Operating Instructions

Diesel Engine
12V1600Rx0
12V1600Rx0L

MS15030/01E

Power. Passion. Partnership.

Engine model	kW/cyl.	rpm	Application group
12V1600R70	47 kW/cyl.	2100	2A, Continuous operation, unrestricted
12V1600R70L	52 kW/cyl.	2100	2A, Continuous operation, unrestricted
12V1600R80	55 kW/cyl.	1900	2A, Continuous operation, unrestricted
12V1600R80L	58 kW/cyl.	1900	2A, Continuous operation, unrestricted

Table 1: Applicability

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1 Change Notices

1.1 Revision overview

Revision overview– General

Chapter	Edition MS15030/00E	Edition MS15030/01E
–	Warning notices in general.	Warning notices were updated.
–	Graphics in general.	Graphics were updated.
–	Chapter "Change notices" was not part	Chapter "Change notices" added

Revision overview – Maintenance schedule

Task No.	Edition MS50137/00	Edition MS50137/01
W1675	–	Task "Fit new fuel prefilter or new fuel prefilter insert" added.

Revision overview – Task description

Chapter	Edition MS15030/00E	Edition MS15030/01E
7.5.1	–	Chapter added "Regeneration procedure"
7.4.3	–	Chapter added "Fuel prefilter – Replacement".
7.5.2	–	Chapter added "Screen filter on reducing agent tank – Replacement".

2 Safety

2.1 Important provisions for all products

General

This product may pose a risk of injury or damage in the following cases:
- Incorrect use
- Operation, maintenance and repair by unqualified personnel
- Changes or modifications which are neither made nor authorized by the manufacturer
- Noncompliance with the safety instructions and warning notices

Nameplates

The product is identified by nameplate, model designation or serial number. This data must match the specifications in these instructions.

Nameplates, model designation or serial number can be found on the product.

All EU-certified engines delivered by MTU come with a second nameplate. This second nameplate is delivered "loosely" with the engine. If the nameplate secured to the engine after installation in the vehicle/system is not visible without the removal of components, the system integrator must install the second nameplate in a clearly visible area on the vehicle/system.

Emission specifications and emission label

Responsibility for compliance with emission regulations

Modification or removal of any mechanical/electronic components or the installation of additional components including the execution of calibration processes that might affect the emission characteristics of the product are prohibited by emission regulations. Emission-related components must only be serviced, exchanged or repaired if the components used for this purpose are approved by the manufacturer.

Noncompliance with these specifications will invalidate the design type approval or certification issued by the emissions regulation authorities. The manufacturer does not accept any liability for violations of the emission regulations.

The product must be operated over its entire life cycle according to the conditions defined as "Intended use" (→ Page 8).

Emission certification applicable to engines with EPA Nonroad Tier 4 emission certification in accordance with 40 CFR 1039

Extract from the standard:

Failing to follow these instructions when installing a certified engine in a piece of nonroad equipment violates federal law (40 CFR 1068.105(b)), subject to fines or other penalties as described in the Clean Air Act.

Extract from the standard:

If you install the engine in a way that makes the engine's emission control information label hard to read during normal engine maintenance, you must place a duplicate label on the equipment, as described in 40 CFR 1068.105.

When fitting the second label, the requirements of 40 CFR 1068.105(c) must be followed and observed. This paragraph describes the process for requesting and fitting the label, the documentation obligations and storage obligations for the required documents.

Replacing components with emission labels

On all MTU engines fitted with emission labels, these labels must remain on the engine throughout its operational life.

Exception: Engines used exclusively in land-based, military applications other than by US government agencies.

Please note the following when replacing components with emission labels:
- The relevant emission labels must be affixed to the spare part.
- Emission labels shall not be transferred from the replaced part to the spare part.
- The emission labels must be removed from the replaced part and destroyed.

2.2 Correct use of all products

Correct use

The product is intended for use in accordance with its contractually-defined purpose as described in the relevant technical documents only.

Intended use entails operation:
- Within the permissible operating parameters in accordance with the (→ Technical data)
- With fluids and lubricants approved by the manufacturer in accordance with the (→ Fluids and Lubricants Specifications of the manufacturer)
- With preservation approved by the manufacturer in accordance with the (→ Preservation and Represervation Specifications of the manufacturer)
- With spare parts approved by the manufacturer in accordance with the (→ Spare Parts Catalog/MTU contact/Service partner)
- In the original as-delivered configuration or in a configuration approved by the manufacturer in writing (also applies to engine control/parameters)
- In compliance with all safety regulations and in adherence with all warning notices in this manual
- In compliance with the maintenance work and intervals specified in the (→ Maintenance Schedule) throughout the useful life of the product
- In compliance with the maintenance and repair instructions contained in this manual, in particular with regard to the specified tightening torques
- With the exclusive use of technical personnel trained in commissioning, operation, maintenance and repair

The product must not be operated in explosive atmospheres unless the engine fulfills the conditions for such use and approval has been granted.

Any other use, particularly misuse, is considered as being contrary to the intended purpose. Such improper use increases the risk of injury and damage when working with the product. The manufacturer shall not be held liable for any damage resulting from improper, non-intended use.

The specifications of the manufacturer will be amended or supplemented as necessary. Prior to operation, make sure that the latest version is used. The latest version can be found on the websites:
- For drive systems: http://www.mtu-online.com
- For power generation: http://www.mtuonsiteenergy.com

Modifications or conversions

Unauthorized changes to the product represent a contravention of its intended use and compromise safety.

Changes or modifications shall only be considered to comply with the intended use when expressly authorized by the manufacturer. The manufacturer shall not be held liable for any damage resulting from unauthorized changes or modifications.

2.3 Personnel and organizational requirements

Organizational measures of the user/manufacturer

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

Keep this manual handy in the vicinity of the product such that it is accessible to operating, maintenance, repair, assembly, installation, and transport personnel at all times.

Personnel must receive instruction on product handling and repair based on this manual. In particular, personnel must have read and understood the safety requirements and warnings before starting work.

This is important in the case of personnel who only occasionally perform work on or around the product. Such personnel must be instructed repeatedly.

Personnel requirements

All work on the product must be carried out by trained, instructed and qualified personnel only:

- Training at the Training Center of the manufacturer
- Qualified personnel from the areas mechanical engineering, plant construction, and electrical engineering and also for work with live parts

The operator must define the responsibilities of the personnel involved in operation, maintenance, repair, assembly, installation, and transport in writing.

Personnel shall not report for duty under the influence of alcohol, drugs or strong medication.

Clothing and personal protective equipment

Always wear appropriate personal protective equipment, e.g. safety shoes, hearing protection, protective gloves, goggles, breathing mask. Follow the instructions concerning personal protective equipment in the descriptions of the individual activities.

Safe handling of Substances of Very High Concern pursuant to the REACH regulation (Registration, Evaluation, Authorization and restriction of Chemicals): We recommend wearing protective gloves at all times in order to reduce risk when working.

2.4 Initial start-up and operation – Safety regulations

Safety regulations for initial start-up

Install the product correctly and carry out acceptance in accordance with the manufacturer's specifications before putting the product into service. All necessary approvals must be granted by the relevant authorities and all requirements for initial startup must be fulfilled.

Whenever the product is subsequently taken into operation ensure that:
- All personnel is clear of the danger zone surrounding moving parts of the machine. Electrically-actuated linkages may be set in motion when the Engine Control Unit (governor) is switched on.
- All maintenance and repair work has been completed.
- All loose parts have been removed from rotating machine components.
- All safeguards are in place.
- All components must be properly grounded. Ground separately by means of a grounding stake as necessary.
- No persons wearing pacemakers or any other technical body aids are present.
- The service room is adequately ventilated.
- In the first few hours of operation, the product emits gases as a result of smoldering e.g. lacquers or oil. These gases may be hazardous to health. Always wear respiratory protection in the operating room during this period.
- The exhaust system is leak-tight and that the gases are vented to atmosphere.
- The product must be free of any damage, this applies in particular to lines and cabling.
- Protect battery terminals, generator terminals or cables against accidental contact.
- Check that all connections have been correctly allocated e.g. +/- polarity, fuel line/reduction agent line, supply/return.

Immediately after putting the product into operation, make sure that all control and display instruments as well as the monitoring, signaling and alarm systems work properly.

Smoking is prohibited in the area of the product.

Safety regulations during operation

The operator must be familiar with the control and display elements.

The operator must be familiar with the consequences of any operations performed.

During operation, the display instruments and monitoring units must be permanently observed with regard to present operating status, violation of limit values and warning or alarm messages.

Malfunctions and emergency stop

Practice emergency procedures, especially emergency stopping, at regular intervals.

Take the following steps if any system malfunctions are detected or signaled by the system:
- Inform supervisor(s) in charge.
- Analyze the message.
- Respond by taking any necessary emergency action, e.g. emergency stop.

After a safety shutdown, the engine must only be started after the cause of the shutdown has been eliminated.

Contact Service if the root cause of the malfunction cannot be clearly identified.

Operation

Do not remain in the operating room when the product is running unless absolutely necessary. Keep your stay as short as possible.

Keep a safe distance away from the product if possible. Do not touch the product unless expressly instructed to do so following a written procedure.

Do not inhale the exhaust gases of the product.

The following requirements must be fulfilled before the product is started:
- Wear hearing protection.
- Mop up any leaked or spilled fluids and lubricants immediately or soak up with a suitable binding agent.

Operation of electrical equipment

When electrical equipment is in operation, certain components of these appliances are electrically live.

Follow the applicable operating and safety instructions when operating the devices and heed warnings at all times.

2.5 Safety regulations for assembly, maintenance, and repair work

Safety regulations for work prior to assembly, maintenance, and repair

Have assembly, maintenance, or repair work carried out by qualified and authorized personnel only.

Allow the product to cool down to less than 50 °C (risk of explosion from oil vapors, fluids and lubricants, risk of burning).

Relieve pressure in fluid and lubricant systems and compressed-air lines which are to be opened. Use suitable containers of adequate capacity to catch fluids and lubricants.

Release residual pressure before removing or replacing a component in the supply line. To depressurize pressurized lines, shut off the lines first, then release the residual pressure.

Work must only be carried out on lines when they are free of fluids and lubricants.

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

Never carry out assembly, maintenance, or repair work with the product in operation, unless:
- It is expressly permitted to do so following a written procedure.

Lock-out the product to preclude undesired starting, e.g.
- Start interlock
- Key switch
- Close supply line for hydraulic starting.

Attach “Do not operate” sign in the operating area or to control equipment.

Disconnect the battery cables or actuate the battery isolating switch, if fitted. Lock circuit breakers.

Before starting work on CaPoS, if used:
- Switch off the charging system (DC/DC converter).
- Discharge the UltraCap modules using the appropriate discharger.
- Short-circuit the UltraCap modules with a suitable wire jumper.

Close the main valve on the compressed-air system and vent the compressed-air line when air starters are fitted.

Before working on the exhaust gas aftertreatment system, close the shutoff valve on the reducing agent tank. Note that the reducing agent pumps continue to run for a certain period when the engine is stopped.

Disconnect the control equipment from the product.

Use the recommended special tools or suitable equivalents when instructed to do so.

Safety regulations when performing assembly, maintenance, and repair work

Special tools and lifting equipment

Use only proper and calibrated tools. Observe the specified tightening torques during assembly or disassembly.

Setting down, lifting and climbing

Carry out work only on assemblies or plants which are properly secured.

Use appropriate lifting equipment for all components. Use all specified attachment points and observe the center of gravity.

Never work on engines or components when they are held in place by lifting equipment.

Make sure components or assemblies are placed on stable surfaces. Adopt suitable measures to prevent components/tools from falling down.

Assume a safe standing position when performing assembly work.

Never use the product as a climbing aid.

When working high on the equipment, always use suitable ladders and work platforms. Special instructions for outdoor areas: There must be no risk of slipping e.g. due to icing.

Removing, installing and cleanliness

Pay particular attention to cleanliness at all times.

Completely wipe up escaped fluids and lubricants due to the risk of slipping.

Take special care when removing ventilation or plug screws from the product.

Ensure that O-rings are not installed in a slanted/twisted condition.

Carry out appropriate cleaning procedures to clean and inspect components requiring special cleanness (e.g. components carrying oil, fuel, or air).

Note cooling time for components which are heated for installation or removal (risk of burning).

Ensure that all mounts and dampers are installed correctly.

Remove any accumulation of condensate after assembling chilled components. Coat the components with a suitable corrosion inhibitor as necessary.

Lines

Ensure that lines for all fluids and lubricants and their connections are clean.

Always seal connections with caps or covers if a line is removed or opened.

Fit new seals when re-installing lines.

Never bend lines and avoid damaging lines, particularly the fuel lines.

Ensure that all fuel injection and pressurized oil lines are installed with enough clearance to prevent contact with other components. Do not place fuel or oil lines near hot components.

Miscellaneous

Sufficient ventilation must be guaranteed during the work.

Wear a breathing mask offering protection against soot, dust, and mineral fibers (filter class P3) when working on exhaust components. Clean the work area with a dust extraction machine of class H. Wear protective gloves and goggles for protection against acidic condensate.

Do not touch elastomeric seals (e.g. Viton sealing rings) with your bare hands if they have a carbonized or resinous appearance.

Elastomer components (e.g. engine mounts, damping elements, couplings and V-belts) must not be painted. Only install them after painting the engine or mask them prior to painting.

The following applies to starters with copper-beryllium alloy pinions:
- Wear a respirator mask (filter class P3). Do not blow out the interior of the flywheel housing or the starter with compressed air. Clean the flywheel housing inside with a class H dust extraction device.
- Observe the safety data sheet.

Safety regulations after performing assembly, maintenance, and repair work

Before barring the engine, make sure no one is in the danger zone of the engine.

Check that all access ports/apertures which have been opened to facilitate working are closed again.

All safety devices must be installed and all tools and loose parts must be removed (especially the barring tool).

Ensure that no unattached parts have been left in/on the product (e.g. including rags and cable straps).

Ensure that the grounding system is properly connected.

Welding work

Welding operations on the product or mounted units are not permitted. Cover the product when welding in its vicinity.

Before starting welding work:
- Switch off the power supply master switch.
- Disconnect the battery cables or actuate the battery isolating switch.
- Separate the electrical ground of electronic equipment from the ground of the unit.

No other assembly, maintenance, or repair work must be carried out in the vicinity of the product while welding is in progress. There is a risk of explosion or fire due to oil vapors or highly flammable fluids and lubricants.

Do not use product as ground terminal.

Never position the welding power supply cable adjacent to, or crossing wiring harnesses of the product. The welding current can induce interfering voltages in the wiring harnesses which may damage the electrical system.

Remove components (e.g. exhaust pipe) from the product before performing necessary welding work.

Hydraulic installation and removal

Check the function and safe operating condition of tools and fixtures to be used. Use only the specified devices for hydraulic removal/installation procedures.

Observe the max. permissible push-on pressure specified for the equipment.

Do not attempt to bend or apply force to lines which are under pressure.

Before starting work, pay attention to the following:
- Vent the installation/removal jig, the pumps and the pipework at the relevant designated points.
- For hydraulic installation, screw on the jig with the piston retracted.
- For hydraulic removal, screw on the jig with the piston extended.

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

During hydraulic installation and removal of components, ensure that nobody is standing in the immediate vicinity of the component to be installed/removed.

Working with batteries

Observe the safety instructions of the manufacturer when working on batteries.

Gases released from the battery are explosive. Avoid sparks and naked flames.

Do not allow battery acids to come into contact with skin or clothing.

Wear protective clothing, goggles and protective gloves.

Do not place objects on the battery.

Before connecting the cable to the battery, check the battery polarity. The battery may explode and spray acid if the battery terminals are connected incorrectly.

Working on electrical and electronic assemblies

Always obtain the permission of the person in charge before commencing assembly, maintenance, and repair work or switching off any part of the electronic system required to do so.

De-energize the relevant areas prior to working on assemblies.

ESD (Electrostatic Discharge): Work on components which could be damaged by electrostatic discharge must always be carried out with appropriate equipment. Appropriate equipment is e.g. electrically conductive work surfaces or antistatic wristbands.

Do not damage wiring during removal work. When reconnecting, ensure that cabling cannot be damaged during operation by:
- Contact with sharp edges
- Chafing on components
- Contact with hot surfaces.

Do not secure cables on lines carrying fluids.

Do not use cable ties to secure lines.

Always use connector pliers to tighten union nuts on connectors.

Subject the device as well as the product to functional testing on completion of all repair work. The emergency stop function must be tested in particular. The functional check of the emergency stop, during which the voltage supply of the ECU is switched off, must only be carried out when the product is cold.

