Technical Publication

Diesel Engine
12V 2000 G22/42/62/82
16V 2000 G22/42/62/82
18V 2000 G62/82

Operating instructions
M015402/00E

DETROIT DIESEL

mtu

DaimlerChrysler Off-Highway

! **Safety**

Safety, accident prevention and environmental protection instructions

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Wichtig / Important
Important / Importante / Importante

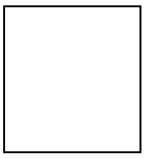
Bitte die Karte „Inbetriebnahmemeldung“ abtrennen und ausgefüllt an MTU Friedrichshafen zurücksenden. Die Informationen der Inbetriebnahmemeldung sind Grundlage für den vertraglich vereinbarten Logistik-Support (Gewährleistung, Ersatzteile etc.).

Please complete and return the „Commissioning Note Card“ below to MTU Friedrichshafen.
The Commissioning Note information serves as a basis for the contractually agreed logistic support (warranty, spare parts, etc.).

Veuillez séparer la carte „Signalisation de mise en service“ et la renvoyer á la MTU Friedrichshafen.
Les informations concernant la signalisation de mise en service constituent la base pour l’assistance en exploitation contrctuelle (garantie, rechanges, etc.).

Rogamos separen la tarjeta „Aviso de puesta en servicio“ y la devuelvan rellenda a MTU Friedrichshafen.
Las informaciones respecto al aviso de puesta en servicio constituyen la base para la asistencia de logístíca contractual (garantía, piezas de repuesto, etc.).

Staccare „Avviso di messa in servizio e rispedirlo debitamente compilato alla MTU Friedrichshafen.
Le informazioni ivi registrate sono la base per il supporto logistico contrattuale (garanzia, ricambi, ecc.).



Postkarte

MTU-Friedrichshafen GmbH
Abteilung**SCSD**
88040 Friedrichshafen

GERMANY

Please use block capitals!

Please use block capitals!

Prière de remplir en lettres capitales!

¡A rellenar en letras de imprenta!

Scrivere in stampatello!

Motornr.: Engine No.: Moteur No.: Motor No.: Motore N.:	Auftragsnr.: Order No.: No. de commande: No. de pedido: N. commessa:
Motortyp: Engine model: Moteur type: Motor tipo: Motore tipo:	Inbetriebnahmedatum: Commissioning date: Mise en service le: Puesto en servicio el. Messa in servizio il:
Eingebaut in: Installation site: Monté: Montado: Installato:	
Endabnehmer/Anschrift: End user's address: Adresse du client final: Dirección clientes final: Indirizzo del cliente finale:	
Bemerkung: Remarks: Remarques: Nota: Commento:	

Inbetriebnahmemeldung

Commissioning Note

Notice de mese en service

Aviso de puesta en servicio

Avviso di messa in servizio

Safety, Accident Prevention and Environmental Protection Instructions

These instructions must be read and followed by every person involved in operation, maintenance or transportation of the machinery plant.

General

In addition to the instructions in this publication, the applicable country-specific legislation and other compulsory regulations regarding accident prevention must be observed.

This engine is a state-of-the art product and conforms with all applicable specifications and regulations. Nevertheless, persons and property may be at risk in the event of:

- Incorrect use
- Operation, maintenance and repair by unqualified personnel
- Modifications or Conversions
- Non-compliance with the Safety Instructions

Correct use

The engine is intended exclusively for the application specified in the contract or defined at the time of delivery. Any other use is considered improper use. The manufacturer will accept no liability for any resultant damage. The responsibility is borne by the user alone.

Correct use also includes observation of and compliance with the maintenance specifications.

Personnel requirements

Work on the engine must only be carried out by properly qualified and instructed personnel.

The specified legal minimum age must be observed.

Responsibilities of the operating, maintenance and repair personnel must be specified.

Modifications or conversions

Modifications made by the customer to the engine may affect safety.

MTU will accept no liability or warranty claims for any damage caused by unauthorized modifications or conversions.

Organizational measures

This publication must be issued to all personnel involved in operation, maintenance, repair or transportation.

It must be kept at hand near the engine and accessible at any time to all personnel involved in operation, maintenance, repair or transportation.

The personnel must be instructed on engine operation and repair by means of this publication, and in particular the safety instructions must be explained.

This is especially important for personnel who work on the engine only on an occasional basis. Such personnel must be given instructions repeatedly.

Spare parts

Only genuine MTU spare parts must be used to replace components or assemblies. In the event of any damage caused by the use of other spare parts, no liability nor warranty claims vis-à-vis the engine manufacturer will be accepted.

Working clothes and protective equipment

Wear proper work clothing for all work.

Depending on the kind of work, use additional protective equipment, e.g. protective goggles, gloves, helmet, apron.

Work clothing must be tight fitting so that it does not catch on rotating or projecting components.

Do not wear jewelry (e.g. rings, chains etc.).

Transportation

Lift the engine only with the lifting eyes provided.

Use only the transport and lifting equipment approved by MTU.

Take note of the engine center of gravity.

Transport the engine only in the installation position.

In the case of special packaging with aluminum foil, suspend the engine on the lifting eyes of the transport pallet or transport with equipment for heavy loads (forklift truck).

Prior to transporting the engine, it is imperative to install transportation locking devices for crankshaft and engine mounts.

Secure the engine against tilting during transportation. The engine must be especially secured against slipping or tilting when going up or down inclines and ramps.

Setting the engine down after transportation

Place the engine only on an even, firm surface.

Ensure appropriate consistency and load-bearing capacity of the ground or support surface.

Never place an engine on the oil pan, unless expressively authorized by MTU on a case-to-case basis to do so.

Working with laser equipment

When working with laser equipment, always wear special laser-protection goggles.

Laser equipment can generate extremely intensive, concentrated radiation by the effect of stimulated emission in the range of visible light or in the infrared or ultraviolet spectral range. The photochemical, thermal and optomechanical effects of the laser can cause damage. The main danger is irreparable damage to the eyes.

Laser equipment must be fitted with the protective devices necessary for safe operation according to type and application.

For conducting light-beam procedures and measurement work, only the following laser devices must be used:

- Laser devices of classes 1, 2 or 3A,
- Laser devices of class 3B, which have maximum output in the visible wavelength range (400 to 700 nm), a maximum output of 5 mW, and in which the beam axis and surface are designed to prevent any risk to the eyes.

Engine operation

When the engine is running, always wear ear protectors.

Ensure that the engine room is well ventilated.

Mop up any leaked or spilt fluids and lubricants immediately or soak up with a suitable bonding agent.

Exhaust gases from combustion engines are poisonous. Inhalation of poisonous exhaust gases is a health hazard. The exhaust pipework must be free of leaks and discharge the gases to atmosphere.

During engine operation, do not touch battery terminals, generator terminals or cables.

Inadequate protection of electrical components can lead to electric shocks and serious injuries.

When the engine is running, never release coolant, oil, fuel, compressed-air or hydraulic lines.

Maintenance and repair

Compliance with maintenance and repair specifications is an important safety factor.

Unless expressly permitted, no maintenance or repair work must be carried out with the engine running. The engine must be secured against inadvertent starting and the battery disconnected. Attach sign "Do not operate" in operating area or to control equipment. Persons not involved must keep clear.

Never attempt to rectify faults or carry out repairs if you do not have the necessary experience or special tools required. Maintenance and repair work must only be carried out by authorized, qualified personnel.

Use only proper, calibrated tools.

Do not work on engines or components which are only held by lifting equipment or crane. Always support these components in accordance with regulations on suitable frames or stands before beginning any maintenance or repair work.

Before barring the engine, make sure that nobody is standing in the danger zone. After working on the engine, check that all guards have been reinstalled and that all tools and loose components have been removed from the engine.

Fluids emerging under high pressure can penetrate clothing and skin and may cause serious injury. Before starting work, relieve pressure in systems and H.P. lines which are to be opened.

Never bend a fuel line and do not install bent lines. Keep fuel injection lines and connections clean. Always seal connections with caps or covers if a line is removed or opened.

During maintenance and repair work, take care not to damage the fuel lines. To tighten the connections when installing the lines, use the correct tightening torque and ensure that all retainers and dampers are installed correctly.

Ensure that all fuel injection lines and pressurized oil lines have sufficient distance to other components to avoid contact with them. Do not place fuel or oil lines near hot components, except when necessary for design reasons during installation.

Elastomers (e.g. "Viton" sealing rings) are stable under normal operating conditions. When subjected to fire or temperatures above 300 °C the material degenerates, giving off hydrogen fluoride gas. The resulting acid leads to serious burning if it contacts the skin. Do not touch elastomeric seals if they have carbonized or resinous appearance. Wear protective gloves!

Take care with hot fluids in lines, pipes and chambers ⇒ Risk of injury!

Note cooling period for components which are heated for installation or removal ⇒Risk of injury!

Take special care when removing ventilation or plugs from engine. In order to avoid discharge of highly pressurized liquids, hold a cloth over the screw or plug. It is even more dangerous if the engine has recently been shut down, as the liquids can still be hot.

Take special care when draining hot fluids. ⇒ Risk of injury!

When draining, collect fluids in a suitable container, mop up any spilt fluids or wipe or soak them with a suitable bonding agent.

When changing the engine oil or working on the fuel system, ensure that the engine room is adequately ventilated.

When working high on the engine, always use suitable ladders and work platforms. Make sure components are placed on stable surfaces.

In order to prevent back injuries when lifting heavy components adults, depending on age and sex, should only lift weights between max. 10 kg and 30 kg, therefore:

- Use lifting gear or seek assistance.
- Ensure that all chains, hooks, slings, etc. are tested and authorized, are sufficiently strong and that hooks are correctly positioned. Lifting eyes must not be unevenly loaded.

Welding work

Never carry out welding work on the engine or engine-mounted units.

Never use the engine as a ground connection. (This prevents the welding current passing through the engine and causing scoring or burning at bearings, sliding surfaces and tooth flanks, which can lead to pitting or other material damage).

Never position the welding power supply cable adjacent to, or crossing MTU plant wiring harnesses. (The welding current could be induced in the cable harnesses and could possibly damage the electrical plant).

The welding unit ground connection must not be more than 60 cm from the weld point.

If components (e.g. exhaust manifold) are to be welded, they must be removed from the engine.

It is not necessary to remove the connector and the connections when carrying out welding operation on MTU electronics if the master switch for power supply is switched from "ON" to "OFF" and the wire is disconnected from the negative and positive poles on the battery.

Hydraulic installation and removal

Only the hydraulic installation and removal equipment specified in the work schedule and in the assembly instructions must be used.

The max. permissible push-on pressure specified for the equipment must not be exceeded.

The H.P. lines for hydraulic installation and removal are tested with 3800 bar.

Do not attempt to bend or apply force to lines.

Before starting work, pay attention to the following:
- Vent the hydraulic installation/removal tool, the pumps and the lines at the relevant points for the system to be used (e.g. open vent plugs, pump until bubble-free air emerges, close vent plugs).
- For hydraulic installation, screw on the tool with the piston retracted.
- For hydraulic removal, screw on the tool with the piston extended.

For a hydraulic installation/removal tool with central expansion pressure supply, screw spindle into shaft end until correct sealing is achieved.

During hydraulic installation and removal, ensure that nobody is standing in the immediate vicinity of the component to be installed/removed. As long as the system is under pressure, there is the risk that the component to be installed/removed may be suddenly released from the pressure connection.

Before use, the tools must be checked at regular intervals (crack test).

Working on electrical assemblies

Switch off all live appliances before carrying out any work on electrical assemblies.

Gases released from the battery are explosive. Avoid sparks and naked flames. Do not allow battery acids to come in contact with skin or clothing. Wear protective goggles. Do not place tools on the battery. Before connecting the cable to the battery, check battery polarity. Battery pole reversal may lead to injury through the sudden discharge of acid or bursting of the battery body.

Do not damage wiring during removal work and when reinstalling wiring and ensure that during operation it is not damaged by contact with sharp objects, by rubbing against other component or by a hot surface.

Do not secure wiring to fluid-carrying lines.

On completion of the maintenance and repair work, any cables which have become loose must be correctly connected and secured.

Always tighten connectors with connector pliers.

If wires are installed beside mechanical components and there is a risk of chafing, use cable clamps to properly support the wires.

For this purpose, no cable binders must be used as, during maintenance and / or repair work, the binders can be removed but not installed a second time.

Operation of electrical equipment

When operating electrical equipment, certain components of this equipment are live.

Noncompliance with the warning instructions given for this equipment may result in serious injury or damage to property.

Fire prevention

Rectify any fuel or oil leaks immediately; even splashes of oil or fuel on hot components can cause fires - therefore always keep the engine in a clean condition. Do not leave cloths soaked with fluids and lubricants lying around on the engine. Do not store combustible fluids near the engine.

Do not weld pipes and components carrying oil or fuel. Before welding, clean with an inflammable fluid.

When starting the engine with a foreign power source, connect the ground lead last and remove it first. To avoid sparks in the vicinity of the battery, connect the ground lead from the foreign power source to the ground lead of the engine or to the ground terminal of the starter.

Always keep suitable fire-fighting equipment (fire extinguishers) at hand and familiarize yourself with their use.

Noise

Noise can lead to an increased risk of accident if acoustic signals, warning shouts or noises indicating danger are drowned.

At all workplaces with a sound pressure level over 85 dB(A), always wear ear protectors (protective wadding, plugs or capsules).

Environmental protection

Dispose of used fluids, lubricants and filters in accordance with local regulations.

Manipulation of the injection control system can influence the engine performance and exhaust emissions. As a result, compliance with environmental regulations may no longer be guaranteed.

Only fuels of the specified quality required to achieve emission limits must be used.

In Germany, the VAwS (= regulations governing the use of materials that may affect water quality) is applicable, which means work must only be carried out by authorized specialist companies (MTU is such a company).

Auxiliary materials

Use only fluids and lubricants that have been tested and approved by MTU.

Fluids and lubricants must be kept in suitable, properly designated containers. When using fluids, lubricants and other chemical substances, follow the safety instructions applicable to the product. Take care when handling hot, chilled or caustic materials. When using inflammable materials, avoid sparks and do not smoke.

⇒ *Lead*

When working with lead or lead-containing pastes, avoid direct contact to the skin and do not inhale lead vapors.

Adopt suitable measures to avoid the formation of lead dust!

Switch on fume extraction system.

After coming into contact with lead or lead-containing materials, wash hands!

⇒ *Acids and alkaline solutions*

When working with acids and alkalis, wear protective goggles or face mask, gloves and protective clothing.

Immediately remove clothing wetted by acids and alkalis!

Rinse injuries with plenty of water!

Rinse eyes immediately with eyedrops or clean tap water.

⇒ *Painting*

When painting in other than spray booths equipped with extractors, ensure good ventilation. Make sure that adjacent work areas are not affected.

It is absolutely necessary to wear masks providing protection against paint and solvent fumes.

Observe fire prevention regulations!

No smoking.

No naked flame!

⇒ Liquid oxygen

Liquid oxygen is highly inflammable.

Liquid oxygen should only be stored in small quantities and in regulation containers (without fixed seals)! Do not bring liquid oxygen in contact with the body (hands), as this causes frostbite and possibly the loss of tissue.

No smoking, no naked flame (risk of explosion)! Excessive oxygen in the air leads to explosive combustion.

Do not store combustible substances (e.g. oils and greases) within 5 m of the working area!

Under no circumstances should clothing be oily or greasy.

Do not allow vapors to penetrate clothing! Oxygen enrichment in fabric can cause working clothes to ignite suddenly!

After working with liquid oxygen, do not smoke until clothing is free of vapors!

Avoid all knocks and jars to the containers, fixtures or workpieces.

⇒ Liquid nitrogen

Store liquid nitrogen only in small quantities and always in regulation containers without fixed covers.

Do not bring liquid nitrogen in contact with the body (eyes, hands), as this causes frostbite and numbing.

Wear protective clothing(including gloves and closed shoes) and protective goggles!

Ensure the room is well ventilated (88% contamination of breathing with nitrogen will result in suffocation).

Avoid all knocks and jars to the containers, fixtures or workpieces.

⇒ *Compressed air*

Compressed air is air compressed at excess pressure and is stored in tanks from which it can be extracted.

The pressure at which the air is kept can be read off at pressure gauges which must be connected to the compressed air tanks and the compressed air lines.

When working with compressed air, safety precautions must be constantly observed:

- Pay special attention to the pressure level in the compressed air network and pressure vessel!
- Connecting devices and equipment must either be designed for this pressure or, if the permitted pressure for the connecting elements is lower than the pressure required, a pressure reducing valve and safety valve (set to permitted pressure) must form an intermediate connection. Hose coupling and connections must be securely attached!
- Always wear protective goggles when blowing off tools or extracting chips!
- The snout of the air nozzle is provided with a protective disc (e.g. rubber disc), which prevents air-borne particles being reflected and thereby prevents injury to eyes.
- First shut off compressed air lines before compressed air equipment is disconnected from the supply line or before equipment or tool is to be replaced!
- Unauthorized use of compressed air, e.g. forcing flammable liquids (danger class AI, AII and B) out of containers, results in a risk of explosion!
- Forcing compressed air into thin-walled containers (e.g. containers made of tin, plastic and glass) for drying purposes or to check for leaks, results in a risk of explosion!
- Do not blow dirty clothing with compressed air when being worn on the body.
  Even compressed air at low pressure penetrates clothing and, if the jet is directed at the back, the air can enter the anal cavity and fatally rupture the intestines!

⇒ *Used oil*

Used oil may contain health-threatening combustion residues.

Rub barrier cream into hands!

Wash hands after contact with used oil.

Warning signs

Before putting the engine into service and before working on the engine, read and follow all warning signs. Do not paint on warning signs. Replace illegible signs.

Warning notices

This Publication contains especially emphasized safety instructions in accordance with the American standard ANSI Z535, which begin with one of the following signal words according to the degree of danger:

! DANGER !
In event of immediate danger. Consequences: Death or serious injury

! WARNING !
In event of dangerous situations. Consequences: Death or serious injury.

! CAUTION !
In event of dangerous situations. Consequences: Slight injury or material damage

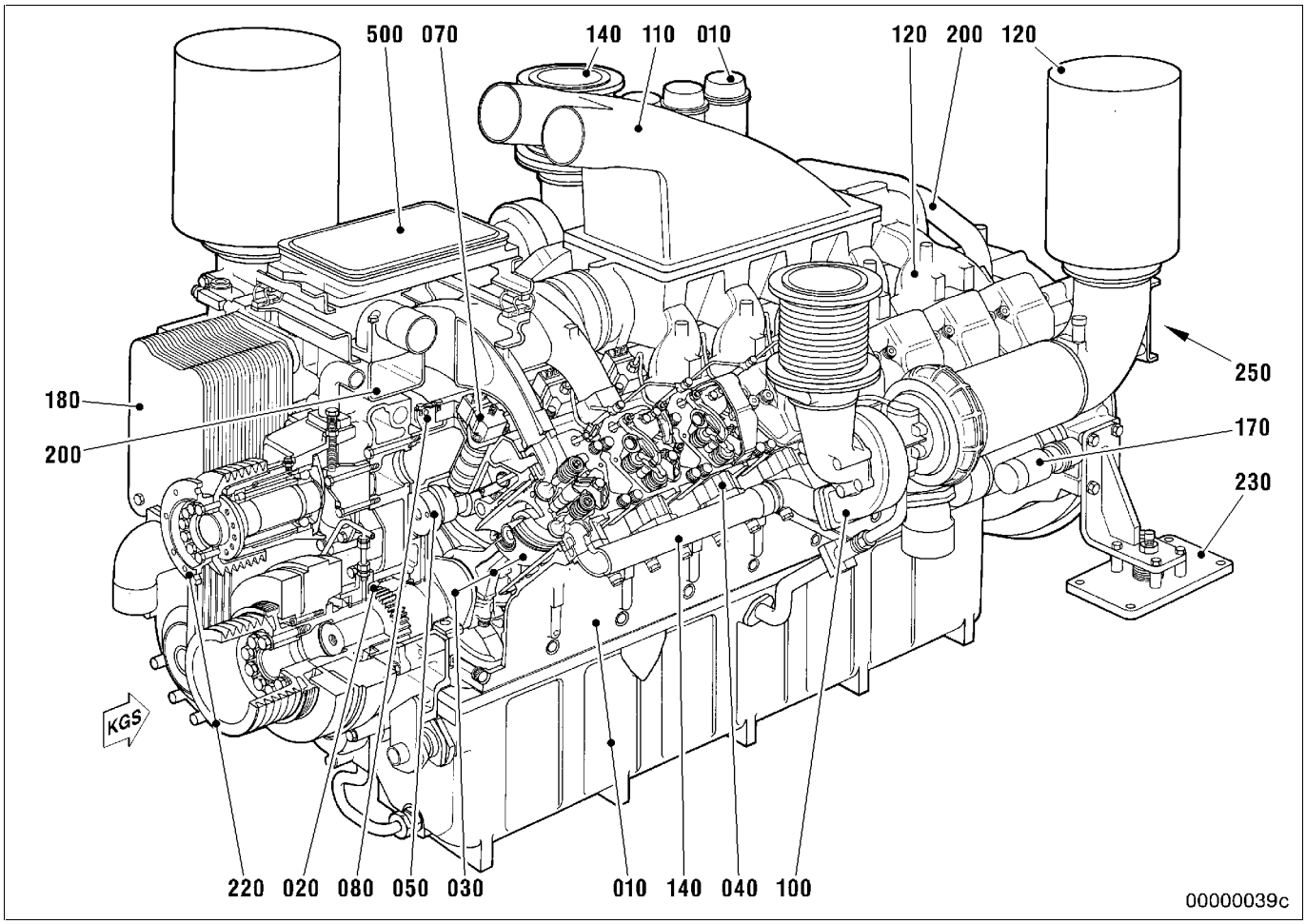
In these cases, take special care.

Read and become acquainted with all cautions and symbols before operating or repairing this product.

Pass on all safety instructions to your operating, maintenance, repair and transport personnel!

Engine layout

Illustration is also valid for 12/16/18V 2000 M60-82 engines



000 Engine, general
010 Crankcase and externally mounted components
020 Gear train
030 Running gear
040 Cylinder head
050 Valve gear
070 Fuel system (high pressure)
080 Fuel system (low pressure)
100 Turbocharger
110 Intercooler
120 Air intake, air supply
140 Exhaust system
170 Starting system
180 Lube oil system
200 Cooling system
210 Power supply, engine side
220 Cooling-air system
230 Mounting / support
250 PTO systems, driving end and free end
290 Pumps (with separate drive)
340 Driving, power generation and safety system
500 Monitoring, control and regulation system

Engine model designation

Key to the engine model designations 12/16/18V 2000 G2x to 8x

12/16/18 = number of cylinders
V = Cylinder configuration: V = Vee engine
2000 = Engine series
G = Application
2/4/6/8 = Application segment
x = Design index (e.g. 2)

Engine side and cylinder designations

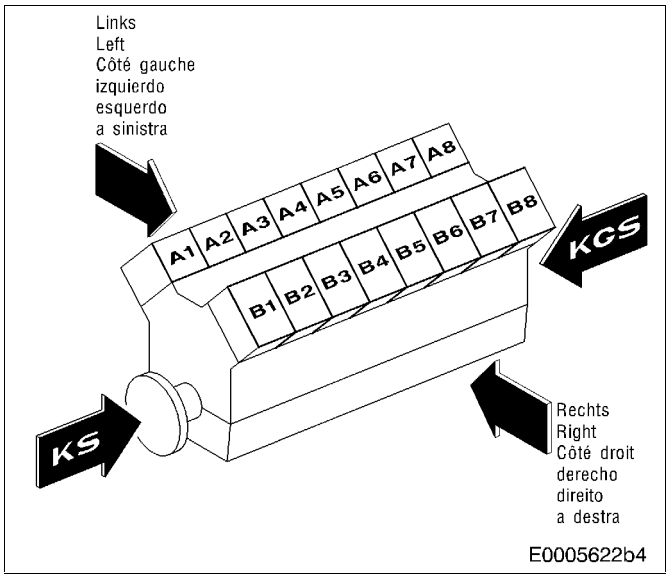
Engine sides are always designated as viewed from the driving end (KS).

The cylinders of the left engine side are designated "A" and those of the right side "B" (as per DIN ISO 1204).

The cylinders of each bank are numbered consecutively, starting with No. 1 at the driving end.

The numbering of engine components is also from the driving end, starting with No. 1.

Illustration is also valid for 12/16/18V 2000 M6082 engines



Applicable designations and abbreviations

Driving end = KS

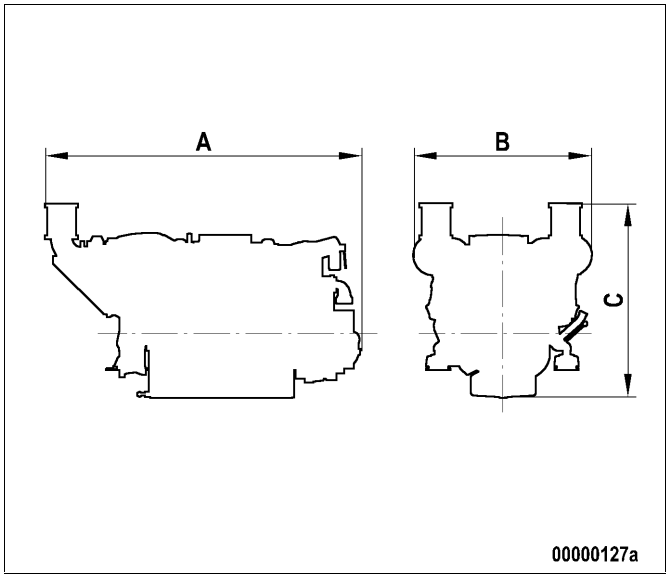
Free end = KGS

Left side

Right side

Main engine dimensions

Illustration is also valid for 12/16/18V 2000 G22-82 engines



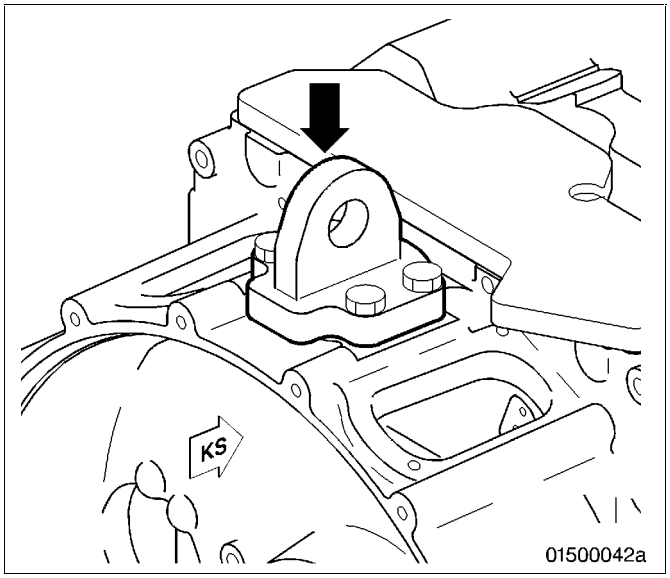
Engine model	Overall length (A)	Overall width (B)	Overall height (C)
12V 2000 G22/42/62/82	approx. 2020 mm	approx. 1580 mm	approx. 1690 mm
16V 2000 G22/42/62/82	approx. 2365 mm	approx. 1580 mm	approx. 1925 mm
18V 2000 G62/82	approx. 2400 mm	approx. 1580 mm	approx. 1605 mm

Engine weight

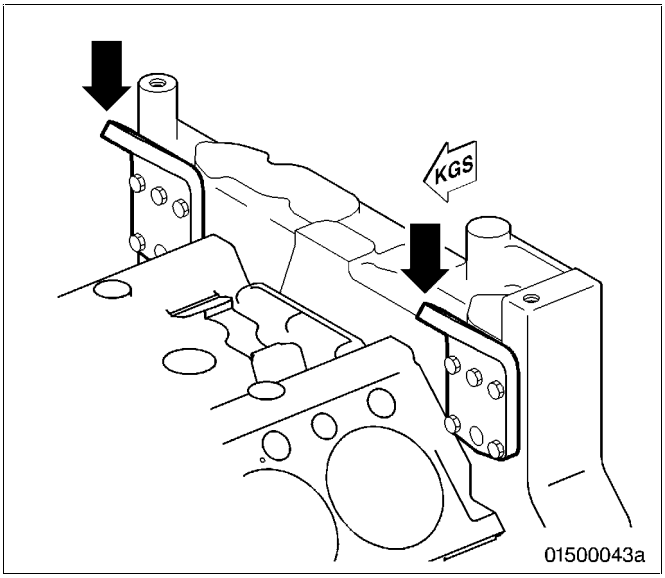
Engine model	Engine dry weight
12V 2000 G22/42/62/82	approx. 2490 kg
16V 2000 G22/42/62/82	approx. 3100 kg
18V 2000 G62/82	approx. 3500 kg

Engine transportation

Driving end (KS)



Free end (KGS)



Use only the transport and lifting equipment approved by MTU.

The engine must only be transported in installation position, max. permissible diagonal pull 10°.

Lift the engine only with the lifting eyes provided.

