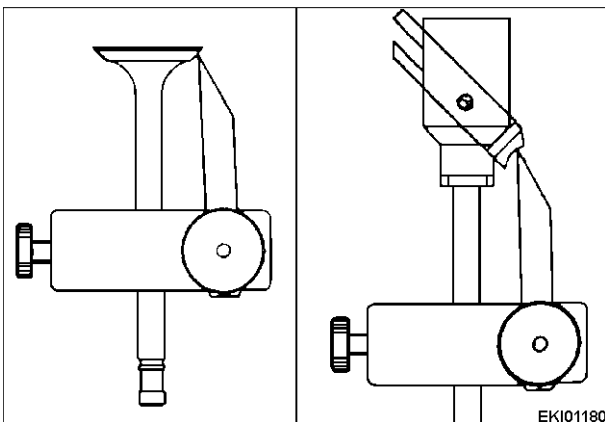


Select suitable guide mandrel, insert with open-end wrench (SW 12) and tighten.

Note:

For maximum precision, the guide mandrel must have a perfect fit.

Select cutting with appropriate valve face with a seat angle and insert.



Adjust cutter with setting gauge and secure with Allen screw.

Using a guide mandrel insert tool into valve guide.

Date	Version	Page	Re-machining the valve seats	Capitel	Index	Docu-No.
19.02.2001	a	1/3		2010	G	000011

Fav 900	<p align="center">Engine / Cylinder head Re-machining the valve seats</p>	<p align="center">G</p>
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Release clamping lever, fit solenoid flange on clamping plate, adjust the height to ensure the cutter is clear of valve seat.

Set rocker switch at position 1.

Tighten clamping lever.



Re-machine valve seat by evenly turning the crank handle in clockwise direction, this moving the thrust nut at the same time.

Note:

Turn the crank firmly and evenly but never in anticlockwise direction since this could cause the carbide cutting edge to break out.



When the re-machining process is completed, reduce working pressure of the cutter for a further 2-3 turns without thrust.

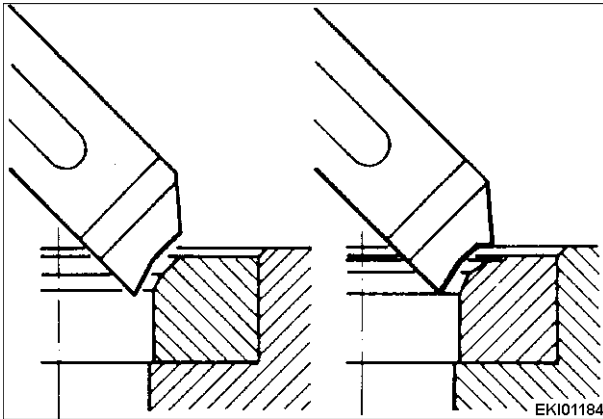
While still turning, reverse the thrust nut by 2-3-turns.

Switch into position 2 : to eliminate magnetic field.

Now pull the entire Mira-tool out and insert into the next valve guide where the centering process is to be repeated.

The cutter setting remains the same for all intake exhaust valve seats.

Fav 900	<p align="center">Engine / Cylinder head Re-machining the valve seats</p>	<p align="center">G</p>
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Observe specified seat angle.

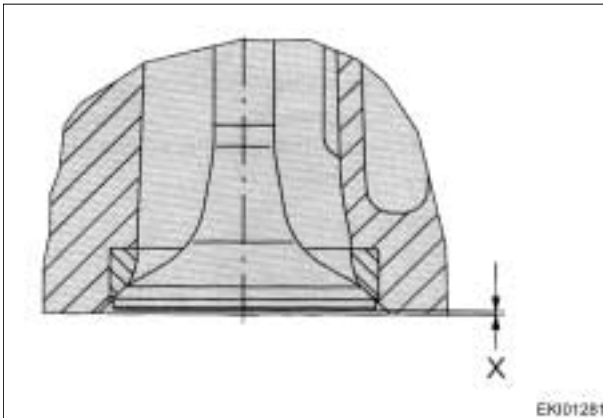


Note:

When re-machining the valve seat inserts, only the minimum of material should be removed. Reference value will be value of valve recess.

If the cylinder head faces are re-machined (max. 1 mm (.039")), it is necessary also to re-machine the inserts in order to obtain the correct valve recess: When fitting new valves and inserts, machine out cylinder head to amount relative to the skimming of the cylinder head face.

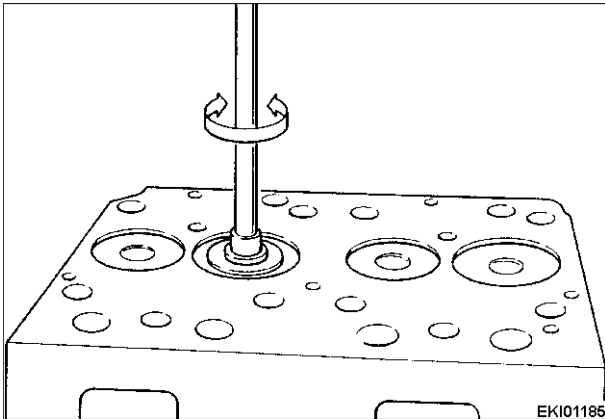
Having skimmed the cylinder head face and machined the valve seat insert, the theoretical valve seat may have become too deep in the cylinder head or the seat surface may be too wide.



In this event the valve seat insert must be replaced.

Always observe the correct value for valve recess.

<p>Fav 900</p>	<p>Engine / Cylinder head Reseating valves</p>	<p>G</p>
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Reseating valves

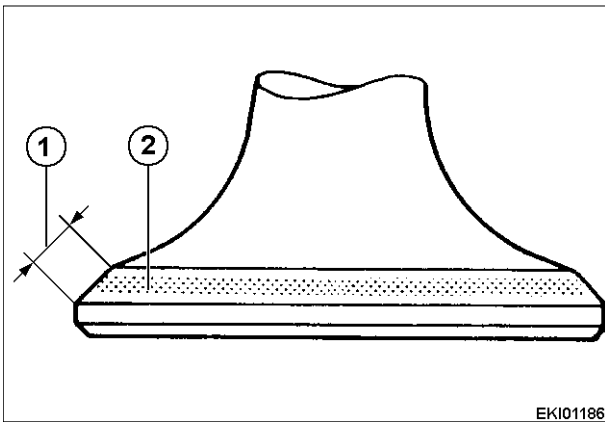
Apply grinding paste to the valve seating face.

Lubricate valve guide and insert valve.

With a valve grinding tool, regrind valve seat with spinning movements.

Note:

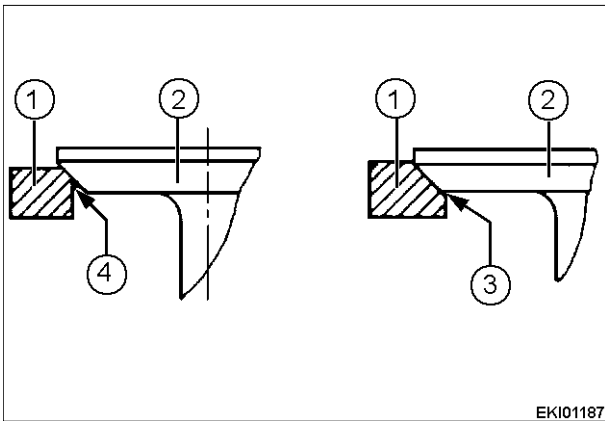
Do not allow grinding paste to come into contact with the valve stem and guide.



The re-grinding process of the valve seat must produce a perfect, closed grinding pattern.

The width of the grinding pattern is the result of a correctly machined valve seat insert.

- 1. Valve cone face
- 2. valve seat



- 1. Valve seat insert
- 2. Valve
- 3. Valve seat - too wide
- 4. Valve seat - correct

Note:

Excessively wide valve seats are favoring carbon deposits,

- Valve may leak -

Excessively narrow valve seats prevent rapid heat transfer from the valve to the cylinder head.

- Valves become scorched-

<p>Date 19.02.2001</p>	<p>Version a</p>	<p>Page 1/1</p>	<p>Reseating valves</p>	<p>Capitel 2010</p>	<p>Index G</p>	<p>Docu-No. 000012</p>
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Fav 900	Engine /Cooling system Replacing engine coolant	G
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Draining the coolant

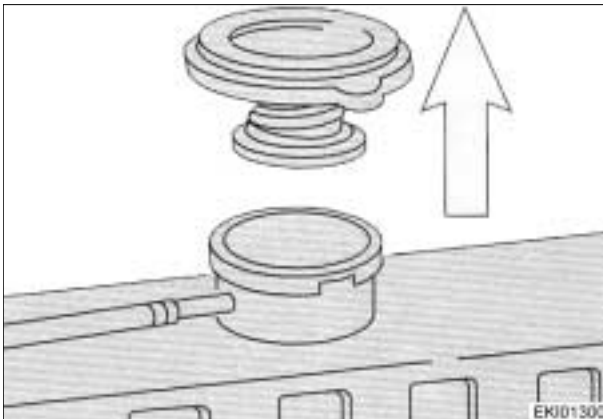


Caution:
Hot coolant may cause severe burns during draining!

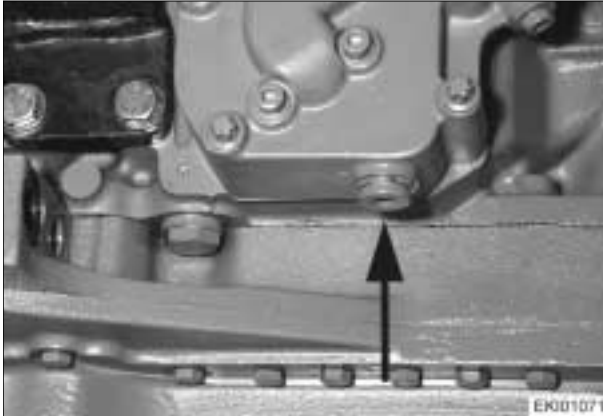
Drain coolant only on a **cooled down** engine as described:

Note:

Collect coolant in a pan and dispose of it properly!



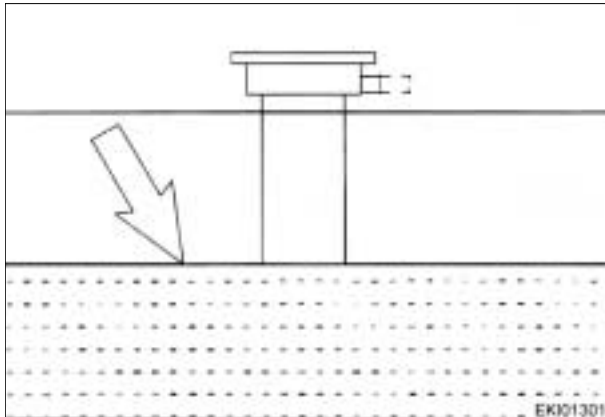
- Open shortly cover from expansion tank in order release pressure.



- Unscrew draining screws from Oil cooler case
- Then unscrew cover
- Drain coolant using a container with sufficient capacity

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Fav 900	Engine /Cooling system Replacing engine coolant	G
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Filling Coolant

(only on a cooled down engine)

Fill in an adequate mixture of tap water and antifreeze based on Ethylene - Glykol and corrosion preventer.

Refer to Lubricants - Chapter I 0000 Reg. A
 Use a proper ratio water / Antifreeze.

- Tighten screw on oil filter body using a new gasket.
- Fill in slowly coolant mixture up to the adequate coolant level
- Put in place screw cap
- After a short engine operation time , check coolant level again



Caution:

If coolant level needs to be checked , the engine being at operating temperature, first open cover with safety valve to release pressure - then open carefully.

Date	Version	Page	Replacing engine coolant	Capitel	Index	Docu-No.
08.02.2001	a	2/2		2050	G	000001

Fav 900	<p align="center">Engine / Cooling</p> <p align="center">Removing and refitting the thermostatic valve</p>	<p align="center">G</p>
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Removing the thermostatic valve

- Drain coolant, chapter G 2050 Reg G
- Disconnect coolant hose from thermostatic valve.
Unscrew and remove the two screws (SW) and remove thermostat housing.



Remove thermostatic valve.

Check correct operation of thermostat as following:

- Place thermostatic valve in pot filled with water
 - Heat water
 - Measure opening temperature with an adequate thermometer
 - Measure opening distance
- Replace faulty thermostatic valve



Refitting thermostatic valve

Fit thermostatic valve with new O-seal "ensuring that the ball valve is pointing upwards" (TOP).

Note:

Never run engine without a thermostatic valve or bypass inserts.

Fit thermostat housing cover, insert screws and tighten. attach feed hose to radiator. Fill up with coolant.



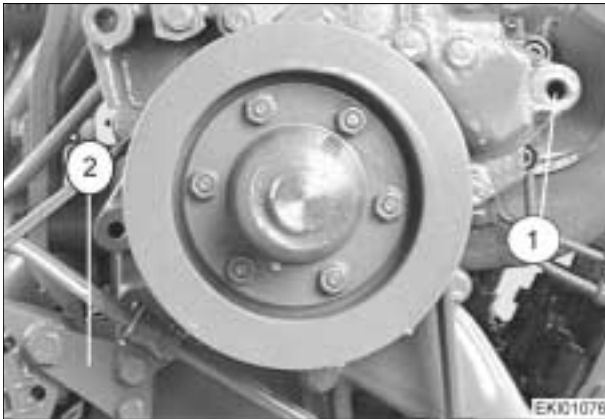
Replacing temperature sensor

Disconnect connections

Unscrew temperature sensor from coolant pipe.
Screw in temperature sensor using "Loctite 648" and tighten to specified torque.

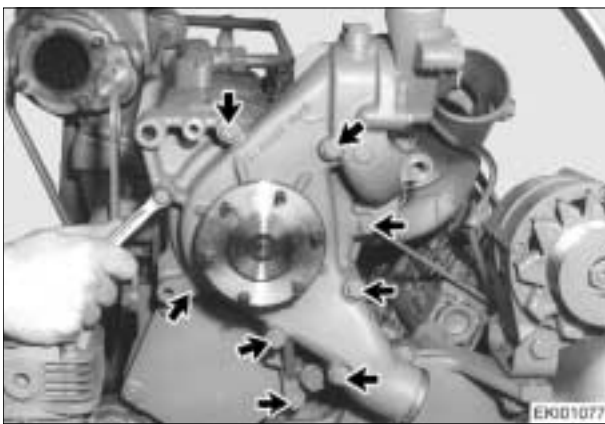
Date	Version	Page	Removing and refitting the thermostatic valve	Capitel	Index	Docu-No.
09.02.2001	a	1/1		2050	G	000002

<p>Fav 900</p>	<p align="center">Engine /Cooling system Removing and refitting water pump</p>	<p align="center">G</p>
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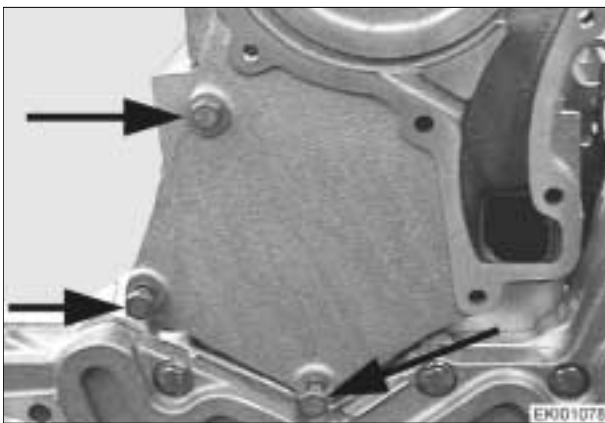


Removing the pump lift section

- Drain coolant.
- Unscrew fan
- Remove feed and drain lines.
- Remove V-belt.
- Remove cooling lines to air compressor
- Remove generator belt tensioner screw (1) top left
- Remove generator pod (2) on the top left
- Remove hub of Viscosity clutch



Unscrew and remove pump lift section.
Clean sealing faces of pump lift- and delivery sections.



Removing the pump lift section

Remove three screws (arrows) and remove the pump lift section.



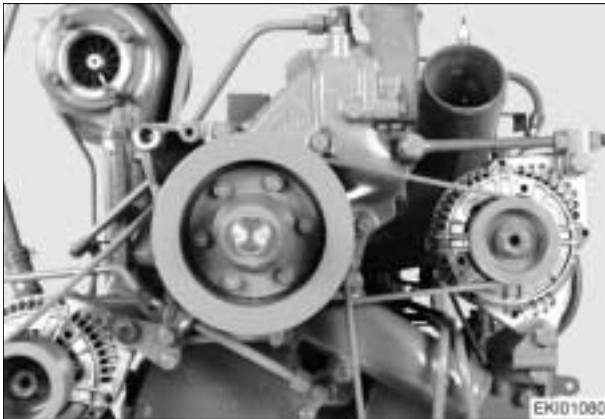
Clean sealing faces of pump lift section and engine block.

Refitting the water pump lift section

Install pump lift section with new gasket.
Tighten screws to specified torque.

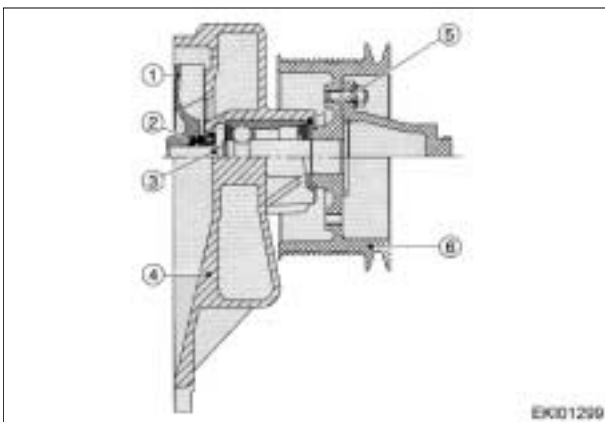
Date	Version	Page	Removing and refitting water pump	Capitel	Index	Docu-No.
14.2.2001	a	1/4		2050	G	000003

<p>Fav 900</p>	<p align="center">Engine /Cooling system Removing and refitting water pump</p>	<p align="center">G</p>
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Refitting the water pump

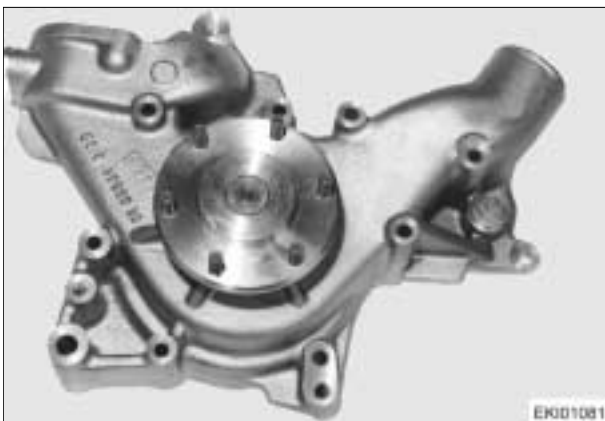
Replace seals on connecting pipe.
Install water pump with new gasket.
Tighten fscrews to specified torque.
Put all removed parts back into place
Fill up coolant.



Overhauling the water pump.

1. Impeller
2. Sliding ring gasket.
3. Water pump bearing.
4. Pump housing.
5. Circlip
6. V-belt pulley

Remove water pump



Clamp water pump lift section in a vise (use non-metallic jaws).

Remove V-belt pulley with pulling device.

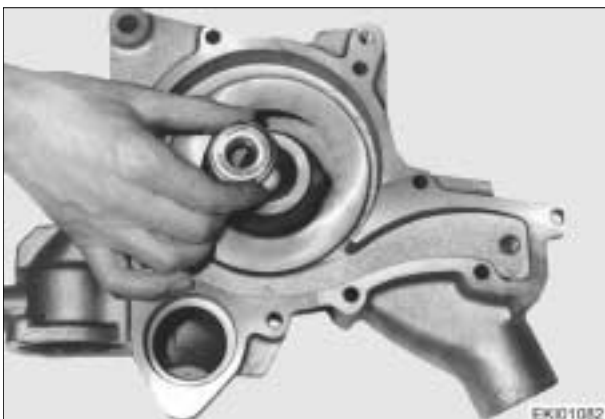
Remove circlip from pump housing.

Invert water pump and fit into hydraulic press

Using a suitable mandrel (same as bearing shaft) press out bearing.

Note:

When the bearing is pressed out, the pump impeller is released.



Using a suitable mandrel, press out and replace sliding ring gasket.

Reassambling the water pump

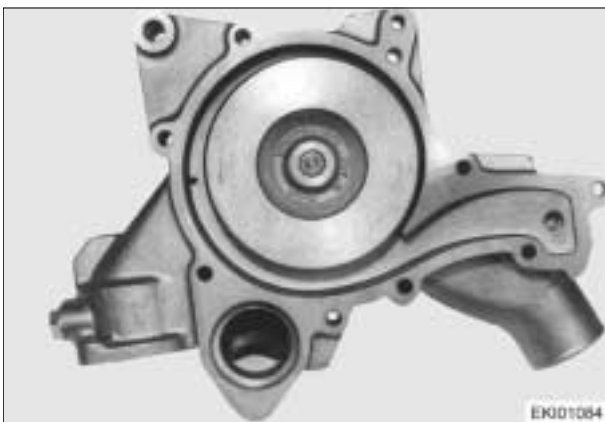
Using pressing bush (special tool) press in a new sliding ring gasket as far as possible. See notes on fitting gasket !

Date	Version	Page	Removing and refitting water pump	Capitel	Index	Docu-No.
14.2.2001	a	2/4		2050	G	000003

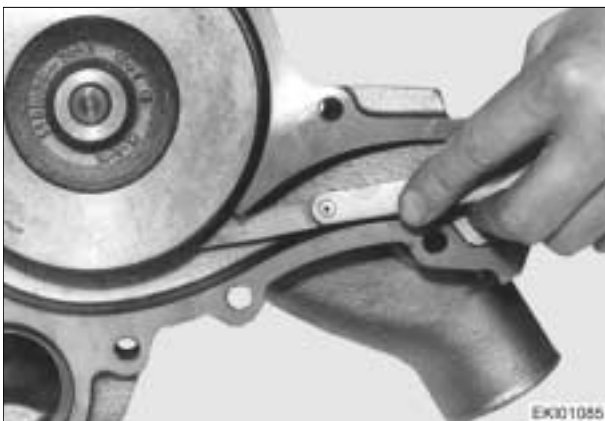
Fav 900	Engine /Cooling system Removing and refitting water pump	G
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Using a pressinf bush, press bearing into pump housing until contact is made.
Insert circlip.
Press pulley into shaft flush with the plate



Invert water pump and let it rest on hub and bearing shaft.
Fit impeller to bearing shaft.



Gradually press impeller onto bearing shaft, using gauge to check for correct clearance.
Rotate impeller and check clearance at several points.

Date	Version	Page	Removing and refitting water pump	Capitel	Index	Docu-No.
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Fav 900	Engine /Cooling system Removing and refitting water pump	G
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When repairing do not replace pump unless a leak has been found.

Depending on design, the sliding ring gasket of the water pump may allow small amounts of coolant to leak which may lead to water marks underneath the drain hole.

This does not call for a pump replacement.

It is advisable to check out the following points before replacing or repairing the pump:

- Is there a visible and repeated loss of water from the coolant on the circuit.
- Whether the loss is caused by discharge from the expansion tank (e.g. too full) or by leakages from the hoses, radiators etc.

Water pump needs to be replaced only if water is dripping while the engine is running or after it is switched off.

Fitting instructions for sliding ring gasket :

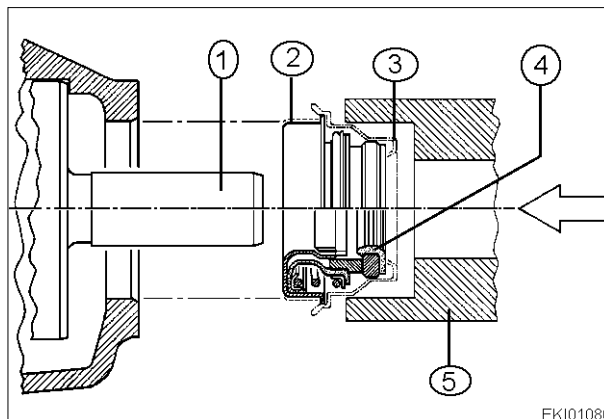
The ring gasket must be mounted "wet". Coat the shaft and sleeve (4) with a mixture of 50 % Water und 50 % alcohol or 35 % to 50 % antifreeze.

Do not use any other lubricant

Fit gasket "wet", i.e. coat retaining collar (1) and pump shaft (2) with a mixture of 50% water and 50% alcohol or a mixture of water and 35 to 50 % antifreeze to MAN in-house standard 324.

If there are any signs of scoring however slight, or other minor damage, apply a bead of Dirko Transparent sealing agent.

Position gasket with plastic cap (3) on shaft (1) and using assembly tool, press into housing until tool makes contact with the housing. Remove plastic cap.



Note:

Investigations have shown that in most cases pump damage is caused by the use of unsuitable coolants.

For trouble free operation use only radiator anti-corrosives by Fendt .

Date	Version	Page	Capitel	Index	Docu-No.
14.2.2001	a	4/4	2050	G	000003

Fav 900

Engine / Cooling system

Removing and refitting coolant pipe

G**Removing the coolant pipe**

Drain coolant while engine is cold. Use a clean pan with sufficient capacity

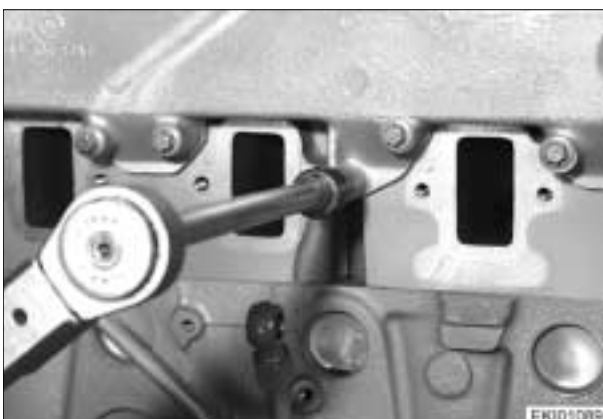
- Remove injection lines
- Remove intake pipe
- Disconnect temperature sensor



Unscrew and remove coolant pipe.
Remove gasket and clean all sealing faces.

**Refitting the coolant pipe**

Replace O-Rings of connecting pipe. Fit coolant pipe using new gaskets.



Insert screws and tighten to specified torque.

Note:

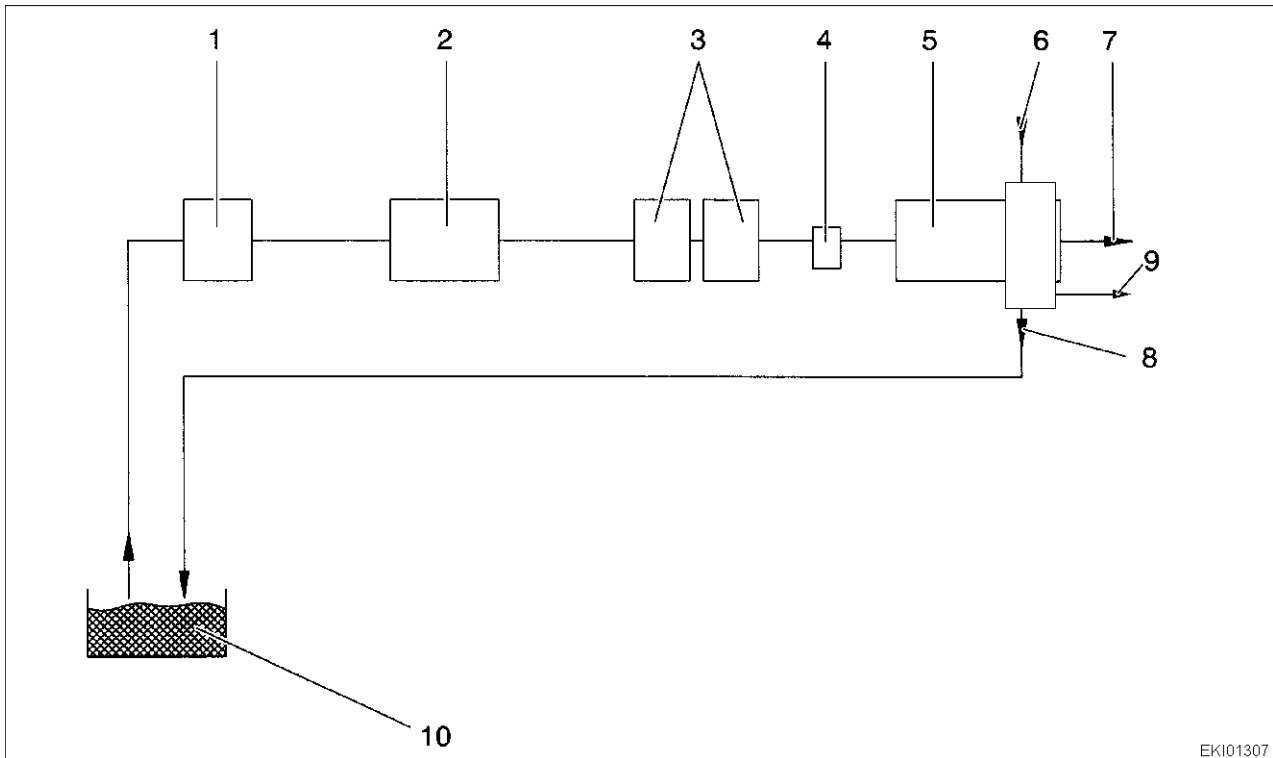
Insert the longer screws into the brackets for injectors.

