

Workshop Manual

B/FM 1008/F



Workshop Manual

F2M 1008

F3M 1008

F4M 1008

BF4M 1008

F2M 1008 F

F3M 1008 F

F4M 1008 F

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FOREWORD

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

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

The Manual has been laid out to ensure quick comprehension of the contents, i. e. illustrations have been placed adjacent to the brief text passages to clearly show the working operations.

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

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

This Workshop Manual is not subject to engineering change service and is valid until next issue.

Therefore please refer to the information in our Technical Circulars when carrying out repairs.

General information:

- Please read carefully and observe the instructions given in this Workshop Manual to avoid accidents and ensure that your engine always functions properly and reliably.
- Make sure that this Workshop Manual is readily available for all those carrying out repairs or adjustments and that the contents are well understood.
- Non-compliance with these repair instructions may result in malfunction and engine damage as well as personal injuries for which the manufacturer shall not accept any liability.
- The accident prevention regulations and all other generally recognized regulations on safety and occupational medicine are to be observed.
- A prerequisite for successful repair is that all required equipment, hand and special tools are available and in perfect working order.
- Optimal operation economy, reliability and durability of the engine can only be ensured when genuine parts of DEUTZ AG are used.
- Engine components such as springs, clamps, snap rings, etc. may cause injury if not handled with care.
- Engine repairs must be carried out in accordance with intended use as defined by the equipment manufacturer. For conversions, only parts approved by DEUTZ AG for a specific purpose should be used.

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This manual contains pertinent information regarding the repair of DEUTZ water-cooled, indirect injection Diesel engines type B/FM 1008/F.

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TROUBLESHOOTING CHART-B/FM 1008/F SERIES

TROUBLESHOOTING CHART- B/FM 1008/F SERIES

POSSIBLE CAUSE	SYMPTOM													
	Engine will not crank	Engine does not start	Engine starts, but stops	Poor acceleration	Unsteady RPM	Black smoke	White smoke	Blue smoke	Low oil pressure	Oil level rising	Excessive oil consumption	Wet exhaust	Overheating	Engine knocks
Low fuel level		.	.		.									
Fuel supply/ return lines clogged										
Clogged fuel tank vent			.		.									
Fuel pump faulty		.	.							.				
Fuel entrained with air										
Unit injector(s) faulty/ worn			
Unit injector settings incorrect	
Injection pump rack sticking		.		.	.									
Oil level too high			
Improper oil viscosity											.	.	.	
Oil diluted by fuel									
Oil pressure relief valve faulty									.					
Oil pick-up tube clogged									.					
Oil pump air entrained at pick-up tube									.					
Glow plugs faulty		.					.							
Glow plug controller faulty		.												
Glow plug relay inoperable		.												
Starter defective	.													
Battery voltage too low	.													
Battery / battery cable connections corroded	.													
Key switch defective	.													
Air filter clogged		
Excessive idle / light load operation								
Incomplete engine run-in								.			.	.		
Engine overloaded		
Excessive parasitic load	.	.				.								
Valve lash insufficient / excessive	
Injection timing out of spec- advanced	
Injection timing out of spec- retarded		.		.		.								
Governor linkage adjustment incorrect										
Governor spring fatigued or defective		.		.	.									
Idle rpm too low		.	.											
Piston rings worn or stuck			
Piston worn or damaged	
Cylinders worn or damaged	
Valves / valve guides worn			
Valves sticking			
Bearings (main / rod) worn									.				.	.
Governor / governor linkage malfunction									
Cylinder head gasket damaged		.					.						.	
Thermostat stuck or malfunctioning													.	
Engine seized	.													
Radiator clogged (external or internal)													.	
Coolant pump faulty													.	
Turbocharger faulty				

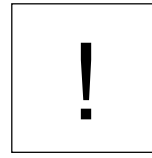
SAFETY AND WARNING DECALS

DANGER



Failure to comply with the instructions could result in damage to persons and property

CAUTION



Failure to comply with the instructions could lead to technical damage to the machine and/or system



SAFETY INSTRUCTIONS



- Deutz Engines are built to supply their performances in a safe and long-lasting way. To obtain these results, it is essential for users to comply with the servicing instructions given in the relative manual along with the safety recommendations listed below.
- The engine has been made according to a machine manufacturer's specifications and all actions required to meet the essential safety and health safeguarding requisites have been taken, as prescribed by the current laws in merit. All uses of the engine beyond those specifically established cannot therefore be considered as conforming to the use defined by Deutz which thus declines all liability for any accidents deriving from such operations.
- The following indications are dedicated to the user of the machine in order to reduce or eliminate risks concerning engine operation in particular, along with the relative routine maintenance work.
- The user must read these instructions carefully and become familiar with the operations described. Failure to do this could lead to serious danger for his personal safety and health and that of any persons who may be in the vicinity of the machine.
- The engine may only be used or assembled on a machine by technicians who are adequately trained about its operation and the deriving dangers. This condition is also essential when it comes to routine and, above all, extraordinary maintenance operations which, in the latter case, must only be carried out by persons specifically trained by Deutz and who work in compliance with the existing documentation.
- Variations to the functional parameters of the engine, adjustments to the fuel flow rate and rotation speed, removal of seals, demounting and refitting of parts not described in the operation and maintenance manual by unauthorized personnel shall relieve Deutz from all and every liability for deriving accidents or for failure to comply with the laws in merit.
- On starting, make sure that the engine is as horizontal as possible, unless the machine specifications differ. In the case of manual start-ups, make sure that the relative actions can take place without the risk of hitting walls or dangerous objects, also considering the movements made by the operator. Pull-starting with a free cord (thus excluding self-winding starting only), is not permitted even in an emergency.
- Make sure that the machine is stable to prevent the risk of overturning.

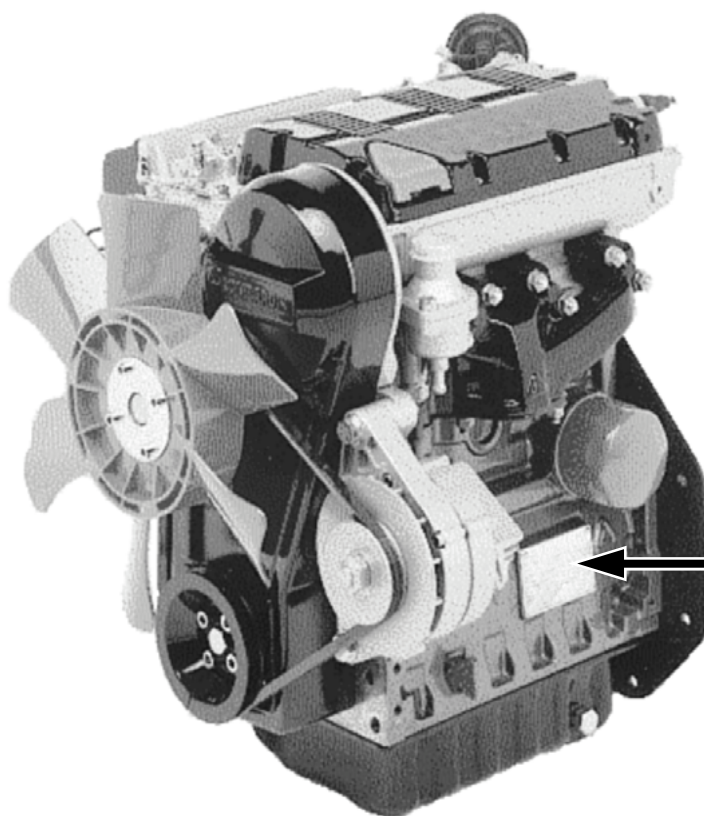
SAFETY AND WARNING DECALS - SAFETY INSTRUCTIONS

- Become familiar with how to adjust the rotation speed and stop the engine.
- Never start the engine in a closed place or where there is insufficient ventilation. Combustion creates carbon monoxide, an odourless and highly poisonous gas. Lengthy stays in places where the engine freely exhausts this gas can lead to unconsciousness and death.
- The engine must not operate in places containing inflammable materials, in explosive atmospheres, where there is dust that can easily catch fire unless specific, adequate and clearly indicated precautions have been taken and have been certified for the machine.
- To prevent fire hazards, always keep the machine at least one meter from buildings or from other machinery.
- Children and animals must be kept at a due distance from operating machines in order to prevent hazards deriving from their operation.
- Fuel is inflammable. The tank must only be filled when the engine is off. Thoroughly dry any spilt fuel and move the fuel container away along with any rags soaked in fuel or oil. Make sure that no soundproofing panels made of porous material are soaked in fuel or oil. Make sure that the ground or floor on which the machine is standing has not soaked up any fuel or oil.
- Fully tighten the tank plug each time after refuelling. Do not fill the tank right to the top but leave an adequate space for the fuel to expand.
- Fuel vapour is highly toxic. Only refuel outdoors or in a well ventilated place.
- Do not smoke or use naked flames when refuelling.
- The engine must be started in compliance with the specific instructions in the operation manual of the engine and/or machine itself. Do not use auxiliary starting aids that were not installed on the original machine (e.g. Startpilot').
- Before starting, remove any tools that were used to service the engine and/or machine. Make sure that all guards have been refitted.
- During operation, the surface of the engine can become dangerously hot. Avoid touching the exhaust system in particular.
- Before proceeding with any operation on the engine, stop it and allow it to cool. Never carry out any operation whilst the engine is running.
- The coolant fluid circuit is under pressure. Never carry out any inspections until the engine has cooled and even in this case, only open the radiator plug or expansion chamber with the utmost caution, wearing protective garments and goggles. If there is an electric fan, do not approach the engine whilst it is still hot as the fan could also start operating when the engine is at a standstill. Only clean the coolant system when the engine is at a standstill.
- When cleaning the oil-cooled air filter, make sure that the old oil is disposed of in the correct way in order to safeguard the environment. The spongy filtering material in oil-cooled air filters must not be soaked in oil. The reservoir of the separator pre-filter must not be filled with oil.
- The oil must be drained whilst the engine is hot (oil T ~ 80°C). Particular care is required to prevent burns. Do not allow the oil to come into contact with the skin.
- Make sure that the drained oil, the oil filter and the oil it contains are disposed of in the correct way in order to safeguard the environment.
- Pay attention to the temperature of the oil filter when the filter itself is replaced.
- Only check, top up and change the coolant fluid when the engine is off and cold. Take care to prevent fluids containing nitrites from being mixed with others that do not contain these substances since "Nitrosamine", dangerous for the health, can form. The coolant fluid is polluting and must therefore be disposed of in the correct way to safeguard the environment.
- During operations that involve access to moving parts of the engine and/or removal of rotating guards, disconnect and insulate the positive wire of the battery to prevent accidental short-circuits and to stop the starter motor from being energized.
- Only check belt tension when the engine is off.
- Only use the eyebolts installed by Deutz to move the engine. These lifting points are not suitable for the entire machine; in this case, the eyebolts installed by the manufacturer should be used.

I GENERAL

All pertinent information needed for engine identification and spare parts ordering can be accessed from the engine data plate. Additionally, the maximum engine speed, ^aK^o number and approval codes are included on the engine data plate. The location of the data plate, as shown below, is identical for all DEUTZ B/FM 1008/F industrial engines. Please supply the engine data plate information to your Authorized DEUTZ Distributor or Dealer when ordering replacement parts or when making technical inquiries.

			DEUTZ AG		
			LOMBARDINI		
MotorTyp			MotorNr.		
<input type="text"/>			<input type="text"/>		
KW	l/min	Code			
<input type="text"/>	<input type="text"/>	<input type="text"/>			
MADE IN EC					



POWER RATINGS FOR B/FM 1008/F GENSET SPEC DIESEL ENGINES

CONTINUOUS (NA) RATING- kW

ENGINE MODEL	1500 r/min	1800 r/min	3000 r/min	3600 r/min
F2M 1008	4.5	5.4	9.0	9.9
F3M 1008	6.7	8.1	14.0	14.9
F4M 1008	9.0	10.8	18.9	19.9
BF4M 1008	11.7	14.0	24.8	25.8
F2M 1008 F	5.0	5.9	9.9	10.6
F3M 1008 F	7.7	9.0	14.9	16.3
F4M 1008 F	9.9	11.7	19.8	22.8

NOTE: THE ABOVE RATINGS ARE FLYWHEEL OUTPUT, NOT ELECTRICAL GENSET OUTPUT

INTERMITTENT (NB) RATING- kW

ENGINE MODEL	1500 r/min	1800 r/min	3000 r/min	3600 r/min
F2M 1008	5.0	6.0	10.0	11.0
F3M 1008	7.5	9.0	15.5	16.5
F4M 1008	10.0	12.0	21.0	22.0
BF4M 1008	13.0	15.5	27.5	28.5
F2M 1008 F	5.5	6.5	11.0	11.7
F3M 1008 F	8.5	10.0	16.5	18
F4M 1008 F	11.0	13.0	22.0	25

NOTE: THE ABOVE RATINGS ARE FLYWHEEL OUTPUT, NOT ELECTRICAL GENSET OUTPUT

POWER RATING STANDARDS

NB- ISO 3046/1-IFN - Maximum intermittent rating with no overload capacity; operation with constant speed and variable load.

NA- ISO 3046/1-ICXN- Continuous rating with 10% intermittent overload allowed; operation with constant speed and constant load.

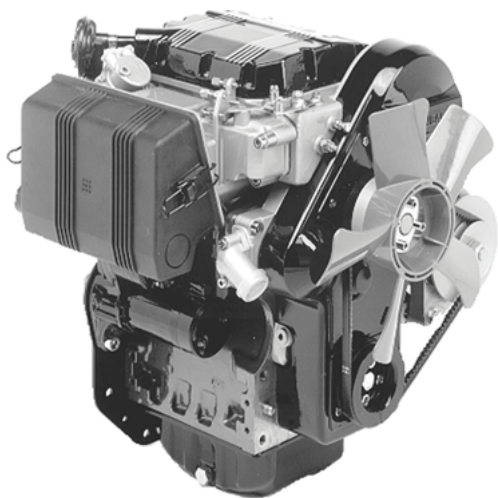
Standard Rating Conditions: 25°C, 100kPa Total Barometric Pressure, 30% Relative Humidity.

Standard Production Power Tolerance = +/- 5%

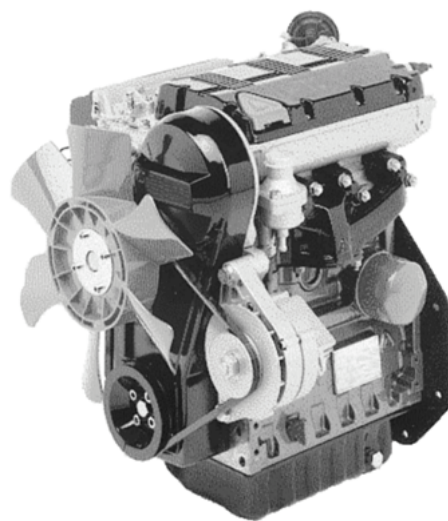
Standard/ General Derations: 2% per 5°C increase in temperature over 25°C; 1% per 100m over mean sea level

B/FM 1008 SERIES- TECHNICAL SPECIFICATIONS AND CAPACITIES				
TECHNICAL SPECIFICATIONS	F2M 1008	F3M 1008	F4M 1008	BF4M 1008
No. of Cylinders	2	3	4	4
Firing Order	1-2	1-3-2	1-3-4-2	1-3-4-2
Cylinder Bore (mm)	72	72	72	72
Cylinder Stroke (mm)	75	75	75	75
Displacement (cc)	611	916	1222	1222
Aspiration Type	Natural	Natural	Natural	Turbo
Compression Ratio	22.8:1	22.8:1	22.8:1	22.8:1
RPM- maximum	3600	3600	3600	3600
Power- (N)- ISO 1585- KW(CV)- @3600 r/min	11.8(16.0)	17.2(23.4)	24.4(33.2)	31.0(42.0)
Power- (Nb)- ISO 3046-1 IFN- KW(CV)- @3600 r/min	10.3(14.0)	15.6(21.2)	22.0(30.0)	28.5(38.7)
Power- (Na)- ISO 3046-1 ICXN- KW(CV)- @3600 r/min	9.2(12.5)	13.7(18.6)	19.9(27.0)	25.8(35.0)
Torque(MAX)/rpm @Nb output, (Nm)	34.5/2200	53.5/2000	75.1/2200	98/2400
Maximum Torque Available @ N0. 3 PTO (Nm)	37/1800	37/1800	37/1800	37/1800
Fuel Consumption (Nb)@3600 rpm- (g/KWh)	282	300	290	305
Oil Consumption (Na)- (Kg/hr)	0.007	0.012	0.017	0.019
Dry Weight- (Kg)	65	85	96	101
Inclination (max)- (30 seconds)	35°	35°	35°	35°
Inclination (max)- (60 seconds)	30°	30°	30°	30°
Inclination (continuous)- APPLICATION DEPENDENT	****	****	****	****
Axial Load (max) on Crankshaft (both directions)- (Kg)	300	300	300	300
Radial (side) Load - APPLICATION DEPENDENT	****	****	****	****
**** - CONTACT DEUTZ APPLICATION ENGINEERING DEPARTMENT FOR DETAILS				

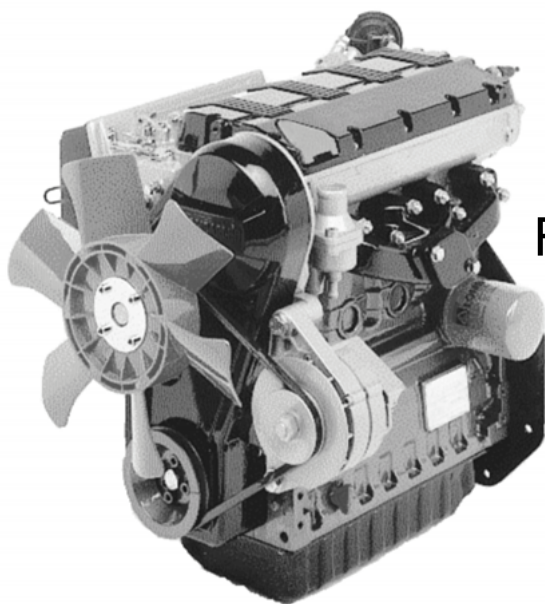
FLUID CAPACITIES (STANDARD)				
TECHNICAL SPECIFICATIONS	F2M 1008	F3M 1008	F4M 1008	BF4M 1008
Oil Capacity (including oil filter)- (liters)	1.6	2.4	3.2	4.3
Oil Capacity (less oil filter)- (liters)	1.5	2.3	3.0	4.1
Coolant Capacity (including std. radiator)- (liters)	4.0	4.9	6.0	7.5
Coolant Capacity (engine only)- (liters)	0.9	1.3	1.8	2.0
Fuel Tank-standard (OPTIONAL)- (liters)	4.3	10.0	15.0	15.0
NOTE: The above cooling system capacities (including radiator) assume that the radiator fitted to your Deutz B/FM 1008 series diesel engine is the standard Deutz radiator. Different OEM machines may or may not be fitted with a standard Deutz radiator. Always refer to your equipment documentation for capacity details.				