Store spare parts properly prior to replacement, i.e. protect them against moisture in particular. Package faulty electronic components or assemblies properly before dispatching for repair:
- Moisture-proof
- Shock-proof
- Wrapped in antistatic foil (as necessary)

Working with laser equipment

Work with laser devices shall be carried out by trained and qualified personnel only. Follow the safety instructions in the manufacturer's user manual when working with laser equipment.

Wear special laser safety glasses when working with laser equipment (danger of concentrated radiation).

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

Measuring component dimensions

Workpieces, components and measuring equipment lie in the specified tolerance range at a reference temperature of 20 °C.

2.6 Fire and environmental protection, fluids and lubricants

Fire prevention and fire

Fire, open flame, and smoking are prohibited.

In case of a fire, stop the fuel supply if this is possible without endangering personnel.

The product has hot surfaces that can ignite combustible gases and other substances in the immediate area. The operating company must install and operate the product a safe distance away from danger sources and observe any relevant safety regulations or recommendations. Products that comply with the SOLAS Convention do not constitute such as danger.

After working with combustible fluids and lubricants (e.g. cleaning agents), ensure the area is well ventilated. The resultant vapor/air mixture must be sufficiently diluted to prevent a potentially explosive atmosphere.

Eliminate leaks of fluids and lubricants immediately. Fluids and lubricants on hot components can cause fires, so keep the product clean at all times. Do not leave rags saturated with fluids and lubricants on the product. Do not store combustible materials near the product.

Incorrect refueling of the reducing agent system with fuel can result in fire.

Before welding, clean the area to be welded with a nonflammable fluid. Do not carry out welding work on pipes and components carrying oil or fuel.

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

Ensure that suitable extinguishing agents (fire extinguishers) are always available and that staff are familiar with their correct handling.

A fire can result in the creation of toxic substances. Always wear protective gloves when handling components and wear additional personal protective equipment is necessary.

Noise

Wear hearing protection in workplaces with a sound pressure level in excess of 85 dB (A).

Noise can lead to an increased risk of accidents if acoustic signals, warning shouts or sounds indicating danger are compromised.

Environmental protection and disposal

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

Within the EU, batteries can be returned free of charge to the manufacturer where they will be properly recycled.

Fluids and lubricants/auxiliary materials (process materials)

Process materials can also be or contain hazardous or toxic substances. When using process materials and other chemical substances, observe the associated safety data sheet. The safety data sheet may be obtained from the relevant manufacturer or from MTU.

Only process materials approved by the manufacturer in accordance with the Fluids and Lubricants Specifications must be used. The most recent respective version must be requested from the manufacturer.

Contamination of process materials with reducing agent (e.g. AdBlue®, DEF): Store process materials in separate containers and their own drip trays. Even extremely small amounts of reducing agent contamination can result in malfunctions in sensors and other components.

Used oil contains combustion residues that are harmful to health.

When handling used oil, protective gloves must be used.

Wash relevant areas after contact with used oil.

Registration, evaluation, approval and restriction of chemicals (REACH ordinance)

Particularly hazardous substances used with our products are named in a list:

www.mtu-online.com/mtu/technische-info → SVHC as per REACH in MTU products

Compressed air

- Unauthorized use of compressed air, e.g. forcing flammable liquids (hazard class AI, AII and B) out of containers, risks causing an explosion.
- Wear goggles when blowing dirt off workpieces or blowing away chips.
- Blowing compressed air into thin-walled containers (e.g. containers made of sheet metal, plastic or glass) for drying purposes or to check for leaks risks bursting them.
- Pay special attention to the pressure in the compressed air system or pressure vessel.
- Assemblies or products which are to be connected must be designed to withstand this pressure. Install pressure-reducing or safety valves set to the admissible pressure if this is not the case.
- Hose couplings and connections must be securely attached.
- Provide the snout of the air nozzle with a protective disk (e.g. rubber disk).
- Release residual pressure before removing a compressed air device from the supply line. To depressurize compressed-air lines, shut off the lines first, then release the residual pressure.
- Carry out a leak test in the specified manner.

Painting

- Observe the relevant safety data sheet for all materials.
- When carrying out painting work outside the spray stands provided with fume extraction systems, ensure that the area is well ventilated. Make sure that neighboring work areas are not adversely affected.
- Avoid open flames in the surrounding area.
- No smoking.
- Observe fire-prevention regulations.
- Always wear a mask providing protection against paint and solvent vapors.

Liquid nitrogen

- Observe the relevant safety data sheet for all materials.
- Work with liquid nitrogen may be carried out only by qualified personnel.
- Store liquid nitrogen only in small quantities and always in specified containers without fixed covers.
- Avoid body contact (eyes, hands).
- Wear protective clothing, protective gloves, closed shoes and safety goggles.
- Make sure that the working area is well ventilated.
- Avoid knocking or jolting the containers, valves and fittings or workpieces in any way.

Acids/alkalines/reducing agents (e.g. AdBlue®, DEF)

- Observe the relevant safety data sheet for all materials.
- When working with acids and alkaline solutions, wear goggles or face mask, gloves and protective clothing.
- Do not inhale vapors.
- If reducing agent is swallowed, rinse out mouth and drink plenty of water.
- Remove any wet clothing immediately.
- After skin contact, wash affected body areas with plenty of water.
- Rinse eyes immediately with eyedrops or clean mains water. Consult a doctor as soon as possible.
  Contamination of reducing agent with other process materials: Store reducing agent in separate containers and use separate drip trays. Even extremely slight contamination can lead to malfunctions in the exhaust aftertreatment system.
  Mistakenly filling the tank of the reducing agent system with fuel can cause leakage at the seals and in the hoses.

2.7 Standards for warning notices in the text and highlighted information

DANGER 	In the event of immediate danger. **Consequences: Death, serious or permanent injury!** • Remedial action.
WARNING 	In the event of a situation involving potential danger. **Consequences: Death, serious or permanent injury!** • Remedial action.
CAUTION 	In the event of a situation involving potential danger. **Consequences: Minor or moderate injuries!** • Remedial action.
NOTICE 	In the event of a situation involving potentially adverse effects on the product. **Consequences: Material damage!** • Remedial action. • Additional product information.

Warning notices

1. This manual with all safety instructions and warning notices must be issued to all personnel involved in operation, maintenance, repair, assembly, installation, or transportation.
2. The highest level warning notice is used if several hazards apply at the same time. Warnings related to personal injury shall be considered to include a warning of potential damage.

Highlighted information

Important
This field contains product information which is important or useful for the user. This information must not refer to hazards related to personal injury or material damage.

3 Transport

3.1 Transportation

Taking the engine's center of gravity into account

For information on the center of gravity of the engine, refer to engine installation/arrangement drawing.

Transportation

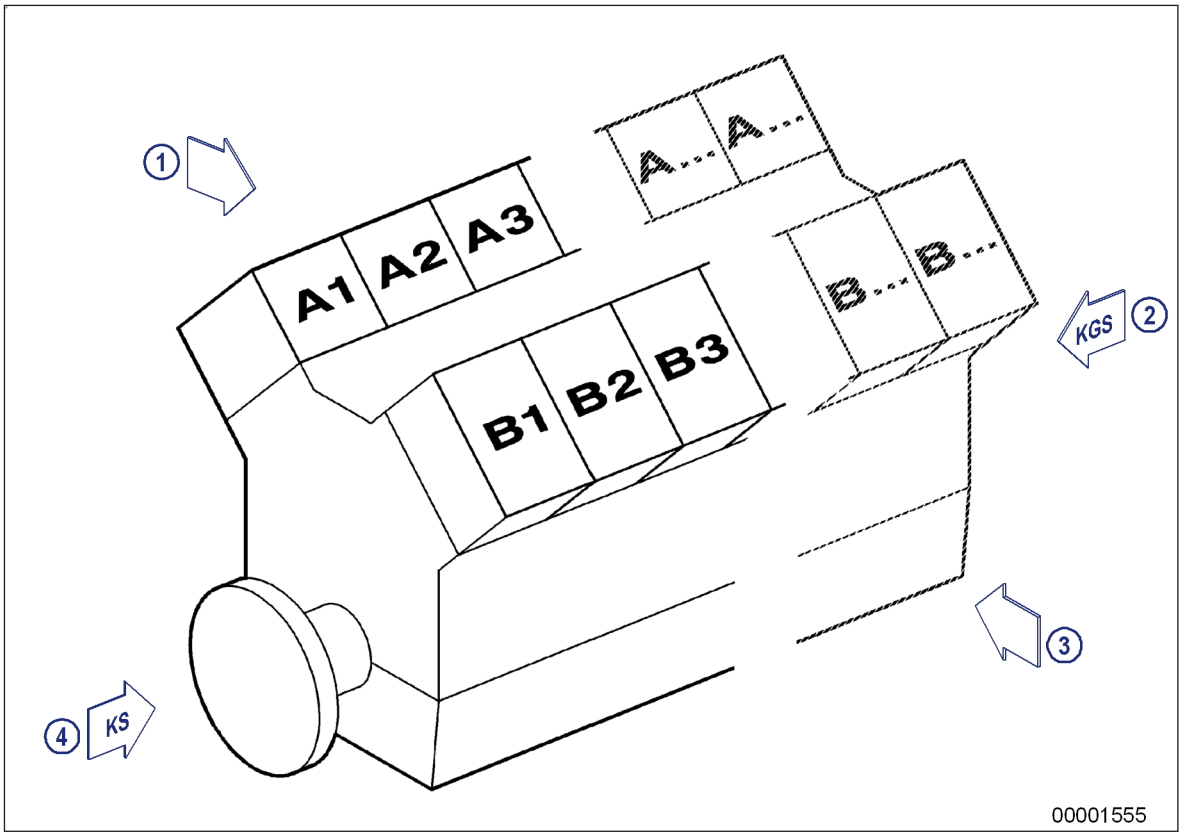
- Lift the engine only with the lifting eyes provided.
- Only use transport and lifting devices approved by MTU.
- Always transport the in installation position, do not exceed max. permissible diagonal pull:
  - Max. permissible diagonal pull in longitudinal direction: 10 degrees, with no diagonal pull in transverse direction.
  - Max. permissible diagonal pull in transverse direction: 10 degrees, with no diagonal pull in longitudinal direction.
- Lift engines by approx. 10 mm and verify that the lifting ropes / chains between engine and lifting equipment run vertically or in accordance with the specifications on the installation drawing. If this is not the case, the lifting equipment must be re-adjusted.
- If the engine is supplied with special aluminium foil packing, lift the engine at the lifting eyes of the bearing pedestal or use a means of transportation which is appropriate for the given weight (forklift truck).
- Secure the engine against tilting during transport.
- Secure the engine such as to preclude slipping and tipping when driving up or down inclines and ramps.

Setting down the engine following transportation

- Make sure that the consistency and load-bearing capacity of the ground or support surface is adequate.
- Never set down the engine onto the oil pan unless expressly permitted by MTU on an engine-specific base.
- Only set down engine on a firm, level surface.

4 General Information

4.1 Engine side and cylinder designations



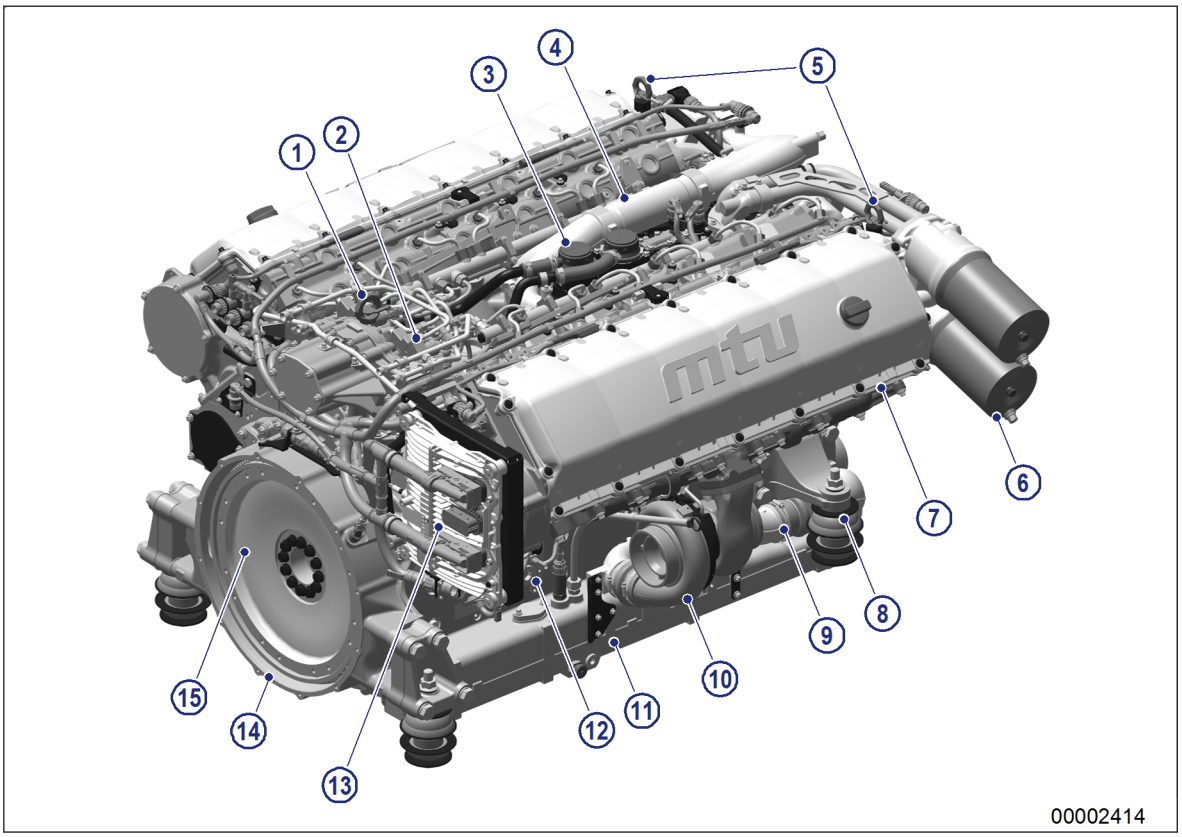
1 Left engine side (A-side)
2 Engine free end in accordance with DIN ISO 1204 (KGS = Kupplungsgegenseite)
3 Right engine side (B-side)
4 Engine driving end in accordance with DIN ISO 1204 (KS = Kupplungsseite)

Engine sides are always designated (in accordance with DIN ISO 1204) as viewed from driving end (4).

For cylinder designation (in accordance with DIN ISO 1204), the letter "Ax" refers to the cylinders on the left-hand side of the engine (1) and letter "Bx" refers to the cylinders on the right-hand side (3). The cylinders of each bank are numbered consecutively, starting with x=1 at driving end (4).

The numbering of other engine components also starts with 1 at driving end (4).

4.2 Engine layout



1 Engine lifting equipment
2 HP pump
3 Oil separator
4 Coolant piping
5 Engine lifting equipment
6 Engine oil filter
7 Cylinder head
8 Engine mounting
9 Charge-air piping
10 Exhaust turbocharger
11 Oil pan
12 EIL (Engine Ident Label)
13 Engine governor (ECU9)
14 Flywheel housing
15 Flywheel

Engine model designation

Key to the engine model designation 12V1600Rxy

12	Number of cylinders
V	Cylinder arrangement: V engine
1600	Series
R	Application
x	Application segment
y	Design index

4.3 Tightening specifications for screws, nuts and bolts

Tightening torques for setscrew and connections as per MTN 5008 standard

This standard applies to setscrews not subject to dynamic loads and the associated nuts according to:

- MMN 384
- ISO 4762 (DIN 912)
- ISO 4014 (DIN 931-1)
- ISO 4017 (DIN 933)
- DIN EN ISO 8765 (EN 28765; DIN 960)
- DIN EN ISO 8676 (EN 28676; DIN 961)
- DIN 6912

This standard applies to studs not subject to dynamic loads and the associated nuts according to:

- DIN 833
- DIN 835
- DIN EN ISO 5395 (DIN 836)
- DIN 938
- DIN 939

This standard applies to screws with hexalobular heads according to:

- DIN 34800
- DIN 34801

The standard does not apply to heat-resistant screws in the hot component zone.

Tightening torques M_A are specified for screws of strength class 8.8 (surface condition bare, phosphatized or galvanized) and 10.9 (surface condition bare or phosphatized).

The values in the table are based on a friction coefficient µtot = 0.125.

Threads and mating faces of screws and nuts must be coated with engine oil prior to assembly.

When hand-tightening (defined torque), an assembly tolerance of -5+15% of the figures in the table is permitted.