- Reconnect temperature sensor,
- Refit intake pipe.
- Refit injection lines.
- Fill up with coolant.

Date	Version	Page	Capitel	Index	Docu-No.
14.02.2001	a	1/1	2050	G	000004

Fav 900

Engine / Fuel system
Layout of fuel system

C

EKI01307

1. Pre-filter with manual fuel lift pump
2. Fuel lift pump
3. Fuel filter
4. Measuring point for fuel pressure.
5. Injection pump
6. Return line from injection pump
7. Line to injector
8. Return tank
9. Line to heater plug
10. Fuel tank

Date	Version	Page	Capitel	Index	Docu-No.
09.03.2001	a	1/1	2060	C	000002

Fav 900

Engine / Fuel supply system
Fuel pre filter / Cartridge

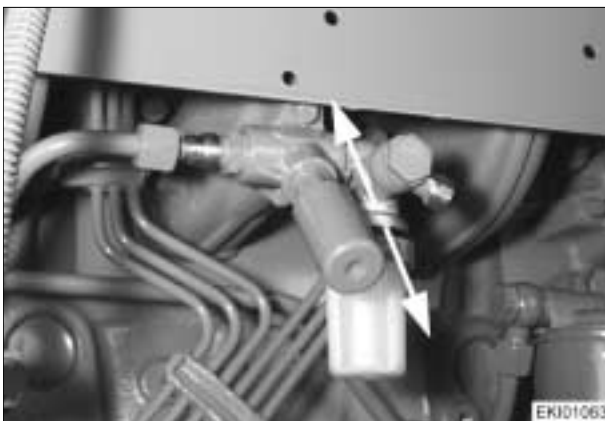
G**Cleaning pre - filter**

Disassemble pre - filter:

- Unscrew filter body



- Clean Filter body (1) and Sieve (2) with clean diesel fuel and dry it with compressed air
- Re - assemble with a new gasket
- Tighten filter body



- Actuate manual pump until overflow valve toward injection pump opens audibly.
- Start engine
- Check Pre - filter for eventual leaks

Note:

Purge air from fuel supply system - Chapter 2060 Reg. G

Date	Version	Page	Capitel	Index	Docu-No.
08.02.2001	a	1/2	Fuel pre filter / Cartridge	2060	G
				G	000002

Fav 900	Engine / Fuel supply system Fuel pre filter / Cartridge	G
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Removing and refitting main fuel filter

Disconnect fuel lines (1) .
Remove screws (2) and take off fuel filter.
Reassemble in reversed order and connect fuel lines with new sealing rings.
Purge air from fuel supply system.



Replace filter element

- Loosen filter element with chocking wrench and unscrew element manually
- Wet gaskets of replacement element with fuel.
- Screw in replacement element and tighten firmly by hand.
- Purge air from fuel supply system - Chapter 2060 Reg. G



Note:
Used fuel filters are hazardous waste

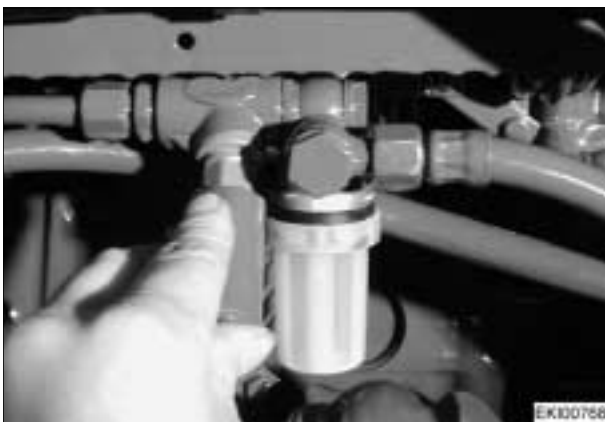
Date	Version	Page	Fuel pre filter / Cartridge	Capitel	Index	Docu-No.
08.02.2001	a	2/2		2060	G	000002

Fav 900	<p align="center">Engine / Fuel Supply System Purging Air from Fuel Supply System</p>	<p align="center">G</p>
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For Operating EDC Injection System, careful purging of the fuel Supply system is compulsory!

Unscrew purging screw of the fuel filter by one to two turns.



Actuate manual fuel lifting pump until fuel flows without any bubbles.

Repeat this procedure on the second purging screw

Check for leaks within the fuel supply system.



If air reaches the high pressure section of the injection pump (Type VP 44), a further purging step is to be carried out:

Purging the high pressure system becomes necessary when the engine does not start any more or if the tank went dry.

On steep slopes and with little fuel in the tank, air may be aspirated by the injection pump eventually. (Failure Code)

or after repairs on the fuel supply system.

Following steps must be carried out on at least 3 following cylinders :

- Loosen nut of the injection line on the injection valve approx 1/2 turn.
- Crank engine with starter motor until fuel runs out of .
- Tighten Nut (10 Nm) then for 60° angle.

Important:

Start engine and run it idle for approx. 30 sec in order to allow the complete system to purge residual air.

Caution:

Fuel runs within the lines! Any fuel spill must be cleaned up with rags . Be aware of safety and environmental regulations!

Date	Version	Page	Purging Air from Fuel Supply System	Capitel	Index	Docu-No.
02.11.2000	a	1/1		2060	G	000001

Fav 900

Engine / Cold start booster Removing and refitting heater plug

G**Remove heater plug**

Disconnect the heater plug.

Unscrew threaded union of fuel line.

Release lock nut of heater plug and remove plug.

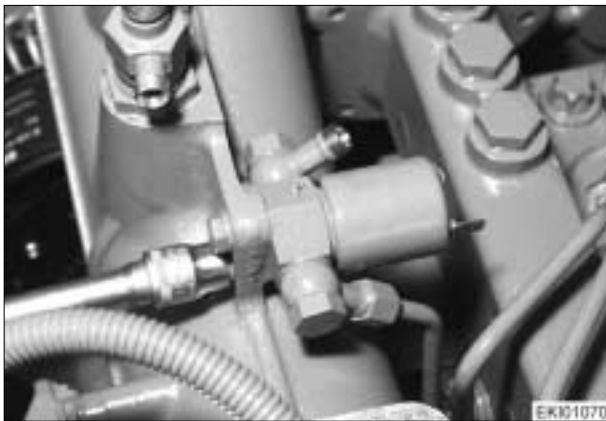
**Refitting heater plug**

Unscrew the lock nut on the heater plug as far as possible. Wetten threads with "Curil T" sealant

Screw in heater plug to the end position of the lock nut and align with fuel line.

Reconnect fuel line and electrical connections.

Tighten lock nut.

**Checking solenoid valve for leaks**

Remove fuel line from heater plug: Make sure there are no fuel leaks when the engine is running and warm.

Removing the solenoid valve

- Remove fuel line.
- Remove electrical connection from valve.
- Unscrew both screws and remove solenoid valve

The valve cannot be repaired.

Damaged valves must be replaced.

Refitting the solenoid valve

- Fit valve bracket.
- Connect fuel lines using new seals.
- Re- connect solenoid valve.

Date	Version	Page	Capitel	Index	Docu-No.
08.02.2001	a	1/1	2180	G	000001

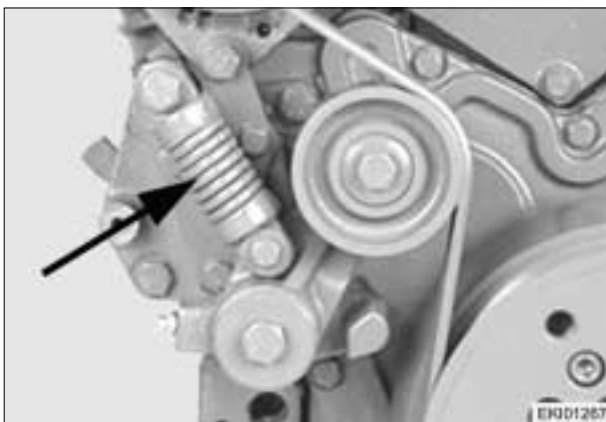
Fav 900	Engine / Short block Power - belts	G
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Generator right
Checking condition

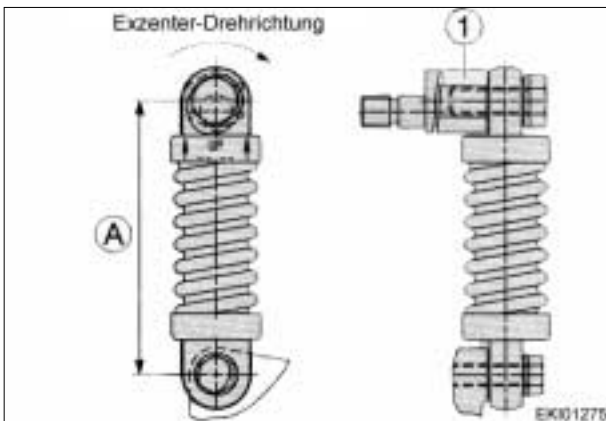
Power belt is maintenance free

- Check belts for cracks, oiling-up, and signs of overheating and wear.
- Replace damaged belt.



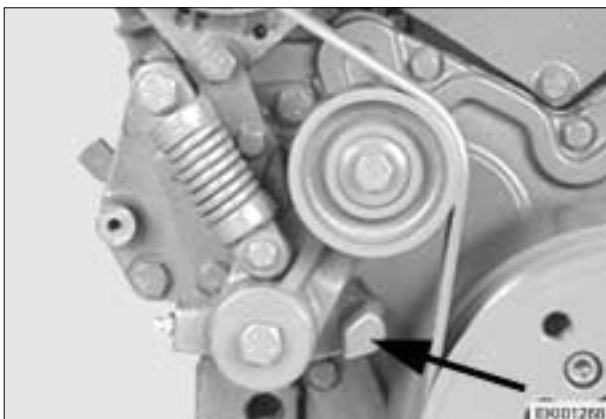
Checking tension

Tensioning device (arrow) keeps permanently a constant tension on the power belt.



Tensioner must be adjusted as follows:

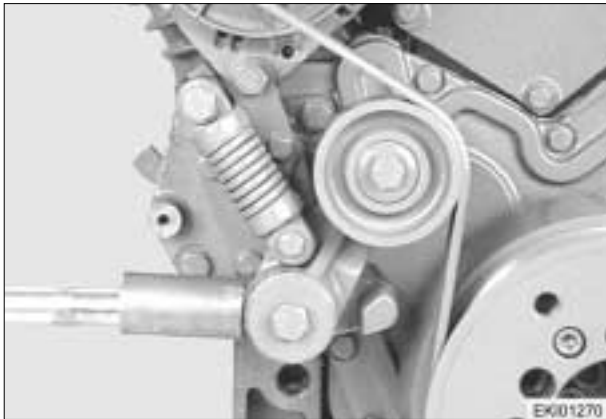
1. New tensioner: distance (A) = 92 ± 1 mm (3.62" ±.04").
2. If distance (A) = 100 mm (3.94"), turn excenter to right to reach a distance of (A) = 92 ± 1 mm (3.62" ±.04"), at least that the excenter (1) allows a reduction of A down to min 92 mm (3.62").
3. If the distance reaches (A) = 100 mm (3.94") and the excenter (1) is at the end position, the power belt must be replaced. Adjust a new power belt according to Point 1.



The replacement of the powerbelt becomes necessary if the tensioning lever comes to rest on console (Arrow).

Note:
Distance of 100 mm (3.94") may cause a total failure of the belt drive because of insufficient tension.

Fav 900	Engine / Short block Power - belts	G
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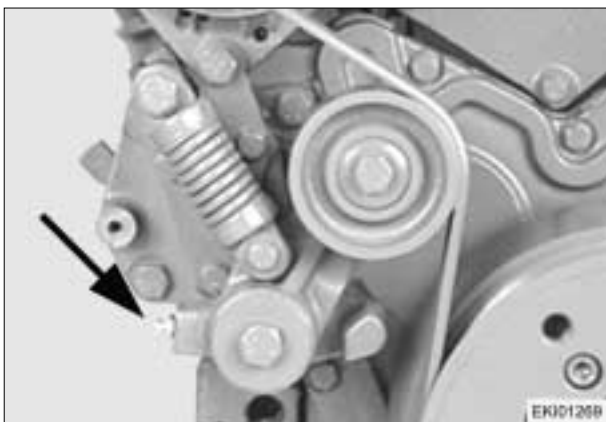


Replacing the powerbelt

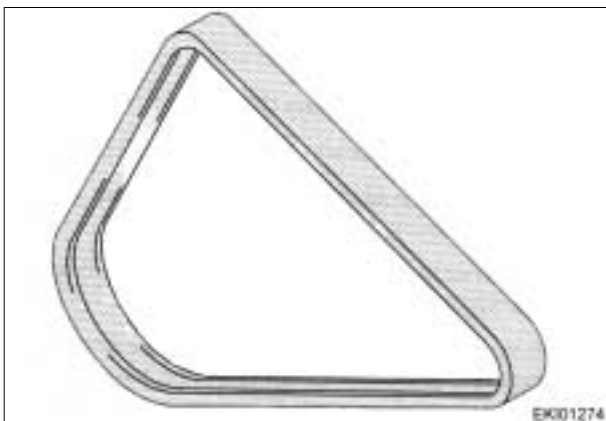
- Place adequate tool onto square shaft.
- Release tension from tensioner
- and remove powerbelt from the pulley .

Refitting :

- Place powerbelt onto pulleys of crankshaft , generator and coolant pump.
- Set tensioner completely back.
- Place powerbelt onto pulley , release tensioner, remove special tool.



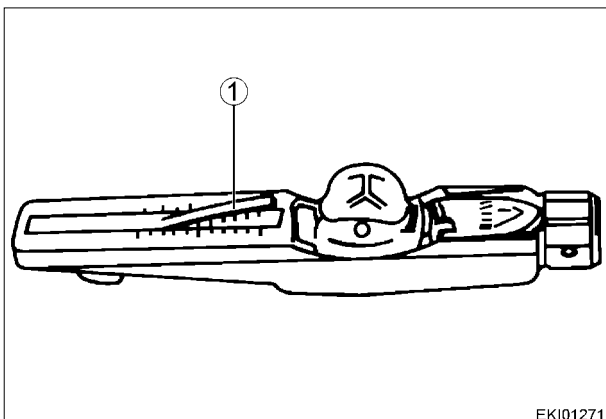
Grease the greasing point.



Alternator left

Checking Powerbelt condition

- Check belts for cracks, oiling-up, and signs of overheating and wear.
- Replace damaged belt.

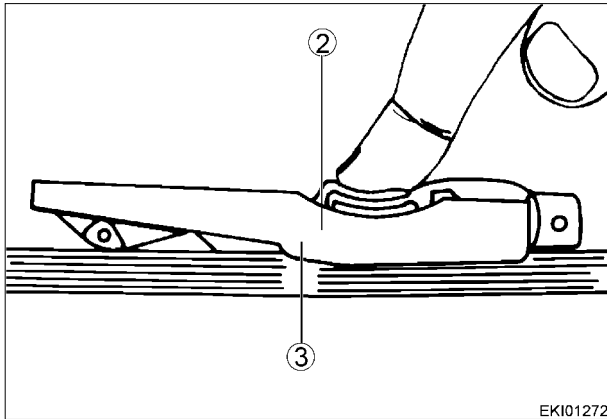


Checking tension

For checking V-belt tension, use V-belt tension gauge.

- Press indicator arm (1) in the scale.

Fav 900	Engine / Short block Power - belts	G
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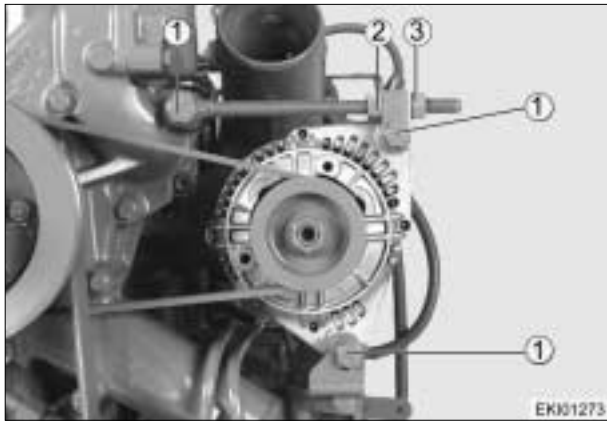


- Position tension gauge (2) in the center between the generator pulleys and the crankshaft.
 - Slowly push pressure pad (3) down until the spring snaps out audibly and the indicator arm moves upwards.
- Continued pressing after the spring has snapped out will result in an incorrect reading!

Determining the span force

Span forces measured on the kg-scale of instrument	
Belt width	Poly V 790 K 4
Newly fitted	
When fitting	60
After 10 minutes running	45-50
Minimal span force	30
Re adjust tension if minimum tension is reached.	40

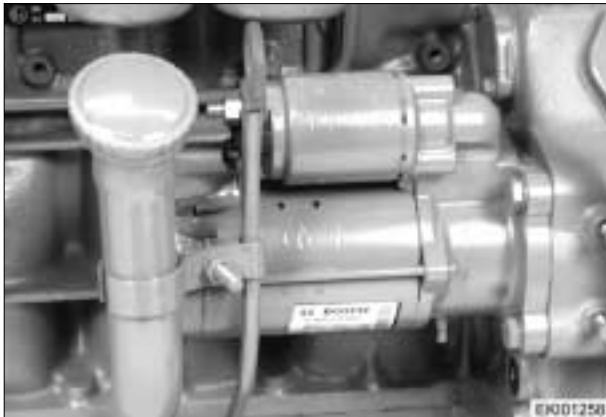
- Read tension force at the point of intersection of the upper side of the indicator arm (1) and the scale.
 - Before reading the values make sure that the indicator arm remains in its position.
- If the value does not agree with the specified setting, the Powerbelt tension must be reajusted.



Tensioning / replacing powerbelt

- Release clamping bolts(1).
 - Loosen counternut (3).
 - Adjust checking nut (2) for correct powerbelt tension.
 - Retighten counternut and clamping bolts.
- When replacing powerbelts, slacken checking nut (3) and swing alternator inwards.

Fav 900	Engine / Short block Removing and refitting the starter engine	G
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**Removing the starter**

Disconnect earth terminal from battery.
Remove cables terminal 30 (thick cable) and terminal 50 from the starter.



Unscrew the screws and a nut from the starter motor flange and remove the starter motor.
Clean exterior of starter engine and check for damage.

Check flywheel ring gear for wear and damage by actuating the crankshaft by hand.
Check in particular the points which final engine oscillations occur ; i.e. when turned off, there are points where the engine comes to rest.
The starter engine pinion engages in these positions during start up.
On 6-cylinder engines these points are staggered by 180° ; i.e. there are 3 points.
To replace the starter ring gear see chapter 2000 Reg G.

**Refitting the starter**

Refit the starter in reverse order of removing, making sure cables are connected correctly.
Observe torque values.
Reconnect battery.
On completion, check starter for correct functioning.

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<p>Fav 900</p>	<p align="center">Engine / Short block Removing and refitting generator</p>	<p align="center">G</p>
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Generator right
Removing generator

Disconnect earth cable from the battery.
Remove connections B+, D+ and W from the generator.



Remove V-belts.
Unscrew bolts (arrows).
Remove generator.



Refitting generator.

- Refit the generator.
- Check, and if necessary, correct cable connections.
- Tighten fixing bolts to specified torque.
- Tension V-belt.
- Fixing cables on generator.

After completion check generator for correct functioning.

Check voltage and charging current .

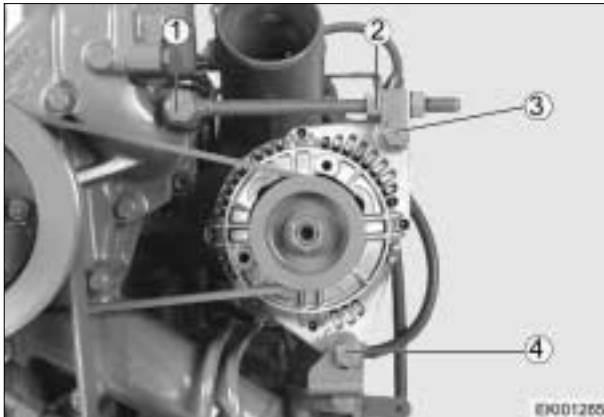


Remove generator, left
Remove generator

Disconnect earth cable from the battery.
Remove connections B+, D+ and W from the generator.

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Fav 900	Engine / Short block Removing and refitting generator	G
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Loosen bolts(1), (3) and (4) from the generator and unscrew tensioning nut (2).

- Push generator toward the engine and take off the power belt.
- Unscrew the upper screws(3).
- Unscrew the lower screws (4).
- Remove generator.
- Check screw and guide for damage (i.e. cracks, bends, etc.) replace if necessary.



Refitting generator

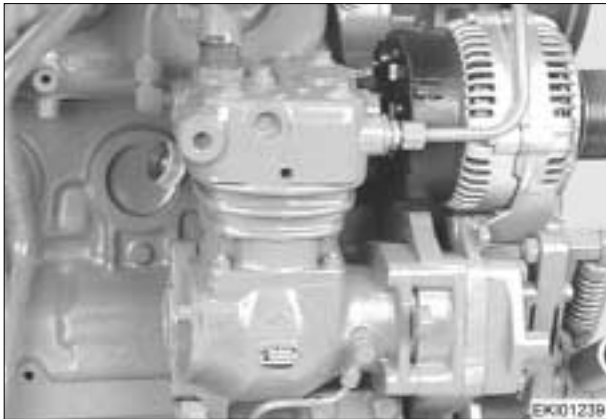
- Refit the generator.
- Check, and if necessary, correct connections.
- Tighten fixing to specified torque.
- Tension V-belt.
- Fixing cables on generator.

After completion check generator for correct functioning.

Check voltage and charging current .

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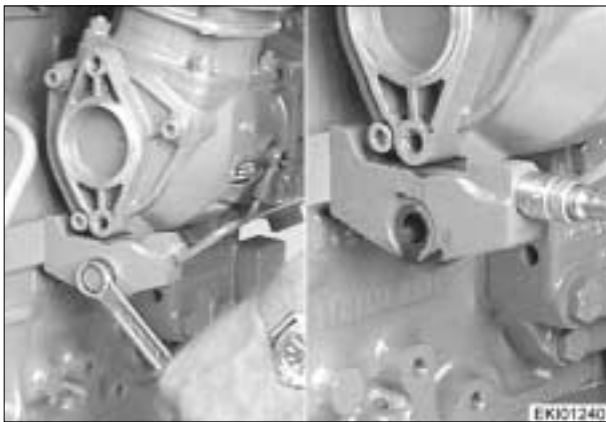
<p>Fav 900</p>	<p align="center">Engine / Short block Removing and refitting air compressor</p>	<p align="center">G</p>
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Removing the compressor

Remove hydraulic pump or rear end cover,
Unscrew fan frame support bracket.
Remove oil feed line, air intake line and
compressed-air line.

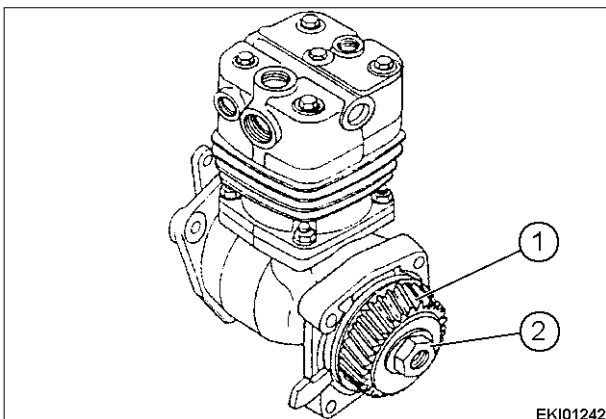
Note:
**For ease of assembly, mark position of
eccentric bearing support on timing case.**



To remove air compressor :



Unscrew the four screws and remove
compressor.



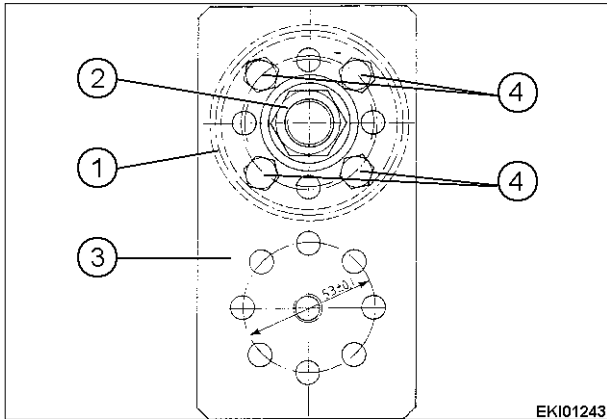
Replace compressor

To remove compressor drive gear (1) loosen nuts
(2).

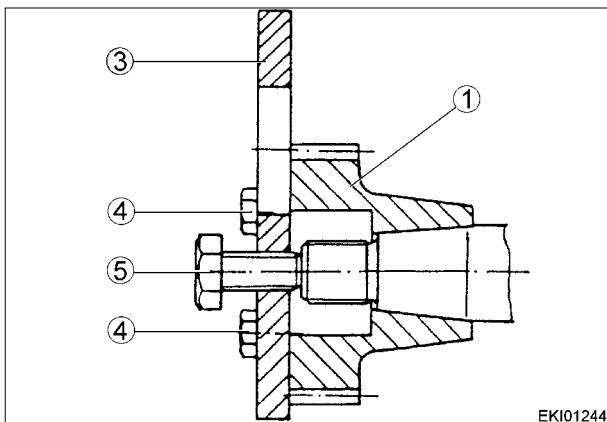
Note:
**Do not swage compressor drive gear into a
vise (Even with soft jaws) for tightening or
loosening the nut of the compressor drive
gear. Risk of damaging drive gear!**
**For this reason, use mounting plate (3)
(Special Tool), as shown.**

Date	Version	Page	Removing and refitting air compressor	Capitel	Index	Docu-No.
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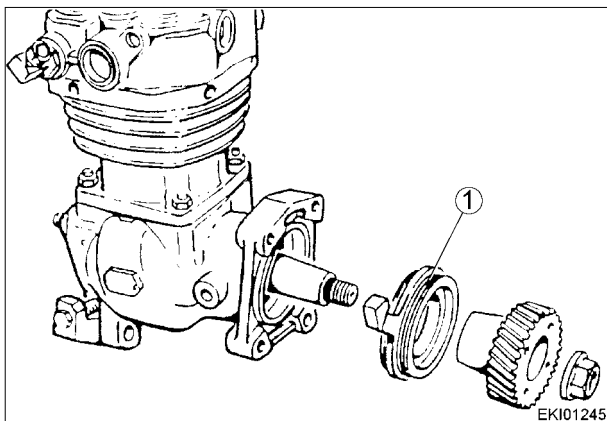
<p>Fav 900</p>	<p align="center">Engine / Short block Removing and refitting air compressor</p>	<p align="center">G</p>
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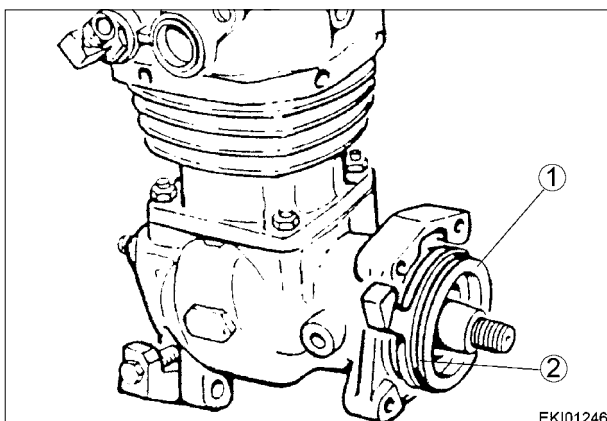
Tighten compressor drive gear (1) with 4 screws (4) on mounting plate (3) to 30 Nm (22.13 lbf-ft).
Loosen nut (2) .
Press out drive gear, fit mounting plate (3) with 4 screws (4) at the bottom side of the drive gear (2).



Screw (5) to be screwed into central threaded hole until drive gear comes loose.
Remove drive gear and mounting plate.