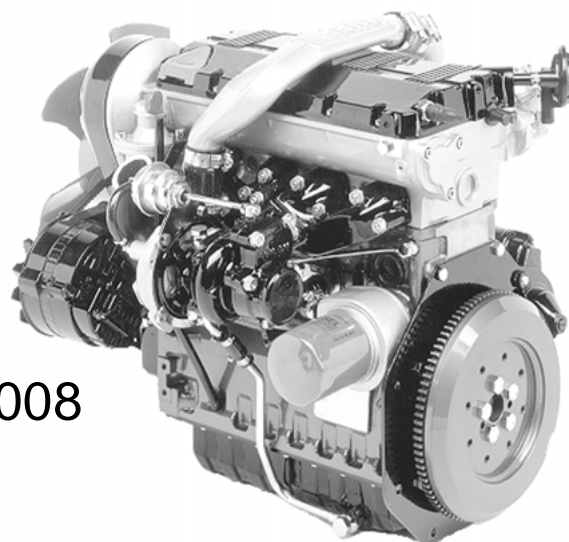
F2M 1008



F3M 1008



F4M 1008

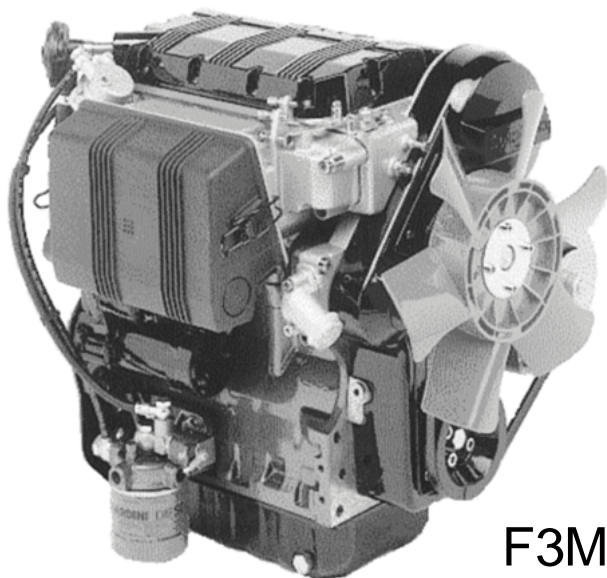
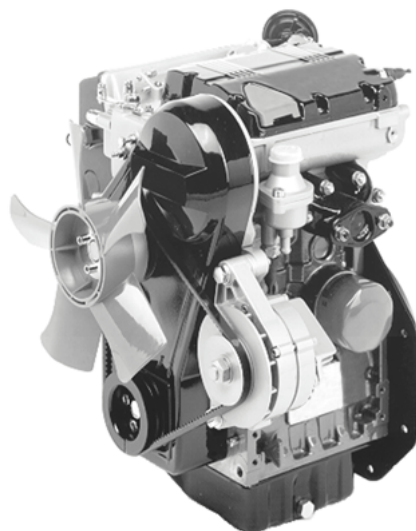


BF4M 1008

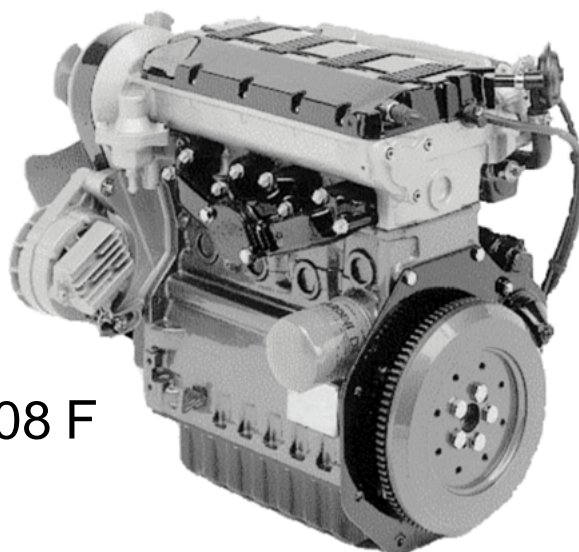
FM 1008 F SERIES- TECHNICAL SPECIFICATIONS AND CAPACITIES			
TECHNICAL SPECIFICATIONS	F2M 1008 F	F3M 1008 F	F4M 1008 F
No. of Cylinders	2	3	4
Firing Order	1-2	1-3-2	1-3-4-2
Cylinder Bore (mm)	75	75	75
Cylinder Stroke (mm)	77.6	77.6	77.6
Displacement (cc)	686	1028	1372
Aspiration Type	Natural	Natural	Natural
Compression Ratio	22.8:1	22.8:1	22.8:1
RPM- maximum	3600	3600	3600
Power- (N)- ISO 1585- KW(CV)- @3600 r/min	13(17.7)	20(27.2)	27.2(36.7)
Power- (Nb)- ISO 3046-1 IFN- KW(CV)- @3600 r/min	11.7(16)	18(24.5)	25(34)
Power- (Na)- ISO 3046-1 ICXN- KW(CV)- @3600 r/min	10.6(14.4)	16.3(22.2)	22.8(31)
Torque(MAX)/rpm @Nb output, (Nm)	40/2200	59/2200	82.5/2200
Maximum Torque Available @ N0. 3 PTO (Nm)	37/1800	37/1800	37/1800
Fuel Consumption (Nb)@3600 rpm- (g/KWh)	320	300	325
Oil Consumption (Na)- (Kg/hr)	0.009	0.013	0.019
Dry Weight- (Kg)	66	87	98
Inclination (max)- (30 seconds)	35°	35°	35°
Inclination (max)- (60 seconds)	30°	30°	30°
Inclination (continuous)- APPLICATION DEPENDENT	****	****	****
Axial Load (max) on Crankshaft (both directions)- (Kg)	300	300	300
Radial (side) Load - APPLICATION DEPENDENT	****	****	****
**** - CONTACT DEUTZ APPLICATION ENGINEERING DEPARTMENT FOR DETAILS			

FLUID CAPACITIES (STANDARD)			
TECHNICAL SPECIFICATIONS	F2M 1008	F3M 1008	F4M 1008
Oil Capacity (including oil filter)- (liters)	1.6	2.4	3.2
Oil Capacity (less oil filter)- (liters)	1.5	2.3	3.0
Coolant Capacity (including std. radiator)- (liters)	2.3	4.9	6.0
Coolant Capacity (engine only)- (liters)	0.9	1.3	1.7
Fuel Tank-standard (OPTIONAL)- (liters)	4.3	4.3	10.0
NOTE: The above cooling system capacities (including radiator) assume that the radiator fitted to your Deutz FM 1008 F series diesel engine is the standard Deutz radiator. Different OEM machines may or may not be fitted with a standard Deutz radiator. Always refer to your equipment documentation for capacity details.			

F2M 1008 F



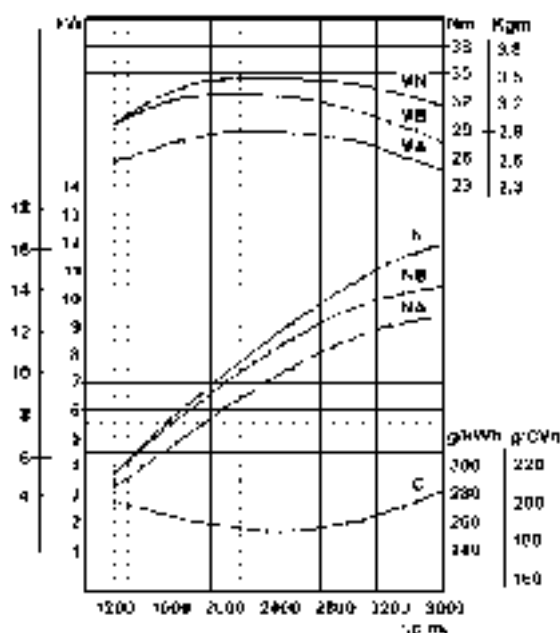
F3M 1008 F



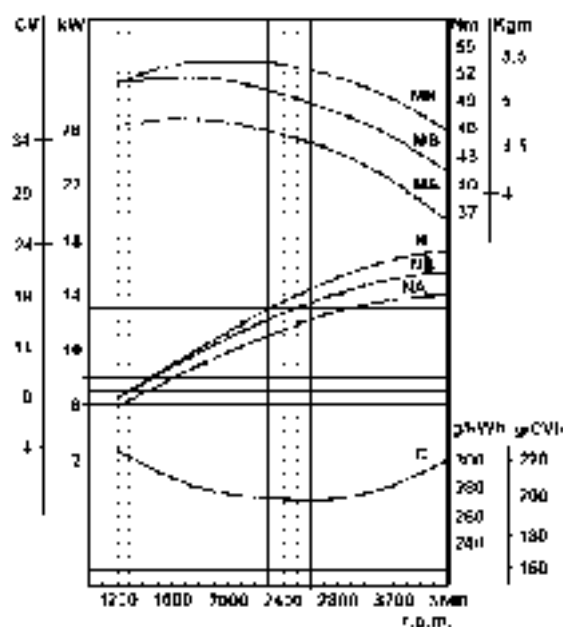
F4M 1008 F

POWER, TORQUE AND SPECIFIC FUEL CONSUMPTION CURVES F2/3M 1008

F2M 1008



F3M 1008



N - 80/1269/CEE- ISO 1585, Gross automotive rating- intermittent operation with variable speed and variable load.

NB- ISO 3046/1-IFN - Maximum intermittent rating with no overload capacity; operation with constant speed and variable load.

NA- ISO 3046/1-ICXN- Continuous rating with 10% intermittent overload allowed; operation with constant speed and constant load.

M(X)- Torque at N, NB and NA ratings respectively.

C- Specific fuel consumption at NB rating.

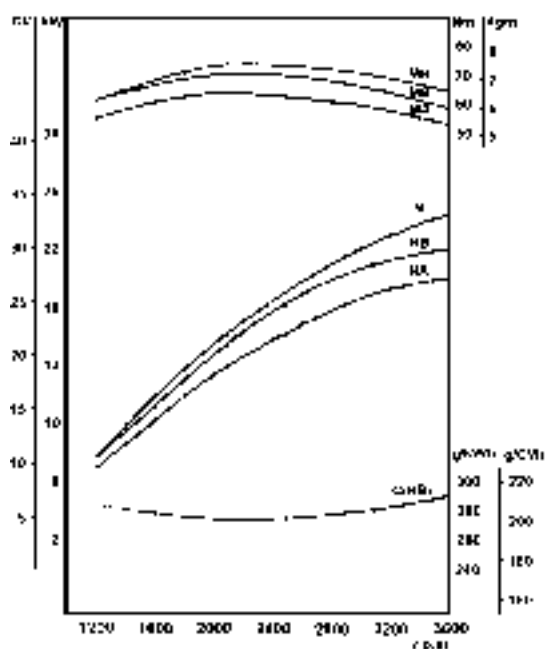
Standard Rating Conditions: 25°C, 100kPa Total Barometric Pressure, 30% Relative Humidity.

Standard Production Power Tolerance = +/- 5%

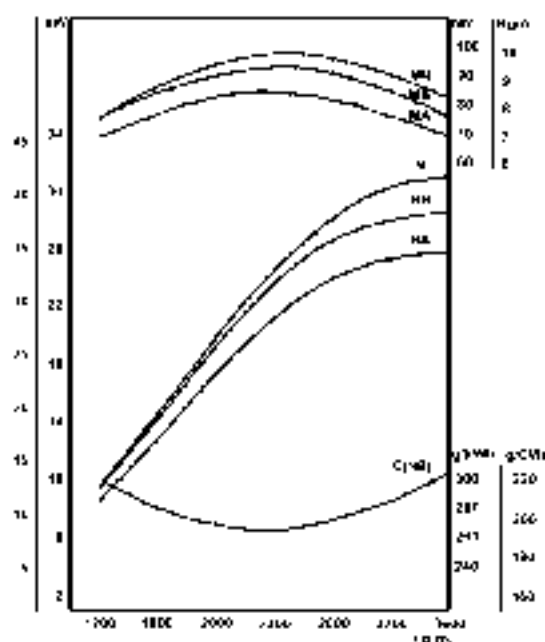
Standard/ General Derations: 2% per 5°C increase in temperature over 25°C; 1% per 100m over mean sea level

POWER, TORQUE AND SPECIFIC FUEL CONSUMPTION CURVES F4M 1008, BF4M 1008

F4M 1008



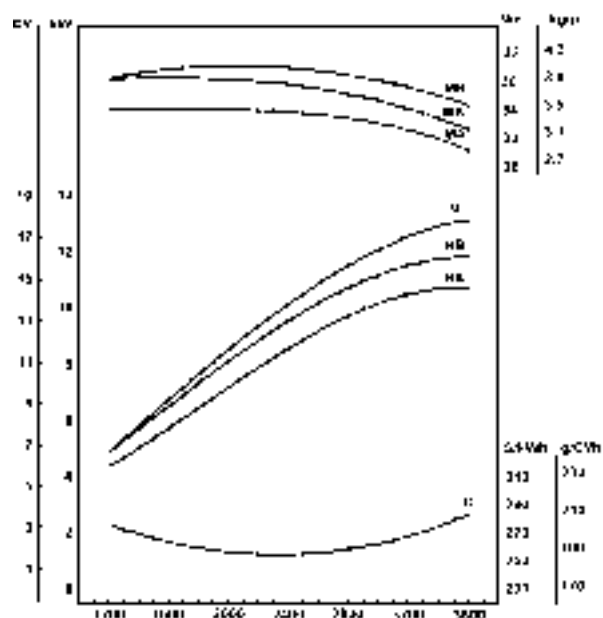
BF4M 1008



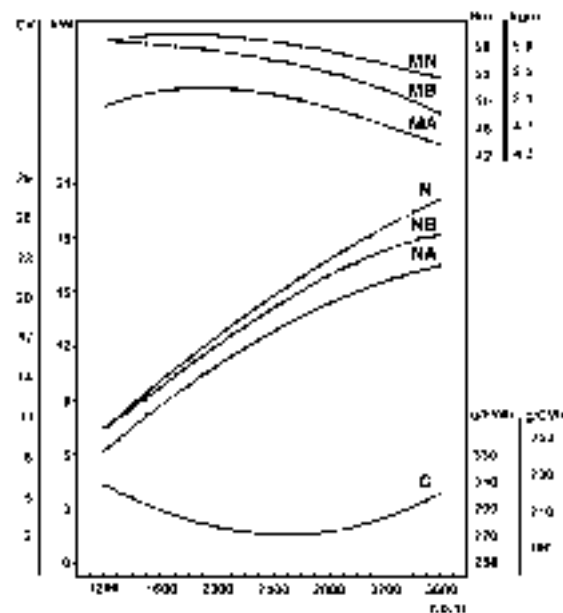
N - 80/1269/CEE- ISO 1585, Gross automotive rating- intermittent operation with variable speed and variable load.
NB- ISO 3046/1-IFN - Maximum intermittent rating with no overload capacity; operation with constant speed and variable load.
NA- ISO 3046/1-ICXN- Continuous rating with 10% intermittent overload allowed; operation with constant speed and constant load.
M(X)- Torque at N, NB and NA ratings respectively.
C- Specific fuel consumption at NB rating.
Standard Rating Conditions: 25°C, 100kPa Total Barometric Pressure, 30% Relative Humidity.
Standard Production Power Tolerance = +/- 5%
Standard/ General Derations: 2% per 5°C increase in temperature over 25°C; 1% per 100m over mean sea level

POWER, TORQUE AND SPECIFIC FUEL CONSUMPTION CURVES F2/3/4M 1008 F

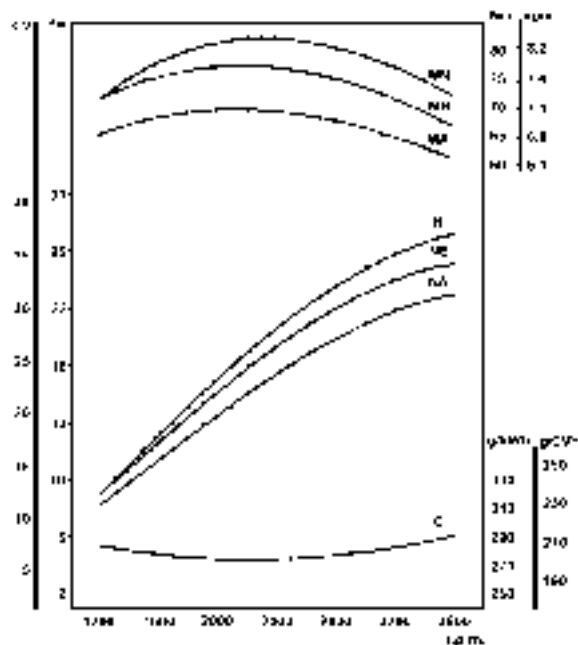
F2M 1008 F



F3M 1008 F



F4M 1008 F



N - 80/1269/CEE- ISO 1585, Gross automotive rating- intermittent operation with variable speed and variable load.