When machine-tightening, the permissible assembly tolerance is ±15%.

Tightening torques for setscrews

Thread	Hand-tightening		Machine-tightening	
	8.8 M_A (Nm)	10.9 M_A (Nm)	8.8 M_A (Nm)	10.9 M_A (Nm)
M6	9	12	8	11
M8	21	31	20	28
M8 x 1	23	32	21	30
M10	42	60	40	57
M10 x 1.25	45	63	42	60
M12	74	100	70	92
M12 x 1.25	80	110	75	105
M12 x 1.5	76	105	72	100
M14	115	160	110	150
M14 x 1.5	125	180	120	170
M16	180	250	170	235
M16 x 1.5	190	270	180	255
M18	250	350	240	330
M18 x 1.5	280	400	270	380
M20	350	500	330	475

Thread	Hand-tightening		Machine-tightening	
	8.8 M_A (Nm)	10.9 M_A (Nm)	8.8 M_A (Nm)	10.9 M_A (Nm)
M20 x 1.5	390	550	350	520
M22	480	680	450	650
M22 x 1.5	520	730	490	700
M24	600	850	570	810
M24 x 1.5	680	950	640	900
M24 x 2	660	900	620	850
M27	900	1250	850	1175
M27 x 2	960	1350	900	1275
M30	1200	1700	1100	1600
M30 x 2	1350	1900	1250	1800
M_A = tightening torques				

Tightening torques for studs

Thread	screwed into		
	Steel M_A (Nm)	Gray cast iron M_A (Nm)	Al alloy M_A (Nm)
M6	9	6	6
M8	11	9	10
M10	17	13	13
M12	27	23	18
M14	37	33	33
M16	55	45	–
M_A = tightening torques			

Tightening torques for setscrews and nuts made of stainless steel

The values in the table are based on a friction coefficient µtot = 0.12, lubricated with Molykote on the thread and under the screw head.

Basic size	Strength class		Material
	70 M_A (Nm)	80 M_A (Nm)	
M5	3.7	4.9	A2 / A4
M6	6.4	8.5	A2 / A4
M8	15.3	20.4	A2 / A4
M10	31	41	A2 / A4
M12	52	70	A2 / A4
M16	126	167	A2 / A4
M20	254	326	A2 / A4
M_A = tightening torques			

Tightening torque for self-locking hex nuts

Thread	M_A (Nm)	Lubricants
M6	7.5 +1	–
M8	17 +2	–
M10	35 +4	–
M12	59 +6	–
M14	100 +10	–
M16	140 +14	–
M20	290 +29	–
M_A = tightening torques		

Tightening torque for stress bolt connections as per MTN 5007 standard

This standard applies to stress pin bolts and stress bolts which are subjected to static and dynamic load of strength class 10.9 as well as to the associated nuts.

Shaft and transition dimensions as per MMN 209 standard and material and machining as per MMN 389 standard (bright surface or phosphatized).

The values in the table are based on a friction coefficient µtot = 0.125.

Threads and mating faces of screws and nuts must be coated with engine oil prior to assembly.

An assembly tolerance of +10% of the figures in the table is permitted due to unavoidable deviations during the tightening process.

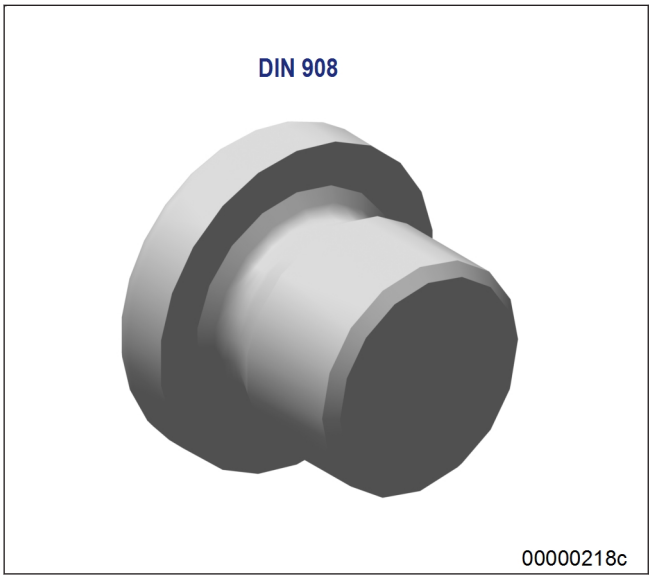
The values in the tables are for manual tightening using a torque wrench.

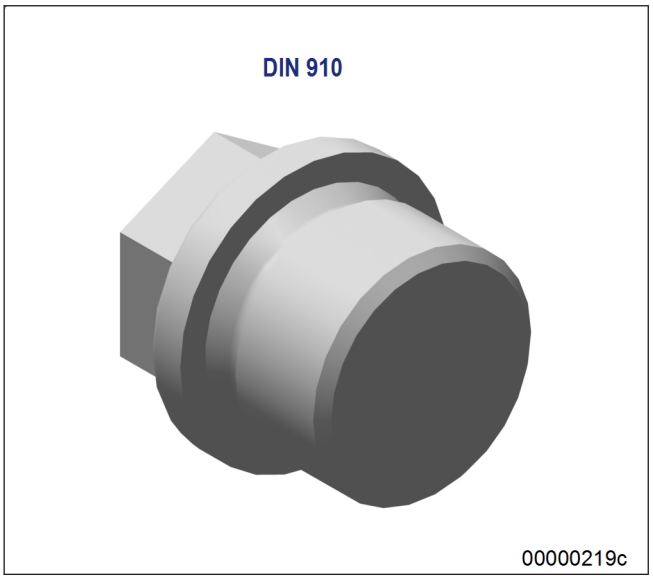
Thread	Not torsion-protected M_A(Nm)	Torsion-protected M_A (Nm)
M6	9	12
M8	21	28
M8 x 1	24	30
M10	42	55
M10 x 1.25	46	60
M12	75	93
M12 x 1.5	78	99
M14	120	150
M14 x 1.5	135	160
M16	180	225
M16 x 1.5	200	245
M18	250	315
M18 x 1.5	300	360
M20	350	450
M20 x 1.5	430	495
M22	500	620
M22 x 1.5	560	675
M24	640	790
M24 x 2	700	850
M27	900	1170
M27 x 2	1000	1230

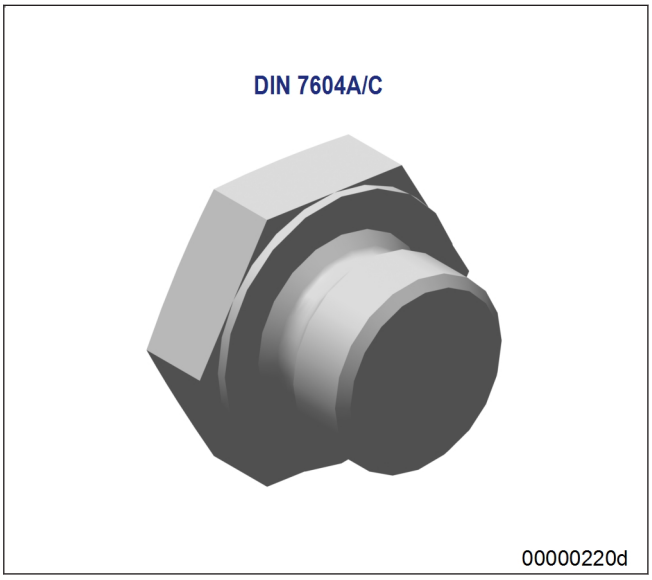
Thread	Not torsion-protected M_A(Nm)	Torsion-protected M_A (Nm)
M30	1250	1575
*Protect screw shaft from torsion when tightening.		
M_A= tightening torques.		

Tightening torques for plug screws as per MTN 5183-1 standard

This standard applies to plug screws to DIN 908, DIN 910 and DIN 7604 with threaded end to DIN 3852 Form A (sealed with sealing ring to DIN 7603-Cu).







Tightening torques M_A are given for screw plugs made of steel (St) with surface protected by a phosphate coating and oiled or galvanized.

Threads and mating faces beneath heads must be coated with engine oil prior to assembly.

An assembly tolerance of +10% of the figures in the table is permitted due to unavoidable deviations during the tightening process.

Tightening torques for plug screws to DIN 908, DIN 910 and DIN 7604A (with short threaded end).

Thread	screwed into	
	Steel/gray cast iron M_A (Nm)	AI alloy M_A (Nm)
M10 x 1	15	15
M12 x 1.5	25	25
M14 x 1.5	35	30
M16 x 1.5	40	35
M18 x 1.5	50	40
M20 x 1.5	60	50
M22 x 1.5	70	70
M24 x 1.5	85	80
M26 x 1.5	100	100
M27 x 2	100	100
M30 x 1.5	110	110
M30 x 2	120	120
M33 x 2	160	160
M36 x 1.5	190	180
M38 x 1.5	220	200
M42 x 1.5	260	240
M45 x 1.5	290	270
M48 x 1.5	310	300
M52 x 1.5	325	320
M56 x 2	380	360

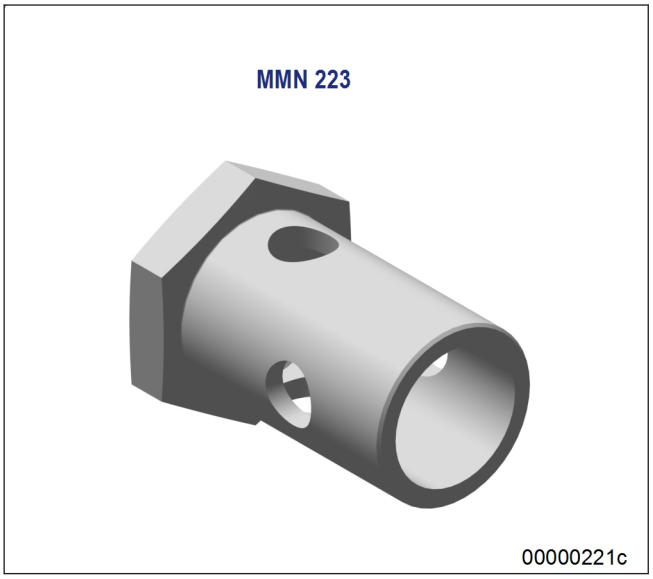
Thread	screwed into	
	Steel/gray cast iron M_A (Nm)	Al alloy M_A (Nm)
M64 x 2	400	400
M_A = tightening torques		

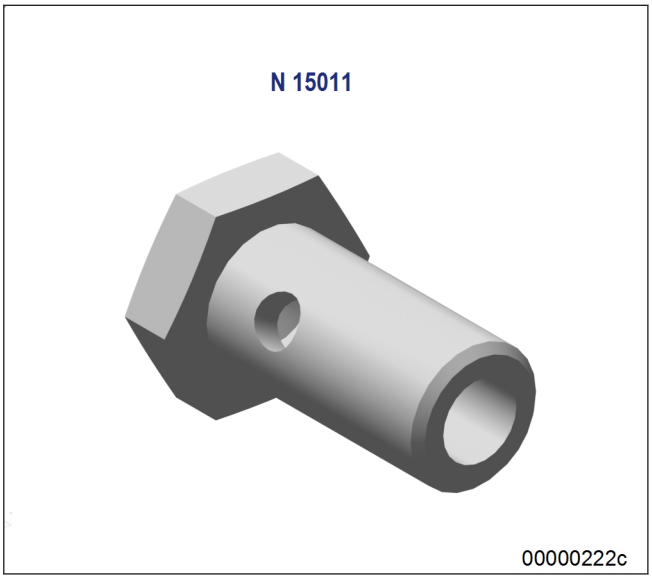
Tightening torque for plug screws DIN 7604C (with long screwed end)

Thread	screwed into	
	Steel/gray cast iron M_A (Nm)	Al alloy M_A (Nm)
M8 x 1	10	10
M22 x 1.5	80	65
M26 x 1.5	105	90
M30 x 1.5	130	130
M38 x 1.5	140	120
M45 x 1.5	160	140
M_A = tightening torques		

Tightening torque for banjo screws as per MTN 5183-2 standard

This standard applies to banjo screws to MMN 223 and N 15011 sealed with sealing ring to DIN 7603-Cu.





The stated tightening torques M_A apply to steel (St) banjo screws with a phosphatized surface and oiled or galvanized and for copper-aluminum alloy.

Threads and mating faces beneath heads must be coated with engine oil prior to assembly.

An assembly tolerance of +10% of the figures in the table is permitted due to unavoidable deviations during the tightening process.

Tightening torques for steel banjo screws

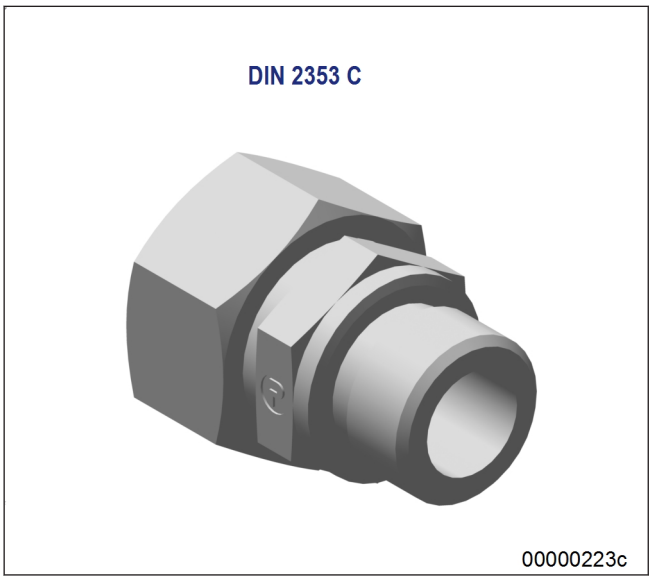
Thread	inserted in steel/gray cast iron/aluminum alloy M_A (Nm)
M8 x 1	10
M10 x 1	15
M12 x 1.5	20
M14 x 1.5	25
M16 x 1.5	25
M18 x 1.5	30
M22 x 1.5	60
M26 x 1.5	90
M30 x 1.5	130
M38 x 1.5	140
M45 x 1.5	160
M_A = tightening torques	

Tightening torques for copper-aluminum alloy banjo screws

Thread	inserted in steel/gray cast iron/aluminum alloy M_A (Nm)
M10 x 1	15
M16 x 1.5	30
M_A = tightening torques	

Tightening torques for male connectors as per MTN 5183-3 standard

This standard applies to male unions to DIN 2353 Series L with threaded end to DIN 3852 Form A (sealed by sealing ring to DIN 7603-Cu).



Tightening torques M_A are given for male unions made of steel (St) with phosphatized surface coating and oiled, or galvanized.

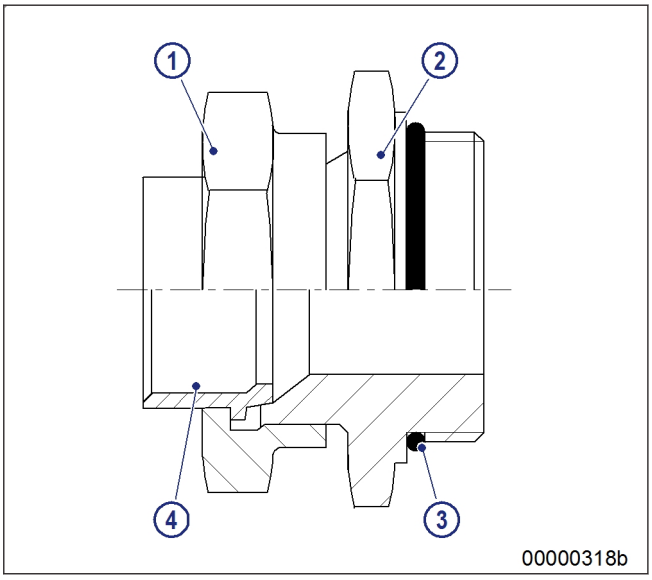
Threads and mating faces beneath heads must be coated with engine oil prior to assembly.

An assembly tolerance of +10% of the figures in the table is permitted due to unavoidable deviations during the tightening process.