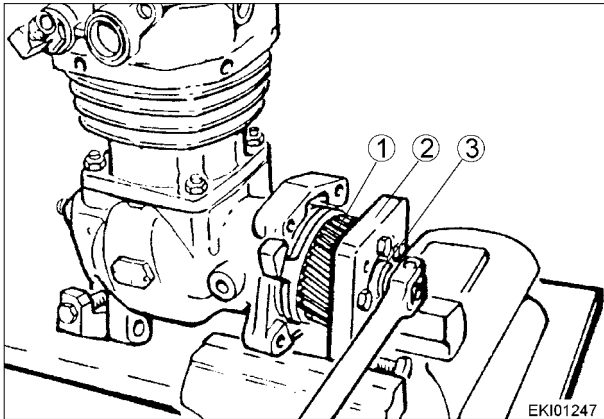
Release eccentric flange (1) from compressor body with a soft hammer.
Remove flange from body.
Unscrew connecting fittings of coolant as well as of compressed air.



Clean eccentric flange (1) .
Replace and put silicon grease on O-Rings (2) .
Put flange (1) into compressor body.

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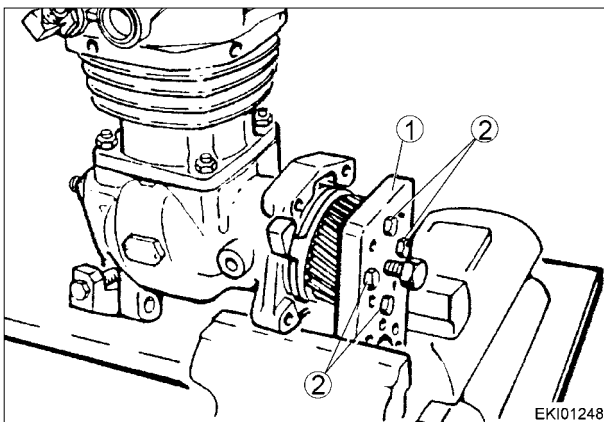
<p>Fav 900</p>	<p align="center">Engine / Short block Removing and refitting air compressor</p>	<p align="center">G</p>
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Place compressor drive gear (1) onto compressor crankshaft using mounting plate (2) (Special Tool).

Note:
Drive gear must be mounted free of grease or oil.

Tighten drive gear nut (3) at 200-250 Nm (148 - 184 lb-ft.).



Remove screws (2) of mounting plate (1) out of drive gear.

Remove mounting plate.

Screw and tighten connection fittings for coolant and compressed air using new gaskets into the cylinder.



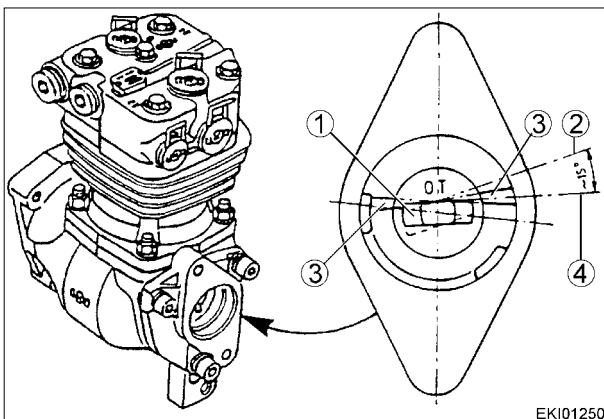
Refitting the compressor

Thoroughly clean sealing faces in compressor control timing case cover.

Use new gaskets and Oil O-rings with silicon oil. O-Rings on eccentric flange must be replaced and greased with silicon oil.

Position flywheel into "TDP" position.

Place lever from the compressor excenter flange onto the highest position.

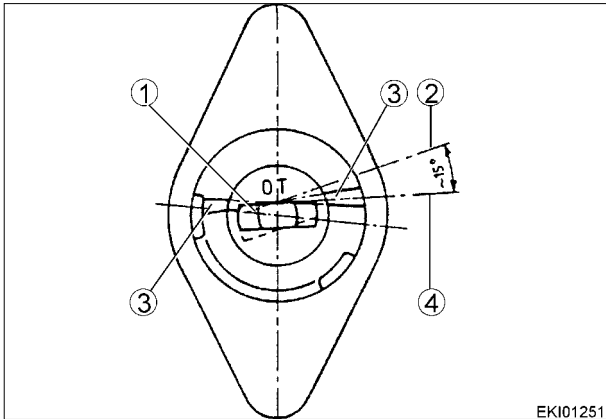


Position compressor crankshaft in such a manner that "TDP" mark on top and the upper edge of the drive fork (1) in position (2) remains about 15° before the unmachined lowlaying part (3) .

Place compressor into timing case using a new O-Ring .

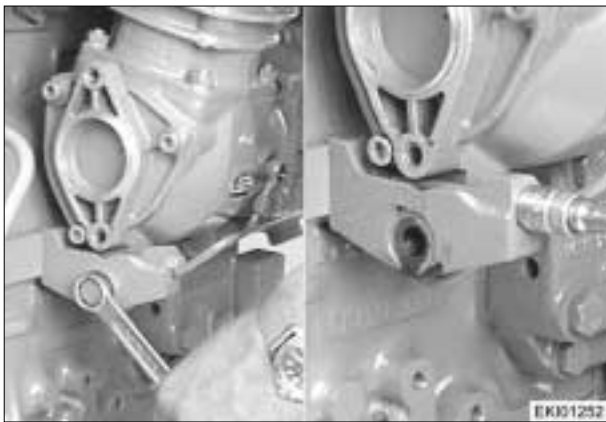
Date	Version	Page	Removing and refitting air compressor	Capitel	Index	Docu-No.
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Due to the slanting teeth cut of the drive gear, the crankshaft will turn by approx 15° by placing the compressor into the timing case. In final position, the upper edge of the drive fork (1) must be in position (4) - flush with the unmachined lowlying part (3) .

If this position cannot be reached, the compressor must be removed and the crankshaft must be turned consequently.



Place 4 screws and tighten them in such a manner that the control eccentric can still be moved.

Screw in the screws of the rear side.

Place eccentric into the marked position of the compressor body.

Consult following pages for avoiding high wear by narrow clearance and excessive noise by excessive clearance, pinion clearance must be precisely adjusted.



Tighten in 3 steps the rear screws at the prescribed torque.

Connect coolant tubes.

Connect lubrication line, intake tube and compressed air line.

Complete coolant and check oil level within the engine.

Fit hydraulic pump or place the substitution cover.

Check all connections for leaks.



Check pinion clearance

Check can only be performed by completely mounted Timing Gear drive and by cold engine.

- Remove hydraulic pump or substitution cover.

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Fav 900	Engine / Short block Removing and refitting air compressor	G
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- Mount dial gauge onto the rear part of the compressor.
- Place shaft extension with dial gauge lever onto drive fork and tighten it in such a manner that the scanning finger of the dial gauge rests without clearance on the gauge lever.
- Turn softly lever with slight pressure axially toward the compressor shaft from one end to the other.

The pinion clearance can be read on the dial gauge.

If the pinion clearance is not OK , then it needs to be adjusted.



Checking backlash

Check backlash between drive wheel and camshaft timing gear by manually turning the knurled collar.

Read off result on the gauge and compare with admissible value.

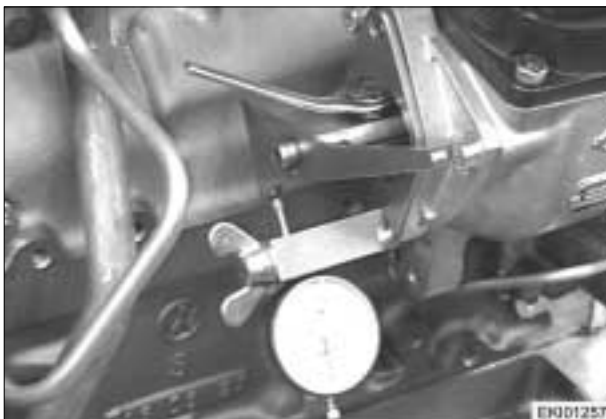
- Unscrew screws as long as the bearing flange and position over drive shaft until the compressor can be actuated easily by turning the flange on the lever .
- By turning the eccentric the pinion clearance must be adjusted between 0,1 - 0,15 mm .

Note:

Position of level

upper = max clearance

down = minimum clearance



- Screw in 3 front screws and rear screws in three steps at the specified torque.
- Refit oil feed line, air intake line and compressor air line.

Screw the frame support bracket.

Refit hydraulic pump or rear end cover.

Date	Version	Page	Removing and refitting air compressor	Capitel	Index	Docu-No.
23.2.2001	a	5/5		2210	G	000013

Fav 900	Engine / Short block Replacing crankshaft front seal	G
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**Removing vibration damper**

Remove fan frame.

Remove power belt.

Unscrew vibration damper, remove vibration damper.

Check vibration damper and washer for damage; replace if necessary.

Remove oil splash ring.

**Replacing crankshaft front seal**

Lever out rotary shaft with special tool.



Apply multi-purpose grease to sealing lips.

Fit new shaft sealing ring.

Note:

Do not damage sealing lips.

Use press-in plate to drive shaft sealing ring into timing case until flush with recess .

**Refitting the vibration damper**

With surfaces free of grease and oil, position vibration damper including oil splash ring, insert screws and tighten to specified torque.

Refit power belt.

Place screws and tighten.

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Fav 900	Engine / Short block Removing and refitting flywheel	G
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**Remove flywheel**

Loosen screws, holding starter ring gear in place with a large screwdriver, if necessary.

Unscrew and remove two screws on opposite side, replace with two guide mandrels (special tool).

Unscrew all screws and remove clutch flange.

Using two M10, ease off the flywheel.

Remove clutch flange and disc.

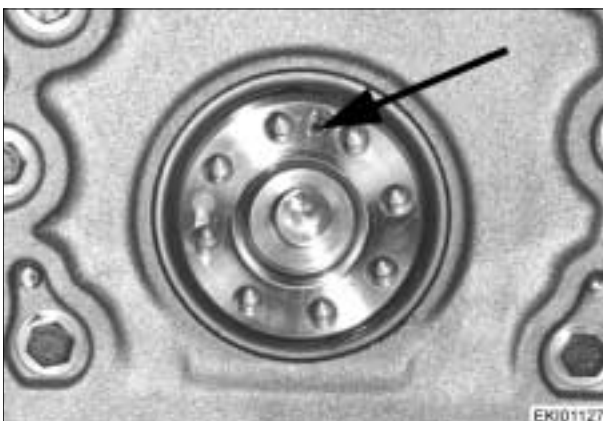
**Danger:**

The flywheel is very heavy.

Use suitable hoisting gear.



Clean and check flywheel.

**Refitting flywheel.**

Position flywheel on two guide mandrels, observing the correct alignment between centering pin (arrowed) and flywheel bore hole: Refit disc and clutch flange. Push on flywheel to end position.

Apply a small amount of oil to the screws.

Insert and tighten to specified torque, alternating sides.

Date	Version	Page	Capitel	Index	Docu-No.
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Fav 900	<p align="center">Engine / Short block</p> <p align="center">Removing and refitting flywheel</p>	<p align="center">G</p>
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Replacing the starter ring gear

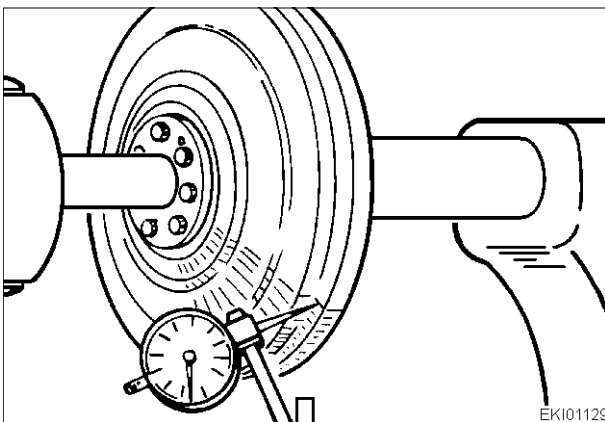
Remove fly wheel.

Drill starter ring gear and force open with a chisel.



Warning:

Do not damage the flywheel.



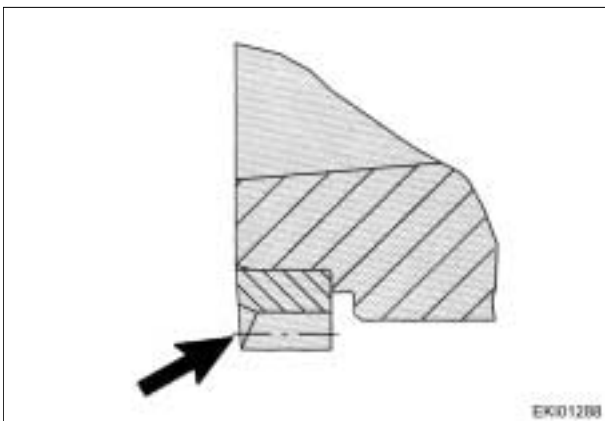
Note:

Since the maximal permissible axial run-out of the starter ring gear must not be exceeded, it is advisable to determine flywheel deviation at ring gear contact face, before ring gear is shrunk on. If this is in excess of the specified value, the flywheel must be replaced.

Clamp flywheel to the hub.

Fit dial gauge to contact face of starter ring gear.

Rotate flywheel several turns by hand and observe gauge reading.



Heat new starter ring gear to approx. 220° to 240°C (428° - 464°F) and press on as far as possible.



Warning:

Watch the position of chamfer (arrowed).

Check maximal deviation.

Date	Version	Page	Removing and refitting flywheel	Capitel	Index	Docu-No.
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Fav 900	<p align="center">Engine / Short block</p> <p>Removing and refitting crankshshaft seal (flywheel).</p>	G
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Rermoving shaft seal

Remove flywheel.
Lever out sealing ring with special tool.



Refitting the shaft seal

Apply a thin coat of multi-purpose grease to lips of new sealing ring.
Fit seal with open side facing the crankshaft using an expanding mandrel - drive in until properly aligned.
Refit the flywheel.

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15.2.2001	a	1/1	2210	G	000003

Fav 900	Engine / Short block Removing and refitting flywheel housing.	G
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Removing flywheel housing

Unscrew and remove the two screws (M16).



Then remove the two screws (M8), screw into the flywheel housing.



Unscrew screws which are fitted right and left on flywheel housing.

Date	Version	Page	Removing and refitting flywheel housing.	Capitel	Index	Docu-No.
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Fav 900	Engine / Short block Removing and refitting flywheel housing.	G
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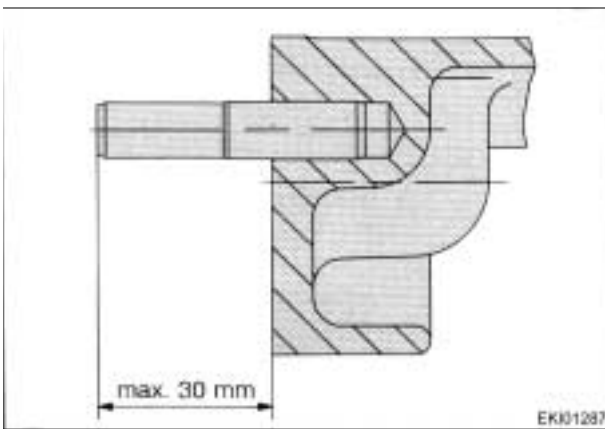
Remove starter.
Remove flywheel.
Unscrew and remove the fixing bolts.

Note:
For easy assembly use two fairly long guide pins.

Remove flywheel housing.

Caution:
The flywheel is very heavy.
Use suitable hoisting gear.

Remove gasket residues from flywheel housing and crankcase.



Note:
If the replacement guide pins are fitted, their projection must not exceed 30 mm: if this is exceeded, they will be in contact to flywheel through the housing.



Refitting the flywheel housing.

Coat flywheel sealing face with sealing compound "Terostat 63" and position on crankcase.

Insert screws (including those to the oil pan) and tighten to specified torque.

Refit flywheel.

Refit starter.

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15.2.2001	a	2/2		2210	G	000005

<p>Fav 900</p>	<p align="center">Engine / Short block Removing and refitting the timing case.</p>	<p align="center">G</p>
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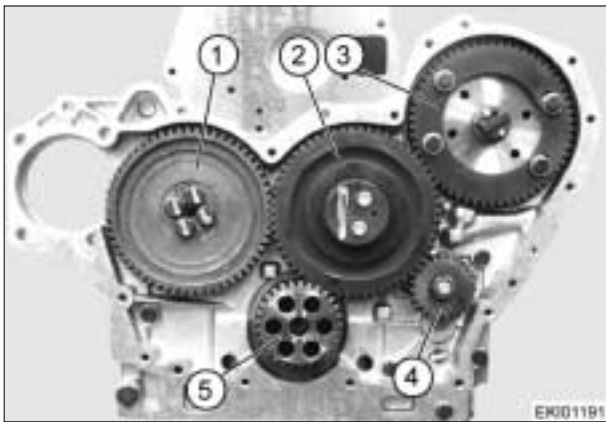


Removing case cover

Remove fan frame, vibration damper and air compressor.

Remove screws of timing case cover.

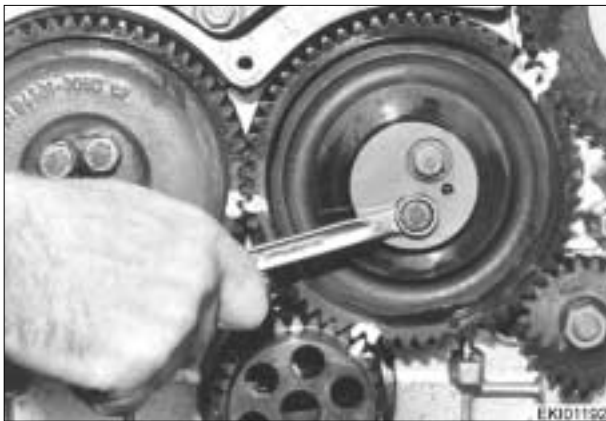
Remove cover.



1. Crankshaft timing gear (observe "2-2-2" on intermediate gear)
2. Intermediate gear
3. Injection pump drive gear.
4. Oil pump drive gear.
5. Crankshaft timing gear (observe "*-*-1" on intermediate gear).

Note:

For easy reassembly mark timing gear appropriately before removing.



Removing intermediate gear

Remove injection pump

Unscrew hex screw, remove thrust washer and pull off intermediate gear by hand.

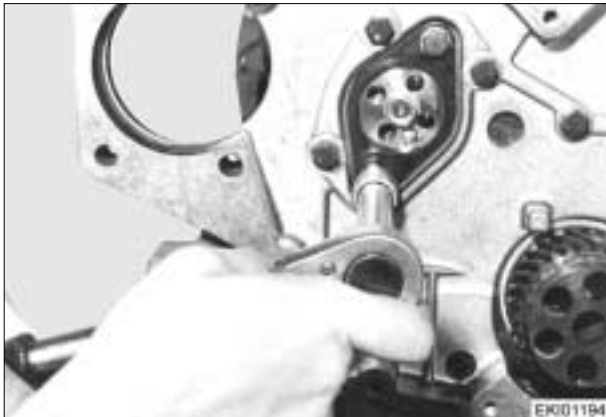


Removing crankshaft timing gear

- Lock up gear with a large screw-driver and remove screws. Avoid damage to the tooth flanks.
- Remove crankshaft timing gear.

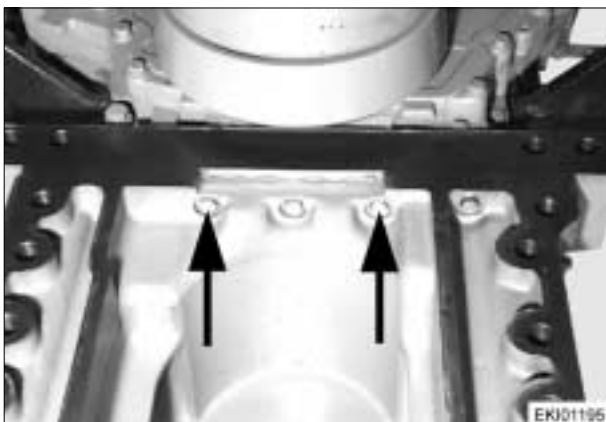
Date	Version	Page	Removing and refitting the timing case.	Capitel	Index	Docu-No.
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<p>Fav 900</p>	<p>Engine / Short block Removing and refitting the timing case.</p>	<p>G</p>
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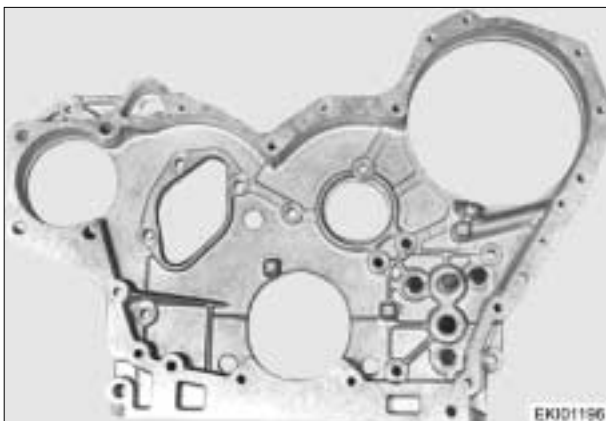
Replacing crankshaft axial stop

If necessary, replace crankshaft axial stop (thrust washer).

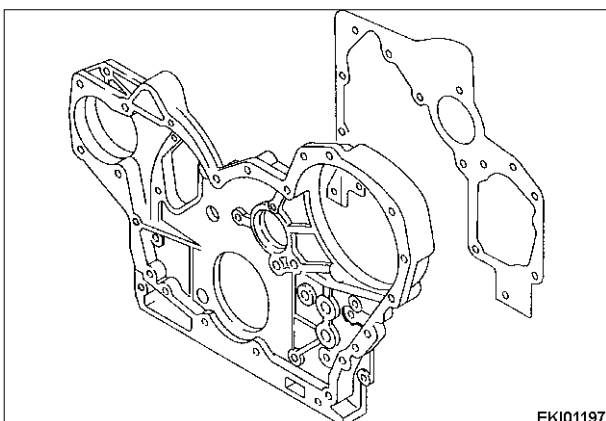


Removing timing case

Unscrew and remove screws (SW13) between oil pan and timing case.



Unscrew and remove all other screws.
 Remove timing case.



Refitting timing case

Fit new gaskets to crankshaft housing.
 Install timing case

Note:
Replacement studs of the injection pump must be inserted with "Loctite 648".

Insert screws and tighten to specified torque.

Note:
Ensure correct fit of gasket.

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<p>Fav 900</p>	<p align="center">Engine / Short block Removing and refitting the timing case.</p>	<p align="center">G</p>
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Refitting crankshaft timing gear

Slide crankshaft timing gear onto the centering pin.

After fitting the intermediate gear tighten screws at the specified torque.



Refitting intermediate gear

Position intermediate gear.

Align camshaft and crankshaft with appropriate markings, insert intermediate gear.

Note:

Position of crankshaft timing gear in relation to intermediate gear is marked with "*-*1".

Position of camshaft timing gear in relation to intermediate gear is marked with "2-2-2".

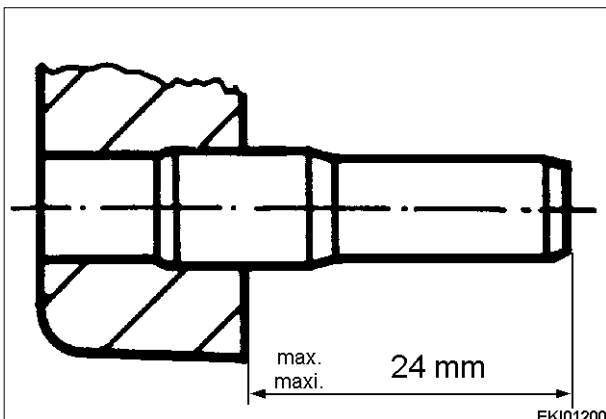


Fit thrust washer and insert screws .

Tighten screws of intermediate gear and camshaft gear at specified torque.

Refit injection pump gear.

Refit injection pump



Note:

Replacement centering pin must be driven in as far as possible; maximal projection is 24 mm. Shorten if necessary.

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Refit timing case cover with new gasket. Insert screws and tighten.

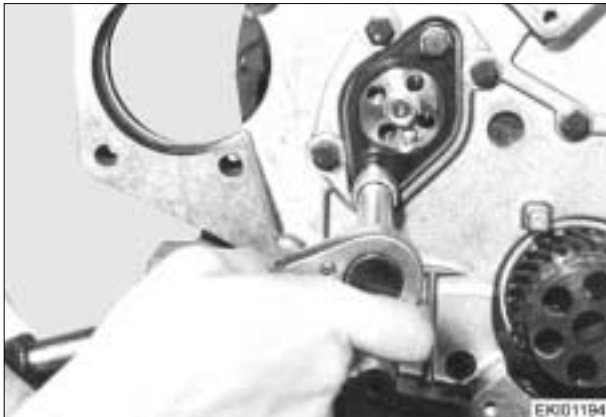
Refit vibration damper, Centaflex-coupling, front axle support, trunnion, alternator, Visco-fan and Power-belt.

Set valve clearance.

Refit cylinder head cover with a new dry gasket, insert screws and tighten.

Date	Version	Page	Removing and refitting the timing case.	Capitel	Index	Docu-No.
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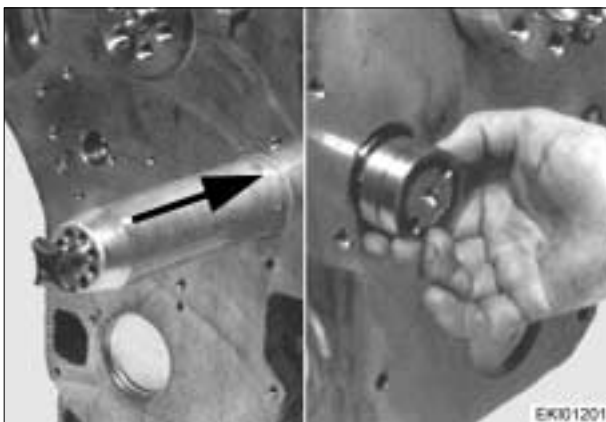
Fav 900	<p align="center">Engine / Short block</p> <p align="center">Removing and refitting camshaft</p>	<p align="center">G</p>
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Removing camshaft

- Remove oil pan
 - Remove timing case cover, idler gear and camshaft gear.
 - Remove flywheel housing
 - Remove rocker arm assembly and pushrods.
- Unscrew axial stop screws and remove axial stop.

Note:
Following photographs show the driving gears and timing case removed. The camshaft can be replaced without removing these parts.

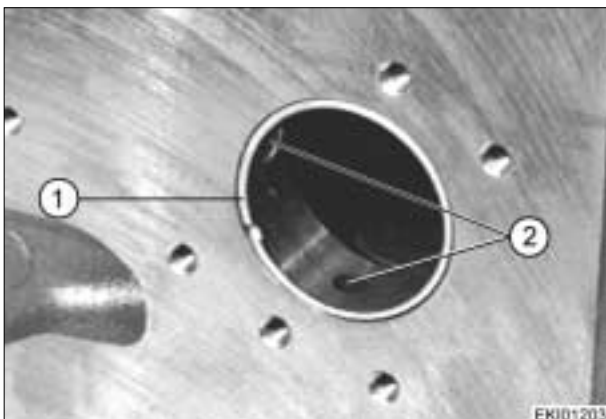


Put engine upside down in order to have the pushrods sliding toward the cylinder head in such a manner that they will not disturb the removing operation of the camshaft!

With a special mandrel push out camshaft from the timing case end, at the same time guiding it at the flywheel end.



Check tappets, replace if necessary.



Replacing camshaft bearings

Using a mandrel, drive out camshaft bushes.

Note:
Crankshaft must be removed.

Note:
On the new bushes the notch must be facing the fan end, and the oil channels should be aligned with those in the timing case.