NB- ISO 3046/1-IFN - Maximum intermittent rating with no overload capacity; operation with constant speed and variable load.

NA- ISO 3046/1-ICXN- Continuous rating with 10% intermittent overload allowed; operation with constant speed and constant load.

M(X)- Torque at N, NB and NA ratings respectively.

C- Specific fuel consumption at NB rating.

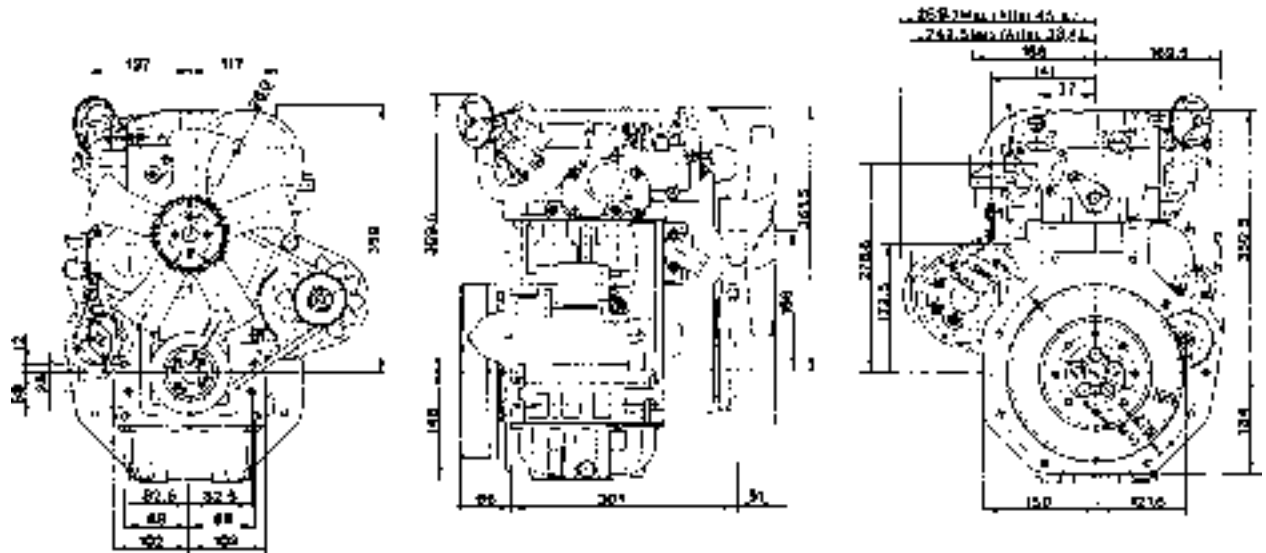
Standard Rating Conditions: 25°C, 100kPa Total Barometric Pressure, 30% Relative Humidity.

Standard Production Power Tolerance = +/- 5%

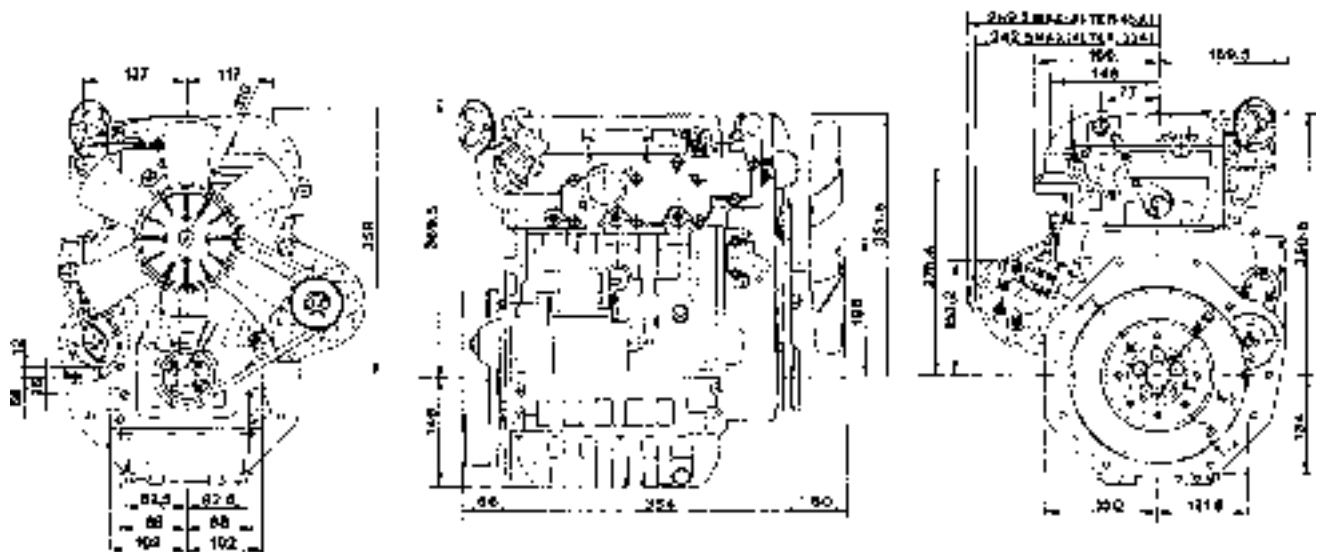
Standard/ General Derations: 2% per 5°C increase in temperature over 25°C; 1% per 100m over mean sea level

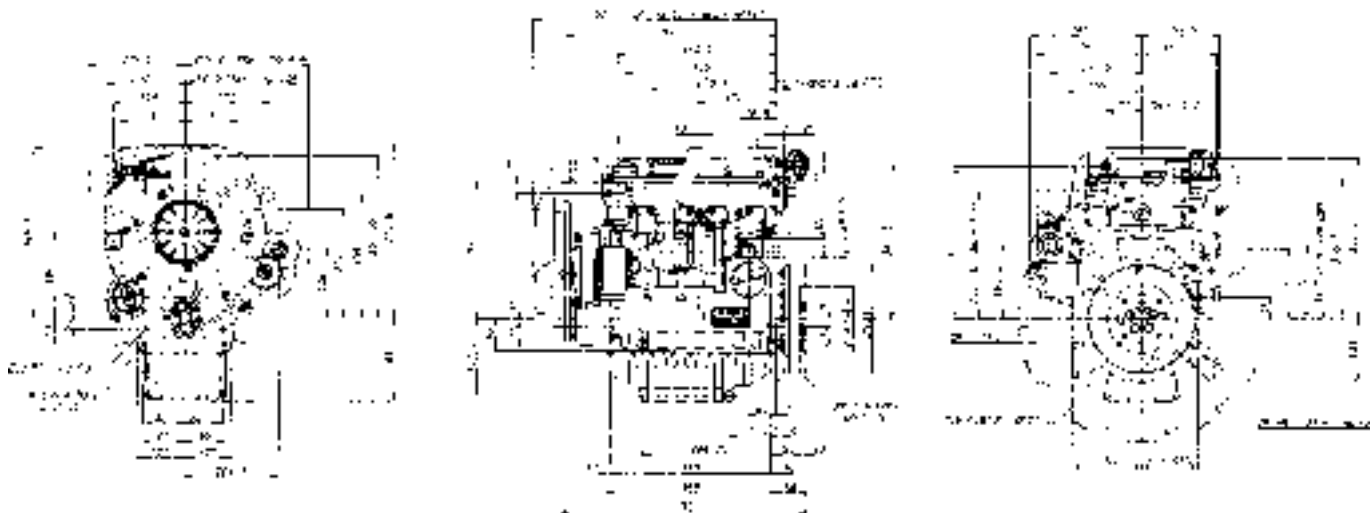
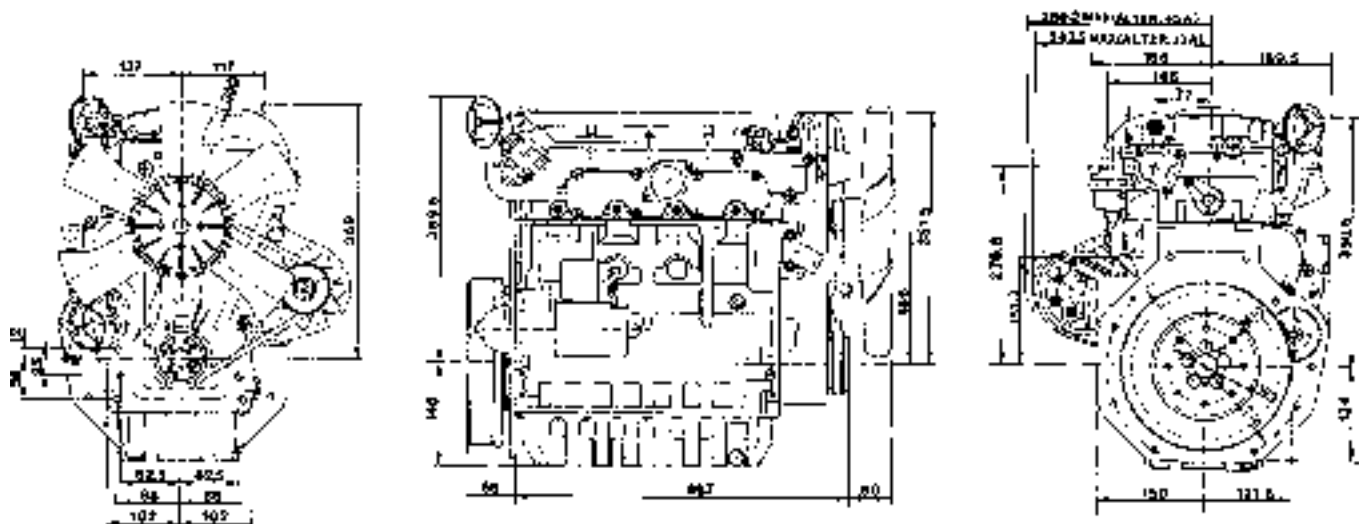
GENERAL ENGINEERING DRAWINGS- F2/3M 1008

F2M 1008



F3M 1008



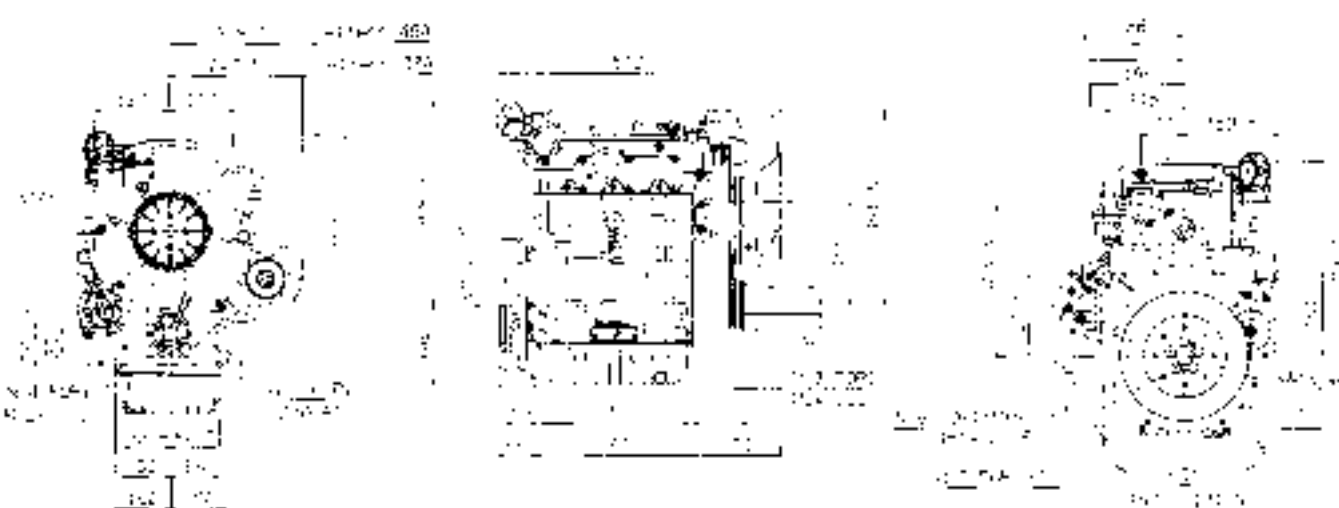


GENERAL ENGINEERING DRAWINGS- F2/3/4M 1008 F

F2M 1008 F



F3M 1008 F



F4M 1008 F



I GENERAL

! Failure to carry out the operations described in the table may lead to technical damage to the machine and/or system

B/FM 1008/F SERIES MAINTENANCE SCHEDULE

MAINTENANCE OPERATION	MAINTENANCE INTERVAL						
	10 hours or DAILY	50 hours	125 hours	250 hours	500 hours	1000 hours	2500 hours
OIL LEVEL CHECK (D)	.						
COOLANT LEVEL CHECK (D)	.						
FAN/ ALTERNATOR BELT INSPECTION (.)	.						
AIR FILTER ELEMENT CHECK (DRY TYPE) (*)	see note						
AIR FILTER CHECK (OIL BATH TYPE) (**)	.						
RADIATOR CORE INSPECTION (⊙)	.						
FLUID LEAK INSPECTION- GENERAL (.)	.						
SAFETY GUARD INSPECTION (.)	.						
OIL REPLACEMENT- INITIAL ONLY-(see RECOMMENDED OIL TYPE)		.					
OIL FILTER REPLACEMENT - INITIAL ONLY		.					
OIL REPLACEMENT- (see RECOMMENDED OIL TYPE)			.				
OIL FILTER REPLACEMENT				.			
FUEL FILTER REPLACEMENT				.			
COOLANT HOSE INSPECTION				.			
FAN/ ALTERNATOR BELT TENSION ADJUSTMENT				.			
VALVE ADJUSTMENT					.		
FAN/ ALTERNATOR BELT REPLACEMENT					.		
FUEL INJECTION SYSTEM ADJUSTMENT					.		
CLEAN FUEL TANK (⊙)						.	
COOLANT REPLACEMENT (***)						.	
REPLACE TIMING BELT							.

- (D) Add fluid(s) as required
 (.) After inspection, adjust, repair or replace as required
 (⊙) Clean as often as required
 (*) Replace air filter after air filter restriction switch indication or one(1) year. DEUTZ does not recommend the removal of air filter elements for purposes of inspection.
 (**) Service oil bath filter element (upper and lower) as required. Replace reservoir oil as required.
 NOTE: In dusty conditions, service the oil bath air filter every four(4) hours.
 (***) Replace coolant every 1000 hours or 2 years

NOTES: 1. USE ONLY GENUINE DEUTZ REPLACEMENT PARTS.
 2. USE ONLY DEUTZ APPROVED FLUIDS.