Thread	inserted in steel/gray cast iron M_A (Nm)
M10 x 1	15
M12 x 1.5	20
M14 x 1.5	35
M16 x 1.5	50
M18 x 1.5	60
M22 x 1.5	70
M26 x 1.5	100
M32 x 2	160
M42 x 2	260
M48 x 2	320
M_A = tightening torques	

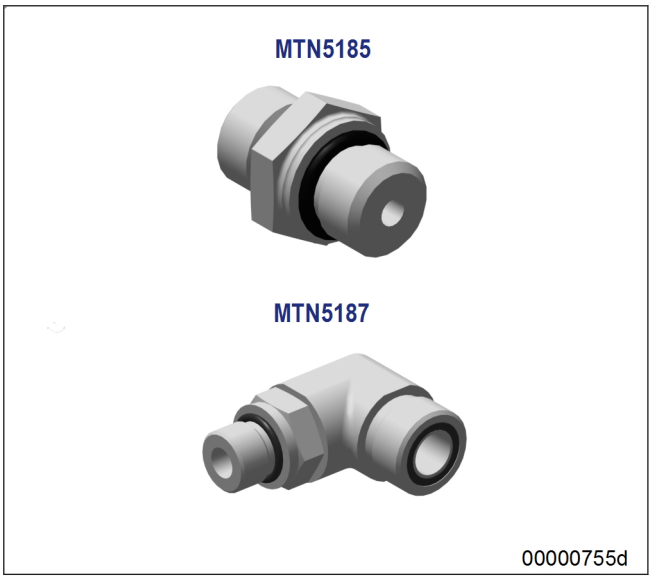
Tightening torques for union nuts as per DIN 3859-2

1 Union nut
2 Screw fixture
3 O-ring
4 Linear ball bearing



Union nut: On installing the ball-type union, after tightening the union nut firmly by hand (noticeable increase in force), it should be tightened another 1/4 turn (90°) past this point.

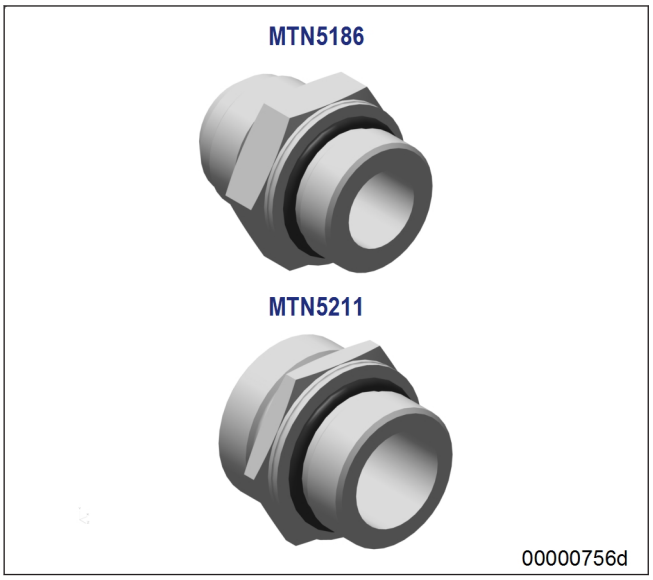
Tightening torques for spigot unions with O-ring to ISO 6149-2



Thread	Torque (Nm) +10%
M8 x 1	10
M10 x 1	20
M12 x 1.5	35
M14 x 1.5	45
M16 x 1.5	55
M18 x 1.5	70
M20 x 1.5[1)]	80
M22 x 1.5	100

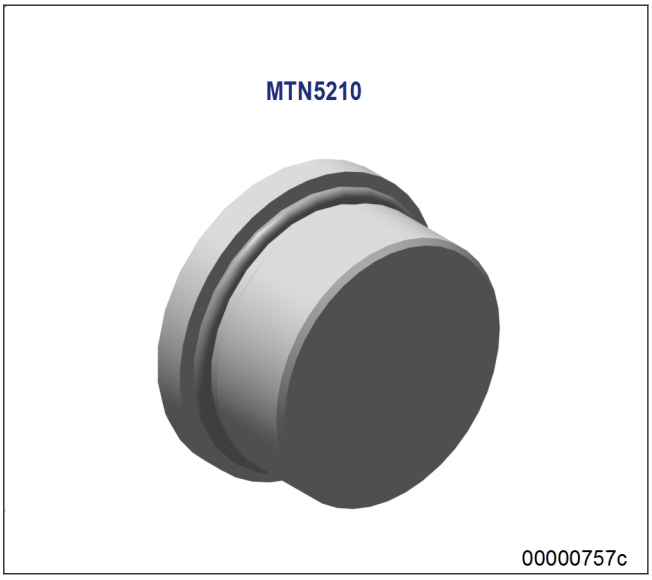
Thread	Torque (Nm) +10%
M27 x 2	170
M33 x 2	310
M42 x 2	330
M48 x 2	420
M60 x 2	500
[1)]Only for sealing off installation spaces for screw-in valves (see ISO 6149-47 and ISO 7789)	

Tightening torques for screwed plugs with O-ring as per ISO 6149-3



Thread	Torque (Nm) +10%
M8 x 1	8
M10 x 1	15
M12 x 1.5	25
M14 x 1.5	35
M16 x 1.5	40
M18 x 1.5	45
M22 x 1.5	60
M27 x 2	100
M33 x 2	160
M42 x 2	210
M48 x 2	260
M60 x 2	315

Tightening torques for plug screw joints as per MTN 5183-6



Thread	screwed into	
	Steel/gray cast iron M_A (Nm)	AI alloy M_A (Nm)
M10 x 1	20	10 +2
M12 x 1.5	35	14 +2
M14 x 1.5	45	15 +3
M16 x 1.5	55	18 +3
M18 x 1.5	70	23 +3
M22 x 1.5	100	33 +4
M27 x 2	170	57 +5
M33 x 2	310	103 +10
M42 x 2	330	110 +11
M48 x 2	420	140 +14
M60 x 2	–	200 +20
M_A = tightening torques		

Assembly instructions and tightening torque for hose fittings with union nuts

These instructions do not apply to ORFS fittings. In contrast to the instructions for pipe unions, hose fittings with sealing heads and the matching adapters must be fitted and connected as follows.

Hose fitting, metallic sealing with union nut: tighten union nut by hand then tighten a further max. 1/4 of a turn with a wrench.

Hose fitting with O-ring and union nut: tighten union nut by hand then tighten a further max. 1/2 of a turn with a wrench.

Hoses must be properly aligned before tightening the union nuts.

Sealing head/sealing cone with metric union nut		
Metric thread	Pipe outer dia.	Torque (Nm)
M12 x 1.5	6	20
M14 x 1.5	8	38

Sealing head/sealing cone with metric union nut		
Metric thread	Pipe outer dia.	Torque (Nm)
M16 x 1.5	8 10	45
M18 x 1.5	10 12	51
M20 x 1.5	12	58
M22 x 1.5	14 15	74
M24 x 1.5	16	74
M26 x 1.5	18	105
M30 x 2	20 22	135
M36 x 2	25 28	166
M42 x 2	30	240
M45 x 2	35	290
M52 x 2	38 42	330

Sealing head with BSP union nut	
BSPP thread	Torque (Nm)
G1/4	20
G3/8	34
G1/2	60
G5/8	69
G3/4	115
G1	140
G1.1/4	210
G1.1/2	290
G2	400

SAE sealing cone with union nut JIC 37°		
UNF thread	Size	Torque (Nm)
7/16-20	-4	15
1/2-20	-5	20
9/16-18	-6	30
3/4-16	-8	50
7/8-14	-10	69
1.1/16-12	-12	98
1.3/16-12	-14	118
1.5/16-12	-16	140
1.5/8-12	-20	210
1.7/8-12	-24	290
2.1/2-12	-32	450

ORFS – flat sealing with union nut		
UNF thread	Size	Torque (Nm)
9/16-18	-4	14 +2
11/16-16	-6	24 +3
13/16-16	-8	43 +4
1-14	-10	60 +8
1.3/16-12	-12	90 +5
1.3/16-12	-14	90 +5
1.7/16-12	-16	125 +10
1.11/16-12	-20	170 +20
2-12	-24	200 +25
2-1/2-20	-32	460 +30

5 Technical Data

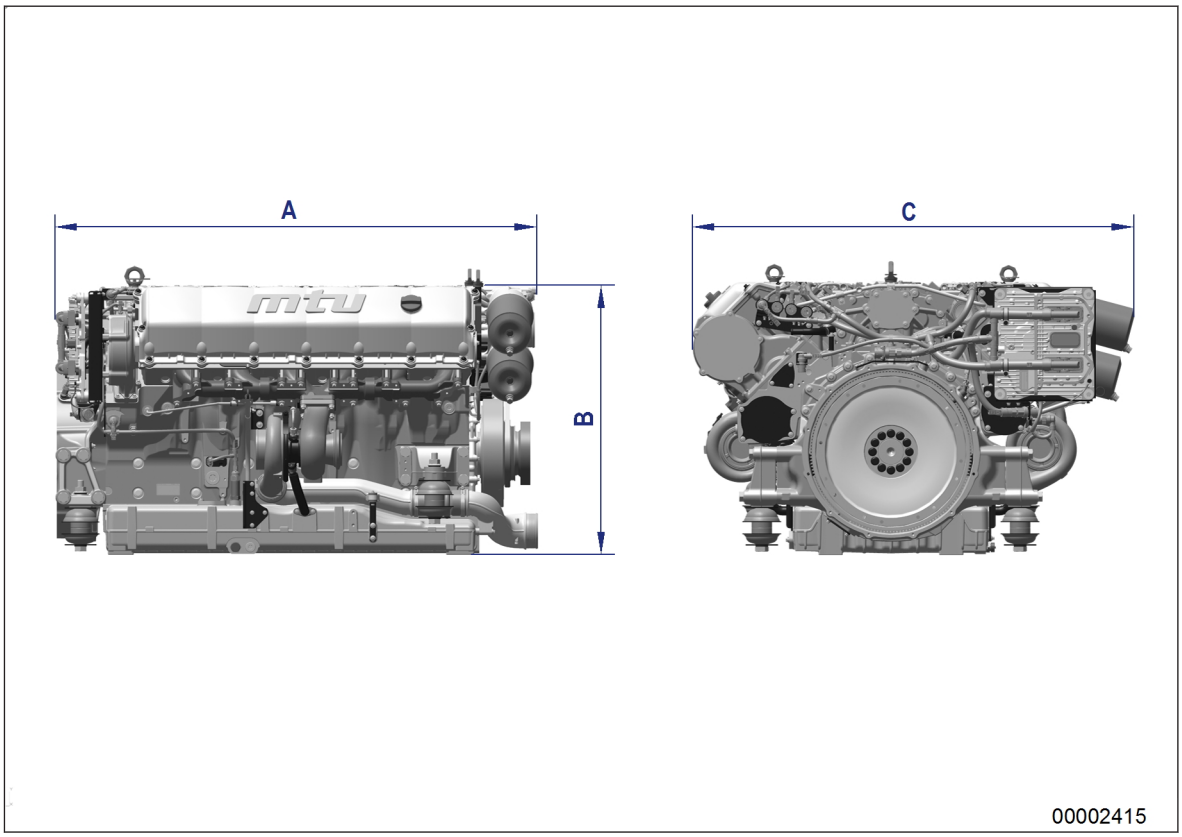
5.1 Firing order

12 V	A1–B2–A5–B4–A3–B1–A6–B5–A2–B3–A4–B6

Direction of rotation

Direction of rotation (as viewed on driving end)	c.c.w., not reversible

5.2 Engine – Main dimensions



Item	Dimensions
Length (A)	approx. 1515 mm
Width (C)	approx. 1369 mm
Height (B)	approx. 850 mm

5.3 12V1600R70/70L/80/80L engine data

Explanation:

DL Ref. value: Continuous power
BL Ref. value: Fuel stop power
A Design value
G Guaranteed value
R Guideline value
L Limit value, up to which the engine can be operated, without change (e.g. of power settings).
N Not yet defined value
- Not applicable
X Applicable

Reference conditions

Engine model			12V1600 R70	12V1600 R70L	12V1600 R80	12V1600 R80L
Application group			2A	2A	2A	2A
Barometric pressure		mbar	1000	1000	1000	1000
Site altitude above sea level		M	100	100	100	100

Power-related data (power ratings are net brake power as per ISO 3046)

Number of cylinders			12	12	12	12
Rated engine speed	A	rpm	2100	2100	1900	1900
UIC rated power (fuel stop power ISO 3046)	A	kW	565	625	660	700

General conditions (for maximum power)

Number of cylinders			12	12	12	12
Intake depression (new filter)	A	mbar	25	25	25	35
Intake depression, max.	L	mbar	50	50	50	50
Fuel temperature at engine inlet connection	R	°C	25	25	25	25
Fuel temperature at engine inlet connection, max (w/o power reduction)	L	°C	70	70	70	70

Consumption

Number of cylinders			12	12	12	12
Specific fuel consumption (be) - 100% BL (+5%; EN 590; 42.8MJ/kg)	R	g/kWh	207	207	200	200
Lube oil consumption after 100 h runtime (B = hourly fuel consumption)	R	% of B	< 0.15	< 0.15	<0.15*	<0.15*

Model-related data (basic design)

Number of cylinders			12	12	12	12
Number of cylinders			12	12	12	12
Cylinder arrangement: V-angle		Degrees (°)	90	90	90	90

Number of cylinders			12	12	12	12
Bore		mm	122	122	122	122
Stroke		mm	150	150	150	150
Displacement, cylinder		Liters	1.75	1.75	1.75	1.75
Displacement, total		Liters	21	21	21	21
Number of inlet valves per cylinder			2	2	2	2
Number of exhaust valves per cylinder			2	2	2	2

Coolant system (HT circuit)

Number of cylinders			12	12	12	12
Thermostat: Starts to open	R	°C	75	75	75	75
Thermostat: Fully open	R	°C	88	88	88	88

Capacities

Number of cylinders			12	12	12	12
Engine coolant capacity, engine side (without cooling equipment)	R	Liters	40*	40*	40*	40*
Engine oil capacity, initial filling (standard oil system) (Option: max. operating inclinations)	R	Liters	75*	75*	75*	75*

Noise

Number of cylinders			12	12	12	12
Exhaust noise, unsilenced - BL (free-field sound pressure level Lp, 1m distance, ISO 6798, +3dB(A) tolerance)	R	dB(A)	111	111	109	110

6 Operation

6.1 Putting the engine into operation after scheduled out-of-service-period

Preconditions

☑ Engine is stopped and starting disabled.

Putting into operation

Item	Measure
Lube oil system	Check engine oil level (→ Page 112).
Coolant circuit	Check engine coolant level (→ Page 119). Check charge-air coolant level (→ Page 124).
Coolant circuit	Preheat engine coolant with coolant preheating unit (if fitted).
Fuel prefilter	Drain fuel prefilter (→ Page 100).
SCR system	Check reducing agent (→ vehicle menufacturer).
Engine control system	Switch on.

6.2 Putting the engine into operation after extended out-of-service periods (>3 months)

Preconditions

☑ Engine is stopped and starting disabled.

☑ MTU Preservation and Represervation Specifications (A001070/..) are available.

Putting into operation after extended out-of-service-periods (>3 months)

Item	Measure
Engine	Depreserve (→ MTU Preservation and Represervation Specifications A001070/..).
Lube oil system	Check engine oil level (→ Page 112).
Fuel system	Ventilation (→ Page 97)
Coolant circuit	Out-of-service period more than 1 year: • Change engine coolant (→ Page 120); • Change charge-air coolant (→ Page 125).
Coolant circuit	Check engine coolant level (→ Page 119). Check charge-air coolant level (→ Page 124).
Coolant circuit	Preheat engine coolant with coolant preheating unit (if fitted).
Engine governor	Check plug connections (→ Page 137).
SCR system	Out-of-service period more than 1 year: • Change reducing agent.
Engine control system	Switch on.

6.3 Starting the engine

Preconditions

☑ Engine is not connected to load.

☑ External start interlock is not active.

DANGER

Rotating and moving engine parts.
Risk of crushing, danger of parts of the body being caught or pulled in!
- Before cranking the engine with starter system, make sure that there are no persons in the engine's danger zone.

WARNING

High level of engine noise when the engine is running.
Risk of damage to hearing!
- Wear suitable hearing protection.

Starting engine

Item	Action
Switchgear cabinet, operator station etc. (depending on manufacturer)	Press start button. • Automatic starting sequence is executed. • Tachometer indicates increasing speed. • After the starting procedure is completed, engine is running at idle speed.

6.4 Operational checks

DANGER

Components are moving or rotating.
Risk of crushing, danger of parts of the body being caught or pulled in!
- Operate the engine at low load only. Keep clear of the danger zone of the engine.

WARNING

High level of engine noise when the engine is running.
Risk of damage to hearing!
- Wear suitable hearing protection.