Engine preservation

For engine preservation procedures refer to MTU Fluids and Lubricants Specification, Publication No. A001061/…

Basic Data - Stationary Power Generation

12V 2000 G22/42/62/82 - 16V 2000 G22/42/62/82 - 18V 2000 G62/82

Engine Power Rating

Engine ratings according to DIN ISO 3046:
ICFN = Fuel stop power (application group 3D)
ICXN = 10% overload capability (application groups 3A, 3B, 3C)

Application

MTU application group 3A:
Diesel engine for power generation in unrestricted continuous operation at 100% load
MTU application group 3B:
Diesel engine for power generation in unrestricted continuous operation at variable load
MTU application group 3D:
Diesel engine for emergency standby power at variable load

Reference Conditions

■ Intake air temperature	25 °C
■ Barometric pressure	1000 mbar
■ Intake air depression	15 mbar
■ Exhaust back pressure	30 mbar

no derating up to
40 °C intake air temperature and
400 m site elevation above sea level (fan power consumption not considered)

Basic Design

■ 12/16/18 cylinders	
■ 90° V cylinder arrangement	
■ Four-stroke diesel	
■ Liquid cooling	
■ Direct fuel injection	
■ Exhaust turbocharging and charge-air cooling	
■ Wet, replaceable cylinder liners	
■ Piston cooling	
■ 2 inlet, 2 exhaust valves per cylinder	
■ Triple-walled, liquid-cooled exhaust lines	
■ Electronically-controlled fuel injection system	
■ Electronic engine management	
■ Bore	130 mm
■ Stroke	150 mm
■ Cylinder displacement	1.99 lit.
■ Total displacement 12/16/18V	23.88 lit. / 31.84 lit. / 35.8 lit.
■ Compression ratio 12/16/18V G22, G62	16 : 1
■ Compression ratio 12/16/18V G42, G82	14 : 1
■ Direction of rotation (facing driving end)	CCW
■ Firing order 12V	A1-B2-A5-B4-A3-B1-A6-B5-A2-B3-A4-B6
■ Firing order 16V	A1-B5-A3-A5-B2-B8-A2-A8-B3-A7-B4-B6-A4-A6-B1-B7
■ Firing order 18V	A1-B6-A3-B4-A5-B2-A7-B1-A9-B3-A8-B5-A6-B7-A4-B9-A2-B8
■ Final compression pressure at 120 rpm	30 to 36 bar
■ Firing speed at 40°C engine coolant temperature	approx. 100 - 120 rpm
■ Flywheel housing	SAE 0
■ Cold start capability: air temperature (w/o start assistance, w/o coolant preheating)	- 10 °C

Basic Engine Configuration

Stationary power generation, with external air-to-air charge-air cooling

Application group	Emergency standby power (ESP) 3D	Prime power limited time (LTP) 3C	Prime power (PRP) 3B	Continuous power (COP) 3A
Operating mode	Emergency standby power generation at variable load	Standby power generation at variable load	Continuous power generation at variable load	Continuous power generation at 100 % load
Load factors	< 85 %	< 75 %	< 75 %	≤ 100 %
Operating hours per year	max. 500	max. 1000	unrestricted	unrestricted
Power rating according to DIN ISO 3046	Fuel stop power (ICFN)	10 % overload capability (ICXN)	10 % overload capability (ICXN)	10 % overload capability (ICXN)

Engine model	kW at 1500 rpm (50 Hz)			
Optimizations[1)]	☒	-	☒ or ①	☒
12V 2000 G22	625	-	565	-
12V 2000 G62	680	-	625	515
16V 2000 G22	805	-	720	-
16V 2000 G62	895	-	805	655
18V 2000 G62	985	-	895	720

Engine model	kW at 1800 rpm (60 Hz)			
Optimizations[1)]	☒ or ②		☒② or	☒ or ②
12V 2000 G42	735	-	-	-
12V 2000 G82	835	-	695	625
16V 2000 G42	1000	-	-	-
16V 2000 G82	1115	-	925	835
18V 2000 G82	1250	-	1040	900

Engine model	kW at 1500/1800 rpm (50/60 Hz) switchable			
Optimizations[1)]	☒ / ②		☒ or ① / ②	☒ / ②
12V 2000 G22	625 / 625	-	565 / 565	-
12V 2000 G62	680 / 680	-	625 / 625	515 / 515
16V 2000 G22	805 / 805	-	720 / 720	-
16V 2000 G62	895 / 895	-	805 / 805	655 / 655
18V 2000 G62	985 / 985	-	895 / 895	720 / 720

Reference conditions	Standard	Specified power ratings available up to
Intake air temperature	25 °C	40 °C
Site elevation above sea level	100 m	400 m
Fan power consumption not considered		

1)

Optimizations	① Exhaust emission (TA-Luft) ② Exhaust emission (EPA)	☒ Fuel consumption

Basic Engine Configuration

Stationary power generation, with external charge-air cooling

Application group	Emergency standby power (ESP) 3D	Prime power limited time (LTP) 3C	Prime power (PRP) 3B	Continuous power (COP) 3A
Operating mode	Emergency standby power generation at variable load	Standby power generation at variable load	Continuous power generation at variable load	Continuous power generation at 100 % load
Load factors	< 85 %	< 75 %	< 75 %	≤ 100 %
Operating hours per year	max. 500	max. 1000	unrestricted	unrestricted
Power rating according to DIN ISO 3046	Fuel stop power (ICFN)	10 % overload capability (ICXN)	10 % overload capability (ICXN)	10 % overload capability (ICXN)

Engine model	kW at 1500 rpm (50 Hz)			
Optimizations[2)]	☒		☒ ⑥⑨ ① 🗋	☒
12V 2000 G22	625	-	565	-
12V 2000 G62	680	-	625	515
16V 2000 G22	805	-	720	-
16V 2000 G62	895	-	805	655
18V 2000 G62	985	-	895	720

Engine model	kW at 1800 rpm (60 Hz)			
Optimizations[2)]	☒ or ②		☒ or ②	☒ or ②
12V 2000 G42	735	-	-	-
12V 2000 G82	835	-	695	625
16V 2000 G42	1000	-	-	-
16V 2000 G82	1115	-	925	835
18V 2000 G82	1250	-	1040	900

Engine model	kW at 1500/1800 rpm (50/60 Hz) switchable			
Optimizations[2)]	☒ / ②		☒ or ②①	☒ / ②
12V 2000 G22	625 / 625	-	565 / 565	-
12V 2000 G62	680 / 680	-	625 / 625	515 / 515
16V 2000 G22	805 / 805	-	720 / 720	-
16V 2000 G62	895 / 895	-	805 / 805	655 / 655
18V 2000 G62	985 / 985	-	895 / 895	720 / 720

Reference conditions	Standard	Specified power ratings available up to
Intake air temperature	25 °C	40 °C
Site elevation above sea level	100 m	400 m
Charge-air coolant temperature	60 °C	60 °C
Charge-air coolant temperature with ① (TA-Luft standard compliance)	55 °C	55 °C
Fan power consumption not considered		

2)

Optimizations	① Exhaust emission (TA-Luft standard) ② Exhaust emission (EPA standard)	☒ Fuel consumption

Acoustics

Sound pressure level according to ISO 8528-10:

Engine model	Characteristics	3D optimized fuel consumption	3D optimized exhaust emission	3B optimized fuel consumption	3B optimized exhaust emission	3A optimized fuel consumption	3A optimized exhaust emission
12V2000G22	Engine surface noise dB(A)	approx. 120		approx. 119	approx. 120		
	Exhaust noise, unsilenced dB(A)	approx. 125		approx. 123	approx. 127		
12V2000G42	Engine surface noise dB(A)	approx. 123					
	Exhaust noise, unsilenced dB(A)	approx. 128					
12V2000G62	Engine surface noise dB(A)	approx. 121		approx. 119	approx. 121	approx. 118	
	Exhaust noise, unsilenced dB(A)	approx. 126		approx. 125	approx. 128	approx. 123	
12V2000G82	Engine surface noise dB(A)	approx. 123		approx. 122		approx. 123	
	Exhaust noise, unsilenced dB(A)	approx. 130		approx. 127		approx. 125	
16V2000G22	Engine surface noise dB(A)	approx. 121		approx. 120	approx. 121		
	Exhaust noise, unsilenced dB(A)	approx. 125		approx. 124	approx. 126		
16V2000G42	Engine surface noise dB(A)	approx. 124					
	Exhaust noise, unsilenced dB(A)	approx. 128					
16V2000G62	Engine surface noise dB(A)	approx. 121		approx. 121	approx. 121	approx. 119	
	Exhaust noise, unsilenced dB(A)	approx. 127		approx. 125	approx. 128	approx. 123	
16V2000G82	Engine surface noise dB(A)	approx. 125		approx. 124		approx. 123	
	Exhaust noise, unsilenced dB(A)	approx. 130		approx. 128		approx. 127	
18V2000G62	Engine surface noise dB(A)	approx. 122	approx. 123	approx. 122	approx. 122	approx. 122	
	Exhaust noise, unsilenced dB(A)	approx. 127	approx. 128	approx. 127	approx. 127	approx. 125	
18V2000G82	Engine surface noise dB(A)	approx. ---	approx. ---				
	Exhaust noise, unsilenced dB(A)	approx. ---	approx. ---				

Operating parameters

The operating parameters specified in the test-stand protocol of the relevant engine are binding.
All data refer to an engine running at operating temperature and rated power.
In case of questions related to the technical operating data please attend to your responsible MTU contact person, specifying engine model and number.

Cooling system (high temperature)		**Unit of measure**	**Guide value**	**Limit value**
Coolant temperature at engine outlet		°C	95	102
Pressure loss in off-engine cooling system, max. permissible		bar	–	0.7
Coolant preheating temperature		°C	> 40	–
Lube Oil System				
Lube oil operating temperature (from / to)		°C	98	103
Lube oil operating pressure before engine				
Application group 3D, emergency standby power (ESP)		bar	7.0	4.0
	12V 2000 G22			
	12V 2000 G42	bar	7.5	5.0
	12V 2000 G62	bar	7.0	4.0
	12V 2000 G82	bar	7.5	5.0
	16V 2000 G22	bar	5.5	4.0
	16V 2000 G42	bar	6.0	5.0
	16V 2000 G62	bar	5.5	4.0
	16V 2000 G82	bar	6.0	5.0
	18V 2000 G62	bar	6.5	4.0
	18V 2000 G82	bar	7.0	5.0
Application group 3B, prime power (PRP)	12V 2000 G22,	bar	7.0	4.0
	12V 2000 G62	bar	7.0	4.0
	12V 2000 G82	bar	7.5	5.0
	16V 2000 G22	bar	5.5	4.0
	16V 2000 G62	bar	5.5	4.0
	16V 2000 G82	bar	6.0	5.0
	18V 2000 G62	bar	6.5	4.0
	18V 2000 G82	bar	7.0	5.0
Application Group 3A, continuous power (COP)	12V 2000 G62	bar	7.0	4.0
	12V 2000 G82	bar	7.5	5.0
	16V 2000 G62	bar	5.5	4.0
	16V 2000 G82	bar	6.0	5.0
	18V 2000 G62	bar	6.5	4.0
	18V 2000 G82	bar	7.0	5.0
Lube oil consumption after 100 hrs operation, average *of fuel consumption in continuous operation with a run-in engine		%*	0.5	
Fuel System				
Fuel pressure at supply connection on engine, min.		bar	–	– 0.3
Fuel pressure at supply connection on engine, max.		bar	–	+ 0.5
Boundary conditions for maximum power				
Intake air depression		mbar	15	30
Exhaust back pressure		mbar	30	50

Charge Air Charge-air pressure before cylinder		**Unit of Measure**	**Guide value**	
			optimized fuel consumption	optimized exhaust emission
Application group 3D, emergency standby power (ESP)		bar ABS	2.8	--
	12V 2000 G42	bar ABS	--	3.2
	12V 2000 G62	bar ABS	3.1	--
	12V 2000 G82	bar ABS	--	3.4
	16V 2000 G22	bar ABS	2.7	--
	16V 2000 G42	bar ABS	--	3.2
	16V 2000 G62	bar ABS	3.1	--
	16V 2000 G82	bar ABS	--	3.3
	18V 2000 G62	bar ABS	3.0	--
	18V 2000 G82	bar ABS	--	3.3
Application group 3B, prime power (PRP)	12V 2000 G22	bar ABS	2.6	2.9
	12V 2000 G62	bar ABS	2.8	3.1
	12V 2000 G82	bar ABS	--	3.1
	16V 2000 G22	bar ABS	2.6	2.9
	16V 2000 G62	bar ABS	2.8	3.1
	16V 2000 G82	bar ABS	--	3.1
	18V 2000 G62	bar ABS	2.8	3.2
	18V 2000 G82	bar ABS	--	3.0
Application group 3A continuous power (COP)	12V 2000 G62	bar ABS	2.6	--
	12V 2000 G82	bar ABS	--	2.9
	16V 2000 G62	bar ABS	2.6	--
	16V 2000 G82	bar ABS	--	2.9
	18V 2000 G62	bar ABS	2.6	--
	18V 2000 G82	bar ABS	--	2.9

Valve clearances

With cold 12/16/18V 2000 engine

- Inlet valve 0.40 mm
- Exhaust valve 0.60 mm

Nozzle opening pressure

12/16/18V 2000 with new spring

- Initial pressure setting 320 to 330 bar

Oil capacity, 12V engines

- Initial filling 12V approx. 82 lit.
- Oil dipstick mark „min“ approx. 50 lit.
- Oil dipstick mark „max“ approx. 67 lit.

Oil capacity, 16V engines

- Initial filling 16V approx. 110 lit.
- Oil dipstick mark „min“ approx. 69 lit.

- Oil dipstick mark „max" approx. 92 lit.

Oil capacity, 18V engines

- Initial filling 18V approx. 130 lit.
- Oil dipstick mark „min“ approx. 87 lit.
- Oil dipstick mark „max approx. 110 lit.

Coolant capacity

- Engine coolant capacity, 12V engines approx. 90 lit.
- Engine coolant capacity, 16V engines approx. 110 lit.
- Engine coolant capacity, 18V engines approx. 120 lit.

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C000.000.01 Operating instructions – preface

Low operating and maintenance costs as well as operational reliability and availability depend on maintenance and servicing being carried out in compliance with our specifications and instructions.

Our Product Support service is available at all times should assistance be needed.

Prior to engine startup it must be determined whether startup is:

– after a short, scheduled operational shutdown
– an extended out-of-service period
– initial startup of a new engine.

Accordingly the Before-Operation Services are sub-divided into:

– B1- Before-Operation Services after a short, scheduled operational shutdown (B1)
– B2- Before-Operation Services after an extended operational shutdown (exceeding 1 week) (B2)
– Before-Operation Services before initial start-up of a new or preserved engine (B3).

Correct engine installation and alignment according to MTU regulations are basic requirements for initial engine start-up.

In the event of an engine malfunction a decision must be made as to whether:

– the engine is to be shut down, or
– operation may be continued, for a short period, using emergency measures, until the fault can be rectified.

Prior to engine shutdown it must be determined whether shutdown is for:

– a short, scheduled operational shutdown
– an extended out-of-service period.

Note:
The code numbers on the following pages refer to the group numbers in Section G.

C000.000.03 Preparations for initial operation

Code No.		Task Description	B	1	2	3
G123.053.01	Contamination indicator	Check signal ring position				
G180.000.01	Engine oil	Check level				
G202.000.03	Engine coolant	Check level				
G202.400.01	Engine coolant	Preheat				
G203.000.03	Charge air coolant	Check level (only TB version)				
G364.000.03	Fuel supply system	Open supply line				
G364.050.01	Fuel supply system	Check supply				
G500.000.01	Engine control system	Switch on				
G000.000.05	Running gear	Bar engine manually				
G307.001.01	Mechanical accessories	Ensure guards are installed				
G500.000.09	Engine wiring	Check				
	Depreservation	See MTU Fluids and Lubricants Specification A001061				
G000.000.27	Attachments	Check security				
G000.000.29	Attachments	Check security of hoses and hose connections				
G080.000.01	Fuel system	Vent				
G120.000.07	Air supply pipework	Check				
G140.000.07	Exhaust system	Check				
G180.000.03	Engine oil	Fill system				
G202.000.01	Engine coolant	Fill system				
G202.401.01	Preheater	Switch on				
G202.651.01	Engine coolant system	Check vent line for obstructions				
G203.000.01	Charge air coolant	Add coolant (only TB version)				
G203.551.01	Charge air coolant system	Check vent line for obstruction (only TB version)				
G231.051.15	Engine/alternator mounting	Remove transportation locking device				

C000.000.05 Initial operation

Code No.		Task Description
G000.000.07	Engine	Turn engine on starting system – only • after 1st startup • after engine oil change • after engine oil filter change • after extended out-of-service period (exceeding 1 month)
G000.000.09	Engine	Start engine
G000.000.13	Engine operation	Check speed
G000.000.15	Engine operation	Check pressures
G000.000.17	Engine operation	Check temperatures
G000.000.19	Engine operation	Check running noises
G000.000.21	Engine operation	Check engine and external pipework for leaks
G080.000.21	Fuel system	Vent
	During initial engine start-up, carry out the following tasks in addition to those described above	
G140.000.09	Exhaust system	Check exhaust backpressure

C000.000.07 Operational Checks –maintenance echelon W1–

Carry out tasks in accordance with Maintenance Schedule section D

C000.000.09 Shutdown

Code No.		Task Description
G000.000.23	Engine	Shut down engine

C000.000.11 After shutdown

Code No.		Task Description
G180.000.01	Engine oil	Check level

C000.000.13 Out-of-service period

Code No.		Task Description
G202.000.07	Engine coolant	Drain[1]
G202.401.05	Preheater	Switch off
G203.000.05	Charge air coolant	Drain[1] (only TB version)

1) Only when freezing temperatures are expected and the engine is to remain out of service for an extended period and

– the engine coolant has no antifreeze additive,
– the engine room cannot be heated,
– the coolant cannot be maintained at a suitable temperature,
– the antifreeze concentration is insufficient for the engine room temperature,
– with an antifreeze concentration of 50% and engine chamber temperature below –40 °C if antifreeze corresponds to MTU Fluids and Lubricants Specification A001061.

If the engine is to remain out of service for more than 1 week, seal the engine air and exhaust sides.

If the engine is to remain out of service for more than 1 month, carry out preservation (see MTU Fluids and Lubrications Specification A001061).

C000.000.15 Emergency measures in event of engine malfunction

Code No.		Emergency Measure
G101.011.01	Exhaust turbocharger	Engine operation without turbocharger

Contents

D000.000.01 Maintenance schedule – preface

Low operating and maintenance costs as well as operational reliability and availability depend on maintenance and servicing being carried out in compliance with our specifications and instructions.

The overall system, of which the engine is an integral part, must be maintained in such a way as to ensure trouble-free engine operation at all times.

For this purpose, always:

– Ensure that sufficient fuel is available
– Ensure that the combustion air is dry and clean
– Use only clean, filtered raw water

Maintenance notes:

– Special care should be taken to keep the machinery plant in a clean and serviceable condition at all times to facilitate detection of possible leaks and prevent subsequent damage.
– Protect rubber and synthetic parts from oil and fuel, never treat with organic detergents. Wipe with a dry cloth only.
– Always replace all seals and gaskets.

D000.000.03 Maintenance system

Preventive maintenance permits advance operational planning and increases availability.

The maintenance system comprises maintenance echelons W1 to W6.

Main features of maintenance echelons

W1:	Operational checks.
W2, W3 and W4:	Periodic maintenance services to be carried out during out-of-service periods without the need for engine disassembly.
W5	This echelon requires partial engine disassembly.
W6:	Major overhaul. Complete engine disassembly.

The maintenance intervals have been determined so as to ensure correct engine operation until the next scheduled maintenance echelon. Particular operating conditions may require the Maintenance Schedule to be altered to compensate.

Note:

The Maintenance Schedule for application 3A and 3B is shown on Pages 2 to 4, for application 3D from Pages 5 to 7.

D000.000.05 Application 3A Continuous operation, unrestricted, and 3B Continuous operation, variable

D000.000.07 Maintenance frequency chart

			3A	3B
Maintenance echelon	W1:	Operational checks daily	X	X
	W2:	Operating hours limit Every month	500 6	500 6
	W3:	Operating hours limit Every year	1000 1	1000 1
	W4:	Operating hours limit Every year	4000 4	3000 4
	W5:	Operating hours limit Every year	8000 8	6000 8
	W6:	See Page 4, D000.000.15		–

D000.000.11 Maintenance schedule

Note:
The code numbers on the following pages refer to the group numbers in Section G.

Code No.	One-time services after first 3 months, limit 50 operating hours – on a new engine, or after W5 or W6 maintenance	
G055.050.01	Valve gear	Check valve clearances
G083.101.09	Fuel prefilter	Check, replace element if necessary
G140.000.03	Exhaust system	Check security
G202.051.01	Engine/charge air coolant pump	Check relief bore
G231.051.01	Engine mounting	Check security

Code No.	Maintenance Echelon W1 – Monthly test run / operational checks	
G000.000.10	Engine operation	Do not carry out trial run with less than 1/3 load at least until steady-state temperature is reached
G000.000.13	Engine operation	Check speed
G000.000.15	Engine operation	Check pressures (where gauges are installed)
G000.000.17	Engine operation	Check temperatures (where gauges are installed)
G000.000.19	Engine operation	Check running noises
G000.000.21	Engine operation	Check engine and external pipework for leaks
G111.051.01	Intercooler	Check drain line for coolant discharge and obstruction (only TB version)
G121.052.01	Air filter	Check contamination indicator
G140.000.05	Exhaust system	Check exhaust gas colour
G180.000.01	Engine oil	Check level
G202.000.03	Engine coolant	Check level
G203.000.03	Charge air coolant	Check level (only TB version)

Code No.	Task Description		W	2	3	4	5
G083.051.03	Fuel filter	Replace filter					
G083.052.03	Fuel filter	Replace filter					
G120.000.03	Air supply pipework	Check intake side for leaks or damage					
G180.000.04	Engine oil	Used oil – take sample and analyse					
G180.000.05	Engine oil	Change – after every 2 years – with oil category 2 no later than after 500 operating hours – with oil category 3 no later than after 1000 operating hours					
G183.052.03	Engine oil filter	Replace – when changing oil					
G213.051.01	Generator drive	Check drive belt condition and tension					
G221.051.01	Fan drive	Check drive belt condition and tension					
G055.050.01	Valve gear	Check valve clearances					
G083.101.15	Fuel prefilter	Clean					
G202.000.05	Engine coolant	Take sample and analyze – Change engine coolant – See MTU Fluids and Lubricants Specification					
G202.051.01	Engine/charge air coolant pump	Check relief bore					
G203.000.07	Charge air coolant	Take sample and analyse (only TB version) – Change charge air coolant, see MTU Fluids and Lubricants Specification					
G205.051.01	Engine coolant cooler	Check cooler elements for external contamination					
G205.051.03	Charge air coolant cooler	Check cooler elements for external contamination (only TB version)					
G000.000.33	Cylinder chambers	Perform endoscopic examination					
G018.101.05	Crankcase breather	Replace filter					
G018.101.07	Crankcase breather	Clean oil preseparator					
G073.051.04	Fuel injection pumps	Replace					
G075.051.05	Fuel injectors	Replace					
G101.011.03	Exhaust turbocharger	Check ease of movement					
G121.051.01	Air filter	Replace					
G231.051.01	Engine mounting	Check security					
G309.001.05	Battery	Check charge state, fluid viscosity and electrolyte level					
G500.000.09	Engine wiring	Check					
	Before starting W5 maintenance services, drain coolant and flush coolant systems.						
	Valve gear	Remove and check rocker arms and valve bridges Check rocker arm bearings, ball joints and push rods for wear					
	Cylinders	Check compression pressures					
	Engine coolant pump	Overhaul or replace					
	Engine/charge air coolant pump	Overhaul or replace (only TB version)					
	Engine coolant cooler	Clean, check for leaks					
	Charge air coolant cooler	Clean, check for leaks (only TB version)					
	Engine coolant thermostat	Replace thermal element					

D000.000.15 Maintenance echelon W6

The W6 echelon requires complete disassembly of the engine.

Repair/overhaul of the relevant components is determined by the actual condition of the components and their dimensions, which are referenced to the Tolerances and Wear Limits List.

Recommended major overhaul:

Application Group	3A	3B
Operating hours	16 000	10 000
Years	16	16

D000.000.17 Out-of-service periods

Turn running gear monthly by hand (Section G).

If the engine is to remain out of service for more than 3 months, carry out preservation (see MTU Fluids and Lubrications Specification A001061).

D000.000.05 Application 3D Emergency power operation

D000.000.07 Maintenance frequency chart

Maintenance echelon	W1:	Every month In extended operation daily	1 x
	W2:	Every month Operating hours limit	6 250
	W3:	Every year Operating hours limit	1 500
	W4:	Every year Operating hours limit	4 1500
	W5:	Every year Operating hours limit	8 3000
	W6:	See Page 7, D000.000.15	–

D000.000.11 Maintenance schedule

Note:
The code numbers on the following pages refer to the group numbers in Section G.

Code No.	One-time services after first 3 months, limit 50 operating hours – on a new engine, or after W5 or W6 maintenance	
G055.050.01	Valve gear	Check valve clearances
G083.101.09	Fuel prefilter	Check, replace element if necessary
G140.000.03	Exhaust system	Check security
G202.051.01	Engine/charge air coolant pump	Check relief bore
G231.051.20	Engine/alternator mounting	Check security
G231.052.20	Engine/alternator mounting	Check security

Code No.	Maintenance Echelon W1 – Monthly test run / operational checks	
G000.000.10	Engine operation	Perform trial run at least until steady-state temperatures have been reached and not under 1/3 load.
G000.000.13	Engine operation	Check speed
G000.000.15	Engine operation	Check pressures (where gauges are installed)
G000.000.17	Engine operation	Check temperatures (where gauges are installed)
G000.000.19	Engine operation	Check running noises
G000.000.21	Engine operation	Check engine and external pipework for leaks
G111.051.01	Intercooler	Check drain line for coolant discharge and obstruction (only TB version)
G123.053.01	Contamination indicator	Check signal ring position
G140.000.05	Exhaust system	Check exhaust gas colour
G180.000.01	Engine oil	Check level
G202.000.03	Engine coolant	Check level
G203.000.03	Charge air coolant	Check level (only TB version)

Code No.		Task Description	W	2	3	4	5
G120.000.03	Air supply pipework	Check intake side for leaks or damage					
G213.051.01	Generator drive	Check condition and tension of drive belt					
G221.051.01	Fan drive	Check condition and tension of drive belt					
G055.050.01	Valve gear	Check valve clearances					
G083.051.03	Fuel filter	Replace filter					
G083.052.03	Fuel filter	Replace filter					
G083.101.15	Fuel prefilter	Clean					
G180.000.04	Engine oil	Used oil – take sample and analyse					
G180.000.05	Engine oil	Change – after every 2 years – with oil category 2 no later than after 500 operating hours – with oil category 3 no later than after 1000 operating hours					
G183.052.03	Engine oil filter	Replace – when changing oil					
G202.000.05	Engine coolant	Take sample and analyze – Change engine coolant – See MTU Fluids and Lubricants Specification					
G202.051.01	Engine/charge air coolant pump	Check relief bore					
G203.000.07	Charge air coolant	Take sample and analyse (only TB version) – Change charge air coolant, see MTU Fluids and Lubricants Specification					
G205.051.01	Engine coolant cooler	Check cooler elements for external contamination					
G205.051.03	Charge air coolant cooler	Check cooler elements for external contamination (only TB version)					
G000.000.33	Cylinder chambers	Perform endoscopic examination					
G018.101.05	Crankcase breather	Replace filter					
G101.011.03	Exhaust turbocharger	Check ease of movement					
G121.051.01	Air filter	Replace					
G231.051.20	Engine/alternator mounting	Check security					
G231.052.20	Engine/alternator mounting	Check security					
G231.052.30	Engine/alternator mounting	Check condition of damping mount					
G309.001.05	Battery	Check charge state, fluid viscosity and electrolyte level					
G500.000.09	Engine wiring	Check					
	Before starting W5 maintenance services, drain coolant and flush coolant systems.						
	Cylinders	Check compression pressures					
	Valve gear	Remove and check rocker arms and valve bridges Check rocker arm bearings, ball joints and push rods for wear					
	Injection pumps	Replace					
	Injectors	Replace					
	Engine coolant pump	Overhaul or replace					
	Engine/charge air coolant pump	Overhaul or replace (only TB version)					
	Engine coolant cooler	Clean, check for leaks					
	Charge air coolant cooler	Clean, check for leaks (only TB version)					
	Engine coolant thermostat	Replace thermal element					
	Elastomers	Replace (external)					

D000.000.15 Maintenance echelon W6

The W6 echelon requires complete disassembly of the engine.

Repair/overhaul of the relevant components is determined by the actual condition of the components and their dimensions, which are referenced to the Tolerances and Wear Limits List.

Recommended major overhaul:

Years	16
Operating hours	6 000

D000.000.17 Out-of-service periods

Turn running gear monthly by hand (Section G).

If the engine is to remain out of service for more than 3 months, carry out preservation (see MTU Fluids and Lubrications Specification A001061).

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E000.000.01 General

In Event of Internal Coolant Leakage

Consequential damage caused by corrosion must be avoided. If the engine cannot be repaired immediately, carry out the following operations:

– drain coolant and engine oil
– introduce corrosion-inhibitor oil, kerosene or diesel fuel into the crankcase via the oil filler neck until the max. level is reached
– disconnect charge air/coolant manifolds
– remove the fuel injectors
– bar the engine manually and spray corrosion-inhibitor oil, kerosene or diesel fuel into the combustion chambers via the opening inlet valves

NOTE: These corrosion-prevention measures are only effective for a few days. Repair of the engine and thorough cleaning of all components should, therefore, be carried out as soon as possible.

Before restarting the repaired engine, fill with new engine oil and engine coolant in compliance with the MTU Fluids and Lubricants Specification A001061.

It is essential to change the engine oil after 50 operating hours as the new oil may be contaminated by coolant residues left in the crankcase.

Engine Oil Diluted by Fuel

It is essential to change the engine oil before restarting the engine after rectifying the fault. Remove the used oil from the oil pan with particular care. Replace the engine oil filter.

After Work on Engine

If running gear components, e.g. pistons, piston rings, cylinder liners, etc. have been replaced, carry out the engine running-in procedure.

