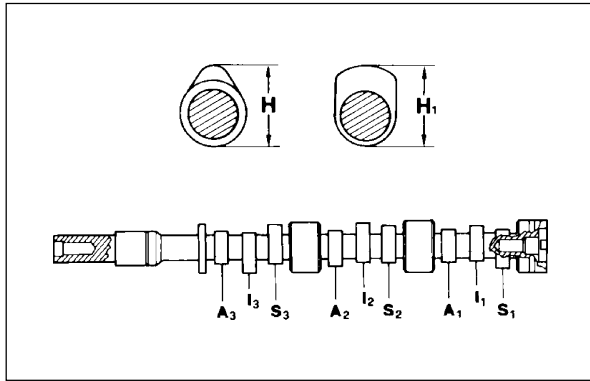


## II DISASSEMBLY/REASSEMBLY



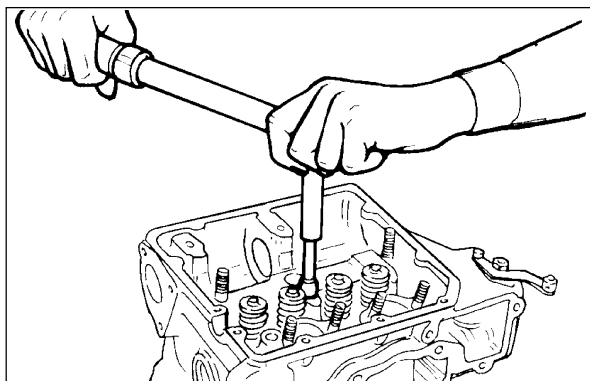
### CAMSHAFT LOBE SPECIFICATIONS

NOTE: The camshaft shown in the figure is reflective of a F3M 1008. However, the cam lobes are identical for the F2/3/4M 1008 diesel engines. The cam lobes are slightly different for the BF 4M 1008 as is shown in the data below.

H - F2/3/4M 1008 = Valve Lobe (intake/exhaust) = 29.598-29.650 mm
H - BF 4M 1008, Intake Lobe = 29.438 - 29.490 mm
H - BF 4M 1008, Exhaust Lobe = 29.778 - 29.830 mm
H - USEABLE Limit (All Models) = Minimum Value minus(-) 0.1 mm
H <sub>1</sub> - Injection Lobe (All Models) = 28.948 - 29.00 mm
H <sub>1</sub> - Injection Lobe USEABLE Limit = 28.848 mm

### LOBE IDENTIFICATION:

<b>A1</b> No. 1 Intake	<b>A2</b> No. 2 Intake	<b>A3</b> No. 3 Intake
<b>S1</b> No. 1 Exhaust	<b>S2</b> No. 2 Exhaust	<b>S3</b> No. 3 Exhaust
<b>I1</b> No. 1 Injection	<b>I2</b> No. 2 Injection	<b>I3</b> No. 3 Injection

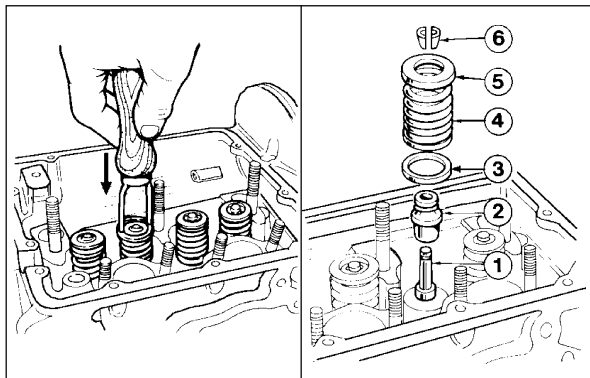


### CYLINDER HEAD REMOVAL

Remove all cylinder head bolts, then lift the cylinder head from the crankcase. Do not pry excessively, lever or strike the cylinder head with a hammer in attempts to break the cylinder head loose from the head gasket. Do not damage the pre-combustion chambers during the handling process.

INSPECTION: Thoroughly clean the cylinder head in a non-caustic solvent. Dry with compressed air. Inspect for cracks and warpage. Check cylinder head warpage using a high quality straight edge and precision feeler gauges. Hold the straight edge on the cylinder head deck and check corner-to-corner and side to side in at least four(4) equidistant zones. The maximum allowable warpage is 0.10 mm. If warpage exceeds 0.10 mm, the cylinder head may be planed a maximum of 0.20 mm.

NOTE: Remove pre-combustion chambers before planing.

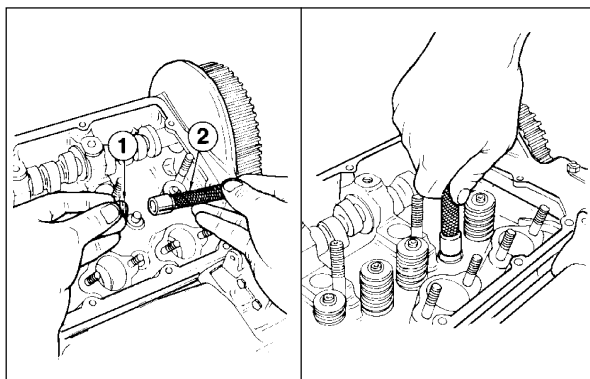


### VALVE REMOVAL

Components:

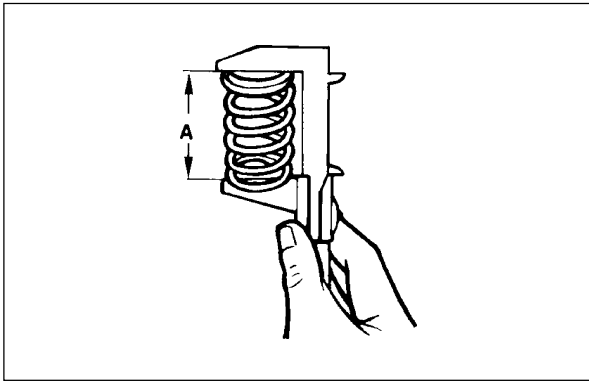
<b>1</b> Valve Stem	<b>4</b> Spring
<b>2</b> Valve Seal	<b>5</b> Spring Cap
<b>3</b> Spring Seat	<b>6</b> Collets

Place the cylinder head on suitable wood spacers so that the pre-chambers do not touch the top of the work bench when the cylinder head is oriented as shown. Using a suitable valve spring compression tool and acting on the spring cap (5), compress the valve springs so that the collets (6) can be removed while the spring is being held in the compressed state. **WARNING:** Valve springs can store a considerable amount of energy while under compression. Compress and hold valve springs under compression with care- wear suitable eye protection. After the collets are removed from all valves, turn the cylinder head 90° so that the cylinder head is resting on the intake or exhaust planes. Remove the valves. If valves are to be reused, label each valve according to cylinder number so that the valves can be reinstalled in the identical position as removed.



### VALVE STEM SEAL INSTALLATION

Following cleaning of the cylinder head and machining or lapping of the valves/ valve seats, install the valves into the cylinder head. Using wooden spacers to prevent pre-chamber damage, orient the cylinder head as shown. Soak new valve stem seals in clean engine oil for five(5) minutes. Liberally lubricate the valve stems with clean engine oil. Using special tool 1460-047, place the valve stem seals in the end of the 1460-047 tool. Carefully push the valve stem onto the valve stem and over the valve guide. Do not force the seal or use a hammer to drive the seals into place. The hand force applied must be parallel to the valve.



**VALVE SPRINGS**

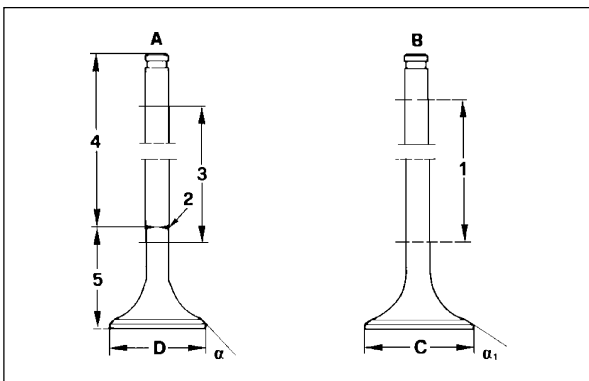
**INSPECTION:**

Clean all valve springs in solvent and dry with compressed air. Inspect the springs for surface cracks and fractures. Orient the spring in normal direction of operation with one end of the spring resting on a flat surface. Make sure that both planes of the spring are parallel. If the springs seats are not parallel, discard the spring.

Measure the free height of the spring as shown in the diagram. The free height should be 45.6 mm (nominal). If the free height is less than 43.5 mm, discard the spring.

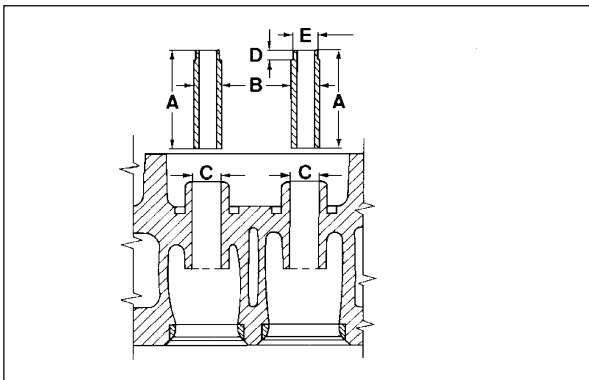
**VALVE SPECIFICATIONS:**

**INTAKE VALVE:** Base Material: X 45 Cr Si 8 UNI 3992  
 Zone 1 - Chrome Plated  
 C = 33.00 mm (F 2/3/4M 1008, BF 4M 1008)  
 C = 34.40 mm (F 4M 1008 F)  
 $\alpha_1 = 60^\circ 30' / 60^\circ 45'$



**EXHAUST VALVE:** Zone 2 - Weld Joint  
 Zone 3 - Chrome Plated  
 Zone 4 - Base Material: X 45 Cr Si 8 UNI 3992  
 Zone 5 - Base Material: X 70 Cr Mn Ni N 216 UNI 3992  
 D = 29.00 mm (F 2/3/4M 1008, BF 4M 1008)  
 D = 30.20 mm (F 4M 1008 F)  
 $\alpha = 45^\circ 30' / 45^\circ 45'$

**VALVE CLEANING:** The face and lower shank of the valves may be power cleaned via an electric brush. **DO NOT POWER BRUSH THE VALVE STEM!**



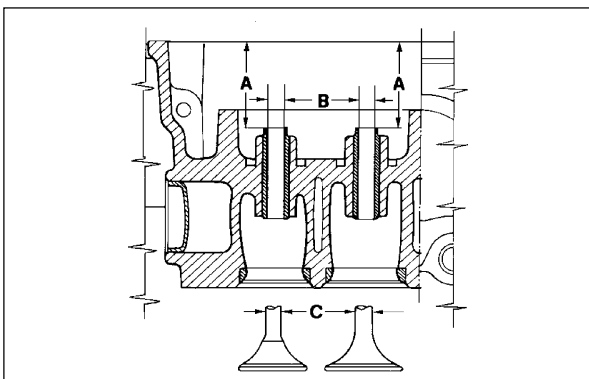
**VALVE GUIDES / VALVE GUIDE BORE**

Both intake and exhaust valve guides are identical dimensionally and are made from phosphoric gray iron with a pearlitic matrix. The dimensional specifications are as follows:

- A** = 36.4 - 36.6 mm
- B** = 11.045 - 11.054 mm
- C** = 11.000 - 11.018 mm
- D** = 5.80 - 6.20 mm
- E** = 9.75 - 9.85 mm

Valve guides are supplied in finished form. No further machining of standard valve guides is required or recommended.

**NOTE:** 0.50mm oversized valve guides (**OD**) are available. If oversized valve guides are used, dimension (**C**) from above must be increased by 0.50mm.



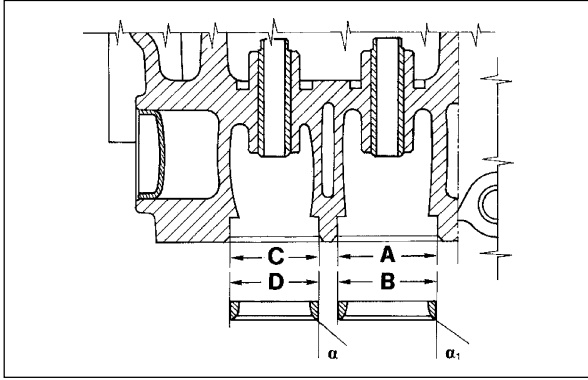
**VALVE GUIDE INSTALLATION GUIDELINES AND POST INSTALLATION VALVE / VALVE GUIDE SPECIFICATIONS**

Deutz does not provide installation tools for valve guides. Deutz recommends that valve guide replacement be done by a suitable shop specializing in cylinder head work.

Whether newly installed or existing, the valve guides should conform to the following:

- A** = 39.5 - 40.0 mm
- B** = 7.005 - 7.020 mm
- C** = 6.960 - 6.990 mm
- B-C** = 0.015 - 0.050 mm; USAGE Limit = 0.10 mm

## II DISASSEMBLY/REASSEMBLY



### VALVE SEATS

Valve seats are supplied fully finished. No further machining of the valve seats is required or recommended except for a final lapping operation as part of valve installation. Deutz does not provide installation tools for valve seats. Deutz recommends that valve seat replacement be done by a suitable shop specializing in cylinder head work. Whether newly installed or existing, the valve seat to cylinder head interface must conform to the following:

#### For F 2/3/4M 1008, BF 4M 1008

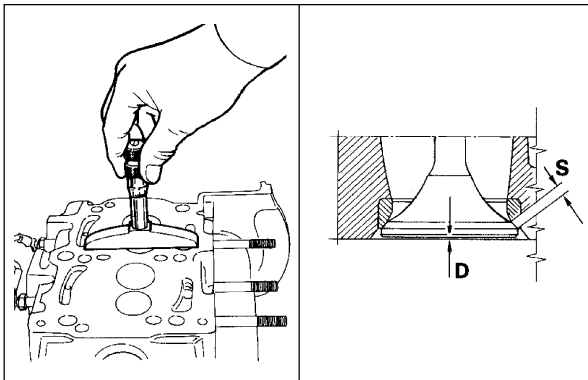
EXHAUST VALVE SEAT: A = 34.020 - 34.045 mm  
B = 34.106 - 34.115 mm  
 $\alpha_1 = 59^\circ 53' - 60^\circ$

INTAKE VALVE SEAT: C = 30.020 - 30.041 mm  
D = 30.108 - 30.116 mm  
 $\alpha = 44^\circ 53' - 45^\circ$

#### For F 2/3/4M 1008 F

EXHAUST VALVE SEAT: A = 35.220 - 35.245 mm  
B = 35.306 - 35.315 mm  
 $\alpha_1 = 59^\circ 53' - 60^\circ$

INTAKE VALVE SEAT: C = 31.220 - 31.241 mm  
D = 31.308 - 31.316 mm  
 $\alpha = 44^\circ 53' - 45^\circ$



### VALVE RECESS and SEAT SEALING WIDTH

Invert the cylinder head as shown with the cylinder head resting on suitable supports. Install the valves, but not the valve springs. Lubricate the valve stems with clean engine oil and perform the final lapping on the valve to valve seat interface using 'fine' lapping compound. Wipe off all excess lapping compound. Remove each valve following lapping and measure the width of the sealing band (S) as shown by the gray lap line.

#### For F 2/3/4M 1008, BF 4M 1008

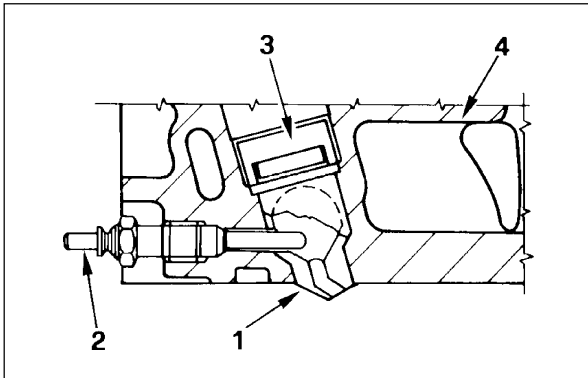
SEALING WIDTH (S) = 1.6 - 1.7 mm; USEABLE Limit = 2.0 mm  
VALVE RECESS (D) = 0.5 - 0.8 mm; USEABLE Limit = 1.1 mm

With the valve resting in the cylinder head, use a depth micrometer to determine the recess (D) that the valve face drops below the cylinder head deck.

If valve recess or valve sealing area does not meet the above specifications, replace the valves/ valve seats as required.

#### For F 2/3/4M 1008 F

SEALING WIDTH (S) = 1.6 mm; USEABLE Limit = 2.0 mm  
VALVE RECESS (D) = 0.7 - 1.0 mm; USEABLE Limit = 1.3 mm

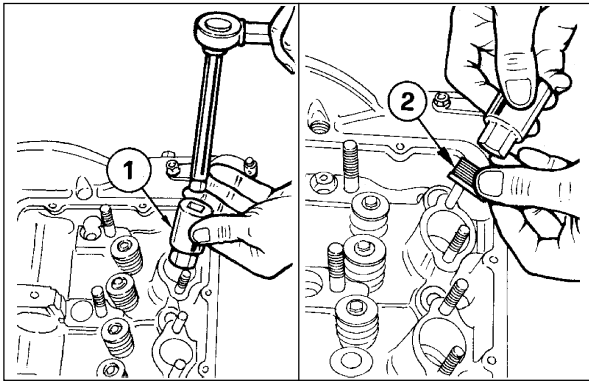


### PRE-COMBUSTION CHAMBER-OVERVIEW

Components of the Pre-combustion chamber configuration

- 1 Pre-combustion Chamber
- 2 Glow Plug
- 3 Pre-combustion Chamber Ring Nut
- 4 Cylinder Head

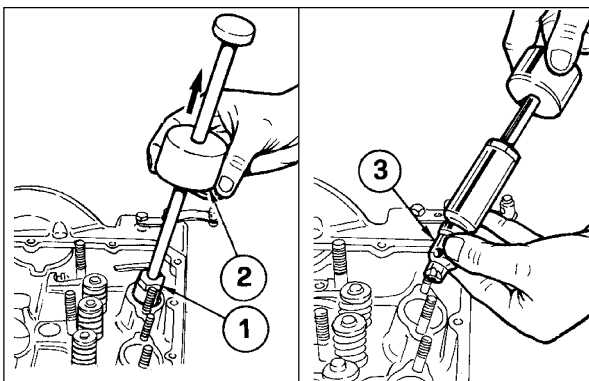
NOTE: Pre-combustion chambers are identical for the F 2/3/4M 1008 and BF 4M 1008.



NOTE: THE PRE-COMBUSTION CHAMBER DOES NOT NORMALLY REQUIRE REMOVAL OR SERVICE AND SHOULD NOT BE DISTURBED UNLESS ABSOLUTELY NECESSARY. DO NOT REMOVE PRE-COMBUSTION CHAMBERS AS PART OF A NORMAL REBUILD OR VALVE JOB. FURTHER, DEUTZ RECOMMENDS THAT NEW PRE-COMBUSTION CHAMBERS BE INSTALLED IF REMOVAL OF THE EXISTING PRE-CHAMBERS IS REQUIRED. THE FOLLOWING PROCEDURES DETAIL PRE-CHAMBER REMOVAL AND INSTALLATION SHOULD SERVICE BE REQUIRED.

**PRE-COMBUSTION CHAMBER RING NUT:**

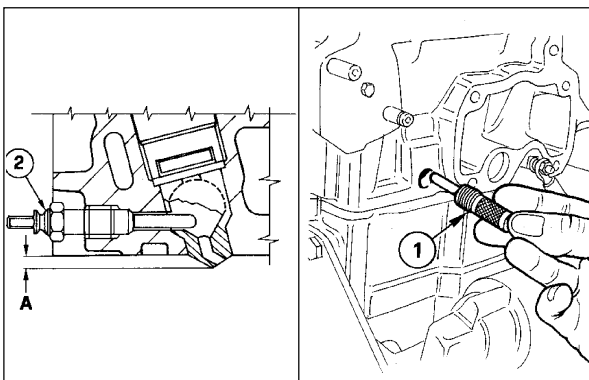
As shown in the diagram at the bottom of page 35, the pre-combustion chamber is secured to the cylinder head by a ring nut. The ring nut (2) may be removed by securing the cylinder head in a safe and suitable manner- resting on wooden blocks to protect the pre-combustion chambers, then using special tool 7107-027 and a breaker bar to loosen and remove the ring nut (2).



**PRE-COMBUSTION CHAMBER REMOVAL**

Remove the glow plug(s) from the cylinder head. Screw special tool 1460-030 into the pre-combustion chamber. Special tool 1460-030 is comprised of shaft/end (1) and slide hammer (2). Make sure that the shaft/end (1) portion of the special tool is completely screwed into the pre-combustion chamber. Carefully, but sharply, slide the slide hammer (2) up the special tool shaft until contact is made with the end of the tool. The hammer effect of the special tool will extract the pre-combustion chamber. Following extraction of the pre-combustion chamber, unscrew the pre-combustion chamber (3) from the special tool.

WARNING: SPECIAL TOOL 7107-030 IS AN IMPACT DEVICE. EYE PROTECTION SHOULD BE WORN DURING OPERATION. GREAT CARE SHOULD BE TAKEN TO PREVENT THE PINCHING OF YOUR HAND OR FINGERS AS THE SLIDE HAMMER IMPACTS THE TOP OF THE TOOL.



**PRE-COMBUSTION CHAMBER INSTALLATION:**

Carefully clean all carbon from the pre-combustion chamber pocket in the cylinder head. Do not use sharp edges or abrasive means to clean the pre-combustion chamber pocket. Non-caustic solvents may be used to assist in carbon removal.

Introduce a new pre-combustion chamber into the cylinder head so that the side hole of the pre-combustion chamber approximately aligns with the glow plug hole (see diagram at left). Screw the pre-chamber alignment tool 7107-031 fully into the glow plug threaded hole, through the pre-chamber side hole. Using the pre-combustion chamber ring nut tool- 7107-027 as shown above, install and tighten the pre-combustion chamber ring nut. Torque the ring nut in two(2) steps- 100 N m, then 180 N m.

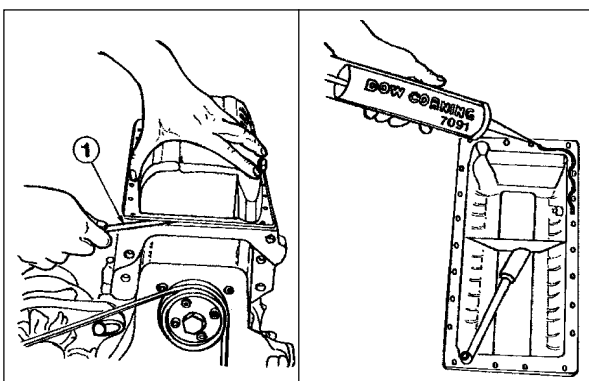
Reinstall the glow plug. Torque the glow plug to 25 N m.

**OIL PAN REMOVAL / INSTALLATION**

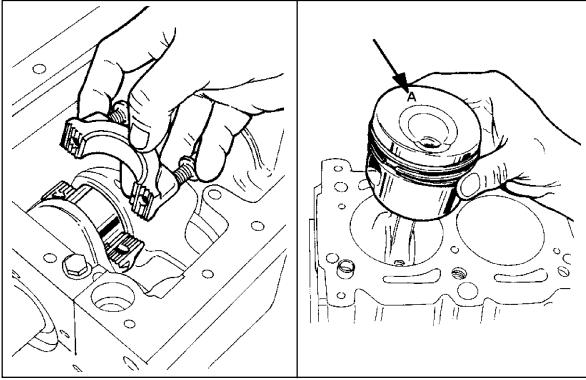
REMOVAL: Drain the oil from the oil pan. Remove all oil pan bolts. Gently, without deforming the pan, pry the pan from the crankcase using a small bar(1). Numerous attempts at several different locations around the perimeter of the pan may be required before the pan releases from the crankcase.

INSPECTION / CLEANING: Thoroughly clean the oil pan in solvent and dry with compressed air. Remove all traces of the oil pan gasket from the oil pan and crankcase. Inspect the oil pan for warpage, cracks, dents, etc.. Inspect the oil pick-up screen for tears and/or clogging. Inspect the oil drain plug holes for thread integrity. Lay the oil pan mounting flange on a flat surface and check for flatness. Repair or replace as required.

INSTALLATION: Install a new oil pick-up O-ring. Apply Dow Corning 7091 Silicone around the perimeter of the sealing surface of the pan as shown. Allow the silicone to "skin". Install the oil pan to the engine. Torque the oil pan bolts to 10 N m. Torque the oil drain plug to 40 N m.



## II DISASSEMBLY/REASSEMBLY



**PISTON REMOVAL:** Rotate the engine to BDC. Clean all carbon from the top of the cylinder bore. If a wear ridge is present at the top of the cylinder bore, remove the ridge with a suitable "ridge reamer". Remove the connecting rod cap as shown. Using a soft, wood rod, carefully and slowly push on the connecting rod- forcing the piston upward. Do not allow the connecting rod to hit the crankshaft. Note: Slight crankshaft rotation may be required to gain adequate access to the connecting rod for purposes of pushing. Push the connecting rod until the piston oil ring is outside of the cylinder bore. Lift the piston from the cylinder bore as shown. Mark the top of the piston and the connecting rod with respect to cylinder number. Loosely re-attach the connecting rod cap to the connecting rod.

**GENERAL PISTON NOTES:** B/FM 1008/F pistons are identical for the F2/3/4M 1008. BF4M 1008 piston is identical to the F2/3/4M 1008, but is fitted with a special top compression ring individual to the BF 4M 1008.

### PISTON / CONNECTING ROD DISASSEMBLY and PISTON INSPECTION

Carefully remove and retain the piston pin snap ring (one(1) side only) using a suitable awl and a small screwdriver as required(see diagram). Do not damage the snap ring seat during the removal process. Push the piston wrist pin far enough to allow the piston and connecting rod to be separated. NOTE: If required, the wrist pin may be tapped with a soft faced drift to assist wrist pin movement. If tapping is required, place the piston on a protected surface so that the skirt of the piston is not damaged during the tapping process. Do not allow the drift to contact the piston pin bore.

**INSPECTION:** Clean the piston and piston pin in solvent. Dry with compressed air. Inspect the piston for scoring, galling and signs of localized overheating. Carefully remove the piston rings. Remove all carbon from the piston top. Clean the carbon from the ring grooves using a suitable ring groove cleaning tool.

**MEASUREMENT:** Measure the diameter (Q) of the piston skirt a distance (A)-9 mm from the bottom of the piston skirt. Measure piston ring land/ ring clearance as detailed on page 39.

### PISTON CLASS, WEIGHT IMBALANCE and GENUINE Deutz MARKINGS

As part of the high quality standards of Deutz, pistons are fitted within B/FM 1008/F engines as a function of finished cylinder size. Four(3) piston classes exist- **A, B, C**. The piston class is stamped into the bottom of the piston as shown in the diagram (at arrow). The Deutz logo on the bottom of the piston crown is your assurance that the piston is GENUINE DEUTZ.