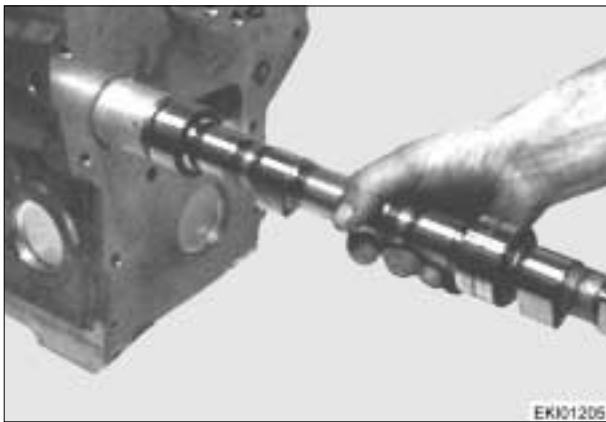
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Fav 900	<p style="text-align: center;">Engine / Short block</p> <p style="text-align: center;">Removing and refitting camshaft</p>	G
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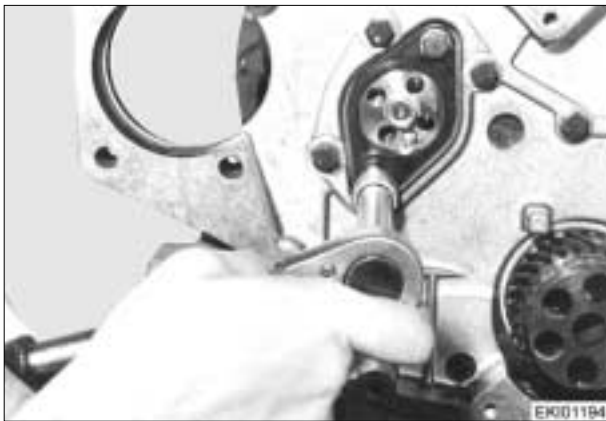
Using a mandrel and in new bushes towards fan until flush with the crankcase.

Note:
Bearing bushes must be machined to the required size. The crankcase must be cleaned with compressed air (oil channels) after this operation.



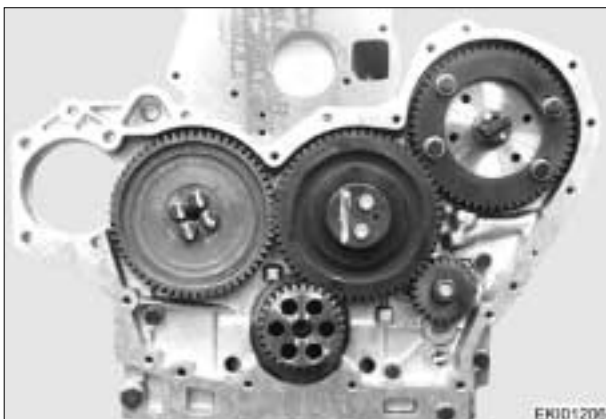
Refitting the camshaft

Slide guide mandrel into crankcase, insert camshaft in mandrel and refit camshaft into the crankcase.



Refit axial stop, insert screws and tighten at specified torque.

Measure end clearance; if necessary replace thrust washer.



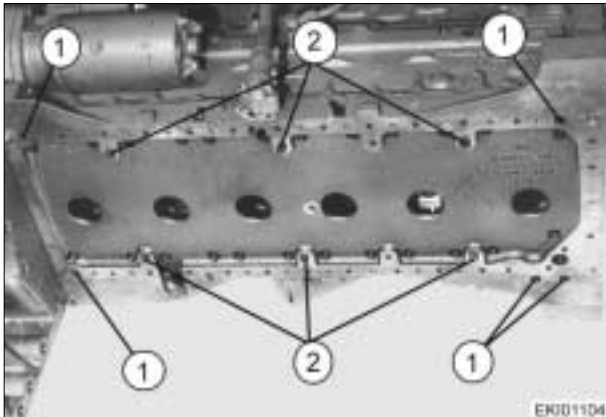
- Refit timing gear.
- Refit timing case.
- Refit oil pan and idler gear.
- Reconnect pushrod and refit rocker arm assembly.

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Fav 900

Removing and refitting intermediate flange

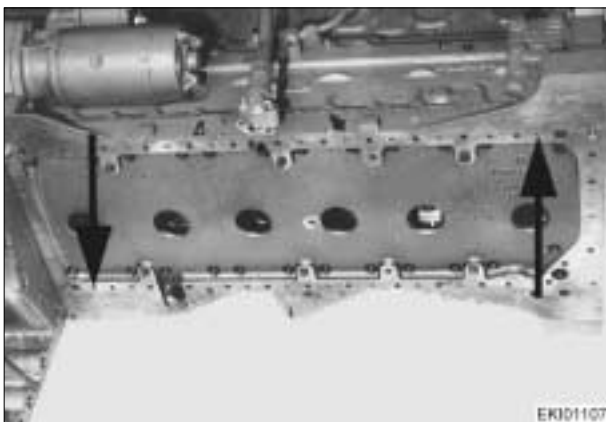
G



Removing intermediate flange

Unscrew and remove dispstick guide tube and undo oil filter cap.

Place a jack, unscrew and remove screws (1)



Insert 2 (M8x60) screws (arrowed) and carefully separate oil pan and intermediate flange.

Clean flange.

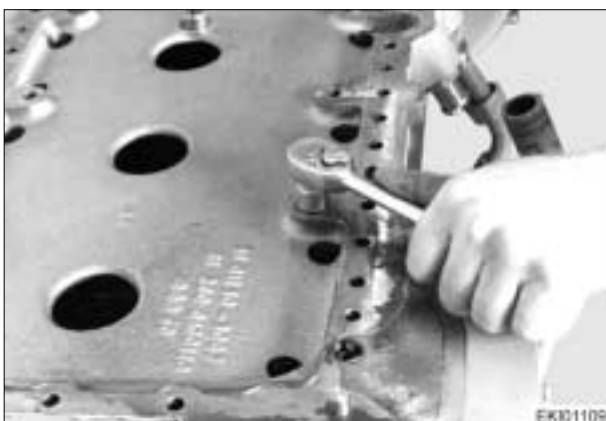
Remove all gasket residue from flange and crankcase.



Refitting the intermediate flange

Coat flange sealing surface with sealant Terostat 63.

Using a jack, slowly raise the flange to the crankcase and insert screws.



Tighten screws at the specified torque.

Refit oil pan and oil intake line.

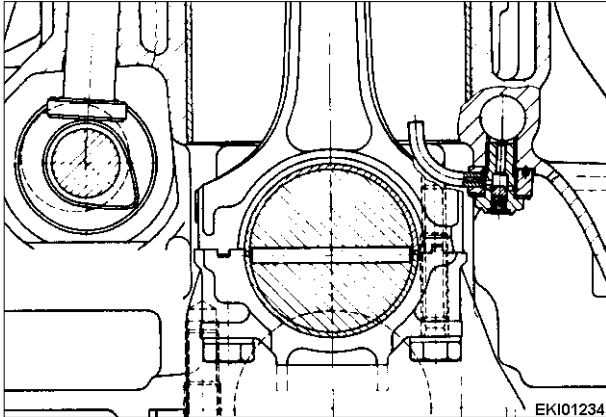
Screw on the flange.

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Fav 900

Engine / Short block
Removing and refitting con-rod bearing shells

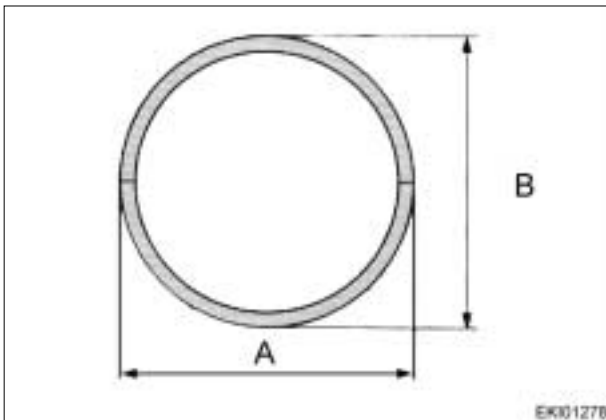
G



Remove piston and con-rod assembly.

Note:

Con-rod bearing shells of open bearings can be used again as long as they produce perfect running.

**Note:**

When repairing con-rod bearing journals, use bearing shells of the relevant repair size.

Check spread of new bearing shells :

Place bearing shells together on a level surface.

Measure and note dimension "A".

Measure and note dimension "B".

Spread= A - B



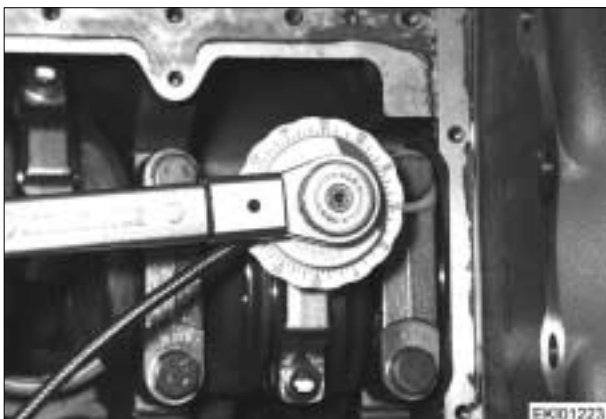
Fit new bearing shells to con-rod big-end and bearing caps.

Note:

Avoid damaging the running-in coating of the shells.

Apply a thin oil film to running surfaces of bearing shells.

Refit piston and con-rod assembly.

**Note:**

Never re-use con-rod bolts.

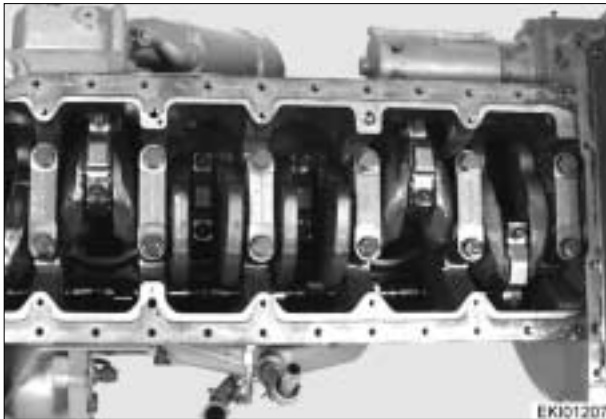
Tighten con-rod bolts only with bearings in place.

Insert new con-rod bolts and gradually tighten to specified torque.

Use torque angle indicator for final tightening process.

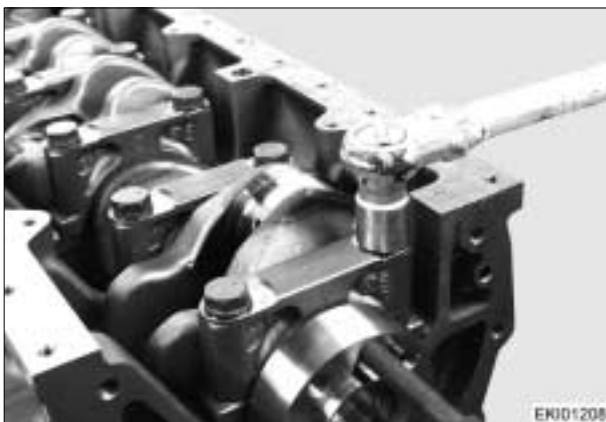
Date	Version	Page	Capitel	Index	Docu-No.
22.02.2001	a	1/1	2210	G	000011

<p>Fav 900</p>	<p align="center">Engine / Short block Removing and refitting the crankshaft</p>	<p align="center">G</p>
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Removing and refitting the crankshaft

- Remove oil pan, oil line and idler gear.
- Remove timing case and flywheel housing.
- Remove cylinder head.
- Remove piston and con-rod.



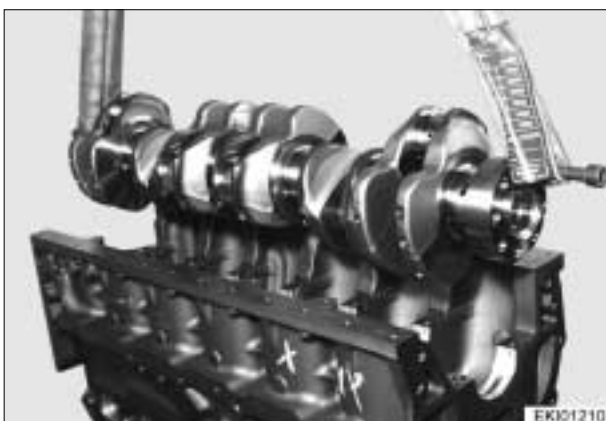
Gradually loosen screws of crankshaft bearing caps from the center outwards and remove: Take off bearing caps and arrange in order of assembly.

Note:
Bearing cap positions in relation to the crankcase are identified by numbers: bearing number 1 is at the fan end.

Remove bearing shells from bearing caps. If they have not been marked, identify bearing shells and caps appropriately.



Remove the lower part of the axial stop washer.



Lift crankshaft out of crank case using a rope or leather strap.

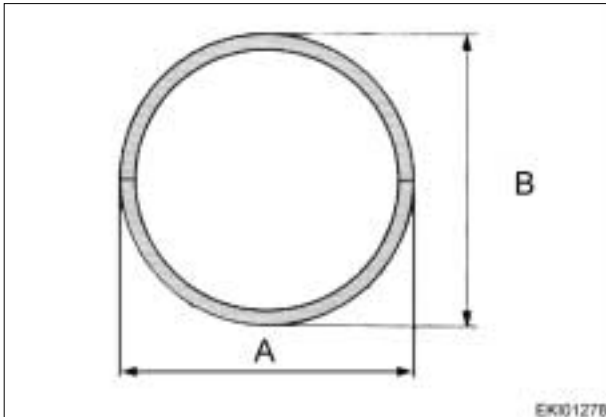
Note:
Do not use a steel cable as this could damage the bearing faces of the crankshaft journals.

Remove bearing shells from crankcase. If they have not been marked, identify bearing shells and bearing caps appropriately.

Clean parts and check for wear; replace if necessary.

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20.2.2001	a	1/3		2210	G	000008

<p>Fav 900</p>	<p align="center">Engine / Short block Removing and refitting the crankshaft</p>	<p align="center">G</p>
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Checking bearing shell spread

Place bearing shells together on a level surface. Measure and note dimension "A", repeat for "B". Spread= A - B.



Refitting the cranshaft

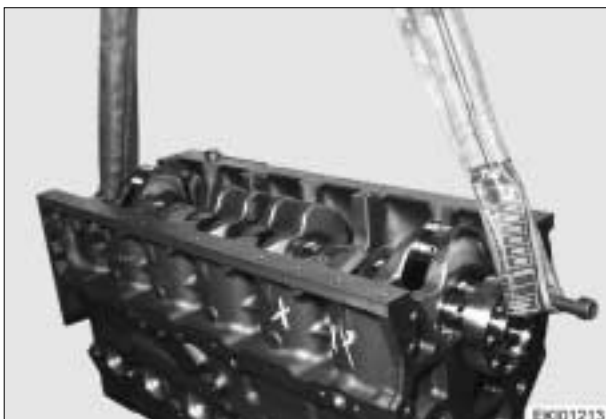
Clean oil ducts in crankcase and camshaft with dry compressed air.



Thoroughly clean bearing shells and journals. Insert bearings shells in crankcase, observing identification numbers.

Stick the upper part of the axial to washer with grease onto crankcase.

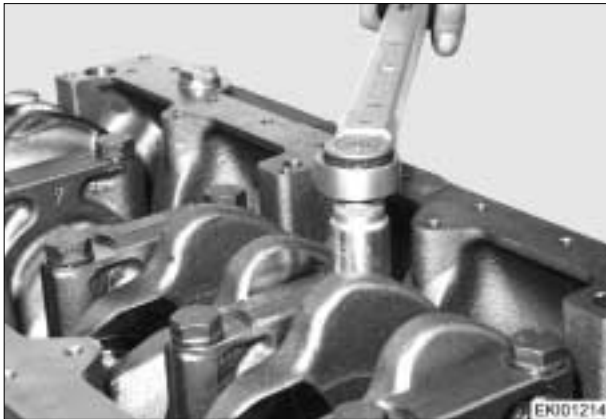
Note:
When using new bearing shells, observe relevant repair size.



Lubricate running surfaces of bearing shells and fit crankshaft.

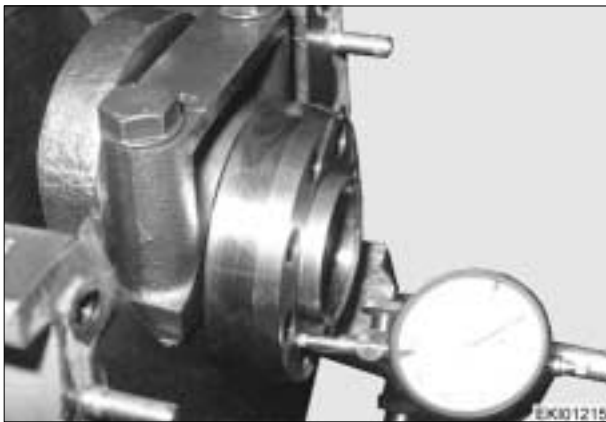
Date	Version	Page	Removing and refitting the crankshaft	Capitel	Index	Docu-No.
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Fav 900	<p align="center">Engine / Short block</p> <p align="center">Removing and refitting the crankshaft</p>	<p align="center">G</p>
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Match bearing caps to relevant bearing shells. Lubricate running surfaces of bearing shells and fit caps. Insert bearing cap screws and gradually tighten from the center outwards at specified torque.

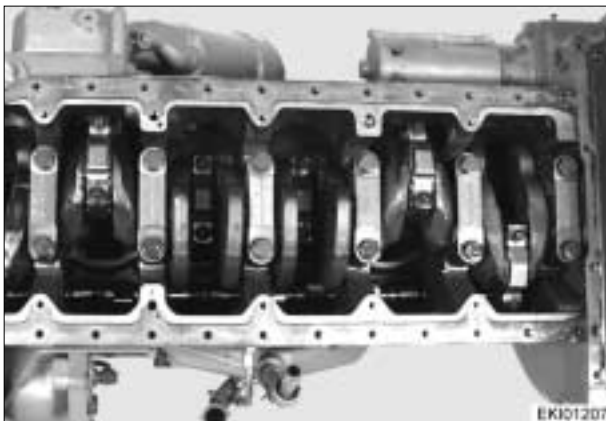
Note:
Faulty bearing caps cannot be replaced uniquely.



Checking end play

Note:
The end play of the crankshaft is determined by the condition of the main bearing.

- Position gauge holder with dial on the crankshaft.
- Press scanning tip of gauge onto flywheel flange or crankshaft.
- Press crankshaft back and forwards and read off end play on the dial gauge.
- If the maximal permissible end play is exceeded, all main bearings must be replaced.



Assembling the engine

- Refit piston and con rod assembly
- Check crankshaft for free running.
- Refit cylinder heads.
- Refit timing case, flywheel housing and flywheel.
- Refit oil pan, oil line and balancer gear.

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Fav 900	Engine / Short block Removing and refitting con-rod	G
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Removing piston from con-rod

- Remove oil pan, suction line and intermediate flange.
- Remove cylinder head.

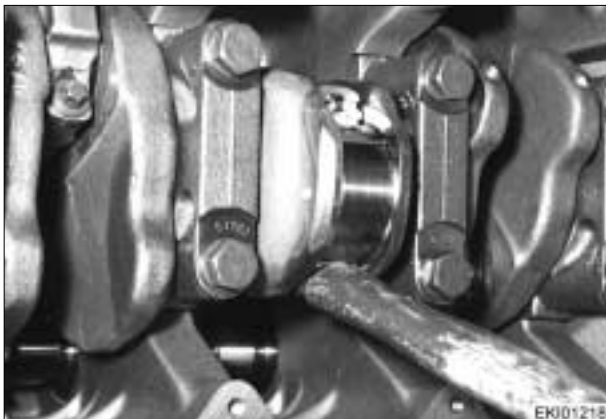
Remove con-rod bearing cap bolts.



Remove con-rod bearing caps and bearing shells, applying light knocks with a plastic hammer if necessary.

Note:

Con-rod bearing caps are numbered to match the big-end and crankcase. Arrange in appropriate order.



Using a piece of hard wood, remove combustion residue (coking) from upper edge of cylinders.

Note:

Do not damage cylinder running surface.

Push con-rod on piston upwards.

Note:

Do not damage cooling oil - nozzle.

Place piston and con-rod next to the matching bearing cap. If available, use the special tray.

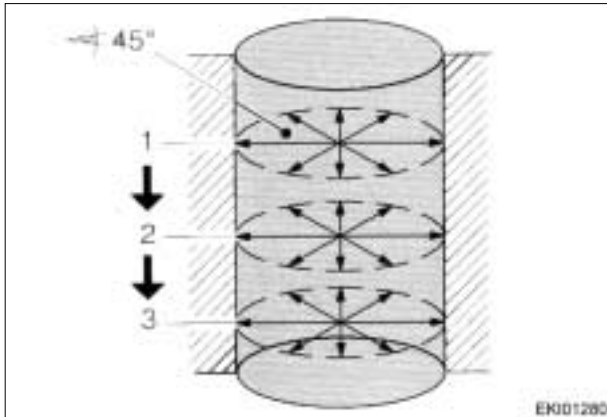
Carry out a visual check on piston and piston rings.

Note:

Repair pistons with a 0,2; 0,4 and 0,6 (.008", .016" and .024") increase in compression height are available for remachined crankcase sealing faces.

Date	Version	Page	Removing and refitting con-rod	Capitel	Index	Docu-No.
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<p>Fav 900</p>	<p align="center">Engine / Short block Removing and refitting con-rod</p>	<p align="center">G</p>
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Determining piston play

Measure cylinder inside diameter with an internal micrometer at **three** levels (top to bottom) and radially at 45° to each other. make a note of the values. Verify diameter of the new piston from the piston crown. Determine diameter of used pistons with an external micrometer (measured from lower edge of piston at right angles to pistons axis; for dimension see Service data). Make a note, subtract piston diameter from largest measured cylinder diameter.

The resulting value is the piston clearance. If clearance ist excessive cylinder liner and piston must be replaced.



Refitting piston and con-rod

Note:

If, for whatever reason, pistons need to be replaced, measure the piston diameter or read dimension on piston crown to find out if replacement pistons were fitted previously. If so, use oversize pistons.

Apply a thin oil film to cylinder walls and pistons.

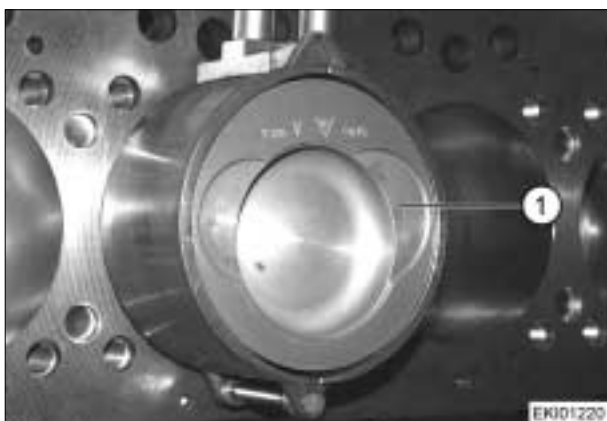
Note:

Use new con-rod shells. Measure spread.

Thinly oil con-rod bearing shells and insert them into con-rod big end.

Offset piston ring gaps by 120°,

Slide on piston ring clamp and compress piston rings.



Insert piston and con-rod onto the cylinder, making sure that piston, conrod and cooling oil nozzle are assembled correctly.

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<p>Fav 900</p>	<p>Engine / Short block Removing and refitting con-rod</p>	<p>G</p>
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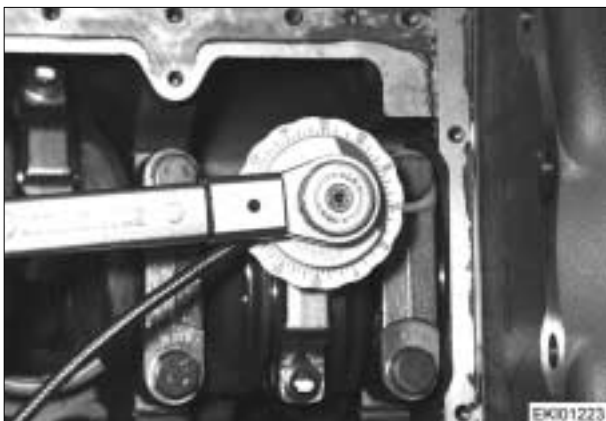


Guide con-rod and insert piston until big end makes contact with the bearing journal.



Fit con-rod bearing shells into bearing caps.
 Fit bearing caps, making sure the numbers are matching.

Note:
Numbers on bearing cap and big end must be on the same side.
Chamfered side (Arrow) on con- rod cap must show toward cooling oil nozzle.



Note:
Never reuse con-rod bearing bolts .
 Insert new con-rod bearing bolts and gradually tighten to specified torque.
 Use torque angle indicator for final tightening process.



Removing piston from con-rod

Remove piston with con-rod.
 Clamp con-rod in a vise, using non-metallic jaws.
 Remove piston pin circlips.

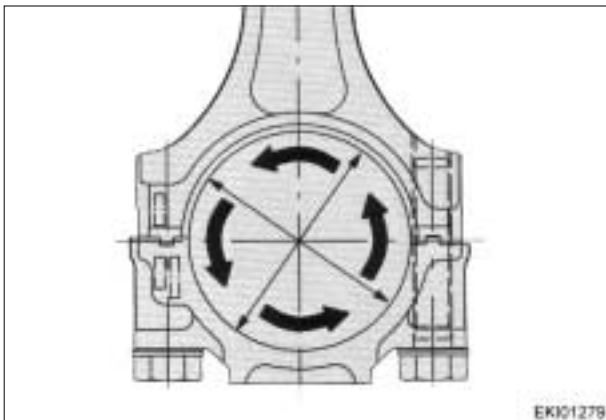
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<p>Fav 900</p>	<p>Engine / Short block Removing and refitting con-rod</p>	<p>G</p>
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Press out piston pin, securely holding the piston. Remove piston and deposit it safely.

Note:
If the con-rod needs replacing, use ready-to-fit new bush or reconditioned con-rod.



Measuring big-end con-rod bore

Screw on con-rod bearing caps (without bearing shells).

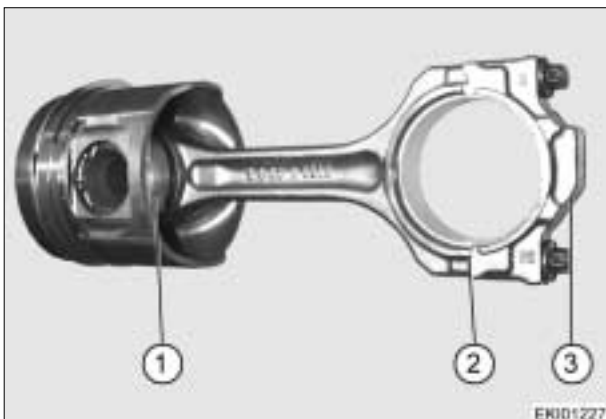
Measure bore diameter with an internal micrometer.

Replace con-rod if this is in excess of the permissible variation.



Refitting piston to con-rod

Fit piston to con-rod, inserting piston pin, and fit circlips.



When reassembling, make sure that piston, con-rod and cooling oil nozzles are assembled correctly.

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Fav 900	Engine / Short block Removing and refitting con-rod	G
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Measuring the piston projection

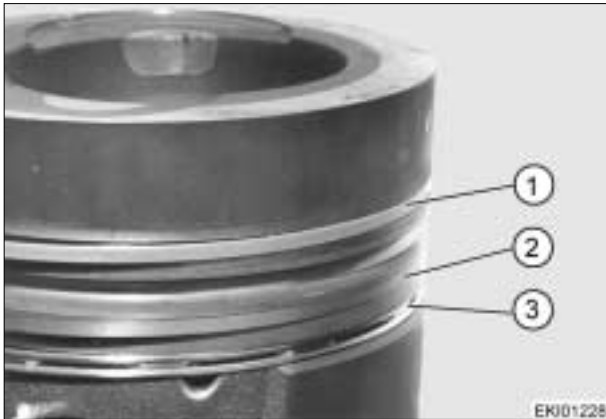
Remove the cylinder heads.
 Turn relevant piston to TDC.
 Position gauge holder with dial on crankcase sealing face.
 Set gauge at "0".



Carefully move dial gauge holder, lifting the gauge tip at the same time.
 Lower tip onto piston crown and check dial reading for piston projection.

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<p>Fav 900</p>	<p>Engine / Short block Removing and refitting the piston rings</p>	<p>G</p>
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Piston ring arrangement

1. Compression ring (keystone ring)
2. Compression ring (chamfered ring)
3. Oil scraper ring (D-ring)



Removing piston rings

Remove piston and con-rod assembly.
 Clamp con-rod in a vise, using non-metallic jaws.
 Set piston ring pliers to piston diameter.



Position pliers at piston ring gap and pry rings out of the piston ring grooves.

Note:

The spring insert of the oil scraper ring causes greater tangential stress.

Carefully clean piston ring with a small piece of wood.

Avoid damage to piston ring grooves.



Checking end clearance

Fit piston rings to respective cylinder and determine end clearance with a feeler gauge.

If this is excessive, piston rings must be replaced.

Date	Version	Page	Removing and refitting the piston rings	Capitel	Index	Docu-No.
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Fav 900	Engine / Short block Removing and refitting the piston rings	G
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Refitting piston rings

Using piston ring pliers, insert piston rings in relevant groove with "Top" facing upwards.



Using a feeler gauge, determine piston ring end play in the relevant piston ring grooves at several points.