E000.000.02 Engine does not turn when starter is actuated

Probable causes	Check	Remedial action
Battery	Battery charge state Cable connections	Charge battery, replace if necessary Connect, replace if necessary
Starter	Starter/engine wiring Starter Ring gear	Connect, replace if necessary Replace Replace
Electronics	Engine monitoring system Voltage supply	See Electronics Documentation Repair

E000.000.03 Engine turns but does not fire

Probable causes	Check	Remedial action
Engine receiving insufficient fuel	See E080.000.01	–
Engine does not reach firing speed	Battery Starter/engine wiring Starter	Charge, replace if necessary Connect, replace if necessary Replace
Electronics	Engine monitoring system Voltage supply	See Electronics Documentation Repair

E000.000.05 Engine fires unevenly

Probable causes	Check	Remedial action
Engine receiving insufficient fuel	See E080.000.01	–
Fuel injection equipment faulty	Injection timing Injectors Injection pumps	See Electronics Documentation Replace (G075.051.05) Replace (G073.051.01) (G073.051.05)
Electronics	Engine monitoring system Wiring Injection pump solenoid valve	See Electronics Documentation Tighten connections Replace

E000.000.07 Engine does not reach rated speed

Probable causes	Check	Remedial action
Engine receiving insufficient combustion air	See E110.000.03	–
Engine receiving insufficient fuel	See E080.000.01	–
Fuel injection equipment faulty	Injection timing Injectors Injection pumps	See Electronics Documentation Replace (G075.051.05) Replace (G073.051.01) (G073.051.05)
Charge air temperature too high	See E110.000.01	–
Compression pressure too low	Compression pressure (G000.000.31)	See E000.000.11
Overloading	Engine overloaded	–
Electronics	Engine governor Injection pump solenoid valve	See Electronics Documentation Replace

E000.000.09 Engine speed not steady

Probable causes	Check	Remedial action
Electronics	Engine governor Voltage supply	See Electronics Documentation Repair

E000.000.11 Compression pressure too low

Probable causes	Check	Remedial action
Cylinder head gasket leaking	Cylinder head gasket	Replace
Valve seats in cylinder head worn	Cylinder head	Repair
Valves do not close	Valve clearances Valves	Adjust (G055.050.01) Recondition, replace if necessary
Piston rings worn	Piston rings	Replace

E080.000.01 Fuel pressure too low

Probable causes	Check	Remedial action
Fuel supply blocked	Shut-off valve(s) in fuel system	Open
Fuel level too low	Fuel supply	Replenish
Fuel line	Seals	Seal pump, replace if necessary
Fuel filter contaminated	Fuel prefilter	Clean (G083.101.15) or if necessary, replace (G083.101.09)
	Fuel filter	Replace filter (G083.051.03) or (G083.052.03)
Fuel delivery pump faulty	Fuel delivery pump	Repair, replace if necessary

E101.011.01 Abnormal turbocharger running noises

Probable causes	Check	Remedial action
Exhaust turbocharger contaminated	Exhaust turbocharger	Clean
Exhaust turbocharger faulty	Turbocharger bearing	Replace
	Rotor assembly	Replace

E110.000.01 Charge air temperature too high

Probable causes	Check	Remedial action
Fan drive	Drive belt condition and tension	(G221.051.01)
Intercooler contaminated	Intercooler	Clean
Antifreeze concentration too high	Engine coolant	Rectify concentration as per specifications
Incorrect corrosion inhibitor (deposits in intercooler)	Engine coolant, corrosion inhibitor	Clean coolant system. Treat engine coolant in accordance with MTU Fluids and Lubricants Specification A001061, replace intercooler if necessary.
Electronics	Engine monitoring system	See Electronics Documentation
	Temperature sensor, wiring	Check monitoring units (G507.098.01)

E110.000.03 Charge air pressure too low

Probable causes	Check	Remedial action
Engine receiving insufficient combustion air	Air filter contamination indicator (G121.052.01)	–
	Air filter	Replace (G121.051.01)
	Intercooler	Clean, replace if necessary
Exhaust turbocharger faulty	Exhaust turbocharger	Repair
Electronics	Engine monitoring system	See Electronics Documentation
	Pressure sensor, wiring	Check monitoring units (G507.098.01)

E114.051.01 Coolant discharge at intercooler relief bore

Probable causes	Check	Remedial action
Intercooler leaking	Whether coolant discharges from drain line (not condensate)	Replace intercooler

E140.000.01 Exhaust gases black

Probable causes	Check	Remedial action
Engine receiving insufficient combustion air	Air filter contamination indicator (G121.052.01)	–
	Air filter	Replace (G121.051.01)
	Intercooler	Clean, replace if necessary
Fuel injection equipment faulty	See E000.000.07	–
Exhaust system faulty	Exhaust backpressure	Clean exhaust silencer
Overloading	See E000.000.07	–

E140.000.02 Exhaust gases blue

Probable causes	Check	Remedial action
Too much oil in combustion chambers	Engine oil level (G180.000.01)	Correct oil level (G180.000.03)
	Exhaust turbocharger	Repair
	Crankcase breather	Replace filter (G018.101.04)
	Valve stem seals	Replace
	Piston rings	Replace
	Valve guides	Replace
	Cylinder liners	Replace
Compression pressure too low	Compression pressure (G000.000.31)	See E000.000.11

E140.000.03 Exhaust gases white

Probable causes	Check	Remedial action
Engine cold	Engine coolant temperature	See E202.000.02
Coolant in combustion chambers	Exhaust turbocharger	Repair
	Intercooler	Replace
	Cylinder heads	Replace
	Cylinder liners	Replace
Fuel injection equipment	Injectors	

E172.000.01 Starting power supply faulty

Probable causes	Check	Remedial action
Battery not or insufficiently charged	Generator drive belt	Check voltage (G221.051.01), drive belt, replace if necessary (G221.051.03)
	Generator	Repair
	Battery	Replace

E180.000.01 Engine oil consumption abnormally high

Probable causes	Check	Remedial action
Engine oil system leaking externally	External subassemblies External pipework Engine oil drains Shaft seals Oil pan Crankcase	Seal pipework Check connections, tighten if necessary Seal pipework Replace Seal pipework Repair
Oil pipes to engine oil heat exchanger leaking	Oil in coolant system	Replace sealing rings
Exhaust turbocharger leaking	Exhaust turbocharger	Replace bearings
Engine wear	Valve stem seal Piston rings Valve guides Cylinder liners	Replace Replace Replace Replace

E180.000.03 Engine oil level abnormally high

Probable causes	Check	Remedial action
Fuel or engine coolant in engine oil	Engine oil quality	Refer to “Fuel in engine oil” and “Engine coolant in engine oil”
Fuel in engine oil	Injectors Injection pumps	Replace seal to cylinder head Replace seal to crankcase
Engine coolant in engine oil	Cylinder heads Cylinder liner seals Cylinder liners Crankcase	Replace Replace Replace Repair

E180.000.05 Engine oil temperature too high

Probable causes	Check	Remedial action
Engine oil heat exchanger dirty	Engine oil heat exchanger	Clean, replace if necessary
Engine coolant temperature too high	See E202.000.01	–
Electronics	Engine monitoring system Temperature sensor, wiring	See Electronics Documentation Check monitoring units (G507.098.01)

E180.000.07 Engine oil pressure too high

Probable causes	Check	Remedial action
Oil viscosity too high	Engine oil viscosity	Change engine oil
Engine oil system	Engine oil pressure relief valve(s)	Replace
Engine coolant in engine oil	Engine oil quality	See under E180.000.03
Electronics	Engine monitoring system Pressure sensor, wiring	See Electronics Documentation Check monitoring units (G507.098.01)

E180.000.09 Engine oil pressure too low

Probable causes	Check	Remedial action
Engine oil level too low	Engine oil level	Top up engine oil
Engine oil system leaking externally	See under E180.000.01	–
Fuel in engine oil	Engine oil quality	See under E180.000.03
Engine oil filter dirty	–	Replace filter
Engine oil pressure relief valve(s)	Opening pressure	Adjust, or replace engine oil pressure relief valve(s)
Engine oil pump	Engine oil pump	Repair, replace if necessary
Electronics	Engine monitoring system Pressure sensor, wiring	See Electronics Documentation Check monitoring units (G507.098.01)
Pressure loss in running gear	Running gear lubrication points	Replace bearings

E202.000.01 Engine coolant temperature too high

Probable causes	Check	Remedial action
Engine coolant level too low	Engine coolant level	Top up engine coolant
Engine coolant system contaminated	Engine coolant system Vent lines Engine coolant cooler	Clean Clean Clean
Fan drive faulty	See E221.051.01	–
Engine coolant thermostat defective	Engine coolant thermostat	Replace
Engine coolant pressure too low	See E202.000.05	
Electronics	Engine monitoring system Temperature sensor, wiring	See Electronics Documentation Check monitoring units (G507.098.01)

E202.000.02 Engine coolant temperature too low

Probable causes	Check	Remedial action
Engine coolant thermostat defective	Engine coolant thermostat	Replace
Electronics	Engine monitoring system Temperature sensor, wiring	See Electronics Documentation Check monitoring units (G507.098.01)

E202.000.05 Engine coolant pressure too low

Probable causes	Check	Remedial action
Coolant system not sealed	Whether cover closed Breather valve	Close cover Replace cover
Engine coolant system leaking externally	External pipework External subassemblies Coolant drain points Engine coolant cooler Crankcase	Check connections, tighten if necessary Check connections, tighten if necessary Seal Repair Check for leaks, replace if necessary
Engine coolant level too low	Engine coolant level	Top up engine coolant
Engine coolant pump faulty Engine coolant system leaking internally	Engine coolant pump Oil quality Cylinder heads Injector protective sleeve gasket Cylinder liner gaskets	Replace Change engine oil (G180.000.05) Replace Replace Replace

E202.000.07 Coolant loss

Probable causes	Check	Remedial action
Engine coolant system leaking externally	See E202.000.05	–
Engine coolant system leaking internally	See E202.000.05	–
Engine coolant pump leaking	Engine coolant pump	Repair
Engine coolant level transmitter display error	Probe, wiring	Check monitoring units (G507.098.01)

E202.000.09 Engine coolant level rising

Probable causes	Check	Remedial action
Engine oil in engine coolant	Engine oil heat exchanger	Repair

E202.051.01 Engine coolant pump leaking at relief bore

Probable causes	Check	Remedial action
Engine coolant pump leaking	For engine oil discharge (G202.051.01) For coolant discharge (G202.051.01)	Replace sealing ring and, if necessary, engine coolant pump Replace slip ring and, if necessary, engine coolant pump

E203.000.01 Charge air coolant temperature too high

Probable causes	Check	Remedial action
Charge air coolant level too low	Charge air coolant level	Top up charge air coolant
Charge air coolant system contaminated	Charge air coolant system Vent lines Charge air coolant heat exchanger	Clean Clean Clean, replace if necessary
Fan drive faulty	See E221.051.01	–
Charge air coolant thermostat	Charge air coolant thermostat	Replace
Charge air coolant pressure too low	See E203.000.05	–
Electronics	Engine monitoring system Temperature sensor, wiring	See Electronics Documentation Check monitoring units (G507.098.01)

E203.000.03 Charge air coolant temperature too low

Probable causes	Check	Remedial action
Charge air coolant thermostat	Charge air coolant thermostat	Replace
Electronics	Engine monitoring system Temperature sensor, wiring	See Electronics Documentation Check monitoring units (G507.098.01)

E203.000.05 Charge air coolant pressure too low

Probable causes	Check	Remedial action
Charge air coolant system not sealed	Whether cover closed Breather valve	Close cover Replace cover
Charge air coolant system leaking externally	External pipework External subassemblies Charge air coolant drain points Intercooler Charge air coolant cooler	Check connections, tighten if necessary Check connections, tighten if necessary Check for leaks, renew sealing if necessary Check for leaks, replace if necessary Repair
Charge air coolant level too low	Charge air coolant level	Top up charge air coolant
Charge air coolant pump faulty	Charge air coolant pump	Replace
Charge air coolant system leaking internally	See E114.051.01	–

E203.000.07 Charge air coolant loss

Probable causes	Check	Remedial action
Charge air coolant system leaking externally	See E203.000.05	–
Charge air coolant system leaking internally	See E203.000.05	–
Charge air coolant level transmitter display fault	Probe, wiring	Check monitoring units (G507.098.01)

E221.051.01 Fan drive faulty

Probable causes	Check	Remedial action
V-belt	V-belt tension	Tension, replace if necessary (G221.051.03)

Contents

G000.000.01 Engine start disabling

Switch off power supply for Engine Control System at control panel.

Note:
Control panel description – see Manufacturer's Documentation.

Disconnect battery.

Shut off fuel supply to engine (G364.000.01).

Attach warning notice "Do not start engine. Work in progress" to control panel.

G000.000.03 Engine start release

Remove warning notice "Do not start engine. Work in progress" from switch cabinet.

Connect battery.

Open fuel supply to engine (G364.000.03).

Switch on power supply for Engine Control System at control panel.

G000.000.05 Barring engine manually

Disable engine start (G000.000.01).

Install engine barring tool (G030.001.01).

Bar engine manually.

Note:
Apart from the normal compression resistance, there should be no abnormal resistance.

Remove engine barring tool (G030.000.03).

Release engine start (G000.000.03).

G000.000.07 Barring engine with starting system

! DANGER !

Rotating and moving engine components.
Risk of bodily harm and fatal injury!
Before barring or starting the engine, ensure that nobody is in the danger zone.

Bar engine without ignition – see control cabinet manufacturer's documentation.

Note:
Engine start is automatically interrupted after approx. 5 seconds. If necessary, repeat engine start after approx. 10 seconds.

G000.000.09 Engine starting

! DANGER !

Rotating and moving engine components.

Risk of bodily harm and fatal injury!

After working on the engine, check that all protective devices have been reinstalled and all tools removed from the engine.

Before barring or starting the engine, ensure that nobody is in the danger zone.

Note:
Always start the engine under no-load conditions.

When the preparatory work has been carried out in accordance with the Operating Instructions (Section C), the engine can be restarted.

Start engine – see control cabinet manufacturer's documentation.

G000.000.10 Trial run

WARNING!

Exhaust gases are harmful to health.

Risk of fume poisoning!

Ensure that engine room is always well ventilated.

Repair leaking exhaust pipework immediately.

Start engine (G000.000.09).

Perform trial run at least until steady-state temperatures have been reached and not under 1/3 load.

Shut down engine (G000.000.23).

G000.000.13 Engine speed check

Check rated speed.

G000.000.15 Pressure checks

Check all pressures (where gauges are installed).

Specified values – see operational data (A000.000.21).

G000.000.17 Temperature checks

Check engine coolant temperature (where gauges are installed).

Specified values – see operational data (A000.000.21).

G000.000.19 Engine running noise check

Operate engine at rated speed.

Apart from the usual running noises, no abnormal sounds must be heard.

G000.000.21 Engine and external lines leak check

WARNING!

Exhaust gases are harmful to health.
Risk of fume poisoning!
Ensure that engine room is always well ventilated.
Repair leaking exhaust pipework immediately.

Run engine under load.

Check engine and all pipework for leaks.

If significant leaks are found, shut down engine.

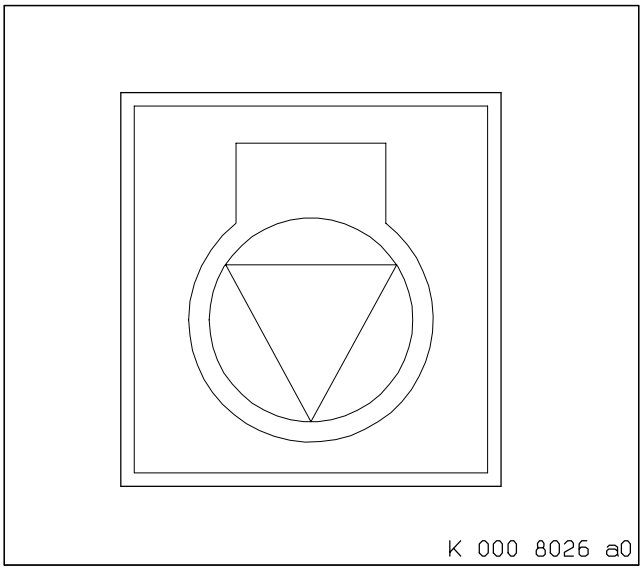
When the engine has cooled, rectify the cause.

Note:
Never tighten lines when under pressure.

G000.000.23 Engine shutdown

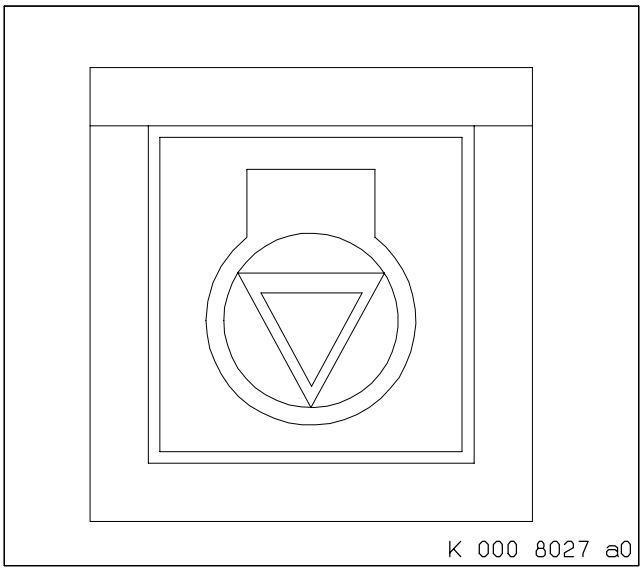
Note:
Never shut down the engine directly from the full-load operation as this may result in overheating and wear of the engine components.

Before shutting down, disengage the alternator and run the engine at rated speed until a falling then constant temperature is recorded.



Press shutdown button on control panel.

G000.000.25 Emergency shutdown



Press emergency shutdown button on control panel.

G000.000.27 Attachments security check

Exhaust system (G140.000.03)

Engine/alternator mount (G231.051.20) or (G231.052.20).

G000.000.29 Attachments, hoses and hose connections check

Check all hoses and hose connections on the engine for condition and leaks.

Immediately replace hoses showing signs of scuffing, aging or cracking.

G000.000.31 Compression pressure check

Special tool:

Engine barring tool

Compression pressure recorder 550 589 09 21 00

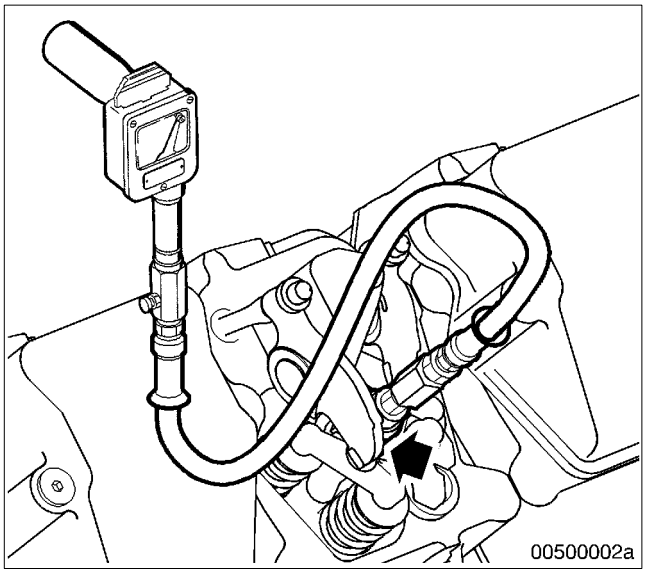
Connector Y4 343 698

Shut off fuel supply to engine (G364.000.01).

Remove injectors (G075.051.01).

Release engine start (G000.000.03).

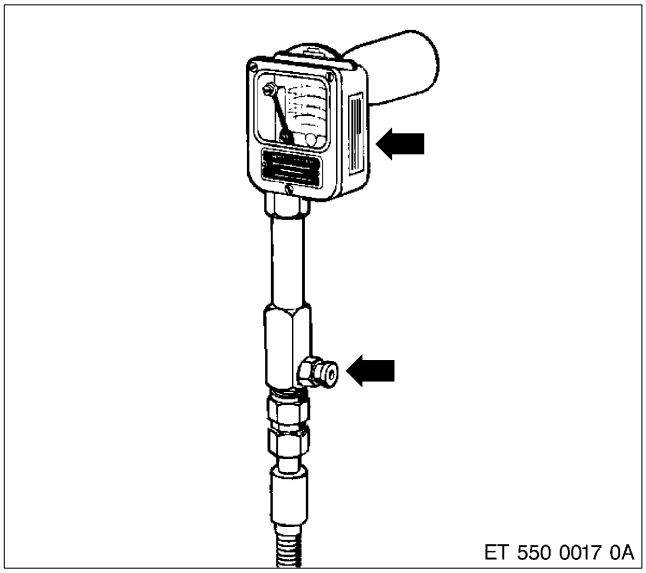
Bar engine with starting system (G000.000.07) to remove any loose carbon deposits from the combustion chambers.



Install connector with sealing ring in the injection nozzle opening and tighten with clamping element.

Connect compression pressure recorder to connector.

Bar engine with starting system until no further pressure rise is indicated.

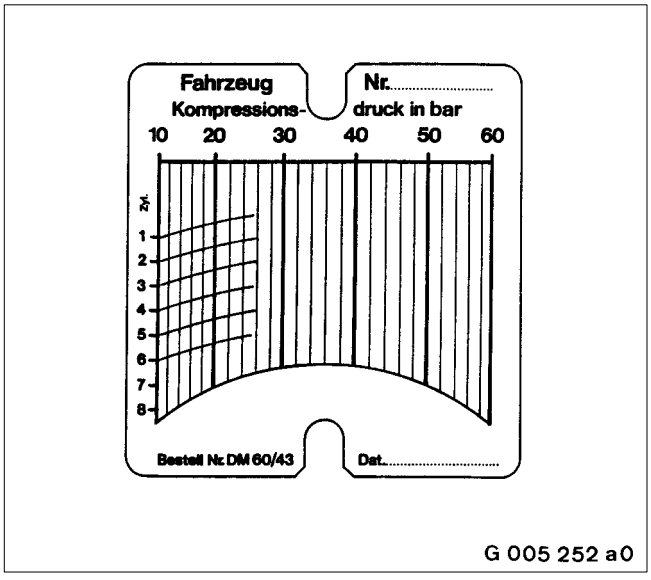


Actuate vent valve.

Tighten adjuster pin to move the diagram sheet to the next position.

Remove compression pressure recorder and connector.

Carry out check in same way on all other cylinders.



Determine mean value of compression pressures:

The difference between the mean value and the individually measured compression pressures must not exceed 3 bar.

Install injectors (G075.051.09).

Open fuel supply to engine (G364.000.03).

G000.000.33 Cylinder chamber endoscopic examination

Special tool:

Endoscope Y2 0097 353

Ratchet with socket (A/F 36 mm).

Note:
For engines in service, if possible carry out a combustion chamber endoscopic examination after operation under load.

Use an endoscope with an adequate light rating and a prism (5) which pivots 95° (total viewing angle 140 °), see – No.I –.

If an endoscope with pivoting prism is not available, individual endoscopes with prism settings of 0°, 45° and 90° are required, see – No.II –.

Max. possible diameter (a): 7 mm.

Before the endoscopic examination:

Remove injector (G075.051.01).

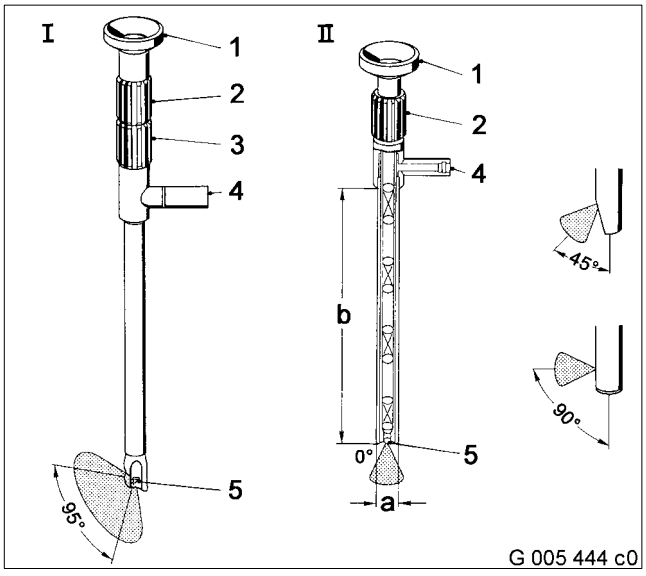
Release engine start (G000.000.03).

Bar engine with starting system (G000.000.07) to remove any loose carbon deposits from the combustion chambers.

Disable engine start (G000.000.01).

Use engine barring tool to turn engine (G000.000.05) until, for the respective cylinder,

– the piston is at BDC for cylinder liner inspection.
– the piston is at a position which permits unobstructed and exact inspection of components for inspecting piston crown and cylinder head lower side and valves.
– all valves are open or closed for inspection of valves and valve seats



Endoscopic examination:

Connect endoscope to light source (4) and insert it through the cylinder head (fuel injector bore) to the combustion chamber.

Use the focussing device (2) to focus the eyepiece (1) and adjuster ring (3) to align the prism (5) with the area under inspection.

Visually assess the cylinder liners, piston crowns, underside of the cylinder heads and valves.

To do this, rotate the endoscope through 360° in each case and set the prism accordingly.

Assessment:

Cylinder liners are OK when:

– the honing pattern is clearly visible
– no or only locally limited polished areas are evident in the honing structure
– no or only minor scoring is evident (minor scoring can be caused during piston installation).
– no or only minor corrosion is evident (film rust after extended out-of-service periods is possible).

Piston crowns are OK when:

– injector spray pattern is clearly visible
– only minor carbon or oil deposits are evident
– no or only minor corrosion is evident (film rust after extended out-of-service periods is possible).

Cylinder heads and valves are OK when:

– only minor carbon or oil deposits are evident
– only minor pitting is evident on valves and valve seats.
– the valves close fully
– no or only minor corrosion is evident (film rust after extended out-of-service periods is possible).

Note:
If extensive wear or damage due to mechanical, chemical or thermal action is found, or the inspection results are otherwise suspect: remove the affected cylinder heads and recheck, repair or replace the individual components as necessary.

After the endoscopic examination:

Remove engine barring tool (G030.001.03).

Install injectors (G075.051.09).

Release engine start (G000.000.03).

G000.000.39 Cleaning engine externally

WARNING!

Hard water jet.

Risk of injury and scalding!

Never aim the water jet at persons or electrical or electronic equipment.

Wear protective clothing, rubber gloves, protective goggles and safety mask.

For environmental reasons, clean the engine only at places with a suitable oil separator.

Before using the H.P. cleaner or steam jet, read the respective operating instructions of the manufacturer.

For exterior cleaning with the high-pressure jet, use a fan jet nozzle only.

Exterior cleaning is carried out as follows:

Disable engine start (G000.000.01).

To loosen dirt:

Note:
Use only cleaning agents which will not damage light metal, nonferrous metal, steel, grey cast iron and elastomers.

Spray on a thin coating of cleaning agent and allow approx. 1 to 5 minutes, depending on the degree of contamination, for it to react.

To remove dirt:

Note:
When cleaning the outside of the engine with a high-pressure cleaner or steam jet, the high-pressure spray must not exceed a pressure of 100 bar.

Moisture penetrating electrical components (temperature sensor, pressure sensor, speed sensor and ECU) may lead to malfunctions and engine failure.

Do not go any closer than 20 cm (8 inches) to the object that is being sprayed.

The temperature of the cleaning agent must not exceed max. 80 °C.

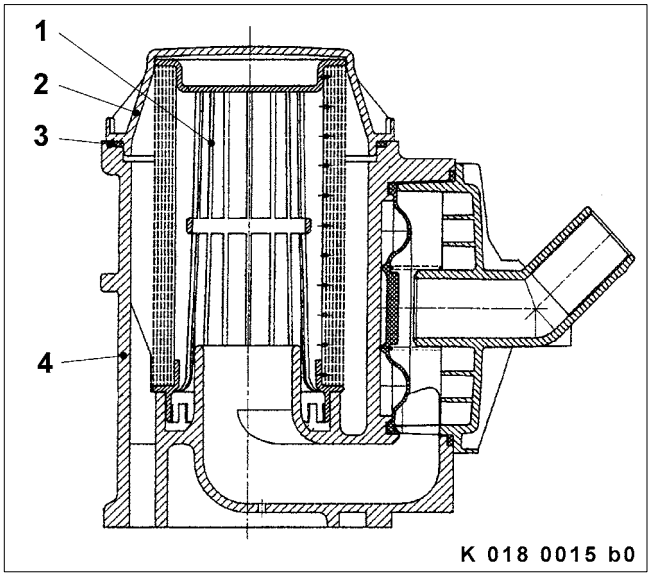
Spray off the dirt that has been loosened with the high-pressure spraying jet.

Release engine start (G000.000.03).

Disposal of Hazardous Materials

Fluids and lubricants (e.g. oils, greases, treated engine coolant, fuels), cleaning agents and numerous auxiliary materials are an environmental hazard and therefore constitute hazardous materials.
When disposing of these hazardous materials, compliance with manufacturer's instructions, general environmental protection regulations and local legal specifications is mandatory.
Under no circumstances must even small amounts of hazardous materials be allowed to drain into water, or be discarded or disposed of outdoors.
Leaked hazardous materials must immediately be absorbed with suitable bonding agents and disposed of in accordance with regulations in appropriate vessels. The contents of these containers must be specified.

G018.101.05 Crankcase ventilation filter replacement



Remove cover (2) and O-ring (3).

Remove filter (1) from housing (4).

Coat new O-ring (3) with petroleum jelly and fit in groove in housing.

Insert new filter in housing, ensuring it is correctly positioned, and install cover with O-ring.

Tighten screws on cover.

Tightening torque: 6 Nm + 2 Nm.

Lubricant: Engine oil.

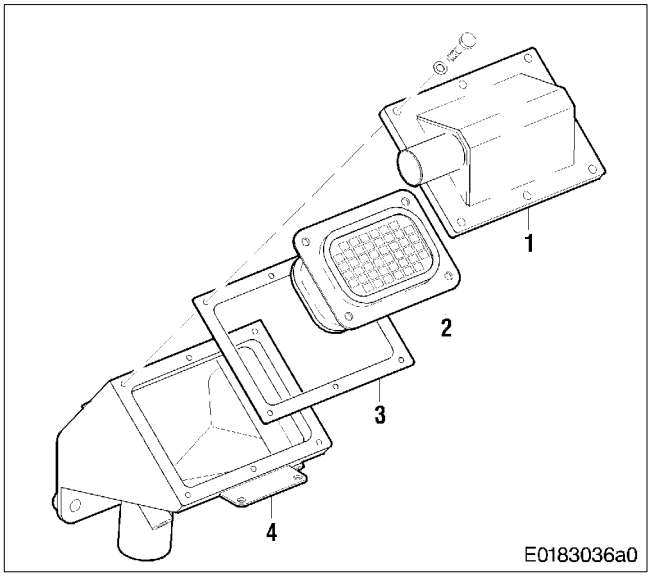
G018.101.07 Crankcase ventilation – oil preseparator cleaning

WARNING!