#### PISTON CLASS DETAILS (F 2/3/4M 1008, BF 4M 1008):

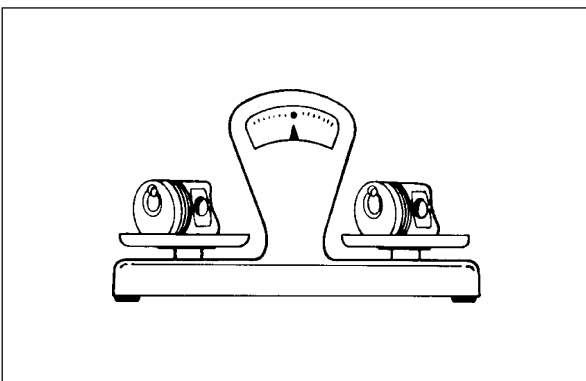
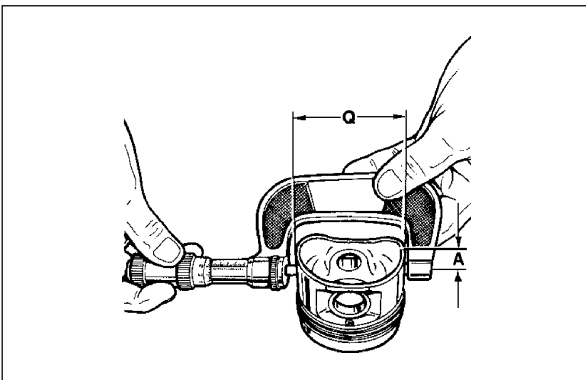
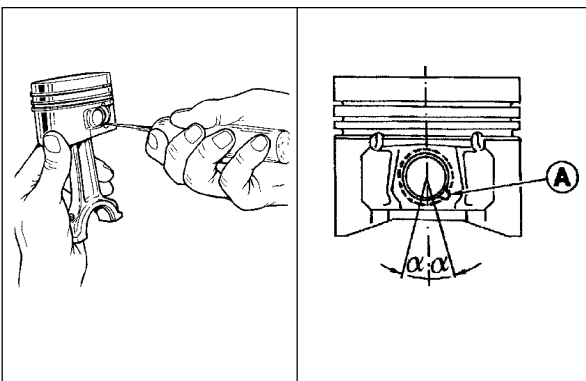
CLASS	Ø Cylinder (mm)	Dimensions (mm):	
		Ø Piston	Clearance (mm)
A	71.990 - 72.000	71.930 - 71.940	0.050 - 0.070
B	72.000 - 72.010	71.940 - 71.950	
C	72.010 - 72.020	71.950 - 71.960	

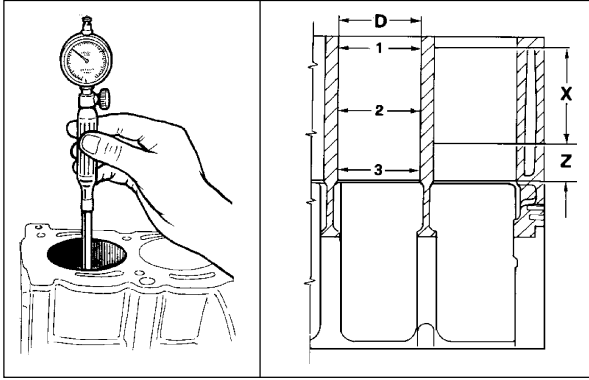
#### PISTON CLASS DETAILS (F 2/3/4M 1008F):

CLASS	Ø Cylinder (mm)	Dimensions (mm):	
		Ø Piston	Clearance (mm)
A	74.990 - 75.000	74.930 - 74.940	0.050 - 0.070
B	75.000 - 75.010	74.940 - 74.950	
C	75.010 - 75.020	74.950 - 74.960	

**REPLACEMENT PISTONS (SPARE PARTS):** Replacement pistons are supplied with piston rings reflective of the piston class. Replacement pistons are supplied as class **A**. Piston classes **B** and **C** are reserved for production engines. Oversized pistons are available as 0.50mm and 1.00mm and are supplied with piston rings reflective of the oversized diameter. **DO NOT FIT PISTON RINGS FOR STANDARD PISTONS ON OVERSIZED PISTONS. DO NOT FIT RINGS FOR OVERSIZED PISTONS ON STANDARD PISTONS.**

**PISTON BALANCE:** Weigh all pistons to be installed within a single engine. The total difference in weight between the lightest and heaviest piston should not exceed 4 grams. Weigh all pistons to be installed within a single engine. The total difference in weight between the lightest and heaviest piston should not exceed 4 grams.

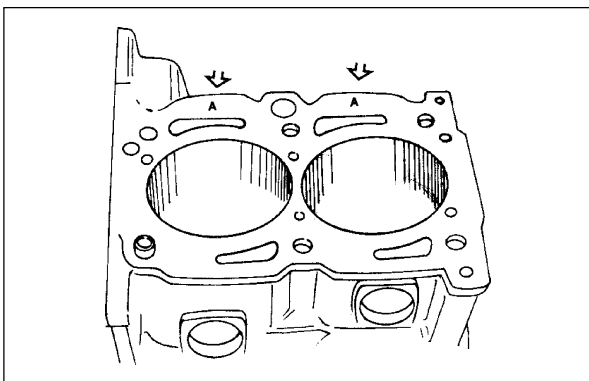




**CYLINDER INSPECTION / DIMENSIONAL SPECIFICATIONS**

Thoroughly clean the cylinders and upper deck of the crankcase. Alternately, completely clean the crankcase with solvent and dry with compressed air. Remove all carbon deposits from the cylinder and carefully remove any excessive ridge at the upper portion of the cylinder using a suitable "RIDGE REAMER" tool. Inspect the cylinders for general wear, scoring, galling and discoloration. Using a calibrated bore gauge, measure the cylinder diameter at four(4) positions in 45° intervals at each of the depths (1), (2) and (3) as shown. The piston ring contact zone is shown as (X), while the piston skirt only contact area is shown as (Z). Dimensional analysis is as follows: **D** = 71.990 - 72.000 mm, CLASS **A**- (All B/FM 1008/F Models)

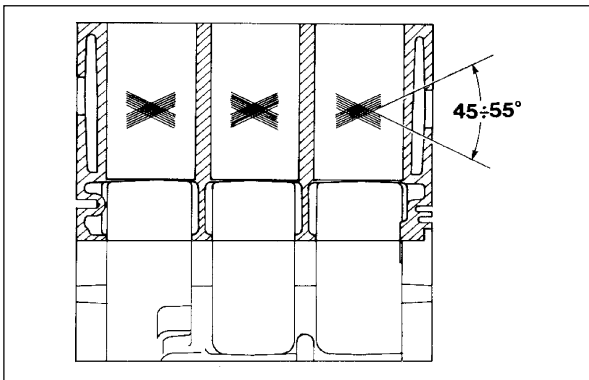
If the cylinder is found to be 72.050mm or greater at any measurement point, bore the cylinder by 0.50 or 1.00mm. Further, if the cylinder is found to be in specification, but the bore is tapered or bell-mouthed, boring is suggested. NOTE: To determine the piston running clearance, measure the piston skirt as detailed on page 37, then measure the cylinder bore in zone (Z). The piston running clearance will be the difference between the two (2) dimensions.



**CYLINDER CLASS**

The cylinder class (at time of manufacture) is stamped on the upper deck of the crankcase as shown in the diagram. Cylinders are classed as **A**, **B**, **C** depending on the exact cylinder diameter.

NOTE: Replacement pistons are available in class **A**. If upon disassembly, the existing pistons cannot be reused, replace the piston with class **A** depending on the cylinder diameters found.



**CYLINDER SURFACE FINISH**

Proper cylinder surface finish is critical for low oil consumption and optimal engine performance. Therefore, the success of an engine rebuild is greatly affected by the preparation of the cylinders with respect to surface finish.

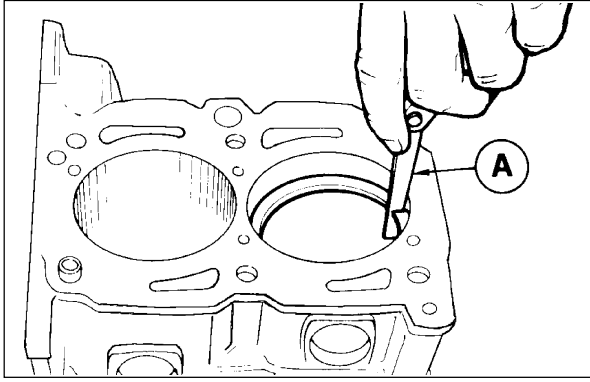
After inspection of the cylinders as detailed above, the cylinders should be power honed. A "BEAD" type hone is preferred for engines that do not require boring. Engines that require boring, should be power honed as part of the boring operation. Since honing removes material, the diameter of the cylinder should be re-checked as detailed above following honing.

The honing operation should produce a pattern oriented at 45-55° as shown in the diagram. The final surface roughness should be 0.5-1.0 mm.

POST HONING CLEANING: Deutz strongly recommends that the cylinders be washed with hot water and a strong degreasing soap following honing. Finish the cleaning operation with a thorough rinsing with clean water, then dry the crankcase with compressed air. Coat all exposed surfaces, especially the cylinders and upper crankcase deck with clean engine oil to prevent corrosion.

NOTE: DO NOT USE EMERY CLOTH, SAND PAPER, ETC. ON THE CYLINDER IN ATTEMPTS TO CREATE A CROSS-HATCH PATTERN BY HAND MOTION.

## II DISASSEMBLY/REASSEMBLY

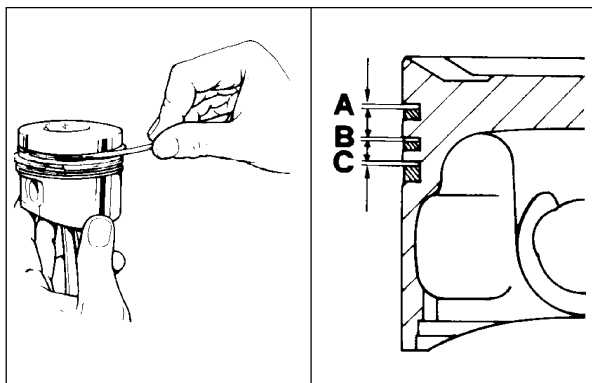


### PISTON RING END GAP

Prior to installing piston rings on each piston, install the rings within the cylinder bore, approximately 25 mm from the top of the crankcase deck as shown. A piston turned upside down should be used to push the rings to the 25mm depth so that assurances of proper orientation can be had. Use a feeler gage(A) to measure the ring end gap. The specifications are as follows:

1st piston ring (compression) = 0.25-0.45 mm, (USEABLE Limit = 1.00 mm)  
 2nd piston ring (compression) = 0.25-0.45 mm, (USEABLE Limit = 1.00 mm)  
 3rd piston ring (oil scraper) = 0.25-0.45 mm, (USEABLE Limit = 1.00 mm)

NOTE: If the ring gap is less than the minimum value shown, gently secure the ring in a soft jaw vise and file (small amount) the ends of the ring, re-checking the end gap periodically until the required clearance is achieved. Remove all burrs from the piston ring ends before installation.



### PISTON RING TO PISTON LAND CLEARANCE

With reference to the diagrams, measure the piston ring to piston land clearance using a feeler gage. If the piston has previously been operated within an engine, the piston should be inspected and cleaned as described on page 36.

The specifications for piston ring to piston land clearance are as follows:

A = 0.090 - 0.125 mm  
 B = 0.050 - 0.085 mm  
 C = 0.040 - 0.075 mm

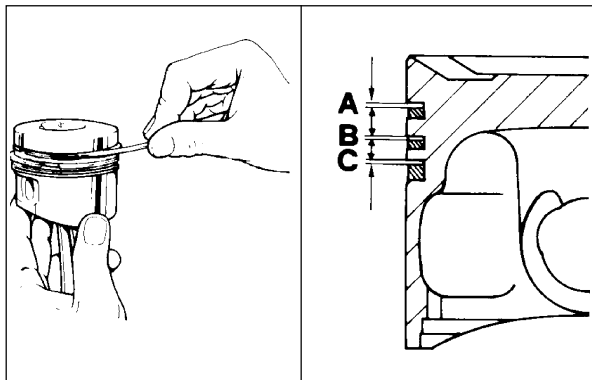
Replace the piston and/or piston rings if the piston ring to piston ring land clearance exceeds the specification.

### PISTON RING ASSEMBLY LOCATION

With reference to the diagram, carefully install the piston rings onto the piston.

A = Top C Compression Ring (Tapered / Torsional)  
 B = No. 2 C Compression Ring (Tapered / Torsional)  
 C = Oil Control Ring (Internal Spring, 2 piece Ring)  
 D = Chrome Plated Portion of Top C Compression Ring  
 E = Chrome Plated Portion of Oil Control Ring

NOTE: As shown on the diagram, install the rings so that the word "top", "UP" or any other markings faces up.



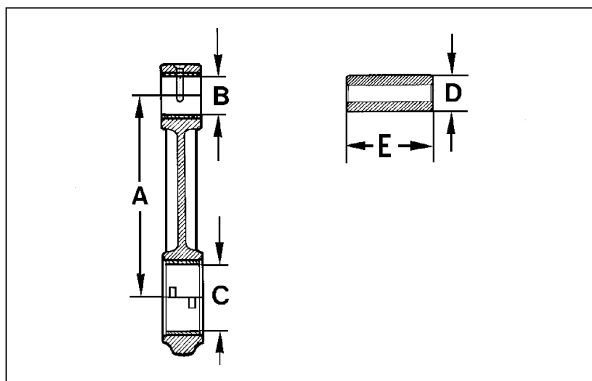
### CONNECTING ROD / CONNECTING ROD BEARINGS SPECIFICATIONS

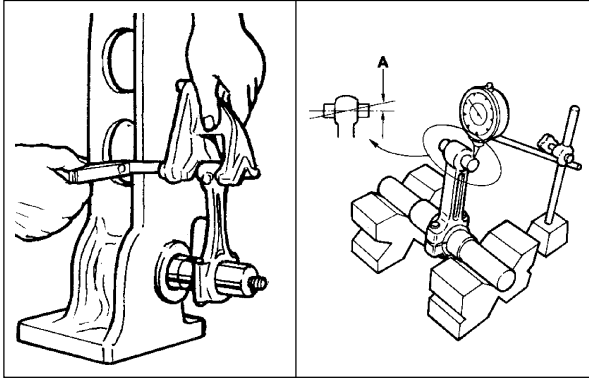
INSPECTION / SET-UP: Remove the connecting rod cap. Remove the connecting rod bearing inserts. Clean the connecting rod and bearings in solvent, then dry with compressed air. Inspect the connecting rod for nicks, gouges and potential stress risers. Inspect the wrist pin bushing for scratches and indications of galling or overheating. Discard the connecting rod if any doubt concerning the general condition of the connecting rod exists. Inspect the connecting rod bearings for wear, dis-coloration, scratches and grooves. Discard the connecting rod bearings if any doubt exists. Install the connecting rod bearing inserts (whether new or existing) into the connecting rod, then torque the connecting rod cap. See page 41 for connecting rod cap orientation and torque specifications. The following provides dimensional specifications for a fully assembled (with bearings) and torque connecting rod. Replace the connecting rod and/or connecting rod bearings if dimension conformance to the following is not shown.

#### Dim. SPECIFICATION NOTES

A	126.48 - 126.520 mm	
B	18.015 - 18.025 mm	BF 4M 1008 = 20.015 - 20.025
C	40.021 - 40.050 mm	(Cap Torqued to 40 Nm)
D	17.996 - 18.000 mm	BF 4M 1008 = 19.996 - 20.000 mm
E	50.900 - 51.100 mm	BF 4M 1008 = 54.000 - 55.100 mm
B-D	0.015 - 0.039 mm	USEABILITY Limit = 0.060

NOTE: If the small end bushing is replaced, the lubrication hole must be aligned



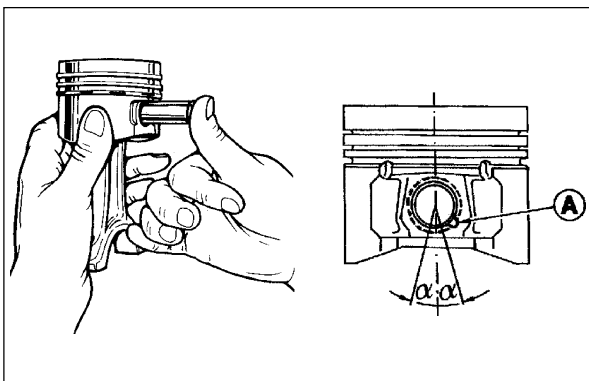


**CONNECTING ROD ALIGNMENT**

C heck the alignment of the connecting rod wrist pin bore with respect to the connecting rod journal diameter by fitting the connecting rod to a suitable fixture as shown or by placing the connecting rod on a mandrel in V-blocks as shown. If the V-block and dial indicator method is used, center the wrist pin in the connecting rod wrist pin bore so that an equal amount of the wrist pin protrudes from each side of the connecting rod. While holding the wrist pin down and seated in the wrist pin bushing, measure the height of the wrist pin on both sides of the connecting rod. If the fixture method is used, press down on the wrist pin as shown and measure the any axial offset

Maximum Axial Mis-alignment = .015 mm (USEABILITY Limit = 0.030 mm)

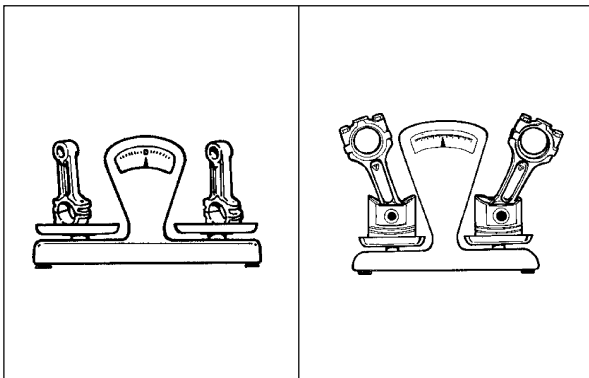
Minor mis-alignment may be corrected by skillfully and gradually working the connecting rod between centers on a press. **DO NOT ATTEMPT TO CORRECT MIS-ALIGNMENT UNLESS PROPERLY TRAINED AND EXPERIENCED.**



**PISTON WRIST PIN INSTALLATION / RETAINING SNAP RING**

A fter thoroughly cleaning and checking the connecting rod as described in the previous, liberally coat the wrist pin , piston wrist pin bore and wrist pin bushing with clean engine oil. While holding the piston and connecting rod as shown, insert the wrist pin into the piston and through the connecting rod. Do not force the wrist pin or use a hammer or drift pin to install the wrist pin. If hand force cannot install the wrist pin, investigate the cause of the problem.

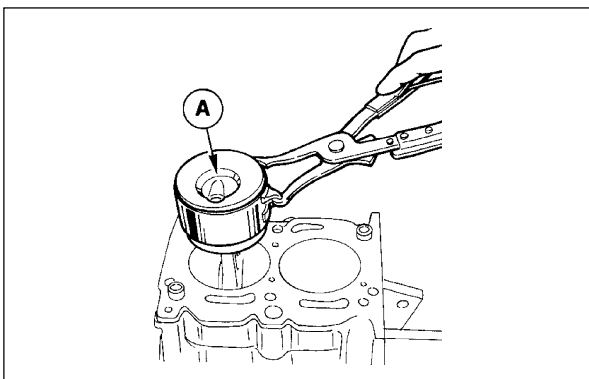
I nstall the piston pin retaining pin so that the open ends of the snap ring are oriented as shown in the diagram. The radial distance between the piston centerline and the open ends of the snap ring should be equal on both sides. The snap ring may be moved into proper position after installation by carefully acting on the snap ring with a suitable awl at point (A).



**CONNECTING ROD- PISTON ASSEMBLY BALANCE**

W eigh the connecting rod / piston assemblies to be installed with a given engine. The maximum allowable weight difference between the lightest and heaviest assembly is 10 grams.

I f the 10 gram differential in weight cannot be achieved, exchange pistons and/ or connecting rods until the maximum differential is 10 grams or less.



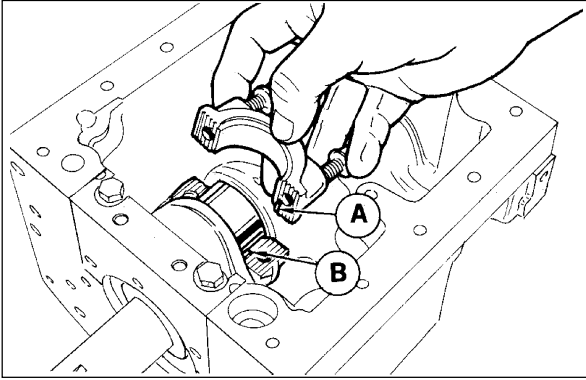
**PISTON / CONNECTING ROD INSTALLATION**

W ith reference to the cylinder bore and preparation specifications on page 38 and the information presented prior regarding pistons, piston rings and connecting rods, install the piston / connecting rod assembly. Rotate the engine so that the respective cylinder for piston/ connecting rod installation is at BDC. C lean the crankshaft rod journal. C oat the rod journal with clean engine oil. Remove the connecting rod cap. Install the upper and lower connecting rod bearings (see page 41). Liberally coat the connecting rod bearings, cylinder, piston and piston rings with clean engine oil. Rotate the piston rings to insure that no ring end gap is located on the thrust side of the piston ( $90^{\circ} \pm 10^{\circ}$  from the wrist pin axis) and that all ring end gaps are spaced approximately  $120^{\circ}$  relative to each other.

C ompress the piston rings with a suitable tool as shown. O rient the piston so that the turbulence chamber(A) in the top of the piston will correspond to the pre-combustion chamber in the cylinder head. Gently lower the piston / connecting rod assembly into the cylinder taking extreme care not to cock the piston in the bore and preventing the connecting rod from contacting the crankshaft. Gently tap the center of the piston with the wooden end of a light hammer while guiding the connecting rod over the crankshaft journal.



## II DISASSEMBLY/REASSEMBLY



### CONNECTING BEARING / ROD CAP INSTALLATION

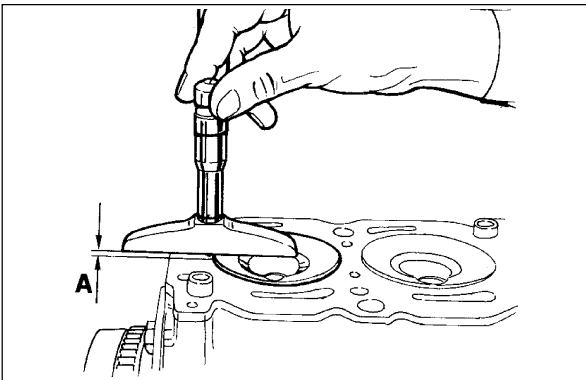
Install the connecting rod bearing inserts into the connecting rod and connecting rod cap. Make sure that the back of the bearing insert and the connecting rod and connecting rod cap bore is free of dirt, rust, oil etc. Insert the bearing inserts so that the tab on the bearing aligns with the slot in the connecting rod or connecting rod cap. Push the bearing completely into the connecting rod and connecting rod cap. Liberally oil the bearings with clean engine oil. Install the connecting rod cap onto the connecting rod making sure that the respective tang/slot locks on the connecting rod cap aligns with the tang/slot lock on the connecting rod.

Torque the connecting rod bolts to 40 N m in 5 N m steps.

### PISTON PROTRUSION

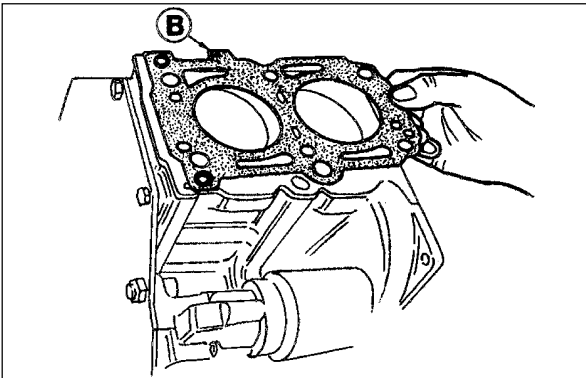
Rotate each cylinder to exact TDC. TDC may be determined by the use of a dial indicator mounted to the cylinder deck and indicating piston height as a function of crankshaft rotation.

After TDC is established, measure the protrusion of the piston (A) from the cylinder deck plane using a calibrated depth micrometer. The height should be measured on a line corresponding to the wrist pin axis as shown. Record the protrusion. Repeat the TDC establishment and piston protrusion procedure for each cylinder, recording the value for each cylinder. The HIGHEST protrusion measured will be used to establish the proper head gasket selection as presented below.



### HEAD GASKET SELECTION/INSTALLATION

Three(3) separate head gasket thickness' are available for B/FM 1008/F engines depending on the measured piston protrusion as measured above. The head gaskets are identified by notches cut in the edge located at point (B) as detailed below. Head gaskets are provided with "0 notch", "1 notch" or "2 notches" to



#### For F 2/3/4M 1008, BF 4M 1008

A (mm) (PISTON PROTRUSION) Head Clearance (mm)	No. of hole	Piston to Cylinder
0.97 - 1.06	0	0.39 - 0.48
1.07 - 1.16	1	
1.17 - 1.25	2	0.40 - 0.48

#### For F 2/3M 1008F

A (mm) (PISTON PROTRUSION) Head Clearance (mm)	No. of hole	Piston to Cylinder
0.82 - 0.91	0	0.55 - 0.63
0.92 - 1.01	1	
1.02 - 1.10	2	0.55 - 0.63

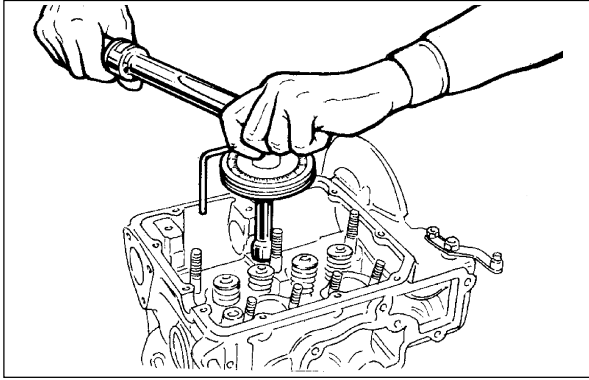
#### For F 4M 1008F

A (mm) (PISTON PROTRUSION) Head Clearance (mm)	No. of Notches	Piston to Cylinder
0.82 - 0.91	1	0.52 - 0.61
0.92 - 1.01	2	
1.02 - 1.10	3	0.53 - 0.61

assist in the identification of the different gaskets.

Match the piston protrusion dimension determined above with dimension (A) from the chart. Install the corresponding head gasket. If a head gasket cannot be chosen based upon the piston protrusion measured, check the connecting rod length, rod bearings, wrist pin bushing, etc. for the cause of the problem.

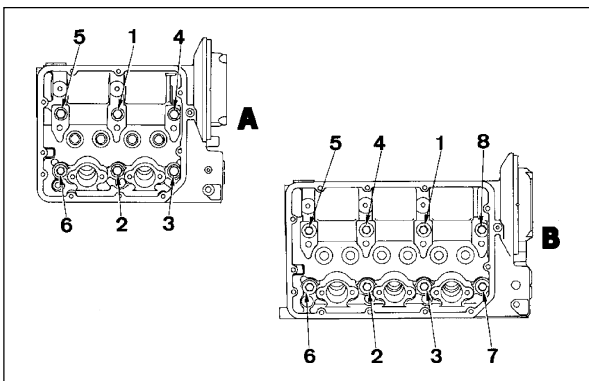
Completely clean the deck surface of oil, old gasket material, varnish, coolant, etc. Remove all traces of fluid from the cylinder head bolt bores. Install the head gasket so that the gasket aligns with the deck dowels and the brand name or "TOP" printed on the gasket faces up.