The engine could be damaged if allowed to operate with insufficient oil. It is also dangerous to add too much oil as its combustion could sharply increase the rotation speed.

Use a suitable oil in order to protect the engine.

The lubrication oil influences the performances and life of the engine in an incredible way.

Use of an inferior quality oil or failure to regularly change the oil will increase the risk of piston seizure, may make the compression rings 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.

Oil viscosity must suit the ambient temperature in which the engine operates.



Old 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 inevitable, you are advised to thoroughly wash your hands with soap and water as soon as possible.

Appropriate protective gloves etc should be wore during this operation.

Old oil is highly polluting and must be disposed of in the correct way. Do not litter.

RECOMMENDED OIL

AGIP SINT 2000 5W40 specification API SJ/CF ACEA A3-96

B3-96 MIL-L-46152 D/E.

ESSO ULTRA 10W40 specification API SJ/CF ACEA A3-96

MIL-L-46152 D/E.

In countries where AGIP and ESSO products are not available, use API SJ/CF oil for gasoline-fuelled engines or oil that complies with military specification MIL-L-46152 D/E.

OIL SUPPLY (liters) F2M 1008/F

Standard oil sump

filter included 1.6

filter excluded 1.5

OIL SUPPLY (liters) F3M 1008/F

Standard oil sump

filter included 2.4

filter excluded 2.3

OIL SUPPLY (liters) F4M 1008/F

Standard oil sump

filter included 3.2

filter excluded 3.0

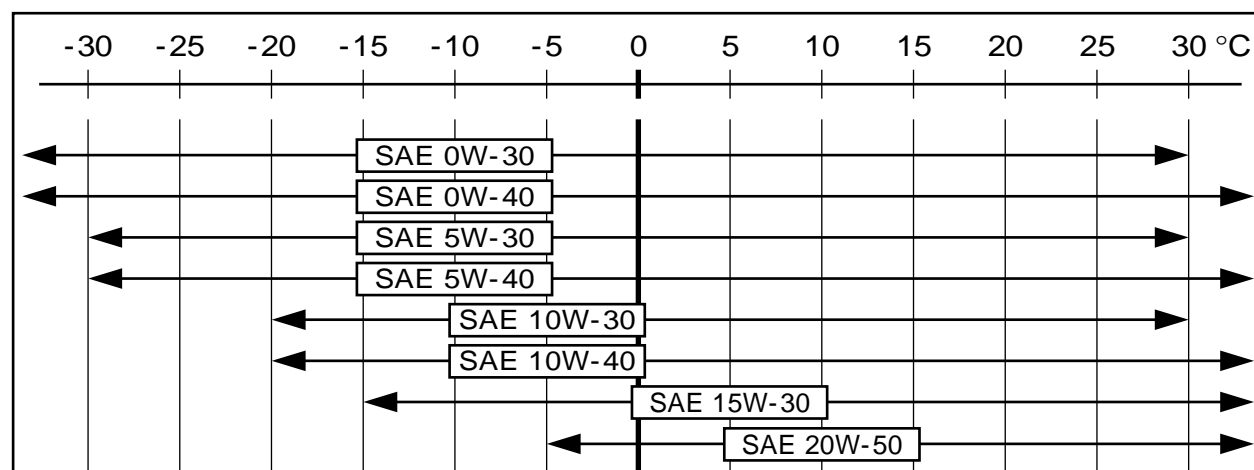
OIL SUPPLY (liters) BF4M 1008

Standard oil sump

filter included 4.3

filter excluded 4.1

GRADE



I GENERAL

DIESEL FUEL SPECIFICATIONS

Diesel fuel must be clean, fresh, meet Deutz fuel specifications and be sourced from a known and reputable supplier. Clean, fresh and properly specified diesel fuel will provide assurances of maximum engine performance and maximum fuel injection system longevity. The use of out-of-spec, dirty or questionable quality diesel fuel will result in engine performance and start ability problems as well as reductions in engine and fuel injection system life.

Deutz diesel engines are designed to operate on No. 2 diesel fuel. However, some geographical areas, by virtue of cold winter temperatures, change the diesel fuel supply depot to No. 1 diesel fuel in winter months. No. 2 diesel fuel provides maximum viscosity and lubricity but can have ^awaxing^o problems at lower temperature. Deutz expressly recommends the use of No. 2 diesel fuels when temperatures are above -10°C (14°F). Deutz recommends that No. 1 diesel fuel be used when temperatures are at or below -10°C (14°F). Deutz allows the use of either EPA- High Sulfur, off-highway diesel fuel or EPA- Low Sulfur, on-highway fuel for non-CARB certified engines. CARB certified engines must consume only EPA- low sulfur diesel fuels conforming to EPA 40 CFR 86-113-94. For general non-CARB certified engines, Deutz highly recommends that either low sulfur or high sulfur fuel be used on a continuous basis. Mixing the usage of low sulfur and high sulfur fuels can cause complications within the fuel injection system and thus is not recommended.

Deutz does not recommend the use of ^aheating oil^o, blended fuel/ waste engine oil, or low grade diesel fuel of any kind. The use of aviation fuels- JP4, JP5 or JP8 must be approved on an application basis and is not recommended for broad range commercial applications.

EPA FUEL SPECIFICATIONS (No. 2 DIESEL FUEL):

	ASTM TEST	EPA 40CFR 86.113-90 (OFF-HIGHWAY FUEL)	EPA 40CFR 86.113-94 (ON-HIGHWAY FUEL)
CETANE NUMBER	D613	42-50	40-48
DISTILLATION RANGE			
BP	D86	340-400°F (171.1-204.4°C)	340-400°F (171.1-204.4°C)
10% point	D86	400-460°F (204.4-237.8°C)	400-460°F (204.4-237.8°C)
50% point	D86	470-540°F (243.3-282.2°C)	470-540°F (243.3-282.2°C)
90% point	D86	550-610°F (287.8-321.1°C)	560-630°F (287.8-321.1°C)
EP	D86	580-660°F (304.4-348.9°C)	610-690°F (304.4-348.9°C)
GRAVITY (API)	D287	33-37	33-37
TOTAL SULFUR (pct.)	D129 D2622	0.2-0.5	0.03-0.05
HYDROCARBONS			
AROMATICS (min. pct.)	D1319	27	27
PARAFFINS, OLEFINS, NAPHTHENES (pct.)	D1319	73	73
FLASHPOINT	D93	130°F (54.4°C)	130°F (54.4°C)
VISCOSITY (CSt)	D445	2.0-3.2	2.0-3.2
NOTE: BY LAW, EPA 40CFR 86.113-90 FUEL MUST BE DYED RED.			

FUEL QUALITY/ STORAGE:

No. 1 and No. 2 Diesel fuel degrades with time. No. 2 diesel fuel has a storage life of approximately one(1) year. No. 1 diesel fuel has a maximum storage life of two(2) years. Further, storage of diesel fuel in contaminated storage tanks can lead to excessive impurities within the stored fuel. As such, aged or contaminated diesel fuel should not be consumed by Deutz diesel engines. Aside from the specifications listed above, fuel measured to have total insolubles > 1mg/100mg, organic matter > 1mg/100ml or rust/mineral matter > 2mg/ml should not be consumed by Deutz diesel engines.

ANTI-FREEZE / COOLANT SPECIFICATIONS/ DETAILS- B/FM 1008/F SERIES

Ethylene Glycol based Anti-freeze / coolant usage is required for all Deutz B/FM 1008/F series engines. Never operate a B/FM 1008/F engine with the cooling system filled with water only. The purpose of the anti-freeze/coolant is three-fold. First the anti-freeze/coolant mixture prevents or reduces the potential for corrosion within the cooling system. Secondly, the anti-freeze/coolant increases the boiling point of the cooling fluid, reducing the potential for localized boiling within the engine and engine overheat in general. Lastly, the anti-freeze/coolant reduces the freezing point of the engine coolant, thereby reducing or preventing potential engine damage caused by freezing.

Many different brands and types of anti-freeze are available in the market. Some anti-freeze/coolants are designed exclusively for automotive type cooling systems with aluminum cooling system components. Other anti-freeze/coolants are designed exclusively for use within heavy-duty, predominately cast iron cooling systems and require that the coolant solution be ^acharged^o with a Supplemental Coolant Additive (SCA). Other anti-freeze solutions are designed for long life and are sometimes designated ^apermanent^o.

Deutz recommends only those anti-freeze/coolants which are ethylene glycol based and designed to protect aluminum coolant components- thus, automotive anti-freeze/coolant. Long life anti-freeze/coolants may be used so long as the anti-freeze/coolant is changed at least every two(2) years as is required by the Deutz maintenance schedule. Deutz does not recommend the use of low silicate heavy duty anti-freeze/coolants which may or may not require the use of SCA's. The following provides guidelines for the selection of acceptable anti-freeze/coolants for B/FM 1008/F series diesel engines.

ANTI-FREEZE/COOLANT CONCENTRATION

Deutz recommends that the minimum anti-freeze/coolant concentration be 30% when mixed with distilled water. Concentrations below 30% will not provide adequate corrosion protection. Deutz further recommends that the maximum allowable anti-freeze/coolant concentration be 60% when mixed with distilled water. Concentrations of anti-freeze/coolant in excess of 60% provide no appreciable additional freeze protection and can actually reduce the heat rejection capability of the cooling system. As such, Deutz recommends that an anti-freeze / coolant mixture of 50% anti-freeze/coolant and 50% distilled water be used for most general applications. In general terms the freezing points of anti-freeze/coolant solutions (ethylene glycol based) with respect to concentration is 30%/ -15°C(5°F); 40%/ -24°C(-12°F); 50%/ -37°C(-34°F); 60%/ -52°C(-62°F). Please refer to the details regarding freezing points as supplied from your anti-freeze/coolant supplier for more exact information.

WATER SPECIFICATIONS

Deutz recommends that the engine cooling fluid solution be made up of the ethylene glycol based anti-freeze/coolant and distilled water. Further, we realize that the use of distilled water is not always practical. The quality of the base water does play a large role in the overall chemical composition of the coolant solution and the corrosion prevention characteristics of the solution. As such, tap water may be used as long as the water meets the following specifications with reference to SAE j1941:




PROPERTY	SPECIFICATION	TEST METHOD
Total Solids (max.)	340ppm	ASTM D1888
Total Hardness (max. CaCO ₃)	170ppm	ASTM D1126
Chloride (max.)	40ppm	ASTM D512
Sulfate (max. SO ₄)	100ppm	ASTM D516
pH	5.5-9.0	ASTM 1293

ANTI-FREEZE COOLANT MINIMUM RECOMMENDATIONS/ SPECIFICATIONS

Deutz recommends that only automotive type anti-freeze/coolants be used in B/FM 1008/F series diesel engines. These anti-freeze/coolants are typically ^aHigh Silicate^o, although not always, and are designed to prevent corrosion in cooling systems with aluminum components. The chosen coolant should meet or exceed ASTM 3306 and SAE j1034. Further, the chosen anti-freeze/coolant should pass ASTM D4340, ASTM D1384 and ASTM D2570 corrosion tests as detailed within SAE j1034.

NOTE: Many brands/ products meet the specifications presented above and may be used within Deutz B/FM 1008/F series diesel engines. The engine owner is responsible for determining the suitability of any given anti-freeze/coolant to the minimum specifications provided. Failure to follow the above coolant guidelines may impact the engine warranty.



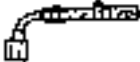






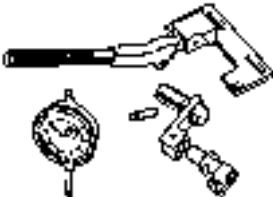




I GENERAL

DRIVING TORQUES FOR STANDARD SCREWS						
DENOMINATION						
Diameter x pitch (mm)	R ≥ 800 N/mm ²		R ≥ 1000 N/mm ²		R ≥ 1200 N/mm ²	
	Nm	Kgm	Nm	Kgm	Nm	Kgm
4x0.70	3.6	0.37	5.1	0.52	6	0.62
5x0.80	7	0.72	9.9	1.01	11.9	1.22
6x1.00	12	1.23	17	1.73	20.4	2.08
7x1.00	19.8	2.02	27.8	2.84	33	3.40
8x1.25	29.6	3.02	41.6	4.25	50	5.10
9x1.25	38	3.88	53.4	5.45	64.2	6.55
10x1.50	52.5	5.36	73.8	7.54	88.7	9.05
13x1.75	89	9.09	125	12.80	150	15.30
14x2.00	135	13.80	190	19.40	228	23.30
16x2.00	205	21.00	289	29.50	347	35.40
18x2.50	257	26.30	362	37.00	435	44.40
20x2.50	358	36.60	504	51.50	605	61.80
22x2.50	435	44.40	611	62.40	734	74.90
24x3.00	557	56.90	784	80.00	940	96.00

SEALANT and THREAD LOCK LOCATIONS/ DETAILS			
LOCATION	DETAIL	SEALANT / THREAD LOCK DEUTZ DW (LOCTITE BRAND)	
Valve / Rocker Cover	12 mm Crankcase Vent Tube	35	Ø
Oil Filter Nipple	M20x1.5 Hollow Nipple	55	Ø
Camshaft Bearing Retainer Bolts	M6	59	Ø
Timing Belt Idler Stud to Crankcase	M10	55	Ø
Crankcase	M12x1.5 Plug	Ø	242
Cylinder Head	18 mm Plug	Ø	510
Cylinder Head	M6x1.0 Stud	55	Ø
Crankcase and Cylinder Head	Welch Plugs (30 mm)	Ø	510
Thermostat housing	M 8x1.25	67	Ø

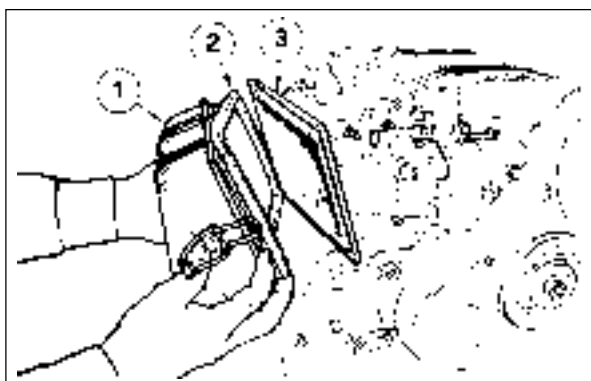
CRITICAL TORQUE SPECIFICATIONS			
POSITION/ LOCATION	Page No. Ref.	Diameter/ Pitch (mm)	TORQUE (Nm)
Injection Pump Control Rod (Rack Adjustment)	78	M3 (special)	1.1
Injection Pump Control Rod to Unit Injector Rack Bolt	34	M3 (special)	1.2
Fuel Rail	34	M4x0.7	4
Connecting Rod (***)	44	M8x1.00	40
Piston Cooling Jet (BF4M 1008)		M8X1.5	12
Glow Plugs		M12x1.25	25
Valve / Rocker Cover	33	M6x1.00	9
Main Bearing Cap	47	M10	60
Oil Pan	40	M6	10
Camshaft Roller Bearing Retainer		M6	10
Glow Plug Wire Nut		M5x0.8	5
Timing Belt Idler	28	M10	40
Stop Lever Nut		M8x1.25	8
Unit Injector Retainer Nut	30	M8	20 (*)
Rocker Arm Support	35	M10	40
Fuel Pump Eccentric	34	M10x1.25	80
Oil Seal Support (Flywheel Side)		M6	12
Pre-chamber Ring Nut	40	M30x1.5	(**)
Governor Fork Pivot		M6x1.00	7
Crankshaft Pulley (V)	26	M16x1.5 (Left Hand)	360
Camshaft Timing Pulley	27	M10x1.25	80
Oil Pressure Switch		M12x1.5	25
Oil Pan Plug		M12x1.5	40
Cylinder Head	46	SEE MANUAL FOR DETAILS	
Flywheel	26	M10x1.5	80
<p>(*) Torque the unit injector retaining nuts alternately in 5 Nm steps</p> <p>(**) Torque the pre-chamber ring nut to 100 Nm first, then torque to 180 Nm.</p> <p>(***) Torque aluminum connecting rods to 35 Nm.</p>			

I GENERAL

SPECIAL TOOLS	DESCRIPTION	PART No.
	Fuel delivery equalization tool. Allows the adjustment of individual unit injector fuel delivery.	7107-090
	Pre-chamber removal tool.	7107-030
	Static timing tool	7107-024
	Main bearing cap lateral seal installation tool.	7107-053
	Unit injector ring nut tool.	7107-029
	Pre-chamber ring nut tool.	7107-027
	Pre-chamber index.	7107-031
	Union for static timing adjustment/ testing.	7107-028
	Valve guide seal installation tool.	7107-047
	T.D.C. determination fixture.	7107-048
	Timing Belt tension tool.	7107-049
	Flywheel/ Ring gear engine locking tool.	7107-051
	Static timing kit for ^a low pressure ^o testing/ adjustment.	7107-074 7107-056 (See pg. 55 for details)
	V-belt tension gauge	8115

Please order all your special tools direct from
Messr. Wilbär, D-42826 Remscheid, Postfach 14 05 80, Fax 02191 / 8 10 92

WARNING: Always exercise extreme care when performing engine service work. Refer to and understand the safety guidelines presented on page 3. Additionally, some engine components have sharp edges which could cause cuts if not handled properly. Wear hand protection. Further, some engine components are heavy. As such, wear foot protection to protect from accidental drops of engine components. Always use proper form and procedures when lifting engine components. Ask for help or assistance if in doubt concerning the lifting or manipulation of the engine or engine components. The use of compressed air is required for some operations. Compressed air can be dangerous. Do not direct compressed air towards yourself or others. Do not allow bearings to spin while drying with compressed air. The use of cleaning solvents is also required for certain service operations. When ^aSOLVENT^o is recommended, a commercially available, low-toxicity, degreasing solvent such as ^aSAFETY-KLEEN^o should be used. Wear hand and eye protection and avoid direct contact with solvents.