Operational monitoring

Item	Measure
Control and display panels	Check readings of operational data (speed, temperature, pressures).
Engine oil	Check engine oil level (→ Page 112).
Engine operation	Visually inspect engine for leaks and general condition; Check for abnormal running noise, exhaust discoloration and vibrations (→ Page 47).
Air filter	Check signal ring position of service indicator on air filter (if fitted) (→ Page 110).
Exhaust system	Check exhaust color (→ Page 47).
Engine coolant pump	Check relief bore.
Charge-air coolant pump	Check relief bore.
SCR system	Check reducing agent level (→ vehicle menufacturer).

6.5 Engine - Stop

Preconditions

☑ Engine is not connected to load

NOTICE

Stopping the engine when it is running at full load subjects it to extreme thermal and mechanical stresses.

Overheating of and, therefore, damage to components is possible!

- Before shutting down the engine, allow it to idle until the engine temperatures decrease and constant levels are indicated.

Stopping engine

Item	Action
Temperature indications	Wait until engine temperatures are constant.
Switchgear cabinet, operator station etc. (depending on manufacturer)	Press stop button. • Automatic stopping procedure is performed. • Engine at a standstill.

6.6 After stopping the engine

Preconditions

☑ MTU Preservation and Represervation Specifications (A001070/..) are available.

NOTICE

Engine coolant with inadequate freeze protection. Water remaining in the pressure sensors freezes at temperatures below 0 °C.
Risk of sensor damage!
- Remove pressure sensors and shake off residual water.

After stopping the engine

Item	Measure
Coolant circuit	Drain engine coolant (→ Page 121); Drain charge-air coolant (→ Page 126) if: • freezing temperatures are expected and the engine is to remain out of service for an extended period, but engine coolant has no antifreeze additive; • the engine room is not heated; • the coolant is not kept at a suitable temperature; • the antifreeze concentration is insufficient for the engine-room temperature; • antifreeze concentration is 50 % and engine-room temperature is below -40 °C.
Engine control system	Switch off.
Air intake and exhaust systems	Out-of-service-period > 1 week: • Seal engine's air and exhaust sides. Out-of-service-period > 1 month: • Preserve engine (→ MTU Preservation and Represervation Specifications A001070/..).

TIM-ID: 0000031879 - 004

6.7 Plant – Cleaning

Preconditions

☑ Engine is stopped and starting disabled.

☑ No operating voltage applied.

Special tools, Material, Spare parts

Designation / Use	Part No.	Qty.
High-pressure cleaner	(→ Tools Catalog)	1
Cleaner (Hakupur 50/136)	X00056700	1

WARNING

Compressed air gun ejects a jet of pressurized air.
Risk of injury to eyes and damage to hearing, risk of rupturing internal organs!
- Never direct air jet at people.
- Always wear safety goggles/face mask and hearing protection.

WARNING

Water jet from high-pressure cleaning unit.
Risk of eye injury, risk of scalding!
- Do not direct water jet at persons.
- Wear protective clothing, protective gloves, and goggles/safety mask.

NOTICE

Cleaning agents should not be left to take effect for too long.
Damage to components is possible!
- Observe manufacturer's instructions.

NOTICE

Blowing down product with compressed air.
Entry of dirt and damage to components is possible!
- Do not aim compressed air gun directly at seals or electronic components such as connectors or ECUs.

Cleaning the plant

1. Carry out plant cleaning only in areas where an appropriate oil separator is provided (environmental protection).
2. Prior to putting the cleaning unit into operation, read the operating instructions of the high-pressure cleaning units carefully and observe the safety precautions.
3. The following requirements apply for cleaning the plant outside with a high-pressure cleaning unit:
   - The pressure of the high-pressure jet (cleaning jet) must not exceed 50 bar.
   - A minimum distance between spray nozzle and plant of 1 m must be observed.
   - The temperature of the cleaning medium must not exceed 80 °C.
4. For external cleaning with high-pressure jet, use a fan jet nozzle only.

Note: Never direct compressed air directly at electronic components.

5. Carry out external cleaning as follows:
   a) Seal all openings in a suitable way.
   b) Remove coarse dirt.
   c) Spray on cleaner sparingly and leave it for 1 to 5 minutes.
   d) Use high-pressure jet to remove loosened dirt.
   e) Dry engine with compressed air.

7 Maintenance

7.1 Maintenance task reference table [QL1]

The maintenance tasks and intervals for this product are defined in the Maintenance Schedule. The Maintenance Schedule is a stand-alone publication.

The task numbers in this table provide reference to the maintenance tasks specified in the Maintenance Schedule.

Task	Option	Maintenance tasks	
W0500		Check engine oil level.	(→ Page 112)
W0501		Carry out visual inspection of engine for general condition and leaks.	(→ Page 42)
W0503	X	Inspect service indicator of air filter.	(→ Page 42)
W0506		Check for abnormal running noises, exhaust gas color and vibration.	(→ Page 42)
W0507		Drain off water and contamination from fuel prefilter.	(→ Page 42)
W1001		Fit new fuel filter or new fuel filter insert.	(→ Page 99)
W1003		Check belt condition and tension Fit new belt(s) if necessary.	(→ Page 128)
W1005	X	Fit new air filters.	(→ Page 109)
W1008		Fit new engine oil filters each time the engine oil is changed or, at the latest, on expiry of the time limit (given in years).	(→ Page 116)
W1027	X	Clean air filter(s) Empty dust collector box.	(→ Page 108)
W1030	X	Carry out visual inspection of the rubber element of the auxiliary PTO coupling. Fit new parts if required.	(→ Page 131)
W1122		Fit new drive belt for coolant pump.	(→ Page 129)
W1207		Check valve clearance, adjust if required. ATTENTION! First adjustment after 1,000 hours.	(→ Page 94)
W1675		Fit new fuel prefilter or new fuel prefilter insert.	(→ Page 101)
W1764		Replace screen filter.	(→ Page 103)
W1765		Replace filter insert.	(→ Page 104)
W1766		Replace reducing agent lines.	(→ Page 106)

Table 2: Maintenance task reference table [QL1]

8 Troubleshooting

8.1 Troubleshooting

Engine does not turn when starter is actuated

Cause	Corrective action
Battery low or faulty	▶ Charge or replace (→ manufacturer's documentation).
Battery: Cable connections faulty	▶ Check if cable connections are properly secured (→ manufacturer's documentation).
Starter: Engine cabling or starter faulty	▶ Check if cable connections are properly secured, contact Service.
Engine wiring defective	▶ Check (→ Page 135).
Connectors on engine governor possibly loose	▶ Check plug connections (→ Page 137).
Running gear blocked (engine cannot be barred manually)	▶ Contact Service.

Engine turns but does not fire

Cause	Corrective action
Poor rotation by starter: Battery low or faulty	▶ Charge or replace battery (→ manufacturer's documentation).
Engine wiring defective	▶ Check (→ Page 135).
Air in fuel system	▶ Vent fuel system (→ Page 97).
Engine governor defective	▶ Contact Service.

Engine fires unevenly

Cause	Corrective action
Injector defective	▶ Contact Service.
Engine wiring defective	▶ Check (→ Page 135).
Air in fuel system	▶ Vent fuel system (→ Page 97).
Engine governor defective	▶ Contact Service.

Engine does not reach rated speed

Cause	Corrective action
Fuel prefilter (if fitted) clogged.	▶ Clean or replace filter element (→ manufacturer's documentation).
Fuel filter clogged	▶ Replace (→ Page 99).
Air filter clogged	▶ Replace air filter .(→ Page 109)
Injector defective	▶ Contact Service.
Engine wiring defective	▶ Check (→ Page 135).
Engine: Overloaded	▶ Contact Service.

Engine speed not steady

Cause	Corrective action
Injector defective	▶ Contact Service.
Speed transmitter defective	▶ Contact Service.
Air in fuel system	▶ Vent fuel system (→ Page 97).
Engine governor defective	▶ Contact Service.

Black exhaust gas

Cause	Corrective action
Air filter clogged	▶ Replace air filter .(→ Page 109)
Injector defective	▶ Contact Service.
Engine: Overloaded	▶ Contact Service.

Blue exhaust gas

Cause	Corrective action
Too much oil in engine	▶ Drain engine oil (→ Page 113).
Exhaust turbocharger, cylinder head, piston rings, cylinder liner defective	▶ Contact Service.

White exhaust gas

Cause	Corrective action
Engine is not at operating temperature	▶ Run engine to reach operating temperature.
Water in fuel	▶ Drain fuel prefilter (→ Page 100).

8.2 Fault messages

5 – HI T-Charge Air

Cause	Corrective action
The charge-air temperature at sensor B9 has exceeded limit value 1. The charge-air temperature is too high.	1. Reduce power. 2. Check whether alarms 9 and 10 are pending. 3. Contact Service.

6 – SS T-Charge Air

Cause	Corrective action
The charge-air temperature at sensor B9 has exceeded limit value 2. The charge-air temperature is too high.	1. Reduce power. 2. Check whether alarms 9 and 10 are pending. 3. Contact Service.

15 – LO P-Lube Oil

Cause	Corrective action
The lube oil pressure at sensor B5.1 has undershot limit value 1. The lube oil pressure is too low.	1. Check engine oil level (→ Page 112). 2. Contact Service.

16 – SS P-Lube Oil

Cause	Corrective action
The lube oil pressure at sensor B5.1 has undershot limit value 2. The lube oil pressure is too low.	1. Check engine oil level (→ Page 112). 2. Contact Service.

23 – LO Coolant Level

Cause	Corrective action
Coolant level at level switch F33 in HT circuit is too low.	1. Check engine coolant level (→ Page 119). 2. Visually check coolant circuit for leaks. 3. Contact Service.

25 – HI P-Diff. Lube Oil

Cause	Corrective action
The oil differential pressure at sensors B5.1 and B5.3 has exceeded limit value 1. The oil differential pressure is too high.	1. Replace engine oil filter (→ Page 116). 2. Contact Service.

26 – HI P-Diff. Lube Oil

Cause	Corrective action
The oil differential pressure at sensors B5.1 and B5.3 has exceeded limit value 2. The oil differential pressure is too high.	1. Replace engine oil filter (→ Page 116). 2. Contact Service.

30 – SS Engine Overspeed

Cause	Corrective action
The engine speed has exceeded the limit value or the engine overspeed test was tripped. Engine emergency stop was tripped.	1. If emergency stop was tripped by the engine overspeed test, restart the engine. 2. If emergency stop was tripped by the engine, notify Service.

33 – HI P-Diff-Fuel

Cause	Corrective action
The differential pressure at sensors B34.1 and B34.2 has exceeded limit value 1. The differential pressure is too high.	1. Replace fuel filter (→ Page 99). 2. Contact Service.

34 – SS P-Diff-Fuel

Cause	Corrective action
The differential pressure at sensors B34.1 and B34.2 has exceeded limit value 2. The differential pressure is too high.	1. Replace fuel filter (→ Page 99). 2. Contact Service.

59 – SS T-Coolant L3

Cause	Corrective action
The coolant temperature at sensor B6 1 has exceeded limit value 3. Coolant temperature too high.	1. Check operation of cooler and fan (plant side). 2. Check engine coolant level (→ Page 119). 3. Contact Service.

60 – SS T-Coolant L4

Cause	Corrective action
Preheater faulty.	1. Check power supply to preheater. 2. Read out fault memory of preheater. 3. Contact Service.

63 – HI P-Crankcase

Cause	Corrective action
The crankcase pressure at sensor B50 has exceeded limit value 1. The crankcase pressure is too high.	1. Stop engine. 2. Contact Service.

64 – SS P-Crankcase

Cause	Corrective action
The crankcase pressure at sensor B50 has exceeded limit value 2. The crankcase pressure is too high.	1. Stop engine. 2. Contact Service.

65 – LO P-Fuel

Cause	Corrective action
The fuel pressure at sensor B34.1 has undershot limit value 1. The fuel pressure is too low.	1. Replace fuel filter (→ Page 99). 2. Replace fuel prefilter (→ Page 101). 3. Contact Service.

66 – SS P-Fuel

Cause	Corrective action
The fuel pressure at sensor B34.1 has undershot limit value 2. The fuel pressure is too low.	1. Replace fuel filter (→ Page 99). 2. Replace fuel prefilter (→ Page 101). 3. Contact Service.

67 – HI T-Coolant

Cause	Corrective action
The coolant temperature at sensor B6.1 has exceeded limit value 1. Coolant temperature too high.	1. Reduce power. 2. Check operation of cooler and fan (plant side). 3. Check engine coolant level (→ Page 119). 4. Contact Service.

68 – SS T-Coolant

Cause	Corrective action
The coolant temperature at sensor B6.1 has exceeded limit value 2. Coolant temperature too high.	1. Check operation of cooler and fan (plant side). 2. Check engine coolant level (→ Page 119). 3. Contact Service.

82 – HI P-Fuel (Common Rail)

Cause	Corrective action
The HP fuel pressure at sensor B48.1 has violated the upper limit value. Fuel pressure is too high.	▶ Contact Service.

83 – LO P-Fuel (Common Rail)

Cause	Corrective action
The HP fuel pressure at sensor B48.1 has violated lower limit value 1. The fuel pressure is too low.	▶ Contact Service.

89 – SS Engine Speed too Low

Cause	Corrective action
The engine speed has undershot the limit value. Engine emergency stop was tripped.	1. Acknowledge alarm. 2. Check for additional messages. 3. Contact Service.

90 – SS Starter Speed Not Reached

Cause	Corrective action
The engine speed does not reach idling within the specified time after reaching starter disengagement speed.	▶ Contact Service.

91 – SS Release Speed Not Reached

Cause	Corrective action
The engine speed does not reach starter disengagement speed within the specified time after reaching starter speed.	1. Check pressure supply (plant side) of starter. 2. Check for additional messages. 3. Contact Service.

92 – SS Starter Speed Not Reached

Cause	Corrective action
The engine has not reached the specified speed threshold within the specified time.	1. Check pressure supply (plant side) of starter. 2. Check for additional messages. 3. Contact Service.

93 – SS T-Preheat

Cause	Corrective action
The engine coolant temperature has not reached specified limit value 2. Preheating is not working. Start interlock.	▶ Contact Service.

94 – LO T-Preheat

Cause	Corrective action
The engine coolant temperature has not reached specified limit value 1. Preheating is not working.	▶ Contact Service.

118 – LO ECU Power Supply Voltage

Cause	Corrective action
The supply voltage of the ECU has undershot specified limit value 1.	1. Check state of charge of the batteries (plant side). 2. Check plug connections to Engine Control Unit (→ Page 137). 3. Contact Service.

119 – LOLO ECU Power Supply Voltage

Cause	Corrective action
The supply voltage of the ECU has undershot specified limit value 2.	1. Check state of charge of the batteries (plant side). 2. Check plug connections to Engine Control Unit (→ Page 137). 3. Contact Service.

120 – HI ECU Power Supply Voltage

Cause	Corrective action
The supply voltage of the ECU has exceeded specified limit value 1.	1. Check state of charge of the batteries (plant side). 2. Check plug connections to Engine Control Unit (→ Page 137). 3. Contact Service.

121 – HIHI ECU Power Supply Voltage

Cause	Corrective action
The supply voltage of the ECU has exceeded specified limit value 2.	1. Check state of charge of the batteries (plant side). 2. Check plug connections to Engine Control Unit (→ Page 137). 3. Contact Service.

122 – HI T-ECU

Cause	Corrective action
The ECU-internal temperature sensor has exceeded the limit value. The internal temperature is too high.	1. Check whether alarms 9 and/or 10 are active. 2. If ECU cooling is connected, check flow. 3. Contact Service.

141 – AL Power too high

Cause	Corrective action
The weighted average of the output in the last 24 hours has exceeded the specified maximum value. The average retrieved power was too high.	▶ Reduce engine capacity utilization. This alarm is reset when the average maximum value is no longer exceeded.

180 – AL CAN1 Node Lost

Cause	Corrective action
Connection or communication with a node at CAN bus 1 failed.	1. Check engine cabling (→ Page 135). 2. Disconnect voltage supply and reconnect again. 3. Contact Service.

181 – AL CAN2 Node Lost

Cause	Corrective action
Connection or communication with a node at CAN bus 2 failed.	1. Check engine cabling (→ Page 135). 2. Disconnect voltage supply and reconnect again. 3. Contact Service.

186 – AL CAN1 Bus Off

Cause	Corrective action
CAN bus 1 for MTU automation (e.g. ECU/MAU/SAM) interrupted or defective.	1. Check plug connections to Engine Control Unit (→ Page 137). 2. Contact Service.

187 – AL CAN1 Error Passive

Cause	Corrective action
CAN bus 1 for MTU automation (e.g. ECU/MAU/SAM) interrupted or defective.	1. Check plug connections to Engine Control Unit (→ Page 137). 2. Contact Service.