**CYLINDER HEAD INSTALLATION**

Cylinder head bolts are tightened/ torqued using a constant tension method as opposed to the traditional simple torque method. In short, the bolts are pre-loaded, then rotated in two(2) steps to ensure all bolts are tensioned exactly the same. The additional rotation after the initial pre-load stretches the bolts.

PREPARATION: Clean the cylinder deck thread holes of all liquid, gasket material, rust, etc. Clean the cylinder head sealing surface of all gasket material, deposits, etc. Clean the head bolt threads. Measure the length of the head bolts. The nominal length (new) is 89.5 / 90.5mm. Each time the bolts are tightened, the bolt stretches slightly. **DO NOT USE HEAD BOLTS WITH MEASURED LENGTHS OF 92mm OR GREATER.** In general terms, head bolts may be tightened three(3) times before replacement. Liberally oil the cylinder head bolt thread, bolt head thrust area and washer. Install the head gasket according to the instructions on page 41. Gently place the cylinder head on the crankcase aligning the index dowels. Fit a suitably sized torque wrench with a dividing head as shown.

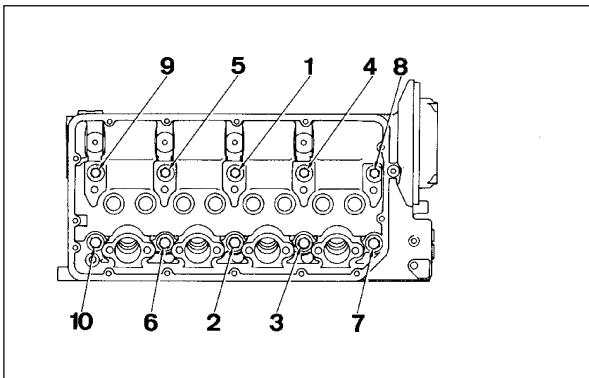


**CYLINDER HEAD TIGHTENING PROCEDURE- F 2/3M 1008 and F2/3M 1008 F:**

FIGURE A = F 2M 1008, F 2M 1008 F  
FIGURE B = F 3M 1008, F 3M 1008 F

- STEP 1: Torque the head bolts to 50 Nm in 10 Nm steps in the order shown.
- STEP 2: Rotate each head bolt, in the order shown, 90° (clockwise)
- STEP 3: Rotate each head bolt, in the order shown, 90° (clockwise)

NOTE: NO POST OPERATION RE-TORQUE OF THE CYLINDER HEAD IS REQUIRED OR RECOMMENDED.

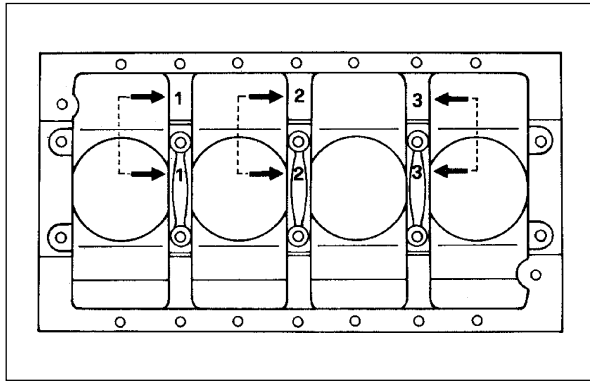


**CYLINDER HEAD TIGHTENING PROCEDURE- F 4M 1008, F 4M 1008 F, BF 4M 1008**

- STEP 1: Torque the head bolts to 50 Nm in 10 Nm steps in the order shown.
- STEP 2: Rotate each head bolt, in the order shown, 90° (clockwise)
- STEP 3: Rotate each head bolt, in the order shown, 90° (clockwise)

NOTE: NO POST OPERATION RE-TORQUE OF THE CYLINDER HEAD IS REQUIRED OR RECOMMENDED.

## II DISASSEMBLY/REASSEMBLY



### MAIN BEARING CAPS / BEARINGS- CENTER

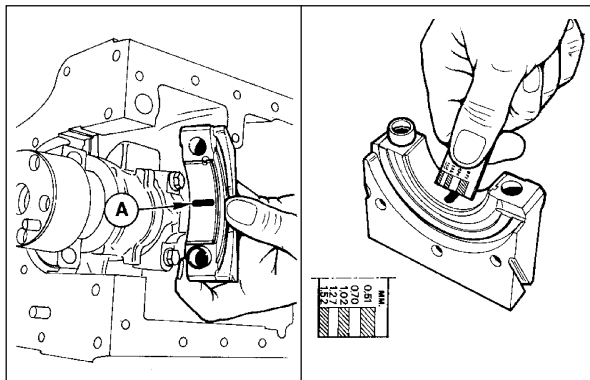
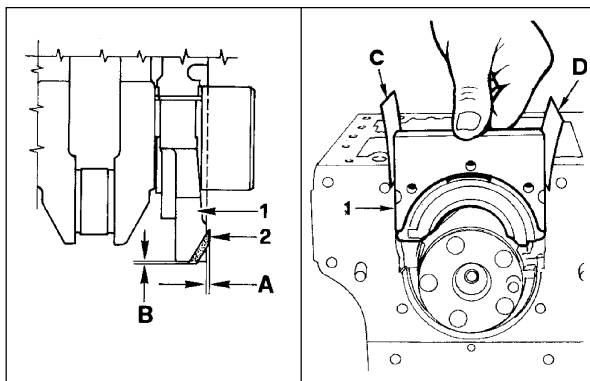
The center main caps are referenced on the actual cap and on the crankcase as shown to allow replacement of the caps in the identical position of removal. The reference number locations are shown in the figure at the left. Always reposition main caps in the original position. NOTE: If main bearings are intended to be re-used following disassembly, mark the bearing position using a permanent marker.

**INSPECTION / CLEANING:** Clean the main bearing caps in solvent and dry with compressed air. Remove all dirt, oil and deposits from the bearing seats. Check/clean all oil passages and remove any and all impurities. Flush the oil passages with clean solvent before assembling the crankshaft. Inspect the main bearing caps and crankcase for cracks, signs of overheating, nicks, etc. Inspect the main bearings for wear and signs of oil starvation, pitting, scoring, etc. Thoroughly scrub, but do not damage the non-bearing surface (back side) of the main bearings if re-use is intended. Replace the main bearings if any doubt exists.

**BEARING INSTALLATION / TORQUE SPECIFICATION.** Install the main bearings (upper and lower) into the respective bearing seats/ caps aligning the "tang" on the bearing with the "slot" in the seat or cap. Liberally oil the bearing surface with clean engine oil. Install the main bearing caps with reference to original position (see above). Torque the main bearing caps to 60 N m in 10 N m steps.

### FRONT / REAR MAIN BEARING CAPS / BEARINGS

The front and rear main bearings of the B/FM 1008/F engine are designed with lateral seals (2) installed between the sides of the main bearing cap and the crankcase saddle. The lateral seals MUST be replaced each time the main bearing caps are removed. Thoroughly clean the main bearing cap and crankcase as described above. Install and lubricate the main bearings as described above. Install the thrust bearings (rear main only) as described on page 43. Install the lateral seals onto the main bearing cap (1). Liberally lubricate the exterior of the seals. Place the special shims (part no. 1460-053) as shown in the figure between the crankcase and the main bearing. Push the main bearing into place. Remove the shims (part no. 1460-053). Torque the front and rear main bearing caps to 60 N m in 10 N m steps. Following installation, the lateral seal must extend 0.5-1.0 mm past the crankcase planes (A) at the front and rear face of the crankcase and 0.5-1.0 mm past the oil pan plane (B) to allow complete sealing. Trim material in excess of 1.00 mm with a razor knife. NOTE: Prior to installation of the rear seal support, oil pump or the oil pan, apply a small amount of RTV Silicone to the lateral seal extended area.



### MAIN BEARING CLEARANCE

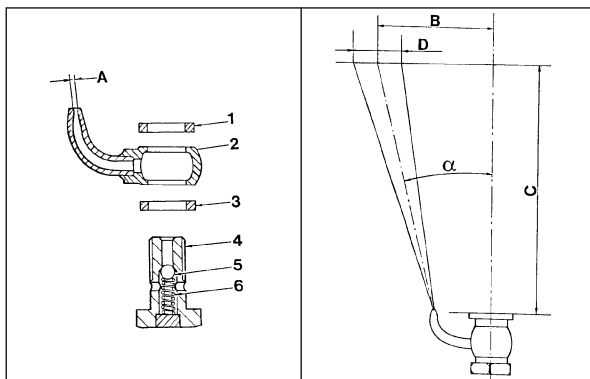
Ideally, main bearing clearance is determined following actual measurement of the main bearing journals and the main bearing diameters. "PLASTIGAGE" however, can provide a quick and reasonably accurate determination of main bearing clearance. Review and understand the instructions provided with the "PLASTIGAGE" kit. Invert (if possible) the engine so that the crankshaft weight is directed away from the main bearing cap. Remove the main bearing cap in question. Clean all oil from the main bearing and crankshaft using a spray solvent. Place a small strip of PLASTIGAGE across the main bearing as shown at (A). Install and torque the main bearing to 60 N m. DO NOT ROTATE THE ENGINE!. Remove the main bearing cap and compare the width of the compressed PLASTIGAGE strip to the "KEY" provided with the PLASTIGAGE (as shown) to determine the bearing clearance.

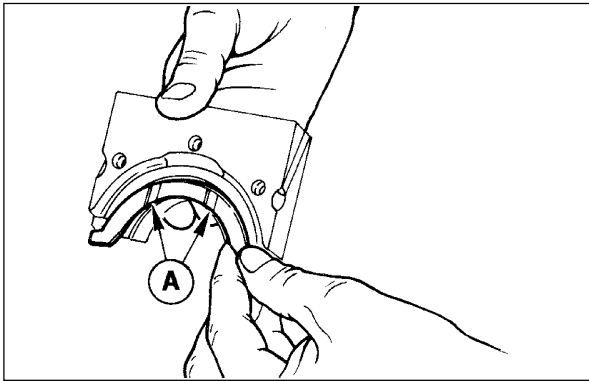
**PISTON COOLING JETS- BF4M 1008:** The BF4M 1008 engine is equipped with cooling jets which spray engine oil on the underside of the piston providing additional engine cooling. The cooling jets attach to the crankcase directly adjacent to the lower cylinder.

**COMPONENTS:**

1 Washer	<b>SPECIFICATIONS:</b>
2 Nozzle	A = 0.80 - 0.85mm
3 Washer	B = 34 mm
4 Banjo Bolt	C = 150 mm
5 Check Ball	D = 16 mm
6 Spring	$\alpha = 5^\circ$

**INSPECTION / CLEANING / INSTALLATION:** Inspect the spray jets for damage and clogging. Using new washers (1), (3), affix the nozzle (2) to the crankcase with bolt (4). Slowly rotate the engine to BDC (each cylinder). Adjust the position of the nozzle (2) so that no contact is made with the piston at BDC and the nozzle is pointed at the center of the piston bottom. Torque the bolt (4).



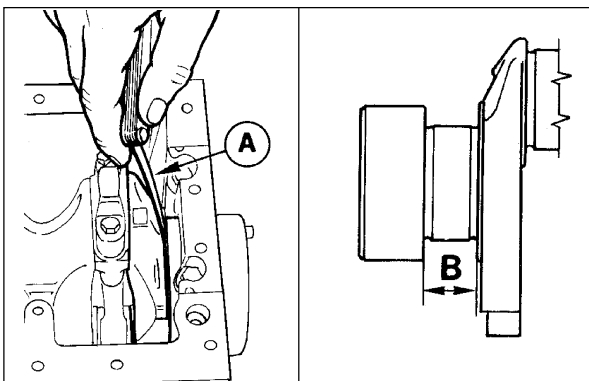


**THRUST BEARINGS**

Thrust bearings on the B /F M 1008/F engine are supported by the rear main bearing cap and the crankcase. The thrust bearing assembly consists of four(4) separate thrust bearing segments. Two(2) of the segments are supported by the crankcase and the remaining two(2) are supported by the rear main bearing cap. All four(4) of the thrust bearing segments act upon the crankshaft thrust surfaces.

**INSPECTION:** Thoroughly clean the rear main bearing cap thrust bearing socket and the crankcase side thrust bearing socket. Inspect the thrust bearings for indications of high wear, scuffing, scratches and general condition. Inspect the crankshaft thrust surfaces for galling, scratches, pitting, etc..

**INSTALLATION:** Liberally coat the crankcase side thrust bearings with clean engine oil and install by "rolling" the segments between the crankcase thrust bearing socket and the crankshaft thrust surface. The bearings must be installed so that the bearing surface, as indicated by oil grooves (A) is oriented toward the crankshaft thrust surface. The main bearing cap thrust bearings are simply placed on the thrust bearing reliefs and indexed with location "ears" as shown in the diagram. The thrust bearings must be oriented so that the oil grooves (A) face the crankshaft thrust surfaces. Liberally coat the thrust bearings with clean engine oil, then install the rear main bearing following the instructions presented on page 43. **NOTE:** The upper thrust bearings (crankcase side) do not include the locator "ears" for purposes of locational index.



**CRANKSHAFT END PLAY**

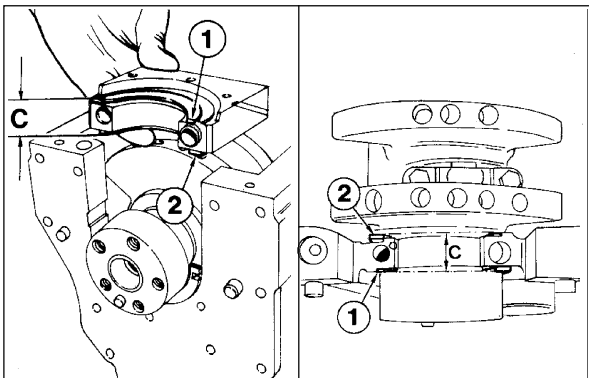
After installing all main bearings and the thrust bearings, the crankshaft end play may be measured.

1. Push the crankshaft toward the crankshaft pulley end of the engine.
2. Using a feeler gage, measure the clearance between the thrust bearing wear surface and the crankshaft thrust surface.

**SPECIFICATIONS:**

- A = 0.130 - 0.313mm (Wear Limit = 0.5 mm)
- B = 23.05 - 23.10mm (Wear Limit = 23.50 mm)

If the crankshaft end play exceeds the specifications above, fit the engine with oversize thrust bearing segments and/or grind the crankshaft thrust surfaces. The following provides guidelines for the application of oversize bearings and for grinding the crankshaft thrust surfaces.



**THRUST SURFACE SPECIFICATIONS- CRANKSHAFT END PLAY CORRECTIONS**

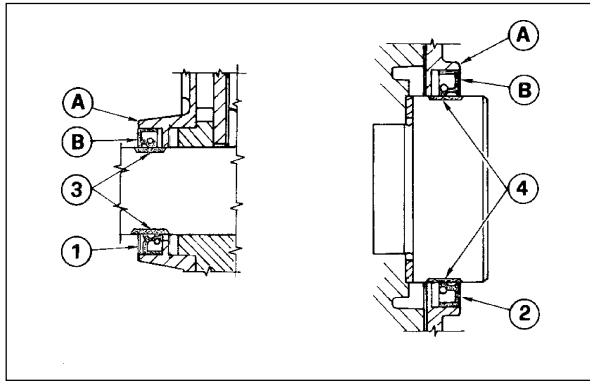
Depending on the condition/ width of the crankshaft thrust surfaces (B) (above figure) and the width (C) of of the main bearing cap thrust bearing socket/ thrust bearing width combination, crankshaft end play can be corrected in several ways. Std, 0.1mm oversized and 0.2mm oversized thrust bearings can be fitted on side (1), side (2) or both. The following table provides details of the combinations of thrust bearing width, thrust surface width(main bearing cap / crankcase) and crankshaft thrust surface width.

**TABLE KEY:**

- A = Crankshaft End Play (resultant)
- B = Width of crankshaft thrust surface

THRUST BEARING COMBINATION	C (mm)	B (mm)	A (mm)
Standard	22.787-22.920	23.050-23.100	0.130-0.313
0.1 mm (both sides)	22.987-23.120	23.250-23.300	
0.1 mm (one sides)	23.087-23.220	23.350-23.400	
0.2 mm (one sides)			
0.2 mm (both sides)	23.187-23.320	23.450-23.500	

## II DISASSEMBLY/REASSEMBLY



### CRANKSHAFT SEALS - FRONT and REAR

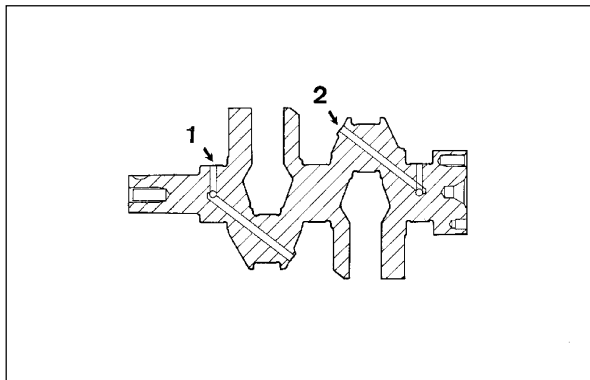
The front seal for the B/FM 1008/F diesel engine is housed within the oil pump assembly. The rear oil seal is supported by the rear oil seal support. Deutz recommends that oil seals be replaced if removed from the supporting bores. The oil seals should also be replaced if upon inspection, signs of hardening, stress cracks, dampness on the exterior or dry rot is noted.

#### SEAL DETAILS:

- A** Seal Support
- B** Seal
- 1** Installation depth plane (initial), front
- 2** Installation depth plane (initial), rear
- 3** Crankshaft wear surface- front
- 4** Crankshaft wear surface- rear

**INSTALLATION:** Remove the oil pump or seal support depending upon front or rear seal replacement. Gently, without deforming the seal supporting bore, pry the seal from the bore. Carefully clean, in a non abrasive manner, the wear surface of the crankshaft. Soak the oil seal in clean engine oil for approximately 1/2 hour. Coat the crankshaft with clean engine oil. Using a suitable mandrel, evenly and squarely push the seal into the bore until the outer seal plane coincides with planes (1) or (2). Reinstall the oil pump or seal support using new gaskets as required. Torque the rear seal support retaining bolts to 12 N.m. Torque the oil pump retaining bolts to 25 N.m.

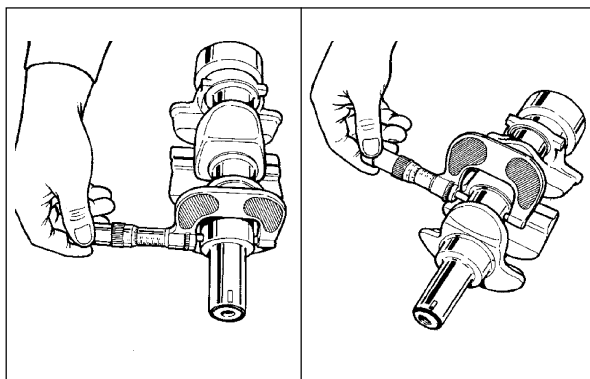
**NOTE:** If the wear surface of the crankshaft showed signs of grooving at the initial installation depth reference (1) or (2), push the seal into the bore an additional 2 mm using a suitable mandrel.



### CRANKSHAFT LUBRICATION DRILLINGS- TYPICAL

The lubrication drillings for the F2M 1008 / F2M 1008 F are shown in the diagram. The lubrication drillings for the F3/4M 1008 and BF4M 1008 are very similar to the F2M 1008 / F2M 1008 F.

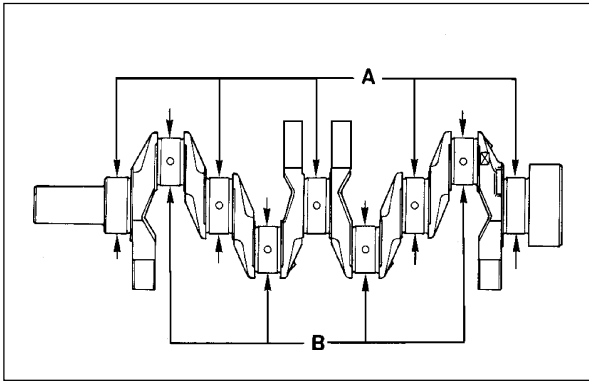
**CLEANING:** Remove plugs at (2) by suitable means. Soak the crankshaft in solvent to loosen any deposits within the drillings. Clean the drillings (1) and (2) by blowing with compressed air, using stem brushes, etc.. Cap the drillings at (2) with new plugs.



### CRANKSHAFT JOURNAL INSPECTION / MEASUREMENT

**INSPECTION:** Inspect each journal (main and rod) for scratches, scoring, grooves and general wear. Replace the crankshaft or machine as required. See page 456 for dimensional specifications.

**MEASUREMENT:** With reference to the diagram, measure each journal with a calibrated micrometer. Each journal should be measured at 45° intervals around the circumference of each journal beginning at the position shown on the left most diagram. At each interval, measure two separate parts of the given diameter- once near the center of the journal and once near the fillet of the journal.



**CRANKSHAFT JOURNAL SPECIFICATIONS**

**For F2/3/4M 1008, BF 4M 1008**

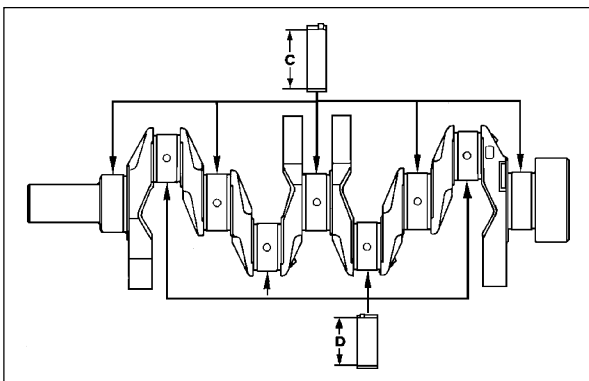
**A** = Main Journals = 47.984 - 48.000 mm (WEAR Limit = 47.900 mm)

**For F2/3/4M 1008 F**

**A** = Main Journals = 50,981 - 51.000 mm (WEAR Limit = 50.900 mm)

**For B/FM 1008/F**

**B** = Rod Journals = 39.984 - 40.000 mm (WEAR Limit = 39.900 mm)



**UNDERSIZED BEARINGS- ROD and MAIN**

Undersized connecting rod and main bearings are available in sizes 0.25 and 0.50mm. Use of the undersized bearings will require the nominal size of the rod/ main journals to be reduced by 0.25 or 0.50 mm respectively.

**MAIN and CONNECTING ROD BEARINGS**

The dimensions shown reflect clean, installed and torqued bearing inserts.

**For F2/3/4M 1008, BF 4M 1008**

**C** = Main Bearings = 47.984 - 48.016 mm (WEAR Limit = 48.055 mm)

**C-A** = 0.022 - 0.074 mm (WEAR Limit = 0.200 mm)

**For F2/3/4M 1008 F**

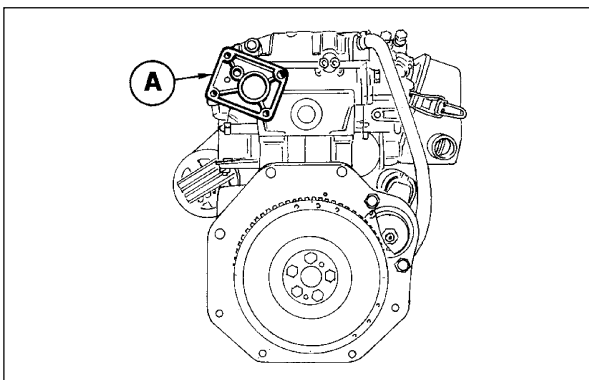
**C** = Main Bearings = 51,023 - 51,059 mm (WEAR Limit = 51,098 mm)

**C-A** = 0.023 - 0.078 mm (WEAR Limit = 0.200 mm)

**For B/FM 1008/F**

**D** = Rod Bearings = 40.021 - 40.050 mm (WEAR Limit = 40.100 mm)

**D-B** = 0.021 - 0.066 mm (WEAR Limit = 0.130 mm)



**HYDRAULIC PUMP PTO- (No. 3PTO)**

All B/FM 1008/F diesel engines may be fitted with a hydraulic pump drive (A) as shown. The hydraulic drive takes power from the back of the engine camshaft.

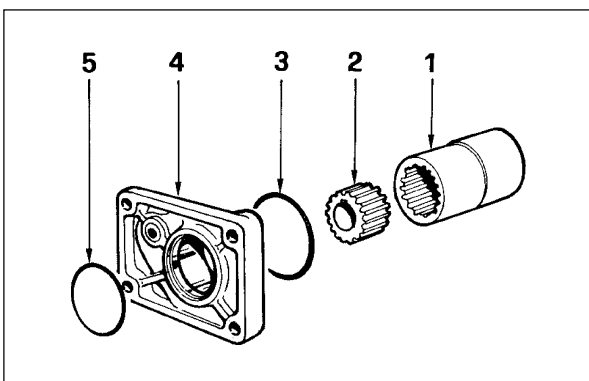
Hydraulic pump adaptations for DIN size 2PD, DIN size 1P and BOSCH pumps are available.

**DRIVE SPECIFICATIONS:**

Speed Ratio: 1 : 2, or 1/2 engine speed.

Maximum Torque = 37 Nm, irrespective of engine speed.

NOTE: 37 Nm @ 3600 r/min corresponds to 7 kW.

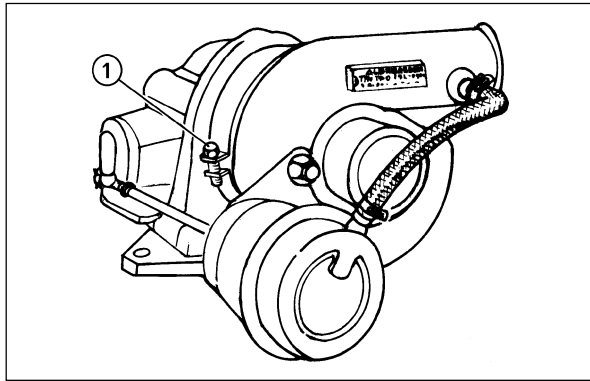


**HYDRAULIC DRIVE COMPONENTS- No. 3PTO**

- 1 Splined Drive- (Bolts to Camshaft)
- 2 Pump Drive Gear (Attaches to Pump Input Shaft)
- 3 O-Ring
- 4 Pump Support (Bolts to Cylinder Head)
- 5 O-Ring

The splined drive (1) also includes the eccentric for the fuel lift pump. The splined drive must be bolted to the camshaft end and torqued to 80 Nm. The pump drive gear (2) must be torqued to the hydraulic pump input shaft. Check with the pump manufacturer for torque specifications at the input shaft.