DRY TYPE AIR FILTER- STANDARD ENGINE MOUNTED

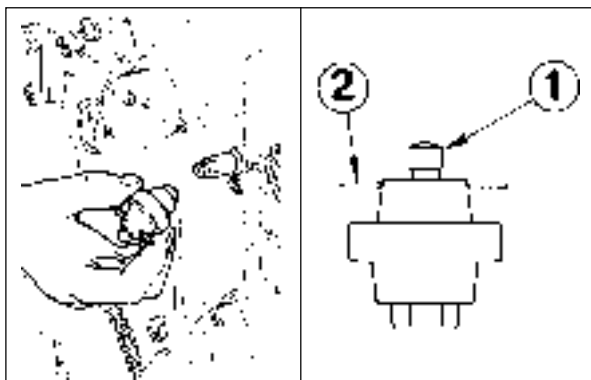
Components:

- 1 Cover
- 2 Filter Element
- 3 Support

Air Filter Specifications:

Filtration Level 13-14 micron
Filtration Area 4470 cm²- F2/3M 1008/F
Filtration Area 7150 cm²- F4M 1008/F

INSPECTION: Inspect the air filter cover for cracks, heat damage or warpage. Replace as required.

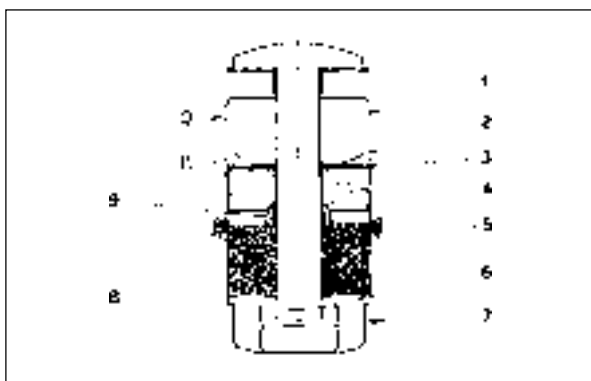


AIR RESTRICTION SWITCH

B/FM 1008/F diesel engines that are supplied with engine mounted, panel type air filters as shown above, are fitted with an air filter restriction switch. The purpose of the air restriction switch is to signal the engine operator, via a lamp or otherwise, of a high air filter restriction condition. The electrical connections for the signal is provided at (2) as shown. Following a signal from the restriction switch, the switch must be reset. Reset the switch by pushing button (1) until the button latches. The restriction switch is set to 600/650 mm-H₂O. After the restriction signal, the air filter should be replaced at once. Do not clean the air filter element. Operation in a high restriction condition could cause excessive oil consumption, low power output, engine overheating and potentially engine damage.

Components:

- 1 Reset Button
- 2 .25" Tab Connection

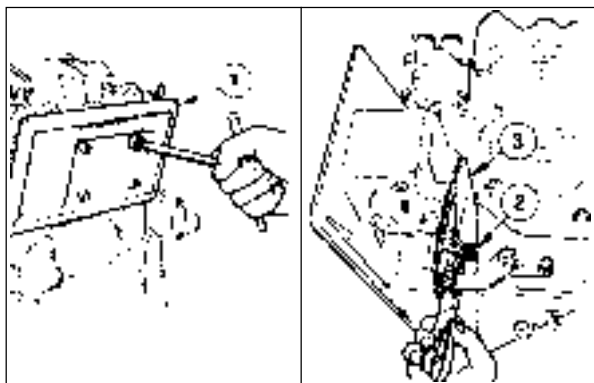


OIL BATH AIR FILTER

- | | |
|------------------------------|-----------------------------------|
| 1 Upper Housing | 6 Oil level reference mark (on 7) |
| 2 Diaphragm Seat | 7 Reservoir bowl |
| 3 Diaphragm | 8 Outer seal ring |
| 4 Polyurethane upper element | 9 Inner seal ring |
| 5 Metal wool lower element | |

SERVICE INSTRUCTIONS: Check the sealing rings regularly. Replace the sealing rings if hardening or damage is noted. Inspect the air filter housing and bowl- replace if damaged. Carefully clean the reservoir bowl and both elements with clean diesel fuel. Blow the lower element dry with compressed air. Dry the upper element by squeezing out excess diesel fuel, then drying with suitable cloths. Fill the reservoir with clean engine oil to the reference mark. **DO NOT OVERFILL.**

II DISASSEMBLY/REASSEMBLY

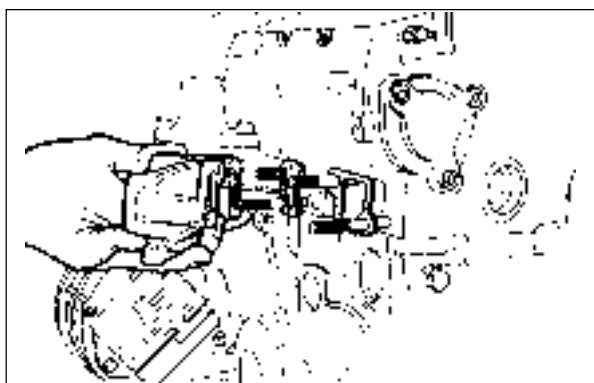


AIR FILTER SUPPORT- (INTAKE MANIFOLD)

REMOVAL: Disassemble the air filter cover and air filter element. Loosen the crankcase ventilation hose (see page 29) and pull the hose from the air filter support. Remove all bolts that secure the air filter support (1) to the cylinder head. Carefully pull the air filter support from the cylinder head. Using suitable pliers, release the governor spring (2) from the air filter support assembly.

INSPECTION: Carefully clean the gasket (3) from the air filter support and the cylinder head. Clean the air filter support with solvent. Dry with compressed air. Inspect the air filter support for cracks or warpage. Replace as required.

INSTALLATION: Using a new gasket, install the air filter support by reversing the procedure detailed above. Torque the air filter support in three (3) steps to 29.6 Nm.

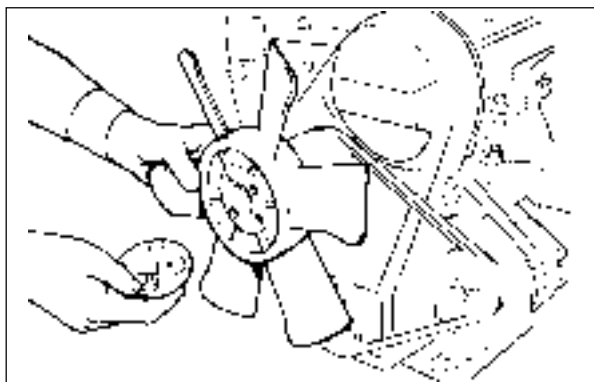


EXHAUST MANIFOLD

REMOVAL: Disconnect the equipment exhaust system. Remove the nuts that affix the exhaust manifold to the cylinder head.

INSPECTION: Carefully clean all gasket material from the exhaust manifold and the cylinder head. Remove all carbon deposits. Check the exhaust manifold mounting flange for warpage and flatness. Inspect the exhaust manifold for cracks and heat stress. Replace as necessary.

INSTALLATION: Using new gaskets, install the exhaust manifold to the cylinder head by reversing the removal procedure. Torque the exhaust manifold nuts to 24.5 Nm.

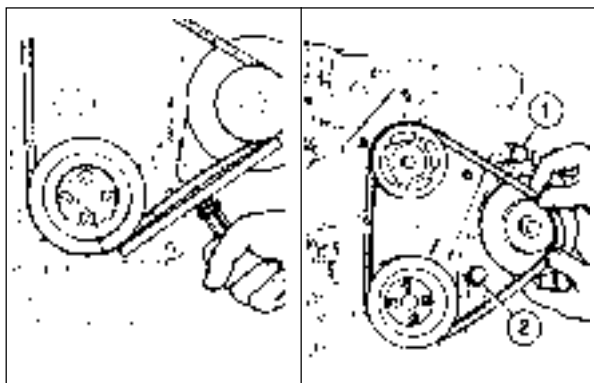


COOLING FAN

REMOVAL: Loosen and remove the four(4) bolts and the stress plate attaching the cooling fan to the cooling fan support.

INSPECTION: Inspect the entire cooling fan for cracks, stress damage, indications of contact with the shroud and brittleness. Replace the cooling fan if ANY damage is noted.

INSTALLATION: Install the stress plate and bolts. Torque the bolts to 20.0 Nm.



ALTERNATOR / COOLING FAN DRIVE BELT

REMOVAL: Loosen bolts (1) and (2). Pivot the alternator so that the belt can be removed. Remove the belt.

INSPECTION: Inspect the belt for brittleness, cracks and general appearance. Replace the belt if any irregularities are noted.

INSTALLATION / ADJUSTMENT: Install the belt over the cooling fan support, crankshaft pulley and alternator pulley. Pivot the alternator, thus tensioning the belt. Adjust the belt tension so that a 100N force at the midpoint of the belt center (as shown) results in a 10-15mm deflection. Tighten bolts (1) and (2).

Do not over tighten the belt, or check V-belt tension with tool 8115.

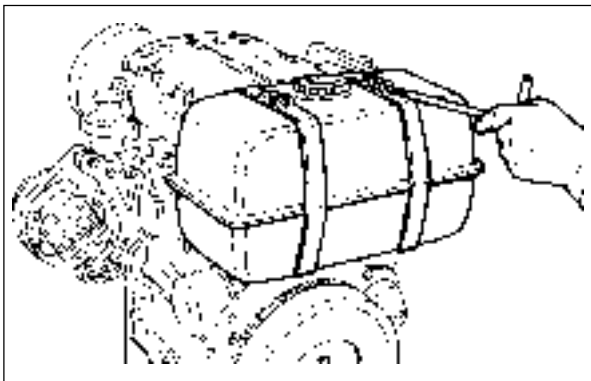
Initial assembly $550 \pm 50N$

Check value after 15 min.

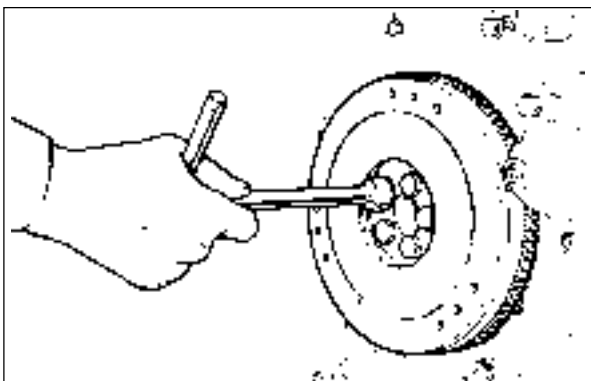
operation under load $300 \pm 50N$

Valve for reuse $300 \pm 50N$

For maintenance instructions see page 8.

**FUEL TANK - (OPTIONAL ACCESSORY)**

A fuel tank may be fitted at the B/FM 1008/F engine as shown on an optional basis. Any fuel tank whether engine mounted or not must be maintained. Extreme care must be taken to make sure that only high quality, clean and properly specified fuel is consumed by the B/FM 1008/F engine. In general terms, service the engine fuel tank as follows: Carefully drain all fuel from the tank in a suitable container. Inspect the fuel cap to make sure that the vent is open and that a good seal is present at the fill neck. Replace the fuel cap as necessary. Flush the fuel tank to remove all scale, rust and impurities. After cleaning, fill the fuel tank with sufficient fuel to allow a thorough rinsing. Drain the rinse fuel from the tank. Dispose of the drained and rinse fuel according to local and national laws. Replace the fuel tank if adequate cleanliness cannot be attained. Always replace the engine fuel filter following fuel tank service and prior to initial start-up.

**FLYWHEEL / RING GEAR**

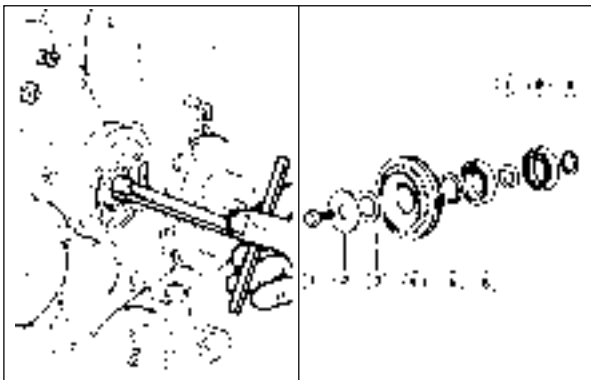
REMOVAL: Remove the engine starter. (See page 63 for warnings). Install the flywheel fixture tool 7107-051 in place of the starter. Remove the flywheel bolts.

WARNING: The flywheel is heavy. Do not remove the final flywheel bolt until the flywheel is secured from accidentally falling.

INSPECTION: Clean the flywheel and flywheel bolts in solvent. Dry with compressed air. Inspect the flywheel for cracks, indications of loose operation and general damage. Inspect the ring gear for damaged teeth. Replace as required. Clean the crankshaft flywheel pilot as required.

RING GEAR REPLACEMENT: Secure the engine flywheel in a soft jawed vise. Carefully drive the ring gear from the flywheel. Remove the flywheel from the vise and lie on a secure flat surface- ring gear side up. Heat the new ring gear to 300°C for 20 minutes in a suitable oven. Using insulated hand protection and suitable hooks, place the heated ring gear on the flywheel ring gear pilot. Tap the ring gear down onto the seat as required. Allow to completely cool.

INSTALLATION: Carefully place the flywheel onto the crankshaft. Align the dowel index. Install the flywheel bolts and torque to 80 Nm.

**COOLING FAN SUPPORT**

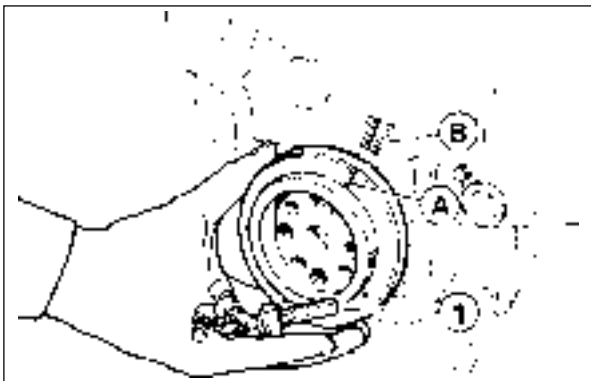
REMOVAL: Remove the center bolt (1) and slide the fan support assembly from the engine.

Components:

1 Bolt	6 Bearing
2 Washer	7 Spacer
3 Spacer	8 Bearing
4 Pulley	9 Snap Ring
5 Snap Ring	

INSPECTION: Disassemble the support assembly. Clean all components. Inspect the pulley for wear. Inspect the bearings for wear. Replace as required.

INSTALLATION: Install the support assembly onto the engine. Using Locktite 270 on bolt (1), torque to 25 Nm.

**CRANKSHAFT PULLEY**

REMOVAL: Secure the engine from rotation by removing the engine starter (see warnings on page 62) and installing the fixture tool 1460-051. Remove the four(4) M6 bolts, then remove the center bolt (1). **NOTE: THE CENTER BOLT (1) IS LEFT-HANDED.**

INSPECTION: Clean the pulley removing all oil residue and dirt. Inspect the pulley for cracks, warpage and V-groove wear or damage. Replace as required.

INSTALLATION: Align the crankshaft pulley with the index pin on the crankshaft. Hand tighten the M6 bolts. Using Locktite on the center bolt thread, torque the center bolt to 360 Nm. Torque the M6 bolts to 12 Nm.

NOTE: When pulley reference mark (A) aligns with the timing cover reference mark (B), the flywheel side piston is at TDC.