188 – AL CAN2 Bus Off

Cause	Corrective action
CAN bus 2 for plant-side automation (e.g. Murphy display) interrupted or defective.	1. Check connection between plant-side automation and MTU automation. 2. Contact Service.

189 – AL CAN2 Error Passive

Cause	Corrective action
CAN bus 2 for plant-side automation (e.g. Murphy display) interrupted or defective.	1. Check connection between plant-side automation and MTU automation. 2. Contact Service.

201 – SD T-Coolant

Cause	Corrective action
The coolant temperature sensor (B6.1) at coolant distribution housing delivers incorrect or no signal.	1. Check engine cabling (→ Page 135). 2. Contact Service.

203 – SD T-Charge Air

Cause	Corrective action
The signal from the A side charge-air temperature sensor (B9.2) is faulty or missing.	1. Check engine cabling (→ Page 135). 2. Contact Service.

208 – SD P-Charge Air

Cause	Corrective action
The signal from the charge-air pressure sensor (B10) after the HP intercooler is faulty or missing.	1. Check engine cabling (→ Page 135). 2. Contact Service.

211 – SD P-Lube Oil

Cause	Corrective action
The lube oil pressure sensor after the filter (B5.1) delivers incorrect or no signal.	1. Check engine cabling (→ Page 135). 2. Contact Service.

214 – SD P-Crankcase

Cause	Corrective action
The crankcase pressure sensor (B50) delivers incorrect or no signal.	1. Check engine cabling (→ Page 135). 2. Contact Service.

215 – SD P-HD

Cause	Corrective action
The signal from the A side rail pressure sensor (B48.1) is faulty or missing.	1. Check engine cabling (→ Page 135). 2. Contact Service.

220 – SD Level Coolant Water

Cause	Corrective action
The coolant level sensor (F33) delivers incorrect or no signal.	1. Check engine cabling (→ Page 135). 2. Contact Service.

221 – SD P-Diff Lube Oil

Cause	Corrective action
Lube oil pressure sensors B5.3 and/or B5.1 deliver incorrect or no signal.	1. Check engine cabling (→ Page 135). 2. Contact Service.

227 – SD P- Lube Oil before Filter

Cause	Corrective action
The lube oil pressure sensor before the filter (B5.3) delivers incorrect or no signal.	1. Check engine cabling (→ Page 135). 2. Contact Service.

228 – SD P-Fuel before Filter

Cause	Corrective action
The fuel pressure sensor before the main fuel filter (B34.2) delivers incorrect or no signal.	1. Check engine cabling (→ Page 135). 2. Contact Service.

229 – AL Stop Camshaft Sensor Defect

Cause	Corrective action
Emergency engine stop following failure of the crankshaft sensor (B13) and camshaft sensor (B1).	▶ Contact Service.

230 – SD Crankshaft Speed

Cause	Corrective action
The crankshaft speed sensor (B13) delivers incorrect or no signal.	1. Check engine cabling (→ Page 135). 2. Contact Service.

231 – SD Camshaft Speed

Cause	Corrective action
The camshaft speed sensor (B1) delivers incorrect or no signal.	1. Check engine cabling (→ Page 135). 2. Contact Service.

239 – SD P-Diff Fuel

Cause	Corrective action
The pressure sensors B34.1 and/or B34.2 deliver incorrect or no signal.	1. Check engine cabling (→ Page 135). 2. Contact Service.

240 – SD P-Fuel

Cause	Corrective action
The fuel pressure sensor after the main fuel filter (B34.1) delivers incorrect or no signal.	1. Check engine cabling (→ Page 135). 2. Contact Service.

321 – AL Wiring Cylinder A1

Cause	Corrective action
Short circuit fault in injector wiring cylinder A1 or injector defective.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

322 – AL Wiring Cylinder A2

Cause	Corrective action
Short circuit fault in injector wiring cylinder A2 or injector defective.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

323 – AL Wiring Cylinder A3

Cause	Corrective action
Short circuit fault in injector wiring cylinder A3 or injector defective.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

324 – AL Wiring Cylinder A4

Cause	Corrective action
Short circuit fault in injector wiring cylinder A4 or injector defective.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

325 – AL Wiring Cylinder A5

Cause	Corrective action
Short circuit fault in injector wiring cylinder A5 or injector defective.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

326 – AL Wiring Cylinder A6

Cause	Corrective action
Short circuit fault in injector wiring cylinder A6 or injector defective.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

331 – AL Wiring Cylinder B1

Cause	Corrective action
Short circuit fault in injector wiring cylinder B1 or injector defective.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

332 – AL Wiring Cylinder B2

Cause	Corrective action
Short circuit fault in injector wiring cylinder B2 or injector defective.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

333 – AL Wiring Cylinder B3

Cause	Corrective action
Short circuit fault in injector wiring cylinder B3 or injector defective.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

334 – AL Wiring Cylinder B4

Cause	Corrective action
Short circuit fault in injector wiring cylinder B4 or injector defective.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

335 – AL Wiring Cylinder B5

Cause	Corrective action
Short circuit fault in injector wiring cylinder B5 or injector defective.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

336 – AL Wiring Cylinder B6

Cause	Corrective action
Short circuit fault in injector wiring cylinder B6 or injector defective.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

341 – AL Open Load Cylinder A1

Cause	Corrective action
Disruption fault in injector wiring to cylinder A1.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

342 – AL Open Load Cylinder A2

Cause	Corrective action
Disruption fault in injector wiring cylinder A2.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

343 – AL Open Load Cylinder A3

Cause	Corrective action
Disruption fault in injector wiring cylinder A3.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

344 – AL Open Load Cylinder A4

Cause	Corrective action
Disruption fault in injector wiring cylinder A4.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

345 – AL Open Load Cylinder A5

Cause	Corrective action
Disruption fault in injector wiring cylinder A5.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

346 – AL Open Load Cylinder A6

Cause	Corrective action
Disruption fault in injector wiring cylinder A6.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

351 – AL Open Load Cylinder B1

Cause	Corrective action
Disruption fault in injector wiring cylinder B1.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

352 – AL Open Load Cylinder B2

Cause	Corrective action
Disruption fault in injector wiring cylinder B2.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

353 – AL Open Load Cylinder B3

Cause	Corrective action
Disruption fault in injector wiring cylinder B3.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

354 – AL Open Load Cylinder B4

Cause	Corrective action
Disruption fault in injector wiring cylinder B4.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

355 – AL Open Load Cylinder B5

Cause	Corrective action
Disruption fault in injector wiring cylinder B5.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

356 – AL Open Load Cylinder B6

Cause	Corrective action
Disruption fault in injector wiring cylinder B6.	1. Check wiring of affected injector (→ Page 135). 2. Contact Service.

365 – AL Stop MV-Wiring Ground

Cause	Corrective action
Short circuit of injector positive connection to ground of one or more injectors. Short circuit of the injector negative connection or of one or more injectors to ground.	1. Check wiring (→ Page 135). 2. Restart engine. 3. Contact Service.

381 – AL Wiring TOP 1

Cause	Corrective action
Short circuit or wire break on transistor output, plant-side 1 (TOP 1).	1. Check wiring (→ Page 135). 2. Contact Service.

382 – AL Wiring TOP 2

Cause	Corrective action
Short circuit or wire break on transistor output, plant-side 2 (TOP 2).	1. Check wiring (→ Page 135). 2. Contact Service.

383 – AL Wiring TOP 3

Cause	Corrective action
Short circuit or wire break on transistor output, plant-side 3 (TOP 3).	1. Check wiring (→ Page 135). 2. Contact Service.

384 – AL Wiring TOP 4

Cause	Corrective action
Short circuit or wire break on transistor output, plant-side 4 (TOP 4).	1. Check wiring (→ Page 135). 2. Contact Service.

410 – LO U-PDU

Cause	Corrective action
The voltage for the ECU for activating the injectors has undershot limit value 1.	1. Check voltage supply (plant side). 2. Check wiring (→ Page 135). 3. Contact Service.

411 – LOLO U-PDU

Cause	Corrective action
The voltage for the ECU for activating the injectors has undershot limit value 2.	1. Check voltage supply (plant side). 2. Check wiring (→ Page 135). 3. Contact Service.

412 – HI U-PDU

Cause	Corrective action
The voltage for the ECU for activating the injectors has exceeded limit value 1.	1. Check voltage supply (plant side). 2. Check wiring (→ Page 135). 3. Contact Service.

413 – HIHI U-PDU

Cause	Corrective action
The voltage for the ECU for activating the injectors has exceeded limit value 2.	1. Check voltage supply (plant side). 2. Check wiring (→ Page 135). 3. Contact Service.

414 – HI Level Water Fuel Prefilter

Cause	Corrective action
Due to the high water content in the fuel, switch F70 in the fuel prefilter has tripped.	1. Drain water and contaminants from fuel prefilter (→ Page 100). 2. Replace fuel prefilter (→ Page 101). 3. Contact Service.

417 – SD Level Water Fuel Prefilter

Cause	Corrective action
The level sensor for water in the fuel prefilter (F70) delivers incorrect or no signal.	1. Check engine cabling (→ Page 135). 2. Contact Service.

438 – LO P-Fuel 2 (Common Rail)

Cause	Corrective action
The HP fuel pressure at sensor B48.2 has violated lower limit value 1. The fuel pressure is too low.	▶ Contact Service.

439 – HI P-Fuel 2 (Common Rail)

Cause	Corrective action
The fuel high pressure at sensor B48 2 has exceeded the limit value. The HP fuel pressure is too high.	1. Check wiring of HP fuel control block. 2. Contact Service.

444 – SD U-PDU

Cause	Corrective action
Fault in internal supply voltage of injector end stage.	▶ Contact Service.

446 – SD P-HD2

Cause	Corrective action
The rail pressure sensor (B48.2), B-side, delivers incorrect or no signal.	1. Check engine cabling (→ Page 135). 2. Contact Service.

448 – HI P-Charge Air

Cause	Corrective action
The charge-air pressure at sensor B10 has exceeded limit value 1. Charge-air pressure is too high.	1. Power reduction. 2. Check sensor B10 and replace as necessary. 3. Contact Service.

449 – SS P-Charge Air

Cause	Corrective action
The charge-air pressure at sensor B10 has exceeded limit value 2. Charge-air pressure is too high.	1. Power reduction. 2. Check sensor B10 and replace as necessary. 3. Contact Service.

454 – SS Power Reduction Active

Cause	Corrective action
Power reduction activated. A main alarm that has occurred activates the power reduction.	1. Check for additional messages. 2. Contact Service.

470 – SD T-ECU

Cause	Corrective action
The ECU-internal temperature sensor delivers incorrect or no signal	1. Check engine cabling (→ Page 135). 2. Contact Service.

478 – AL Comb. Alarm Yel (Plant)

Cause	Corrective action
The alarm is issued if a plant device of the ECU indicates via the PCS5-CAN that it is to set the yellow summary alarm.	1. Check for additional messages. 2. Contact Service.

479 – AL Comb. Alarm Red (Plant)

Cause	Corrective action
The alarm is issued if a plant device of the ECU indicates via the PCS5-CAN that it is to set the red summary alarm.	1. Check for additional messages. 2. Contact Service.

520 – SD P-Intake Air after Filter A

Cause	Corrective action
The signal from the intake air pressure sensor (B81.3) after filter is faulty or missing.	1. Check engine cabling (→ Page 135). 2. Contact Service.

536 – AL Wiring PWM_CM1

Cause	Corrective action
The HP fuel control block M8.1 (A-side) of the HP fuel pump can not be activated.	1. Check engine cabling (→ Page 135). 2. Contact Service.

549 – AL Power Cut-Off detected

Cause	Corrective action
ECU operating voltage was switched off while the engine was running. Do not disconnect the voltage supply until the engine is stationary.	1. Check engine cabling if the power supply was not disconnected manually (→ Page 135). 2. Contact Service.

558 – AL Wiring PWM_CM2

Cause	Corrective action
The HP fuel control block M8.2 (B-side) of the HP fuel pump can not be activated.	1. Check engine cabling (→ Page 135). 2. Contact Service.

565 – AL L1 P-Intake Air after Filter A

Cause	Corrective action
The intake air pressure measured at sensor B81.3 has violated limit value 1. The intake air pressure is too high.	1. Check engine cabling (→ Page 135). 2. Contact Service.

581 – AL Wiring PWM_CM3

Cause	Corrective action
The supply unit of the A side RA dosing system (AG5.1) cannot be addressed.	1. Check wiring to A side supply unit (→ Page 135). 2. Contact Service.

582 – AL Emergency Stop Failure

Cause	Corrective action
The alarm occurs if the engine fails to come to a standstill during a specific time after the emergency stop signal is received.	▶ Contact Service.

587 – AL Wiring PWM_CM4

Cause	Corrective action
The supply unit of the B side RA dosing system (AG5.2) cannot be addressed.	1. Check wiring to B side supply unit (→ Page 135). 2. Contact Service.

594 – AL L1 PRV Defective

Cause	Corrective action
The number of opening operations of the pressure relief valve on the rail, A-side, has exceeded the maximum number (limit value 1).	▶ Contact Service.

595 – AL L2 PRV Defective

Cause	Corrective action
The number of opening operations of the pressure relief valve on the rail, A-side, has exceeded the maximum number (limit value 2).	▶ Contact Service.

596 – AL Test Parameters

Cause	Corrective action
The parameter set is used for trials. The alarm remains set until a series parameter set is loaded.	▶ No action required.

597 – AL Wiring PWM_CM5

Cause	Corrective action
Voltage supply for NOx sensors, A-side (B88.3 + B88.4), is defective.	1. Check engine cabling (→ Page 135). 2. Contact Service.

597 – AL Wiring PWM_CM5

Cause	Corrective action
Disruption or short circuit in wiring to servomotor of thermomanagement flap 2 (M58.2).	1. Check engine cabling (→ Page 135). 2. Contact Service.

598 – AL L1 PRV Defect 2

Cause	Corrective action
The number of opening operations of the pressure relief valve on the rail, B-side, has exceeded the maximum number (limit value 1).	▶ Contact Service.

599 – AL L2 PRV Defect 2

Cause	Corrective action
The number of opening operations of the pressure relief valve on the rail, B-side, has exceeded the maximum number (limit value 2).	▶ Contact Service.

602 – AL CAN Engine Start Lock

Cause	Corrective action
The ECU on the plant side has received a start interlock via the CAN bus.	1. Check plant control. 2. Contact Service.

606 – AL Double Nodes Lost CAN 1+2

Cause	Corrective action
One of the connected and monitored CAN bus devices is not detected either on CAN bus 1 or on CAN bus 2.	1. Check engine cabling (→ Page 135). 2. Contact Service.

608 – AL Wiring PWM_CM6

Cause	Corrective action
Voltage supply for NOx sensors, B-side (B88.5 + B88.6), is defective.	1. Check engine cabling (→ Page 135). 2. Contact Service.

609 – AL Wiring PWM_CM7

Cause	Corrective action
Voltage supply B93 for oil level is defective.	1. Check engine cabling (→ Page 135). 2. Contact Service.

615 – AL EIL Protection

Cause	Corrective action
Engine number in EIL (A19) does not match engine number stored in ECU.	1. Check engine cabling (→ Page 135). 2. Contact Service.

616 – AL EIL Fault

Cause	Corrective action
ECU can not detect EIL (A19).	▶ Contact Service.

626 – AL Wiring PWM_CM8

Cause	Corrective action
Disruption or short circuit in the power supply wiring for the A side supply unit (AG5.1).	1. Check engine cabling (→ Page 135). 2. Contact Service.

627 – AL Wiring PWM_CM9

Cause	Corrective action
Disruption or short circuit in the power supply wiring for the B side supply unit (AG5.2)	1. Check engine cabling (→ Page 135). 2. Contact Service.

628 – AL Wiring PWM_CM10

Cause	Corrective action
Disruption or short circuit in the wiring for solenoid valve water tank heating (MB47)	1. Check engine cabling (→ Page 135). 2. Contact Service.

636 – SD Level Lube Oil J1939

Cause	Corrective action
The combined oil temperature and level sensor (B93) delivers incorrect or no level signal.	1. Check engine cabling (→ Page 135). 2. Contact Service.

637 – SD T-Lube Oil Pan J1939

Cause	Corrective action
The combined oil temperature and level sensor (B93) delivers incorrect or no level signal.	1. Check engine cabling (→ Page 135). 2. Contact Service.

748 – AL_SD_T_Exh_SCRsys_inl_F1

Cause	Corrective action
The signal from the exhaust gas temperature sensor before SCR system flow 1 (B85.1) is faulty or missing.	1. Check engine cabling (→ Page 135). 2. Contact Service.