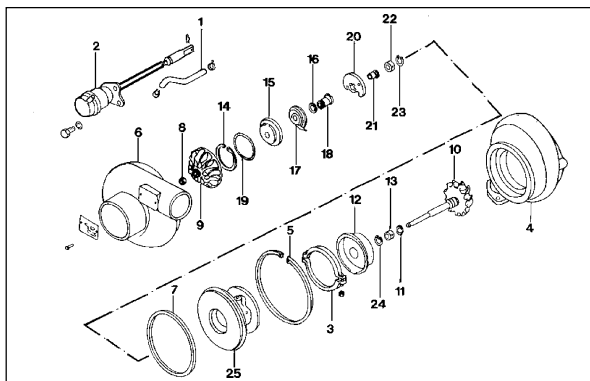
### III TURBOCHARGER



#### TURBOCHARGER IDENTIFICATION

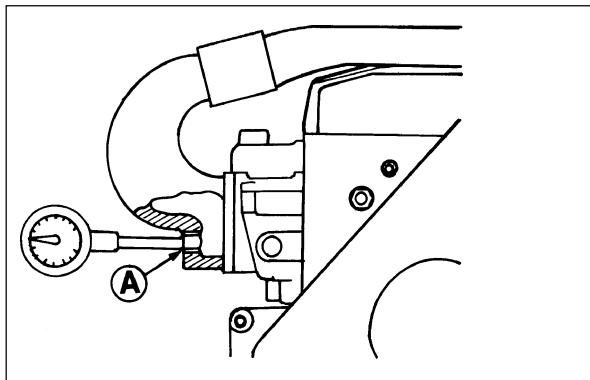
Only the BF 4M 1008 is supplied with a turbocharger. The BF 4M 1008 is available in two(2) versions with respect to no-load speed. A version operating up to 3000 rpm and a version operating up to 3600 rpm is offered. The two(2) engine versions are fitted with different turbocharger models with respect to the engine speed. The turbocharger can be identified by the manufacturing ID numbers on the data plate of the turbocharger.

TD 025 03C 2.8 - 3600r/min  
 TD 025 03C 2.0 - 3000r/min



#### TURBOCHARGER COMPONENTS

- |                       |                   |                    |
|-----------------------|-------------------|--------------------|
| 1 Waste gate tube     | 10 Turbine wheel  | 19 O-ring          |
| 2 Waste gate actuator | 11 Ring-oil       | 20 Thrust bearing  |
| 3 Band clamp          | 12 Fire ring      | 21 Thrust ring     |
| 4 Turbine housing     | 13 Bearing        | 22 Bearing         |
| 5 Ring                | 14 Band clamp     | 23 Ring            |
| 6 Compressor scroll   | 15 Shim           | 24 Ring            |
| 7 Shim                | 16 Ring-oil       | 25 Bearing support |
| 8 Nut                 | 17 Oil shield     |                    |
| 9 Lock nut            | 18 Thrust bearing |                    |

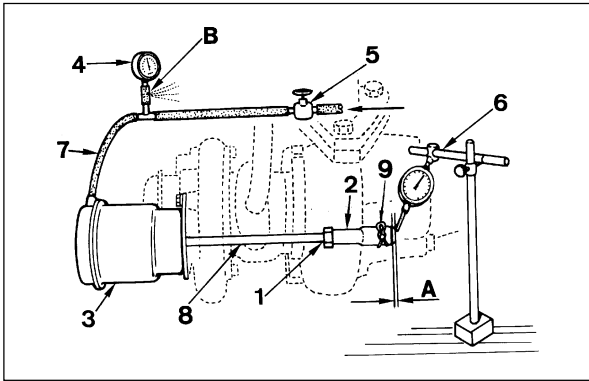


#### TURBOCHARGER PRESSURE TESTING

Install a 0-2bar pressure gauge at position (A) after removing the existing plug.

Start the engine and operate at low idle for five(5) minutes to allow warm-up. Increase the engine speed to 3000 r/min or 3600 r/min (depending on engine specification while applying full N b load to the engine). See page 10 for the power output curve.

The gauge pressure, at full speed, full load, should be 0.87-0.91 bar. If the pressure setting does not reach specification, adjust the turbocharger waste gate as is defined on page 48.



## TURBOCHARGER WASTE GATE ADJUSTMENT- BENCH METHOD

The adjustment of the turbocharger wastegate is a critical adjustment that should be carried out with the utmost care.

Prepare the following group of tools/ materials.

- 1 Calibrated, liquid filled pressure gauge with a mid-range scale of 1.2 bar.
- 2 Dial indicator with suitable magnetic base.
- 3 Regulated compressed air supply.
- 4 Suitable "TEE" fitting for gauge.

### PROCEDURE:

- 1 Disconnect wastegate tube (7) from the turbocharger compressor side.
- 2 Drill a 1.5 mm hole (B) in the gauge side of the "TEE" fitting. The relief hole will be required to allow stable pressure readings.
- 3 Sub-assemble the gauge onto the "TEE" fitting.
- 4 Using a suitable barb fitting, connect the gauge sub-assembly to the tube (7).
- 5 Fit the remaining open port of the "TEE" with a suitable regulated compressed air supply.
- 6 Set-up a magnetic based dial indicator so as to accurately measure the horizontal travel of actuation rod (8). The dial indicator should act upon rod end (2). Zero the dial indicator.
- 7 Slowly charge the tube (7) with air by gradually increasing air pressure from the regulated air supply (5). Continue to allow air flow until the dial indicator shows a total and accurate rod (8) movement of 1.00 mm.
- 8 Note the gauge (4) pressure when the rod movement is 1.00 mm (A).
- 9 The gauge pressure should be 1.11-1.19 bar.
- 10 If the proper gauge reading is not observed, remove pin (9), loosen nut (1), and adjust the rod end (2) position until the proper pressure reading is observed. Repeat the above procedure as required.

NOTE: When reassembling the rod end (2) onto the waste gate, take care not to position rod end (2) so as to impede free motion. DO NOT LOAD THE WASTEGATE LEVER.



## IV LUBRICATION SYSTEM

**!** The engine can be damaged if allowed to operate with insufficient oil. It is also dangerous to add too much oil because its combustion may lead to a sharp increase in the rotation speed.

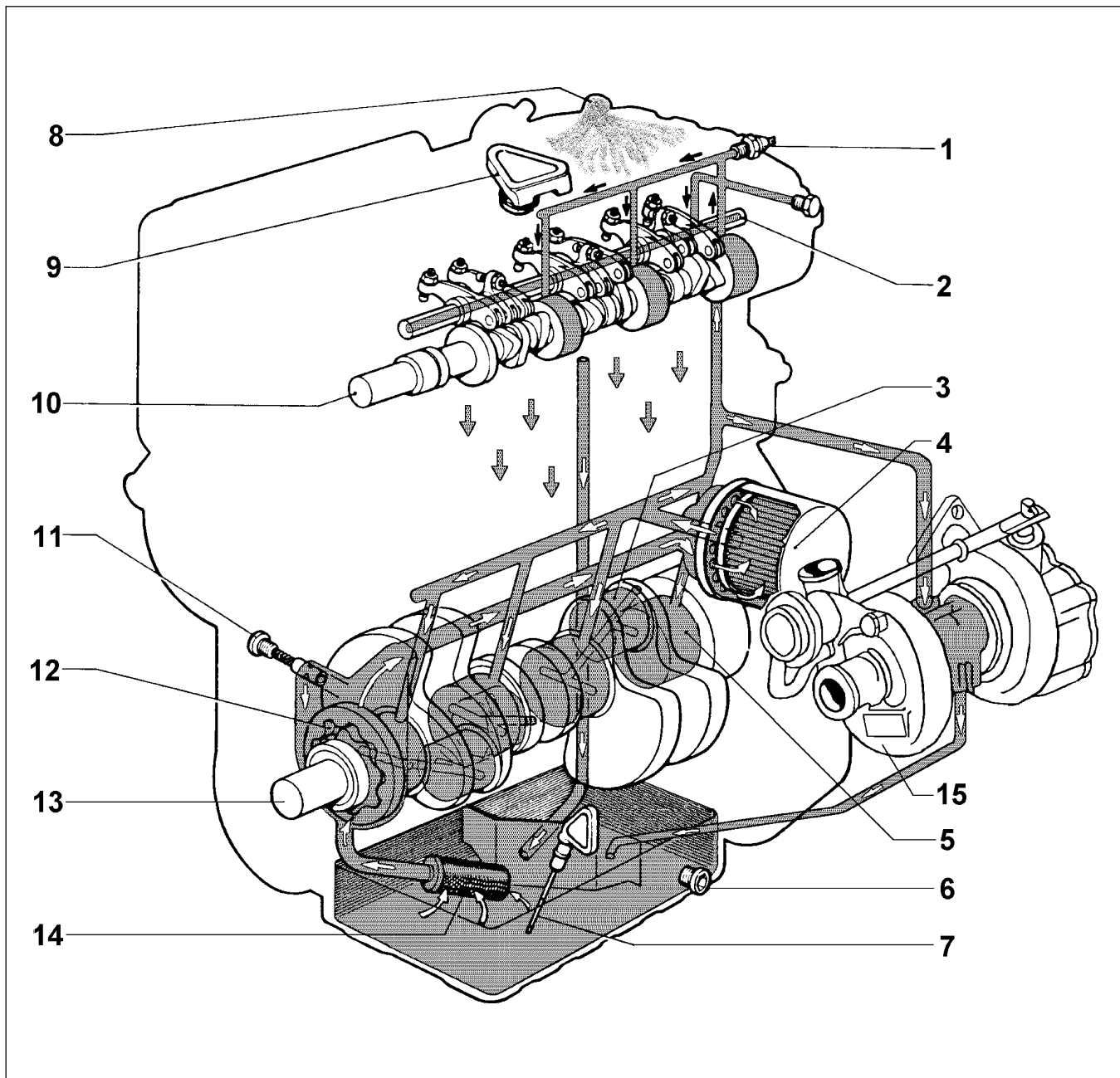
Use suitable oil in order to protect the engine.

Nothing more than lubrication oil can influence the performances and life of an engine.

Use of an inferior quality oil or failure to regularly change the oil will increase the risk of piston seizure, will cause the piston rings to jam and will lead to rapid wear on the cylinder liner, the bearings and all other moving parts. Engine life will also be notably reduced.

The oil viscosity must suit the ambient temperature in which the engine operates.

**!** Old engine oil can cause skin cancer if repeatedly left in contact with the skin and for long periods of time. If contact with the oil is unavoidable, you are advised to wash your hands with soap and water as soon as possible. Dispose of old oil in the correct way as it is highly polluting.



1 Oil Pressure Switch

2 Rocker Arm Shaft

3 Connecting Rod Journal

4 Oil Filter

5 Main Bearing Journal

6 Oil Drain Plug

7 Oil Dipstick

8 Crankcase Breather

9 Oil Fill Cap

10 Camshaft

11 Oil Pressure Relief Valve

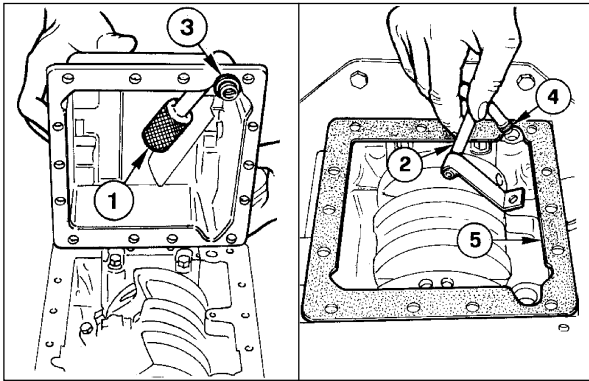
12 Oil Pump

13 Crankshaft

14 Oil Pick-up Screen

15 Turbocharger

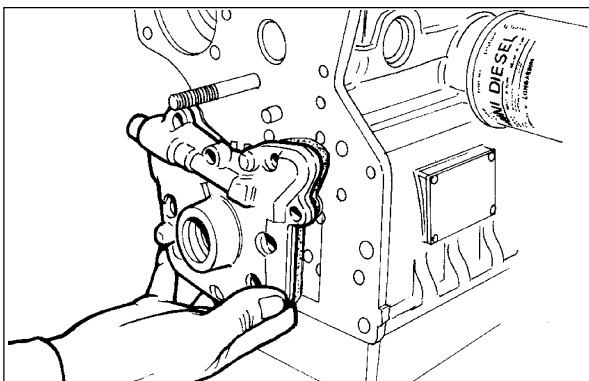
NOTE: Only the BF 4M 1008 is equipped with a turbocharger (item 15) and turbocharger lubrication circuit.



## OIL PICK-UP SCREEN AND OIL DRAIN BACK TUBE

After oil pan removal, remove the oil drain back tube (2) from the engine crankcase. Clean both the oil pan and drain back tube in solvent. Dry the oil pan and oil drain back tube with compressed air. Inspection: Inspect the oil pick-up tube for dents, holes, corrosion and cracks. The oil pick-up screen must be free of obstructions. Inspect the oil pick-up tube O-ring seat for any damage or dents. Replace as required. Inspect the oil drain back tube for crimps, dents and cracks. Inspect the oil drain back tube O-ring seat for any damage. Replace as required.

Installation: Always replace O-rings (3) and (4) and oil pan gasket (5). NOTE: The oil pan gasket may be replaced by Dow Corning 7091. See pag 40



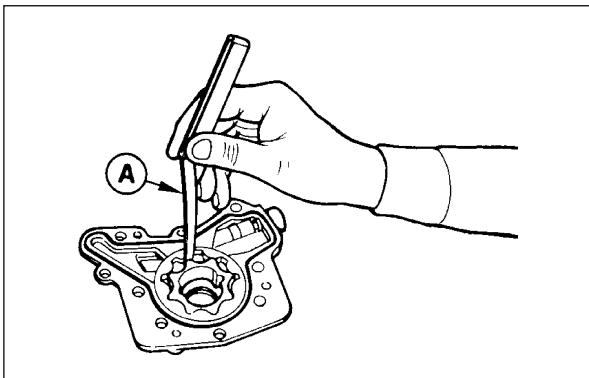
## OIL PUMP SPECIFICATION:

Oil pump delivery (average figures) at 1000 r/min and oil temperature of 120°C

ENGINE MODEL	DELIVERY (l/min)	Pressure (Bar)
F2/3M 1008/F	4.0 - 4.3	3.0 - 3.5
B/F 4M 1008/F	6.0 - 6.5	3.0 - 4.5

Oil pump delivery (average figures) at 3600 r/min and oil temperature of 120°C

ENGINE MODEL	DELIVERY (l/min)	Pressure (Bar)
F2/3M 1008/F	19.3	4.0 - 4.5
B/F 4M 1008/F	28.5	4.0 - 4.5



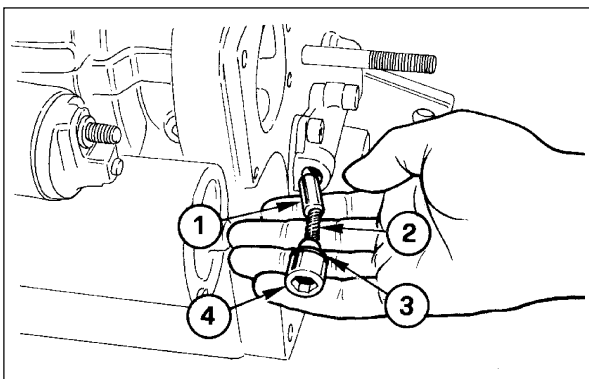
## OIL PUMP ROTOR INSPECTION

NOTE: See page 28, «OIL PUMP ASSEMBLY» for additional comments.

The oil pump rotor set should be replaced as part of the oil pump assembly. The condition of the oil pump can be ascertained by carefully disassembling the oil pump noting the thrust surface position of the rotor sets. The rotor set should be refitted in the original position. Remove the oil pressure relief valve (see below).

Carefully clean the oil pump rotor and oil pump body in clean solvent. Dry the components with compressed air. DO NOT DRY OR WIPE THE OIL PUMP COMPONENTS WITH A RAG. Coat the rotor the assembly and oil pump body with clean engine oil. Reassembly the rotor assembly as explained above. Using a tapered feeler gauge, gently determine the rotor tip clearance. DO NOT FORCE THE MEASUREMENT.

MAXIMUM CLEARANCE = 0.174 mm



## OIL PRESSURE RELIEF VALVE

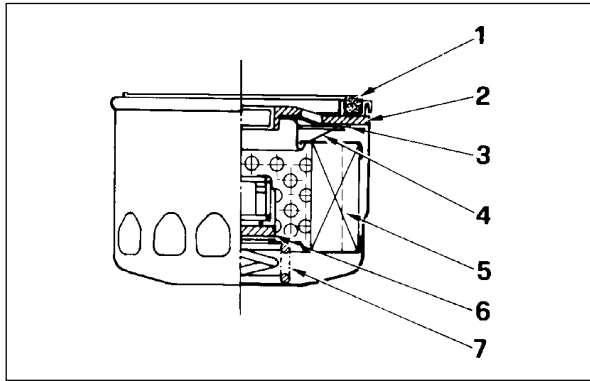
Components:

- 1 Plunger Valve
- 2 Spring
- 3 Gasket
- 4 Plug

Inspect the plunger (1) for scoring or galling. Replace the oil pump assembly if any damage is noted. Measure the length of the pressure relief spring. The spring length tolerance is 27.50 - 27.75 mm.

By-pass pressure setting (opening threshold) = 4.5 - 5.5 Bar

## IV LUBRICATION SYSTEM



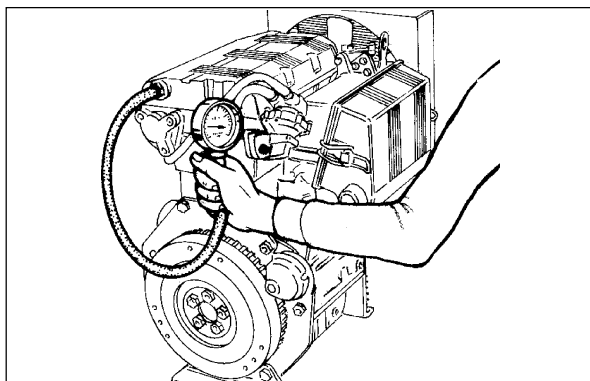
### OIL FILTER

Components:

<b>1</b> GASKET	<b>5</b> FILTRATION MEDIA
<b>2</b> HEAD PLATE	<b>6</b> BYPASS VALVE
<b>3</b> GASKET	<b>7</b> SPRING - BYPASS
<b>4</b> SPRING	

<b>Oil filter Specifications:</b>	Max. operating pressure: 7 Bar
Max. rupture pressure:	20 Bar
Filtration level:	20µm
By-pass valve setting:	1,5 - 1,7 Bar
Total filter area (F 2/3M 1008/F):	730 cm <sup>2</sup>
Total filter area (B /F 4M 1008/F):	1450 cm <sup>2</sup>

**NOTE:** Always use genuine Deutz replacement oil filters. Apply a coating of clean engine oil to the oil filter gasket before installation. Hand tighten the oil filter onto the engine.



### OIL PRESSURE TESTING

Remove the standard oil pressure switch from the engine valve cover. Replace the oil pressure switch with a calibrated oil pressure gauge arrangement as shown.

The following describes the proper procedure to measure engine oil pressure.

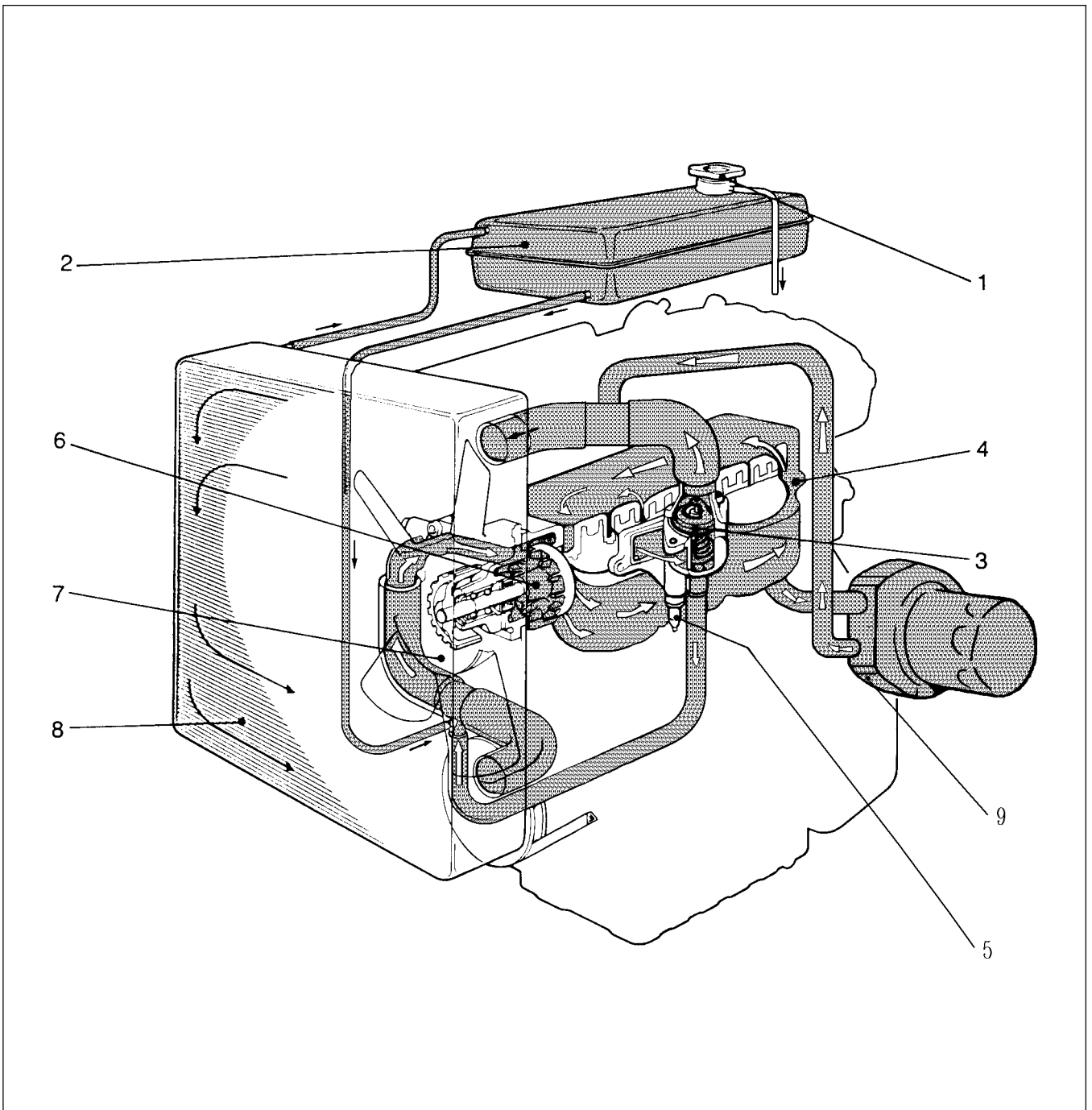
- 1** Check and top off all engine fluid levels.
- 2** Start the engine and allow a five (5) minute warm-up period at low idle.
- 3** Increase the engine speed to high idle.
- 4** Allow the engine to reach operating temperature.
- 5** Record the oil pressure at high idle and at low idle only after the engine is at operating temperature.

**NOTE:** The minimum allowable oil pressure is 1.1 Bar at an oil temperature of 120° C and operating at 900 r/min.



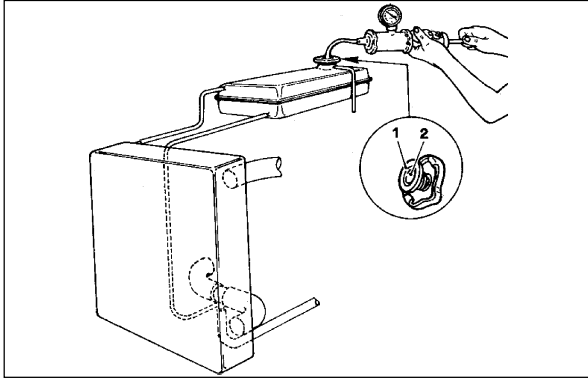
The cooling circuit contains fluid under pressure. Do not carry out any inspections until the engine has cooled and even then, open the plug of the radiator or expansion chamber with caution. Keep well away from a hot engine if an electric fan is installed since this could start up even when the engine is at a standstill. Coolant fluid is polluting. It must therefore be disposed of correctly. Do not litter.

**B/FM 1008/F COOLING SYSTEM SCHEMATIC**



- |                                 |                             |
|---------------------------------|-----------------------------|
| 1 Pressure cap                  | 6 Coolant Pump              |
| 2 Expansion Tank                | 7 Cooling Fan               |
| 3 Thermostat                    | 8 Radiator (Heat Exchanger) |
| 4 Cylinder Block Coolant Jacket | 9 Oil Cooler                |
| 5 High Temperature Switch       |                             |

## V COOLING SYSTEM



### COOLING SYSTEM PRESSURE CHECK / RADIATOR CAP INSPECTION

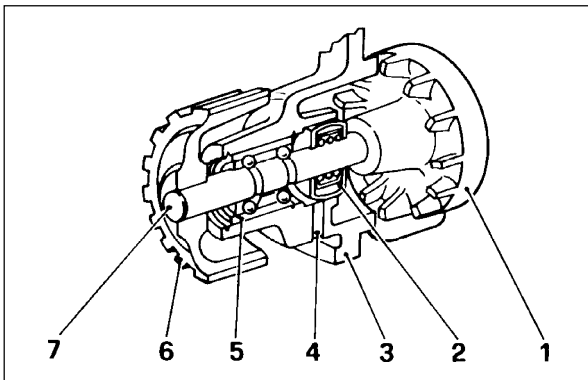
Pressure checking the cooling system is the only reliable method of determining the source of coolant leaks and the condition of the radiator, hoses and coolant pump seals. The radiator cap controls operating cooling system pressure and thus must be inspected regularly. The illustration shown depicts a cross flow type radiator with a remote expansion tank. The procedures / inspection criterion below is applicable to both cross flow and top tank radiators.

**Radiator Cap:** Inspect the vacuum valve (1) and the relief valve (2). Fit the radiator cap onto a suitable radiator cap testing fixture. Pressurize to 0.7 bar to insure the radiator cap holds rated pressure. Replace the cap if 0.7 bar cannot be reached before pressure relief. Replace the radiator cap if any degradation is seen on the vacuum valve seal or the pressure relief seal or if the cap is bent, deformed or damaged.

**Radiator Seat:** The sealing ability of the radiator cap is a function of the radiator or expansion tank seat. Inspect the radiator cap seat and replace/ repair as needed.

**Cooling System Pressure Test:** Fill the cooling system completely with a 50/50% solution- water/ ethylene glycol. Fit a cooling system pressurizing device to the cooling system fill port. Pressurize the cooling system to 0.7 bar. The pressure should hold steady. If the pressure does not hold steady at 0.7 bar, a malfunction in the pressure device exists or a leak in the cooling system exists. Inspect the cooling system for signs of liquid at all joints, hoses and at the coolant pump. Tighten, repair or replace as required.