II DISASSEMBLY/REASSEMBLY

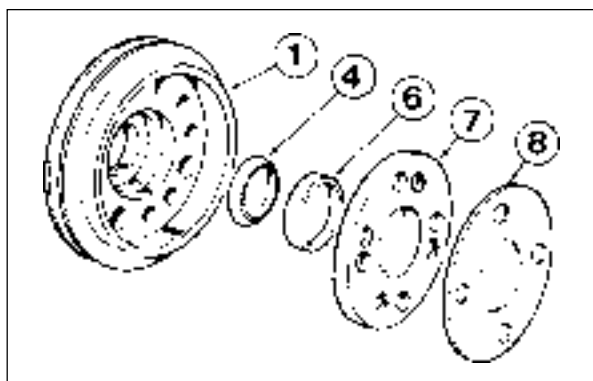


No. 2 PTO (CRANKSHAFT PULLEY) with ^aRINGFEDER[®]-F4M 1008/F, BF4M 1008

The maximum allowable power to be taken from the F4M 1008 and BF4M 1008 and F4M 1008 F standard No. 2 PTO is 75% of the speed specific output (see page 10). In order provide 100% of the available power, a ^aRINGFEDER[®] coupling must be fitted to the engine.

Components:

- | | |
|---------------------------|---------------------------|
| 1 Pulley- Special | 6 RINGFEDER External Ring |
| 2 M6 Bolt | 7 Spacer Flange |
| 3 M16x1.5 Bolt | 8 Shoulder Plate |
| 4 RINGFEDER Internal Ring | 7 Spacer Flange |
| 5 M8 Bolt | 9 Crankshaft |



INSTALLATION: Clean the crankshaft of all nicks, rust, dirt and oil. Clean all components of the RINGFEDER in solvent and dry with compressed air. Saturate all RINGFEDER components with clean engine oil. Lock the engine by removing the engine starter and installing the 1460-051 fixture (see page 62 for warnings). With reference to the diagram at the left, insert into pulley (1) -internal ring (4), external ring (6) and flange (7). The protruding portion of flange (7) must be oriented toward the external ring (6). Install the plate (8) onto the crankshaft. Install the (1), (4), (6), (7) subassembly onto the crankshaft. Loosely install the M6 bolts (2) through the pulley assembly, through the plate (8) and into the crankshaft timing pulley. Install the M8 bolts (5) loosely.

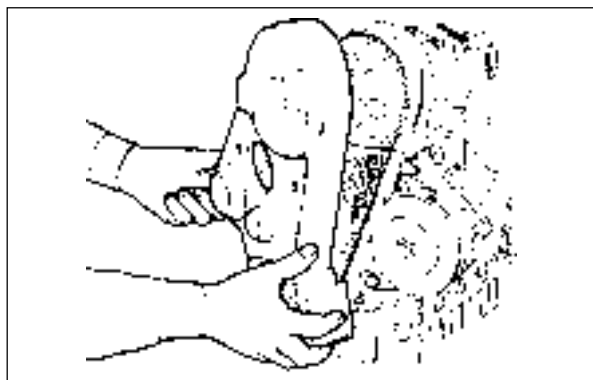
Torque (crossing pattern) the M6 bolts (2) to 10 Nm.

Torque the M16 bolt (3) to 360 Nm. (Note: Left Hand thread.)

Torque (crossing pattern) the M8 bolts (5) to 15 Nm.

Torque (crossing pattern) the M8 bolts (5) to 35 Nm.

Torque (crossing pattern) the M8 bolts (5) to 35 Nm (confirmation step).

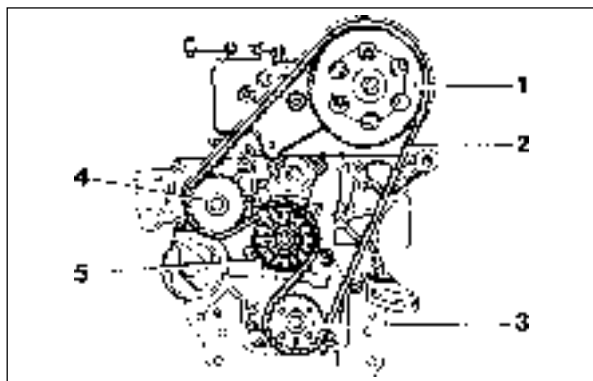


TIMING BELT COVER

REMOVAL: Remove and note position of the five (5) allen head screws attaching the timing cover to the engine. The attachment screws are of differing lengths.

INSPECTION: Clean the cover (inside and out) with a solvent soaked rag. **DO NOT SOAK THE TIMING COVER IN SOLVENT.** Inspect the cover for cracks and warpage. For engines equipped with a sealed timing cover, inspect the integrity of the exterior perimeter seal and the condition of the lip seals at the fan support and crankshaft pulley. Replace the cover and/or seals as required.

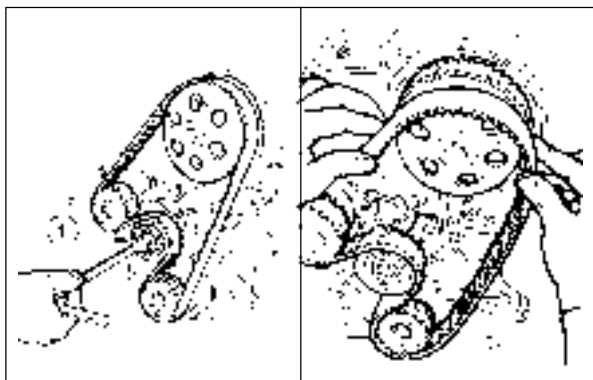
INSTALLATION: Fit the timing cover to the engine. Install the five (5) allen head screws in the exact location as removed. Torque the screws to 10 Nm.



TIMING BELT / TIMING PULLEY ARRANGEMENT

COMPONENT IDENTIFICATION:

- 1 Camshaft Pulley
- 2 Timing Belt
- 3 Crankshaft Pulley
- 4 Coolant Pump Pulley
- 5 Belt Tensioner Pulley

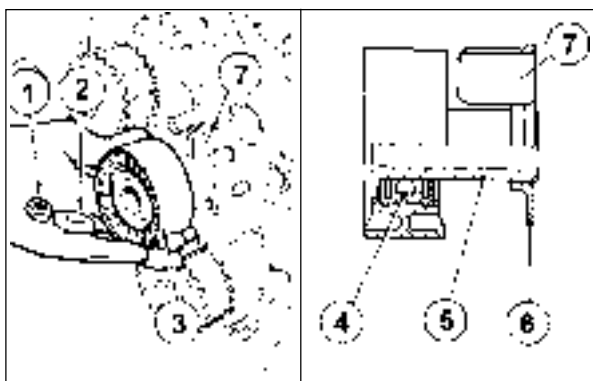


TIMING BELT REMOVAL

REMOVAL: Loosen nut (1). Slide the timing belt off of the pulleys.

NOTE 1.: Timing belt refitting can be greatly simplified if the engine is rotated until the timing marks align prior to removing the timing belt.

NOTE 2.: Discard the timing belt after removal irrespective of operational hours. Timing belts take a "set" during operation and subsequent reinstallations will not allow replacement in the identical position as prior.



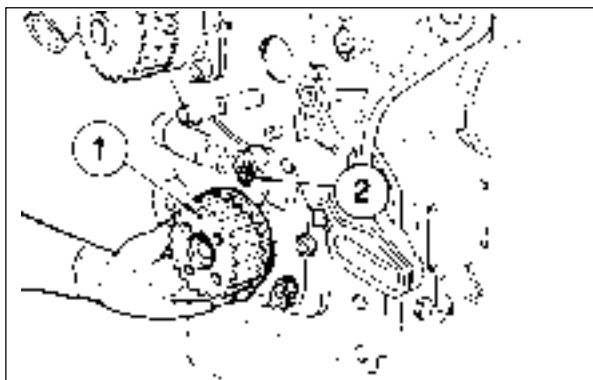
IDLER PULLEY

REMOVAL: Remove nut (1) and washer (2). Remove the idler pulley assembly from the engine.

INSPECTION: Inspect the pulley idler surface for chips, wear, degradation, etc. Check the bearing for radial run-out and smooth operation. Replace the bearing, pulley or assembly as required.

Components:

- | | |
|----------|------------------|
| 1 Nut | 4 Bearing |
| 2 Washer | 5 Shaft/ Support |
| 3 Pulley | 6 Mounting Plate |



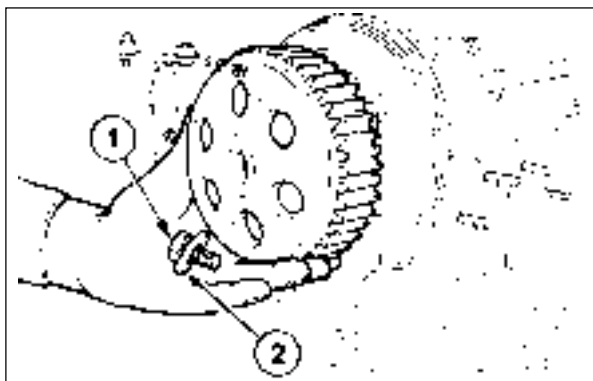
CRANKSHAFT TIMING PULLEY

REMOVAL: Slide pulley from the crankshaft.

INSPECTION: Clean the pulley in solvent. Dry with compressed air. Inspect the pulley for chips, tooth profile wear and cracks. Inspect the keyway for fretting or indications of loose operation. Inspect the crankshaft for signs of fretting at the keyway. Inspect the key condition. Replace components as required. Remove all rust and deposits from the crankshaft.

INSTALLATION: Slide the clean timing pulley onto the crankshaft aligning the keyway in the pulley with the key on the crankshaft.

NOTE: Reference mark (1) on the crankshaft timing pulley and reference mark (2) on the oil pump housing are timing marks. When aligned, No. 1 piston (flywheel side) is at TDC.



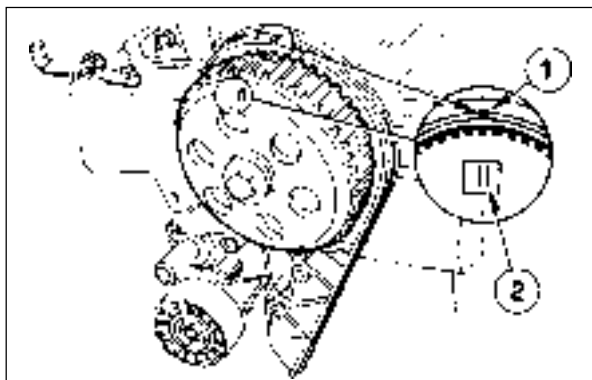
CAMSHAFT TIMING PULLEY

REMOVAL: Loosen and remove bolt (1) and washer (2). Slide the camshaft pulley from the camshaft.

INSPECTION: Clean the pulley in solvent. Dry with compressed air. Inspect the pulley for chips, tooth profile wear and cracks. Inspect the keyway for fretting or indications of loose operation. Inspect the seal race on the backside of the pulley for excessive grooving, erosion or roughness. Replace as required.

INSTALLATION: Coat the seal race of the camshaft pulley with clean engine oil. Install the camshaft pulley onto the camshaft taking care not to damage the camshaft seal. Install the washer (2) onto the bolt (1). Torque the camshaft retaining bolt to 80 Nm.

II DISASSEMBLY/REASSEMBLY

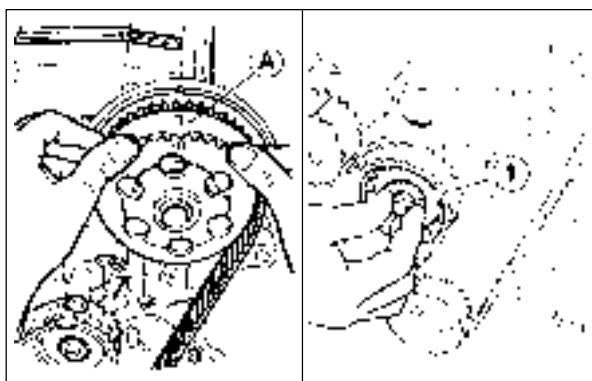


TIMING PULLEY - REFERENCE MARKS

All B/FM 1008/F engines (F2/3/4M 1008 and BF4M 1008) utilize the same camshaft timing pulley. Carefully review the diagram to the left and the chart below to assure the correct timing marks are used with respect to the engine model.

1 Timing Reference Mark on Cylinder Head.

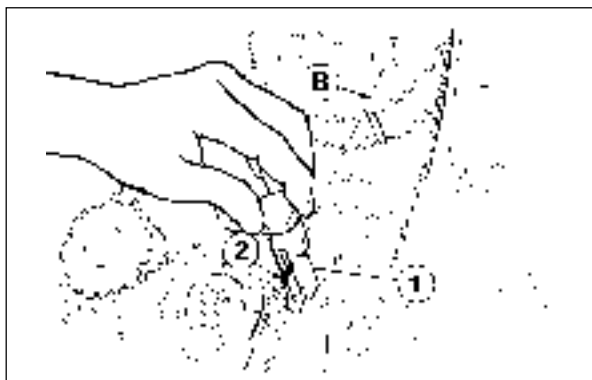
2 Camshaft Pulley Timing Mark



TIMING BELT INSTALLATION- TIMING PROCEDURE

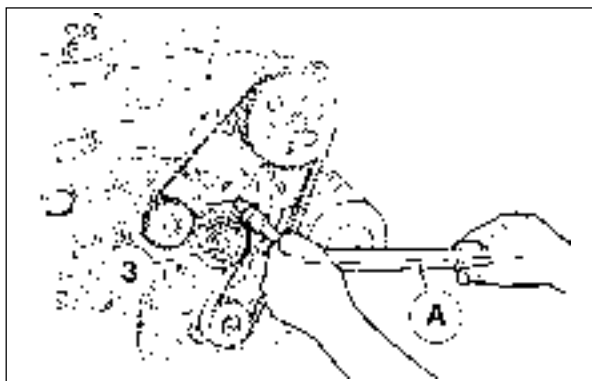
With reference to the Crankshaft Timing Pulley section on the previous page, align the crankshaft timing pulley mark with the TDC reference mark on the oil pump housing. Align the camshaft timing pulley with the timing reference mark as detailed above.

Loosen the timing belt idler pulley (see page 24). Orient the new timing belt with the directional marks (A) as shown. Install the timing belt onto the engine routing the timing belt over the crankshaft pulley, over the camshaft pulley, over the coolant pump pulley and finally around the idler. Push the timing belt against the back of the crankshaft pulley and align the timing belt on all other pulleys. Pivot the timing belt idler by hand and slightly tension the belt. Hand tighten the tensioner nut, then loosen the nut by 1/2 turn.



TIMING BELT TENSIONING PROCEDURE- SETUP

Position belt preload tool 7107-049 (1) over the timing belt idler adjustment ear (2). The tool should be oriented so that parallelism with axis (B) is attained.

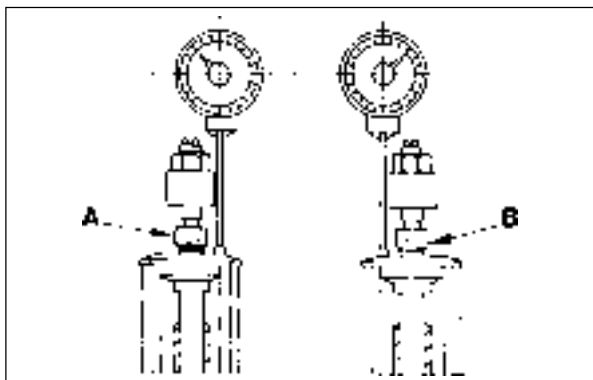


TIMING BELT TENSION PROCEDURE

Position a torque wrench as shown, engaging the 1460-049 tension tool. The torque wrench axis (A) should be 90° from axis (B) as shown above. Tension the belt by applying a torque of 30 Nm. While holding the torque at 20 Nm, tighten the idler nut (3) securely. Torque nut (3) to 40 Nm.

Rotate the engine in the normal direction of rotation (CW when viewed from fan end of engine) three(3) complete revolutions to allow the timing belt to "seat" and to align perfectly.

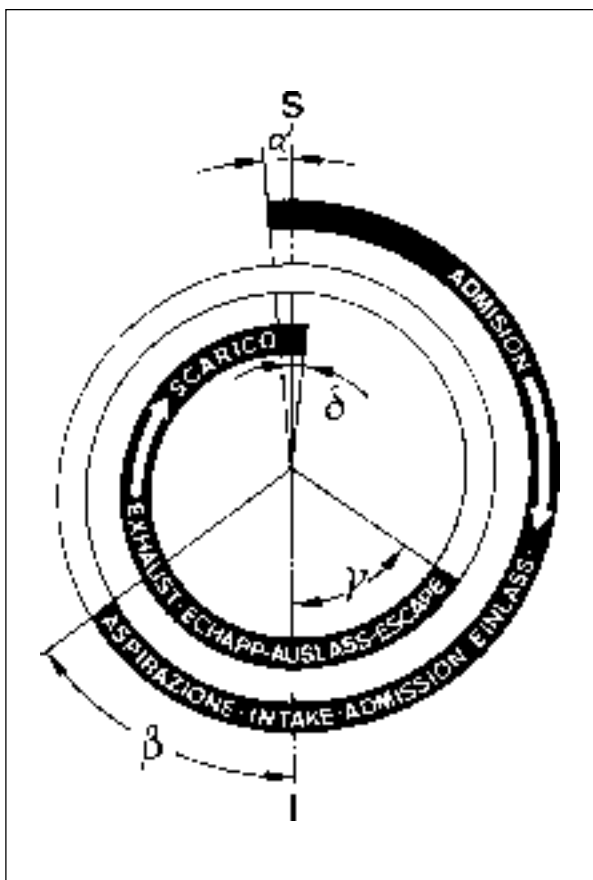
Repeat the above procedure two(2) times, including rotating the engine to allow complete and confident tensioning.