Fuels are combustible.
Risk of burning and explosion.
Avoid open flames, electric sparks and sources of ignition.
Do not smoke

WARNING!

Compressed air
Risk of injury!
Never aim compressed air jet at persons.
Wear protective goggles/safety mask and ear protection.



Release clamps and remove hose from adapter.

Remove cover (1) from housing (4).

Remove oil separator (2) and gasket (3).

Wash out oil separator in fuel and blow out with compressed air.

Moisten oil separator with engine oil.

Fit oil separator with new gasket on housing and install cover.

Fit hose in position and tighten clamps.

Disposal of Hazardous Materials

Fluids and lubricants (e.g. oils, greases, treated engine coolant, fuels), cleaning agents and numerous auxiliary materials are an environmental hazard and therefore constitute hazardous materials.
When disposing of these hazardous materials, compliance with manufacturer's instructions, general environmental protection regulations and local legal specifications is mandatory.
Under no circumstances must even small amounts of hazardous materials be allowed to drain into water, or be discarded or disposed of outdoors.
Leaked hazardous materials must immediately be absorbed with suitable bonding agents and disposed of in accordance with regulations in appropriate vessels. The contents of these containers must be specified.

G030.001.01 Engine barring tool installation

Special tool:
Engine barring tool, 12V: F6 558 556
Engine barring tool, 16V: F6 558 557
Engine barring tool, 18V: F6 558 557

Disable engine start (G000.000.01).

Remove cover from flywheel housing.

Install engine barring tool on flywheel housing.

G030.001.03 Engine barring tool removal

Remove engine barring tool.

Screw cover to flywheel housing.

Release engine start (G000.000.03).

G055.050.01 Valve clearance check and adjustment

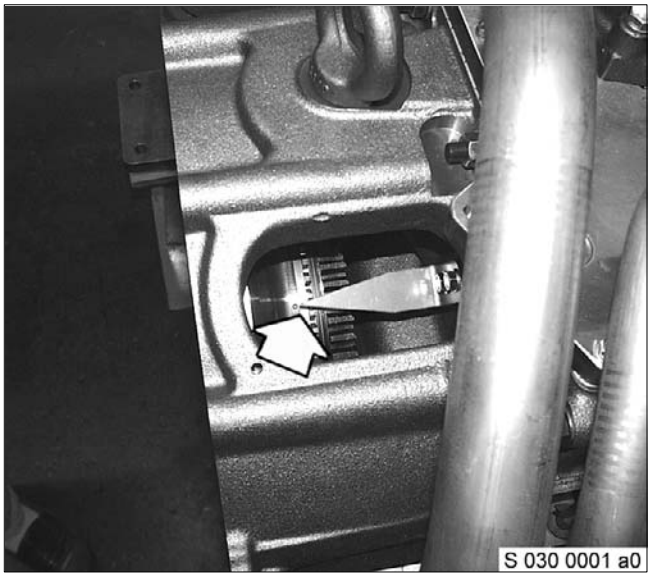
Special tool:

Feeler gauge Y2 0010 128

Note:
Check with the valve closed and when coolant temperature does not exceed 40 °C.

Disable engine start (G000.000.01).

Remove cylinder head cover (G055.101.01).



Bar crankshaft with engine barring tool in engine direction of rotation until marking TDC-A1 on flywheel (see arrow) and pointer on flywheel housing are aligned.

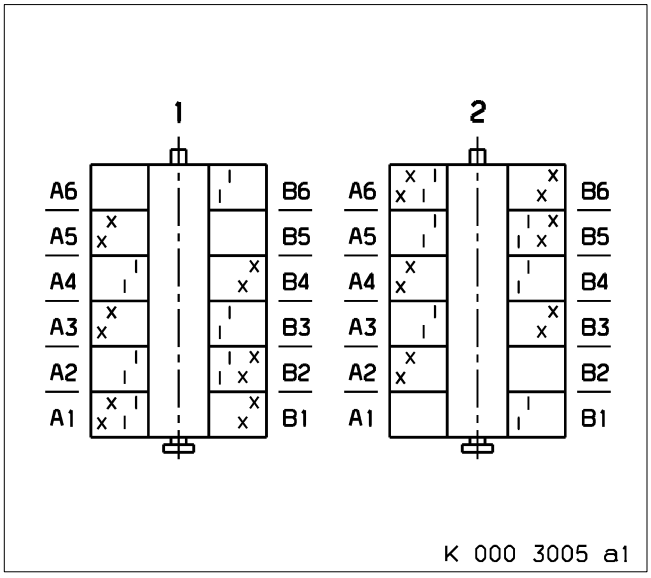


Diagram shows 12V 2000

If the rocker arms are unloaded on cylinder A1, the piston is in firing TDC. Check and adjust valve clearances as per adjacent valve clearance adjustment diagram (1).

If the rocker arms are loaded on cylinder A1, the piston is in overlap TDC. Check and adjust valve clearances as per adjacent valve clearance adjustment diagram (2).

Turn crankshaft a further 360° (to next TDC position) and adjust remaining valve clearances as per adjacent valve clearance adjustment diagram.

1 = Firing TDC at cylinder A1

2 = Overlap TDC at cylinder A1

X = Exhaust valve

I = Inlet valve

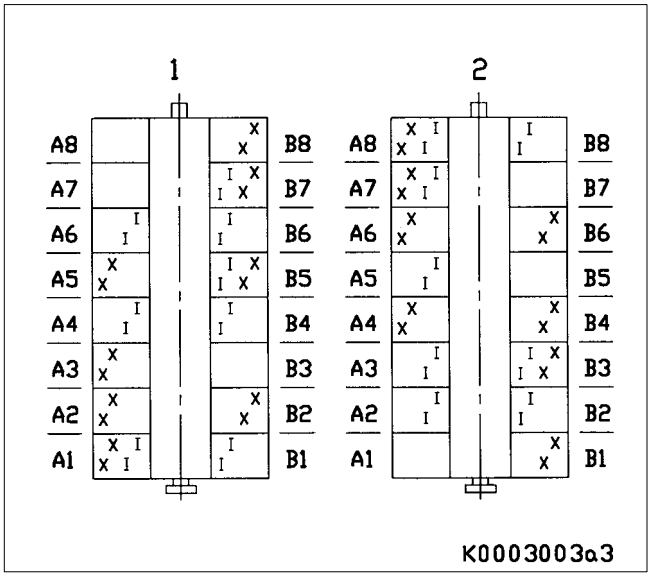


Diagram shows 16V 2000

Procedure – see diagram for 12V 2000

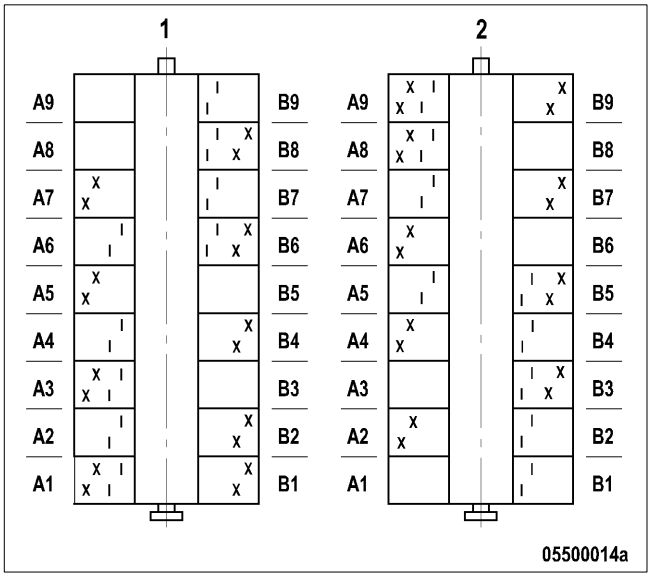
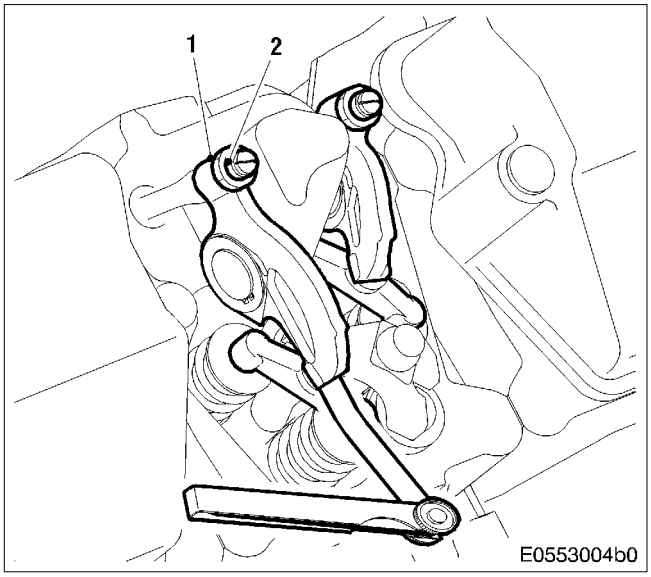


Diagram shows 18V 2000

Procedure – see diagram for 12V 2000



Use feeler gauge to check distance between valve bridge and rocker arm.

Settings – see Section A (valve clearance).

Note:
It must be possible to just pull the feeler gauge through the gap.

If the variation from the specified value exceeds 0.1 mm, adjust the valve clearance as follows:

Release locknut (1) and back off adjusting screw (2).

Insert feeler gauge between valve bridge and rocker arm.

Set adjusting screw so that feeler gauge just passes through gap when locknut is tightened.

Use torque wrench to tighten locknut, holding adjusting screw firmly in position with screwdriver.

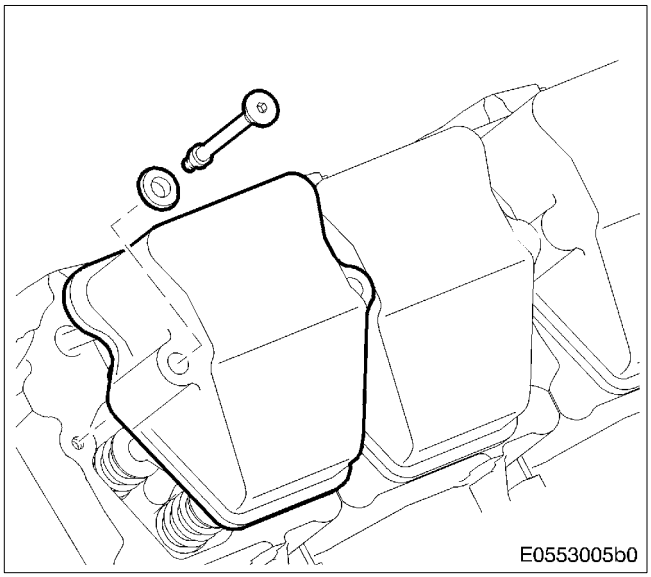
Tightening torque: 50 Nm

Install cylinder head cover (G055.101.03).

Release engine start (G000.000.03).

G055.101.01 Cylinder head cover removal

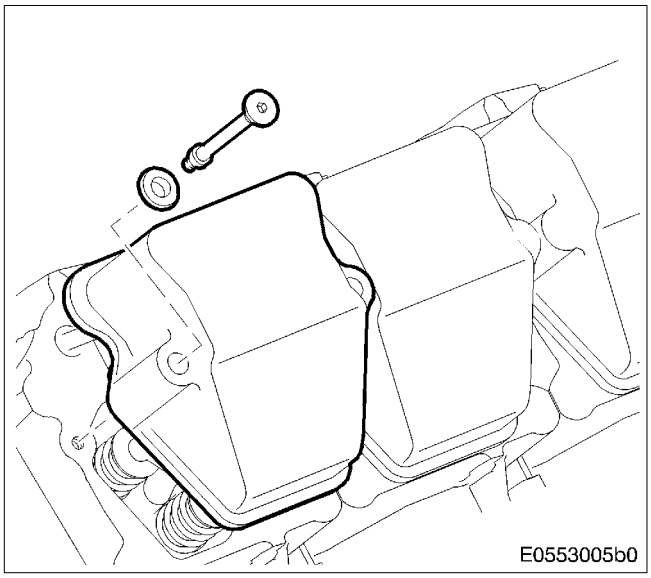
Disable engine start (G000.000.01).



Remove screws.

Remove cylinder head cover from cylinder head.

G055.101.03 Cylinder head cover installation



Clean mating faces.

Check that profile gasket in cylinder head cover is in perfect condition, replace if necessary.

Fit cylinder head cover.

Tighten screw with torque wrench.

Tightening torque: 20 Nm

Lubricant: Engine oil

Release engine start (G000.000.03).

G073.051.01 Injector removal

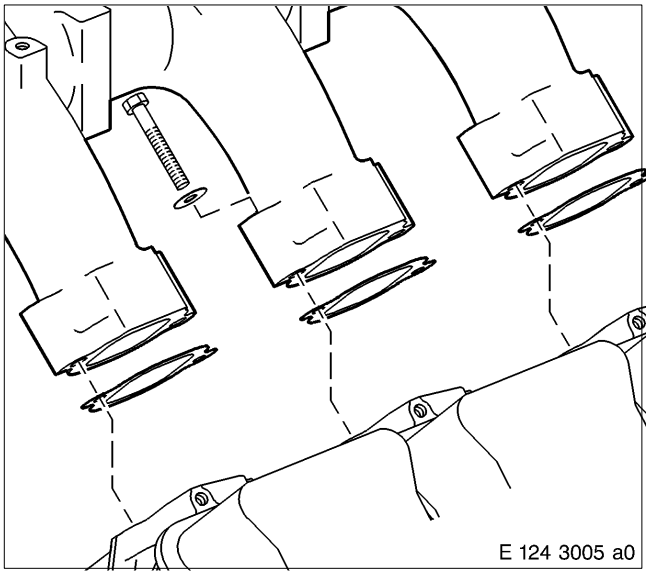
WARNING!

Fuels are combustible.
Risk of burning and explosion.
Avoid open flames, electric sparks and sources of ignition.
Do not smoke

Disable engine start (G000.000.01).

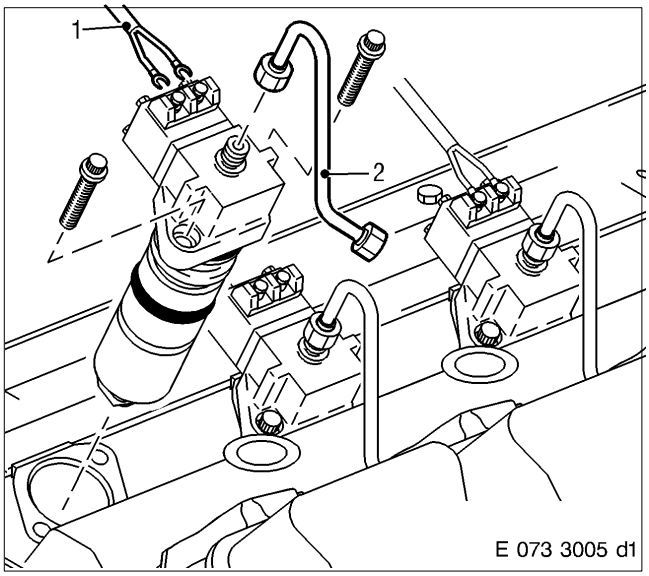
Remove engine control system.

Drain fuel (G080.000.02).



Remove charge air pipes.

Remove gaskets.



Disconnect wiring (1) from injection pump.

Disconnect H.P. line (2).

Remove securing screws on injection pump.

Mark installation location on injection pump.

Note:
The injection pump must not be levered out by force applied at the solenoid valve or the intermediate plate.

Remove injection pump.

If necessary, carefully remove injection pump at the recess in the injection pump head.

Remove O-rings (3) from injection pump.

Cover installation bore.

G073.051.04 Injection pump replacement

WARNING!

Fuels are combustible.
Risk of burning and explosion.
Avoid open flames, electric sparks and sources of ignition.
Do not smoke

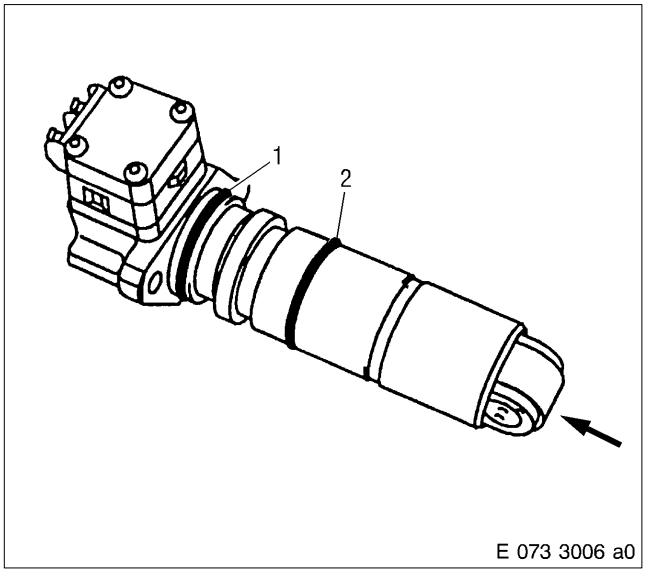
Remove injection pump (G073.051.01).

Install new injection pump (G073.051.05).

G073.051.05 Injection pump installation

WARNING!

Fuels are combustible.
Risk of burning and explosion.
Avoid open flames, electric sparks and sources of ignition.
Do not smoke

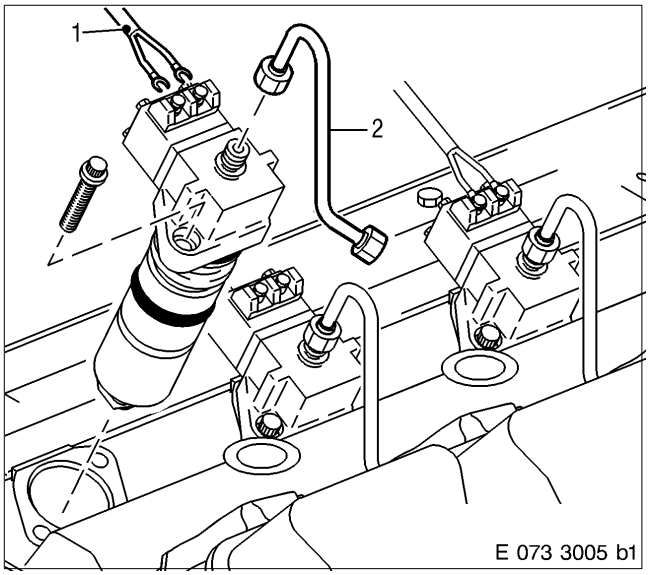


Clean mating faces on the injection pump and roller.

Coat new O-rings (1) and (2) with petroleum jelly and fit to injection pump.

Note:
Sealing rings have different part numbers. Pay attention to location – see Spare Parts Catalogue.

Coat roller (arrow) with engine oil.



Note:
Before installation, remove all plugs and covers.

If a new injection pump is being installed, work according to the coding in the engine control system (request assistance from MTU Service).

Clean sealing surfaces at crankcase and installation bore.

Using the engine barring tool, set the pump cam on the camshaft to base circle.

Install injection pump in accordance with markings for installation position and tighten screws with torque wrench.

Tightening torque: 60 Nm + 12 Nm

Lubricant: Engine oil

Install injection line (2) and tighten union nuts with torque wrench.

Note:
The injection line must not be bent. Ensure that the installation position is correct.

Tighten union nut on injection pump:

Tightening torque: 30 Nm + 5 Nm

Tighten union nut on pressure pipe joint:

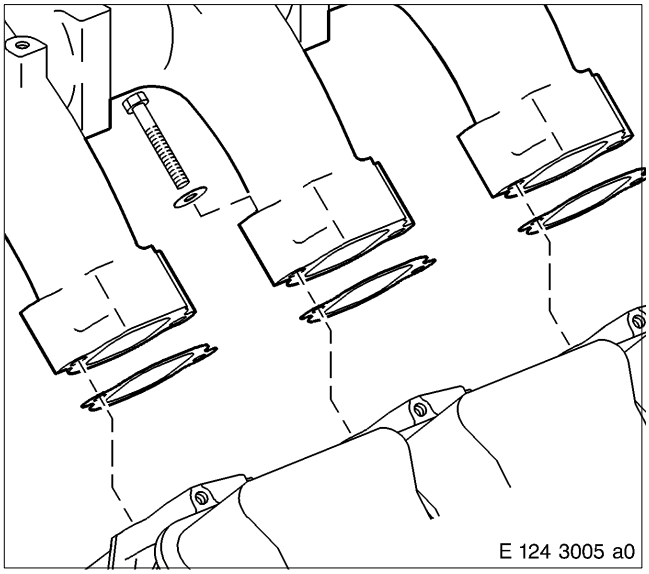
Tightening torque: 20 Nm + 5 Nm

Lubricant: Engine oil

Install wiring (1) on injection pump and tighten the screws using a torque wrench.

Tightening torque: 1.0 Nm +/– 0.2 Nm

Lubricant: Engine oil



Clean mating faces on cylinder head and charge air pipe.

Check gaskets for damage, replace if necessary.

Fit gasket on cylinder head.

Install charge air pipework.

Install engine control system.

Open fuel supply to engine (G364.000.03).

Vent fuel system (G080.000.01).

Release engine start (G000.000.03).

G075.051.01 Injector removal

WARNING!

Fuels are combustible.
Risk of burning and explosion.
Avoid open flames, electric sparks and sources of ignition.
Do not smoke

Special tool:

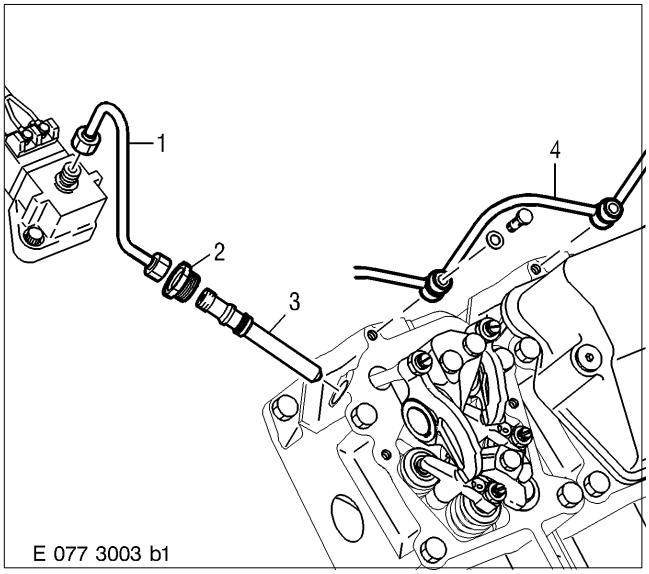
Impact extractor F3 0377 999

Fuel suction lifter F3 0378 207

Disable engine start (G000.000.01).

Remove cylinder head cover (G055.101.01).

Drain fuel (G080.000.02).



Note:
Fuel must not enter the cylinder chamber.

Disconnect H.P. line (1).

Remove fuel return line (4).

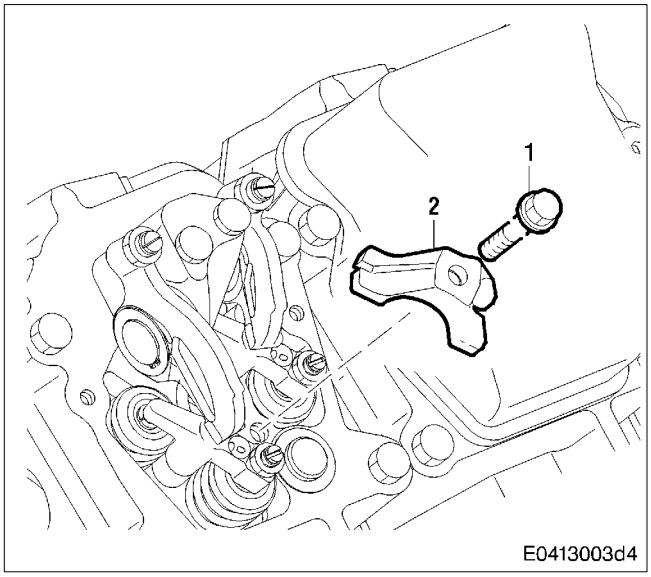
Remove thrust screw (2).

Remove pressure pipe joint (3).

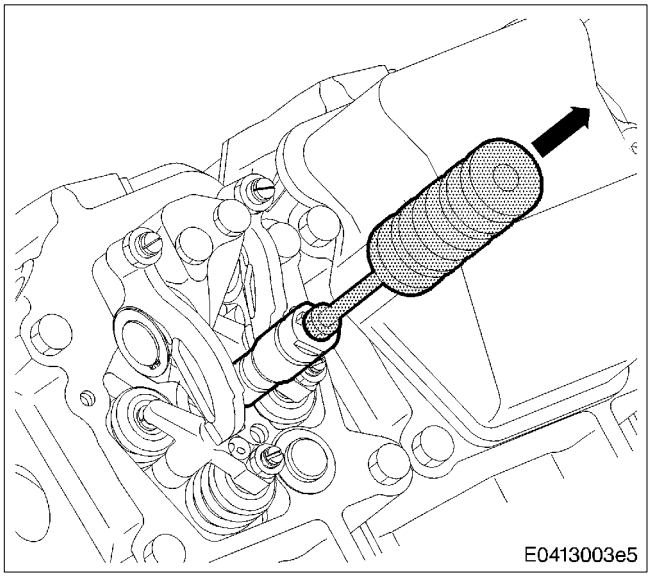
Using the fuel syphon, drain the fuel from the bore, which is now clear.

Seal all connections with suitable plugs.

Remove O-ring from pressure pipe joint.



Unscrew hex screw (1) and remove clamping element (2).



Screw removal tool into injector.
Remove injector with removal tool.
Remove sealing ring (copper) with wire hook.
Remove sealing ring from injector.

G075.051.05 Injector replacement

Remove injector (G075.051.01).
Install new injector (G075.051.09).

G075.051.09 Injector installation

WARNING!

Fuels are combustible.

Risk of burning and explosion.

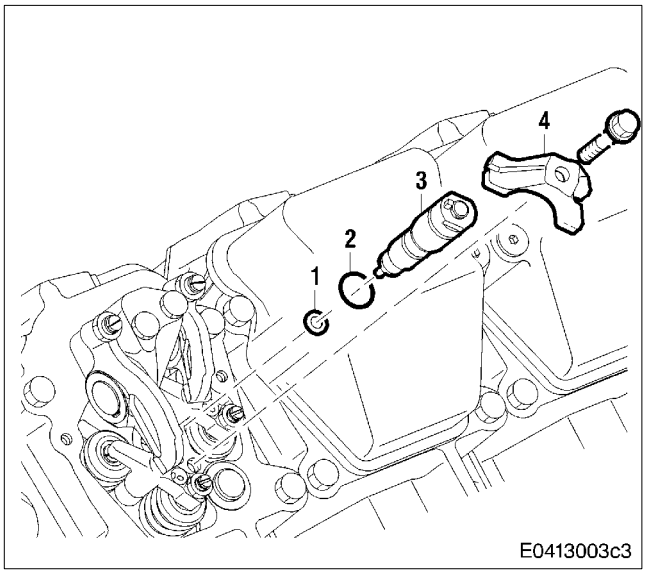
Avoid open flames, electric sparks and sources of ignition.

Do not smoke

Note:
Make sure fuel-carrying components are perfectly clean.

Before installation, remove all plugs and covers.

Bar engine several times with starter to blow out the remaining fuel.



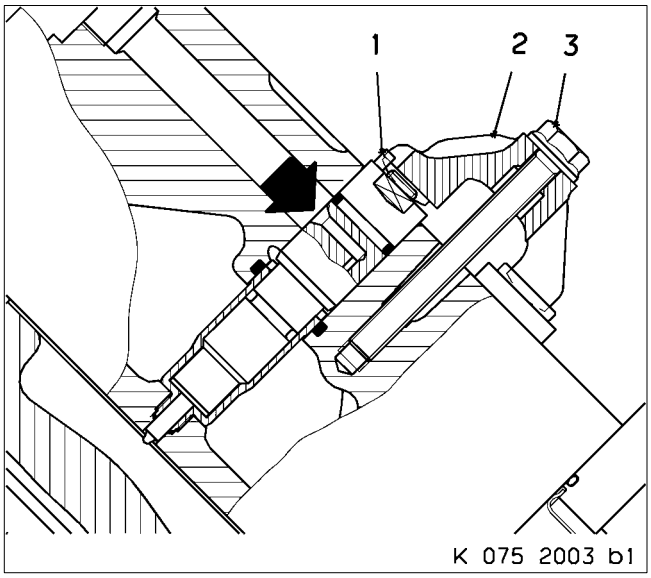
Check sealing surfaces on cylinder head and injector retainer, clean if necessary.

Coat new sealing ring (2) with petroleum jelly and fit on injector (3).

Fit new copper sealing ring (1) with grease on injector.

Press injector into cylinder head by hand, ensuring that pin is positioned at 11 o'clock with regard to engine longitudinal axis in injector.

Install clamping element (4) with hex screw, positioning correctly, and ensure that clamping element is perfectly seated on injector and end cover.



The injector feed bore must face installation direction (arrow) of pressure pipe connection.