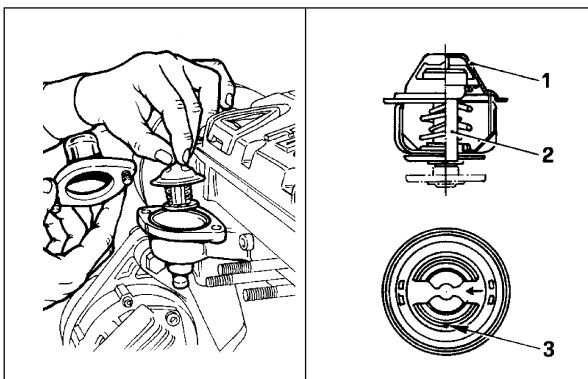
**NOTE:** Deutz recommends a radiator cap pressure relief setting of 0.7 bar. Do not operate the engine with a pressure cap of higher or lower setting installed.



### COOLANT PUMP DETAILS

The design of all B / F M 1008 / F coolant pumps is similar. However, the impeller (1) size and seal assembly (2) are larger for the F 4M 1008, BF 4M 1008 and F 4M 1008 F, allowing for greater coolant flow.

Components:  
 1 Impeller  
 2 Seal assembly  
 3 Pump body  
 4 Weep hole  
 5 Bearing  
 6 Pulley  
 7 Shaft



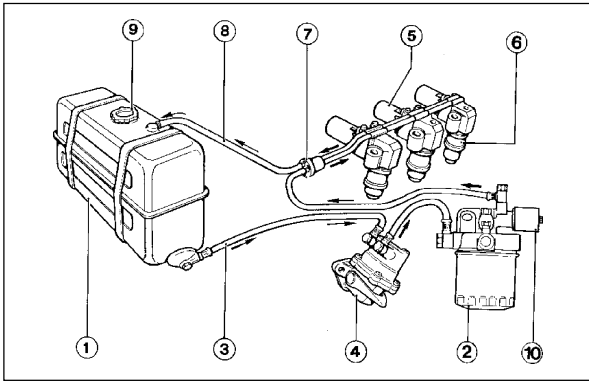
### THERMOSTAT

**Removal:** Drain the engine coolant in a suitable container. Remove the two (2) capcrews retaining the coolant outlet to the thermostat housing. Remove the thermostat from the thermostat housing.

**Inspection:** Inspect the thermostat for deposits, corrosion and deformation. Clean or replace as required.

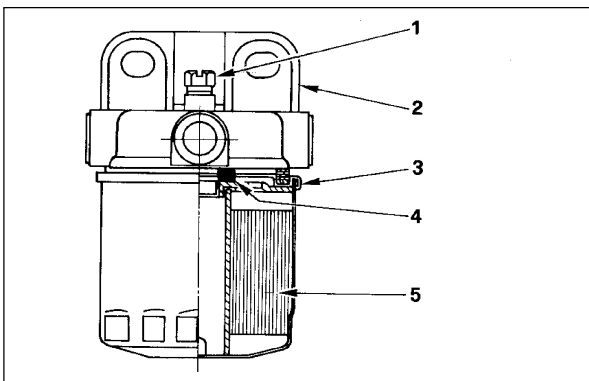
Components:  
 1 Thermostat body- stainless steel, brass or thermoplastic.  
 2 Expansion bulb  
 3 Bleed vent

**NOTE:** Metallic thermostats require a O -ring gasket- replace as required.



## FUEL SYSTEM SCHEMATIC

- 1 Fuel Tank
- 2 Fuel Filter
- 3 Supply Hose
- 4 Fuel Pump
- 5 Injector
- 6 Injection Pump
- 7 Fuel Rail Grommet
- 8 Return Hose
- 9 Fuel Tank Fill Cap (Vented)
- 10 Fuel Shut-off Valve (Electric)

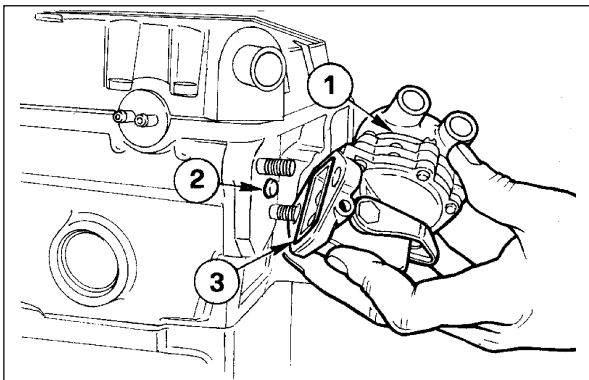


## FUEL FILTER ASSEMBLY

- 1 Air Bleed Plug
- 2 Filter Head (Base)
- 3 Spin-on Fuel Filter
- 4 Gasket
- 5 Filter Media

Fuel Filter Specifications:

Media Type	PF 905
Filtration Area	2400 cm <sup>2</sup>
Filtration Level	2-3µm
Max. Pressure	4 bar



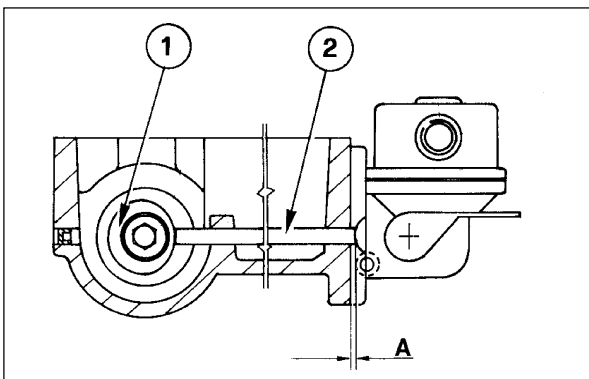
## FUEL TRANSFER PUMP

Components:

- 1 Fuel Transfer Pump Assembly
- 2 Push Rod
- 3 Sealing O-Ring

The fuel transfer pump is a diaphragm type pump actuated by the camshaft driven push rod. Manual fuel system bleeding is facilitated by operating the pumping bail lever.

Performance: At an engine speed of 3000 r/min, the fuel transfer pump delivers 60 l/h at a self-regulated pressure of 4.5 / 5.5 m - H<sub>2</sub>O.

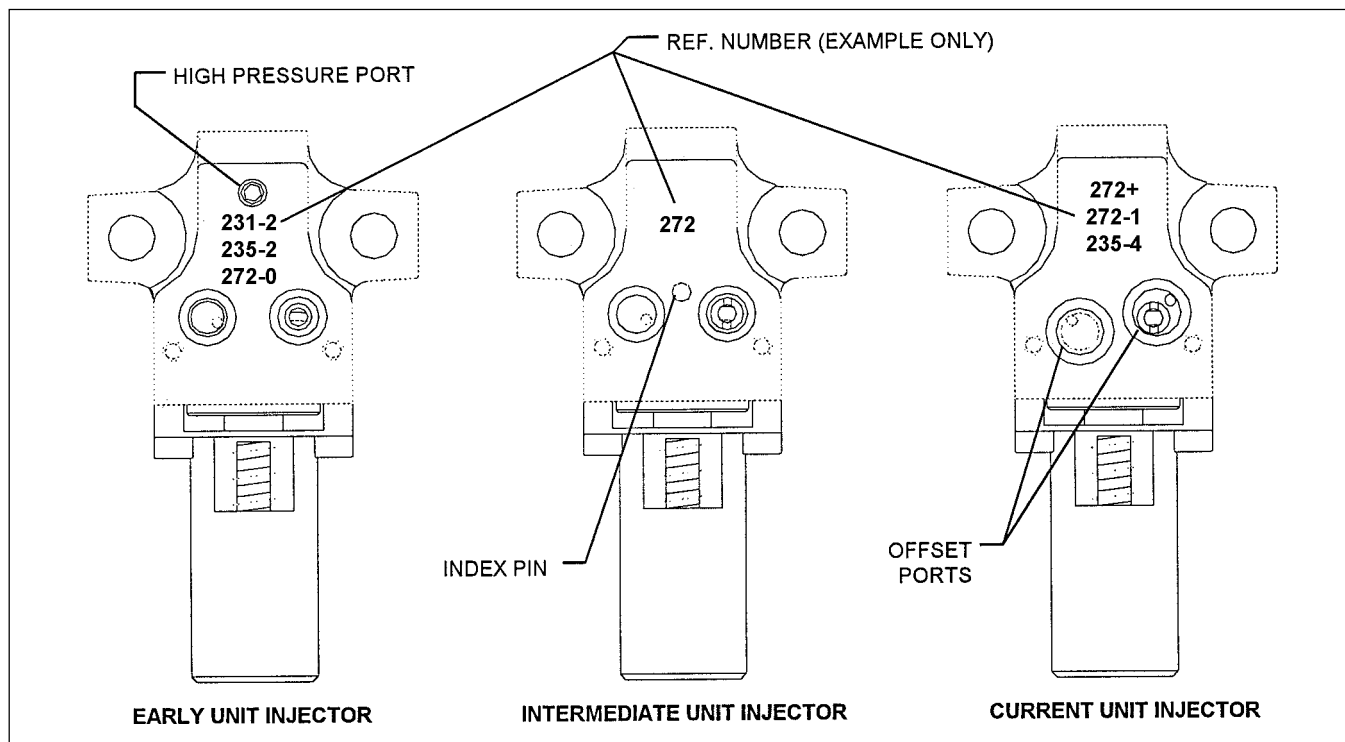


## FUEL TRANSFER PUMP PUSH ROD PROTRUSION

With the engine rotated to position the camshaft eccentric (1) as shown, resulting in the lowest possible push rod (2) position with respect to the cylinder head plain, dimension 'A' should be 0.96-1.48 mm.

If the proper clearance cannot be attained, measure the push rod (2) length. The push rod (2) should be 152.45-152.65 mm in length. Replace the push rod as required. No other adjustments can be made to change fuel pump push rod protrusion.

## VI FUEL SYSTEM



DEUTZ CONTINUALLY DEVELOPS THE B/FM 1008/F DIESEL LINE. CONSTANT RESEARCH AND DEVELOPMENT IS CARRIED OUT TO IMPROVE OVERALL PERFORMANCE OF B/FM 1008/F PRODUCTS. AS SUCH, THE DESIGN OF THE B/FM 1008/F UNIT INJECTOR HAS CHANGED DURING THE DEVELOPMENT PROCESS. THE FIGURE ABOVE PROVIDES A REFERENCE FOR THE THREE (3) DIFFERENT VERSIONS OF THE B/FM 1008/F UNIT INJECTOR TO DATE.

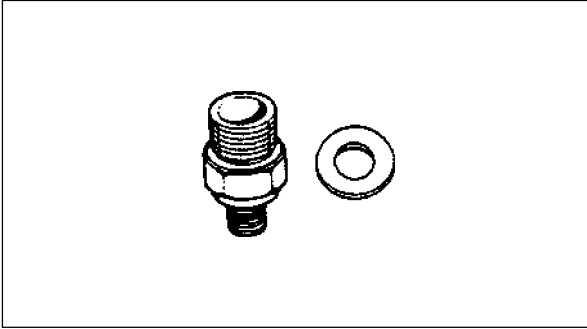
**EARLY UNIT INJECTORS** ARE CHARACTERIZED BY THE HIGH PRESSURE PORT AS SHOWN.

**INTERMEDIATE UNIT INJECTORS** ARE CHARACTERIZED BY THE LACK OF A DRILLED HIGH PRESSURE PORT (HIGH PRESSURE PLUG MAY BE PRESENT, BUT IS NOT FUNCTIONAL) AND THE ADDITIONAL INDEX PIN AS SHOWN.

**CURRENT UNIT INJECTORS** ARE CHARACTERIZED BY OFFSET FUEL PORTS, NO HIGH PRESSURE PORT AND RELATIVELY LARGER PORT SIZES.

THE FOLLOWING CHART MAY BE USED AS A GENERAL REFERENCE FOR UNIT INJECTOR IDENTIFICATION, SPECIAL TOOL REQUIREMENTS AND CRITICAL ADJUSTMENT SPECIFICATIONS. WHEN SERVICING B/FM 1008/F UNIT INJECTORS, ALWAYS REFERENCE THE ENGINE MODEL, ENGINE SERIAL NUMBER, APPLICATION AND UNIT INJECTOR REFERENCE NUMBER.

REFERENCE NUMBER	PART NUMBER	APPLICATION	STATIC TIMING (°BTDc)	STATIC TIMING METHOD	SPECIAL TOOLS FOR TDC, TIMING AND PRESSURE TESTING
231-2	6590.262	F 2/3/4M 1008	11-13	HIGH PRESSURE	TIMING - 7107.028 + 7107.024 PRESSURE - 7107.028 TDC - 7107.048
235-2	6590.235	BF 4M 1008	4-6	HIGH PRESSURE	TIMING - 7107.028 + 7107.024 PRESSURE - 7107.028 TDC - 7107.048
272	6590.272	F 2/3/4M 1008	8-10	LOW PRESSURE	TIMING /PRESSURE -7107.056 7107.028 / TDC -7107.048
272-1	6590.285	F 2/3/4M 1008	8-10 > 2999 rpm 12-14 < 3000 rpm	LOW PRESSURE	TIMING /PRESSURE -7107.074 TDC - 7107.048
235-4 235-3	6590.290 6590.287	BF 4M 1008	6-8	LOW PRESSURE	TIMING /PRESSURE -7107.074 TDC - 7107.048
235-4	6590.290	F 2/3/4M 1008 F	8-10	LOW PRESSURE	TIMING /PRESSURE -7107.074 TDC - 7107.048

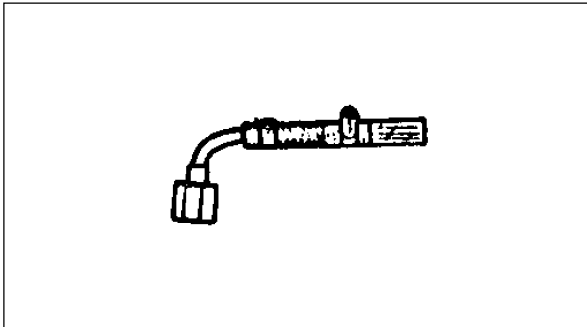


**FUEL SYSTEM SPECIAL TOOLS**

**UNION- 7107.028**

FUNCTION: Allows high pressure testing of unit injectors. Use for both static timing and pressure testing of early unit injectors. The 7107.028 union screws directly into the unit injector after removal of the high pressure plug.

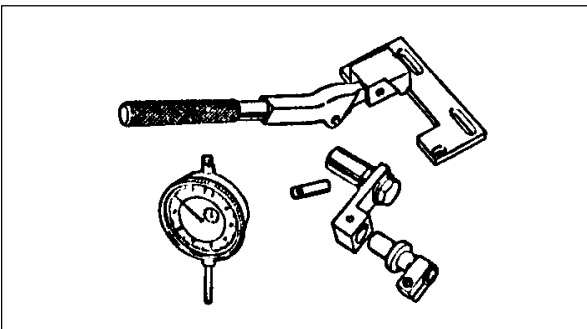
Application: 6590.262, 6590.283, 6590.235 unit injectors.



**TIMING TOOL- 7107.024**

FUNCTION: Allows high pressure static timing of early unit injectors. Use with the 7107.028 union.

Application: 6590.262, 6590.283, 6590.235 unit injectors.

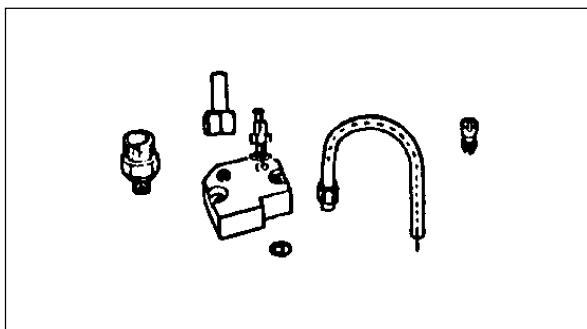


**LOW PRESSURE TEST SET**

Includes adapter block, union, plug, drip tube, eccentric washers and fill tube for low pressure static timing and allows pressure testing for intermediate and current unit injectors.

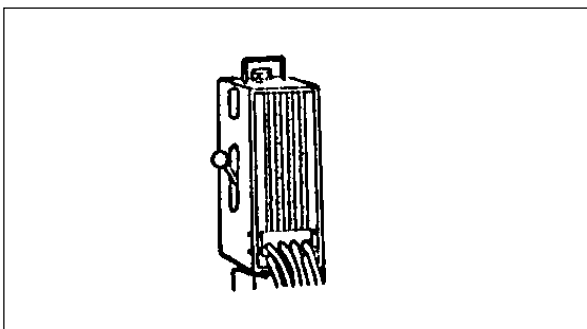
PART No. 7107.056- Only for 6590.272 unit injectors

PART No. 7107.074- Use with 6590.285, 6590.286, 6590.287 and 6590.290 Unit Injectors.



**TDC DETERMINATION / TIMING FIXTURE- 7107.048**

FUNCTION: Determination of exact TDC for purposes of static injection timing. After exact TDC is found, the static injection point may be determined as a function of piston position as measured by the TDC fixture. Refer to the following pages for more detail.



**EQUALIZATION TOOL**

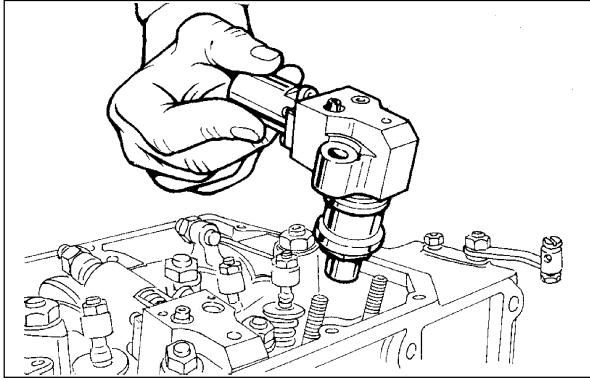
FUNCTION: Allows each individual cylinder fuel consumption to be measured. Thus, the individual delivery rates can be adjusted to insure equivalent fuel delivery to all cylinders. The equalization tool set includes fuel rail blocks to allow attachment to the unit injectors. Three(3) different equalization tools have been issued reflective of improvements in the tool and changes to the unit injectors. A side from the fuel rail blocks included with the equalization tool, the equalization tool will work on all unit injector types. Fuel rail blocks as detailed below can be ordered to allow complete interchangeability with all unit injector styles.

Equalization Part No.'s: 7107.020 (early), 7107.050 (intermediate) and 7107.090 (current).

Fuel Block Part No.'s: 7107.081 (early / intermediate) with in-line fuel ports. 7107.089 (current) with offset fuel ports.

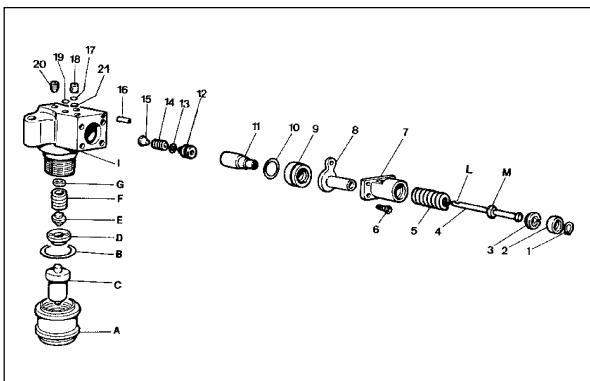


## VI FUEL SYSTEM



### UNIT INJECTOR:

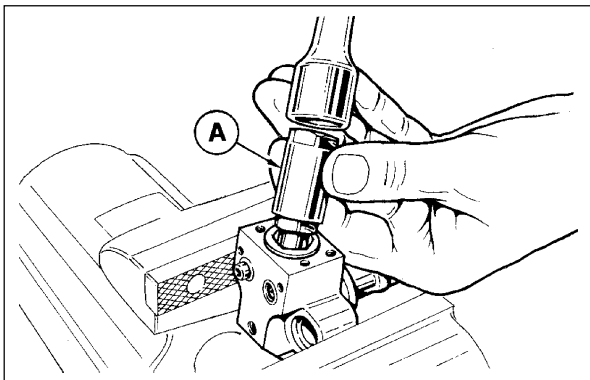
The unit injectors fitted within Deutz B/FM 1008/F diesel engines are designed by Deutz. One unit injector is required for each cylinder. In the continuing development of the B/FM 1008/F diesel engine, design changes have been made to the unit injector resulting in less than total interchangeability between older and newer B/FM 1008/F engines. Please refer to the previous pages for details regarding the identification, special tool requirement, testing method and application of unit injectors. Always use the utmost cleanliness and care when servicing fuel injection equipment.



### UNIT INJECTOR COMPONENTS

1 Circlip	12 Delivery Valve	A Cup
2 Tappet	13 Shim/Gasket	B O-Ring
3 Retainer	14 Spring	C Nozzle
4 Plunger	15 Filler	D Spacer
5 Spring	16 Pin	E Spring Seat
6 Bolt	17 O-Ring	F Spring
7 Support	18 Check Valve	G Shim
8 Rack Lever	19 O-Ring	I Unit Inj. Body
9 Ring Nut	20 Plug	L Helix
10 O-Ring	21 Gasket	M Index
11 Barrel		

**Note:** Cup (A) torque = 70 N m.

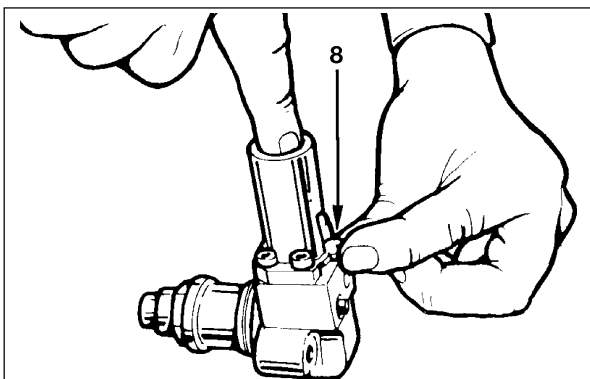


### UNIT INJECTOR RING NUT REMOVAL / REPLACEMENT

When disassembling or reassembling the unit injector, follow the numerical order presented above, then proceed through the alphabetical order A-I.

After disassembling items one (1) through seven (7) (see above), fit the injector into a suitable vice with soft jaws. Use special tool (A) 7107-029 to remove the ring nut (9) as shown.

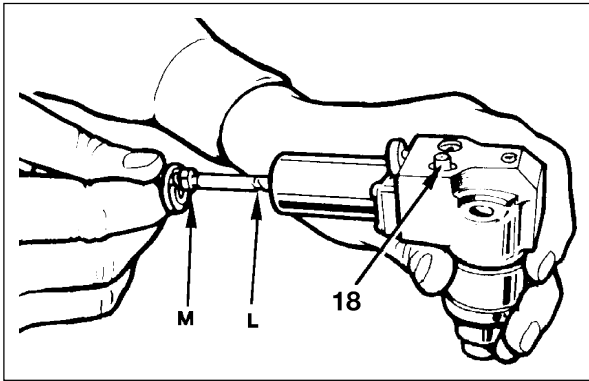
When reassembling the unit injector, torque the ring nut to 34 N m.



### UNIT INJECTOR PLUNGER REASSEMBLY

When reassembling the unit injector, refer to the above exploded diagram. Assemble in the following order: I-A, then 21-1.

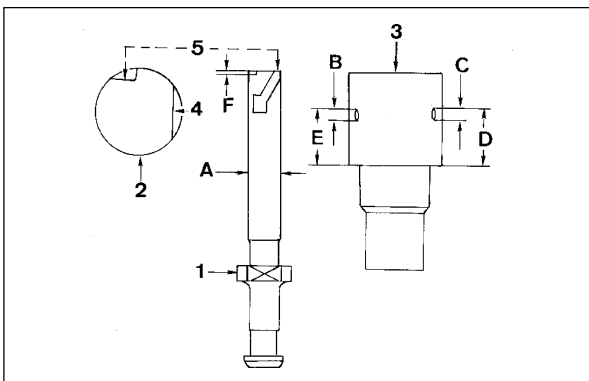
When refitting the plunger, orient the plunger helix (L) to align with the check valve (18). See also the figure and explanation on the next page.



**UNIT INJECTOR REASSEMBLY (CONT.)**

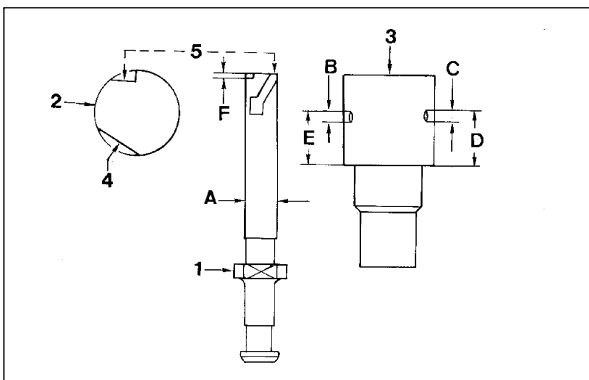
With reference to the previous frame, and the exploded view of the unit injector on the previous page, continue to introduce the plunger into the unit injector, while gently rotating rack lever (8) back and forth until index (M) can be engaged with the rack lever (8).

NOTE: If the plunger is accidentally installed incorrectly positioned with respect to the helix location, the engine will not operate.



**BARREL AND PLUNGER DETAIL- EARLY UNIT INJECTORS (TYPICAL)**

Component Details	Dimensional Details
1 Plunger	A = 5.5 mm (nominal)
2 Plunger End View	B = 2.00-2.03 mm (Inlet Port)
3 Barrel	C = 1.50-1.53 mm (Bypass)
4 Retardation Notch	D = 10.00 mm
5 Helix	E = 9.6 mm
	F = 0.7 mm

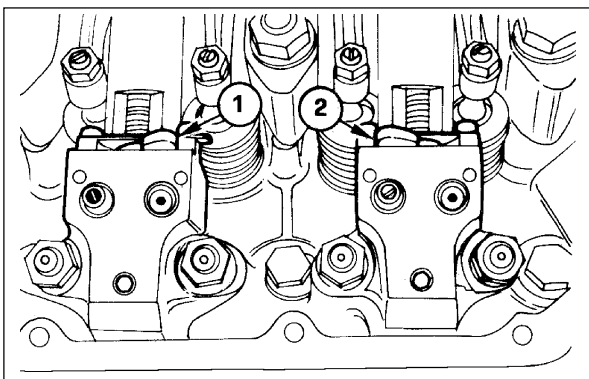


**BARREL AND PLUNGER DETAIL- (TYPICAL) CURRENT UNIT INJECTORS (EXAMPLE- 6590-285)**

Component Details	Dimensional Details
1 Plunger	A = 6.0 mm (nominal)
2 Plunger End View	B = 1.50-1.53 mm (Inlet Port)
3 Barrel	C = 1.50-1.53 mm (Bypass)
4 Retardation Notch	D = 9.965-10.035 mm
5 Helix	E = 9.565-9.635 mm
	F = 0.9 mm

**For F4M 1008, F2/3/4M 1008F CURRENT UNIT INJECTORS (EXAMPLE- 6590-290)**

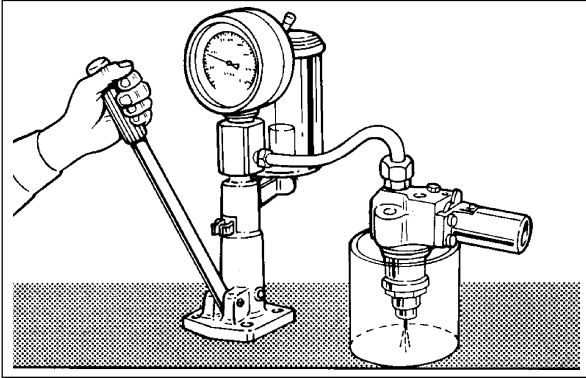
A = 6.5 mm (nominal)



**UNIT INJECTOR TEST STAND SPECIFICATIONS**

- 1 Rack lever in stop or no delivery position
- 2 Rack lever in maximum delivery position

## VI FUEL SYSTEM



**WARNING:** THE TESTING AND SERVICE OF FUEL INJECTION EQUIPMENT SUCH AS DETAILED BELOW INCLUDES HIGH PRESSURE AND SPRAYING FLUIDS. WEAR PROPER EYE AND HAND PROTECTION. DO NOT ALLOW ANY PART OF YOUR BODY TO COME INTO CONTACT WITH HIGH PRESSURE FUEL OR TESTING FLUID. FURTHER, HIGH PRESSURE FUEL IS VERY FLAMMABLE. DO NOT TEST FUEL INJECTION EQUIPMENT NEAR ANY OPEN FLAME, SPARKS OR LIT CIGARETTES.