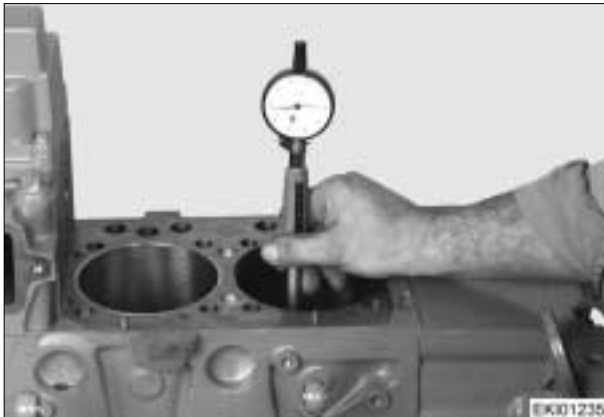
If this is excessive, piston and piston rings must be replaced.

Date	Version	Page	Removing and refitting the piston rings	Capitel	Index	Docu-No.
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Fav 900

**Engine / Short block
Replacing cylinder liners**

G



Checking cylinder liners

Measure cylinder inside diameter with an internal micrometer at three different levels (top to bottom) and radially at 45° to each other: Make a note of these values.

Determine piston clearance.

If worn beyond a useful life, both piston and cylinder liners must be replaced.

Note:

For the liner outer diameter an upper deviation of 0,5 mm (.020") is permissible.

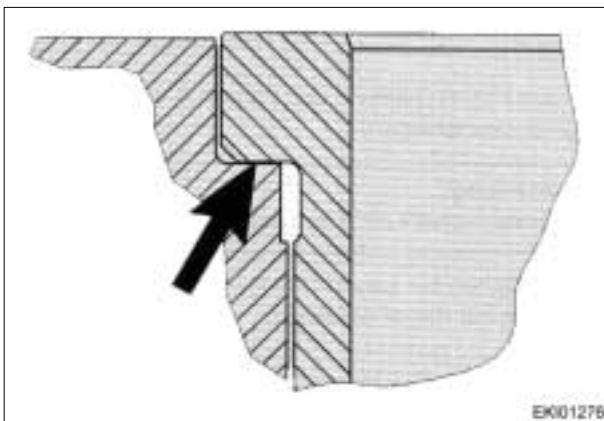


Removing the cylinder liner

Removing cooling oil nozzles chapter 2312 Reg G.

Usually the cylinder liner can be removed by hand.

If not loosen slip-fit liner with extractor tool and remove.



Refitting the cylinder liner

Note:

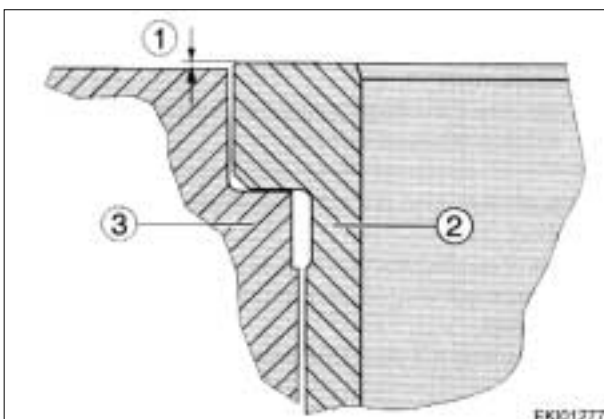
Before fitting, clean seating.

Position cylinder liner, making sure it is straight, and press in by hand.

The liner must make contact with the seat (arrowed).

The collar outer diameter should not be in contact with the bore.

Refit oil spray nozzle.



Check projection of liner (2) in relation to the crankcase(3).

Position gauge holder with dial at the crankcase sealing face.

Measuring liner projection (1) at 4 points.

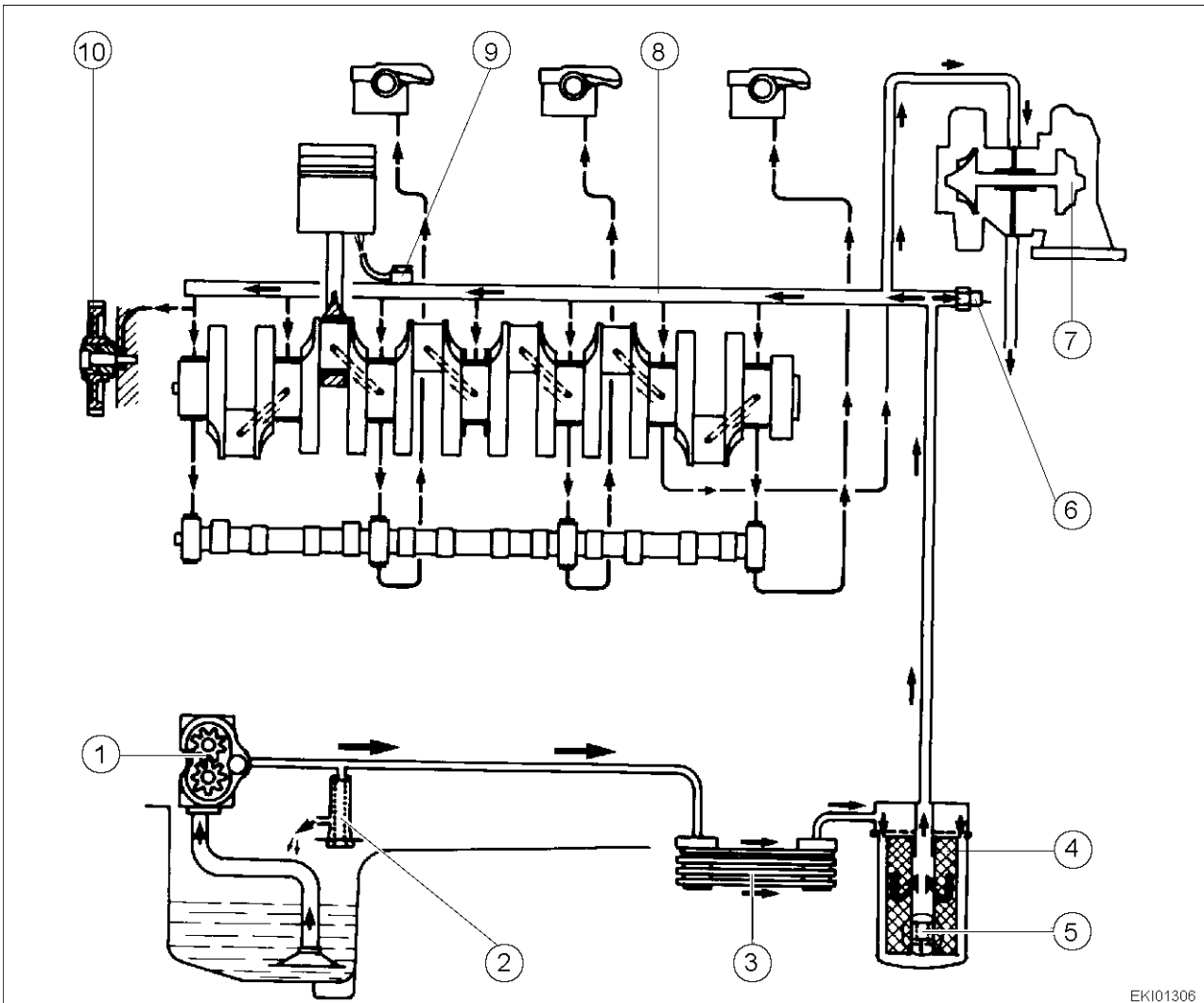
Permissible deviation = 0,01-0,06 mm (.0004 - .0024").

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Fav 900

**Engine / Lubrication
Layout of engine lubrication**

C



EKI01306

- 1. Lubrication Gear pump
- 2. Pressure relief valve
- 3. Oil cooler
- 4. Main stream oil filter
- 5. Oil filter Bypass valve
- 6. Oil pressure switch
- 7. Turbocharger
- 8. Main oil duct
- 9. Oil cooling nozzle
- 10. Intermediate timing gear

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Fav 900	Engine / Lubrication Replacing oil filter	G
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Replacing oil filter



Caution:

**The cartridge is filled with hot oil.
Danger of severe burns.**

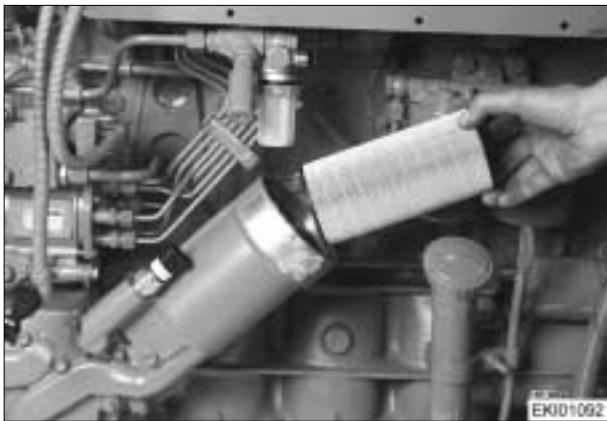
- Loosen filter lid 2 turns, wait about 5 minutes until all the remaining oil has drained from the oil filter housing in the oil pan.
- Remove cover completely .



- Pull out filter cartridge with the central guiding tube.

Collect dripping oil using an appropriate recipient below cartridge.

- Replace cartridge.
- Replace O-Rings of the central tube and on the cover.
- Put cover and filter cartridge in place and tighten at 25 Nm .



Fill up with engine oil and check for eventual leaks.

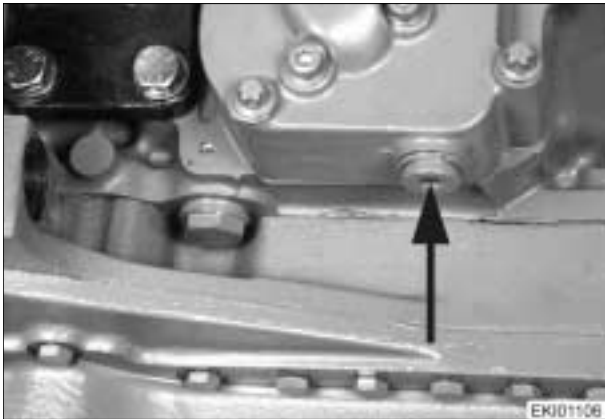
Check oil level.

Note:

Used oil and cartridge are hazardous waste.

Date	Version	Page	Replacing oil filter	Capitel	Index	Docu-No.
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<p>Fav 900</p>	<p align="center">Engine / Lubrication Removing and refitting oil cooler</p>	<p align="center">G</p>
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Removing oil filter

Note:

Used oils and filter cartridges are hazardous waste! Dispose properly!

Remove oil filter.

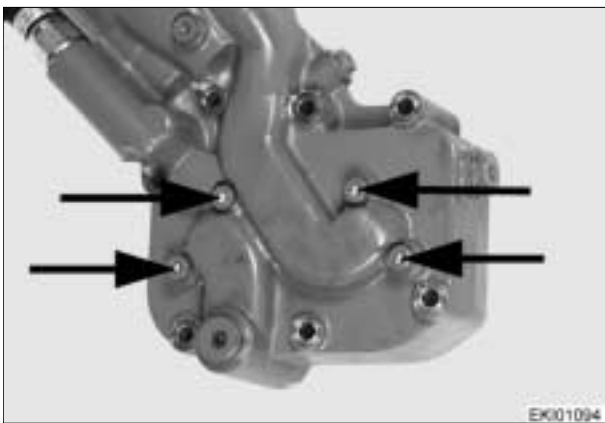
Unscrew drain plug (arrowed) from oil filter head and drain fluid into a container of adequate size.



Disconnect oil pressure sensor.

Remove screws from oil filter head.

Remove gasket residue from the sealing surfaces.

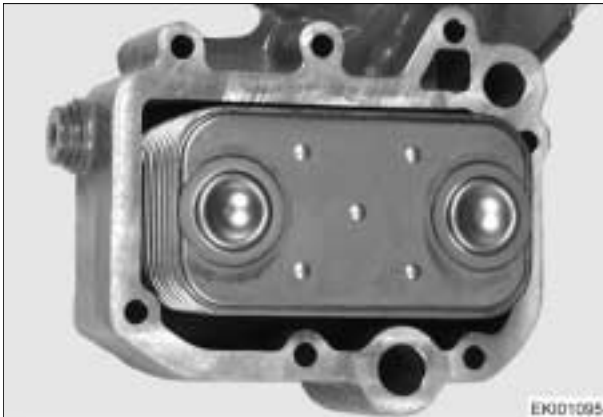


Remove screws from oil cooler.

Check oil cooler for damage; if necessary, replace.

Remove gasket residue from the sealing surfaces.

Fav 900	Engine / Lubrication Removing and refitting oil cooler	G
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Refit oil cooler

Fit oil cooler to the oil filter head with new gaskets. Position oil filter head on engine block, using new gasket. Place screws and tighten.



Warning:

Make sure gasket fits properly.

Refit oil filter:

Screw in drain plug for coolant, using a new seal.

Connect sensor.

Check oil and coolant levels; top up if necessary.

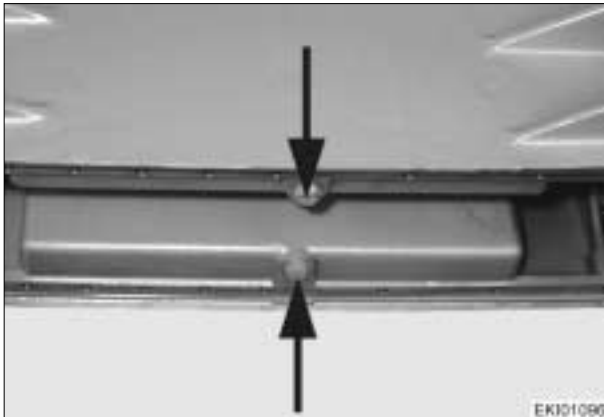
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Fav 900

Engine / Lubrication

Removing and refitting oil pan

G



Removing oil pan

Note:

Used oils are hazardous waste. Dispose properly ! Respect safety regulations!

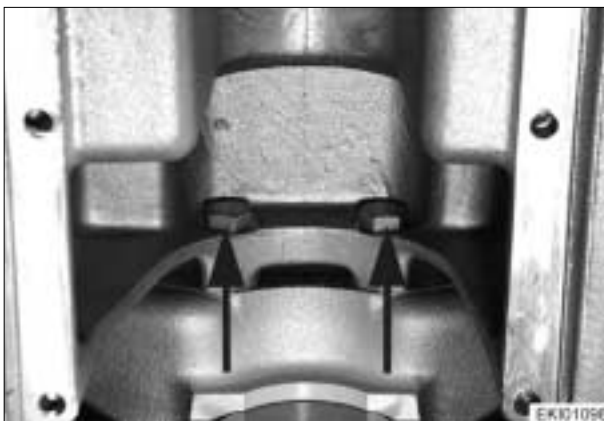
Pull out dipstick and remove filling cover..

Remove drain plug (Arrows) and drain oil.

Use a recipient with sufficient capacity.



Remove screws (arrowed) at the front of the oil pan (water pump).



Remove two screws as shown.



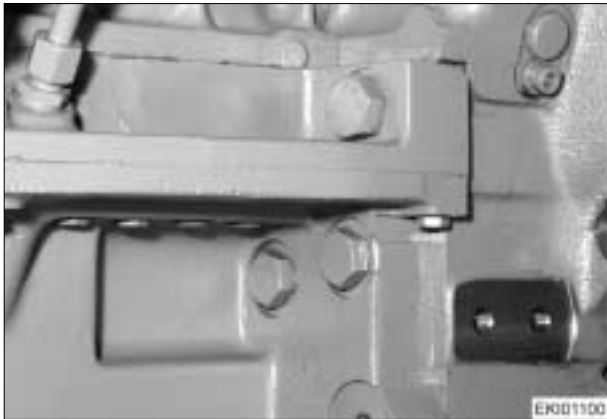
Then remove the two (M8) screws which are fully screwed (not shown) into the flywheel housing.

Note:

When removing the oil pan it is essential to use a jack : The oil pan is extremely heavy (approx. 100kg).

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Fav 900	<p align="center">Engine / Lubrication</p> <p align="center">Removing and refitting oil pan</p>	<p align="center">G</p>
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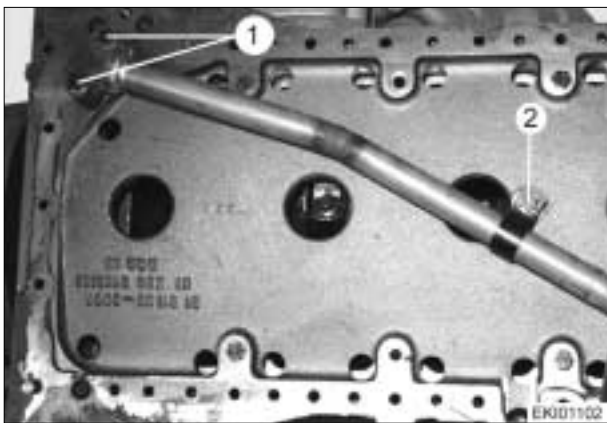


Remove screws from flywheel housing (3 on each side of engine).
 Position jack with cradle inderneath the oil pan and remove all externally accessible screws from the oil pan.

Note:
For ease of reassembling, note the screws sequence (l.e. short / long).



Insert two (M8*20)screws at the rear of the oil pan (arrowed) and slowly press down the oil pan.
 Clean the oil pan and remove all gasket residue from pan and intermediate flange.



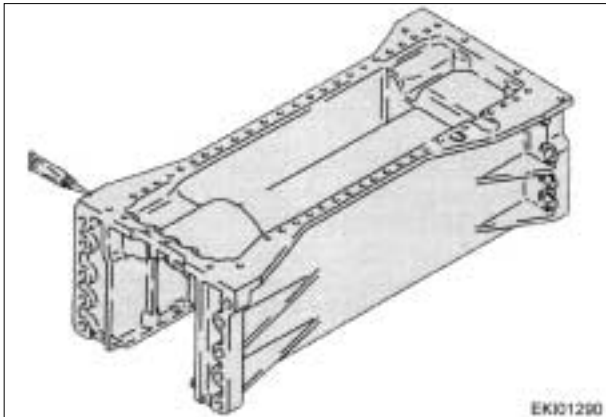
Removing the oil intake line
 Remove screws from the bracket (2)
 Remove screws from intake pipe flange(1).
 Remove intake pipe and gasket.

Note:
Avoid dirt contamination of the oil duct.



Refitting oil intake pipe
 Position intake pipe and new gasket and insert screws by hand.
 After fitting the bracket, tighten scews to specified torque. Replace O-rings.

Fav 900	Engine / Lubrication Removing and refitting oil pan	G
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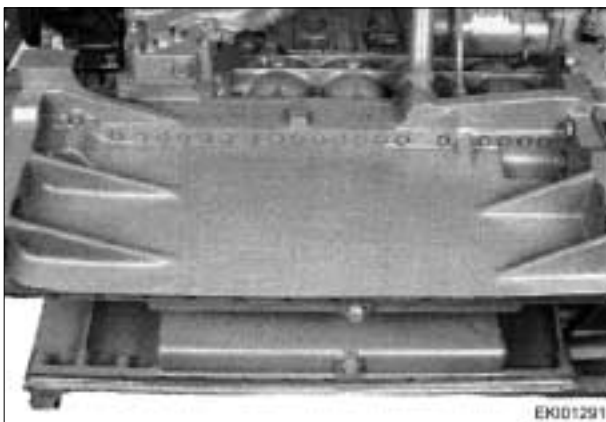


Refitting the oil pan

Coat oil pan sealing surface with sealing compound "Terostat 63" avoiding bore holes.

Note:

The length of time between applying "terostat 6" and assembling must not exceed 20 minutes.



Using a jack, slowly raise the oil pan to the intermediate flange and insert fscrews.

Tighten screws.

Fit clean drain plug together with new seal and tighten to specified torque.

Refill with new engine oil.

Check the oil pan for leaks

Date	Version	Page	Removing and refitting oil pan	Capitel	Index	Docu-No.
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<p>Fav 900</p>	<p align="center">Engine / Lubrication Removing and refitting oil pump</p>	<p align="center">G</p>
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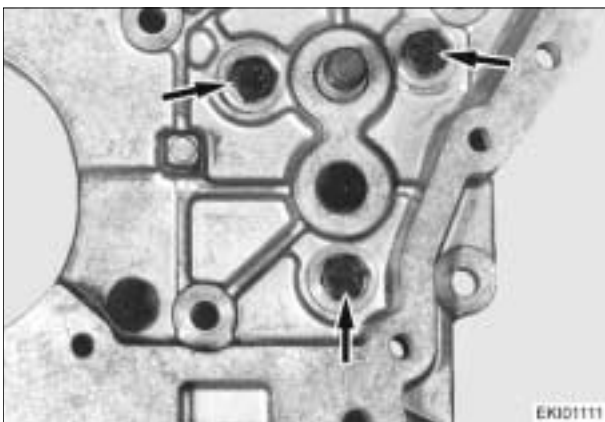
Removing the oil pump gear wheel

Remove the fan frame, Power belt, vibration damper, air compressor, generator and the timing case cover.

Unscrew nut of pump gear wheel, holding the crankshaft with a rotating device.

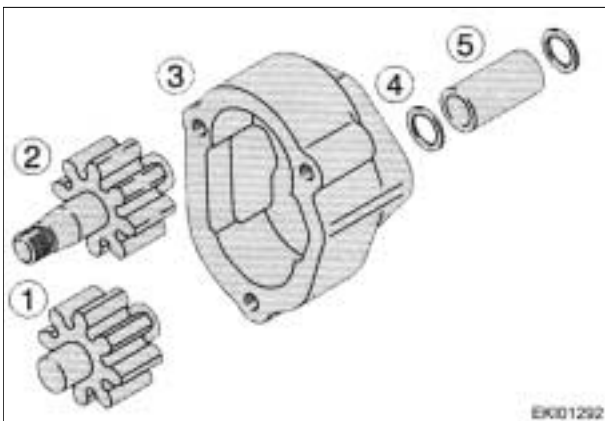
Remove washer and withdraw gear wheel from the cone using a puller.

Remove timing case.



Removing the oil pump

Remove screws (arrowed) and withdraw oil pump from the timing case.

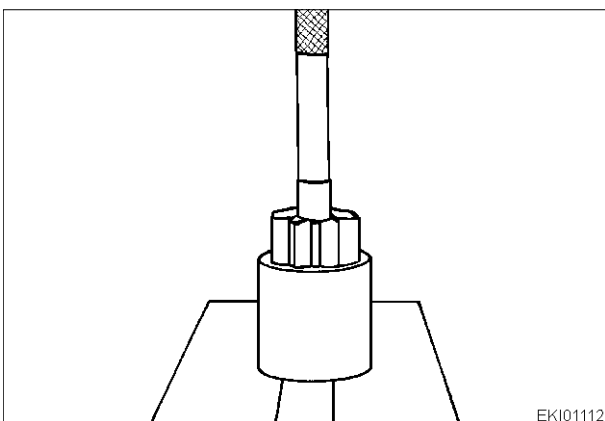


Dismantling the oil pump

Withdraw driving and driven gears (1 and 2) together with shafts and oil pipe from the housing (3).

Check gears and pump housing for wear.

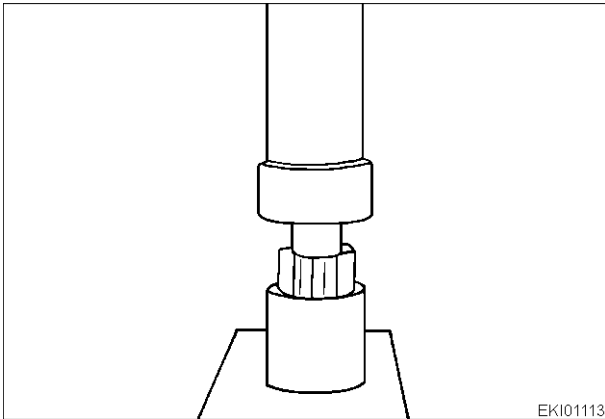
Note:
Always replace O-Rings (4).



Insert gear wheel and shaft into the bush and push out with a suitable mandrel.

Date	Version	Page	Removing and refitting oil pump	Capitel	Index	Docu-No.
14.2.2001	a	1/3		2312	G	000004

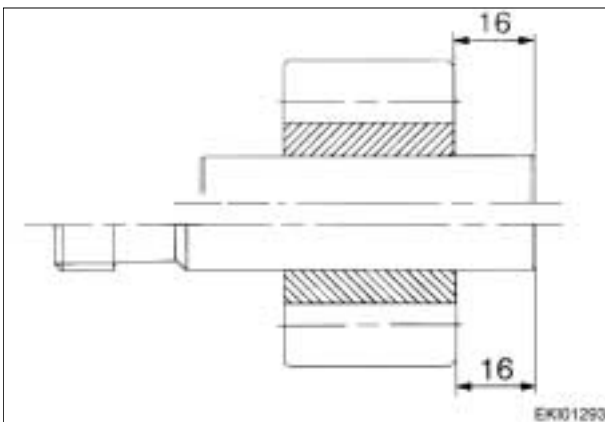
Fav 900	<p align="center">Engine / Lubrication</p> <p align="center">Removing and refitting oil pump</p>	<p align="center">G</p>
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Reassembling the oil pump

- Insert gear wheel in bush (2).
- Fit oil shaft.
- Slide on spacer sleeve (1) and press in shaft flush with the edge of the sleeve.

Note:
Bush(1) and spacer sleeve(2) are available as special tools.



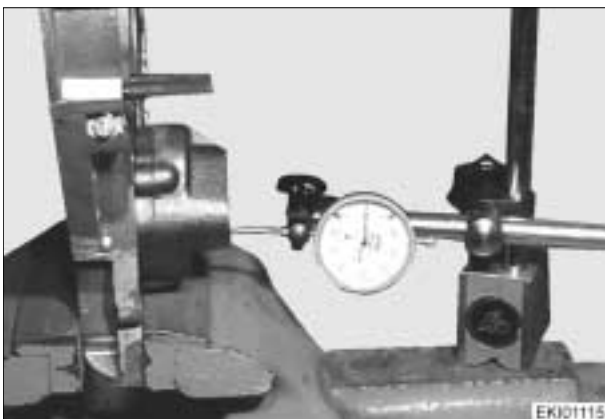
Note:
The press in depth (16 mm) of the driving shaft is determined by the spacer sleeve. Make sure there are no signs of scoring on the shaft after pressing in.



Refitting the oil pump

Clean sealing surfaces of timing case and oil pump: Position oil pump on timing case. Insert screws with washers and tighten.

Warning:
Ensure drive shaft rotates easily.



checking end play of geared wheels (with oil pump in place)

Fit dial gauge as illustrated. Turn shaft to the stop position in one direction and set gauge at "0". Press shaft in the opposite direction and take a reading of the movement. Insert oil pipe into oil pump.

Date	Version	Page	Removing and refitting oil pump	Capitel	Index	Docu-No.
14.2.2001	a	2/3		2312	G	000004

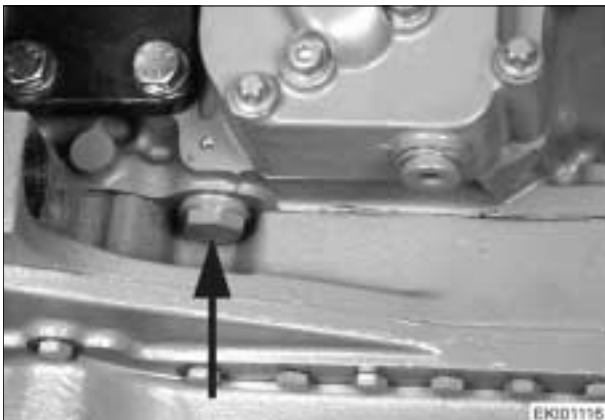
<p>Fav 900</p>	<p align="center">Engine / Lubrication Removing and refitting oil pump</p>	<p align="center">G</p>
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Refitting the oil pump gear.

With the inner core free of grease, slide oil pump gear onto the ungreased drive shaft cone. Fit washer, screw on nut and tighten to specified torque.

Remove the fan frame, Power-belt, vibration damper, air compressor, alternator and the timing case cover.



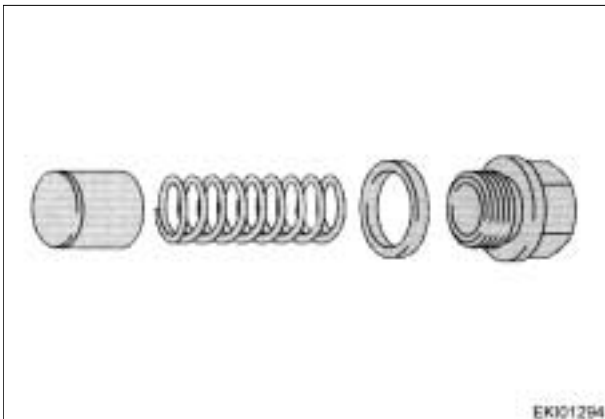
Removing and refitting the pressure regulating valve

Note:

The pressure regulating valve is accessible from the outside.