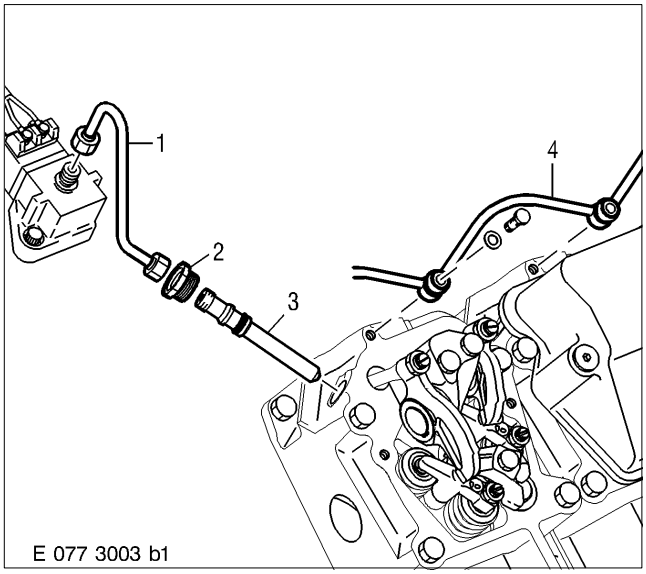
The pin (1) must be positioned in the recess in the clamping element (2).

The fork on the clamping element must engage in the cover.

Tighten screw (3) with torque wrench.

Tightening torque: 50 Nm

Lubricant: Engine oil



Coat new O-ring (4) with petroleum jelly and fit on pressure pipe connection.

Moisten sealing cone of pressure pipe connection with engine oil.

Insert pressure pipe connection up to contact on sealing ring into cylinder head, but do not yet press in firmly.

To guide pressure pipe connection when pressing into cylinder head, screw in thrust screw (2) a few turns into cylinder head.

Tighten thrust screw with torque wrench.

Tightening torque: 40 Nm + 5 Nm

Lubricant: Engine oil

Install injection line (1) and tighten union nut with torque wrench.

Note:
The injection line must not be bent. Ensure that the installation position is correct.

Tighten union nut on injection pump:

Tightening torque: 30 Nm + 5 Nm

Tighten union nut on pressure pipe joint:

Tightening torque: 20 Nm + 5 Nm

Lubricant: Engine oil

Install fuel return line (6).

Install cylinder head cover (G055.101.03).

Vent fuel system (G080.000.01).

Release engine start (G000.000.03).

Check fuel system for leaks during engine operation.

G080.000.01 Fuel system venting

WARNING!

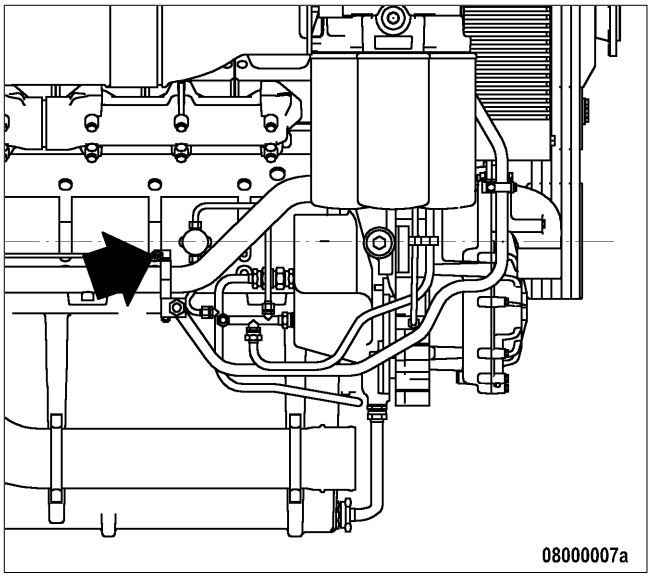
Fuels are combustible.

Risk of burning and explosion.

Avoid open flames, electric sparks and sources of ignition.

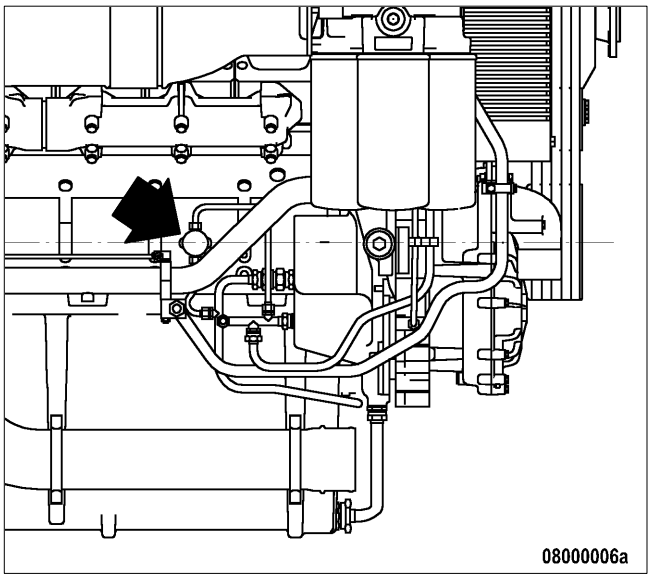
Do not smoke

Release vent plugs on fuel filter (G083.051.05).

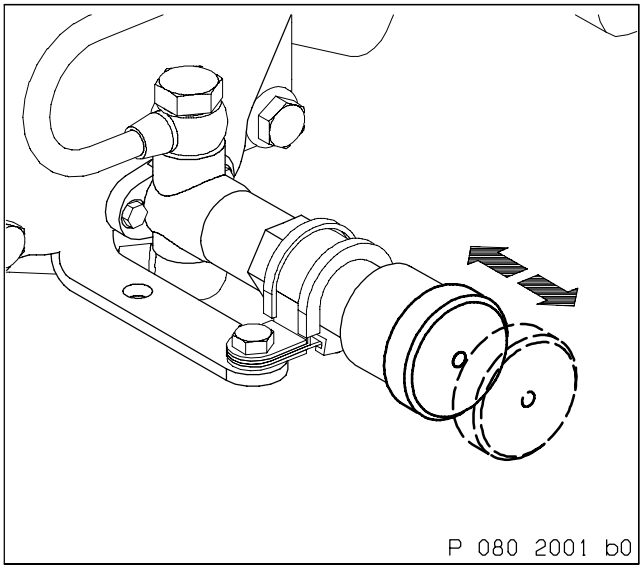


Provide a suitable container in which to collect and dispose of the coolant.

Release plug and allow fuel to drain into the container.



Release fuel hand pump by unscrewing handle.



Actuate fuel hand pump until bubble-free fuel emerges at the vent plugs and the vent line.

Close vent plugs on fuel filter (G083.051.05).

Tighten plug.

Secure fuel hand pump by screwing in handle.

Disposal of Hazardous Materials

Fluids and lubricants (e.g. oils, greases, treated engine coolant, fuels), cleaning agents and numerous auxiliary materials are an environmental hazard and therefore constitute hazardous materials.
When disposing of these hazardous materials, compliance with manufacturer's instructions, general environmental protection regulations and local legal specifications is mandatory.
Under no circumstances must even small amounts of hazardous materials be allowed to drain into water, or be discarded or disposed of outdoors.
Leaked hazardous materials must immediately be absorbed with suitable bonding agents and disposed of in accordance with regulations in appropriate vessels. The contents of these containers must be specified.

G080.000.02 Fuel draining

WARNING!

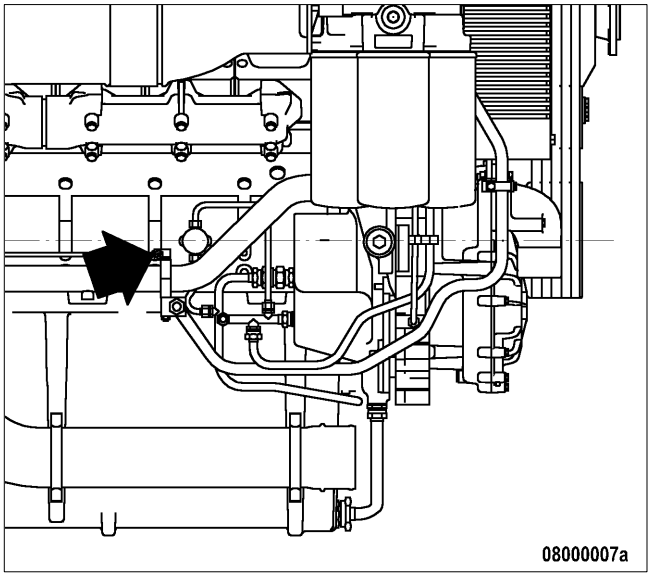
Fuels are combustible.

Risk of burning and explosion.

Avoid open flames, electric sparks and sources of ignition.

Do not smoke

Release vent plugs on fuel filter (G083.051.05).



Provide a suitable container in which to collect and dispose of the coolant.

Release plug and drain fuel into container.

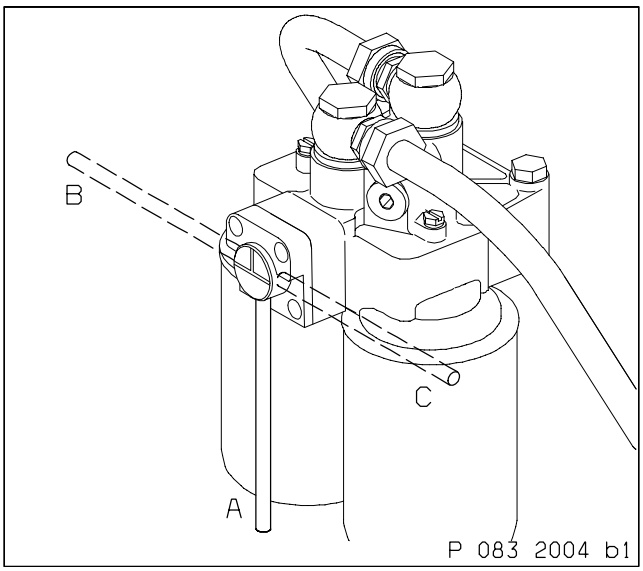
Tighten plug when no more fuel emerges.

Close vent plugs on fuel filter (G083.051.05).

Disposal of Hazardous Materials

Fluids and lubricants (e.g. oils, greases, treated engine coolant, fuels), cleaning agents and numerous auxiliary materials are an environmental hazard and therefore constitute hazardous materials.
When disposing of these hazardous materials, compliance with manufacturer's instructions, general environmental protection regulations and local legal specifications is mandatory.
Under no circumstances must even small amounts of hazardous materials be allowed to drain into water, or be discarded or disposed of outdoors.
Leaked hazardous materials must immediately be absorbed with suitable bonding agents and disposed of in accordance with regulations in appropriate vessels. The contents of these containers must be specified.

G083.051.01 Fuel filter, operating position check



Note:
During engine operation the three-way cock must always be set to position A.

Only for filter replacement during engine operation, the three-way cock can be set to position B or C.

Reset three-way cock at fuel filter.

Position A:

Operating position. Both filters cut in.

Position B:

Left filter cut out. Right filter cut in.

Position C:

Right filter cut out. Left filter cut in.

G083.051.03 Fuel filter replacement

WARNING!

Fuels are combustible.

Risk of burning and explosion.

Avoid open flames, electric sparks and sources of ignition.

Do not smoke

Special tool:

Oil filter wrench F3 0379 104

Note:
With the engine running, only one filter may be briefly cut out at any time for replacement.

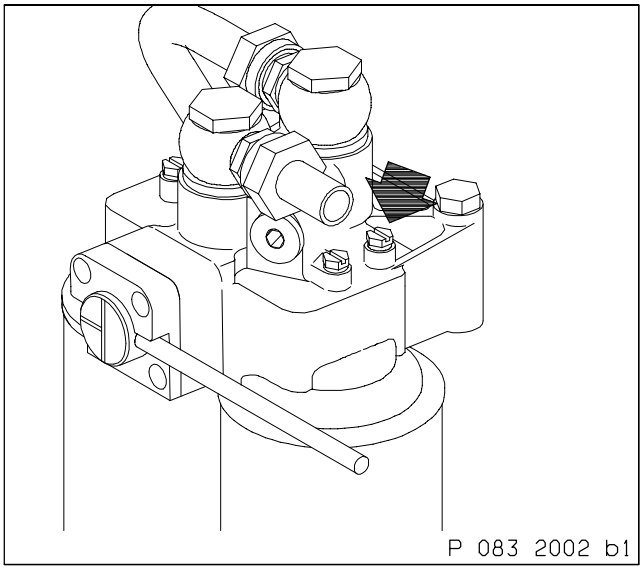
A distinction is made between:

– Fuel filter changing with engine running.

– Fuel filter changing with engine stationary.

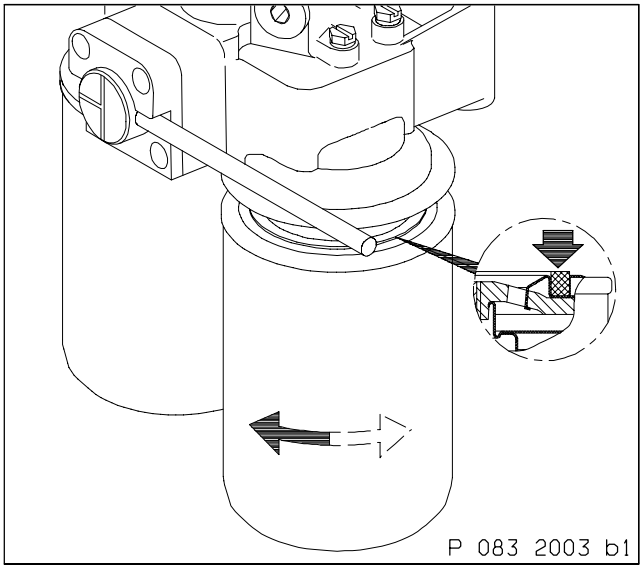
Fuel filter changing with engine running:

Close filter to be changed – see G083.051.01.



Open respective vent plug and release pressure.

Close vent plug.



Use oil filter wrench to unscrew filter and dispose of filter in accordance with local regulations.

Clean sealing surface at connector.

Check sealing ring of new filter and moisten with fuel.

Install filter and tighten by hand.

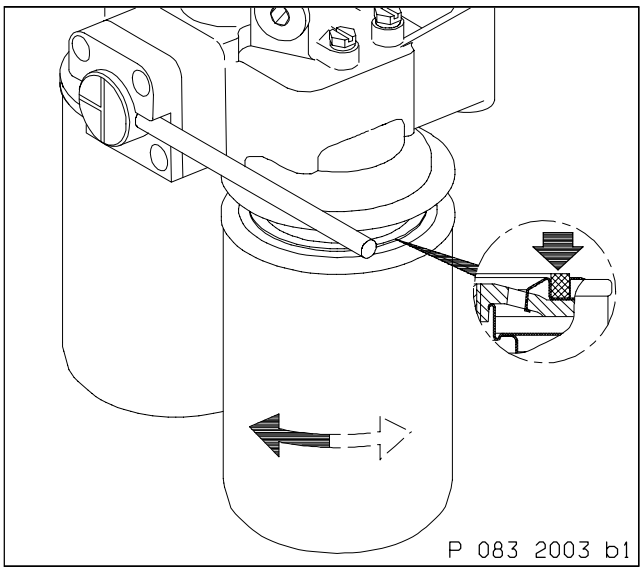
Close vent plug.

Replace second filter in same way.

Setting fuel filter to operating position – see G083.051.01.

Fuel filter changing with engine stationary:

Close fuel supply to filter to be changed – see G083.051.01.



Use oil filter wrench to unscrew filter and dispose of filter in accordance with local regulations.

Clean sealing surface at connector.

Check sealing ring of new filter and moisten with fuel.

Install filter and tighten by hand.

Replace second filter in same way.

Setting fuel filter to operating position – see G083.051.01.

Vent fuel filter (G083.051.05).

Disposal of Hazardous Materials

Fluids and lubricants (e.g. oils, greases, treated engine coolant, fuels), cleaning agents and numerous auxiliary materials are an environmental hazard and therefore constitute hazardous materials.
When disposing of these hazardous materials, compliance with manufacturer's instructions, general environmental protection regulations and local legal specifications is mandatory.
Under no circumstances must even small amounts of hazardous materials be allowed to drain into water, or be discarded or disposed of outdoors.
Leaked hazardous materials must immediately be absorbed with suitable bonding agents and disposed of in accordance with regulations in appropriate vessels. The contents of these containers must be specified.

G083.051.05 Fuel filter venting

WARNING!

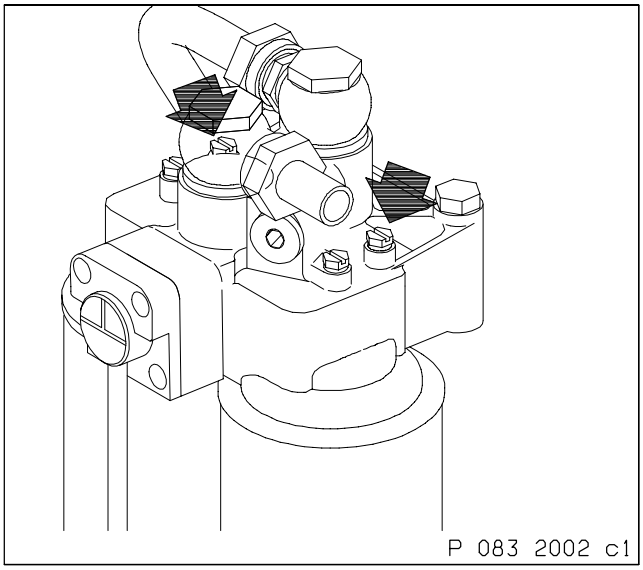
Fuels are combustible.

Risk of burning and explosion.

Avoid open flames, electric sparks and sources of ignition.

Do not smoke

Setting fuel supply to operating position – see G083.051.01.



Release both vent plugs.

Actuate fuel hand pump (G080.000.01) until bubble-free fuel emerges at the vent plugs.

Close vent plugs.

G083.052.03 Fuel filter replacement

WARNING!

Fuels are combustible.

Risk of burning and explosion.

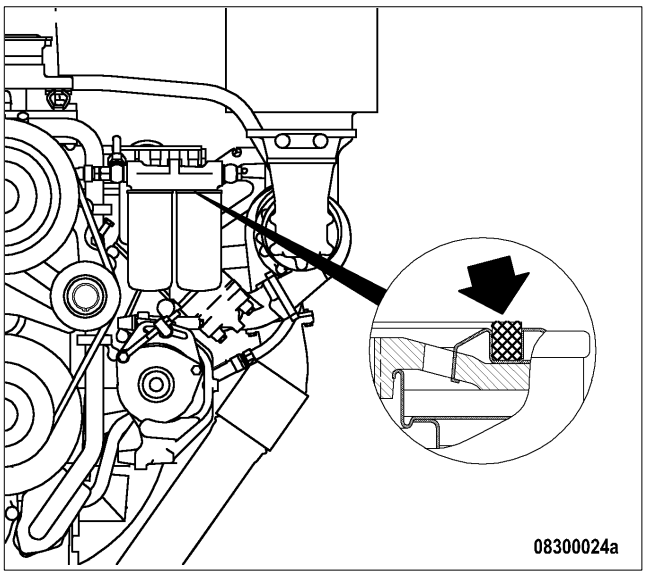
Avoid open flames, electric sparks and sources of ignition.

Do not smoke

Special tool:

Oil filter wrench F3 0379 104

Disable engine start (G000.000.01).



Use oil filter wrench to unscrew filter and dispose of filter in accordance with local regulations.

Clean sealing surface at connector.

Check sealing ring of new filter and moisten with fuel.

Install filter and tighten by hand.

Replace second filter in same way.

Release engine start (G000.000.03).

Disposal of Hazardous Materials

Fluids and lubricants (e.g. oils, greases, treated engine coolant, fuels), cleaning agents and numerous auxiliary materials are an environmental hazard and therefore constitute hazardous materials.

When disposing of these hazardous materials, compliance with manufacturer's instructions, general environmental protection regulations and local legal specifications is mandatory.

Under no circumstances must even small amounts of hazardous materials be allowed to drain into water, or be discarded or disposed of outdoors.

Leaked hazardous materials must immediately be absorbed with suitable bonding agents and disposed of in accordance with regulations in appropriate vessels. The contents of these containers must be specified.

G083.101.09 Fuel prefilter, element and gasket replacement

WARNING!

Fuels are combustible.
Risk of burning and explosion.
Avoid open flames, electric sparks and sources of ignition.
Do not smoke

Carry out tasks specified by manufacturer.

G083.101.15 Fuel prefilter cleaning

WARNING!

Fuels are combustible.
Risk of burning and explosion.
Avoid open flames, electric sparks and sources of ignition.
Do not smoke

Carry out tasks specified by manufacturer.

G101.011.01 Exhaust turbocharger, engine operation in event of turbocharger failure

In the event of turbocharger failure, determine the cause and assess whether the engine can continue in operation without risk.

If, in the event of turbocharger failure (e.g. if rotor is seized), the engine must continue in operation, run the engine only under partial load.

Run the engine in this condition only until it is possible to replace or repair the turbocharger.

G101.011.03 Exhaust turbocharger, ease-of-movement check

Disable engine start (G000.000.01).

Remove air filter from air intake housing – see (G121.051.01.).

Remove intake housing from exhaust turbocharger.

Rotate rotor assembly by hand, at same time pressing against compressor housing.

Note:
Compressor and turbine wheels must not scrape against housing.

Install intake housing on exhaust turbocharger.

Install air filter on intake housing – see G121.051.01.

Release engine start (G000.000.03).

G111.051.01 Intercooler, drain line water discharge and obstruction check

CAUTION!

Engine noise above 85 dB(A).
Risk of damage to hearing!
Wear ear protectors.

Check engine coolant temperature:

Note:
If only a small amount of coolant is discharged, it is condensate.

If considerable coolant is discharged and the coolant level falling, the intercooler is leaking.

If the intercooler is leaking, activate engine only in an emergency.

If a leaking intercooler cannot be repaired immediately, before starting the engine:

– Remove injectors (G075.051.01).
– Bar engine manually (G000.000.05).
– Bar engine with starting system (G000.000.07) and blow out combustion chambers.

Obstruction check:

With the engine running, oil-containing air must emerge at the drain line.

G120.000.03 Intake air system, intake side leak and damage check

! DANGER !

Rotating and moving engine components.
Risk of bodily harm and fatal injury!
After working on the engine, check that all protective devices have been reinstalled and all tools removed from the engine.
Before barring or starting the engine, ensure that nobody is in the danger zone.

CAUTION!

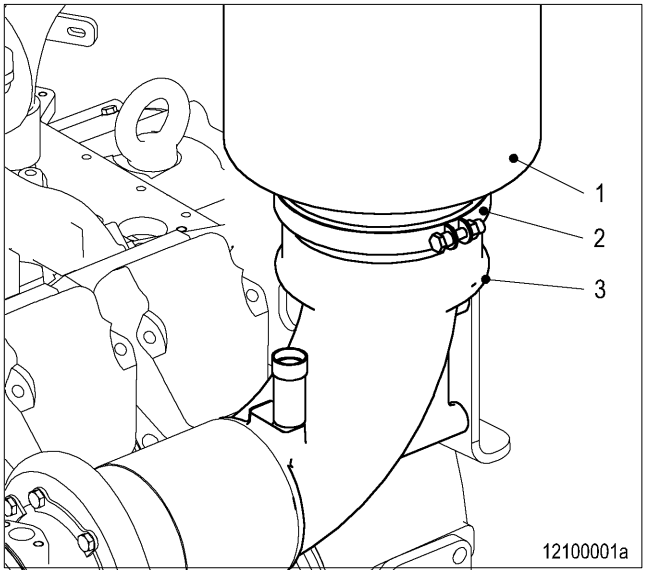
Engine noise above 85 dB(A).
Risk of damage to hearing!
Wear ear protectors.

Check intake side of engine for condition and leaks with the engine running.

G120.000.07 Intake air system check

Check that the cover from the air filters has been removed.

G121.051.01 Air filter replacement



Disable engine start (G000.000.01).

Release clamp (2).

Remove air filter (1) and dispose of filter in accordance with local regulations.

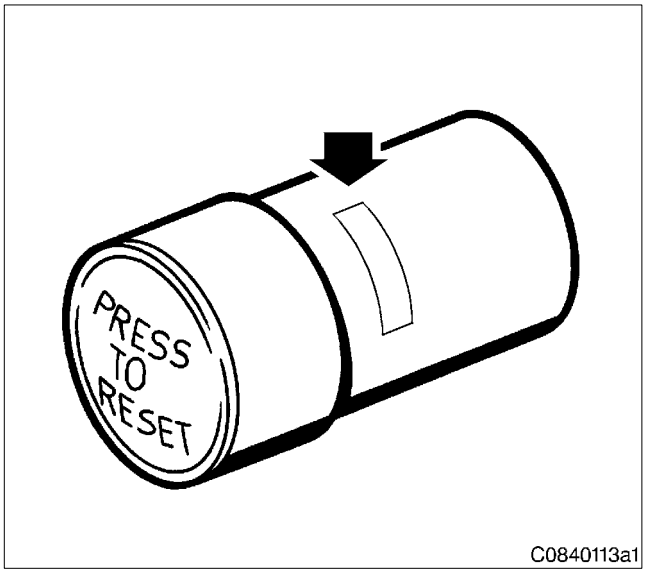
Clean connection on intake housing (3).

Install new air filter with clamp.

Reset contamination indicator (G123.053.10).

Release engine start (G000.000.03).

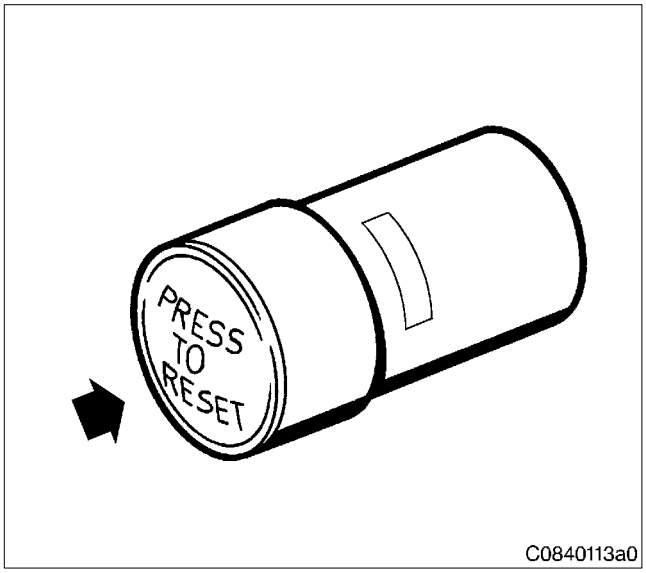
G123.053.01 Contamination indicator, signal ring position check



Check position of signal ring at observation window.

If the signal ring is completely visible once the engine has been shut down, and it remains in this position, replace air filter (G121.051.01).

G123.053.10 Contamination indicator resetting



Press reset button to return signal ring to normal position.

G140.000.03 Exhaust system security check

When the engine is cold, check tightness of securing screws by torque wrench application and retighten as necessary.

G140.000.05 Exhaust system, exhaust gas colour check

Exhaust gases light grey: good combustion.

Exhaust gases black: incomplete combustion.

Exhaust gases blue: excessive engine oil in combustion chamber.

Exhaust gases white: unburnt fuel.

G140.000.07 Exhaust system check

Check that the housing cover has been removed from the exhaust turbocharger outlet.

G140.000.09 Exhaust system, exhaust backpressure check

Connect U-pipe pressure gauge to exhaust manifold.

Run engine at full load and read off measurement on U-pipe pressure gauge.

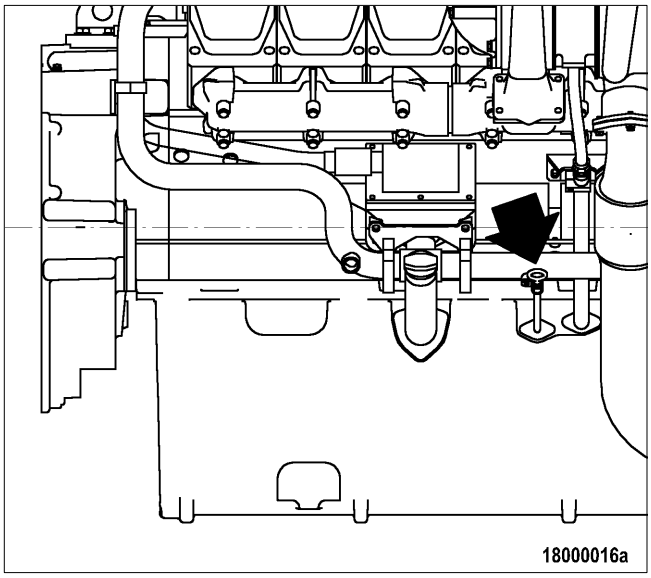
For specified values, see Engine Acceptance Test Record.

Remove U-pipe pressure gauge.

G180.000.01 Engine oil level check

Note:
Always use only MTU-approved engine oil, see MTU Fluids and Lubricants Specification A001061.

Do not fill engine oil above the ”max. mark”.



Checking before starting engine:

Withdraw dipstick from guide tube and wipe.

Carry out oil level check.

Engine oil must be between Min. and Max. marks.

If necessary, top up oil to Max. mark (G180.000.03).

Insert dipstick in guide tube.

Checking after engine shutdown:

Shut down engine and after approx. 5 minutes withdraw dipstick from guide tube and wipe.

Carry out oil level check.

Engine oil must be between Min. and Max. marks.

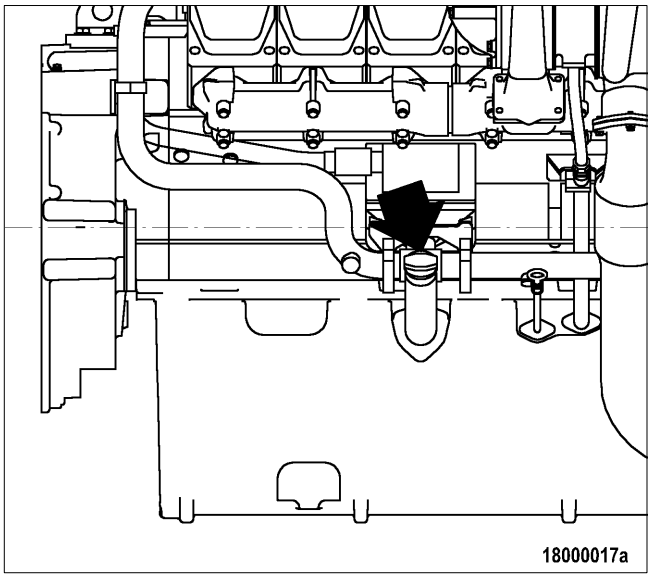
If necessary, top up oil to Max. mark (G180.000.03).