### UNIT INJECTOR POPPING PRESSURE TESTING AND ADJUSTMENT- HIGH PRESSURE PROCEDURE (EARLY UNIT INJECTORS- ALL REF. NO's OTHER THAN 272, 272-, 272-1, 235-3)

With reference to the exploded view from page 57, remove the high pressure plug (20). Fit to the injector, in place of plug (20), union 1460-028. Install the injector onto a hand pop test machine. Using extreme care and proper eye and hand protection, cycle the injector several times until all air is out of the injector. Operate the popping tester taking note of the injection pressure. The injector should require 130-140 bar before injection. If the pressure is not to specification, again refer to the exploded view as above. The pressure can be increased by adding shims (G) or reduced by removing shims (G). Shims are available ranging from 1 to 2 mm in eleven steps. When servicing the unit injector, initial pressure settings should be 10 bar higher than specified to allow for seating during operation.

Injector nozzle leakage may be checked by holding a pressure of 130 bar on the injector for 10 seconds. The nozzle should be replaced if leakage is noted.

### UNIT INJECTOR POPPING PRESSURE TESTING AND ADJUSTMENT- LOW PRESSURE PROCEDURE (CURRENT / INTERMEDIATE UNIT INJECTORS)

Unit injectors having codes 272, 272-, 272-1, 235-3, 235-4 are not equipped with a high pressure port drilling as above. With reference to the exploded view on page 57, pressure checks of the unit injector are facilitated by removing the check valve (18), then installing the plug, eccentric gasket and block (1) which are supplied as components within part no. 7107-074. Fit the block (1) onto the injector making sure that the rack lever is held in the maximum deliver position as is shown. Fit the supplied union (2) (part of 7107-074) onto the block. Using extreme care and proper eye and hand protection, test the injector on a hand popping pressure testing machine as is detailed above. Pressure settings, nozzle leakage testing and pressure adjustments are carried out as explained above. The new style injector should require 140 / 150 bar of pressure before injection. If service is required to increase the injection pressure, set the injector to 10 bar higher than nominal to allow for seating.

NOTE: 6590-272 (ref. no. 272) unit injectors will require the block (1) as supplied within part no. 7107-056.

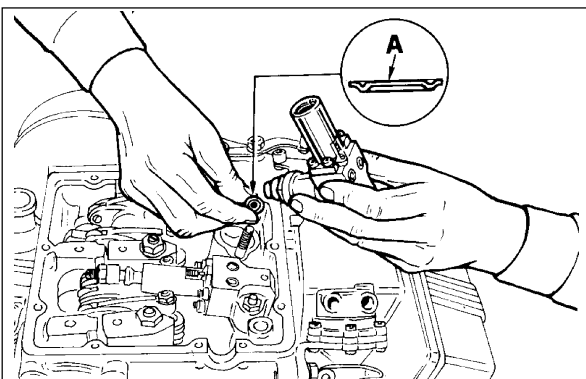
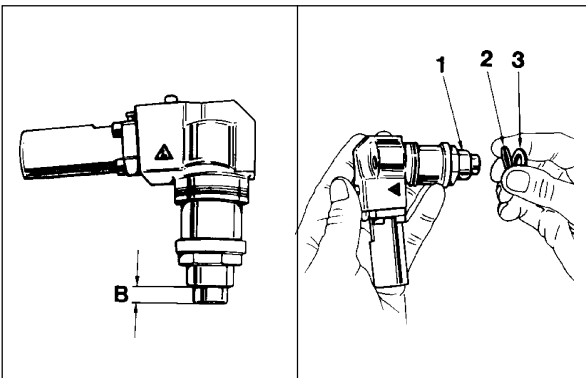
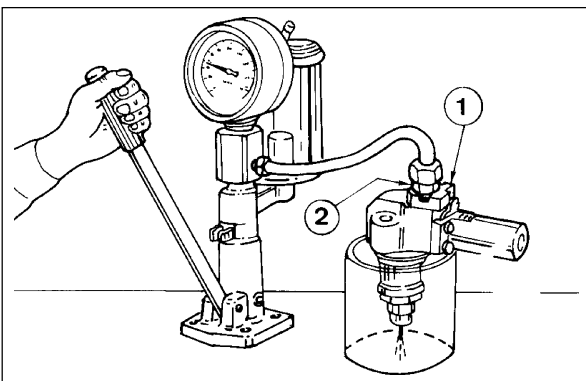
### INJECTOR NOZZLE PROTRUSION

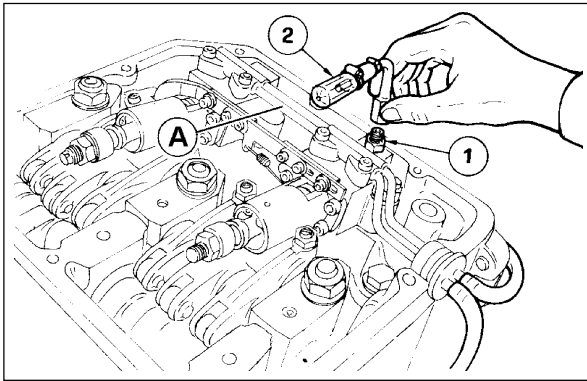
Injector nozzle protrusion (B) should be 6.80 - 7.05 mm. If the injector nozzle protrusion exceeds the above dimension, additional 0.25 mm copper washers (2) may be placed on the injector nozzle, resting against the cup (1) to supplement the thickness of the standard copper washer (3) and offset any injector nozzle protrusion problems. The 0.25 mm supplemental washers are available as special spare parts. Contact your local distributor for details.

### UNIT INJECTOR FIRE RING

The unit injector fire ring should be replaced following unit injector removal. DO NOT REUSE fire rings.

Clean the fire ring sealing surface in the cylinder head and injection nozzle. (Do not damage the injector nozzle or pre-cup ring nut. Orient the fire ring so that plane (A) will face the unit injector nozzle. Reinstall the injector, tightening the unit injector securing nuts to 20 Nm alternately and in 5 Nm steps.





**STATIC INJECTION TEST INSTRUMENTATION- EARLY UNIT INJECTORS**

Carefully remove the engine valve cover. With reference to the exploded unit injector diagram on page 57, remove plug (20). Replace plug (20) with union (1)- 7107-028. Install Injection timing tool (2)- 7107-024 onto the 7107-028 union.

NOTE 1: When refitting the plug (20), carefully check the sealing properties of the plug.

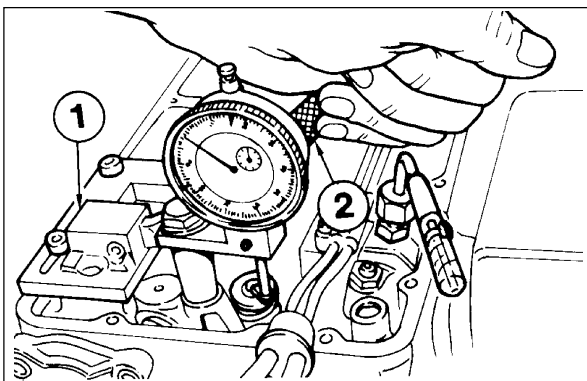
NOTE 2: Later versions of the unit injector are not equipped with the plug (20). Therefore, static timing adjustments require alternative approaches than those shown. Please see page 56 for details of the static injection timing instrumentation for later versions of the B/FM 1008/F unit injector.

**TDC DETERMINATION and STATIC INJECTION TIMING CHECKING**

With the static injection timing instrumentation installed as described above, fit the engine with the timing fixture(1), part no. 7107-048 as shown. The dial indicator support should be oriented over the engine valve spring cap. Remove the injection pump rack assembly starting aid spring. Adjust and secure the injection pump rack at 1/2 stroke.

Rotate the engine until the cylinder being static timed approaches TDC, compression stroke. Alternately, rotate the crankshaft toward TDC and press down on the timing fixture lever (2) until minimum dial indicator travel is established. At minimum dial indicator travel, TDC is established. Zero the dial indicator at the TDC position.

Insure that a good supply of clean diesel fuel is available to the engine, preferable from an external fuel tank elevated above the level of the engine.

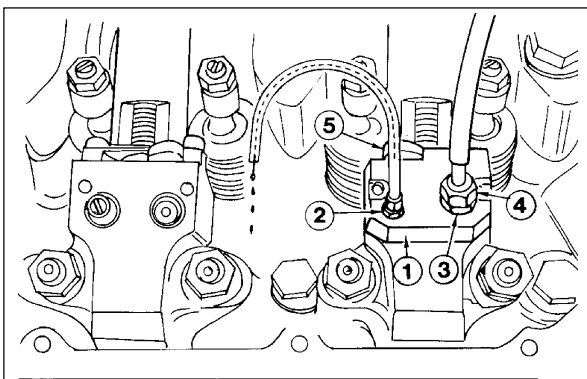


**EARLY UNIT INJECTORS** (RefN o's: 231-2, 235-2, 272o)-With reference to the upper figure, bleed the injection timing tool by bringing the engine to such a position as the injection pump is being acted upon via the camshaft. Alternately rotate the engine back and forth until fuel is injected out of the injection timing tool and free of air. Rotate the engine in opposite normal direction approximately 90°. Rotate the engine in normal direction of rotation until a fuel movement is noted in the static timing sight glass. Stop rotation IMMEDIATELY upon any notice of fuel movement. Depress the timing fixture lever and note the dial indicator reading. Check the corresponding dimension listed in the chart to the left- determine static injection timing from the chart. Correct, if needed, the injection timing by turning screw (E)- see next page. Refer to the chart on page 55 for static timing specifications with respect to the injector reference number. See the following page for static timing adjustment procedures.

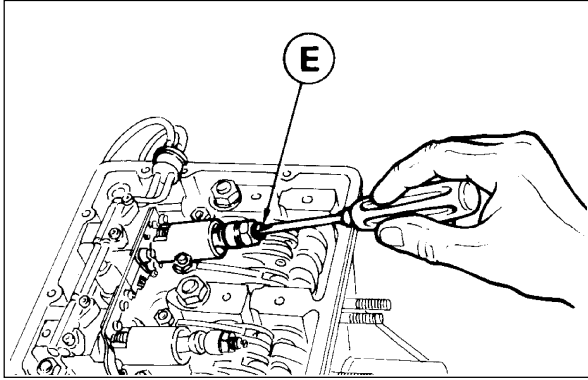
$\alpha$	F 2/3/4M 1008 BF 4M 1008 mm	F 2/3/4M 1008 F mm
13°	1.242	1.296
12°	1.059	1.105
11°	0.891	0.930
10°	0.737	0.769
9°	0.597	0.623
8°	0.472	0.493
7°	0.362	0.378
6°	0.266	0.277
5°	0.185	0.193
4°	0.118	0.123

**LATE/ INTERMEDIATE UNIT INJECTORS-** (6590-272, 6590-285, 6590-286, 6590-287, 6590-290) Remove the check valve from all injectors, remove the check valve side o-ring from all injectors, replace the o-ring with special eccentric gasket supplied within 7107-074. With reference to the lower diagram, fit the unit injectors with a special tool block (1), bleed fitting (2), union (3), supply fitting (4) and nylon bleed tube (5) as supplied within 7107-074. Note: 6590-272 unit injectors do not require the eccentric gaskets as detailed above but do require a special block (1) as supplied under part no. 7107-056.

Place a small cup beneath the nylon bleed tube, rotate the engine in the normal direction of rotation until fuel stops flowing from the bleed tube. At the very instant of fuel flow stoppage, stop rotating the engine. The fuel flow stoppage indicates the beginning of injection. Depress the timing fixture lever and note the dial indicator reading. Check the corresponding dimension listed in the chart to the left- determine static injection timing from the chart. Correct, if needed, the injection timing by turning screw (E)- see next page. Refer to page 64 for the static timing specification with respect to the unit injector reference number. See the following page for static timing adjust procedures.



## VI FUEL SYSTEM

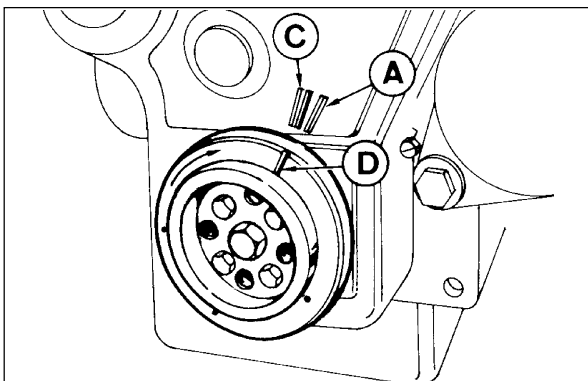


### STATIC TIMING ADJUSTMENT

Should the static timing testing procedures as presented on the previous page show the need for static timing adjustment, proceed as follows.

1. Locate timing adjustment screw (E), loosen the locking nut
2. Rotate the adjustment screw (E) clockwise to advance the static timing, or rotate the adjustment screw counterclockwise to delay the static timing.
3. Tighten the timing adjustment screw lock nut.
4. Repeat the static timing test procedure.

NOTE: 1/2 turn equates to approximately a 5° change in static timing.



### ENGINE TIMING REFERENCE MARKS

Although not as accurate as the procedure presented in the previous section, TDC for B/FM 1008/F diesel engines may be determined via timing marks on the timing cover and crankshaft pulley. Further, the timing marks on the timing cover can greatly assist the static timing test due to outside confirmation of TDC with respect to the findings of the timing fixture assembly- 7107-048. Deutz strongly recommends the use of the 7107-048 timing fixture for purposes of static timing adjustments.

With reference to the figure to the left, Pulley mark (D) corresponds to the No. 1 piston (flywheel side piston). Timing cover mark (C) corresponds to approximately 11°-13° BTDC.

With reference to the figure below, note the following:

D aligns with A - TDC No. 1 cyl. and No. 4 cyl., B/F 4M 1008/F

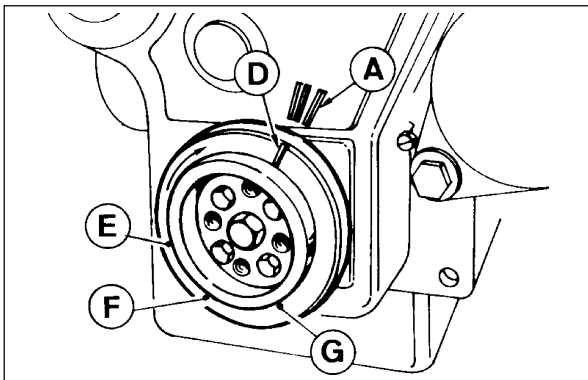
E aligns with A - TDC No. 2 cyl., F3M 1008/F

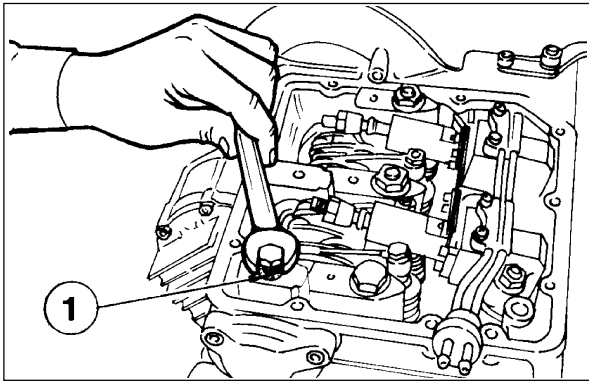
F aligns with A - TDC No. 2 cyl., F2M 1008/F  
TDC No. 2 cyl. and No. 3 cyl., B/F 4M 1008/F

G aligns with A - TDC No. 3 cyl., F3M 1008/F

NOTE 1: The firing order of the F3M 1008/F is 1-3-2, thus on the crankshaft pulley, D,G,E.

NOTE 2: The firing order of the B/F 4M 1008/F is 1-3-4-2, thus on the crankshaft pulley, D,F,D,F. However, in order to properly follow the B/F 4M 1008 firing order, an initial establishment of TDC compression stroke for No. 1 cylinder must be made.



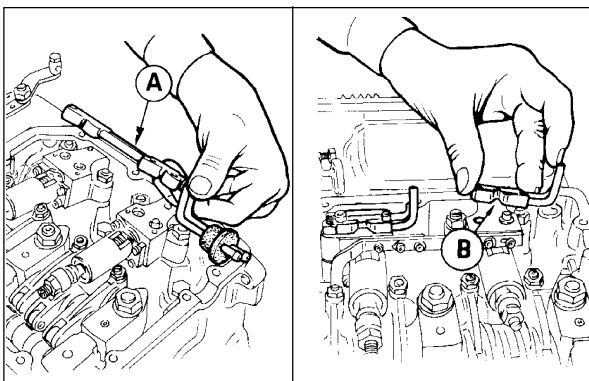


**UNIT INJECTOR DELIVERY EQUALIZATION- PREPARATION**

Due to the fact that unit injectors are both injection pump and injector, all unit injectors within a B /F M 1008/F diesel engine must be equalized to facilitate the identical delivery of fuel within individual cylinders. The equalization procedure is a operational test with the valve cover removed. Therefore, proper eye protection must be worn and great care must be taken to insure no body or clothing contact with rotating engine components.

After carefully removing the engine valve cover, install a M8x1.25x10mm capscrew and 8 mm copper gasket at position (1) as shown. Failure to install the bolt as shown will result in a large scale oil spill and loss of oil pressure to the engine during the operational procedure presented below.

NOTE: SEE PAGE 74 FOR INITIAL INJECTOR CONTROL RACK AND GOVERNOR ADJUSTMENT PROCEDURES.

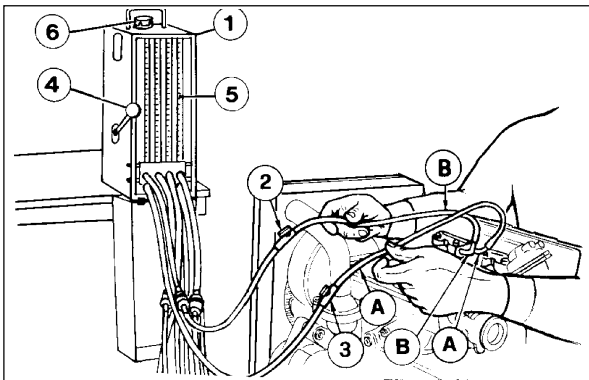


**UNIT INJECTOR DELIVERY EQUALIZATION- PREPARATION (cont.)**

Remove the fuel manifold assembly (A). In place of the fuel manifold, install on each unit injector a test head (B). The test heads are supplied as part of the equalization tool package. Please note that early versions of the unit injector and late versions of the unit injector require different test heads. Please refer to page 56 for further details.

**EQUALIZATION TOOL INSTALLATION, PLUMBING**

Place the equalization tool on a stable surface, with the base of the equalization tool at least 20 cm higher than the level of the unit injectors. Close all valves (2,3). Remove fuel cap (6) and fill the reservoir with clean diesel fuel. With reference to the diagram, connect the lower hoses (A) coming from the equalization fixture to the test head position (A). The hoses should be connected to the test heads in a logical manner. That is, the left most hose should be connected to No. 1 unit injector (flywheel side), then subsequent hoses from left to right, connected to cylinders 2 3 4 as required. Connect the upper hoses (B) to the test head position (B). Make sure that the control lever (4) is in the upper position.



After completion of the hose routing/ plumbing, open the valves (2,3). Start the engine and allow to idle. Increase and lock the engine speed to 1500 rpm. Once the engine operates smoothly and the 1500rpm is reconfirmed, pull the control lever (4) downward for approximately one (1) minute. While closely watching the fuel level in the cylinder tubes (5), note the rate at which fuel is consumed. NOTE:, the control lever (4) must be returned to the upper position prior to fuel depletion in the tubes (5).

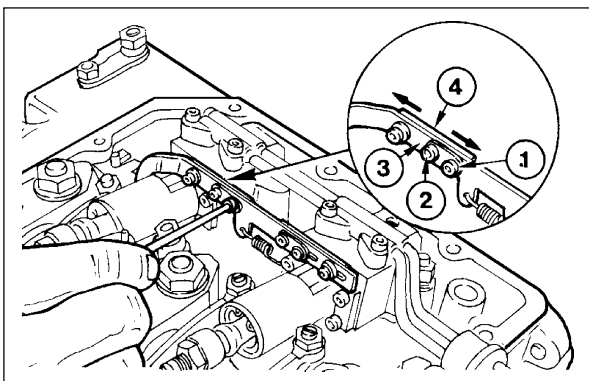
During operation with the control lever down, determine the cylinder(s) which are consuming more fuel as indicated by the speed at which the fuel is depleted from each individual tube (5). Delivery rates in each cylinder should be within 2 cm<sup>3</sup> during one (1) minute of operation. Reduce the fuel delivery rate to the cylinder(s) consuming the most fuel. Delivery may be adjusted as follows:

**FUEL RATE ADJUSTMENT DETAILS**

To increase the fuel delivery of an individual unit injector, the injector rack must be moved slightly toward the flywheel end of the engine. With reference to the figure on the left, loosen screws (1) and (2) 1/2 turn. Increase the cylinder fuel delivery by moving plate (4) slightly towards the flywheel, thus changing the relative position of control rod (3). Reductions in fuel delivery can be facilitated by moving the plate away from the flywheel. After adjustment, torque screws (1) and (2) to 1.1 Nm.

Repeat the equalization test until the individual cylinder fuel consumptions are within 2 cm<sup>3</sup> during a one(1) minute period.

NOTE: The equalization procedure should be performed following an injector re



## VII ELECTRICAL SYSTEM

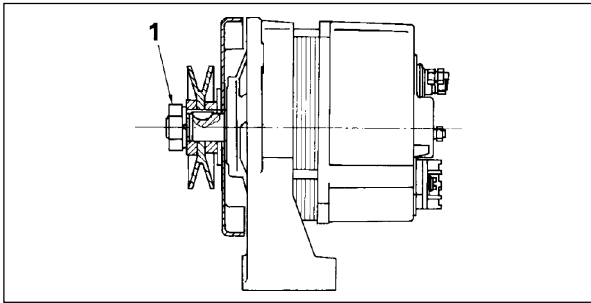
### ELECTRICAL SYSTEM SERVICE PRECAUTIONS / WARNING:

The improper service of electrical components can result in shock injuries, burn injuries (from both heat and chemical acids) and produce sparks which could ignite fires. Therefore proper precautions must always be taken.

1. Always wear safety glasses and hand protection when performing diagnostic work of electrical systems.
2. Keep hands, arms, clothing, hair, etc. well away from rotating components.
3. Always remove the negative (-) battery cable before removing and/or handling any electrical system wires or components.
4. Use extreme care when handling batteries. Hand protection and eye protection should be worn at all times. Batteries contain acids which can cause severe chemical burns.
5. The fumes emitted from batteries are flammable, therefore do not weld, smoke or use an open flame around batteries.
6. Read, understand and follow the operational and safety precautions supplied with your electrical service equipment (battery chargers, load testers, meters, etc.).

**BATTERY SIZING:** The chart presented below provides strict guidelines for the sizing of system batteries for Deutz B/FM 1008/F diesel engines. Batteries must be sized so as to provide sufficient reserve capacity (Amp-Hours), but yet not so large as to damage the starter motor due to excessive amperage. Depending on the cold starting ambient conditions (Normal or Extreme), size the system battery according to the data presented below with respect to the engine model and engine starter rating.

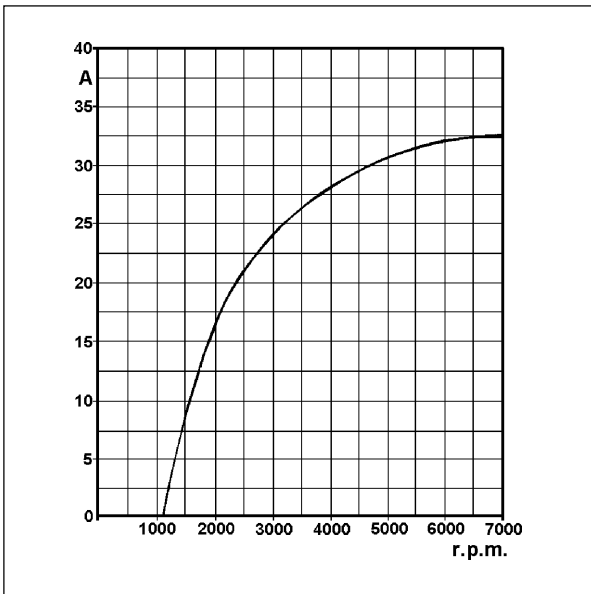
ENGINE MODEL	STARTER RATING (KW)	NORMAL AMBIENT CONDITIONS		EXTREME AMBIENT CONDITIONS	
		Amp-Hours @ 20hour Rating	Maximum Battery Amps @ -18°C	Amp-Hours @ 20 hour Rating	Maximum Battery Amps @ -18°C
F 2M 1008	1.1	44	210	66	300
F 2M 1008	1.6	66	300	88	330
F 3M 1008	1.1	44	210	66	300
F 3M 1008	1.6	66	310	88	330
F 4M 1008	1.1	44	210	66	300
F 4M 1008	1.6	66	310	88	330
BF 4M 1008	1.1	55	255	66	300
BF 4M 1008	1.6	66	300	88	330



## ISKRA ALTERNATOR- 14V / 33A

NOMINAL VOLTAGE: 14V  
 NOMINAL CURRENT OUTPUT: 33A  
 MAXIMUM r/min: 12000 r/min  
 VOLTAGE REGULATOR: AER 1503  
 ROTATION (VIEWED AT PULLEY END): CLOCKWISE

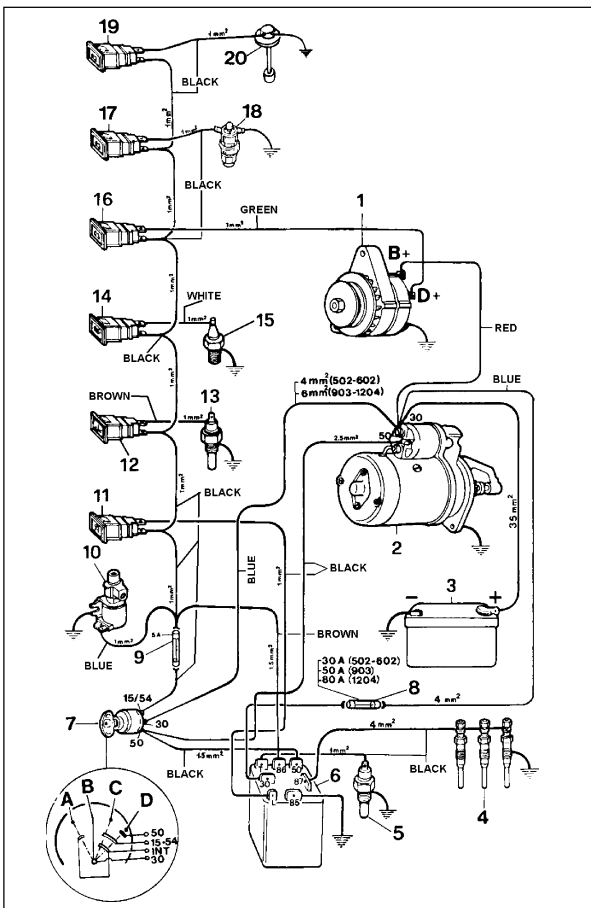
NOTE: Pulley nut torque (1): 35-45 N m



## ISKRA 14V / 33A PERFORMANCE CURVE

The attached performance curve was plotted at a constant system voltage of 13V and at an ambient temperature of 25°C.