Unscrew and remove screw plug.

Remove sealing ring, compression spring and piston.



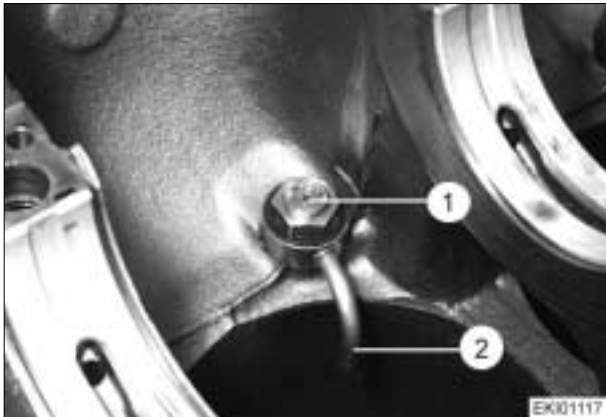
Check valve as illustrated and refit using a new seal.

Assemble valve as illustrated and refit using a new seal.

Tighten screw plug to the specified torque.

Date	Version	Page	Removing and refitting oil pump	Capitel	Index	Docu-No.
14.2.2001	a	3/3		2312	G	000004

<p>Fav 900</p>	<p align="center">Engine / Lubrication Removing and refitting splash nozzle</p>	<p align="center">G</p>
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Removing oil splash nozzle

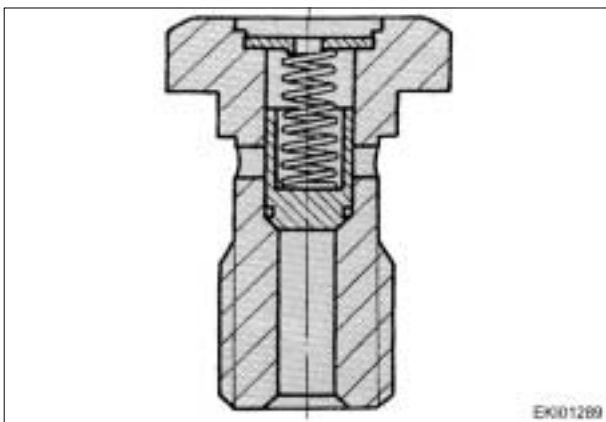
Remove oil pan and intermediate flange.

Note:

the nozzle can be removed and refitted without removing the crankshaft. In the illustration on this page the crankshaft has been removed to allow a clear picture.

Unscrew and remove oil pressure valve (1) and nozzle (2).

Remove nozzle and valve assembly.



Check oil splash nozzle valve.

With a small screwdriver check whether the valve spring pressure is sufficient to push the valve piston onto the valve seat. If necessary, replace nozzle valve.

Observe opening pressure.



Refitting oil splash nozzle

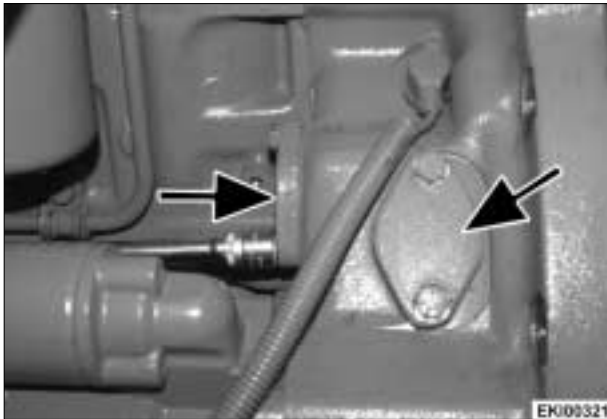
Position nozzle, making sure that the adjusting ball (arrowed) on the nozzle body comes to rest in the appropriate hole (arrowed).



Insert oil pressure valve and tighten to specified torque.

Date	Version	Page	Removing and refitting splash nozzle	Capitel	Index	Docu-No.
15.02.2001	a	1/1		2312	G	000005

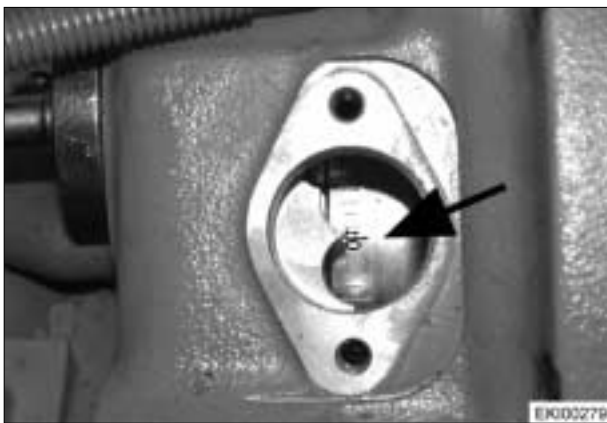
Fav 900	Engine / Injection Pump Checking Start of Delivery VP 44	E
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Remove cover (Arrows).



Set actuation tool (X 899.980.220.000).



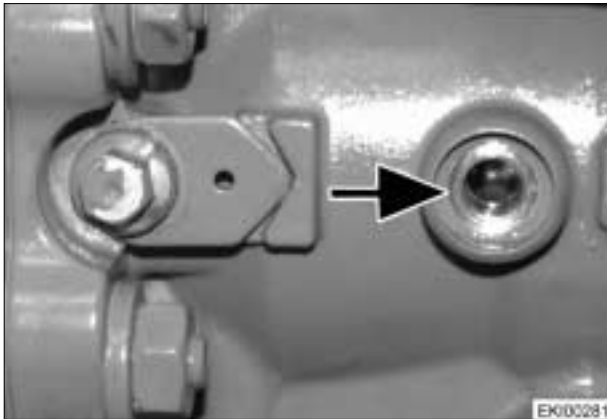
Set 1st Cylinder in Top Dead Point (TDP) position (arrow).



Remove sealing screw of TDP measuring point.

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<p>Fav 900</p>	<p align="center">Engine / Injection Pump Checking Start of Delivery VP 44</p>	<p align="center">E</p>
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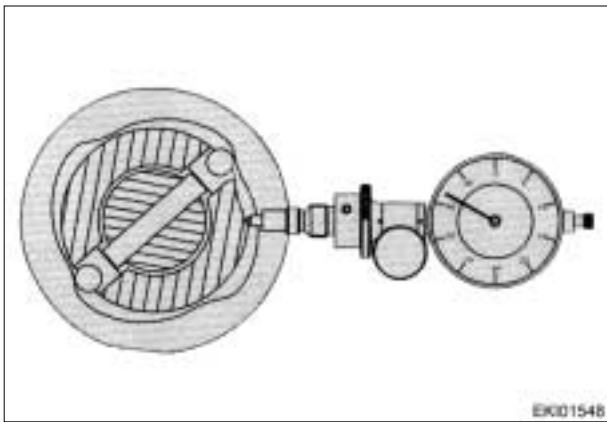


Important:

1. Cylinder (fan side) is in TDP Position, when the flat part of the control shaft can be recognized through the TDP measuring hole.

If the flat part cannot be recognized, turn the crank shaft further 360° with the actuation tool in order to place the flat part of the control shaft in front of the measuring hole.

Valves of the 6th cylinder (flywheel side) are in middle position.



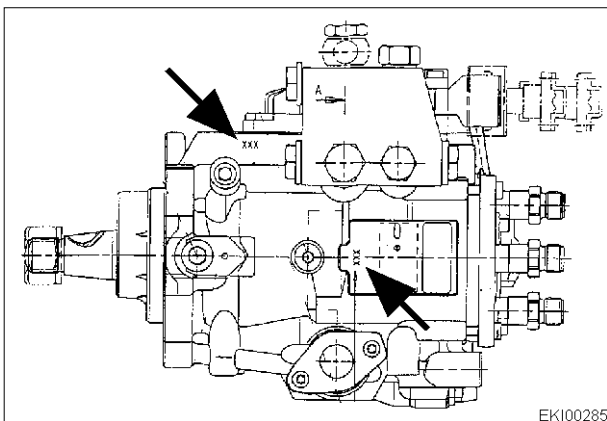
Turn crank shaft back by at least 20° before TDP and then set dial gauge with adaptor (X 899.980.245.000) into the TDP measuring Hole .

Note:

Use dial gauge with ball tip R=1 mm (0.039").



Set dial gauge into "0" display position.



3 - Digit Number: Identification (arrows) possible on following locations.

Date	Version	Page	Checking Start of Delivery VP 44	Capitel	Index	Docu-No.
01/2000	b	2/7		2710	E	000003

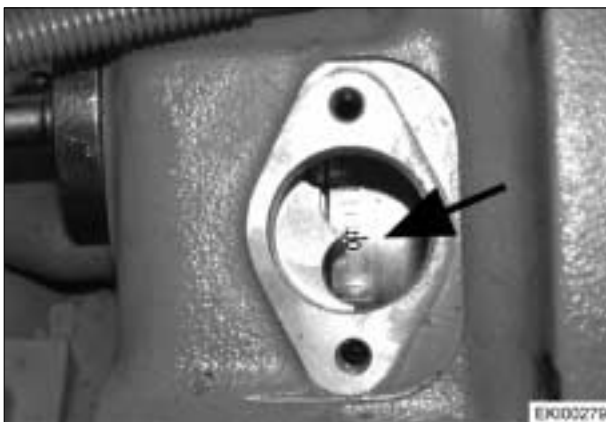
Fav 900	<p align="center">Engine / Injection Pump Checking Start of Delivery VP 44</p>	<p align="center">E</p>
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Turn crankshaft back toward TDP until displacement (X . XX) which is indicated on the injection pump will be reached .

E.g.: Indicated Value on Injection Pump: 0.79
 Consequently: Adjust TDP to reach 0,79 mm on dial gauge

Note:
Scanning head of dial gauge runs into slanted surface of the control shaft.
Do not turn crankshaft any further , risk of shearing the scanning head of the dial gauge.



TDP is correctly set when flywheel is in TDP position ($\pm 0,5^\circ$).

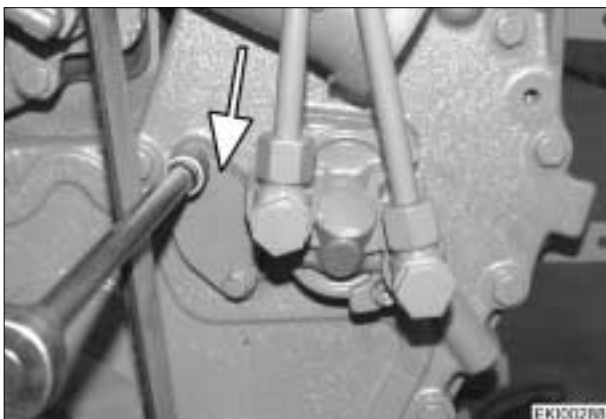
Note:
The effective start of delivery, approx. 6° vor O.T. (under full load) will be set automatically by the injection controller .

If the flywheel is in wrong position, start of delivery will not be correct (adjust start of delivery).



Adjusting start of delivery

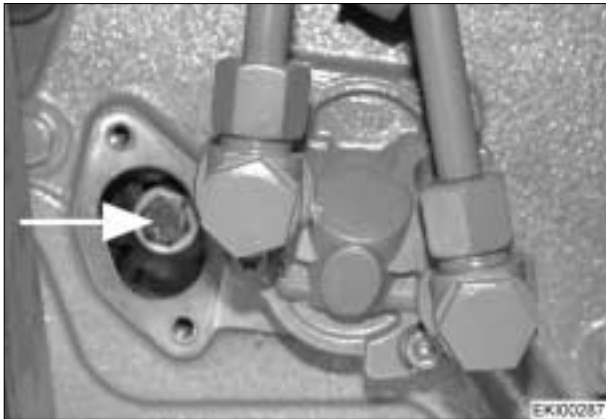
Remove dial gauge and adaptor.



Remove cover (M8)

Date	Version	Page	Checking Start of Delivery VP 44	Capitel	Index	Docu-No.
01/2000	b	3/7		2710	E	000003

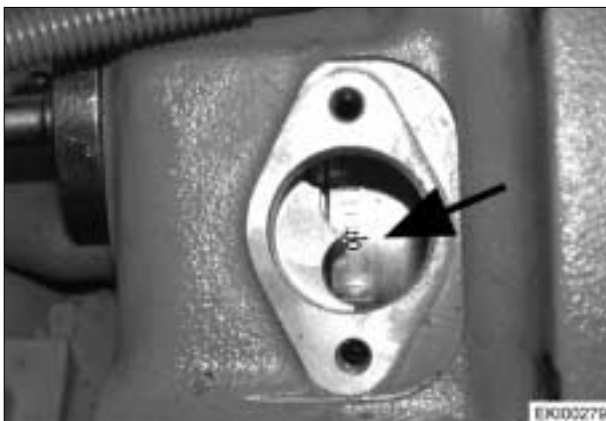
Fav 900	<p style="text-align: center;">Engine / Injection Pump Checking Start of Delivery VP 44</p>	E
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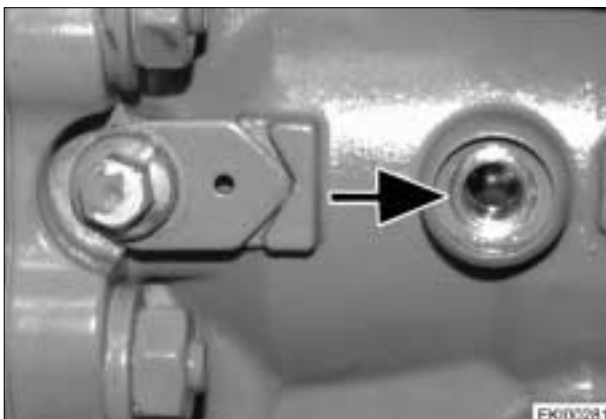
Important:
 Do not loosen first visible screw (M8) (TDP Screw).



Turn crankshaft using the actuation tool and loosen the visible screws 2,3 and 4 .



Set first cylinder (fan side) using the actuation tool onto TDP (arrow).



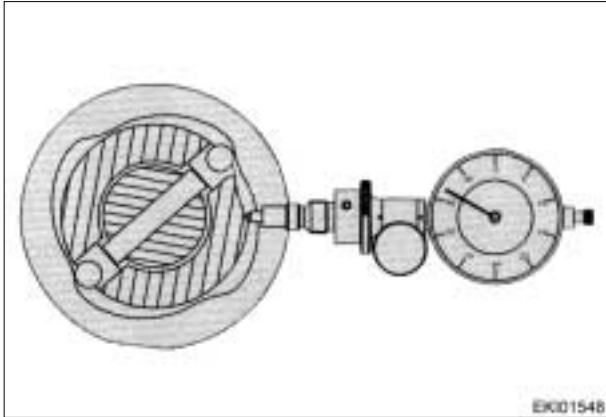
Important:
 1. Cylinder (fan side) is in TDP Position, when the flat part of the control shaft can be recognized through the TDP measuring hole.

If the flat part cannot be recognized , turn the crank shaft further 360° with the actuation tool in order to place the flat part of the control shaft in frontt of the measuring hole.

Valves of the 6th cylinder (flywheel side) are in middle position.

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<p>Fav 900</p>	<p align="center">Engine / Injection Pump Checking Start of Delivery VP 44</p>	<p align="center">E</p>
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Turn crank shaft back by at least 20° before TDP and then set dial gauge with adaptor (X 899.980.245.000) into the TDP measuring hole.

Note:
Use dial gauge with ball tip R=1 mm (0.039").



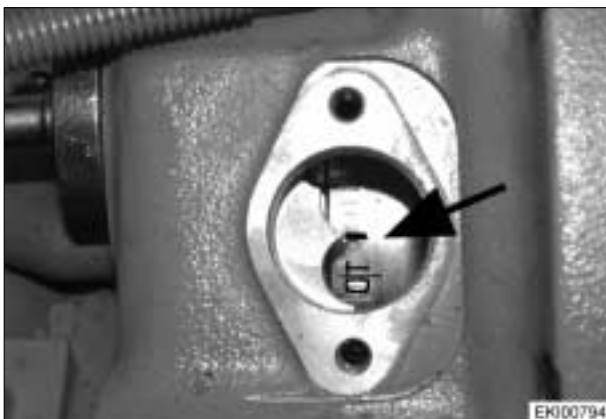
Set dial gauge into "0" display position.



Turn crankshaft back toward TDP until displacement (X . XX) which is indicated on the injection pump will be reached .

E.g. : Indicated value on injection pump: 0.79
Consequently : Adjust TDP to reach 0,79 mm on dial gauge

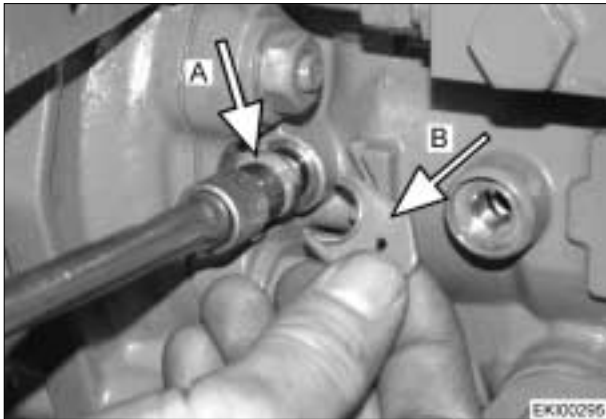
Note:
Scanning head of dial gauge runs into slanted surface of the control shaft.
Do not turn crankshaft any further , risk of shearing the scanning head of the dial gauge.



Start of Delivery point is wrong!
Requested value start of delivery: TDP (+/- 0,5°)

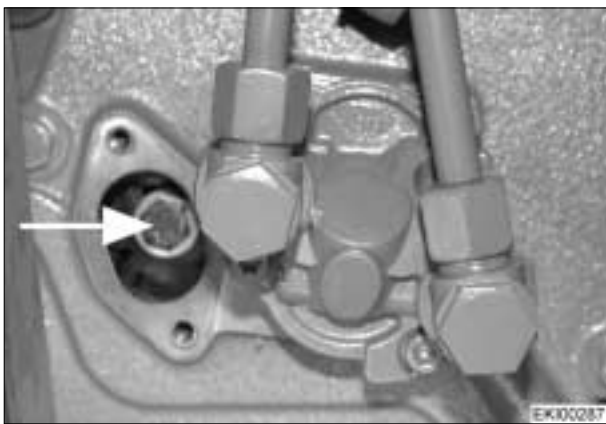
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Fav 900	<p style="text-align: center;">Engine / Injection Pump Checking Start of Delivery VP 44</p>	E
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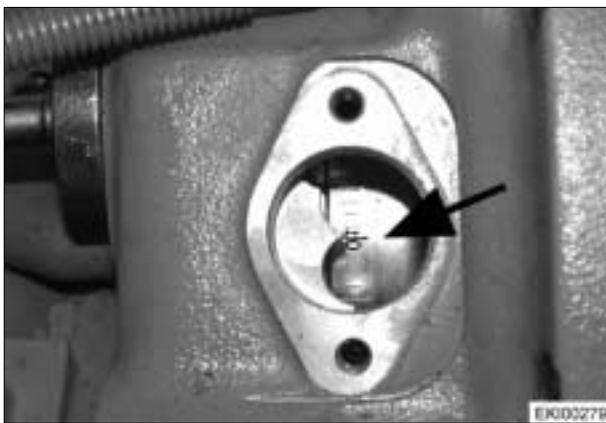


Important:
 Bock injection pump. (Note sequence!)

- Loosen locking screw (Pos. A).
- Remove spacer washer (Pos. B).
- Tighten locking screw (Pos. A) .

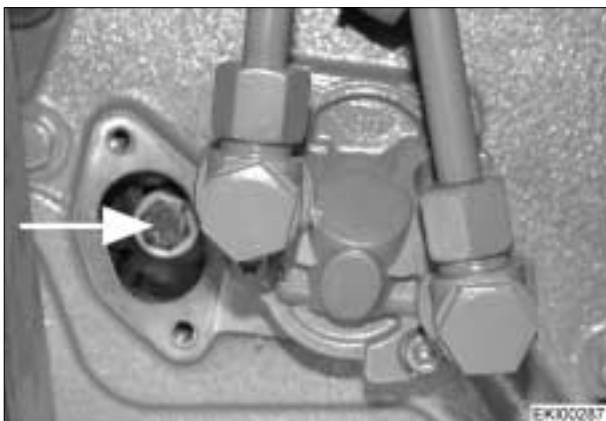


Loosen TDP screw.



Turn cankshaft further until start of delivery , TDP (+/- 0,5°) is reached.

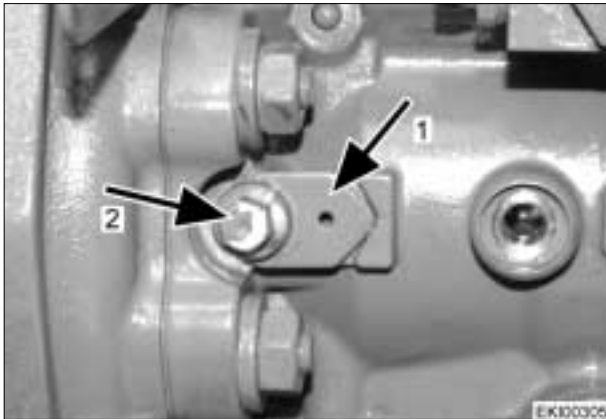
Note:
 If this position cannot be reached, the injection pump drive pinion must be shifted by one tooth.
 Chapter 2700 Reg.G (Injection pump VP44 - Replacement)



Tighten "TDP screw" at 25 Nm .

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<p>Fav 900</p>	<p align="center">Engine / Injection Pump Checking Start of Delivery VP 44</p>	<p align="center">E</p>
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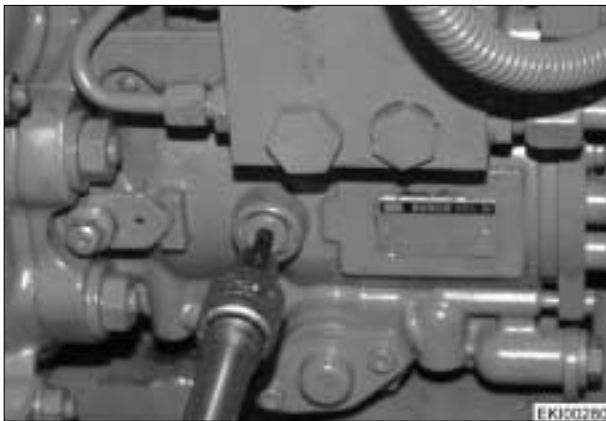


- Loosen locking screw (Pos..2)
- Put spacing washer (Pos. 1) into place
- Tighten locking screw (Pos.2) .

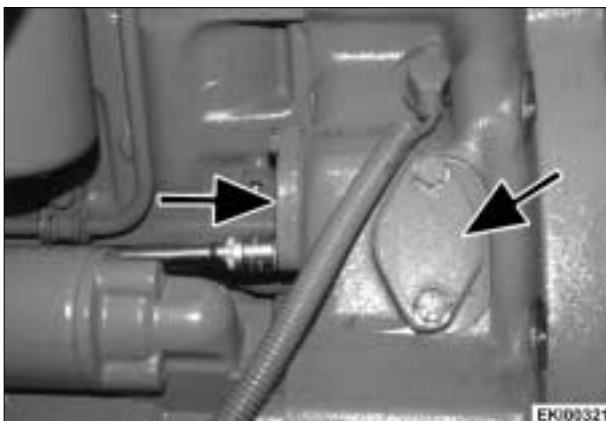
Check start of delivery as decribed.



Turn crankshaft with the actuation tool and tighten the visible screws 2,3 and 4 at 25 Nm. Put cover back in place.



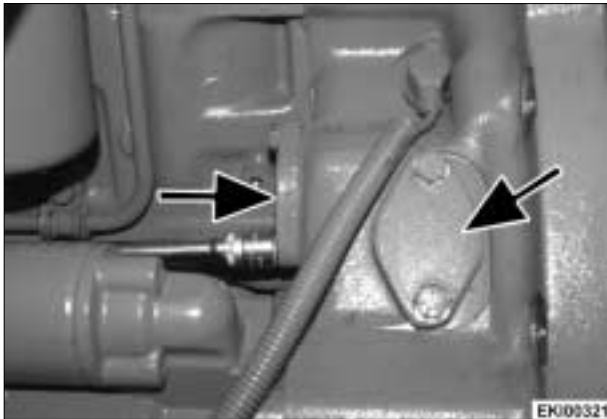
Put sealing screw TDP back into place.



Put cover (arrows) back into place.

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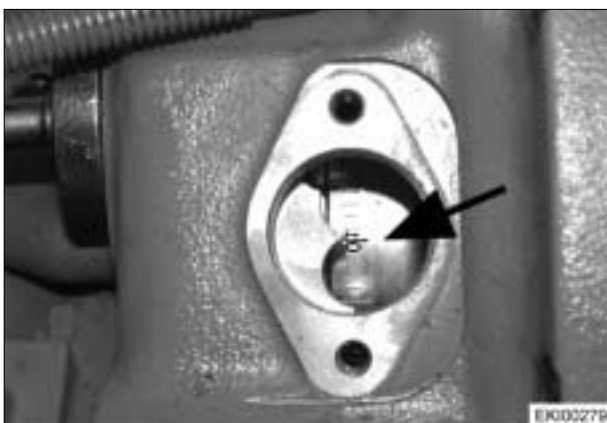
<p>Fav 900</p>	<p align="center">Engine / Injection Pump Fuel Injection Pump VP 44 - Mounting - Dismounting</p>	<p align="center">G</p>
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Remove cover (arrows - left engine side).



Put actuation tool (X 899.980.220.000) into place



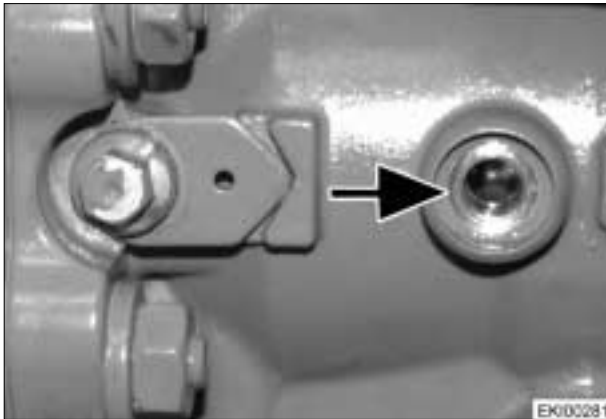
Set first cylinder into Top Dead Point position (TDP) (Arrow) using actuation tool.



Remove screw TDP Measuring Point.

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<p>Fav 900</p>	<p align="center">Engine / Injection Pump Fuel Injection Pump VP 44 - Mounting - Dismounting</p>	<p align="center">G</p>
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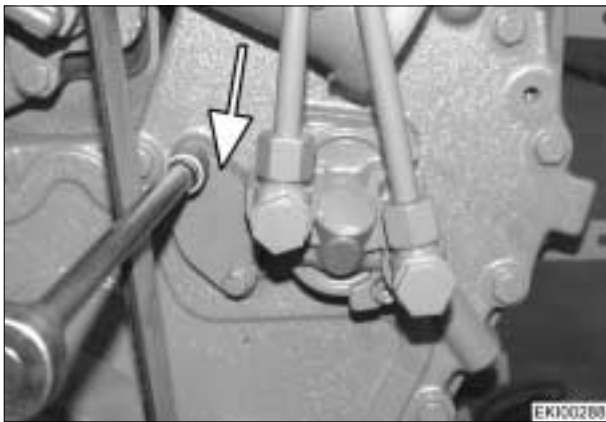


Important:

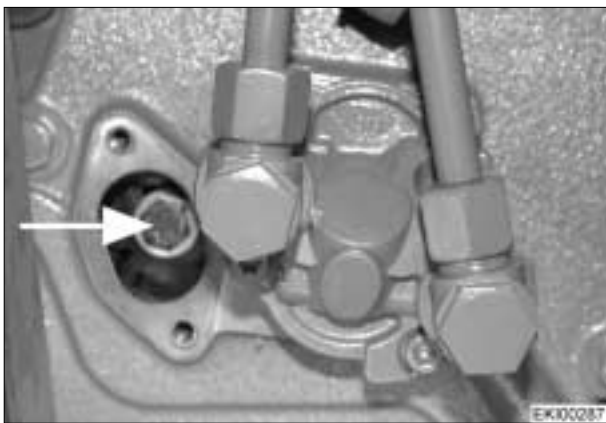
1. Cylinder will be in TDP Position, if the flat section of the control shaft appears in the TDP hole.

If the flat section does not appear on the control shaft, rotate the engine for another 360° into TDP position.

Valves of cylinder 6 (Flywheel side) are in central position.