Insert dipstick in guide tube.

G180.000.03 Engine oil system filling

Note:
Always use only MTU-approved engine oil, see MTU Fluids and Lubricants Specification A001061.

Do not fill engine oil above the Max. mark.



Turn handle counterclockwise until the cover of the oil filler neck can be removed.

Pour engine oil in at oil filler neck up to Max. mark on oil dipstick.

Seal oil filler neck with cover and tighten handle.

Start engine and run at idle for approx. 1 to 2 minutes.

Shut down engine and after approx. 5 minutes withdraw dipstick from guide tube and wipe.

Carry out oil level check.

Engine oil must be between Min. and Max. marks.

If necessary, top up oil to Max. mark.

G180.000.04 Engine oil sample extraction and analysis

WARNING!

Engine oil can contain combustion residues which are harmful to health.

Risk of injury and scalding!

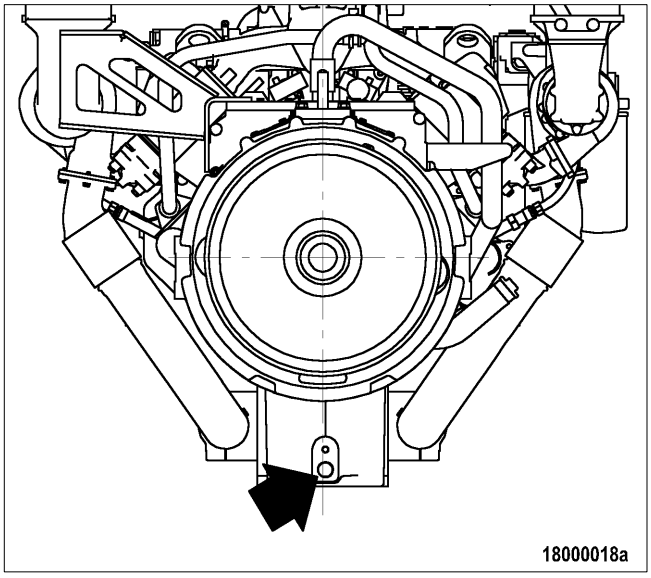
Wear protective clothing, rubber gloves, protective goggles and safety mask.

Avoid contact with skin.

Do not inhale oil vapour.

Disable engine start (G000.000.01).

Note:
Drain engine oil with the engine at operating temperature.



Remove drain plug and drain approx. 2 litres of engine oil into a container in order to flush out the oil sludge.

Drain approx. 1 litre of engine oil coolant into a clean container.

Install drain plug with a new sealing ring.

Release engine start (G000.000.03).

Using equipment and chemicals from the MTU Test Kit, inspect the engine oil for dispersion capability (spot test), coolant content and fuel dilution – see Publication for MTU Test Kit.

Disposal of Hazardous Materials

Fluids and lubricants (e.g. oils, greases, treated engine coolant, fuels), cleaning agents and numerous auxiliary materials are an environmental hazard and therefore constitute hazardous materials.
When disposing of these hazardous materials, compliance with manufacturer's instructions, general environmental protection regulations and local legal specifications is mandatory.
Under no circumstances must even small amounts of hazardous materials be allowed to drain into water, or be discarded or disposed of outdoors.
Leaked hazardous materials must immediately be absorbed with suitable bonding agents and disposed of in accordance with regulations in appropriate vessels. The contents of these containers must be specified.

G180.000.05 Engine oil change

Disable engine start (G000.000.01).

Drain engine oil (G180.000.07).

Replace engine oil filter (G183.052.03).

Pour in new engine oil (G180.000.03).

Release engine start (G000.000.03).

Note:
After each engine oil change and filter replacement, bar the engine with the starting system (G000.000.07).

G180.000.07 Engine oil draining

WARNING!

Engine oil can contain combustion residues which are harmful to health.

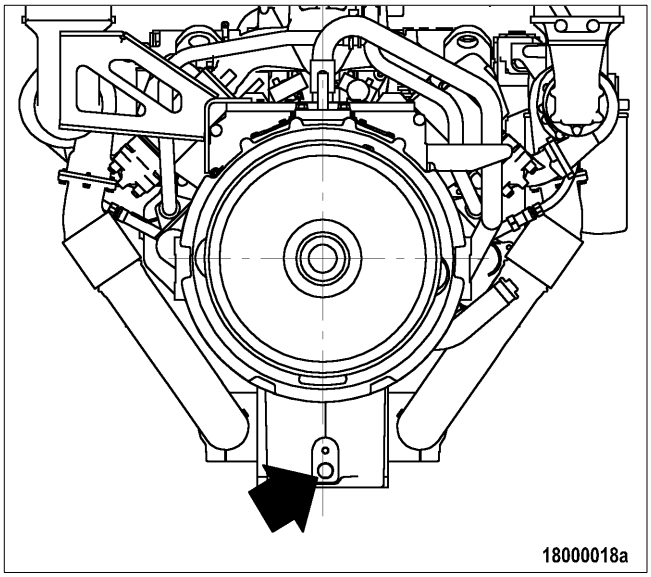
Risk of injury and scalding!

Wear protective clothing, rubber gloves, protective goggles and safety mask.

Avoid contact with skin.

Do not inhale oil vapour.

Note:
Drain engine oil with the engine at operating temperature.



Provide a suitable container in which to collect and dispose of the engine oil.

Open oil drain plug and drain the engine oil into the container.

Install drain plug with a new sealing ring.

Disposal of Hazardous Materials

Fluids and lubricants (e.g. oils, greases, treated engine coolant, fuels), cleaning agents and numerous auxiliary materials are an environmental hazard and therefore constitute hazardous materials.
When disposing of these hazardous materials, compliance with manufacturer's instructions, general environmental protection regulations and local legal specifications is mandatory.
Under no circumstances must even small amounts of hazardous materials be allowed to drain into water, or be discarded or disposed of outdoors.
Leaked hazardous materials must immediately be absorbed with suitable bonding agents and disposed of in accordance with regulations in appropriate vessels. The contents of these containers must be specified.

G180.000.09 Corrosion inhibitor oil filling

Note:
Always use only new MTU-approved corrosion inhibitor oil – see current MTU Fluids and Lubricants Specification A001061.

Fill engine with corrosion inhibitor oil in same way as engine oil (G180.000.03).

G180.000.11 Corrosion inhibitor oil draining

Note:
Drain the corrosion inhibitor oil with the engine at operating temperature.

Drain corrosion inhibitor oil in same way as engine oil (G180.000.07).

G183.052.03 Engine oil filter replacement

WARNING!

Engine oil can contain combustion residues which are harmful to health.

Risk of injury and scalding!

Wear protective clothing, rubber gloves, protective goggles and safety mask.

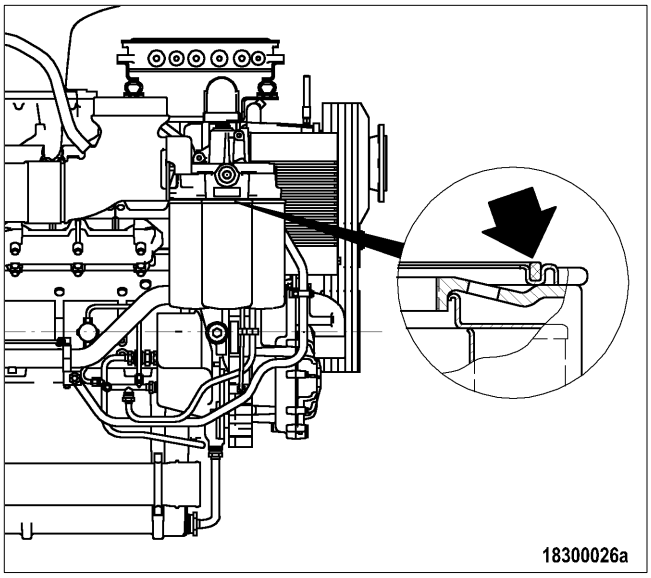
Avoid contact with skin.

Do not inhale oil vapour.

Special tool:

Oil filter wrench F3 0379104

Disable engine start (G000.000.01).



Remove engine oil filter with oil filter wrench.

Drain remaining oil out of engine oil filter into a container.

Clean sealing surface at connector.

Check sealing ring of new engine oil filter and coat with oil.

Install new engine oil filter and tighten by hand.

Replace other engine oil filters in same way.

Note:
After each engine oil change and filter replacement, bar the engine with the starting system (G000.000.07).

Check engine oil level (G180.000.01).

When the engine is started again, check the oil filters for leaks.

Release engine start (G000.000.03).

Disposal of Hazardous Materials

Fluids and lubricants (e.g. oils, greases, treated engine coolant, fuels), cleaning agents and numerous auxiliary materials are an environmental hazard and therefore constitute hazardous materials.
When disposing of these hazardous materials, compliance with manufacturer's instructions, general environmental protection regulations and local legal specifications is mandatory.
Under no circumstances must even small amounts of hazardous materials be allowed to drain into water, or be discarded or disposed of outdoors.
Leaked hazardous materials must immediately be absorbed with suitable bonding agents and disposed of in accordance with regulations in appropriate vessels. The contents of these containers must be specified.

G202.000.01 Engine coolant system filling

WARNING!

Coolant is hot and under pressure.

Risk of injury and scalding!

Allow engine to cool.

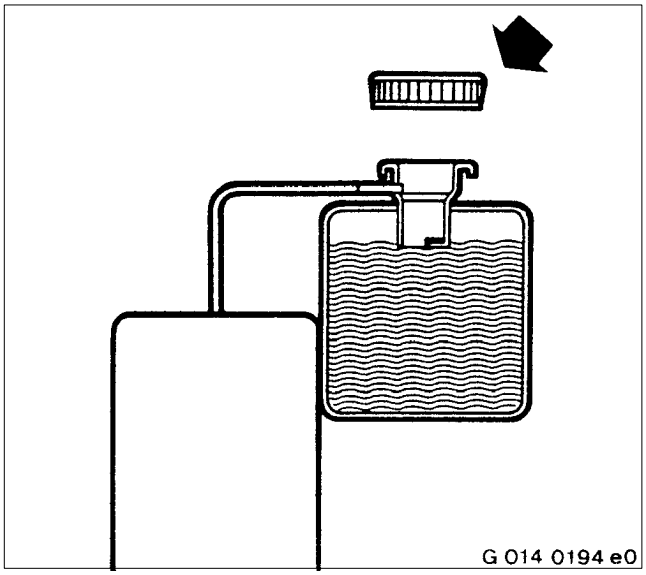
Wear protective clothing, rubber gloves, protective goggles and safety mask.

Note:
Always use only treated coolant in accordance with MTU Fluids and Lubricants Specification A001061.

Never pour cold coolant into a hot engine.

If, in an emergency, untreated water is used to top up the coolant system, the coolant concentration must be checked and rectified at the earliest opportunity.

Open breather valve (G208.101.01).



Add treated engine coolant via the filler line or the filler neck.

Check engine coolant level (G202.000.03).

Close breather valve (G208.101.03).

Run engine a number of minutes at idling speed.

Check engine coolant level (G202.000.03).

G202.000.03 Engine coolant level check

Note:
The ”Min.” coolant level is automatically monitored by the engine control system.

Via level sensor:

Switch on engine control system (G500.000.01) and check indicator.

Via filler neck:

WARNING!

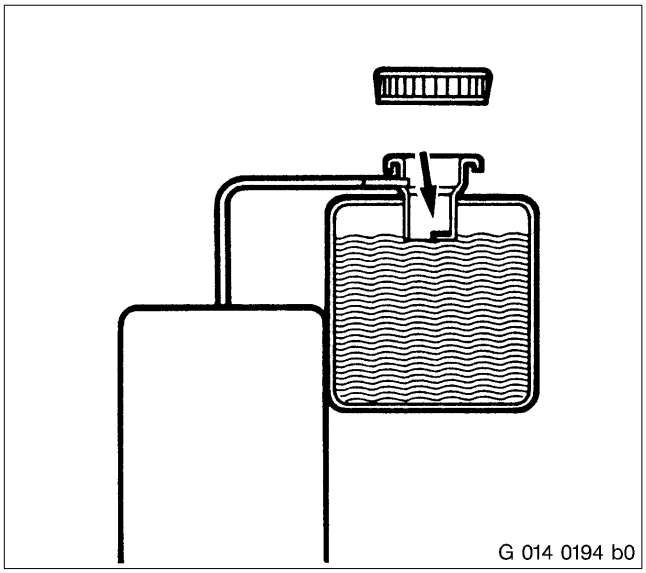
Coolant is hot and under pressure.
Risk of injury and scalding!
Allow engine to cool.
Wear protective clothing, rubber gloves, protective goggles and safety mask.

Note:
Always use only treated coolant in accordance with MTU Fluids and Lubricants Specification A001061.

Never pour cold coolant into a hot engine.

If, in an emergency, untreated water is used to top up the coolant system, the coolant concentration must be checked and rectified at the earliest opportunity.

Open breather valve (G208.101.01).



The engine coolant must be visible at the lower edge of the filler neck.

Top up only with treated engine coolant, as required (G202.000.01).

Close breather valve (G208.101.03).

G202.000.05 Engine coolant sample extraction and analysis

WARNING!

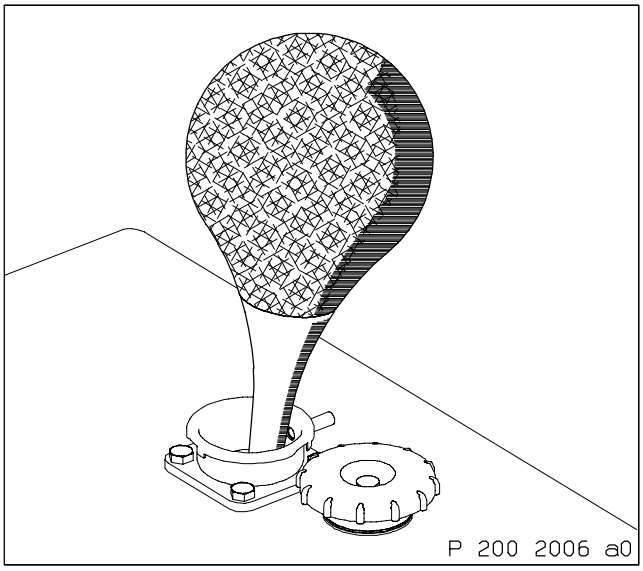
Coolant is hot and under pressure.

Risk of injury and scalding!

Allow engine to cool.

Wear protective clothing, rubber gloves, protective goggles and safety mask.

Open breather valve (G208.101.01).



Draw off precipitated corrosion inhibitor oil from expansion tank via filler neck and dispose of oil in appropriate manner.

Via the filler neck, draw off approx. 1 litre engine coolant into a clean container.

Using the equipment and chemicals provided in the MTU Test Kit, check coolant for:

– Antifreeze,
– Corrosion-inhibitor
– pH value

Close breather valve (G208.101.03).

Change engine coolant according to the coolant operating times in the MTU Fluids and Lubricants Specification A001061 (G202.000.09).

Disposal of Hazardous Materials

Fluids and lubricants (e.g. oils, greases, treated engine coolant, fuels), cleaning agents and numerous auxiliary materials are an environmental hazard and therefore constitute hazardous materials.
When disposing of these hazardous materials, compliance with manufacturer's instructions, general environmental protection regulations and local legal specifications is mandatory.
Under no circumstances must even small amounts of hazardous materials be allowed to drain into water, or be discarded or disposed of outdoors.
Leaked hazardous materials must immediately be absorbed with suitable bonding agents and disposed of in accordance with regulations in appropriate vessels. The contents of these containers must be specified.

G202.000.07 Engine coolant draining

WARNING!

Coolant is hot and under pressure.

Risk of injury and scalding!

Allow engine to cool.

Wear protective clothing, rubber gloves, protective goggles and safety mask.

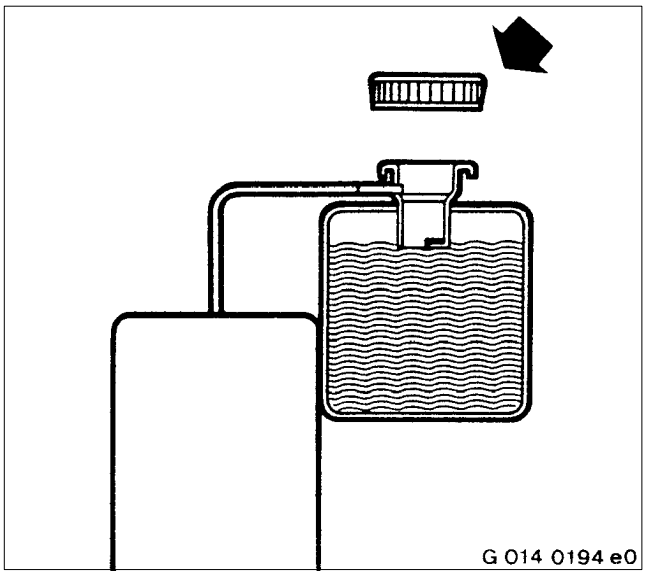
Disable engine start (G000.000.01).

Note:
Drain engine coolant when engine has cooled.

Preheating unit (if fitted) must be switched off.

Provide a suitable container in which to collect and dispose of the engine coolant.

Open breather valve (G208.101.01).

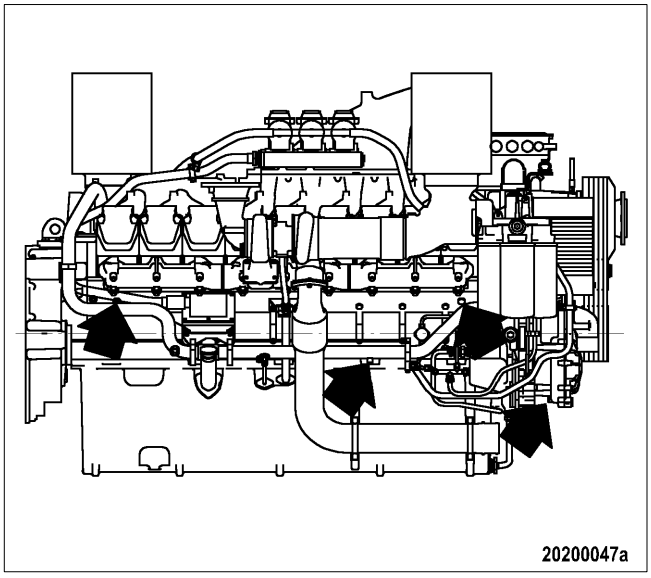


Draw off precipitated corrosion inhibitor oil from expansion tank via filler neck and dispose of oil in appropriate manner.

Drain the expansion tank via the filler neck.

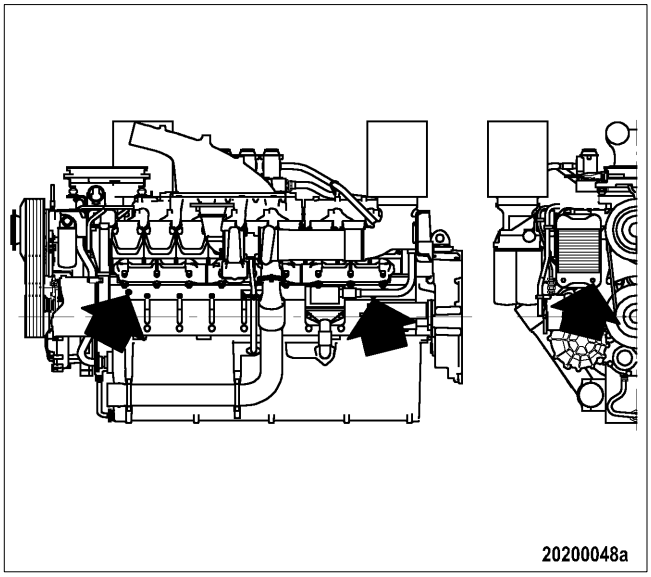
Open drain plugs on engine coolant cooler and preheating unit and drain coolant.

Start at lowest point of coolant system.



Drain remaining coolant at following points:

– crankcase, right side
– coolant line
– engine coolant pump



– crankcase, left side
– oil heat exchanger

Fit all plugs with new sealing rings.

Close breather valve (G208.101.03).

Dispose of engine coolant.

Release engine start (G000.000.03).

Disposal of Hazardous Materials

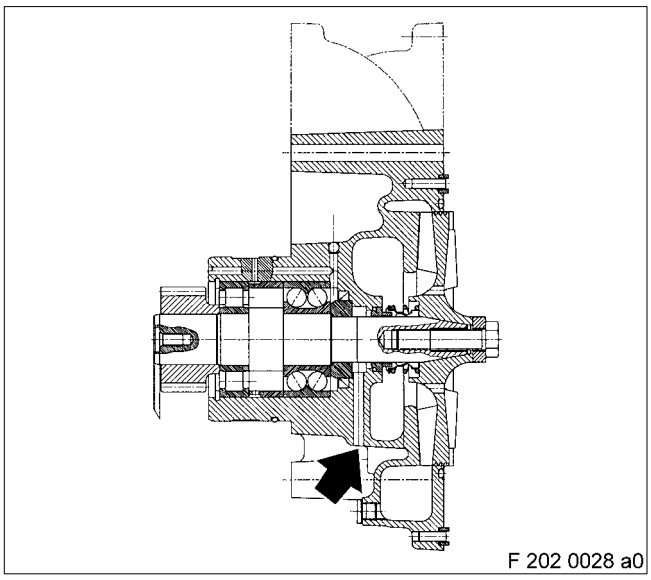
Fluids and lubricants (e.g. oils, greases, treated engine coolant, fuels), cleaning agents and numerous auxiliary materials are an environmental hazard and therefore constitute hazardous materials.
When disposing of these hazardous materials, compliance with manufacturer's instructions, general environmental protection regulations and local legal specifications is mandatory.
Under no circumstances must even small amounts of hazardous materials be allowed to drain into water, or be discarded or disposed of outdoors.
Leaked hazardous materials must immediately be absorbed with suitable bonding agents and disposed of in accordance with regulations in appropriate vessels. The contents of these containers must be specified.

G202.000.09 Engine coolant change

Drain engine coolant (G202.000.07).

Fill engine coolant system (G202.000.01).

G202.051.01 Engine coolant pump relief bore check



Check relief bore for oil and coolant discharge (visual inspection).

Clean the bore if it is contaminated.

Permissible volume of discharge:

Coolant up to 10 drops/hour

Oil up to 5 drops/hour

Note:
Repair engine coolant pump only if number of drops exceeds the above.

G202.400.01 Engine coolant preheating

Switch on preheating unit (G202.401.03).

Engine coolant preheat temperature (A000.000.21).

G202.401.01 Engine coolant preheating unit initial operation

Carry out tasks specified by manufacturer.

G202.401.03 Engine coolant preheating unit, switching on

Carry out tasks specified by manufacturer.

G202.401.05 Engine coolant preheating unit, switching off

Carry out tasks specified by manufacturer.

G202.651.01 Engine coolant system, vent line obstruction check

WARNING!

Compressed air

Risk of injury!

Never aim compressed air jet at persons.

Wear protective goggles/safety mask and ear protection.

Remove vent lines and blow out with compressed air.

Install vent lines.

G203.000.01 Charge air coolant system filling

WARNING!

Coolant is hot and under pressure.

Risk of injury and scalding!

Allow engine to cool.

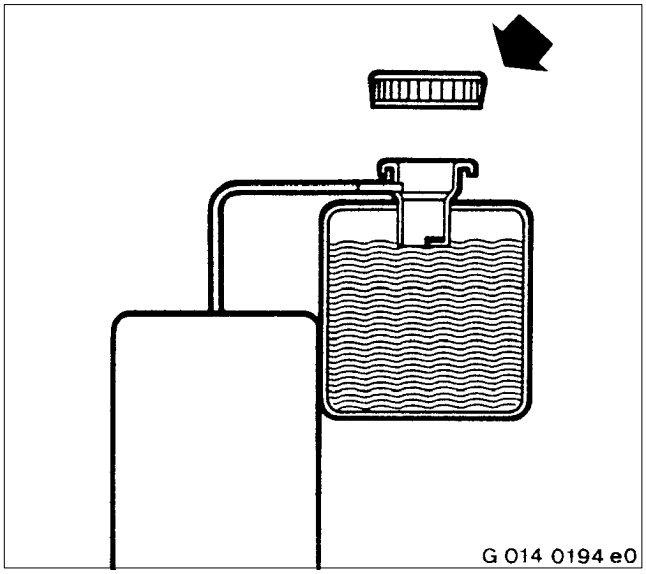
Wear protective clothing, rubber gloves, protective goggles and safety mask.

Note:
Always use only treated coolant in accordance with MTU Fluids and Lubricants Specification A001061.

Never pour cold charge air coolant into a hot engine.

If, in an emergency, untreated charge air coolant is used to top up the coolant system, the charge air coolant concentration must be checked and rectified at the earliest opportunity.

Open breather valve (G208.101.01).



Add treated charge air coolant via the filler line or the filler neck.

Check charge air coolant level (G203.000.03).

Close breather valve (G208.101.03).

Run engine a number of minutes at idling speed.

Check charge air coolant level (G203.000.03).

G203.000.03 Charge air coolant level check

Note:
The ”Min” charge air coolant level is automatically monitored by the engine control system.

Via level sensor:

Switch on engine control system (G500.000.01) and check indicator.

Via filler neck:

WARNING!

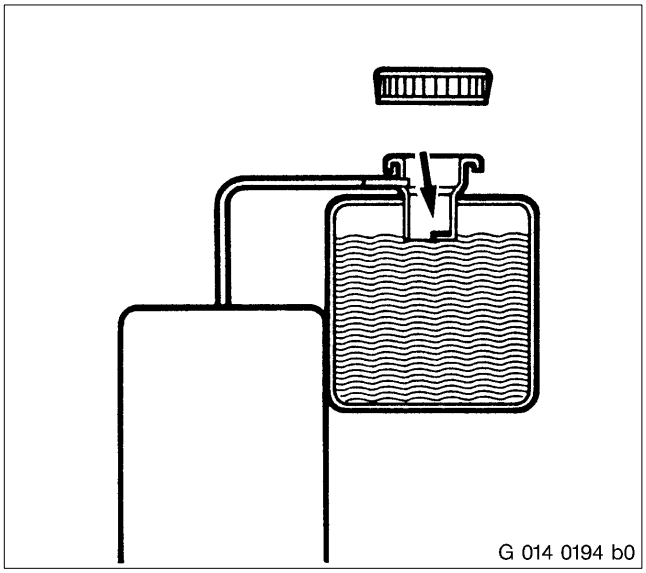
Coolant is hot and under pressure.
Risk of injury and scalding!
Allow engine to cool.
Wear protective clothing, rubber gloves, protective goggles and safety mask.

Note:
Always use only treated coolant in accordance with MTU Fluids and Lubricants Specification A001061.

Never pour cold charge air coolant into a hot engine.

If, in an emergency, untreated charge air coolant is used to top up the coolant system, the charge air coolant concentration must be checked and rectified at the earliest opportunity.

Open breather valve (G208.101.01).



Charge air coolant must be visible at the lower edge of the filler neck.

Top up only with treated charge air coolant, as required (G202.000.01).

Close breather valve (G208.101.03).

G203.000.05 Charge air coolant draining

WARNING!

Coolant is hot and under pressure.

Risk of injury and scalding!

Allow engine to cool.

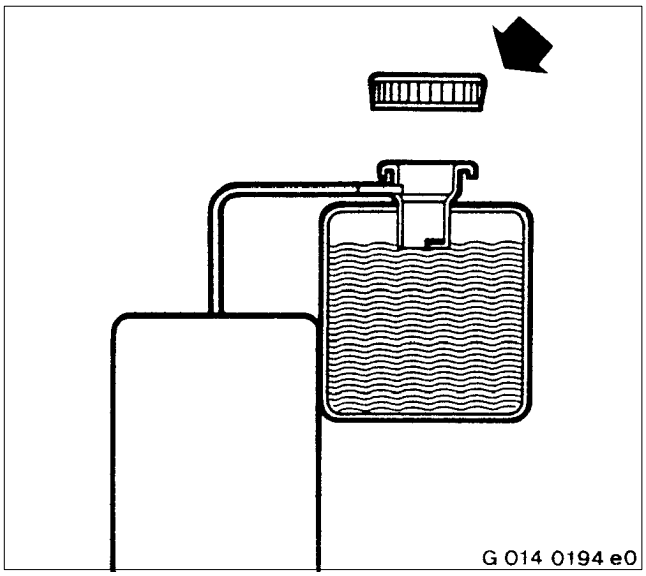
Wear protective clothing, rubber gloves, protective goggles and safety mask.

Disable engine start (G000.000.01).

Note:
Drain charge air coolant when engine has cooled.

Provide a suitable container in which to collect and dispose of the charge air coolant.

Open breather valve (G208.101.01).



Draw off precipitated corrosion inhibitor oil from expansion tank via filler neck and dispose of oil in appropriate manner.

Drain charge air coolant at drain plug into a clean container.

Install plug with a new sealing ring.

Close breather valve (G208.101.03).

Release engine start (G000.000.03).

Disposal of Hazardous Materials

Fluids and lubricants (e.g. oils, greases, treated engine coolant, fuels), cleaning agents and numerous auxiliary materials are an environmental hazard and therefore constitute hazardous materials.
When disposing of these hazardous materials, compliance with manufacturer's instructions, general environmental protection regulations and local legal specifications is mandatory.
Under no circumstances must even small amounts of hazardous materials be allowed to drain into water, or be discarded or disposed of outdoors.
Leaked hazardous materials must immediately be absorbed with suitable bonding agents and disposed of in accordance with regulations in appropriate vessels. The contents of these containers must be specified.