**NOTE:** The rpm shown is reflective of an ISKRA alternator fitted to an engine with a 88mm crankshaft pulley. The rpm shown is that of the alternator rotor. Thus, at an engine speed of 3600 rpm, the alternator is turning approximately 4680 rpm, or a ratio of 1.3 : 1.



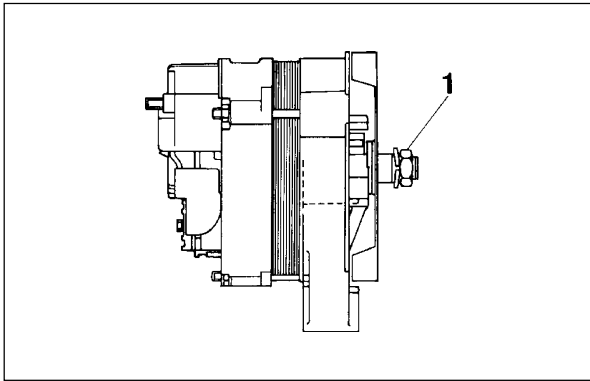
## 12V ELECTRICAL SCHEMATIC- ISKRA 14V-33A

- 1 Alternator
- 2 Starter Motor
- 3 Battery- (See below for sizing details)
- 4 Glow Plugs
- 5 Thermistor (Glow Plug Controller Circuit)
- 6 Glow Plug Controller / Timer
- 7 Key Switch
- 8 System Fuse, 30A (F2M 1008), 50A (F3M 1008), 80A (F4M 1008, BF4M 1008)
- 9 Fuse (Accessory)- 5A
- 10 Fuel Valve
- 11 Glow Plug Indicator Lamp
- 12 Coolant High Temperature Lamp
- 13 Coolant High Temperature Switch (N.O.)
- 14 Oil Pressure (Low) Lamp
- 15 Oil Pressure Switch (N.C.)
- 16 Alternator Charging Lamp (Off if Charging)
- 17 Air Filter High Restriction Indicator Lamp
- 18 Air Filter Restriction Switch (N.O.)
- 19 Low Fuel Level Lamp
- 20 Low Fuel Level Switch (N.O.)

- A Accessory Position
- B Off Position
- C On Position
- D Starting Position



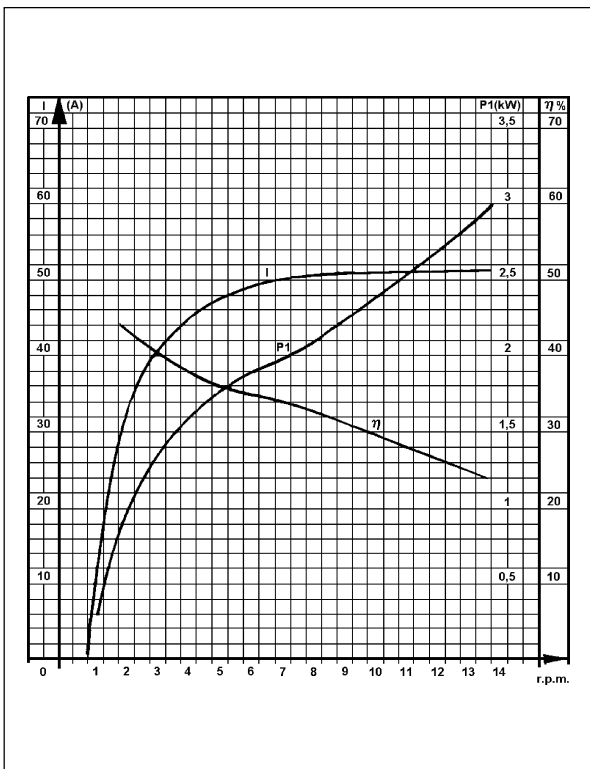
## VII ELECTRICAL SYSTEM



### MARELLI ALTERNATOR (AA 125R) - 14V / 45A

NOMINAL VOLTAGE: 14V  
 NOMINAL CURRENT OUTPUT: 45A  
 MAXIMUM r/min: 14000 r/min  
 VOLTAGE REGULATOR: RTT 119 A  
 BEARING (Pulley End): 6203-2Z  
 BEARING (Voltage Regulator End): 6201-2Z /C 3  
 ROTATION (VIEWED AT PULLEY END): CLOCKWISE

**NOTE:** 1. Pulley nut torque (1): 60 N m  
 2. Use only high temperature grease when servicing bearings.



### MARELLI AA 125R, 14V / 45A PERFORMANCE CURVE

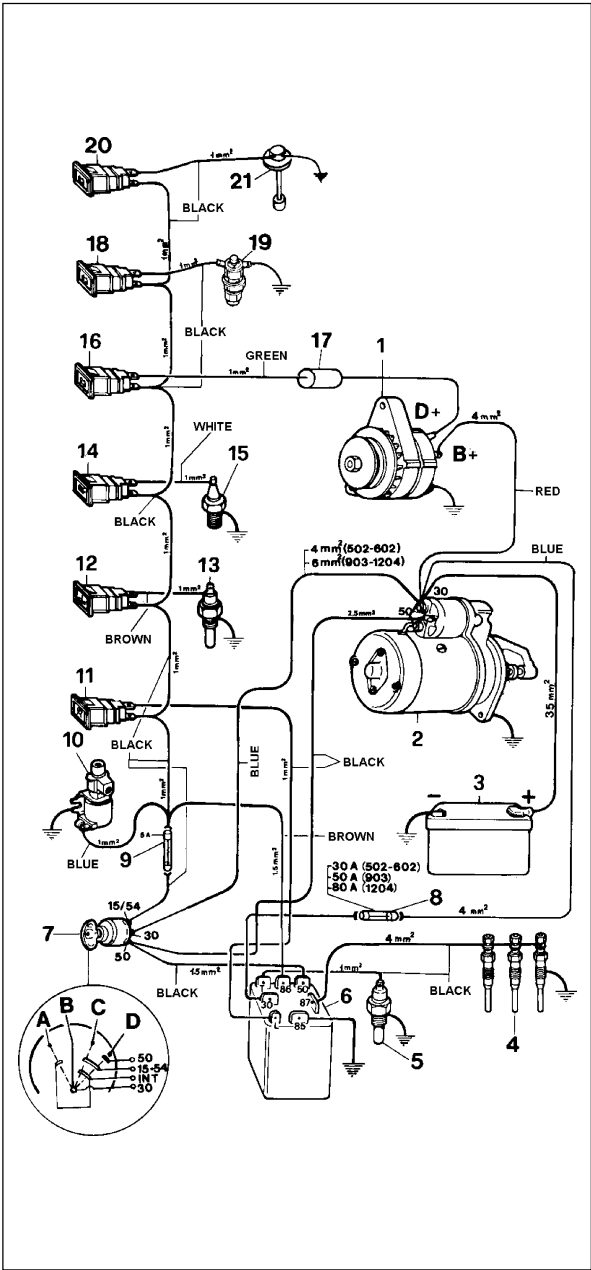
The attached performance curve was plotted at a constant system voltage of 13.5V and at an ambient temperature of 25°C.

**P1** = Power Output (kW)  
**I** = Current Output (Amps)  
 $\eta$  = Efficiency

#### NOTES:

- The RPM shown is that of the alternator. The value of the rpm axis must be multiplied by 1000.
- Alternator speed is a function of engine speed and the crankshaft pulley diameter. If the engine pulley is 88 mm, then the alternator speed ratio is 1.3:1. If the engine pulley is 108 mm, then the alternator speed ratio is 1.6:1.

12V ELECTRICAL SCHEMATIC- MARELLI 14V-33A



- 1 Alternator
  - 2 Starter Motor
  - 3 Battery- (See below for sizing details)
  - 4 Glow Plugs
  - 5 Thermistor (Glow Plug Controller Circuit)
  - 6 Glow Plug Controller / Timer
  - 7 Key Switch
  - 8 System Fuse, 30A (F2M 1008), 50A (F3M 1008), 80A (F4M 1008, BF4M 1008)
  - 9 Fuse (Accessory)- 5A
  - 10 Fuel Valve
  - 11 Glow Plug Indicator Lamp
  - 12 Coolant High Temperature Lamp
  - 13 Coolant High Temperature Switch (N.O.)
  - 14 Oil Pressure (Low) Lamp
  - 15 Oil Pressure Switch (N.C.)
  - 16 Alternator Charging Lamp (Off if Charging)
  - 17 Diode
  - 18 Air Filter High Restriction Lamp
  - 19 Air Filter Restriction Switch (N.O.)
  - 20 Low Fuel Level Lamp
  - 21 Low Fuel Level Switch (N.O.)
- A Accessory Position  
 B Off Position  
 C On Position  
 D Starting Position

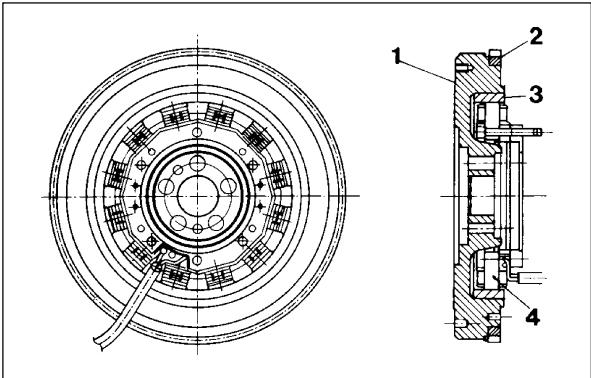
BATTERY SIZING- PLEASE REVIEW PAGE 62

FLYWHEEL ALTERNATOR- 12V

Flywheel driven alternators are available in two(2) amperage ratings at 3600 r/min - 20A and 30A.

COMPONENTS:

- 1 Flywheel
- 2 Ring Gear
- 3 Magnet Ring (Rotor)
- 4 Stator



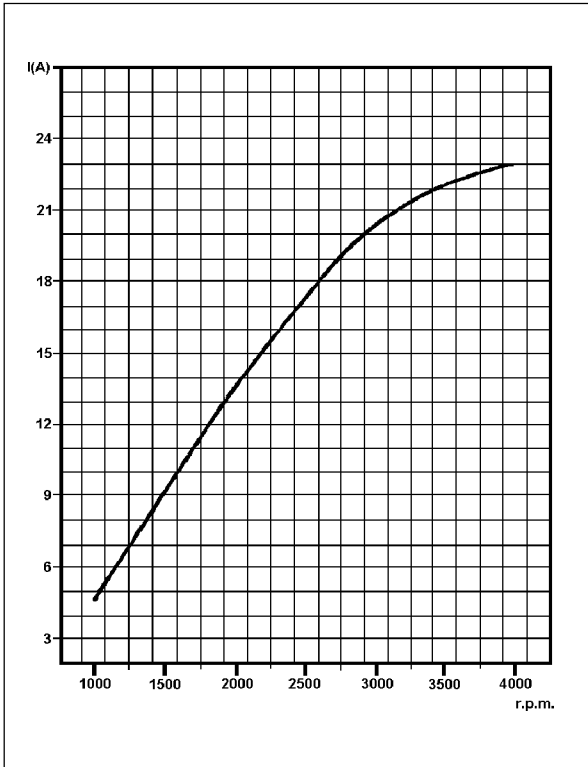
## VII ELECTRICAL SYSTEM

### PERFORMANCE CURVE - 20A FLYWHEEL ALTERNATOR

The performance curve at the left was plotted at a constant system voltage of 12V and an ambient temperature of 20°C.

RPM values shown on the performance curve are engine speeds.

The statistical charging output of the flywheel alternator is +10% to -5% of the values shown.

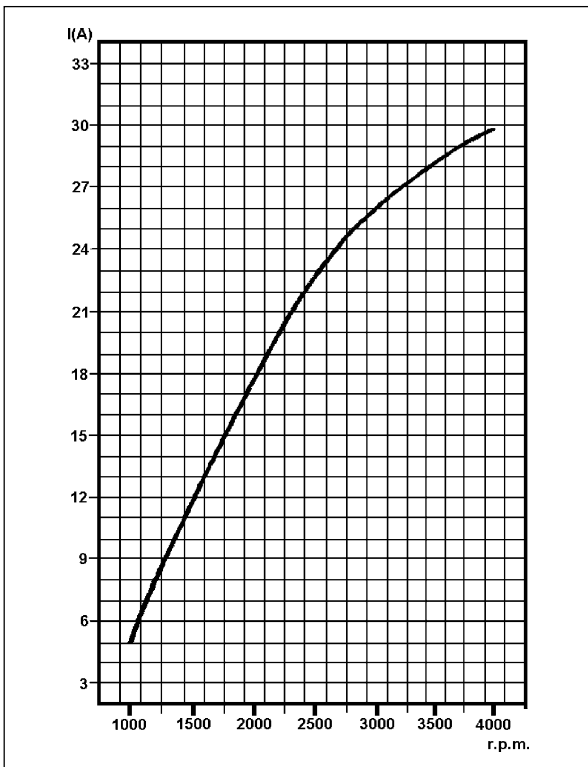


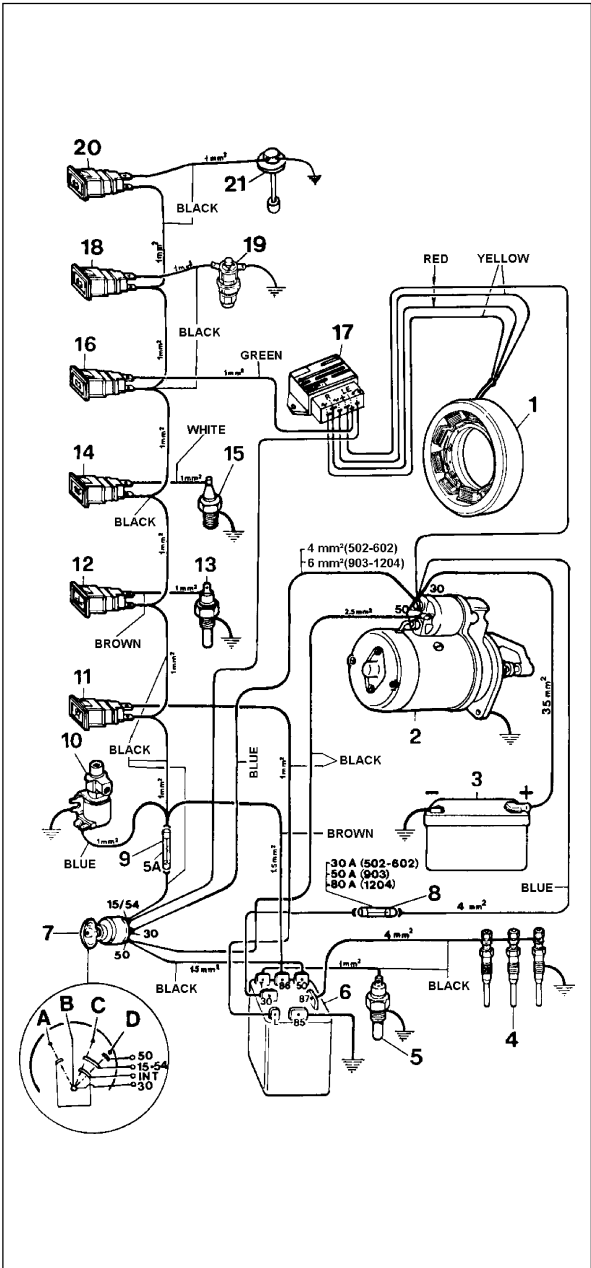
### PERFORMANCE CURVE - 30A FLYWHEEL ALTERNATOR

The performance curve at the left was plotted at a constant system voltage of 12V and an ambient temperature of 20°C.

RPM values shown on the performance curve are engine speeds.

The statistical charging output of the flywheel alternator is +10% to -5% of the values shown.

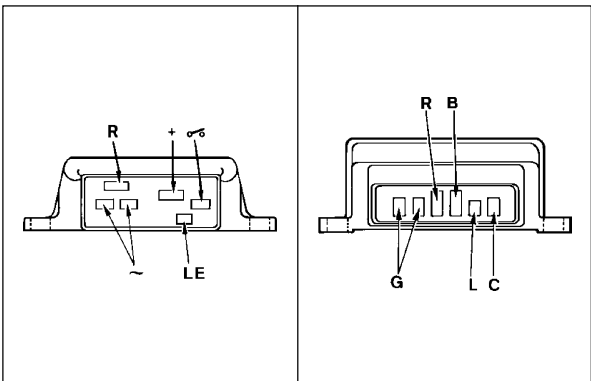




**12V ELECTRICAL SCHEMATIC- 20/30A FLYWHEEL ALTERNATOR**

- 1 Alternator
  - 2 Starter Motor
  - 3 Battery- (See below for sizing details)
  - 4 Glow Plugs
  - 5 Thermistor (Glow Plug Controller Circuit)
  - 6 Glow Plug Controller / Timer
  - 7 Key Switch
  - 8 System Fuse, 30A (F 2M 1008), 50A (F 2M 1008 F, F 3M 1008/F), 80A (B/F 4M 1008, F 4M 1008 F)
  - 9 Fuse (Accessory)- 5A
  - 10 Fuel Valve
  - 11 Glow Plug Indicator Lamp
  - 12 Coolant High Temperature Lamp
  - 13 Coolant High Temperature Switch (N.O.)
  - 14 Oil Pressure (Low) Lamp
  - 15 Oil Pressure Switch (N.C.)
  - 16 Alternator Charging Lamp (Off if Charging)
  - 17 Voltage Regulator
  - 18 Air Filter High Restriction Indicator Lamp
  - 19 Air Filter Restriction Switch (N.O.)
  - 20 Low Fuel Level Lamp
  - 21 Low Fuel Level Switch (N.O.)
- A Accessory Position  
 B Off Position  
 C On Position  
 D Starting Position

**BATTERY SIZING- PLEASE SEE PAGE 62**



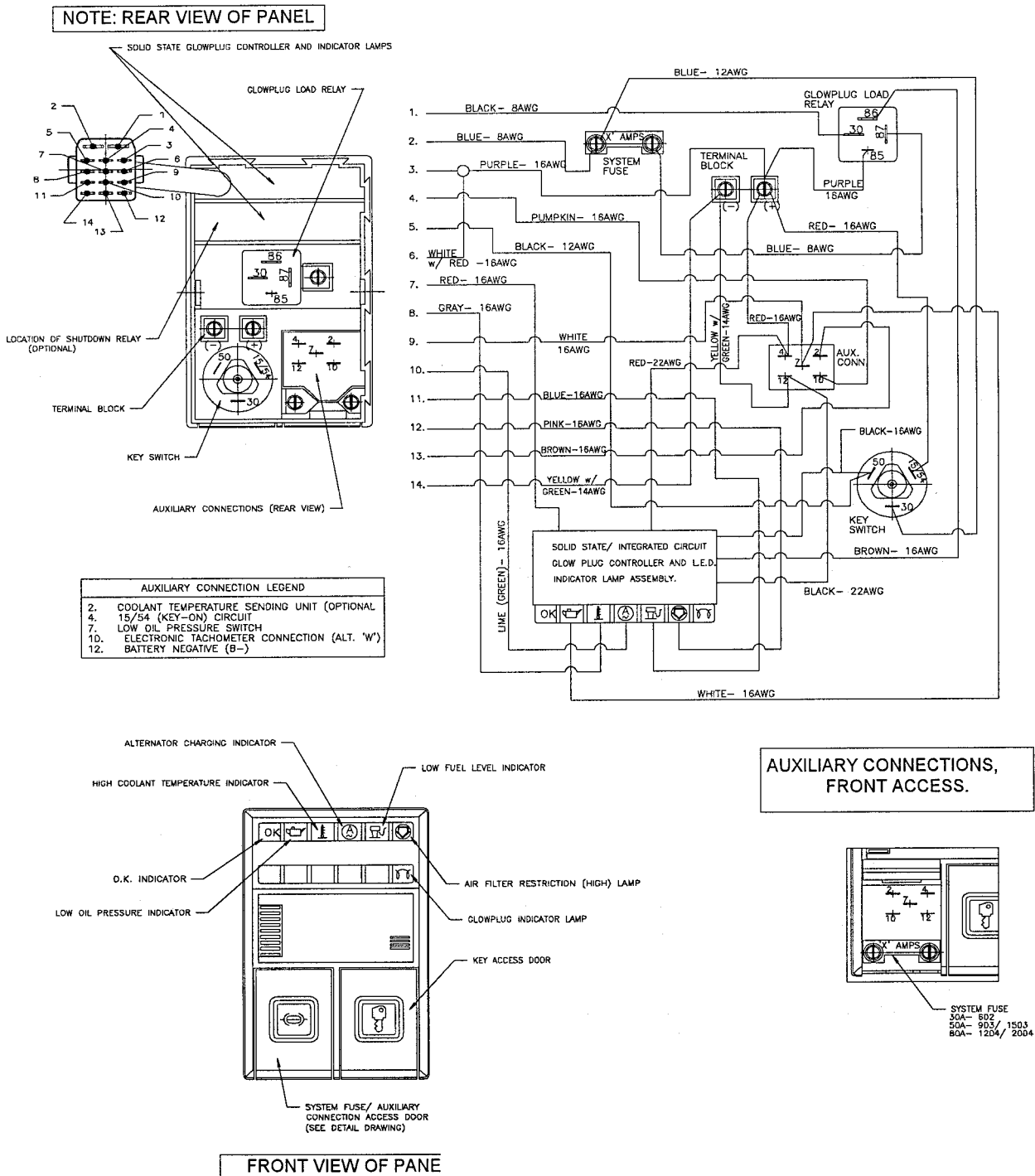
**VOLTAGE REGULATOR CONNECTION DETAILS (FLYWHEEL ALTERNATOR ONLY)**

SAPRISA, AETSA, NICSA	STD. WIRE COLOR	DUCATI	CONNECTOR DIMENSIONS	
			WIDTH	THICKNESS
~	YELLOW	G	6.35	0.8
R	RED	R	9.5	1.2
+	RED	B	9.5	1.2
LE	GREEN	L	4.75	0.5
⏏	BROWN	C	6.35	0.8

# VII ELECTRICAL SYSTEM

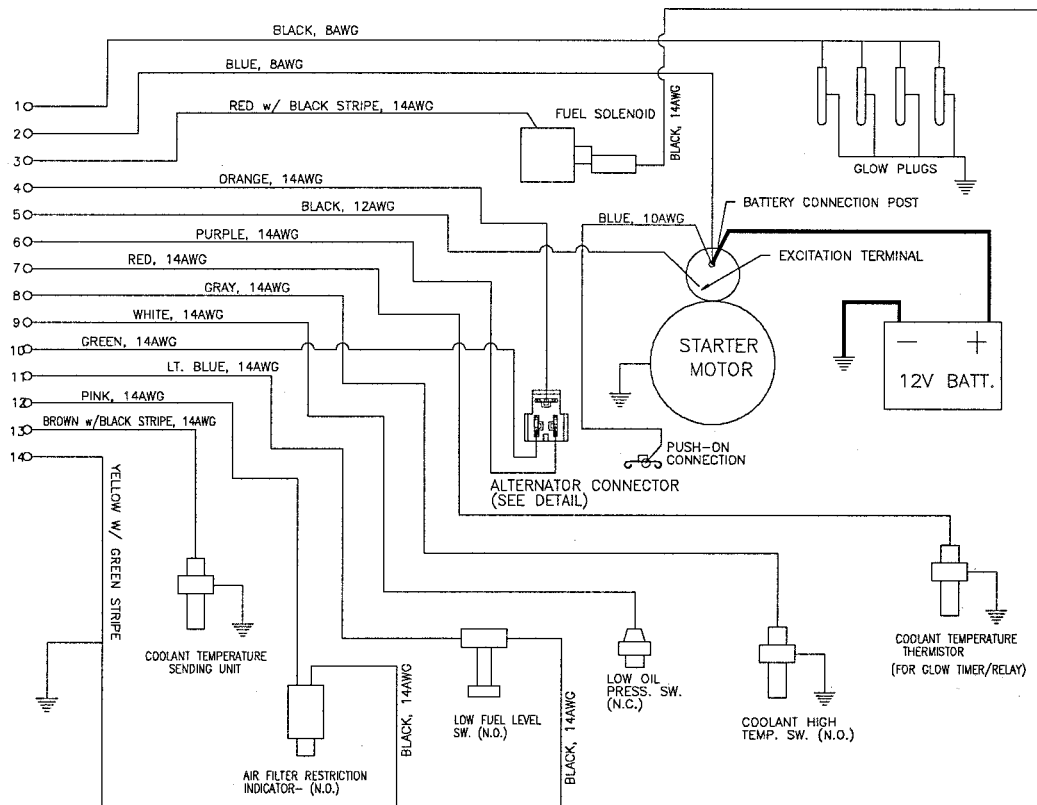
## DEUTZ SUPPLIED CONTROL PANEL

As an accessory, B/FM 1008/F series engines may be fitted with a Deutz supplied engine control panel. The control panel includes indicator lamps for low oil pressure, high coolant temperature, charging failure, high air filter restriction, low fuel level, glow plug heating and "OK". Integral to the panel, a glow plug relay and solid state glow plug controller is included. The diagram below provides details of the control panel. Please also refer to the diagram on page 70, which details the interface engine side wiring harness for the Deutz control panel. The panel connector index numbers correspond to the index numbers for the engine side harness.