Remove cover



Important:

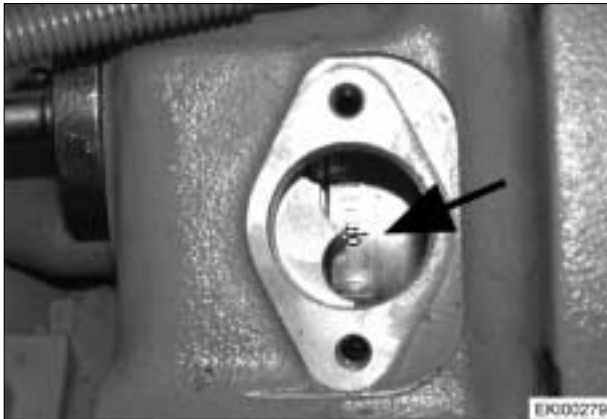
Do not loosen first visible screw M8 (TDP screw)



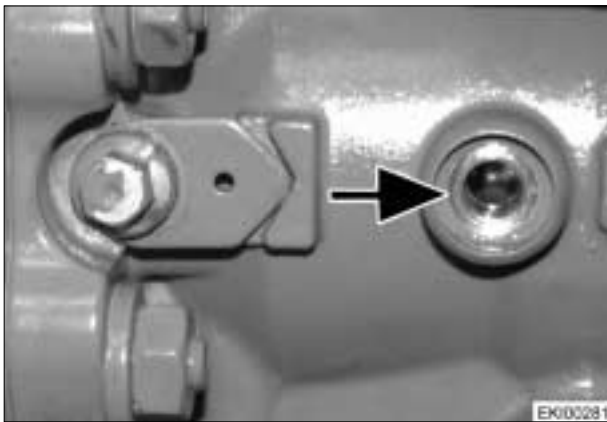
Rotate crank shaft in order to enable loosening of visible screws 2,3 and 4. (Necessary for the slantcut injection pump drive pinion)

Date	Version	Page	Fuel Injection Pump VP 44 - Mounting - Dismounting	Capitel	Index	Docu-No.
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Fav 900	<p align="center">Engine / Injection Pump</p> <p align="center">Fuel Injection Pump VP 44 - Mounting - Dismounting</p>	G
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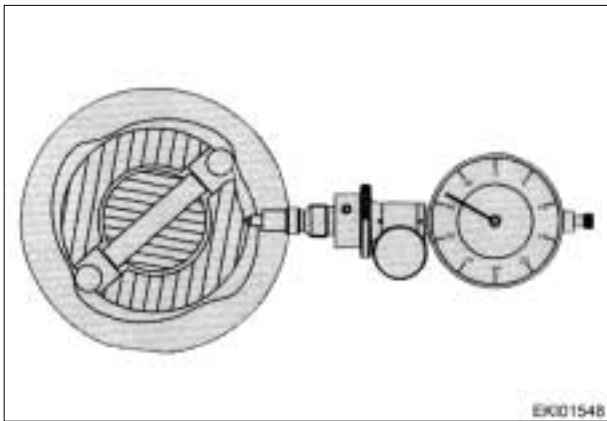
Put first cylinder into TDP position (Arrow) using the actuation tool.



Important:
 1. Cylinder will be in TDP Position, if the flat section of the control shaft appears in the TDP hole

If the flat section does not appear on the control shaft, rotate the engine for another 360° into TDP position.

Valves of cylinder 6 (Flywheel side) are in central position.



Turn back the crank shaft by at least 20° before TDP and put dial gauge with adaptor (X 899.980.245.000) into the hole of TDP.

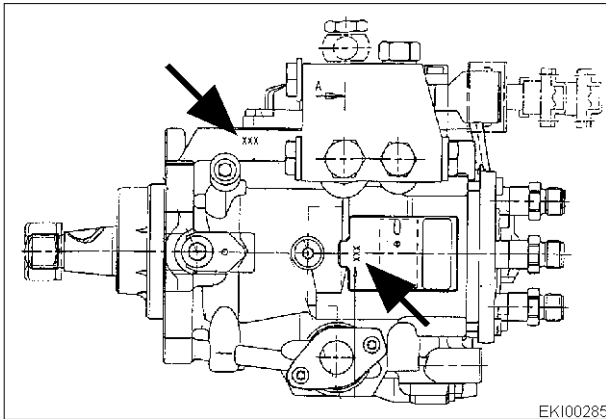
Note:
 Use dial gauge with ball tip R=1mm (0.039").



Set Dial gauge onto "0".

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Fav 900	<p style="text-align: center;">Engine / Injection Pump</p> <p style="text-align: center;">Fuel Injection Pump VP 44 - Mounting - Dismounting</p>	G
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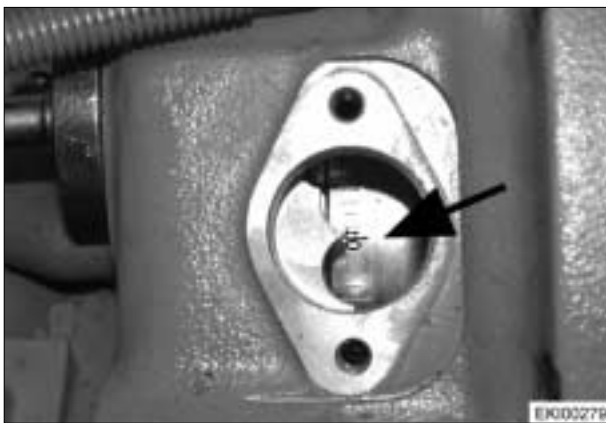


3 - digit Number. Marking (arrows) is possible on following positions.



Move crank shaft again into TDP Position until the marked displacement (X . XX) will be reached.
 e.G.: Displacement on injection pump 0.79 means 0,79 mm (0.0311") displacement on dial gauge

Note:
Scanning rod of dial gauge reaches the flat section of the control shaft.
Do not move the crank shaft any more , in order to avoid the sheering of the scanning rod.



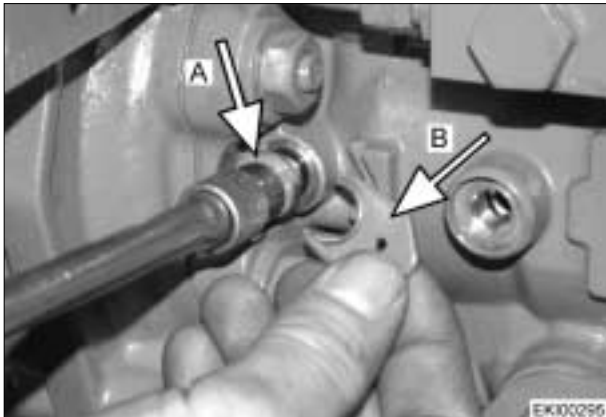
Start of delivery will be adequate if the flywheel is in position TDO ($\pm 0,5^\circ$).
 If this position is not correct, start of delivery point will not be correct.
 (Check start of delivery, Chapter 2710 Reg.E)



Remove dial gauge and adaptor.

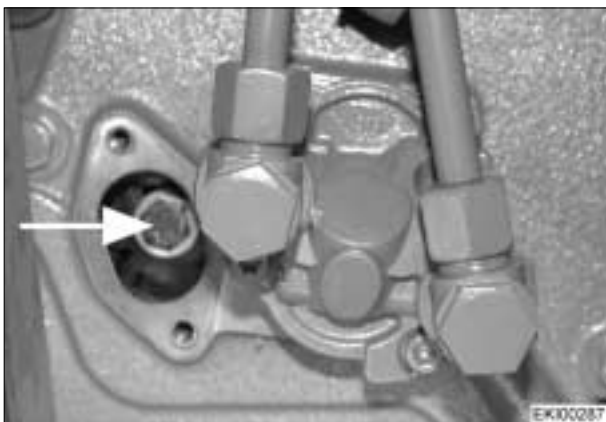
Date	Version	Page	Capitel	Index	Docu-No.
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<p>Fav 900</p>	<p align="center">Engine / Injection Pump Fuel Injection Pump VP 44 - Mounting - Dismounting</p>	<p align="center">G</p>
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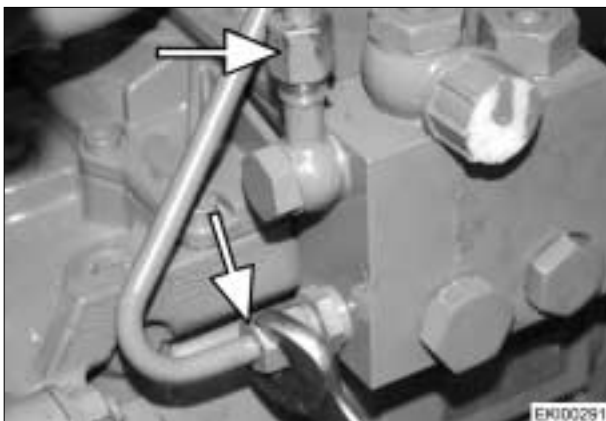


Important:
Block injection pump (follow sequence)

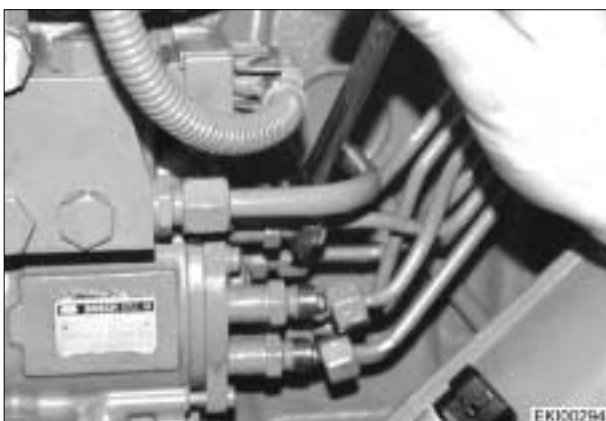
- Loosen locking screw (Pos. A).
- Remove spacing washer (Pos. B).
- Tighten locking screw (Pos. A).



Loosen "TDP screw"



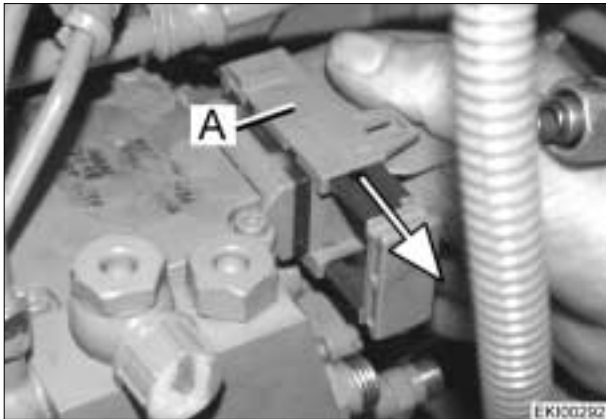
Loosen and remove "Cold Start tubing"



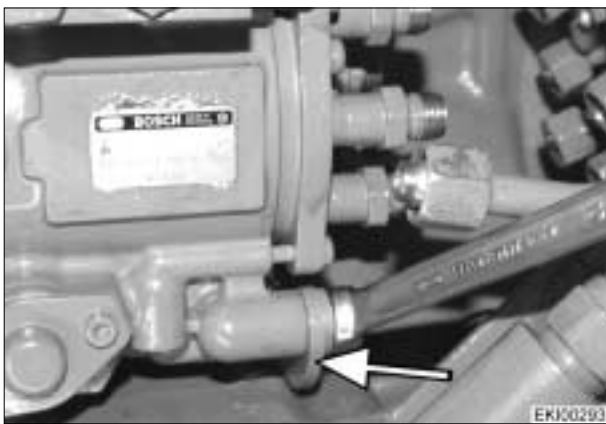
Loosen and remove injection lines.

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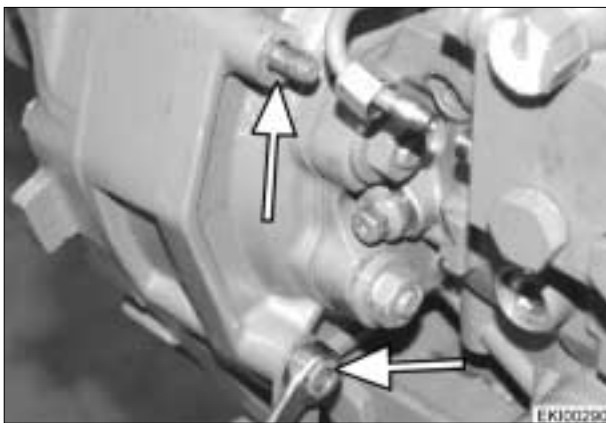
Fav 900	Engine / Injection Pump Fuel Injection Pump VP 44 - Mounting - Dismounting	G
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Pull out connector lock into arrow direction and then remove connector X046 (Pos. A) from injection pump.



Remove rear pump bracket



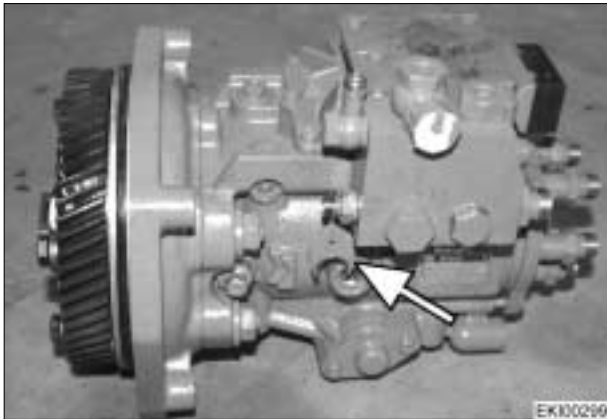
Remove 4 xnuts (M8) from pump flange (Arrows) .



Remove injection pump.

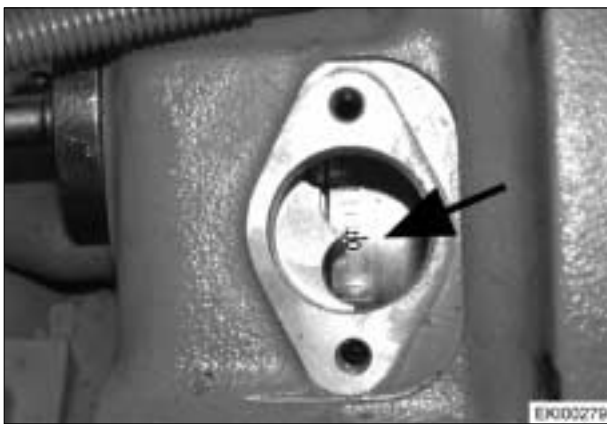
Date	Version	Page	Capitel	Index	Docu-No.	
01/2000	b	6/10	Fuel Injection Pump VP 44 - Mounting - Dismounting	2710	G	000002

Fav 900	<p align="center">Engine / Injection Pump</p> <p align="center">Fuel Injection Pump VP 44 - Mounting - Dismounting</p>	G
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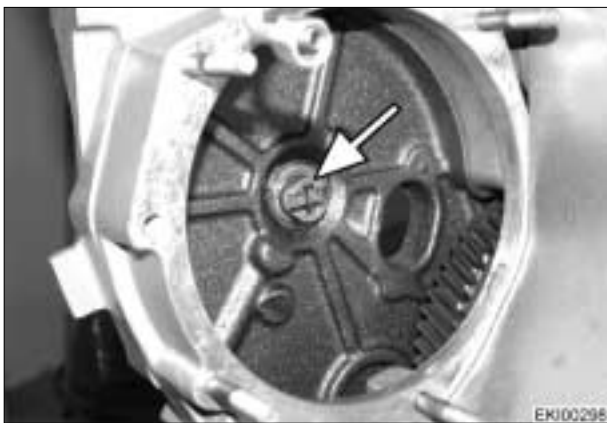


Settings of a new injection pump VP 44.

- Start of delivery from TDP of first cylinder (Fan Side) .
- Screws of injection pump drive pinion (4 x M8) are loose.
- Blocking screw is tightened without spacing washer.
- Spacing washer is tied on pump body.



Check TDP of the first cylinder.



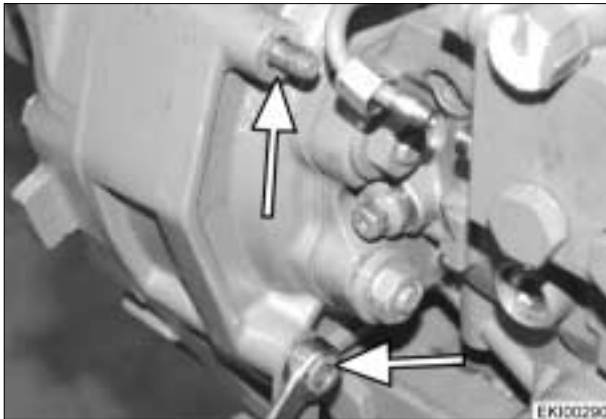
Adjust fuel lifting pump drive (arrow) as well as the injection pump drive (arrow).



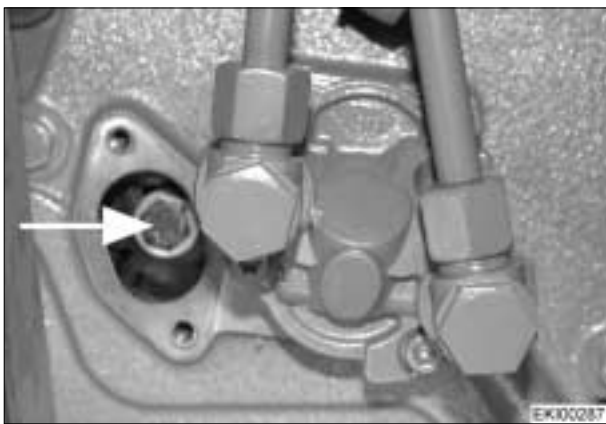
Put injection pump into place.

Date	Version	Page	Capitel	Index	Docu-No.	
01/2000	b	7/10	Fuel Injection Pump VP 44 - Mounting - Dismounting	2710	G	000002

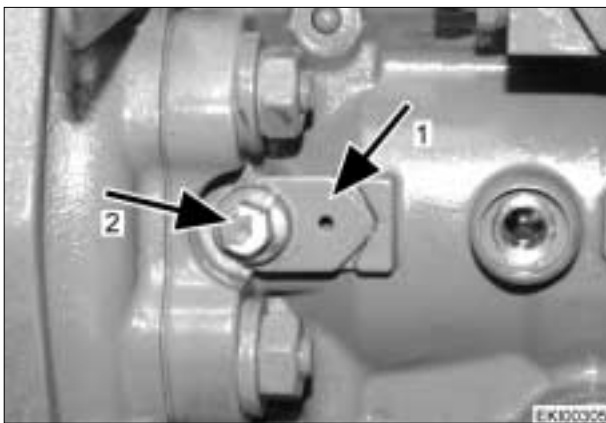
<p>Fav 900</p>	<p align="center">Engine / Injection Pump Fuel Injection Pump VP 44 - Mounting - Dismounting</p>	<p align="center">G</p>
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Tighten 4 x nuts (M8) from pump flange (arrows) at 25 Nm .



Tighten first visible screw (M8) at 25 Nm .



- Loosen blocking screw (Pos. 2).
- Put spacing washer (Pos. 1) into place.
- Tighten blocking screw (Pos. 2).

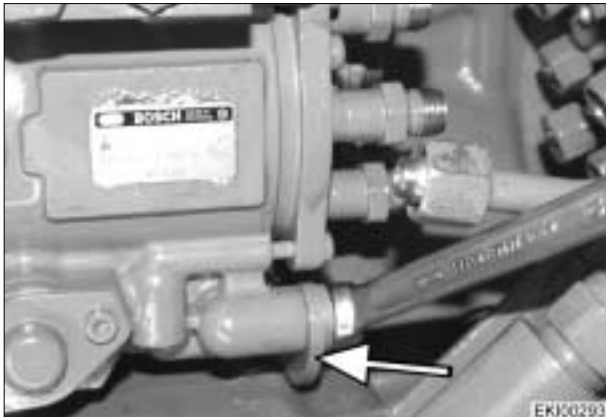


Turn crank shaft with the actuation tool and tighten visible screws 2,3 and 4 at 25 Nm . Put cover into place.

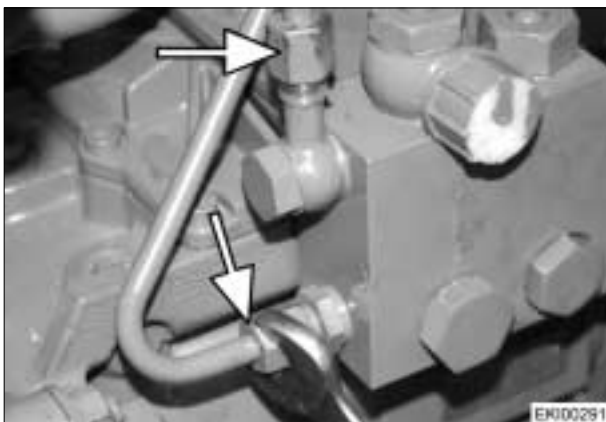
Note:
Check start of delivery point.

Date	Version	Page	Fuel Injection Pump VP 44 - Mounting - Dismounting	Capitel	Index	Docu-No.
01/2000	b	8/10		2710	G	000002

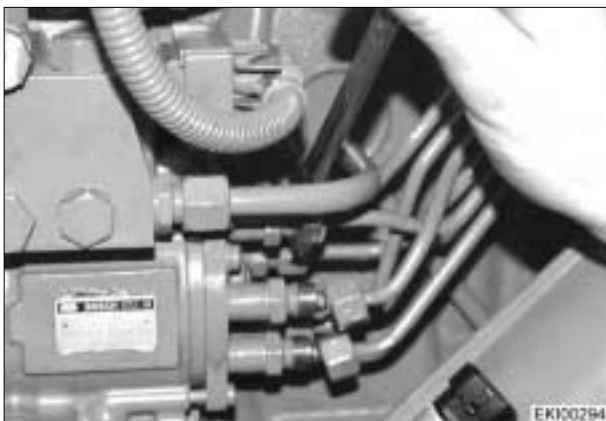
<p>Fav 900</p>	<p align="center">Engine / Injection Pump Fuel Injection Pump VP 44 - Mounting - Dismounting</p>	<p align="center">G</p>
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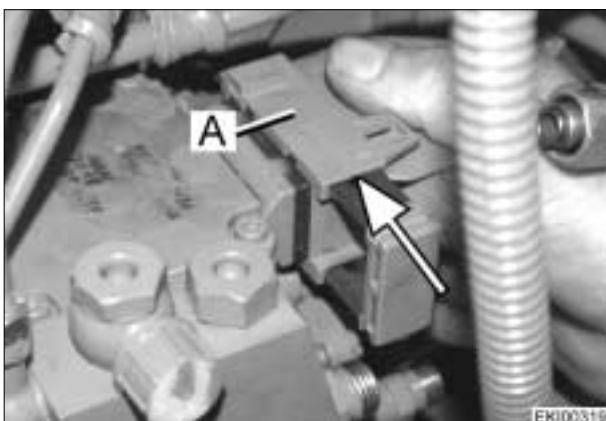
Put rear pump bracket into place.



Put cold start lines into place



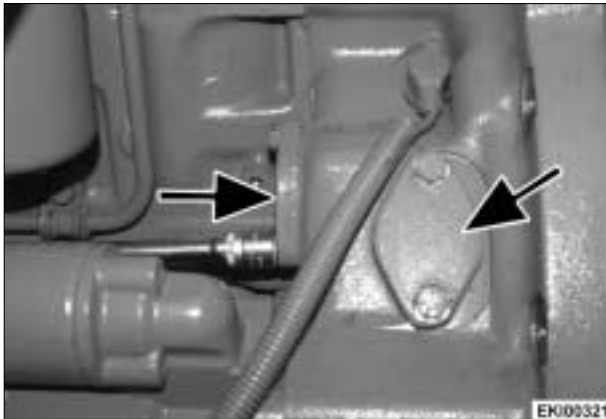
Put Injection lines into place.



Connect connector X046 (Pos. A) onto injection pump and put locking pin into place (arrow).

Date	Version	Page	Fuel Injection Pump VP 44 - Mounting - Dismounting	Capitel	Index	Docu-No.
01/2000	b	9/10		2710	G	000002

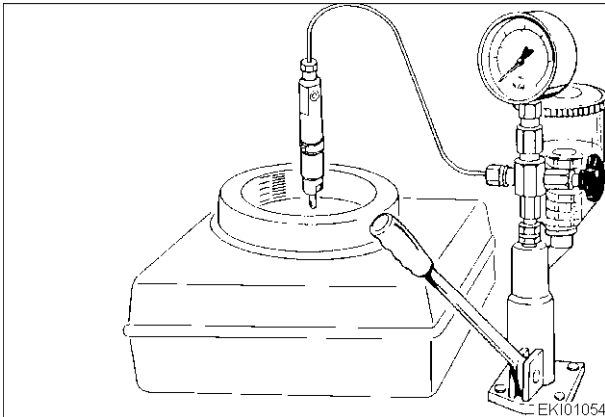
Fav 900	<p align="center">Engine / Injection Pump</p> <p>Fuel Injection Pump VP 44 - Mounting - Dismounting</p>	G
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Note:
 Purge air from the fuel supply system.
 Chapter 2060 Reg. G

Date	Version	Page	Capitel	Index	Docu-No.	
01/2000	b	10/10	Fuel Injection Pump VP 44 - Mounting - Dismounting	2710	G	000002

Fav 900	Engine / Injection valves Checking injection nozzles	E
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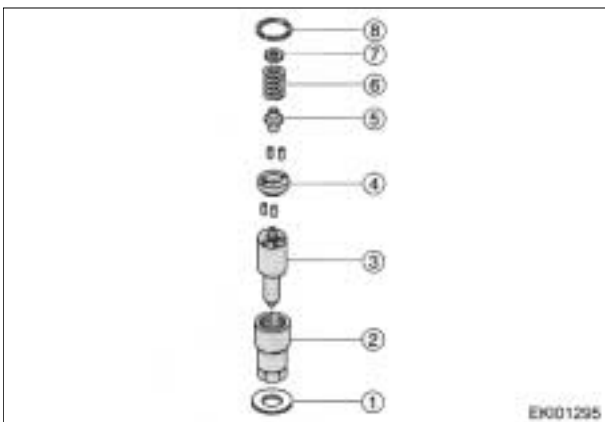
Checking injection nozzles

With injection nozzle tester (manual test appliance) check nozzle for :

- - opening pressure (spray pressure)
- - leak tightness and
- - spray pattern.

Use clean test oil or diesel fuel.

Before testing, clean nozzle and check for wear.



- 1 = Seal
- 2 = Nozzle tensioning nut
- 3 = Injection nozzle
- 4 = Intermediate washer
- 5 = Pressure pin
- 6 = Compression spring
- 7 = Compensating washer
- 8 = Circlip

Check nozzle and its holder

Fit nozzle inlet connection to pressure line of test appliance

Warning:
The high injection pressure may cause severe injury.
Never touch the spray pattern!
Wear safety goggles!

1. Check opening pressure :

Connect pressure gauge , push hand lever down slowly until the nozzle ejects spray, vibrating slightly. Read off **Opening pressure** on the pressure gauge. If necessary, insert new washer.

If the pressure is too low, use a thinner washer (7), for excessive pressure use a thicker one.

High operating hours cause a reduction in the tension of the spring(6).

Which in turn slightly reduces the injection pressure. When repairing nozzles, always set opening pressure at the upper limit (+8bars).

Note:

Washers with 0,01mm (.0004") increments are available from 1,0 to 1,99 mm (.039" to .78").

2. Check for leaks :

Operate the hand lever.

At 20 bar (290 PSI) below the specified opening pressure the nozzle must be free from droplets for 10 secs.

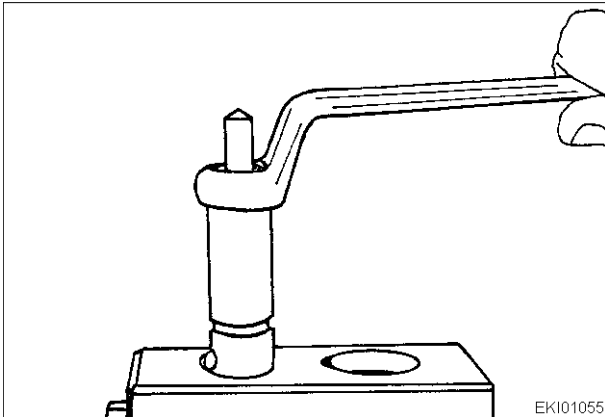
3. Check jet :

With the pressure gauge **switched off** apply fast pumping movements: The nozzle should vibrate audibly and/or have even spray pattern.

Date	Version	Page	Checking injection nozzles	Capitel	Index	Docu-No.
05.02.2001	a	1/3		2712	E	000001

Fav 900	<p align="center">Engine / Injection valves Checking injection nozzles</p>	<p align="center">E</p>
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Nozzles meeting these three requirements may be used again.