G203.000.07 Charge air coolant sample extraction and analysis

WARNING!

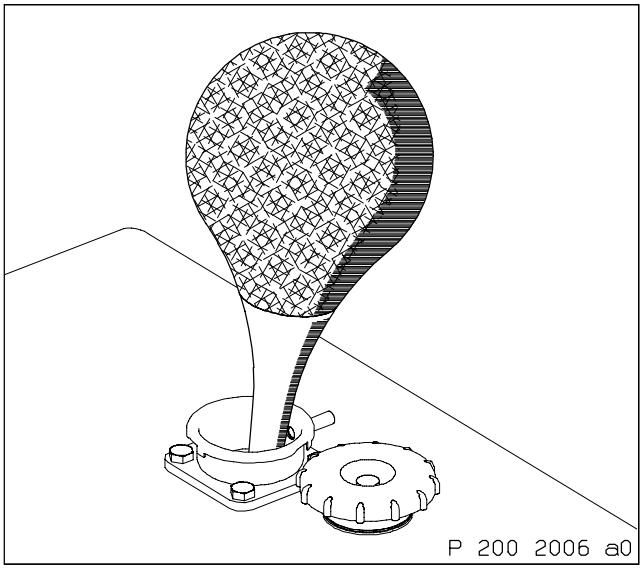
Coolant is hot and under pressure.

Risk of injury and scalding!

Allow engine to cool.

Wear protective clothing, rubber gloves, protective goggles and safety mask.

Open breather valve (G208.101.01).



Draw off precipitated corrosion inhibitor oil from expansion tank via filler neck and dispose of oil in appropriate manner.

Via the filler neck, draw off approx. 1 litre charge air coolant into a clean container.

Using the equipment and chemicals provided in the MTU Test Kit, check charge air coolant for:

– Antifreeze,
– Corrosion-inhibitor
– pH value

Close breather valve (G208.101.03).

Change charge air coolant according to the coolant operating times in the MTU Fluids and Lubricants Specification A001061 (G203.000.09).

Disposal of Hazardous Materials

Fluids and lubricants (e.g. oils, greases, treated engine coolant, fuels), cleaning agents and numerous auxiliary materials are an environmental hazard and therefore constitute hazardous materials.
When disposing of these hazardous materials, compliance with manufacturer's instructions, general environmental protection regulations and local legal specifications is mandatory.
Under no circumstances must even small amounts of hazardous materials be allowed to drain into water, or be discarded or disposed of outdoors.
Leaked hazardous materials must immediately be absorbed with suitable bonding agents and disposed of in accordance with regulations in appropriate vessels. The contents of these containers must be specified.

G203.000.09 Charge air coolant changing

Drain charge air coolant (G203.000.05).

Fill system with charge air coolant (G203.000.01).

G203.051.01 Charge air coolant pump relief bore check

See G202.051.01.

G203.551.01 Charge air coolant system, vent line obstruction check

WARNING!

Compressed air
Risk of injury!
Never aim compressed air jet at persons.
Wear protective goggles/safety mask and ear protection.

Remove vent line and blow out with compressed air.

Install vent line.

G205.051.01 Engine coolant cooler, external element contamination check

WARNING!

Compressed air
Risk of injury!
Never aim compressed air jet at persons.
Wear protective goggles/safety mask and ear protection.

Check cooler elements for contamination (visual inspection).

Clean heavily contaminated cooler elements.

Note:
The direction of the jet must be parallel to the cooling fins in order to avoid deforming the blades.

Blow out cooler elements against direction of cooling air with a compressed air jet or spray with a water jet.

In event of heavily contaminated cooler elements, before cleaning treat elements with a hot, grease-dissolving alkali cleaning agent.

Disposal of Hazardous Materials

Fluids and lubricants (e.g. oils, greases, treated engine coolant, fuels), cleaning agents and numerous auxiliary materials are an environmental hazard and therefore constitute hazardous materials.
When disposing of these hazardous materials, compliance with manufacturer's instructions, general environmental protection regulations and local legal specifications is mandatory.
Under no circumstances must even small amounts of hazardous materials be allowed to drain into water, or be discarded or disposed of outdoors.
Leaked hazardous materials must immediately be absorbed with suitable bonding agents and disposed of in accordance with regulations in appropriate vessels. The contents of these containers must be specified.

G205.051.03 Charge air coolant cooler, external element contamination check

WARNING!

Compressed air

Risk of injury!

Never aim compressed air jet at persons.

Wear protective goggles/safety mask and ear protection.

Check cooler elements for contamination (visual inspection).

Clean heavily contaminated cooler elements.

Note:
The direction of the jet must be parallel to the cooling fins in order to avoid deforming the blades.

Blow out cooler elements against direction of cooling air with a compressed air jet or spray with a water jet.

In event of heavily contaminated cooler elements, before cleaning treat elements with a hot, grease-dissolving alkali cleaning agent.

Disposal of Hazardous Materials

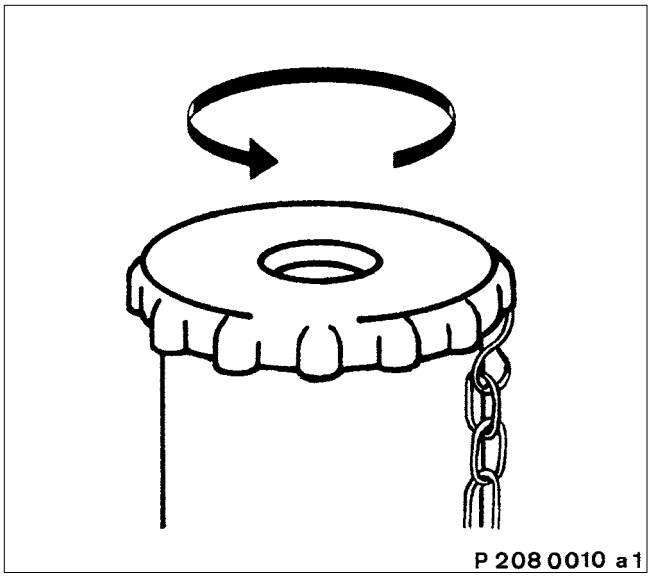
Fluids and lubricants (e.g. oils, greases, treated engine coolant, fuels), cleaning agents and numerous auxiliary materials are an environmental hazard and therefore constitute hazardous materials.
When disposing of these hazardous materials, compliance with manufacturer's instructions, general environmental protection regulations and local legal specifications is mandatory.
Under no circumstances must even small amounts of hazardous materials be allowed to drain into water, or be discarded or disposed of outdoors.
Leaked hazardous materials must immediately be absorbed with suitable bonding agents and disposed of in accordance with regulations in appropriate vessels. The contents of these containers must be specified.

G208.101.01 Breather valve opening

WARNING!

Coolant is hot and under pressure.
Risk of injury and scalding!
Allow engine to cool.
Wear protective clothing, rubber gloves, protective goggles and safety mask.

Disable engine start (G000.000.01).



Turn breather valve counterclockwise to first stop.

Allow pressure to escape.

Continue to turn breather valve counterclockwise and remove.

G208.101.03 Breather valve closing

Check that breather valve is in perfect condition.

Clean sealing surfaces.

Fit breather valve and turn clockwise as far as it will go.

Release engine start (G000.000.03).

G213.051.01 Generator drive, drive belt condition and tension check

! DANGER !

Rotating and moving engine components.

Risk of bodily harm and fatal injury!

After working on the engine, check that all protective devices have been reinstalled and all tools removed from the engine.

Before barring or starting the engine, ensure that nobody is in the danger zone.

Special tool:

Pretension gauge Y2 0097 429

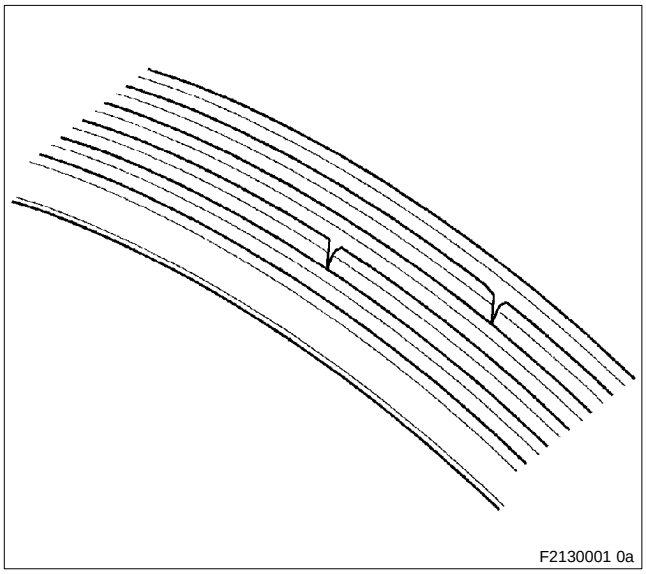
Condition check:

Disable engine start (G000.000.01).

Remove guard plate.

Note:
Never use solvents such as petroleum or benzol or sharp-edged objects.

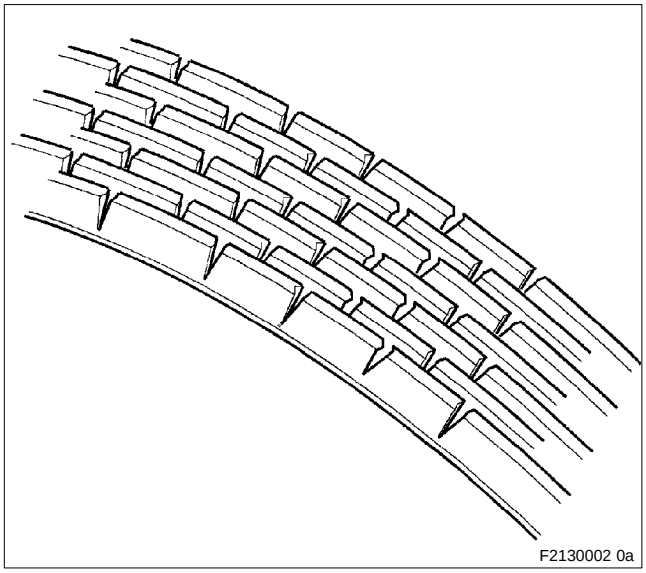
Check ribs for cracks, oil, overheating and wear; clean or replace as necessary.


F2130001 0a

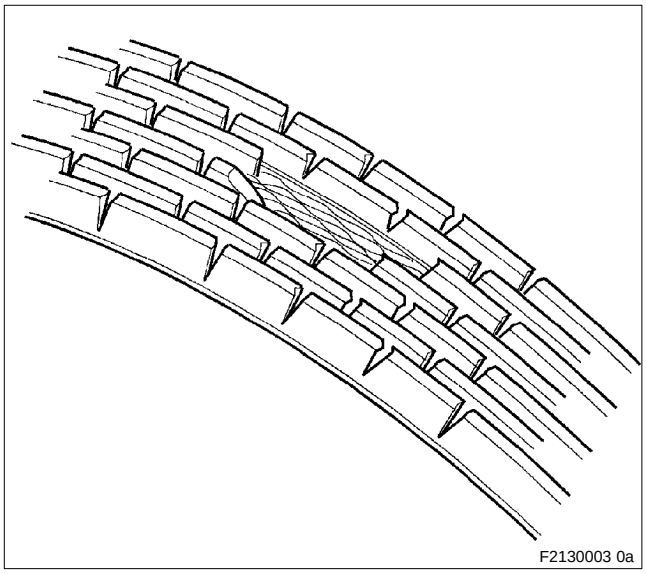
Damage pattern of ribbed belt:

Normal wear:

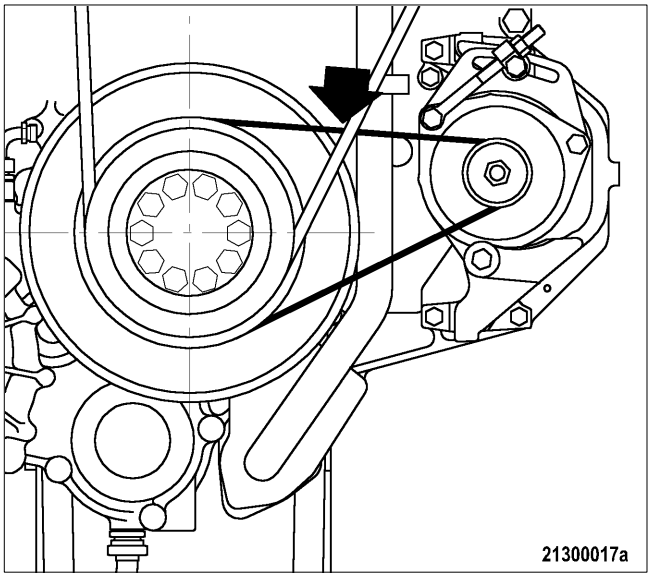
One or two rib fractures over 25 mm can be considered normal after a long period of service, the V-ribbed belt can continue in service.



The V-ribbed belt must be replaced as the ribs are broken around the entire circumference.

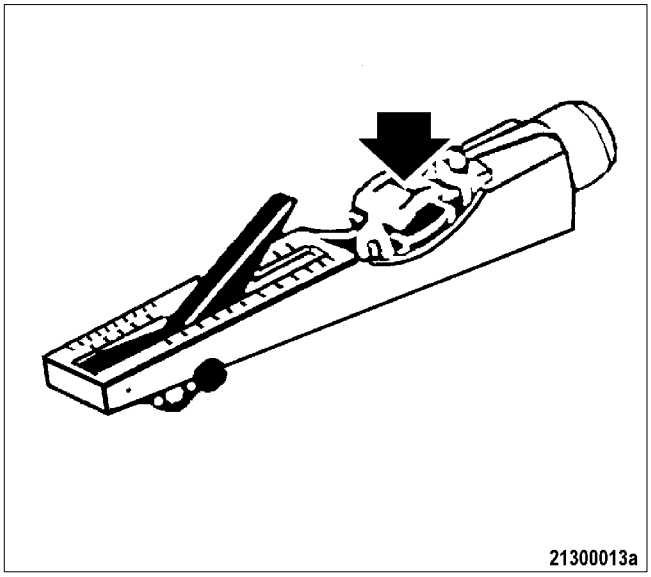


The V-ribbed belt must be replaced immediately as the ribbed material has broken through and the ribs are broken around the entire circumference.



Tension check:

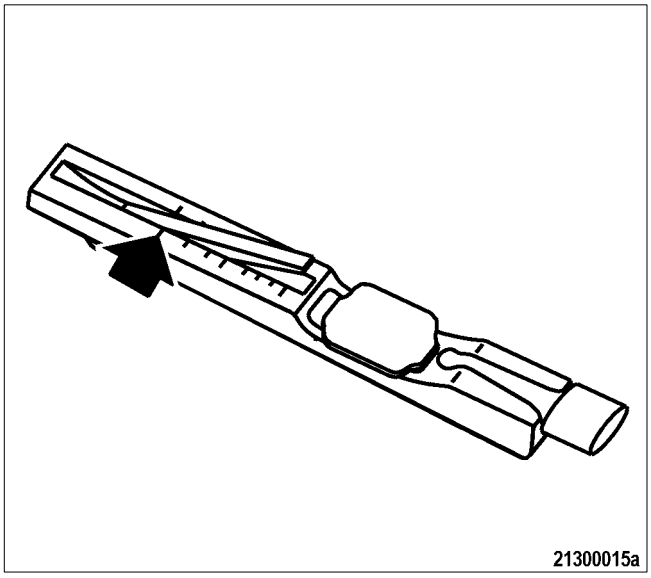
Place measuring instrument in the centre between pulleys on the V-ribbed belt (arrow).



Note:
The gauge pointer must be inside the gauge.

Press straight down with the pressure pad onto the belt upper surface until the spring is heard or felt to be released.

In order to avoid errors in measurement, exert pressure only on the pressure pad and stop pressing when the spring is released.



Read off the value from the scale.

Carefully lift V-belt tension gauge without altering the position of the pointer.

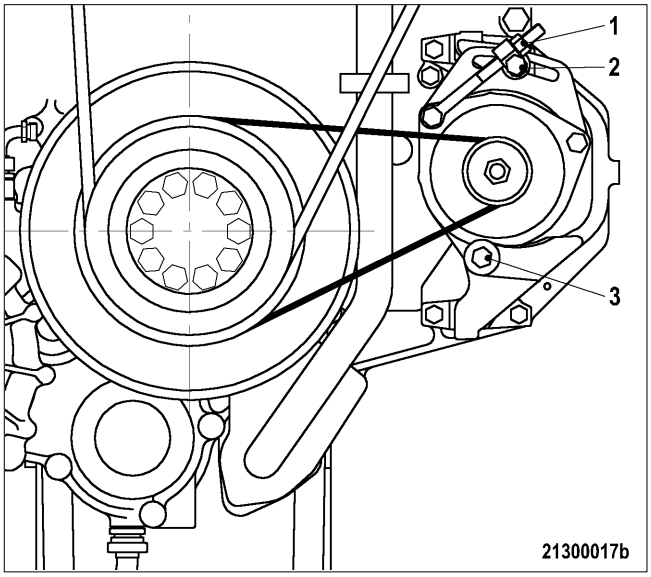
Read off belt tension indicated where pointer crosses scale.

Settings:

New drive belt: 450 N – 50 N.

Worn drive belt: 350 N – 50 N.

If the measured value does not correspond to the specified setting, the V-ribbed belt tension must be readjusted.



Tension adjustment:

Release securing screws (2+3).

Tension ribbed belt with clamping nut (1).

Check V-ribbed belt tension.

Tighten securing screw (2) with torque wrench.

Tightening torque: 40 Nm + 4 Nm

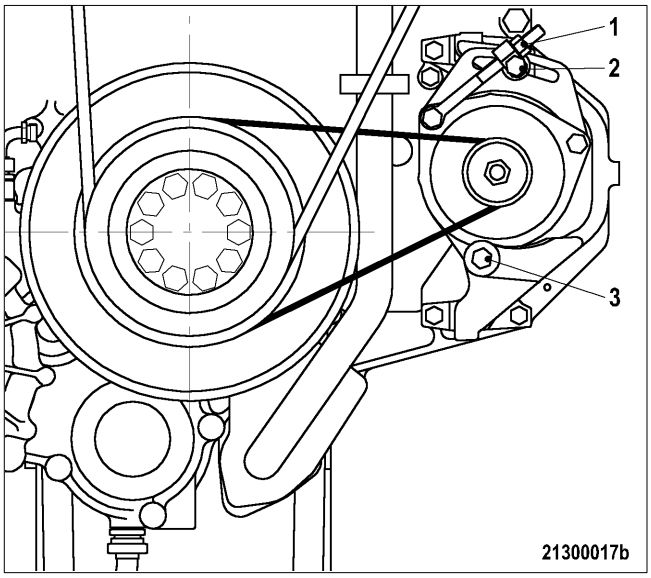
Lubricant: Engine oil

Tighten securing screw (3).

Check V-ribbed belt tension.

Release engine start (G000.000.03).

G213.051.05 Generator drive belt replacement



Disable engine start (G000.000.01).

Remove guard plate.

Remove drive belt from fan drive – see G221.051.03.

Release securing screws (2+3).

Release clamping nut (1) so that the ribbed belt can be removed.

Check that V-ribbed belt pulleys are clean; clean if necessary.

Fit new ribbed belt.

Tension ribbed belt with clamping nut (1).

For V-ribbed belt tension setting, see G213.051.01.

Tighten securing screws (2) with torque wrench.

Tightening torque: 40 Nm + 4 Nm

Lubricant: Engine oil

Tighten securing screw (2).

Install drive belt of fan drive – see G221.051.03.

Install guard plate.

Release engine start (G000.000.03).

G221.051.01 Fan drive, drive belt condition and tension check

! DANGER !

Rotating and moving engine components.

Risk of bodily harm and fatal injury!

After working on the engine, check that all protective devices have been reinstalled and all tools removed from the engine.

Before barring or starting the engine, ensure that nobody is in the danger zone.

Special tool:

Pretension gauge 550 589 01 19/0 00

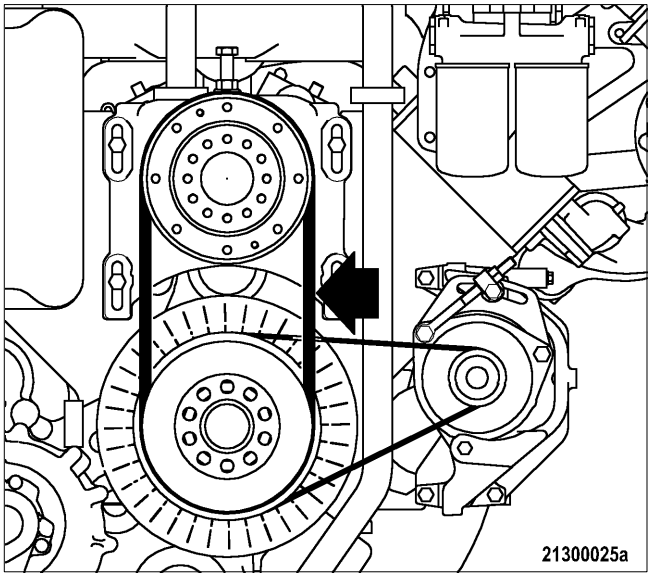
Condition check:

Disable engine start (G000.000.01).

Note:
Never use solvents such as petroleum or benzol or sharp-edged objects.

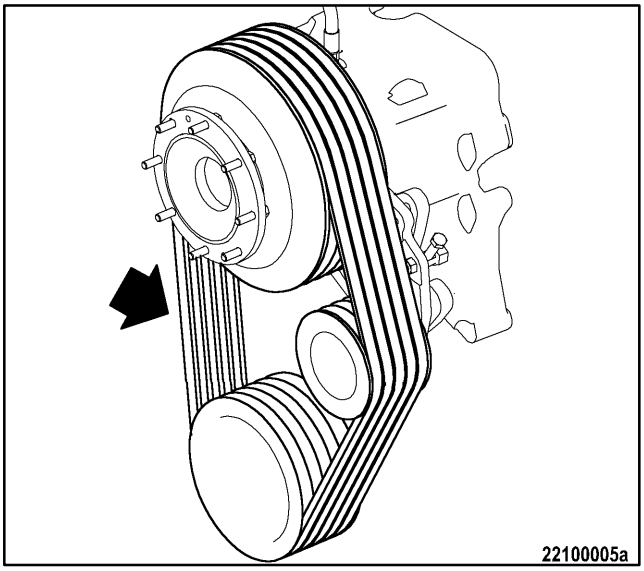
Check V-ribbed belt for cracks, oil, overheating and wear; clean or replace as necessary.

If, for whatever reason, one or more of the V-belts becomes defective, a new V-belt set must be installed.



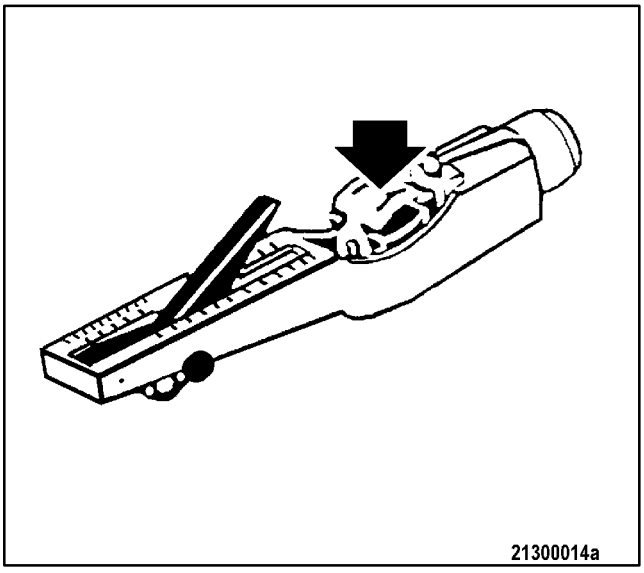
Check voltage 12V/16V:

Place tension gauge in the centre between pulleys on the V-ribbed belt (arrow).



Check voltage 18V:

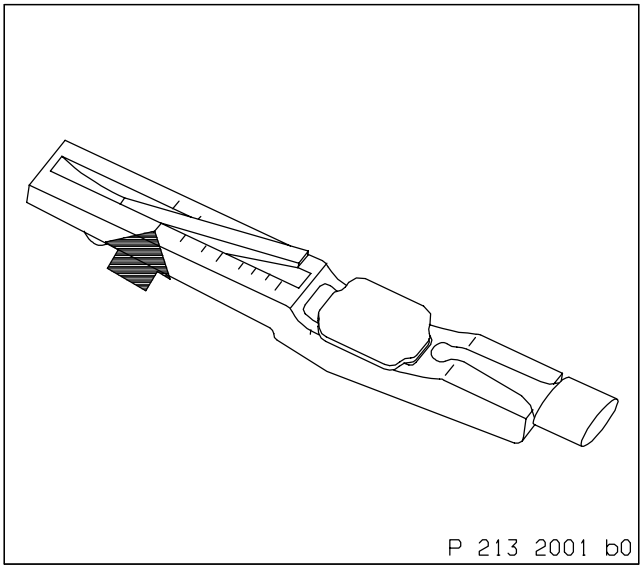
Place tension gauge in the centre between pulleys on the V-ribbed belt (arrow).



Note:
The stop (arrow) of the gauge must be positioned to the side of the drive belt and the pointer in the gauge.

Press straight down with the pressure pad onto the belt upper surface until the spring is heard or felt to be released.

In order to avoid errors in measurement, exert pressure only on the pressure pad and stop pressing when the spring is released.



Read off the value from the scale.

Carefully lift V-belt tension gauge without altering the position of the pointer.

Read off belt tension indicated where pointer crosses scale.

Settings 12/16V:

New V-belt: 660 N

Used V-belt: 510 N

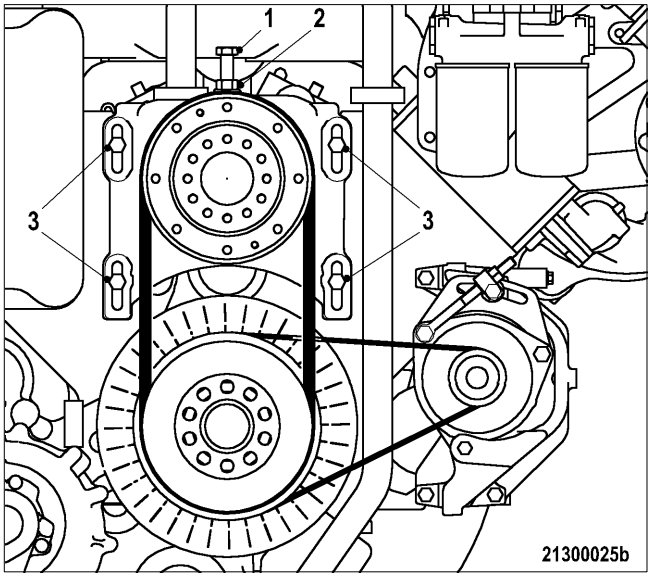
Settings 18V:

New V-belt: 670 N – 50 N

Used V-belt: 570 N – 50 N

If the measured value does not correspond to the specified setting, the V-ribbed belt tension must be readjusted.

Note:
NOTE: For multi V-belt drives, check all V-belts.



Adjust voltage 12V/16V:

Release securing screws (3).

Release locknut (2).

Screw in tensioning screw (1) and tighten V-belt.

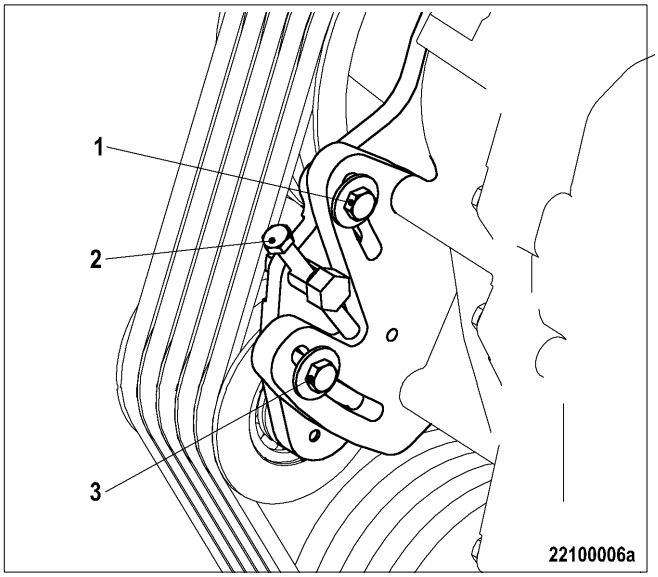
Tighten locknut (2).

Tighten securing screws (3) with torque wrench.

Tightening torque: 100 Nm

Lubricant: Engine oil

Release engine start (G000.000.03).



Adjust voltage 18V:

Release securing screws (2+3).

Screw in tensioning screw (1) and tighten V-belt.

Check V-belt tension.

Tighten securing screws (2+3) with torque wrench.

Tightening torque: 69 Nm

Lubricant: Engine oil

Check V-belt tension.

Release engine start (G000.000.03).

G221.051.03 Fan drive belt replacement

! DANGER !

Rotating and moving engine components.

Risk of bodily harm and fatal injury!

After working on the engine, check that all protective devices have been reinstalled and all tools removed from the engine.

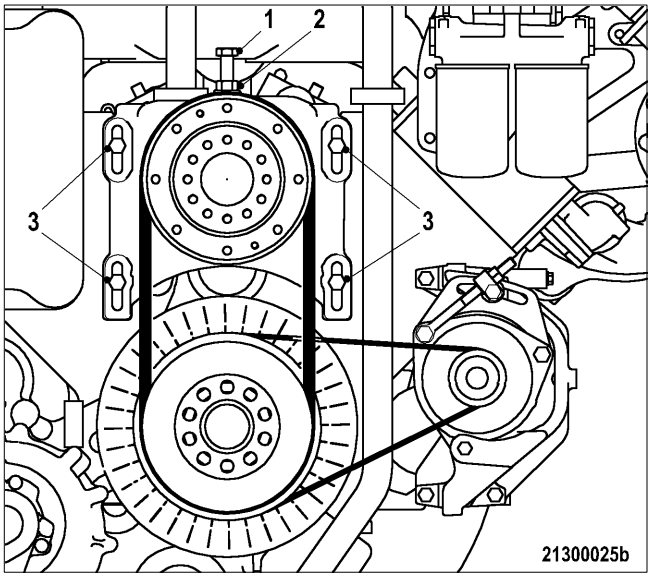
Before barring or starting the engine, ensure that nobody is in the danger zone.