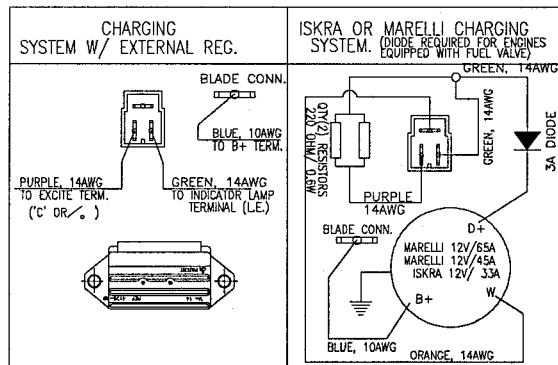
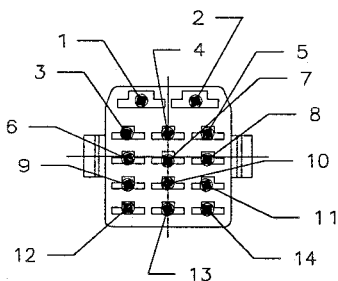


## ENGINE SIDE WIRING HARNESS FOR THE DEUTZ SUPPLIED CONTROL PANEL

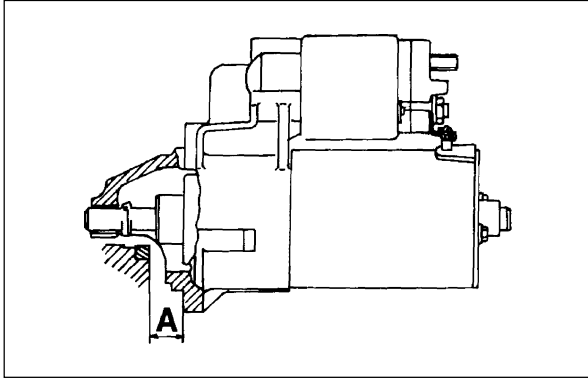
In conjunction with the engine control panel detailed on page 69, B/FM 1008/F engines may be fitted with an engine side wiring harness and optional sensors. The following diagram details the engine side wiring harness. Please also reference the diagram on page 69. The connector index numbers as shown on the engine side wiring harness interfaces with the connector index numbers for the control panel.



### Connector Key



## VII ELECTRICAL SYSTEM

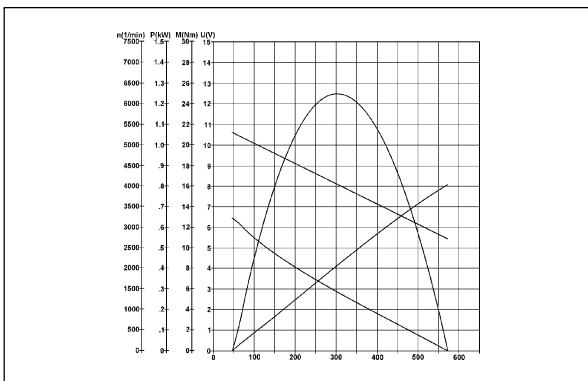


### BOSCH 12V / 1.1 KW STARTER MOTOR (DW 12V)

NOTE: Before removing the starter motor or attempting to service any electrical component, remove the negative(-) cable from the system battery.

Distance (A), from starter mounting flange to ring gear face must be checked and confirmed to be 17.5 - 19.5mm.

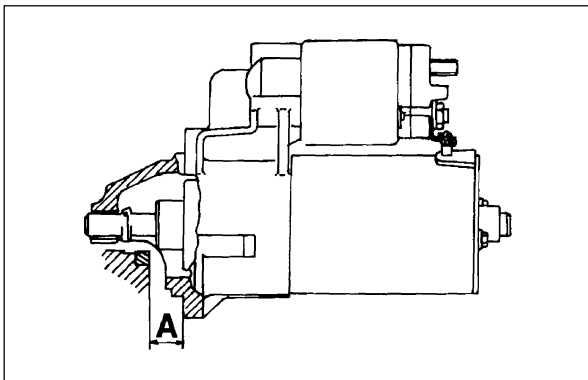
Please refer to your local BOSCH distributor for service parts, repair criterion and warranty service.



### PERFORMANCE CURVE - BOSCH 12V / 1.1KW (DW 12V) STARTER

The performance data presented is reflective of an ambient temperature of -20°C and operation with a fully charged 66Ah battery.

- U** = Starter Motor Voltage
- η** = Armature r/min
- I** = Absorbed Amperage
- P** = Starter Output Power (K W)
- M** = Starter Output Torque (N m)

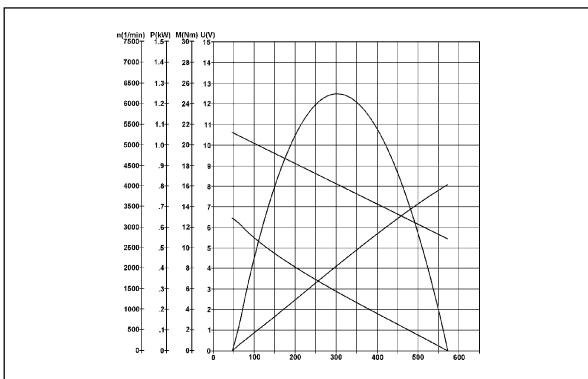


### BOSCH 12V / 1.6KW STARTER MOTOR (DW 12V)

NOTE: Before removing the starter motor or attempting to service any electrical component, remove the negative(-) cable from the system battery.

Please refer to your local BOSCH distributor for service parts, repair criterion and warranty service.

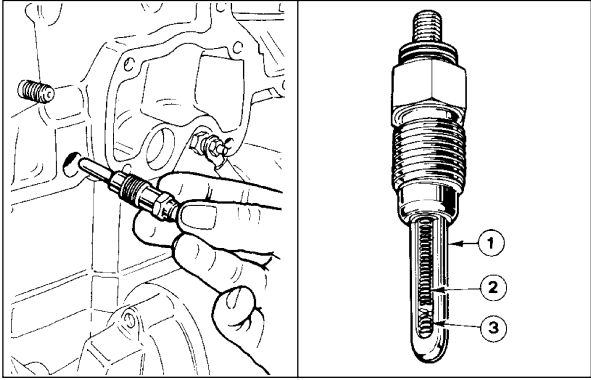
Distance (A), from starter mounting flange to ring gear face must be checked and confirmed to be 29.5 / 31.5mm.



### PERFORMANCE CURVE - BOSCH 12V / 1.6KW (DW 12V) STARTER

The performance data presented is reflective of an ambient temperature of -20°C and operation with a fully charged 88Ah battery.

- U** = Starter Motor Voltage
- η** = Armature r/min
- I** = Absorbed Amperage
- P** = Starter Output Power (K W)
- M** = Starter Output Torque (N m)



**GLOW PLUG**

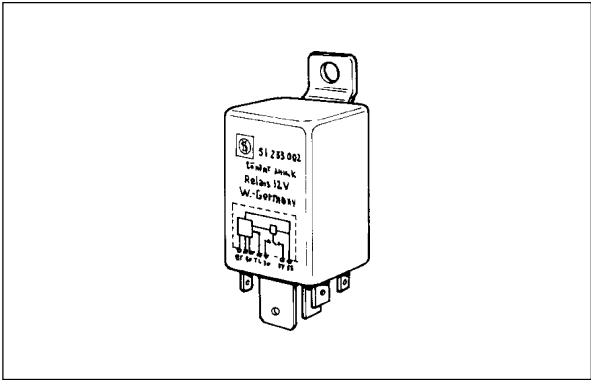
One(1) glow plug is required per engine cylinder. Proper glow plug operation is required for good start ability at any ambient temperature. A11B /FM 1008/F diesel engines should be preheated before attempting to start the engine. Further, Deutz recommends that all applications be fitted with an automatic glow plug controller system such as is detailed below. The use of a glow plug control circuit will insure the proper amount of preheat at all temperatures.

Glow Plug Specifications: Nominal Voltage- 12.5V  
 Current Absorption-12/14A at 5 seconds  
 Sheath Temperature-850°C at 5 seconds

**COMPONENTS:**

- 1 Sheath
- 2 Primary Heating Coil
- 3 Secondary Heating Coil

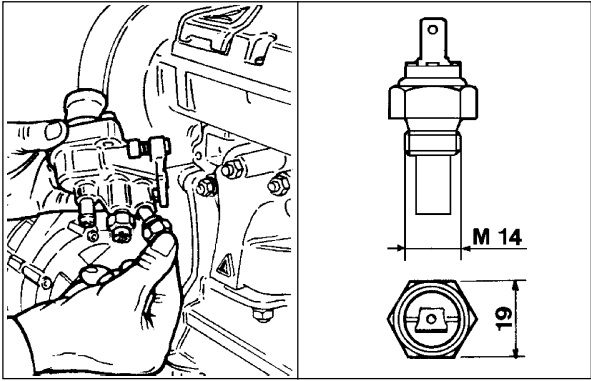
NOTE: GLOW PLUG TORQUE- 20Nm



**GLOW PLUG CONTROLLER / RELAY WITH COOLANT TEMP. SENSOR**

As discussed above, a glow plug control circuit is available. The glow plug controller acts as both a load relay and timer. The timer function is a function of coolant temperature as measured by a temperature sensor (thermistor) as shown below. An electrical schematic of the glow plug control circuit is shown on page 65.

THERMISTOR		GLOW PLUG HEAT TIME (sec)	
Resistance (ohms)	Coolant Temp. (°C)	Pre-heat	Post-heat
7000	-20	26.5±3	5 (+2, -1)
2400	0	15.0±1.5	5 (+2, -1)
1000	+20	9.5±1	5 (+2, -1)
460	+40	7.0±1	5 (+2, -1)
≤320	+50	0	0



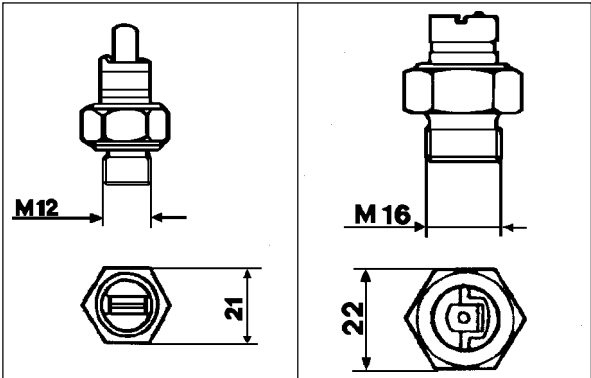
**TEMPERATURE SENSOR (THERMISTOR)**

The thermistor is located on the thermostat housing, adjacent to the high coolant temperature switch. The thermistor must be installed in the thermostat housing in the port located nearest to the cylinder head. (see the figure to the left)

THERMISTOR SPECIFICATIONS:  
 Temperature Range: 30-50°C  
 Voltage Range: 6-24V  
 Maximum Temperature: 150°C  
 Installation Torque: 30 Nm

Oil Pressure (Low) Switch- N.C.

Coolant Temperature (High) Switch- N.O.



**OIL PRESSURE (LOW) SWITCH, COOLANT TEMPERATURE (HIGH) SWITCH**

**Oil Pressure (low) Switch Specifications:**

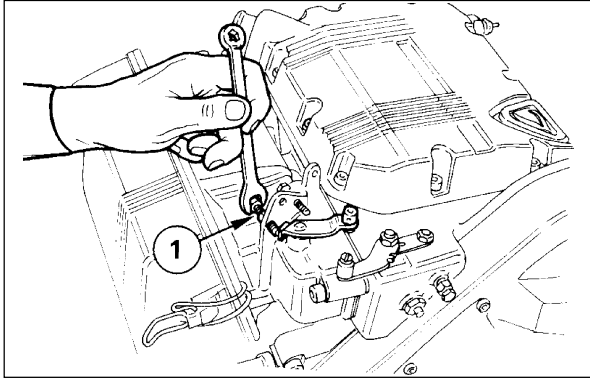
General: Single Pole, N.C.  
 Opening Pressure: 0.15 - 0.45 bar  
 Installation Torque: 25 Nm

**Coolant Temperature (High) Switch Specifications:**

General: Single Pole, N.O.  
 Closing Temp.: 107 / 113°C  
 Max. Power Absorption: 3 W  
 Voltage Range: 6 / 24V  
 Installation Torque: 25 Nm



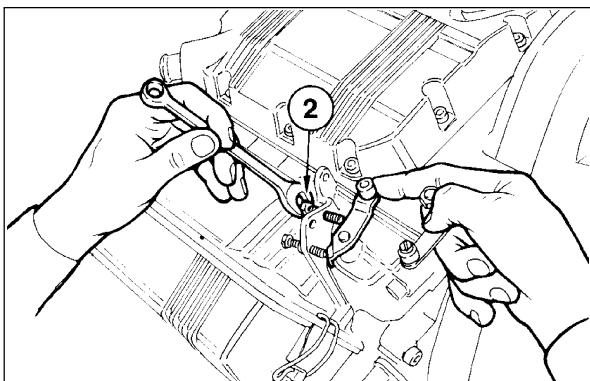
## VIII TESTING- OPERATIONAL ADJUSTMENTS



### IDLE SPEED ADJUSTMENT

1. Check and/or fill the engine with coolant and engine oil. Fill the engine or machine fuel tank with fuel.
2. Attach or set-up a calibrated tachometer.
3. Start the engine and allow a 10 Minute warm-up period.
4. Remove all loads from the engine.
5. Loosen the locknut at position (1). Adjust screw (1) until an idle speed of 850 - 900 r/min is achieved.
6. Tighten the locknut at position (1).

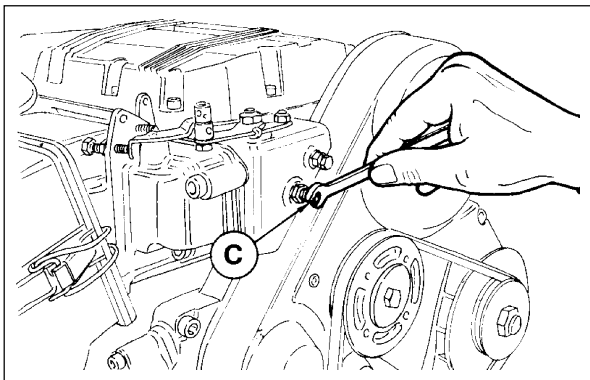
NOTE: Rotating the screw (1) clockwise increases the idle speed, while rotating the screw (1) counter-clockwise reduces the idle speed.



### HIGH (MAXIMUM) SPEED ADJUSTMENT

1. Check and/or fill the engine with coolant and engine oil. Fill the engine or machine fuel tank with fuel.
2. Attach or set-up a calibrated tachometer.
3. Start the engine and allow a 10 Minute warm-up period.
4. Remove all loads from the engine.
5. Loosen the lock nut at position (2). Simultaneously adjust screw (2) and hold the throttle lever at full travel as shown until the maximum speed is 3800 r/min.
6. Tighten the locknut at position (2).

NOTES: Rotating screw (2) clockwise will reduce the maximum speed, while rotating the screw (2) counter-clockwise will allow a higher maximum speed. Setting the maximum no-load speed at 3800 r/min will allow for 3600 r/min operation when the engine is fully loaded. Some fine adjustment may be required after the engine is applied within the given machine.

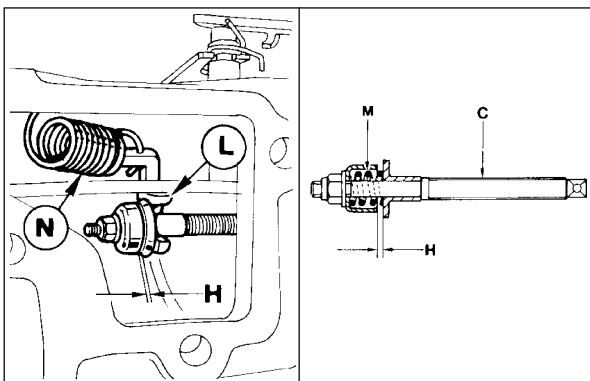


### TORQUE DEVICE ADJUSTMENT (WITHOUT DYNAMOMETER)

Deutz dynamometer. Therefore, the adjustment procedure presented in the following is only approximate.

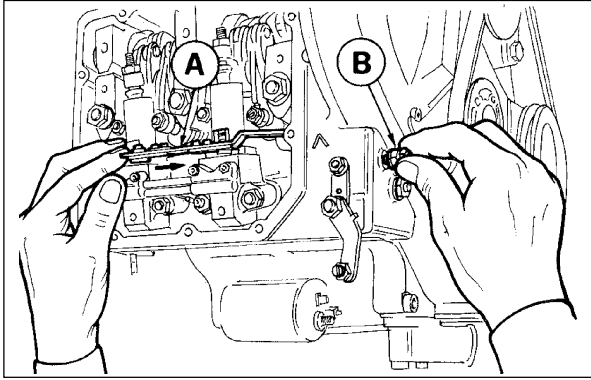
**WARNING: ADJUSTMENT OF THE TORQUE DEVICE WILL REQUIRE THE USE OF TOOLS IN CLOSE PROXIMITY TO THE COOLING FAN. DO NOT PERFORM THIS OPERATION WITHOUT A PROPER FAN GUARD IN PLACE. USE EXTREME CARE NOT TO ALLOW TOOLS OR BODY PARTS TO COME IN CONTACT WITH THE COOLING FAN, FAN SUPPORT OR FAN BELT.**

1. Loosen the torque device locknut at point (C).
2. Rotate the torque device (C) clockwise several revolutions.
3. Tighten the torque device locknut.
4. Start the engine, allow to warm and lock the speed at 3800 r/min.
5. Loosen the locknut at position (C).
6. Rotate the torque device (C) counter-clockwise until the speed begins to reduce.
7. Rotate the torque device (C) clockwise 2.5 revolutions.
8. Tighten the locknut at position (C).



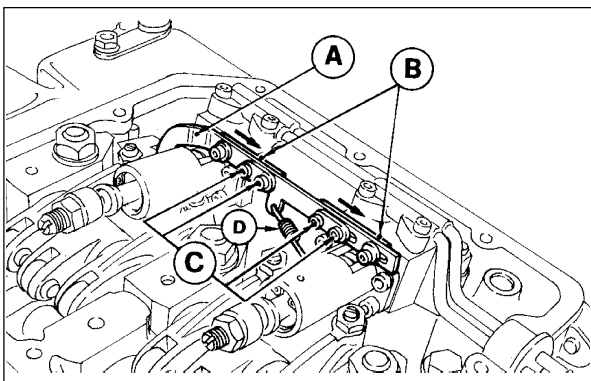
### TORQUE DEVICE DETAILS

The torque device (C) serves two (2) primary functions. First, the torque device limits the maximum power output by limiting maximum fuel delivery. Fuel delivery is limited by controlling the travel of lever (L), thus the injection control rack. Secondly, the torque device (C) provides a torque rise in the engine as the fuel delivery is limited. As the governor spring (N) pulls the lever (L) toward the torque device (C) during high load situations, an additional travel equivalent to (H) is allowed providing for the maximum fuel delivery and maximum engine torque. The distance (H) is a direct function of the internal torque device spring (M). (H) is typically equal to 0.4 mm.



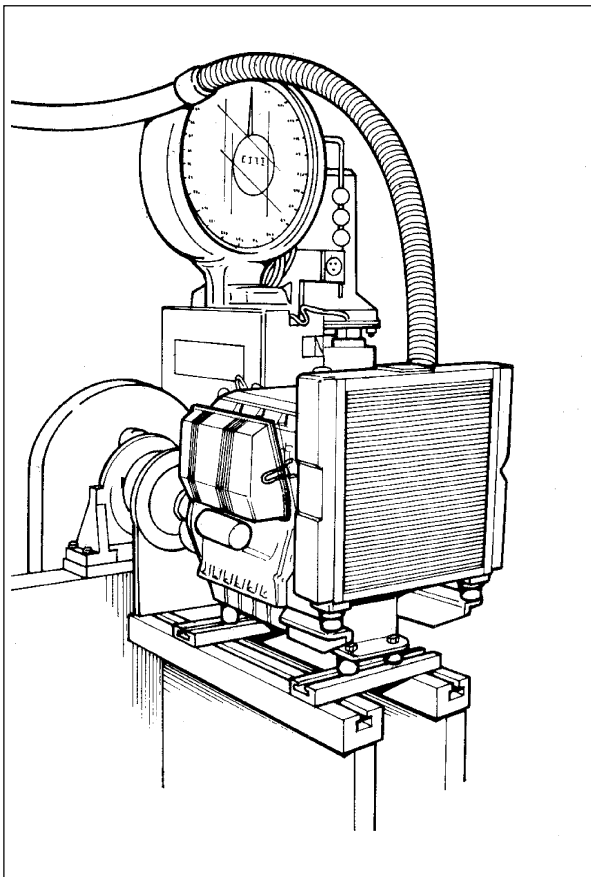
## INJECTION PUMP CONTROL ROD STROKE LIMIT ADJUSTMENT

1. Remove the valve/ rocker cover.
2. Loosen bolt (B) completely.
3. Push the injection pump control rod toward the fan end of the engine and hold in position as shown.
4. Rotate screw (B) clockwise until contact is made with the control rod.
5. Rotate screw (B) clockwise an additional 1/2 to 1 turn.
6. While holding screw (B) in position and preventing rotation, tighten the locknut.
7. Replace the valve cover following the instructions from page 29.



## GOVERNOR / UNIT INJECTOR RACK ADJUSTMENT

1. Remove the valve/ rocker cover.
2. Loosen screws (C).
3. Make sure that starting aid spring (D) is connected to the control arm (A) as shown.
4. Push the control arm (A) fully toward the flywheel ("right" as shown).
5. Slide each plate (B)- (One(1) per unit injector) toward the flywheel ("right as shown").
6. While holding the plates in the direction shown tighten screws (C) at each unit injector.
7. Torque screws (C) to 1.1Nm

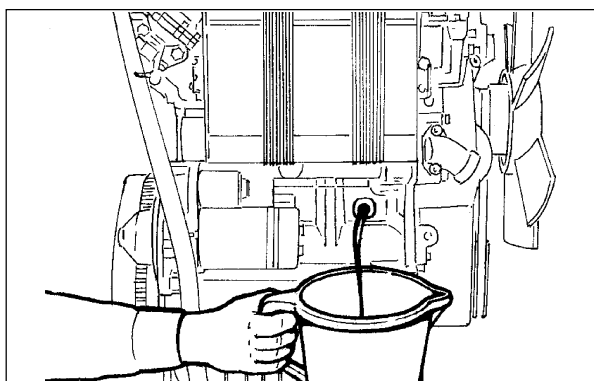
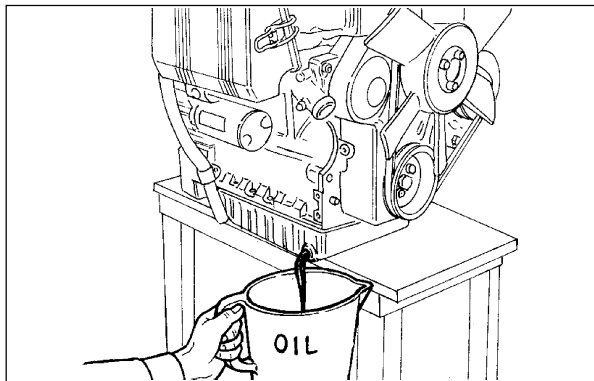


## POWER, TORQUE DEVICE and SPEED ADJUSTMENTS- DYNAMOMETER METHOD. (SEE WARNINGS REGARDING TORQUE DEVICE ADJUSTMENT ON PAGE 73)

1. Assemble the engine to the dyno. Fill the engine with fluids. Start the engine and allow an idling warm-up of 5 minutes.
2. Loosen the torque device locknut and rotate the torque device several revolutions clockwise. Tighten the locknut.
3. Adjust the engine speed and dynamometer load as required.
4. Allow the engine to stabilize thermally.
5. Check the specific fuel consumption. If the fuel consumption is not within specification, remove the load, allow the engine to cool and re-adjust the governor and fuel delivery rates. Repeat steps 1-4.
6. Rotate the torque device counterclockwise until the engine speed begins to fall. Lock the torque device locknut.
7. Remove the dyno load while maintaining the existing throttle position. Note the speed increase for purposes of droop calculation.
8. Allow the engine to cool at idle speed for 10 minutes.

DYN0 TEST PARAMETERS- kW and SPECIFIC FUEL CONSUMPTION				
ENGINE	r/min	NB Output (kW)	Specific Fuel Consumption	
			Sec./100cc	g/kW*hr
F 2M 1008	2200	7.4	147-155	265-279
	3600	10.3	89-93	326-340
F 3M 1008	2200	11.1	99-105	261-274
	3600	15.6	58-60	328-342
F 4M 1008	2200	22.0	75-79	258-272
	3600	20.2	44-45.8	326-340
BF 4M 1008	3600	28.5	35-36	284-290

## IX STORAGE



### STORAGE

Measures should be taken to protect your B/FM 1008/F series engine if the engine is not operated for a period of 30 days or more. Proper storage will protect the engine from corrosion and prevent costly repairs due to storage induced problems.

### STORAGE - 1 to 6 MONTHS

- 1 Start and idle the engine at a no-load condition for 15 minutes.
- 2 Stop the engine, allow the engine to cool enough to safely drain the oil as shown. Reinstall the oil drain plug, then fill the crankcase with MIL-L-644-P9 protectant oil. Fill the fuel tank with a high grade fuel preservative (add-mix) such as STA-BIL per the manufacturer recommendations.
- 3 Start and operate the engine at 3/4 speed for 5-10 minutes.
- 4 Stop the engine, allow to cool enough to safely drain the engine oil as shown. Reinstall the oil drain plug.
- 5 Refill the engine with standard recommended lubricating oil. See page 17.
- 6 Drain the fuel tank. Remove the fuel filter. Install a new fuel filter.
- 7 Carefully clean all debris from the radiators fins.
- 8 Remove the intake manifold. Rotate the engine until the intake valve opens at each cylinder. Using suitable means, pour approximately one(1) teaspoon of engine oil into each cylinder. Rotate the engine several revolutions. Spray the inside of the intake manifold with SAE 10 W oil. Replace the intake manifold using a new gasket
- 9 Spray the inside of the exhaust manifold with SAE 10 W oil.
- 10 Cover all openings with tape.
- 11 Apply grease to any and all unpainted surfaces.
- 12 Loosen the fan belt
- 13 Wrap the engine in plastic film and store in a dry place off of the ground and away from any high voltage source.

### STORAGE - IN EXCESS OF 6 MONTHS

Perform the storage preparation procedures approximately as detailed above, except with the following changes.

1. Replace the oil in step 2 above with MIL-L-21260 P 10, grade 2, SAE 30W rustproof oil.
- 2 Delete step 5 from above.
- 3 Delete step 11 from above.
- 4 Coat any and all unpainted surfaces with MIL-C 16173D, grade 3 anti-rust grease.
- 5 Replace the anti-freeze solution every two (2) years by draining the crankcase water jacket as shown and refilling with a pre-mixed coolant solution according to the prevailing lowest ambient temperatures and the recommendations from page 17.

### PREPARING THE ENGINE FOR USE AFTER STORAGE

1. Remove all plastic wraps and protective tape.
- 2 Clean all grease, dirt and oil from the exterior of the engine.
- 3 Drain the oil.
- 4 Drain the coolant as shown.
- 5 Refill the engine with the recommended lubricating oil (page 17). Install a new oil filter.
- 6 Refill the engine with the recommended anti-freeze / coolant (page 19)
7. Remove the injectors. Test and repair the injectors as required.
- 8 Pour a teaspoon of oil into each cylinder. Rotate the engine several revolutions.
- 9 Reassemble the injectors, adjust the governor, adjust the valves.
- 10 Inspect the fuel tank for rust and corrosion. Clean as required.
11. Fill the fuel tank with fresh fuel. Install a new fuel filter.
- 12 Install a new air filter.
- 13 Carefully start the engine and allow to idle for 20 minutes. Repeat step 5.

NOTE: If the engine has been stored for more than six (6) months, remove the oil pan and inspect several engine bearings to make sure no corrosion damage has taken place.





Knowing it's DEUTZ.

DEUTZ AG  
Service-Technik  
Instandhaltungstechnik Motoren  
Deutz-Mülheimer Str. 147-149  
D-51057 Köln  
Tel.: ++49 (0)2 21-8 22-0  
Fax: ++49 (0)2 21-8 22-53 58  
<http://www.deutz.de>

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