752 – AL_SD_Level_RA_RA_tank_1

Cause	Corrective action
The signal from the level sensor in the RA tank (B39.1) is faulty or missing.	1. Check engine cabling (→ Page 135). 2. Contact Service.

753 – AL_SD_T_RA_RA_tank

Cause	Corrective action
The signal from the temperature sensor in the RA tank (B39.1) is faulty or missing.	1. Check engine cabling (→ Page 135). 2. Contact Service.

758 – AL Urea-Water Solution Nozzle Damaged

Cause	Corrective action
The number of aborted overshoot cycles for the reducing agent pump was exceeded. Cooling for the reducing agent nozzles was inadmissibly terminated too often.	▶ Contact Service.

809 – AL F1 NOx before SCR Sensor Defect

Cause	Corrective action
The NOx sensor before the catalyst (B88.3), A-side, delivers incorrect or no signal.	1. Check engine cabling (→ Page 135). 2. Contact Service.

810 – AL F1 NOx before SCR Comm. Loss

Cause	Corrective action
The ECU can no longer detect the NOx sensor before the catalyst (B88.3), A-side, on the bus.	1. Check engine cabling (→ Page 135). 2. Contact Service.

811 – AL F1 NOx after SCR Sensor Defect

Cause	Corrective action
The NOx sensor after the catalyst (B88.4), A-side, delivers incorrect or no signal.	1. Check engine cabling (→ Page 135). 2. Contact Service.

812 – AL F1 NOx after SCR Comm. Loss

Cause	Corrective action
The ECU can no longer detect the NOx sensor after the catalyst (B88.4), A-side, on the bus.	1. Check engine cabling (→ Page 135). 2. Contact Service.

813 – AL F2 NOx before SCR Sensor Defect

Cause	Corrective action
The ECU can no longer detect the NOx sensor after the catalyst (B88.4), A-side, on the bus.	1. Check engine cabling (→ Page 135). 2. Contact Service.

814 – AL F2 NOx before SCR Comm. Loss

Cause	Corrective action
The ECU can no longer detect the NOx sensor before the catalyst (B88.5), B-side, on the bus.	1. Check engine cabling (→ Page 135). 2. Contact Service.

815 – AL F2 NOx after SCR Sensor Defect

Cause	Corrective action
The NOx sensor after the catalyst (B88.6), B-side, delivers incorrect or no signal.	1. Check engine cabling (→ Page 135). 2. Contact Service.

816 – AL F2 NOx after SCR Comm. Loss

Cause	Corrective action
The ECU can no longer detect the NOx sensor after the catalyst (B88.6), B-side, on the bus.	1. Check engine cabling (→ Page 135). 2. Contact Service.

832 – AL EIL Engine Number Different

Cause	Corrective action
Engine number in EIL (A19) does not match engine number stored in ECU.	1. Check engine cabling (→ Page 135). 2. Contact Service.

851 – AL External Start and HP too high

Cause	Corrective action
On starting the engine, but before the starter engages, the pressure in the HP accumulator measured at sensors B48.1 A side and/or B48.2 B side exceeds the limit value.	▶ Allow blankshot functionality (pressure relief in the HP fuel system) to be completed after engine stop. Wait at least 2 minutes before switching off the ignition after engine stop.

852 – AL Max. Blankshot Time Elapsed

Cause	Corrective action
Alarm is generated with the engine stationary if the pressure in the HP accumulator could not be released within the specified time.	▶ Contact Service.

853 – AL HSB1 Communication Loss

Cause	Corrective action
The ECU can no longer detect heating control box 1 (AG5.5) on the bus.	1. Check engine cabling (→ Page 135). 2. Contact Service.

854 – AL HSB1 Actuator Defect

Cause	Corrective action
Internal equipment error of heating control box 1 (AG5.5).	1. Check engine cabling (→ Page 135). 2. Contact Service.

873 – AL Urea Tank Empty

Cause	Corrective action
The level in the RA tank measured at sensor B39, B39.1 or B39.2 has violated the lower limit value.	1. Fill reducing agent . 2. Contact Service.

882 – AL SCR F1 SU Speed Range

Cause	Corrective action
The speed of the pump in the RA supply unit on the A side (AG5.1) has violated the min./max. limit values for longer than the set time. The pump can not maintain its setpoint speed.	▶ Contact Service.

883 – AL SCR F2 SU Speed Range

Cause	Corrective action
The speed of the pump in the RA supply unit on the B side (AG5.2) has violated the min./max. limit values for longer than the set time. The pump can not maintain its setpoint speed.	▶ Contact Service.

884 – AL SCR F1 SU AdBlue Quantity

Cause	Corrective action
The actual reducing agent quantity for the A side (AG5.1) deviates from the set quantity.	▶ Contact Service.

885 – AL SCR F2 SU AdBlue Quantity

Cause	Corrective action
The actual reducing agent quantity for the B side (AG5.2) deviates from the set quantity.	▶ Contact Service.

886 – AL SCR AdBlue Pressure F1

Cause	Corrective action
The pressure measured by the internal pressure sensors of the dosing units on the A and/or B side (AG5.1/AG5.2) has violated the internal upper/lower limit values for longer than the set time.	▶ Contact Service.

888 – AL SCR SU AdBlue Pressure

Cause	Corrective action
The pressure measured by the internal pressure sensors of the dosing units on the A and/or B side (AG5.1/AG5.2) has violated the internal upper/lower limit values of the supply unit.	▶ Contact Service.

892 – AL Flood 1 Supp. Unit 1 Comm. Loss

Cause	Corrective action
The ECU can no longer detect the A side supply unit (AG5.1).	1. Check engine cabling (→ Page 135). 2. Contact Service.

894 – AL Flood 2 Supp. Unit 1 Comm. Loss

Cause	Corrective action
The ECU can no longer detect the B side supply unit (AG5.2).	1. Check engine cabling (→ Page 135). 2. Contact Service.

899 – AL OLT Communication Lost

Cause	Corrective action
The ECU can no longer detect the J1939 combined oil temperature and level sensor B93 on the bus.	1. Check engine cabling (→ Page 135). 2. Contact Service.

902 – HI T-Coolant Cylinder Head

Cause	Corrective action
The coolant temperature at sensor B6.3 has exceeded limit value 1. Coolant temperature too high.	1. Reduce power. 2. Check sensor B6.3, replace as necessary. 3. Contact Service.

904 – SS T-Coolant Cylinder Head

Cause	Corrective action
The coolant temperature at sensor B6.3 has exceeded limit value 2. Coolant temperature too high.	1. Reduce power. 2. Check sensor B6.3, replace as necessary. 3. Contact Service.

920 – AL_HI1_T_Exh_SCRsys_inl_F1

Cause	Corrective action
The exhaust gas temperature before SCR inlet 1 / flow 1 at sensor B85.1 has violated limit value 1. Exhaust gas temperature too high.	1. Reduce power. 2. Contact Service.

921 – AL_HI2_T_Exh_SCRsys_inl_F1

Cause	Corrective action
The exhaust gas temperature before SCR inlet 1 / flow 1 at sensor B85.1 has violated limit value 2. Exhaust gas temperature too high.	1. Reduce power. 2. Contact Service.

922 – AL_HI1_T_Exh_SCRsys_outl_F1

Cause	Corrective action
The exhaust gas temperature after SCR outlet 1 / flow 1 at sensor B85.2 has violated limit value 1. Exhaust gas temperature too high.	1. Reduce power. 2. Contact Service.

923 – AL_HI2_T_Exh_SCRsys_outl_F1

Cause	Corrective action
The exhaust gas temperature after SCR outlet 1 / flow 1 at sensor B85.2 has violated limit value 2. Exhaust gas temperature too high.	1. Reduce power. 2. Contact Service.

924 – AL_HI1_T_Exh_SCRsys_inl_F2

Cause	Corrective action
The exhaust gas temperature before SCR inlet 2 / flow 2 at sensor B85.3 has violated limit value 1. Exhaust gas temperature too high.	1. Reduce power. 2. Contact Service.

925 – AL_HI2_T_Exh_SCRsys_inl_F2

Cause	Corrective action
The exhaust gas temperature before SCR inlet 2 / flow 2 at sensor B85.3 has violated limit value 2. Exhaust gas temperature too high.	1. Reduce power. 2. Contact Service.

926 – AL_HI1_T_Exh_SCRsys_outl_F2

Cause	Corrective action
The exhaust gas temperature after SCR outlet 2 / flow 2 at sensor B85.4 has violated limit value 1. Exhaust gas temperature too high.	1. Reduce power. 2. Contact Service.

927 – AL_HI2_T_Exh_SCRsys_outl_F2

Cause	Corrective action
The exhaust gas temperature after SCR outlet 2 / flow 2 at sensor B85.4 has violated limit value 2. Exhaust gas temperature too high.	1. Reduce power. 2. Contact Service.

941 – AL SCR Operating Temp. too low

Cause	Corrective action
The ambient air temperature at sensor B82 or the temperature in one of the dosing units (AG5.1/ AG5.2) have undershot the limit value. Engine start is blocked or the engine is shut down.	1. Check sensor B82, replace as necessary. 2. Check dosing units, replace if necessary. 3. Contact Service.

942 – AL_LO1_NOx_conversion_SCRsys_F1

Cause	Corrective action
The aging adjuster for the NOx setpoint value integrated in the ECU logic has reached the limit value. Perfect operation of the catalyst on the A-side is no longer guaranteed.	▶ Contact Service.

943 – AL_LO1_NOx_conversion_SCRsys_F2

Cause	Corrective action
The aging adjuster for the NOx setpoint value integrated in the ECU logic has reached the limit value. Perfect operation of the catalyst on the B-side is no longer guaranteed.	▶ Contact Service.

950 – AL SCR SU Fault F1

Cause	Corrective action
The common control logic of the supply and dosing unit (AG5.1), A-side, reports a fault to the ECU.	▶ Contact Service.

965 – AL SCR SU Fault F2

Cause	Corrective action
The common control logic of the supply and dosing unit (AG5.2), B-side, reports a fault to the ECU.	▶ Contact Service.

967 – AL_SU_priming_request_revocation_F1

Cause	Corrective action
The supply unit (AG5.1), A-side, has not received a command to start up the pump in spite of activation and engine operation.	▶ Contact Service.

968 – AL_SU_priming_request_revocation_F2

Cause	Corrective action
The supply unit (AG5.2), B-side, has not received a command to start up the pump in spite of activation and engine operation.	▶ Contact Service.

973 – AL Checksum IIG

Cause	Corrective action
The entered IIG value does not correspond to the specified input format.	1. Check input of the IIG in the DiaSys and repeat if necessary. 2. Contact Service.

974 – AL CAN3 Bus Off

Cause	Corrective action
The first Engine-CAN (CAN 3) for the engine-side sensor / actuator system is interrupted or defective.	1. Check engine cabling (→ Page 135). 2. Contact Service.

975 – AL CAN3 Error Passive

Cause	Corrective action
The first Engine-CAN (CAN 3) for the engine-side sensor / actuator system is faulty.	1. Check engine cabling (→ Page 135). 2. Contact Service.

976 – AL CAN4 Bus Off

Cause	Corrective action
The second Engine-CAN (CAN 4) for the engine-side sensor / actuator system is interrupted or defective.	1. Check engine cabling (→ Page 135). 2. Contact Service.

977 – AL CAN4 Error Passive

Cause	Corrective action
The second Engine-CAN (CAN 4) for the engine-side sensor / actuator system is faulty.	1. Check engine cabling (→ Page 135). 2. Contact Service.

983 – AL Stop by Trigger CR

Cause	Corrective action
The alarm indicates that the crash recorder has been triggered and a start interlock was activated as a result.	▶ Contact Service.

1000 – SD Level Urea-Water Solution Tank B

Cause	Corrective action
The signal from the level sensor in the RA tank (B39.2) is faulty or missing.	1. Check engine cabling (→ Page 135). 2. Contact Service.

1003 – AL L1 Coolant Level

Cause	Corrective action
The level in the coolant expansion tank at sensor F33 has undershot limit value 1.	1. Fill with engine coolant (→ Page 123). 2. Contact Service.

1004 – AL L2 Coolant Level

Cause	Corrective action
The level in the coolant expansion tank at sensor F33 has undershot limit value 2.	1. Fill with engine coolant (→ Page 123). 2. Contact Service.

1005 – AL L1 Hydraulic Oil Level

Cause	Corrective action
The level in hydraulic oil expansion tank at sensor B104 has undershot limit value 1.	1. Fill hydraulic system with oil . 2. Contact Service.

1006 – AL L2 Hydraulic Oil Level

Cause	Corrective action
The level in hydraulic oil expansion tank at sensor B104 has undershot limit value 2.	1. Fill hydraulic system with oil . 2. Contact Service.

1009 – SD Level Air Filter Clogging

Cause	Corrective action
The intake air depression switch (B81.3) delivers incorrect or no signal.	1. Check engine cabling (→ Page 135). 2. Contact Service.

1010 – AL_HI1_Level_Air_Filter_Clogging

Cause	Corrective action
The intake depression at switch B81.3 is too high.	1. Fit new air filters. 2. Contact Service.

1011 – AL Urea Tank Low

Cause	Corrective action
The level in the RA tank measured at sensor B39, B39.1 or B39.2 has violated the lower limit value. The level is too low.	1. Fill reducing agent . 2. Contact Service.

1018 – AL_RA_consumption_plausibility_F1

Cause	Corrective action
The consumption of reducing agent measured at the A side dosing unit (AG5.1) is out of the specified range.	▶ Contact Service.

1019 – AL_RA_balance_plausibility_F1

Cause	Corrective action
The ratio between NOx reduction and the reducing agent quantity injected on the A side is below the stored range.	▶ Contact Service.

1020 – AL_c_NOx_raw_gas_expected_F1

Cause	Corrective action
The nitric oxide emissions at sensor B88.3 before the catalyst, A-side, deviate impermissibly from the expected value.	1. Check sensor B88.3 and replace as necessary. 2. Contact Service.

1021 – AL_c_NOx_inl_outl_approach_F1

Cause	Corrective action
The nitric oxide emissions at sensor B88.4 deviate from the nitric oxide emissions measured at sensor B88.3.	1. Check sensors B88.3 and B88.4 and replace as necessary. 2. Contact Service.

1022 – AL T Exhaust Gas before SCR between F1 and F2

Cause	Corrective action
The difference in exhaust gas temperature before catalyst between sensor B85.1, A-side, and sensor B85.3, B-side, deviates by more than the saved maximum value for longer than the saved delay time.	1. Check sensors B85.1 (A side) and B85.3 (B side) and replace as necessary. 2. Contact Service.

1023 – AL T Exhaust Gas after SCR between F12 and F2

Cause	Corrective action
The difference in exhaust gas temperature before catalyst between sensor B85.2, A-side, and sensor B85.4, B-side, deviates by more than the saved maximum value for longer than the saved delay time.	1. Check sensors B85.2 (A side) and B85.4 (B side) and replace as necessary. 2. Contact Service.

1027 – AL Engine Cold Active

Cause	Corrective action
If one of the temperature measured values is below the defined limit values, this fault is issued and the "Engine Cold" function is started.	1. Switch on preheater. 2. Check preheater and overhaul if necessary (see manufacturer's documentation). 3. Contact Service.

1028 – AL_Exp_T_Exh_SCRsys_inl_F1

Cause	Corrective action
The exhaust gas temperature before catalyst, A-side, at sensor B85.1 deviates from the saved value and saved time.	1. Check sensor B85.1 (A side) and replace as necessary. 2. Contact Service.

1072 – AL_Exp_T_Exh_SCRsys_outl_F1

Cause	Corrective action
The exhaust gas temperature after catalyst, A-side, at sensor B85.2 increased by more than the saved temperature gradient. The rate of the temperature increase is not plausible.	1. Check sensor B85.2 (A side) and replace as necessary. 2. Contact Service.

1073 – AL_HI1_gradient_T_Exh_SCR_inl_F1

Cause	Corrective action
The exhaust gas temperature before catalyst, A-side, at sensor B85.1 increased by more than the saved temperature gradient. The rate of the temperature increase is not plausible.	1. Check sensor B85.1 (A side) and replace as necessary. 2. Contact Service.

1074 – AL_HI1_gradient_T_Exh_SCR_outl_F1

Cause	Corrective action
The exhaust gas temperature after catalyst, A-side, at sensor B85.2 increased by more than the saved temperature gradient. The rate of the temperature increase is not plausible.	1. Check sensor B85.2 (A side) and replace as necessary. 2. Contact Service.