VALVE TIMING CONFIRMATION

- A Intake Valve
B Exhaust Valve

Rotate the engine in the normal direction of rotation until the No. 1 piston (flywheel side) approaches TDC- compression stroke. Setup dial indicators on the intake and exhaust valve caps as shown. Locate the dial indicators so that the full valve travel will be indicated by needle movement. Rotate the engine (normal direction) until the valves are on "rocking point". Rocking point is defined as the condition at which any small movement of the crankshaft results in opposing valve movements. That is, a movement of the crankshaft CW with result in one valve tending to open and the other valve tending to close. Further, a movement of the crankshaft CCW will result in the opposite valve behavior. Position the crankshaft so that both valves are at the highest point possible with reference to the dial indicator movements—thus TDC. Zero the dial indicators. Rotate the engine 360° so that the engine is at TDC- exhaust stroke. Check the valve timing angles as detailed below.



VALVE TIMING ANGLES

With the engine setup as above and positioned at TDC- exhaust stroke as determined above, fit the engine crankshaft with a suitable "degree wheel" and pointer. Set the pointer to 0°. Adjust valve clearance to 0.25mm at the camshaft to rocker arm roller interface. Zero the dial indicators. Rotate the engine clockwise (when facing the crankshaft pulley end of the engine) and check conformance to the chart to the left and the data below.

- S = TDC (Top Dead Center)
I = BDC (Bottom Dead Center)

- α = Intake Valve Opening Angle
 β = Intake Valve Closing Angle
 γ = Exhaust Valve Opening Angle
 δ = Exhaust Valve Closing Angle

F2/3/4M 1008/F:

- α = 16° BTDC
 β = 36° ABDC
 γ = 36° BBDC
 δ = 16° ATDC

BF4M 1008

- α = 10° BTDC
 β = 42° ABDC
 γ = 56° BBDC
 δ = 16° ATDC

II DISASSEMBLY/REASSEMBLY

SPEED GOVERNOR

The B/FM 1008/F speed governor is driven by the camshaft and is housed within the cylinder head. Access to the speed governor is gained by removing the camshaft front support as shown. Disassemble the front camshaft support by first loosening and removing three(3) securing bolts holding the camshaft support to the cylinder head, then pulling the support from the cylinder head. Following removal of the camshaft support, the governor assembly may be removed from the engine.

Components: (Speed Governor) (see figure directly at left)

- 1 Thrust Washer
- 2 Spool
- 3 Flyweight Assy.

Components (Governor / Camshaft Support Assembly)

- 1 Oil Seal
- 2 Bolt
- 3 Support
- 4 O-Ring
- 5 Bearing
- 6 Retainer
- 7 Bolt
- 8 Flyweight Assy.
- 9 Spool
- 10 Thrust Bearing

NOTE: The flyweight assembly has four(4) weights up to 4000 r/min and two(2) weights over 4000 r/min. Further, the flyweight mass is reduced by 25% for limiting speed governors.

INSPECTION: Remove the bearing (5) from the support by removing the bolts (7) and retainer (6). Clean the camshaft support and governor components in solvent then blow dry with compressed air. Inspect the spool (3) (thrust surfaces and internal bushing), thrust bearing (10), bearing (5) and flyweights (8) for wear. Replace as required.

GOVERNOR FORK

After removal of the intake manifold/ air filter support (page 20) and the governor/ camshaft support assembly, remove the governor fork pivot pin (not shown) located on top of the cylinder head in the area of the governor. Remove the fork assembly as shown making sure that the governor spring (C) does not drop off. Clean the fork assembly in solvent and dry using compressed air. Inspect the for wear at points (B) and make sure that the contact areas at points (B) are parallel within 0.05 mm. Replace the fork if the contact points(B) show evidence of flat spots or if the assembly does not operate freely and smoothly. Check dimension (A) to make sure that the distance is 45/46 mm.

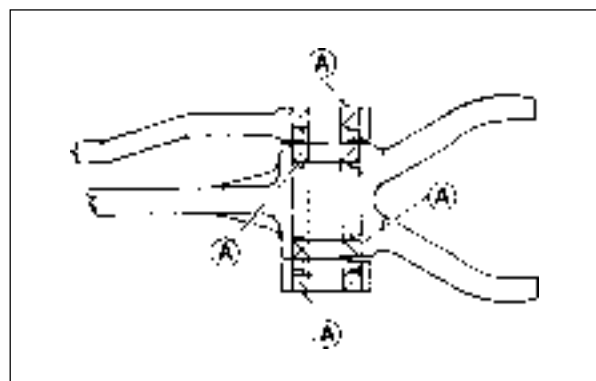
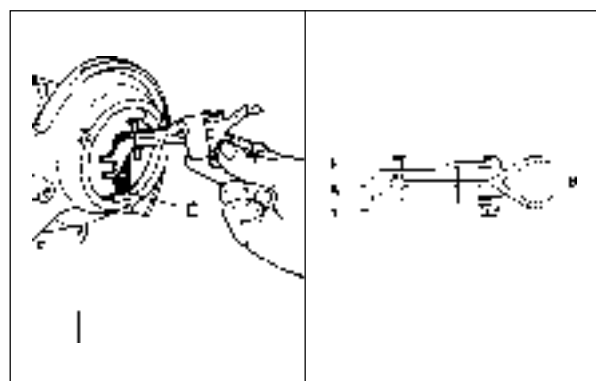
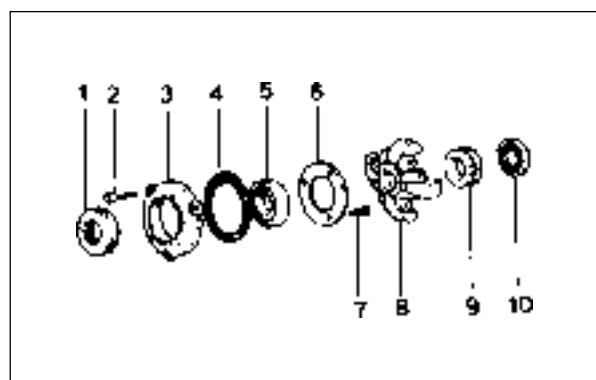
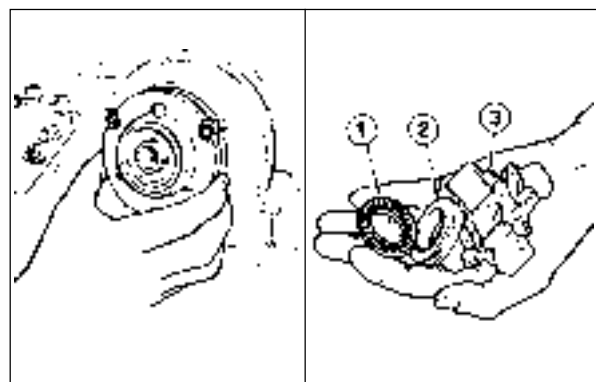
GOVERNOR SPRINGS

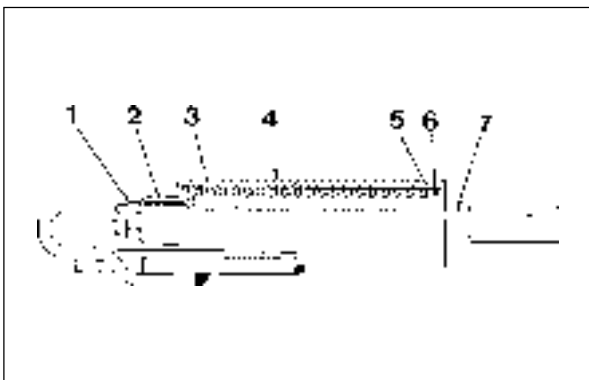
Governor springs are fitted within B/FM 1008/F series engines as a function of the intended operating speed. Springs are available in the following ranges: 3600 r/min, 3000 r/min, 2400-2600 r/min, 1800 r/min and 1500 r/min. Additionally, a special spring is available for the limiting speed governor.

PRECISION SPEED GOVERNOR -(GENSETS)

B/FM 1008/F engines ordered and specified for genset applications at 1500 or 1800 r/min are supplied with a modified governor fork assembly with respect to standard. The governor fork for genset applications utilizes qty(4) bearings as shown at (A). The additional bearings reduce friction, there by providing better governor regulation at 1500 or 1800 r/min.

INSPECTION: Clean the governor fork assembly using solvent. Dry with compressed air. Inspect the fork wear surfaces and actuating pin height as described above for the standard fork assembly. Test the fork assembly for smooth operation. Replace as required. Coat with clean engine oil before installation.

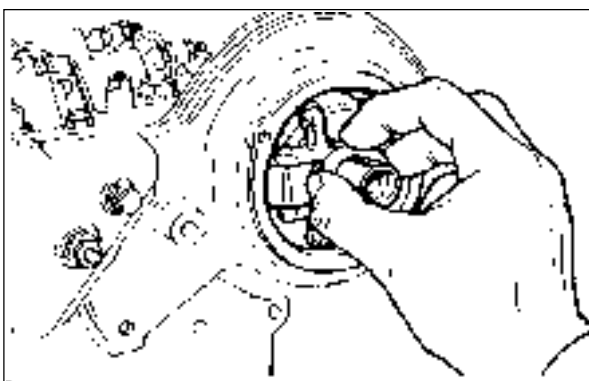




LIMITING SPEED GOVERNOR

Applications requiring true operator ^afoot^o control, such as vehicles, are specified with a limiting speed or ^aMIN-MAX^o governor. The limiting speed governor spring is designed as a singular unit but comprises two(2) separate springs- an idle spring and a high speed spring. The spring assemblies are speed specific and are identified by color code as detailed below.

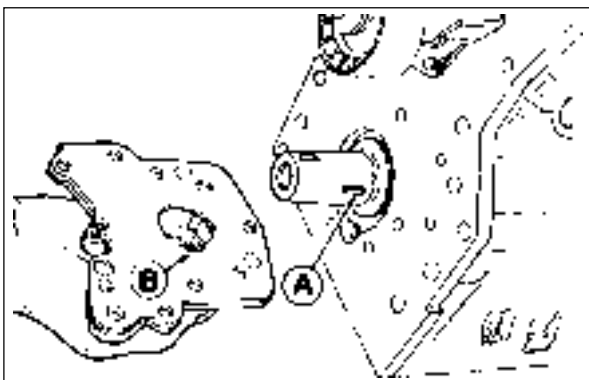
Components:	Ref. Color	Speed
1 Nut- Adjustment	red	3000
2 Idle Spring	(none)	3200
3 High Speed Spring	black	3600
4 Case	orange	3750
5 Register	white	4200
6 Seat- Elastomeric	brown	4500
7 Actuation Rod	green	4300



SPEED GOVERNOR REASSEMBLY

Install the governor fork assembly (with governor spring). After coating with oil, install the governor fork pivot bolt (use new -o-ring on pivot bolt). Torque the pivot bolt to 7 Nm. With reference to the previous page (Governor/Camshaft Support Assembly), install the governor assembly using a new O-Ring (4) and Seal (1). Coat all components with clean engine oil. Subassemble the camshaft support by installing the bearing (5), retainer (6) and bolts (7). Torque the retainer bolts (7) to 10 Nm. Install the governor assembly onto the camshaft as shown in the diagram, beginning with the thrust bearing (10), then the spool (9), then the flyweight assembly (8), making sure that the needle bearing side of the thrust bearing faces the spool. Install the camshaft support. Torque the camshaft support bolts to 10 Nm.

NOTE: After assembly, check the camshaft end play. If end play is noted, replace the camshaft support bearing.



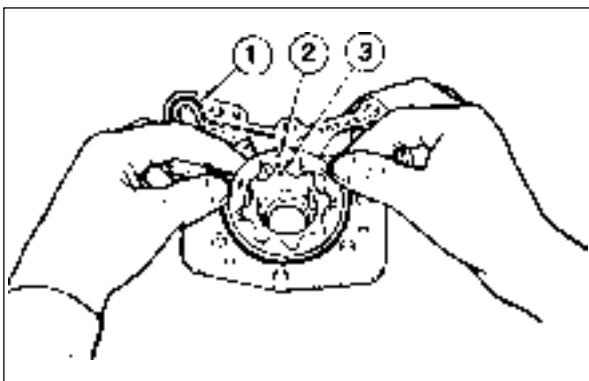
OIL PUMP ASSEMBLY

The B/FM 1008/F oil pump is supplied as an assembly. Deutz therefore recommends that the oil pump be handled as an assembly from a service standpoint. Deutz does not recommend that the oil pump be disassembled, then reassembled for purposes of installation on the engine except during emergency situations.

REMOVAL: Rotate the crankshaft until the crankshaft timing pulley keyway is vertical as shown. Remove the oil pump assembly retaining bolts. When the crankshaft timing pulley keyway is vertical, the oil pump drive keyway (A) will be at 3:00 o'clock allowing removal of the oil pump assembly via relief (B).

OIL PUMP INSPECTION:

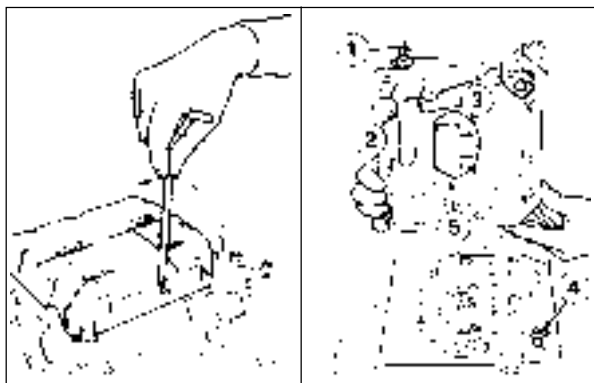
Tear down analysis and failure analysis regarding the oil pump is facilitated by removing the oil pump back plate. Cleanliness is very important. Do not wipe the oil pump housing or rotors with a rag. Clean the oil pump rotor and housing using clean solvent. Dry with compressed air. When reassembling the oil pump, coat all components with clean engine oil and align timing marks (2) and (3). Replace O-ring (1) before installing the back plate. Torque the back plate bolts to 10 Nm. Replace the crankshaft oil seal if any indication of seal degradation or wear is noted (see page 45).



OIL PUMP ASSEMBLY TO THE ENGINE:

Thoroughly clean the crankshaft to remove dirt, rust and residue. Coat the oil seal with clean engine oil. Install the oil pump assembly onto the crankshaft taking care not to damage the crankshaft oil seal. Torque the oil pump retaining

II DISASSEMBLY/REASSEMBLY



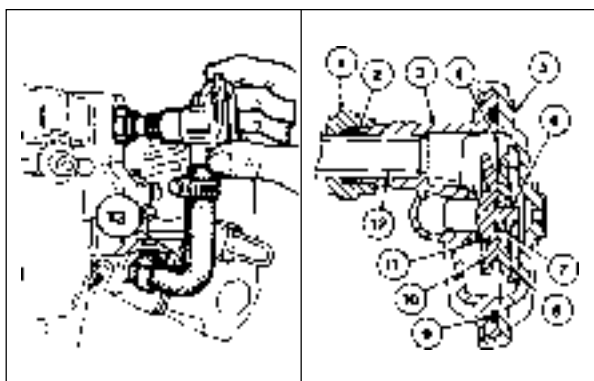
VALVE / ROCKER COVER

All critical engine adjustments require the removal of the valve/ rocker cover. Remove the valve / rocker cover by removing the crankcase vacuum regulator valve (see below), removing the retaining bolts, then lifting the valve / rocker cover assembly. The engine crankcase breather system is integrally contained by the valve / rocker cover. Additionally, the valve / rocker cover facilitates oil pressure measurement and camshaft/ rocker arm lubrication via oil ports.

Components:

- | | |
|-------------------------------|--|
| 1 Oil Pressure Switch | 4 Boot/Tube for oil return to the Oil Sump |
| 2 Camshaft Lubrication Port | 5 Crankcase Ventilation Chamber |
| 3 Rocker Arm Lubrication Port | |

INSPECTION / CLEANING: Inspect the valve/ rocker cover for clogged oil ports, varnish deposits, cracks and lack of parallelism at the mounting flange. Remove boot (4), clean in solvent and dry (COMPLETELY) with compressed air. Replace the boot (4) if swelling, cracking or degradation is noted.