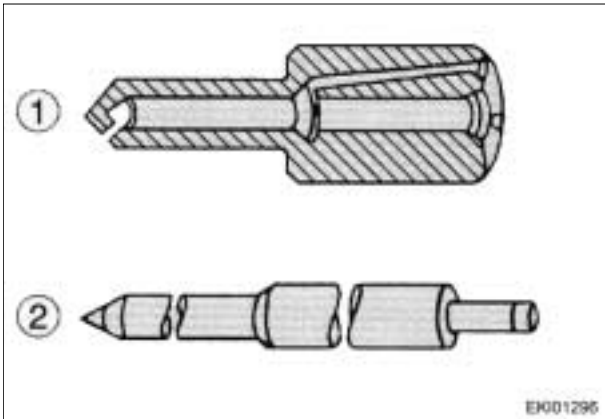


Dismantling injection nozzle

With the inlet opening facing downwards, fit nozzle holder and nozzle assembly into the holding device and clamp unit into the vise.

Unscrew threaded union, remove nozzle body, intermediate washer, pressure screw, compression spring and adjusting washer.

Remove the pressure pipe from the vise.



Overhauling injection nozzles

using a small piece of wood and petroleum or diesel fuel, clean interior of nozzle (1).

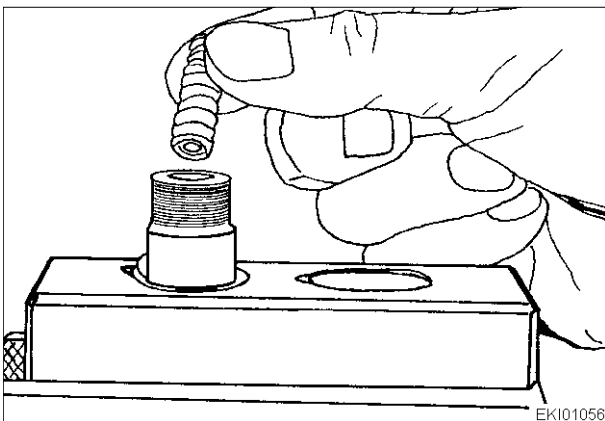
With a clean rag remove dirt from needle valve (2). Coked up needle sections can be placed on a lathe and cleaned with a soft wooden stick dipped in oil.

Note:

To prevent corrosion, do not touch rectified surfaces of the needle valve.

Needles and nozzles are paired and must not be interchanged.

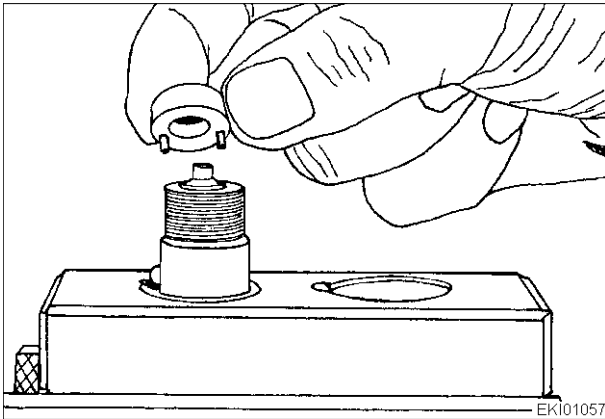
Check clean components for wear and damage ; replace if necessary. Degrease all new parts.



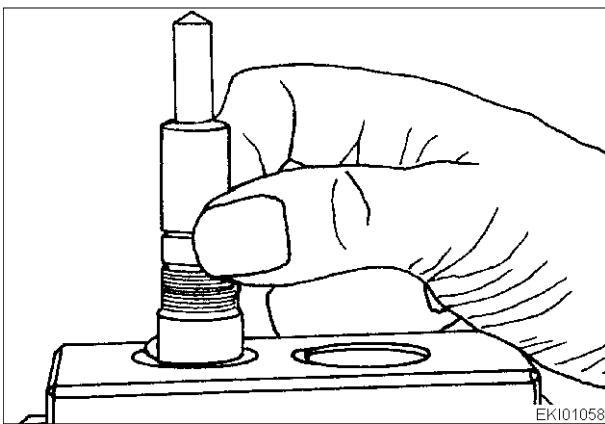
Reassembling injection nozzle

Remove pressure pipe connector from the vise and refit compression spring and adjusting washer.

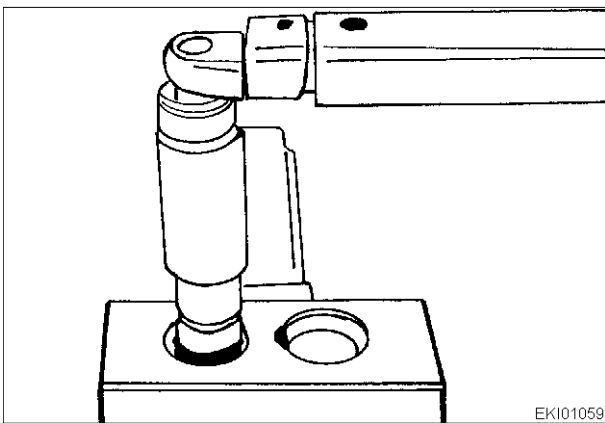
Fav 900	<p align="center">Engine / Injection valves</p> <p align="center">Checking injection nozzles</p>	<p align="center">E</p>
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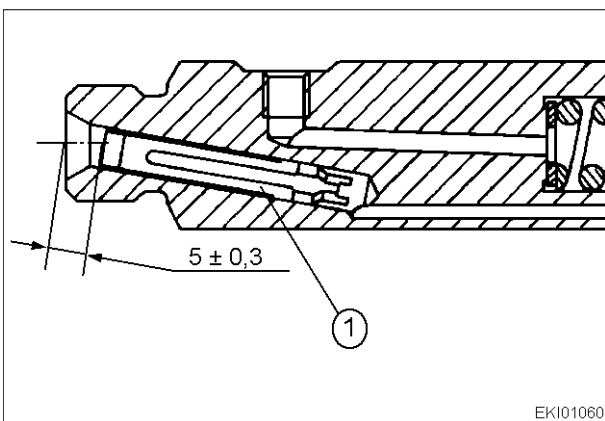
Test intermediate washer for wear.
Fit pressure pin and intermediate washer.



Dip nozzle and needle separately into filtered diesel fuel, and check slide resistance.
When the needle is withdrawn from the nozzle body by one third and released, it must drop back into the position by its own weight.
Fit injection nozzle observing the location of pins.

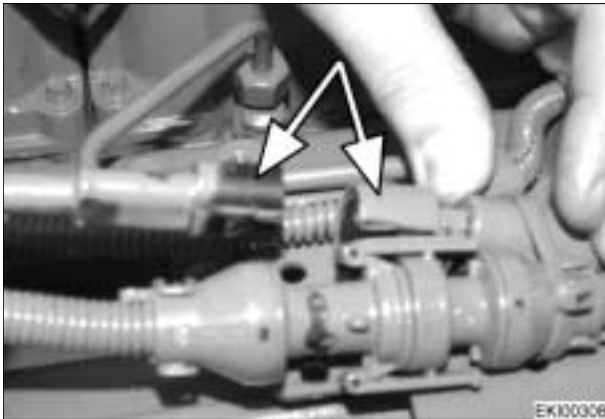


Screw on threaded union and tighten to specified torque.
Check injection nozzle on the test appliance.



Observe correct seating of filter in the nozzle holder.
The cause for these problems may well be due to an off-center filter in the nozzle holder. The injection flow is throttled and slowed down, leading to engine problems.
Always measure the press-in depth of the filter in the nozzle holder inlet.
The permissible press-in depth is approx. 5 mm (.197").
If the filter can be inserted further, the nozzle holder must be replaced.

<p>Fav 900</p>	<p align="center">Engine / Injetion valves</p> <p>Replacing Injection valve with needle Motion sensor</p>	<p align="center">G</p>
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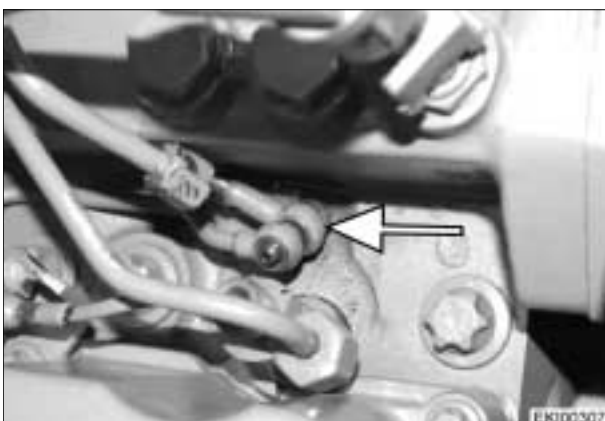
Disconnect connector X173 (Needle motion sensor EDC).



Disconnect fuel line from injector



Disconnect return lines from **all** Injectors.



Push return line in the direction of arrow.

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Fav 900	Engine / Injetion valves Replacing Injection valve with needle Motion sensor	G
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Lead Cable through special tool (MAN 80996030246), Place special tool and unscrew the injector.



New Injector and Needle Motion Sensor



Place a new copper gasket.
Grease an put new gasket into place.

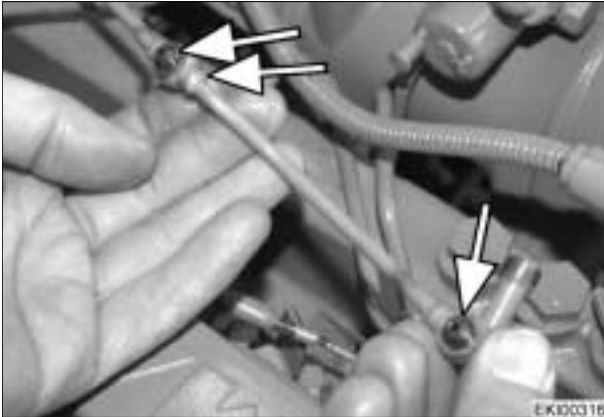


Lead Cable through special tool (MAN 80996030246), Place special tool and tighten the injector.

Date	Version	Page	Capitel	Index	Docu-No.	
01/2000	a	2/3	Replacing Injection valve with needle Motion sensor	2712	G	000002

Fav 900

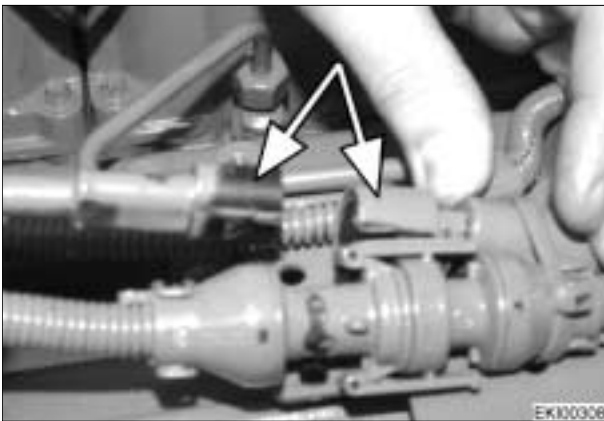
Engine / Injection valves
Replacing Injection valve with needle Motion sensor

G

Put new "usit" gaskets on the hollow screw on both sides of the return line .



Put return Linmes back into place.



Connect connector X173 (Needle motion sensor EDC).



Put fuel line from injector into place.

Important:
Purge air from the fuel supply system using the manual pump.

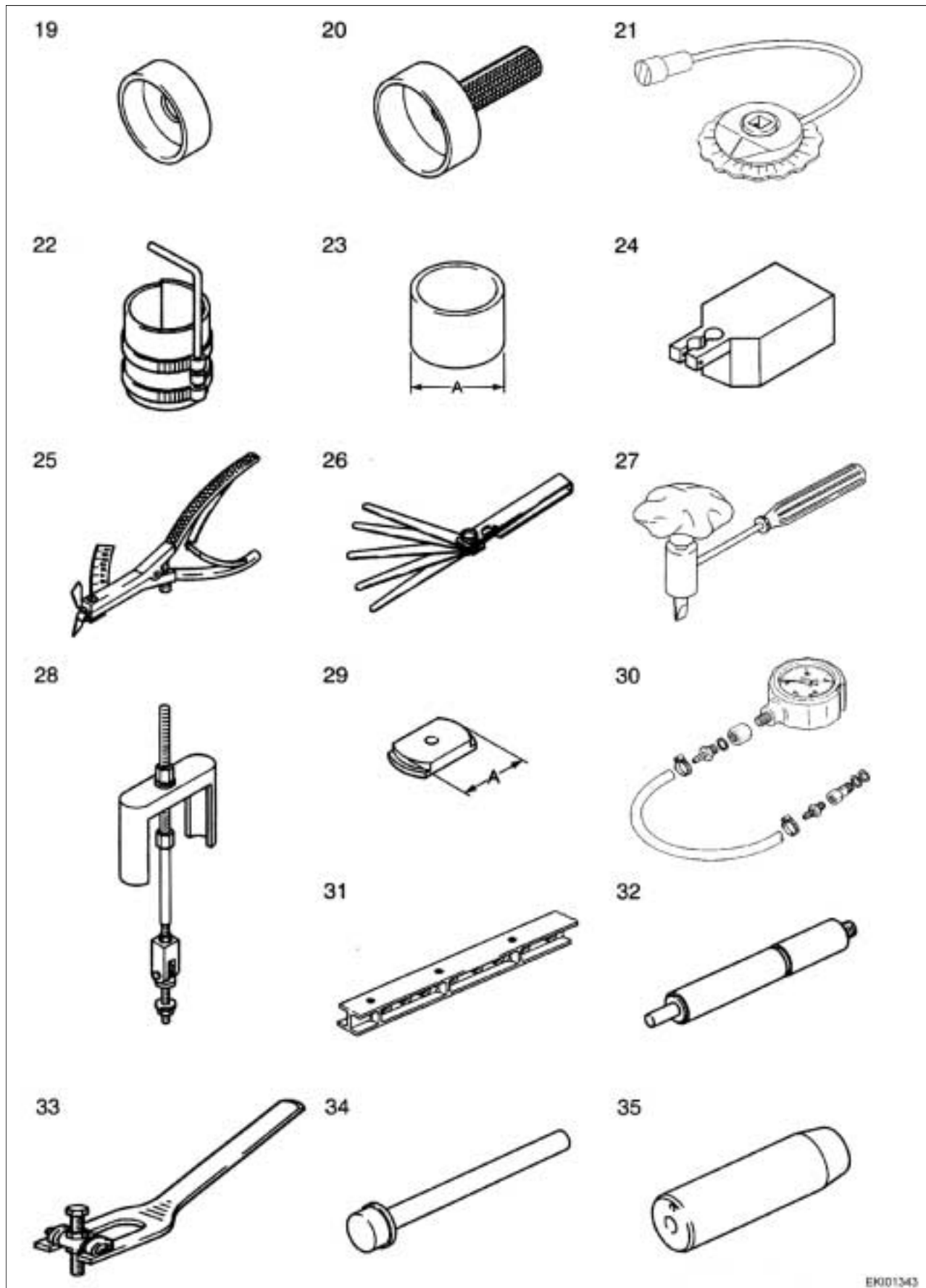
Date	Version	Page	Capitel	Index	Docu-No.
01/2000	a	3/3	Replacing Injection valve with needle Motion sensor	2712	G 000002

Fav 900	Engine / Generalities Special tools	A
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Schema - Nr.	Description	Reference
1	Dial gauge for checking and setting start of delivery.	08.71000-1205*
2	Scanning extension for 1	80.99605-0266*
3	Adaptor for 1	X 899.980.245.00-0**
4	Special wrench (SW 17) for injection pressures lines	80.99605-6002*
5	Optical Signal generator for setting start of delivery	80.99605-6002*
6	Tenon wrench for injection valve holder , with opening needle motion sensor.	80.99603-0240*
7	Puller for injection valves. Adaptor	80.99602-0011* 80.99602-0059*
8	Fitting tool for injection valve	80.99606-0008*
9	Socket wrench for injection valve	80.99603-0024*
10	Extractor for water pump pulley and flange	83.09143-6060*
11	Pressing bush for sliding ring gasket in water pump	80.99617-0091*
12	Pressing bush for water pump bearing shaft	80.99635-0008*
13	Pressing plate for water pump impeller	80.99614-0016*
14	Wrench for Oil filter cartridge	80.99603-0254*
15	Pressing device for valve guides for oil pump camshaft Consist of Contact bush Spacer bush	80.99604-0055* 80.99604-0056* 80.99604-0057*
16	Extractor hook percussion type extractor	80.99602-0127*
17	Percussion type extractor to 16	80.99602-0016*
18	Slip-on grip for all pressing plates	80.99617-0129*

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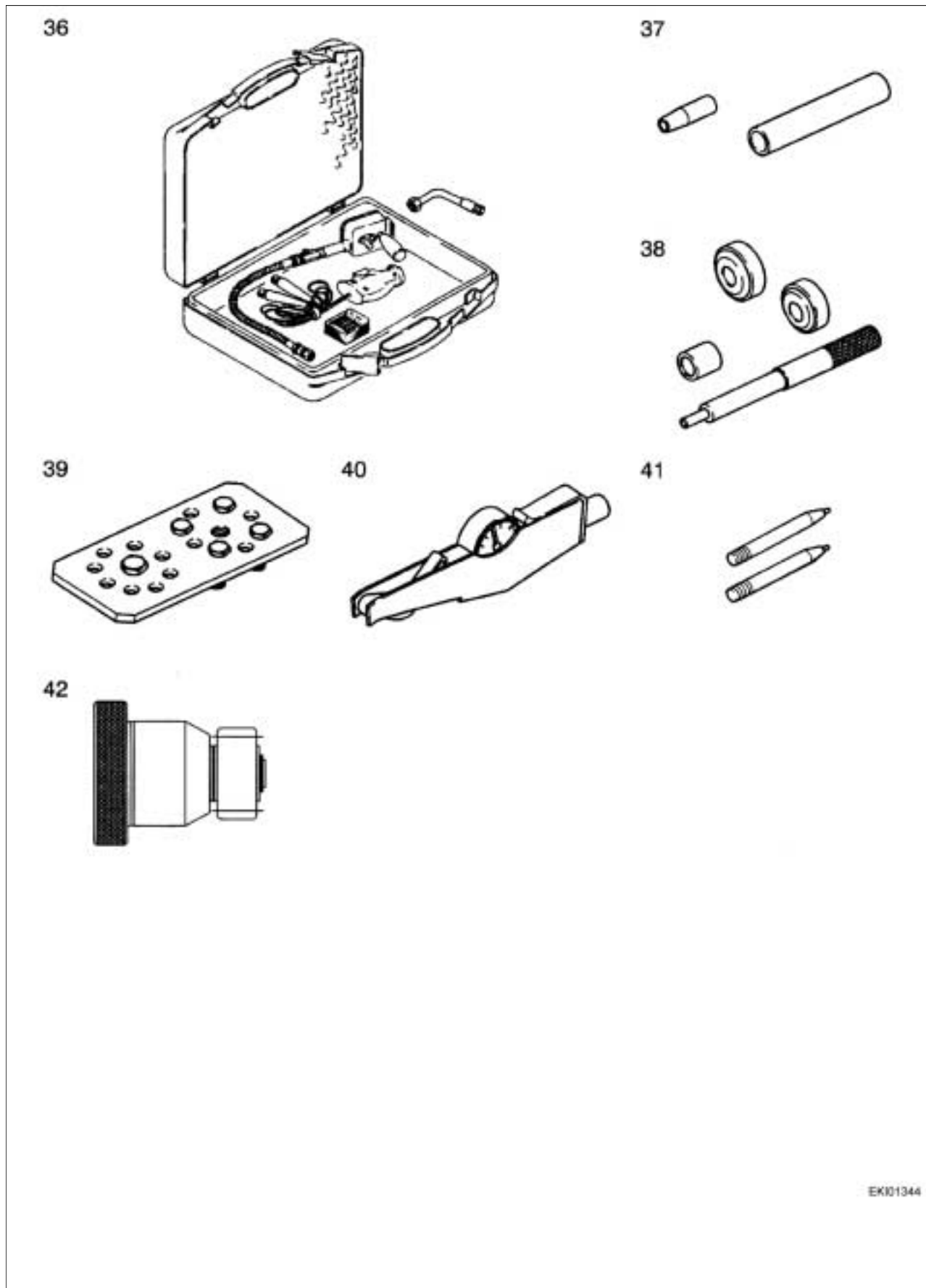
Date 19/03/2001	Version a	Page 3/7	Special tools	Capitel 9920	Index A	Docu-No. 000004
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Fav 900	Engine / Generalities Special tools	A
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Diagram Nb.	Description	Reference
19	Percussion type extractor to 18	80.99602-0016*
20	Slip-on grip for all pressing plates	80.99617-0129*
19	Pressing plate for front crankshaft seal	80.99617-0073*
20	Pressing plate for front crankshaft seal, flywheel end	80.99614-0032*
21	Dial for torque wrench and torque angle.	80.99607-0134*
22	Piston ring clamp	80.99613-0035*
23	Sliding bush Ø 108 mm	83.09144-0057*
24	Dial gauge bracket	80.99605-0172*
25	Piston ring pliers	83.09144-6090*
26	Scanner gauge 0,2 / 0,25 / 0,35 / 0,4 / 0,5, for valve setting	80.99607-0076*
27	Valve setting wrench	80.99603-6007*
28	Cylindre liner extractor, (Set).	80.99602-0019*
29	Extractor plate Ø 107,8 mm	80.99602-0123*
30	Intake air pressure gauge 0 to 2,5 bar, (Set).	80.99605-6010*
31	Ruler for Cylinder heads	80.99607-0044*
32	Test connector for compression recorder.	X899.980.205**
33	Valve fitting lever	80.99606-0301*
34	Mandrel for inserting camshaft	80.99617-0060*
35	Mandrel for pressing camshaft bearing bushes in and out	A5.00026-1136*

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Fav 900	Engine / Generalities Special tools	A
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Diagram - Nb.	Description	Reference
36	Compression recorder	80.99605-0164*
	- Angle adaptor	81.98110-0099*
	- Diagram discs (Packs.of 100 pieces)	80.99605-0165*
37	Mounting tube for valve rod bushings	80.99606-0287*
	Press tube for valve rod bushings	80.99604-0106*
38	Press in and out device for valve guides including pressing plate for valve seat rings	80.99604-0050*
	Device consisting of:	
	Press mandrel for valve guides	80.99604-0051*
	Pressing bush (spacer bush)	80.99604-0052*
	pressing plate for inlet valve seat ring	80.99604-0114*
	pressing plate for exhaust valve seat ring	80.99604-0054*
39	Mounting plate for compressor drive gear. necessary	80.99606-0078*
	4 Screws M 8*22 DIN 933	06.01304-7114*
	1 Screw M 12*30 DIN 933	06.01304-7317*
	Belt tension gauge (typ1; 200 - 600N)	X899.980.218**
40	Belt tension gauge (typ1; 500 - 1500N)	X899.980.219**
41	Guide mandrel (2 off) for fitting flywheel, see sketch for manufacturing.	
42	Crankshaft actuating device.	X899.980.220.0-00**

Note:

* MAN-tools without a Fendt-spare part number can be ordered by MAN-Service-Centres.

** Fendt-spare part number

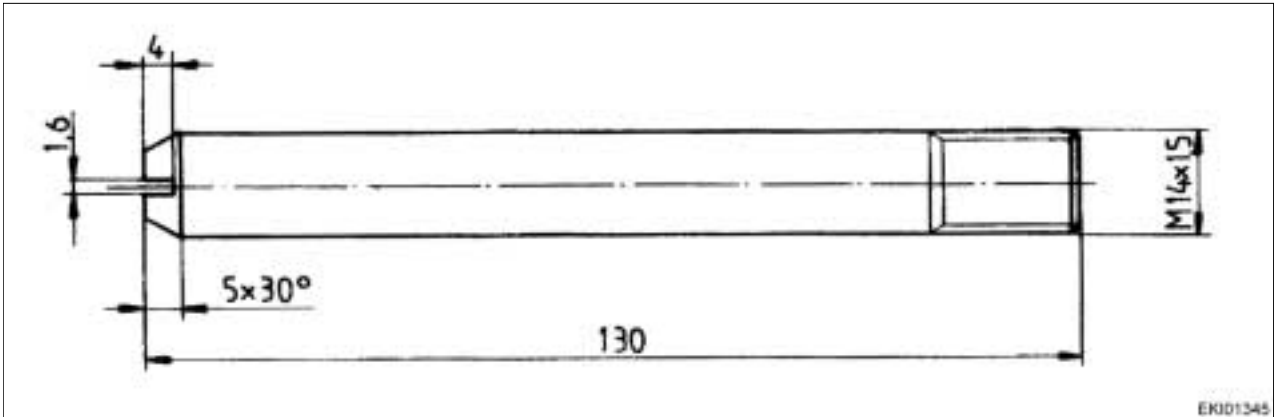
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Tools to be manufactured

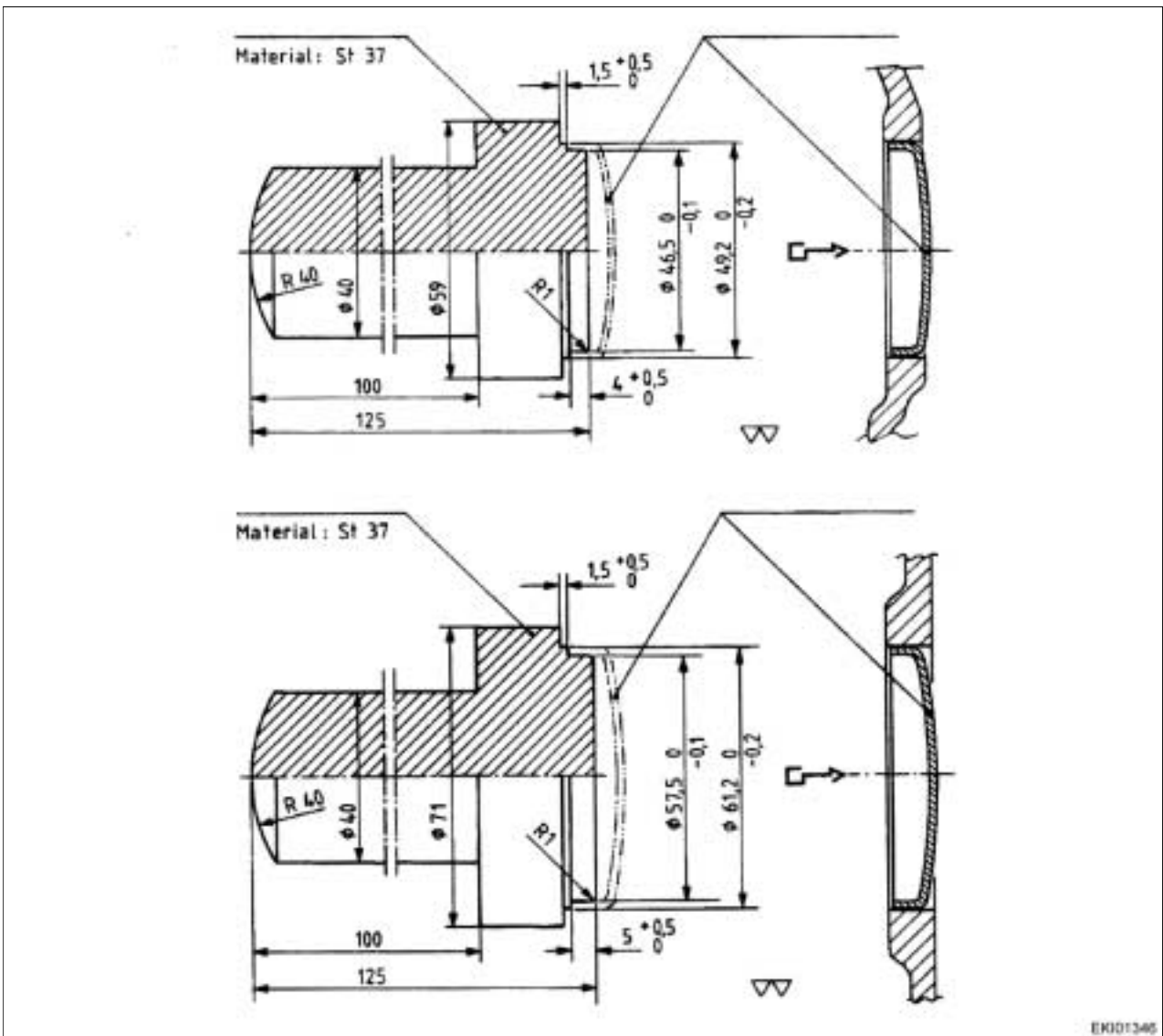
Guide mandrel for flywheel assembly

Material: made from M14*140



Pressing mandrels for sealing caps

Ø 50,1 mm, Ø 62,1 mm



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