Disable engine start (G000.000.01).

Note:
Always replace V-belts in sets.

Remove guards from cooler.

Remove air filter.



Replace drive belts, 12V/16V:

Release securing screws (3).

Release locknut (2).

Release bearing cap stud (1) so that the V-belts can be removed.

Check belt pulley on the fan bearing pedestal and crankshaft for cleanness, clean if necessary.

Fit new set of V-belts.

V-belts must be placed in the grooves without the use of force.

The fan bearing pedestal must contact the gear case for V-belt tensioning. Pretension V-belt with clamping screw.

Set V-belt tension, see under (G221.051.01).

Tighten locknut (2).

Tighten securing screws (3) with torque wrench.

Tightening torque: 100 Nm

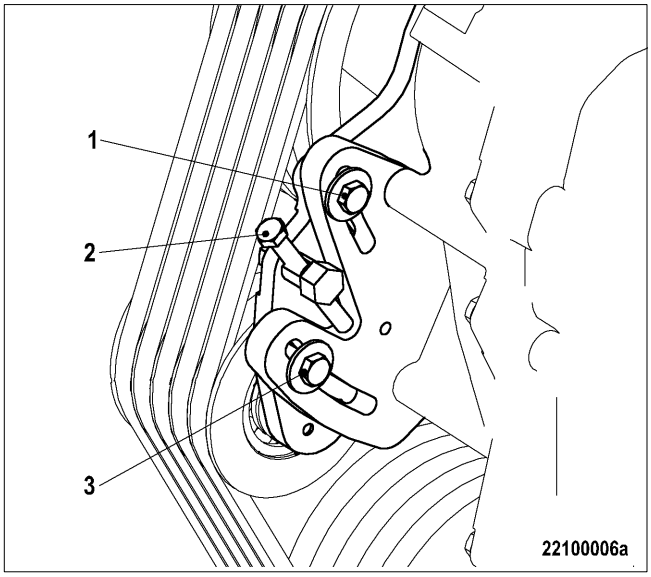
Lubricant: Engine oil

Check V-belt tension.

Install fan.

Install guard plates.

Release engine start (G000.000.03).



Replace drive belts, 18V:

Release securing screws (2+3).

Release bearing cap stud (1) so that the V-belts can be removed.

Check belt pulley on the fan bearing pedestal and crankshaft for cleanness, clean if necessary.

Fit new set of V-belts.

V-belts must be placed in the grooves without the use of force.

For V-belt tensioning, the fan bearing pedestal must be in contact with the gear case.

Secure V-belt with stress bolt (1).

Set V-belt tension, see under (G221.051.01).

Tighten securing screws (2+3) with torque wrench.

Tightening torque: 69 Nm

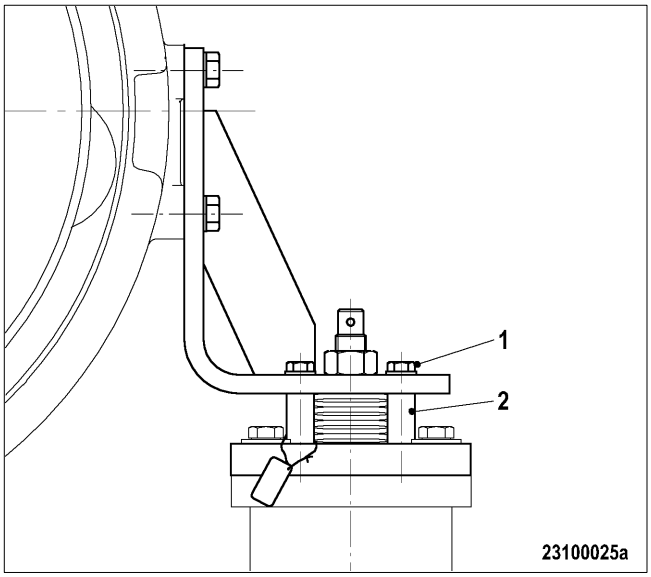
Lubricant: Engine oil

Install fan.

Install guard plates.

Release engine start (G000.000.03).

G231.051.15 Engine/alternator mounting, transportation locking device removal

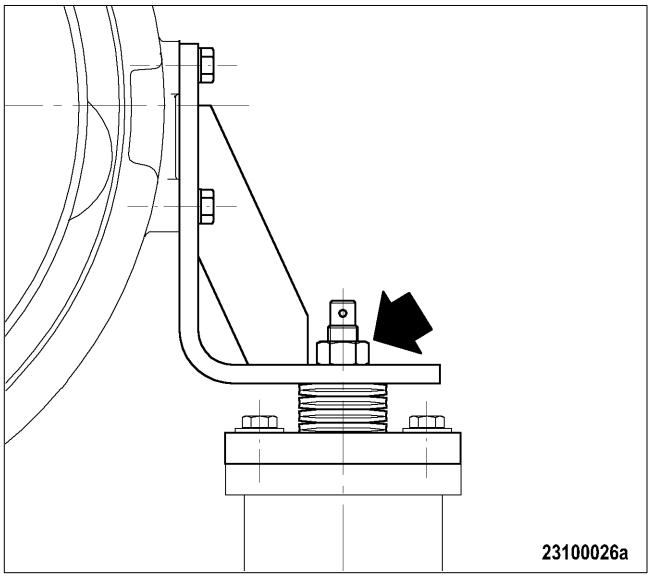


Before initial operation or after engine/plant transportation, remove transportation locking devices.

The engine/plant must not be operated with the engine mounts locked in place.

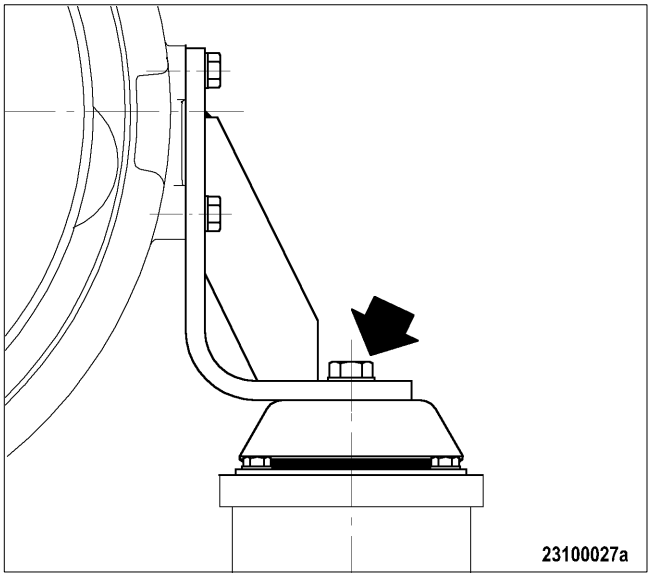
Remove screws (1), remove washers and spacer sleeve (2).

G231.051.20 Engine/alternator mount security check



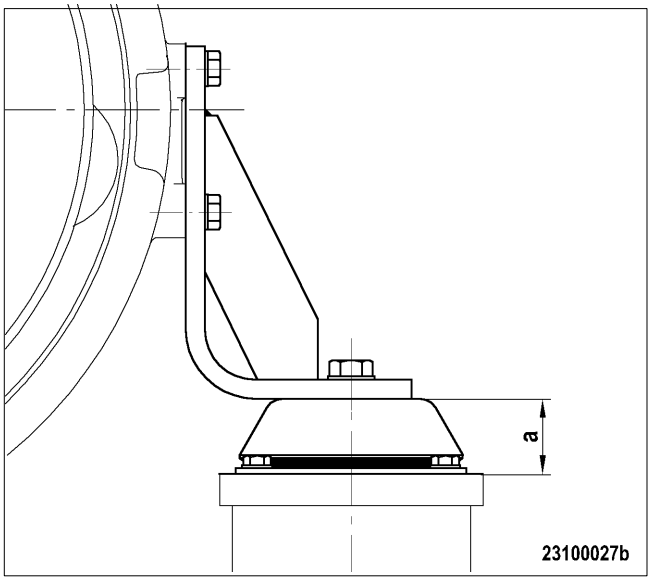
Check tightness of all engine/alternator mount securing screws by torque wrench application and retighten as necessary.

G231.052.20 Engine/alternator mount security check



Check tightness of all engine/alternator mount securing screws by torque wrench application and retighten as necessary.

G231.052.30 Engine/alternator mount, damping mount condition check



Note:
Wipe rubber surfaces with dry cloth only, never clean with organic detergents.

The engine must be filled with coolant and engine oil.

Check damping mounts for cracks and deformation (visual check).

Replace cracked mounts.

Positioning check:

Measure distance (a).

If dimension (a) = 55 mm is not reached, replace damping mount.

G307.001.01 Protective device check

Check that all guards are correctly installed on generator and fan drive.

G309.001.05 Battery charge state, electrolyte condition and level check

Carry out tasks specified by manufacturer.

G364.000.01 Fuel supply closing

Close shut-off valve in the supply line.

G364.000.03 Fuel supply opening

Open shut-off valve in the supply line.

G364.050.01 Fuel system supply check

WARNING!

Fuels are combustible.
Risk of burning and explosion.
Avoid open flames, electric sparks and sources of ignition.
Do not smoke

Check fuel supply in fuel tank, top up if necessary.

Note:
A full fuel tank reduces condensation and the growth of bacteria.

G364.050.03 Fuel supply system filling

WARNING!

Fuels are combustible.

Risk of burning and explosion.

Avoid open flames, electric sparks and sources of ignition.

Do not smoke

G500.000.01 Engine control system switching on

Move power supply switch on control panel from “Off” to “On”.

Note:
Control panel description – see Manufacturer’s Documentation.

G500.000.03 Engine control system switching off

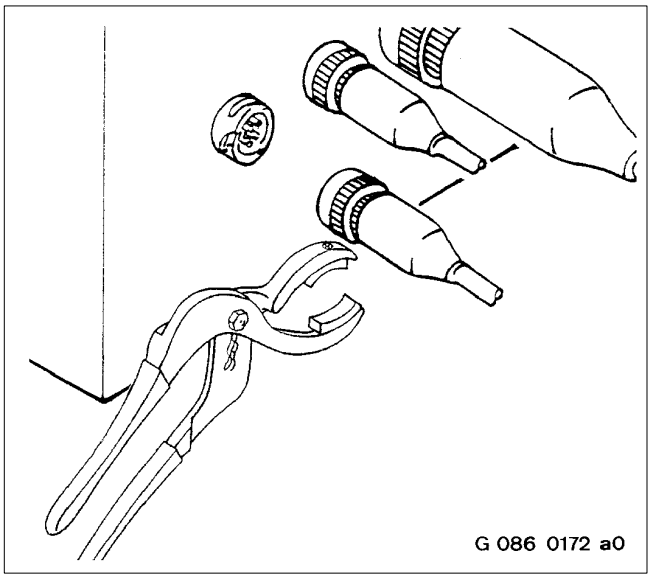
Move power supply switch on control panel from “On” to “Off”.

Note:
Control panel description – see Manufacturer’s Documentation.

G500.000.09 Engine wiring check

Special tool:

Pipe wrench F3 0017 884



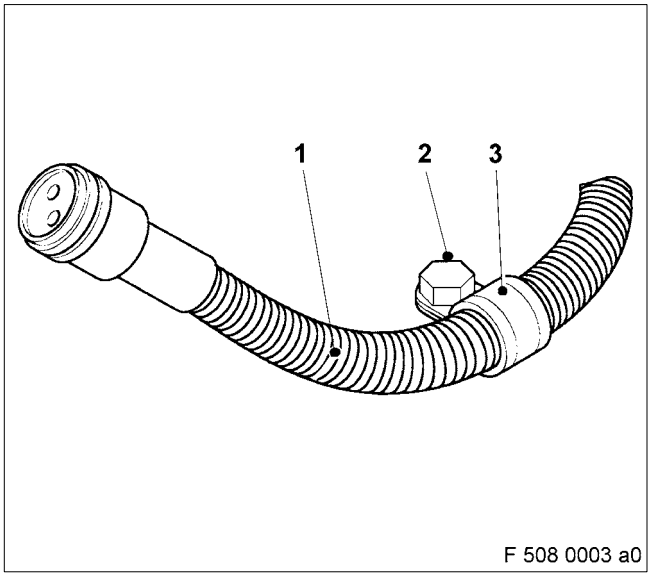
Disable engine start (G000.000.01).

Check security of all plug connectors on ECU with a pipe wrench (pliers).

Note:
It is not sufficient to tighten the bayonet union nut by hand. There is the risk that the lock does not properly engage and the connector may then come loose during engine operation. Pliers must therefore be used to tighten the union nut.

Check security of all plug connectors on temperature sensors, pressure sensors, speed sensors, and coolant level probes by hand.

Release engine start (G000.000.03).



Check security of cable guides:

Check security of cable in plastic tube (1) secured to engine with a bracket (3).

Check security of screw (2).

Check security of cable clamps, install new clamps if necessary.

Check electrical lines:

Clean connector housing, contacts and connector bushes thoroughly with isoprophyl alcohol.

Check lines and connection terminals for damage.

If the outer insulation of the cable is damaged and individual cores are visible, wrap insulating tape around the cable, provided that none of the individual cores are damaged.

If individual cores are damaged, replace the wiring harness.

Check plug-in contacts for scorching, wear and vibration damage.

Check fixture components for damage.

Damaged parts must be replaced immediately.

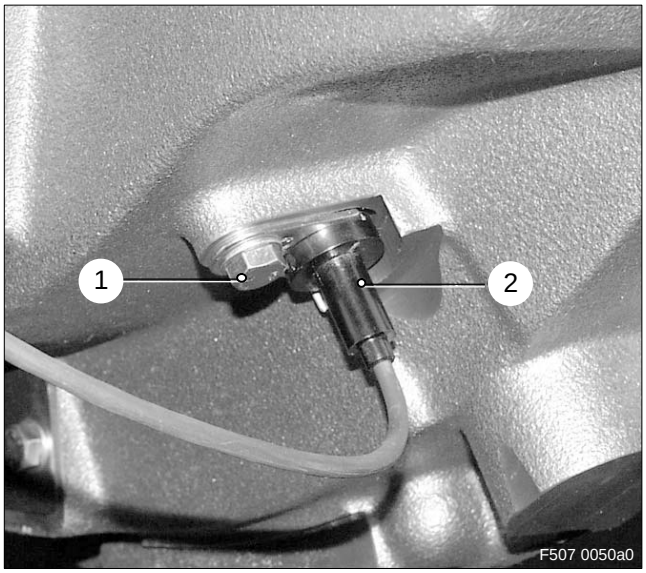
G507.098.01 Monitoring system, equipment function check

Disable engine start (G000.000.01).

Switch off engine control system (G500.000.03).

The temperature sensor, pressure sensor and speed sensor are continuously monitored with the Integrated Test System (ITS) in the Engine Control System. If a monitoring unit fails, a warning is given.

In event of a fault signal, replace respective component.



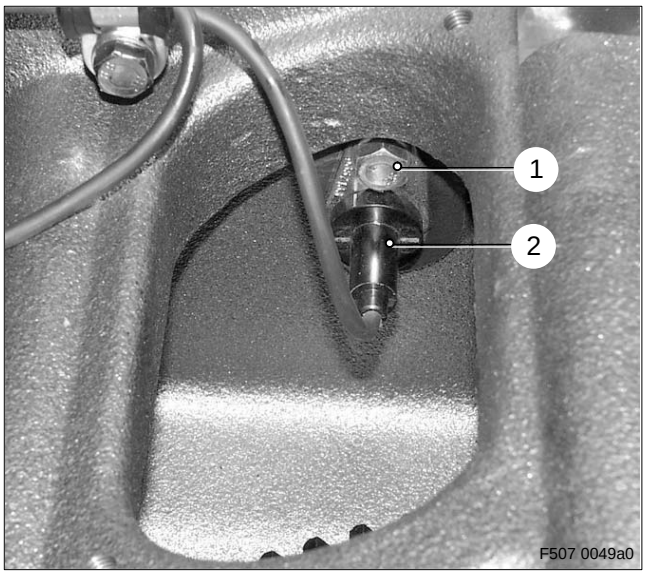
Removing speed sensor (crankshaft)

Note:
The speed sensor is an electronic component. Appropriate care is required for removal.

Disconnect electrical plug connector for speed sensor (2).

Remove securing screw (1).

Withdraw speed sensor from flywheel housing.



Removing speed sensor (camshaft)

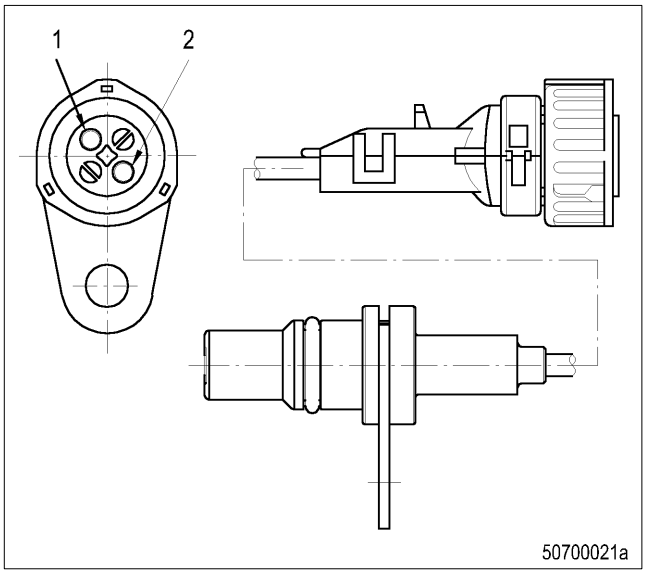
Note:
The speed sensor is an electronic component. Appropriate care is required for removal.

Remove end cover from flywheel housing.

Disconnect electrical plug connector for speed sensor (2).

Remove securing screw (1).

Withdraw speed sensor from flywheel housing.



Checking speed sensor

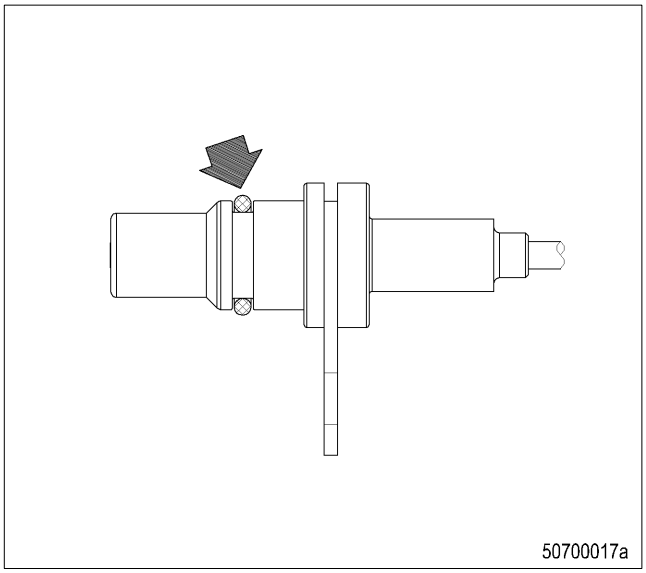
Use an ohmmeter to measure resistance between Pin 1 and Pin 2.

Required resistance = 136 ohms ± 20 ohms

In event of deviation from specified value, replace sensor.

Check magnetic force as follows:

Apply iron screwdriver to the front end of speed sensor; magnetic attraction should be clearly detectable, otherwise replace speed sensor.

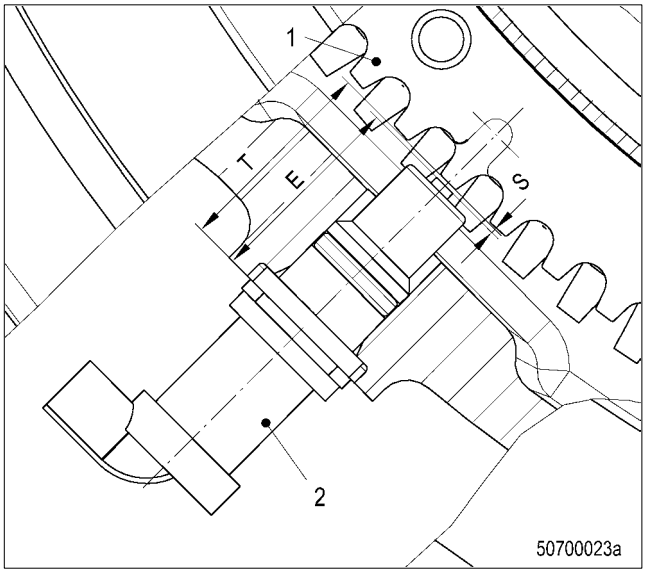


Installing speed sensor (crankshaft)

Note:
The speed sensor is an electronic component. Appropriate care is required for installation.

Check seating surface in flywheel housing, clean if necessary.

Coat O-ring (arrow) with petroleum jelly.

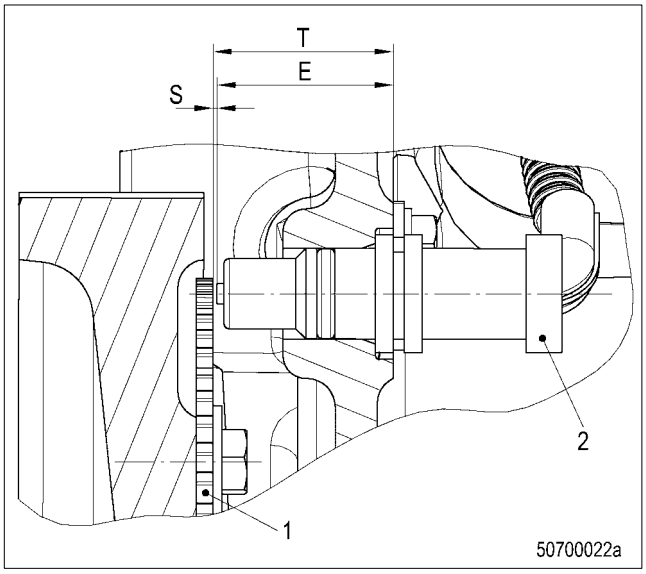


Check gap clearance “S” between graduated disc (1) and speed sensor (2):

S = from 0.45 mm to 1.45 mm

Measure fitting length “E” of speed sensor and compare with depth of location hole. Fitting length “E” must be smaller than insertion depth “T” by dimension “S”.

Insert speed sensor in appropriate fitted bore in flywheel housing and tighten mounting screw.



Installing speed sensor (camshaft)

Installation sequence is the same as with –Installing speed sensor (crankshaft)–.

Gap clearance “S” between graduated disc (1) and speed sensor (2):

S = from 0.1 mm to 1.6 mm

Remove pressure sensor, temperature sensor and coolant level probe:

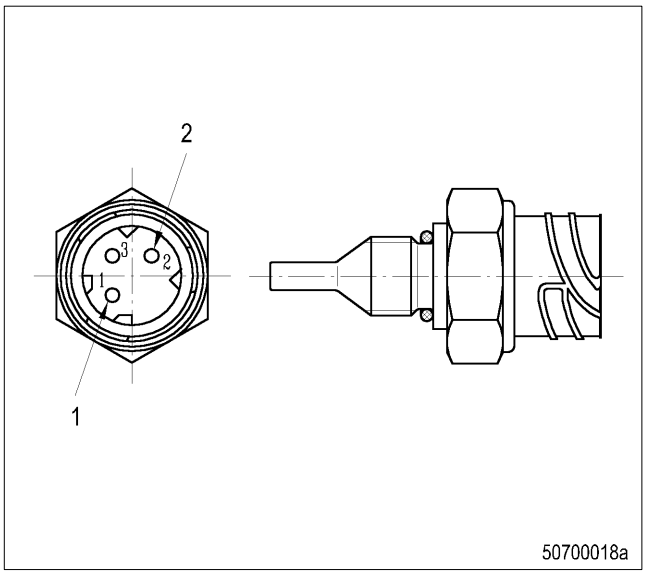
Note:
Sensor and probe are electronic components. Appropriate care is required for removal.

Remove sensor and probe with open-end wrench.

Attach suitable dust caps to screw-in thread of pressure sensors.

Store sensors so that they are protected from dirt and mechanical damage.

If necessary, seal removal bores with suitable plugs.



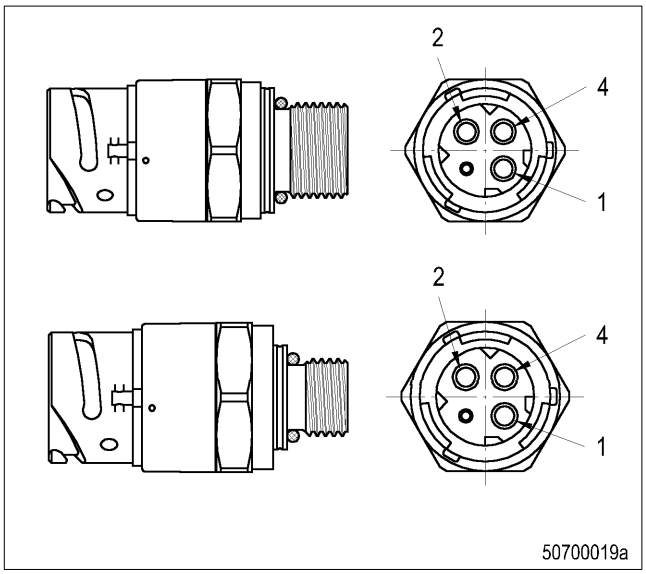
Checking temperature sensor

Measure resistance between Pin 1 and Pin 2 with an ohmmeter at different bath temperatures.

Specified resistance at 0 °C = 1000 ohms

Specified resistance at 100 °C = 1385 ohms

In event of deviation from specified values, replace sensor.



Checking speed sensor

Carry out DC voltage test on sensor.

Pin 1 = Voltage input

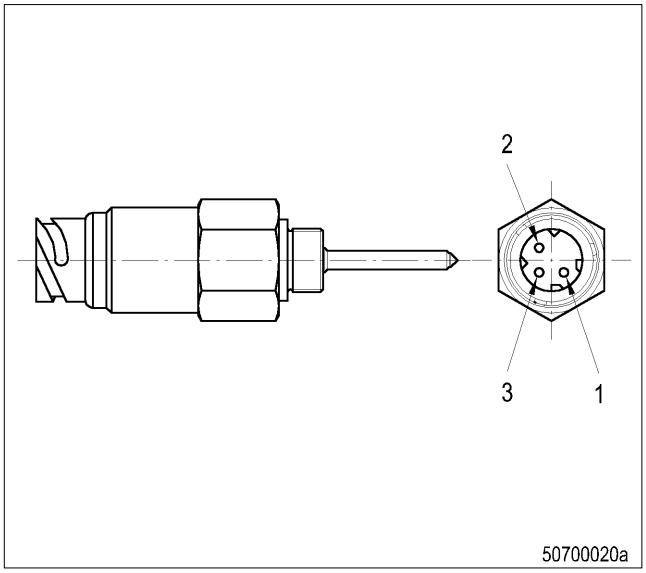
Pin 2 = Voltage output

Pin 4 = Earth

Input voltage at 25 °C= 5 VDC

Specified output voltage (1) = 0.5 VDC

In event of deviation from specified value, replace sensor.



Checking coolant level probe (minimum probe)

Note:
In the case of minus-switching probes, there is a danger of destruction if the minus potential is connected to the signal connection and plus potential to the minus connection.

Check operation of probe with falling coolant level; when doing so, measure switching threshold between plug contacts 2 and 3 with a voltmeter.

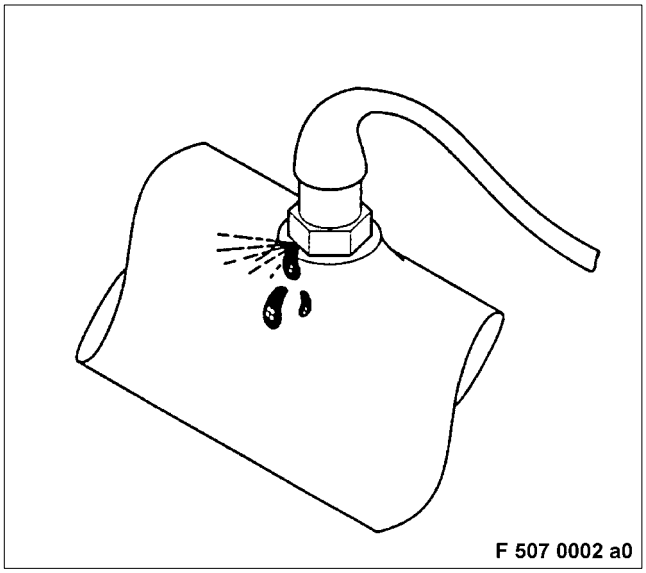
Rated voltage: 24 VDC

Contact designations:

1 = plus ($+U_B$)

2 = minus ($\perp$)

3 = signal (U_{out})



Installing pressure sensor, temperature sensor and coolant level probe:

Note:
Sensor and probe are electronic components. Appropriate care is required for installation. Make sure that lube oil sensor and charge air sensor are particularly clean.

Remove blanking plug.

Check sealing surface and sensor installation bore (thread) for particular cleanness, and clean if necessary.

Insert sensor and coolant level probe and tighten with a torque wrench.

Tightening torque:

– Temperature sensor: 15 Nm to 30 Nm
– Charge air pressure sensor: 20 Nm to 70 Nm
– Lube oil pressure sensor: 20 Nm to 45 Nm
– Coolant level probe: max. 30 Nm

Lubricant: Engine oil

Note:
After starting the engine, check the connection for leaks (visual inspection).

If leaks are found, lightly tighten connection.

If correct sealing cannot be achieved in this way, remove sensor and replace gasket.
Switch on engine control system (G500.000.01).

Release engine start (G000.000.03).