CRANKCASE VACUUM REGULATOR VALVE

The crankcase breather system is closed loop design. Therefore, all crankcase vapors are induced into the intake manifold and consumed by the engine. As such, a crankcase vacuum regulator is required so that in conditions of high air filter restriction, excessive oil is prevented from entering the engine potentially causing speed regulation problems.

Components:

- | | | |
|--------------|---------------|-----------|
| 1 Gland Nut | 6 Clip / Lock | 11 Spring |
| 2 Bushing | 7 O-Ring | 12 Tube |
| 3 Body | 8 Washer | 13 Hose |
| 4 Diaphragm | 9 O-Ring | |
| 5 Cap/ Cover | 10 Valve | |



VALVE / ROCKER COVER GASKET

The B/FM 1008/F valve/ rocker cover gasket (A) is a critical part of the lubricating system. Always replace the valve / rocker cover gasket when reinstalling the valve / rocker cover.

Thoroughly clean all gasket material from the cylinder head and valve / rocker cover. Place a small bead of RTV Silicone at positions (1) and (2). Install the valve / rocker cover gently, inserting the drain boot (see top diagram, No. 4) into the cylinder head. Torque the valve / rocker cover bolts to 9 Nm.

**VALVE ADJUSTMENT**

Valve adjustments should be performed on a cold engine. Remove the engine valve / rocker cover. Rotate the engine to TDC- compression stroke before adjusting the valves on each respective cylinder.

Loosen the adjustment lock nut and adjust the clearance at (A) to 0.20mm or 0.15mm at (B) for both intake and exhaust valves.

While holding the adjustment screw with a suitable screwdriver, tighten the adjustment lock nut. Re-check the valve clearance and re-adjust as required. Repeat the procedure for each cylinder.

After adjusting the valves, replace the valve / rocker cover using a new gasket and following the instructions from the previous page.

INJECTION PUMP CONTROL ROD

Depending on the engine model, the injection pump control rod will link two(2), three(3), or four(4) injectors to the engine governor.

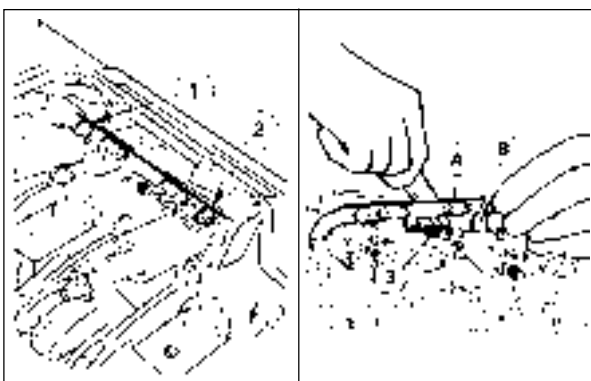
REMOVAL: Carefully remove spring (3). Carefully remove bolts (1), (2) at point (B) of each unit injector. Do not loosen the bolts at (A).

NOTE: Each unit injector has a pivot bolt identical to bolts (1), (2). For purposes of illustration, a F2M 1008 engine is shown, thus, two(2) pivot bolts. Disengage the control rod from the unit injectors and the governor fork. Remove the control rod.

INSPECTION: Clean the control rod with solvent and dry with compressed air. Inspect the actuation slot at the the point the control rod attaches to the governor for wear, bending, galling, etc. Inspect the control rod for bending or general degradation. Replace as required.

INSTALLATION: Install the control rod by reversing the removal procedure detailed above. Coat the control rod with clean engine oil. Torque bolts (1), (2) to 1.1 Nm.

NOTE: Adjustment of the control rod is covered on page 74.

**FUEL RAIL**

Fuel supply to the unit injectors and the return of excess fuel from the unit injectors to the fuel tank is facilitated by the fuel rail.

REMOVAL: Remove the supply and return lines from the end of the fuel rail. Remove the bolts securing the fuel rail to the unit injectors (two(2) bolts per unit injector). Carefully lift fuel rail (A) from the unit injectors making sure that the sealing O-rings (C) do not fall into the engine.

INSPECTION: Clean the fuel rail in clean diesel fuel. Inspect the fuel rail for welded joint fatigue or cracks, degradation and flatness at the O-ring joint. Inspect the fuel rail grommet joint (located at the fuel rail / cylinder head interface on the rear of the cylinder head). Replace the grommet if brittleness or evidence of oil leakage is evident. Replace the fuel rail as required.

INSTALLATION: Remove all O-rings (C) and clean the seats of all O-rings. Replace the O-rings (C). Lightly coat the grommet seat on the cylinder head with RTV silicone. Carefully lower the fuel rail onto the unit injectors. Torque the retaining bolts to 4 Nm.

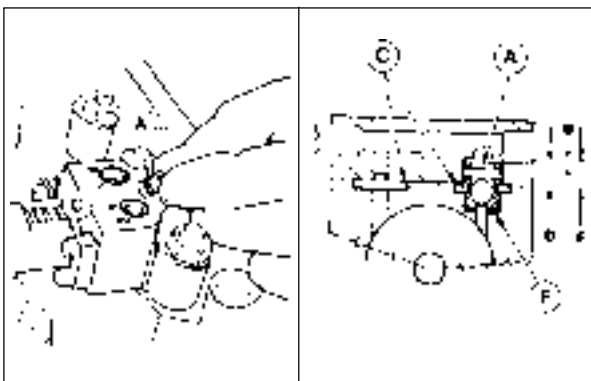
WARNING: Do not use any type of sealing compound at the O-ring joints.

**UNIT INJECTOR CHECK VALVE**

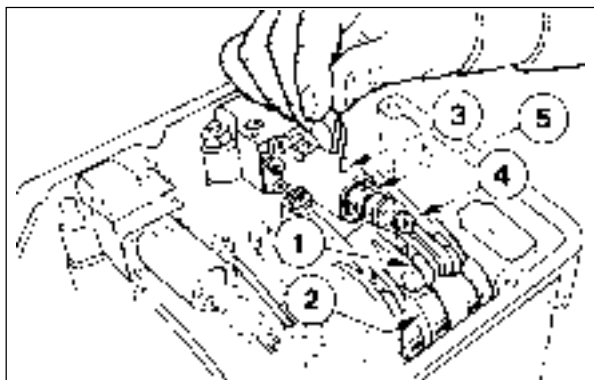
The unit injector check valve (A) allows an instantaneous engine shutdown via a simple fuel shut-off valve. With reference to the unit injector identification chart on page 55, remove the unit injector check valve. Please note that unit injector reference no.'s 231-2, 235-2 and 272-0 are equipped with push-in check valves, while all other unit injector reference no.'s are equipped with screw-in check valves.

INSPECTION: Inspect the check valves for general condition, indication of loose operation within the unit injectors, loose or damaged check valve balls/retaining pins and erosion. Replace as required. Reassemble the check valves into the unit injectors. Measure the and confirm the following dimensions as shown on the diagram: B = 1.0-1.85mm; D = 5.5-6.0mm; E = 7.0-7.1mm (F2/3/4M 1008) and B = 0.5-1.15mm; D = 5.95-6.5mm; E = 7.0-7.1mm. Special spacer washers are available to increase the height of the check valve to specifications.

NOTE: The sealing of the fuel rail and check valves is critical to prevent fuel from entering the oil sump. The sealing mechanisms are O-rings (C). If in doubt, always replace the O-rings.



II DISASSEMBLY/REASSEMBLY



UNIT INJECTOR REMOVAL / INSTALLATION

Unit injectors may require removal for either service on the unit injector, or for purposes of allowing other service operations. If unit injector service is required, a static timing and fuel delivery equalization procedure will be required (see FUEL SYSTEM).

If unit injector service is not required, the following procedure may be used to allow unit injector removal and replacement without the need for other adjustments.

1. Remove the valve/rocker cover (page 29).
2. Remove the control rod (page 30).
3. Remove the fuel rail (page 30).
4. Label all injectors with respect to cylinder number.
5. DO NOT LOOSEN THE UNIT INJECTOR ADJUSTMENT SCREW (4).
6. Rotate the engine until the unit injector cam lobe (2) forces the cam follower (1) to the highest position.
7. Insert a suitable sized (hardened) pin into the hole (3).
8. Rotate the engine until the cam follower (1) is at the lowest position.
9. Loosen and remove the two (2) M8 unit injector retainer nuts and washers.
10. Remove the unit injector from the cylinder head while making sure that the push rod (5) does not fall into the engine. Set aside the ^alabeled^o unit injector, keeping the push rod (5) from each cylinder with the respective unit injector.

ASSEMBLY: Inspect the unit injector O-rings for damage and replace as required. Using a new fire ring (see page 59), reassemble the unit injectors and unit injector push rods into the exact cylinder from which they were removed. Install the unit injectors using a procedure reverse from the removal procedure. Torque the unit injector retaining nuts in 5 Nm steps to 20 Nm.

ROCKER ARM ASSEMBLY

NOTE: The rocker arm assembly may be removed without removal of the unit injectors. If unit injector removal is not required, follow steps 1, 5, 6, 7 and 8. Upon reinstallation of the rocker arm assembly, follow steps 8, 7, 6, 5 and 1 as detailed above.

REMOVAL: Remove the nuts and washers attaching the rocker arm assembly to the cylinder head. Lift the rocker arm assembly from the engine as shown in the diagram. Take measures to insure that the unit injector push rods do not fall into the engine when lifting the rocker arm assembly.

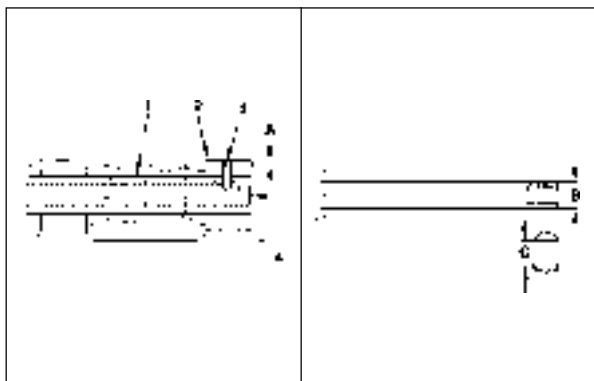
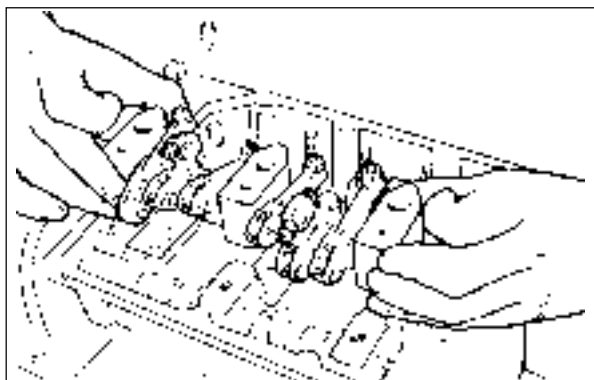
INSPECTION: Clean the rocker arm assembly in solvent and dry with compressed air. Inspect the rocker arm to valve stem contact areas, inspect the unit injector actuation balls, inspect the rocker arms for signs of looseness or galling and fractures. If complete disassembly and dimensional analysis of the rocker arm assembly is required or desired, refer to the lower diagram.

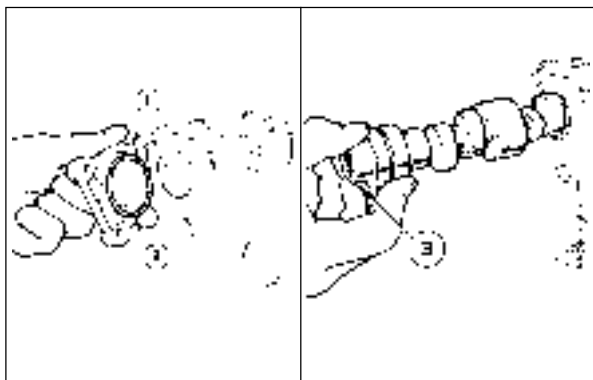
DISASSEMBLY: Label all rocker arms so that the rocker arms may be reinstalled in the same position. Using a 4mm drill bit and a suitable drill and vise, drill out the pin (3). Remove the support blocks (2) and the rocker arms. Remove plug (4) and thoroughly clean shaft (1) with solvent.

SPECIFICATIONS

- | | | | | | |
|-----|---|--------|---|--------|-------------------------------|
| A | = | 0 | - | 1.00 | mm |
| B | = | 17.989 | - | 18.000 | mm |
| C | = | 18.015 | - | 18.030 | |
| C-B | = | 0.015 | - | 0.041 | mm (USEABLE Limit = 0.090 mm) |

INSTALLATION: Reassemble the rocker arm assembly installing the rocker arms in identical positions as removed (if reused), coating all components with clean engine oil. Reassemble the rocker arm assembly onto the engine taking





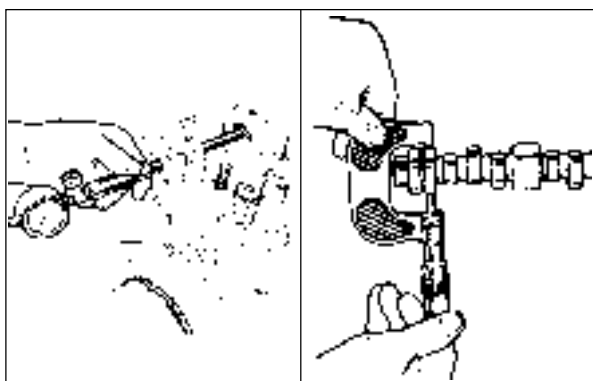
CAMSHAFT REMOVAL/ REPLACEMENT

PREPARATION: Remove the rocker arm assembly, remove the camshaft end cover (1), remove the camshaft timing pulley, remove the governor assembly, remove the fuel lift pump, remove the fuel lift pump push rod.

REMOVAL: Gently and slowly, slide the camshaft toward the flywheel end of the engine. Slight rotation(s) may be required to prevent binding of the camshaft lobes against the camshaft bearing surface bores.

INSPECTION: Clean the camshaft with solvent and dry with compressed air. Inspect all lobes and journals for wear, seizure, pitting, etc. Refer to the data presented in the following for dimensional analysis of the camshaft. Replace the camshaft as required.

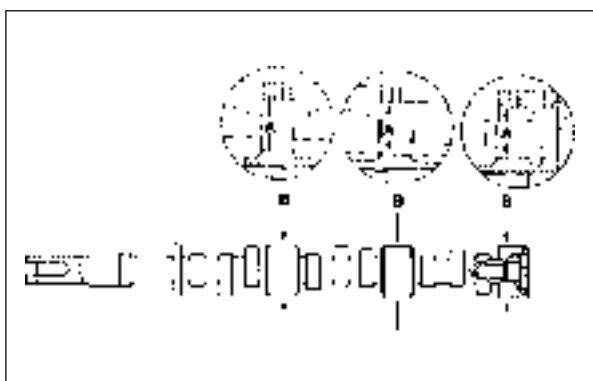
INSTALLATION: Liberally oil the cylinder head camshaft support bores and the camshaft journals. Install the camshaft into the cylinder head, gently rotating the camshaft as required to allow installation. Replace O-ring (2) and replace the camshaft cover (1).



NOTE: The flywheel end of the camshaft includes a bolt-on eccentric (3) for purposes of lift pump drive. Torque the eccentric (3) to 80 Nm.

CAMSHAFT JOURNAL / SUPPORT MEASUREMENT

After thoroughly cleaning the camshaft and cylinder head bores, measure the critical diameters with calibrated micrometers as shown.



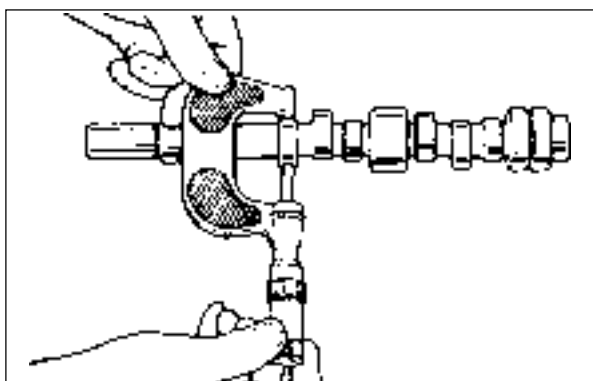
CAMSHAFT JOURNAL / SUPPORT BORE SPECIFICATIONS

A = 37.035 - 37.060 mm

B = 36.975 - 37.000 mm

A-B = 0.035 - 0.085 mm (USEABLE Limit = 0.170 mm)

NOTE: The camshaft journal and cylinder head camshaft bore dimensions are identical for all B/FM 1008/F series engines.



CAMSHAFT LOBE MEASUREMENT PROCEDURE

After thoroughly cleaning the camshaft, measure the camshaft lobes from the circle base to the top of the lobe (maximum possible dimension) using a calibrated micrometer.