1075 – AL_HI1_T_RA_SUDU_F1

Cause	Corrective action
The temperature of the reducing agent measured at the A side dosing unit (AG5.1) has violated the upper limit value. The temperature of the reducing agent is too high.	▶ Contact Service.

1076 – AL F1 T-Exh. Gas before SCR too low

Cause	Corrective action
The exhaust gas temperature before catalyst, A-side, at sensor B85.1 has undershot the limit temperature.	1. Check sensor B85.1 (A side) and replace as necessary. 2. Contact Service.

1077 – AL F1 T-Exh. Gas after SCR too low

Cause	Corrective action
The exhaust gas temperature after catalyst, A-side, at sensor B85.2 has undershot the limit temperature.	1. Check sensor B85.2 (A side) and replace as necessary. 2. Contact Service.

1078 – AL_RA_consumption_plausibility_F2

Cause	Corrective action
The consumption of in the reducing agent measured at the B side dosing unit (AG5.2) is out of the specified range.	▶ Contact Service.

1079 – AL_RA_balance_plausibility_F2

Cause	Corrective action
The ratio between NOx reduction and the quantity of reducing agent injected in flow 2 has violated the lower range setting.	▶ Contact Service.

1080 – AL_c_NOx_raw_gas_expected_F2

Cause	Corrective action
The nitric oxide emissions at sensor B88.5 before the catalyst, B-side, deviate impermissibly from the expected value.	1. Check sensor B88.5 and replace as necessary. 2. Contact Service.

1081 – AL_c_NOx_inl_outl_approach_F2

Cause	Corrective action
The nitric oxide emissions at sensor B88.5 deviate from the nitric oxide emissions at sensor B88.6.	1. Check sensors B88.5 and B88.6 and replace as necessary. 2. Contact Service.

1082 – AL_Exp_T_Exh_SCRsys_inl_F2

Cause	Corrective action
The exhaust gas temperature before catalyst, B-side, at sensor B85.3 deviates from the saved value and saved time.	1. Check sensor B85.3 and replace as necessary. 2. Contact Service.

1083 – AL_Exp_T_Exh_SCRsys_outl_F2

Cause	Corrective action
The exhaust gas temperature after catalyst, B-side, at sensor B85.4 deviates from the saved value and saved time.	1. Check sensor B85.4 (B side) and replace as necessary. 2. Contact Service.

1084 – AL_HI1_gradient_T_Exh_SCR_inl_F2

Cause	Corrective action
The exhaust gas temperature before catalyst, B-side, at sensor B85.3 increased by more than the saved temperature gradient. The rate of the temperature increase is not plausible.	1. Check sensor B85.3 and replace as necessary. 2. Contact Service.

1085 – AL_HI1_gradient_T_Exh_SCR_outl_F2

Cause	Corrective action
The exhaust gas temperature after catalyst, B-side, at sensor B85.4 increased by more than the saved temperature gradient. The rate of the temperature increase is not plausible.	1. Check sensor B85.4 (B side) and replace as necessary. 2. Contact Service.

1086 – AL_HI1_T_RA_SUDU_F2

Cause	Corrective action
The temperature of the reducing agent measured at the B side dosing unit (AG5.2) has violated the upper limit value. The temperature of the reducing agent is too high.	▶ Contact Service.

1087 – AL F2 T-Exh. Gas before SCR too low

Cause	Corrective action
The exhaust gas temperature before catalyst, B-side, at sensor B85.3 has undershot the limit temperature.	1. Check sensor B85.3 and replace as necessary. 2. Contact Service.

1088 – AL F2 T-Exh. Gas after SCR too low

Cause	Corrective action
The exhaust gas temperature before catalyst, B-side, at sensor B85.4 has undershot the limit temperature.	1. Check sensor B85.4 (B side) and replace as necessary. 2. Contact Service.

1089 – AL Oil Niveau Too High

Cause	Corrective action
The lube oil level measured by sensor B93 with the engine at standstill violates the upper limit value. The lube oil level was/is too high.	1. Check engine oil level and drain oil as required. 2. Contact Service.

1090 – AL Oil Niveau Too Low

Cause	Corrective action
The lube oil level measured by sensor B93 with the engine at standstill violates the lower limit value. The lube oil level is/was too low.	1. Check engine visually for oil leak. 2. Check oil level and top up if necessary. 3. Contact Service.

1091 – AL Oil Niveau Far Too Low

Cause	Corrective action
The lube oil level measured by sensor B93 with the engine at standstill violates the lower limit value. The lube oil level is/was far too low.	1. Check engine visually for oil leak. 2. Check oil level and top up if necessary. 3. Contact Service.

1094 – AL Urea-Water Solution Tank Temperature SD

Cause	Corrective action
The signal from the temperature sensor in the RA tank (B39.1) is faulty or missing.	1. Check engine cabling (→ Page 135). 2. Contact Service.

1095 – AL Coolant Valve Defect (Urea-Water Solution)

Cause	Corrective action
The temperature of the reducing agent in the tank does not increase although the engine coolant valve (MB47) was activated. The heating device is faulty.	1. Check engine cabling (→ Page 135). 2. Contact Service.

1117 – SD-T-Hydraulic Oil

Cause	Corrective action
The temperature sensor (B104) for the hydraulic oil of the fan drive delivers an incorrect or no signal.	1. Check engine cabling (→ Page 135). 2. Contact Service.

1118 – AL L1 T Hydraulic Oil

Cause	Corrective action
The hydraulic oil temperature at sensor B104 has exceeded limit value 1. The hydraulic oil temperature has increased.	1. Check sensor B104 and replace as necessary. 2. Contact Service.

1119 – AL L2 T Hydraulic Oil

Cause	Corrective action
The hydraulic oil temperature at sensor B104 has exceeded limit value 2. The hydraulic oil temperature is too high.	1. Check sensor B104 and replace as necessary. 2. Contact Service.

1130 – AL Short Circuit Analog Output 1

Cause	Corrective action
Incorrect value on plant side at analog output 1 (e.g. moving-coil instrument, output signal for fan control in HT circuit)	▶ Contact Service.

1131 – AL Short Circuit Analog Output 2

Cause	Corrective action
Incorrect value on plant side at analog output 2 (e.g. moving-coil instrument, output signal for fan control in LT circuit)	▶ Contact Service.

1157 – AL_RA_post_cooling_aborted

Cause	Corrective action
The automatic RA circulation was terminated. Power supply is disconnected.	▶ Check engine cabling (→ Page 135).

1178 – AL J1939 Heartbeat1 Lost

Cause	Corrective action
No message via J1939 plant bus (CAN2).	▶ Contact Service.

1179 – AL J1939 Heartbeat2 Lost

Cause	Corrective action
No message via J1939 plant bus (CAN2).	▶ Contact Service.

1183 – AL Invalid Measurement Config

Cause	Corrective action
Selected measuring point not activated or configured incorrectly.	▶ Contact Service.

1184 – AL HLT Sensor Communication Lost

Cause	Corrective action
The ECU can no longer detect the combined hydraulic oil level and temperature sensor (B104) on the Engine CANBus (J1939).	1. Check engine cabling (→ Page 135). 2. Check sensor B104 and replace as necessary. 3. Contact Service.

1185 – SD Level Hydraulic Oil J1939

Cause	Corrective action
The signal from the combined hydraulic oil level and temperature sensor (B104) connected to the Engine CANBus (J1939) is faulty or missing.	1. Check engine cabling (→ Page 135). 2. Contact Service.

1207 – SD T-Hydraulic Oil J1939

Cause	Corrective action
The signal from the combined hydraulic oil level and temperature sensor (B104) connected to the Engine CANBus (J1939) is faulty or missing.	1. Check engine cabling (→ Page 135). 2. Contact Service.

1315 – AL_RA_line_feed_DU1_defect

Cause	Corrective action
Heating of RA line “Flow 1 supply unit / dosing unit 1 supply” is faulty.	1. Check component(s) and wiring, replace as necessary. 2. Contact Service.

1326 – AL_RA_line_feed_DU4_defect

Cause	Corrective action
Heating of RA hose “Flow 2 supply unit / dosing unit 1 supply” is faulty.	1. Check component(s) and wiring, replace as necessary. 2. Contact Service.

1349 – AL_RA_line_feed_RA_tank_1_1_defect

Cause	Corrective action
Heating of supply line from reducing agent tank is faulty.	1. Check engine cabling (→ Page 135). 2. Check component, replace as necessary. 3. Contact Service.

1350 – AL_RA_line_return_RA_tank_1_2_defec

Cause	Corrective action
Heating of return line to reducing agent tank is faulty.	1. Check engine cabling (→ Page 135). 2. Check component, replace as necessary. 3. Contact Service.

1370 – SD P-HD Constant Value

Cause	Corrective action
The ECU has not detected any variation in pressure at HP fuel sensor on A side (B48.1). HP fuel sensor B48 1 is defective.	▶ Contact Service.

1371 – SD P-HD Constant Value

Cause	Corrective action
The ECU has not detected any variation in pressure at HP fuel sensor on B side (B48.2). HP fuel sensor on B side B48.2 is defective.	▶ Contact Service.

1442 – AL Emergency Stop Active

Cause	Corrective action
The engine was shut down by an emergency stop	▶ Contact Service.

1446 – AL_SD_T_Exh_SCRsys_inl_F2

Cause	Corrective action
The signal from the exhaust gas temperature sensor before SCR system flow 2 (B85.3) is faulty or missing.	1. Check engine cabling (→ Page 135). 2. Check engine cabling (→ Page 135). 3. Contact Service. 4. Contact Service.

1461 – AL_SD_T_Exh_SCRsys_outl_F2

Cause	Corrective action
The signal from the exhaust gas temperature sensor after SCR system flow 2 (B85.4) is faulty or missing.	1. Check engine cabling (→ Page 135). 2. Contact Service.

1462 – AL_SD_T_Exh_SCRsys_outl_F1

Cause	Corrective action
The signal from the exhaust gas temperature sensor after SCR system flow 1 (B85.2) is faulty or missing.	1. Check engine cabling (→ Page 135). 2. Contact Service.

1477 – AL_SD_NOx_EGAT_inl_F1

Cause	Corrective action
The signal from the NOx sensor before SCR inlet 1 / flow 1 (B88.3) is faulty or missing.	1. Check engine cabling (→ Page 135). 2. Contact Service.

1478 – AL_CommLost_NOx_EGAT_inl_F1

Cause	Corrective action
The ECU can no longer detect the NOx sensor before SCR inlet 1 / flow 1 (B88.3) on the CAN bus.	1. Check engine cabling (→ Page 135). 2. Contact Service.

1479 – AL_SD_NOx_EGAT_inl_F2

Cause	Corrective action
The signal from the NOx sensor before SCR inlet 2 / flow 2 (B88.5) is faulty or missing.	1. Check engine cabling (→ Page 135). 2. Contact Service.

1480 – AL_CommLost_NOx_EGAT_inl_F2

Cause	Corrective action
The ECU can no longer detect the NOx sensor before SCR inlet 2 / flow 2 (B88.5) on the CAN bus.	1. Check engine cabling (→ Page 135). 2. Contact Service.

1483 – AL_SD_NOx_EGAT_outl_F1

Cause	Corrective action
The signal from the NOx sensor after SCR outlet 1 / flow 1 (B88.4) is faulty or missing.	1. Check engine cabling (→ Page 135). 2. Contact Service.

1484 – AL_CommLost_NOx_EGAT_outl_F1

Cause	Corrective action
The ECU can no longer detect the NOx sensor after the SCR outlet 1 / flow 1 (B88.4) on the CAN bus.	1. Check engine cabling (→ Page 135). 2. Contact Service.

1485 – AL_SD_NOx_EGAT_outl_F2

Cause	Corrective action
The signal from the NOx sensor after SCR outlet 2 / flow 2 (B88.6) is faulty or missing.	1. Check engine cabling (→ Page 135). 2. Contact Service.

1486 – AL_CommLost_NOx_EGAT_outl_F2

Cause	Corrective action
The ECU can no longer detect the NOx sensor after the SCR outlet 2 / flow 2 (B88.6) on the CAN bus.	1. Check engine cabling (→ Page 135). 2. Contact Service.

1489 – AL_CommLost_SUDU1

Cause	Corrective action
The ECU can no longer detect supply unit / dosing unit 1 (A5.1/ A5.2, flow 1) of the SCR system on the CAN bus.	1. Check component(s) and wiring, replace as necessary. 2. Contact Service.

1490 – AL_dosing_unit_defect_DU1

Cause	Corrective action
Supply unit / dosing unit 1 (A5.1/ A5.2, flow 1) of the SCR system has signaled an internal fault via component CAN bus 4.	▶ Check component(s) and wiring, replace as necessary.

1492 – AL_CommLost_SUDU2

Cause	Corrective action
The ECU can no longer detect supply unit / dosing unit 2 (A5.3/ A5.4, flow 2) of the SCR system on the CAN bus.	1. Check component(s) and wiring, replace as necessary. 2. Contact Service.

1493 – AL_dosing_unit_defect_DU2

Cause	Corrective action
Supply unit / dosing unit 2 (A5.3/ A5.4, flow 2) of the SCR system has signaled an internal fault via component CAN bus 5.	1. Check component(s) and wiring, replace as necessary. 2. Contact Service.

1569 – AL_HI1_number_hot_shutdowns_RA_sys

Cause	Corrective action
The admissible number of “ECU shutdown before completing cool down” events has been exceeded in one of the flows.	▶ Contact Service.

1570 – AL_RA_line_feed_RA_tank_2_1_defect

Cause	Corrective action
Heating of supply line from reducing agent tank is faulty.	▶ Check engine cabling (→ Page 135).

1576 – AL_HI1_mt_RA_deviation

Cause	Corrective action
The actual reducing agent mass flow has exceeded the requested nominal reducing agent mass flow.	▶ Contact Service.

1577 – AL_LO1_mt_RA_deviation

Cause	Corrective action
The actual reducing agent mass flow has fallen below the requested nominal reducing agent mass flow.	▶ Contact Service.

1578 – AL_LO2_mt_RA_deviation

Cause	Corrective action
The actual reducing agent mass flow has fallen below the requested nominal reducing agent mass flow.	▶ Contact Service.

1590 – AL_RA_line_return_RA_tank_2_2_defec

Cause	Corrective action
Heating of return line to reducing agent tank is faulty.	▶ Check engine cabling (→ Page 135).

1592 – AL J1939 AddressClaiming Conflict

Cause	Corrective action
There is another node in the J1939 plant CAN which claims the same SourceAddress as the ECU and the name of which has a higher priority than the ECU. Result: The J1939 plant CAN does no longer transmit anything from the ECU.	▶ Contact Service.

1594 – AL L1 P-HD Injection

Cause	Corrective action
This alarm is output if the rail pressure on A side exceeds the value defined in PR 1.1300.381 more often than the frequency defined in PR 1.1300.384.	1. If ECU cooling is connected, check flow. 2. Check whether alarms 9 and/or 10 are active. 3. Check whether alarms 82 and/or 83 are active. 4. Contact Service.

1595 – AL L2 P-HD Injection

Cause	Corrective action
This alarm is output if the rail pressure on A side exceeds the value defined in PR 1.1300.381 more often than the frequency defined in PR 1.1300.385.	1. Check whether alarms 82 and/or 83 are active. 2. Contact Service.

1596 – AL L1 P-HD Injection 2

Cause	Corrective action
This alarm is output if the rail pressure on B side exceeds the value defined in PR 1.1300.381 more often than the frequency defined in PR 1.1300.384.	1. Contact Service. 2. Check whether alarms 82 and/or 83 are active.

1597 – AL L2 P-HD Injection 2

Cause	Corrective action
This alarm is output if the rail pressure on B side exceeds the value defined in PR 1.1300.381 more often than the frequency defined in PR 1.1300.385.	1. Check whether alarms 82 and/or 83 are active. 2. Contact Service.

1700 – AL_supply_unit_defect_SU1

Cause	Corrective action
The OBD system of RA dosing system 1 has signaled one or more fault states in the supply unit. The fault may lead to dosing / circulation cooling failure.	▶ Contact Service.

1703 – AL_hydraulics_fault_SUDU1

Cause	Corrective action
The OBD system of RA dosing system 1 has signaled one or more hydraulic fault states. The fault may lead to dosing / circulation cooling failure.	▶ Contact Service.

1704 – AL_supply_unit_defect_SU2

Cause	Corrective action
The OBD system of RA dosing system 2 has signaled one or more fault states in the supply unit. The fault may lead to dosing / circulation cooling failure.	▶ Contact Service.

1705 – AL_hydraulics_fault_SUDU2

Cause	Corrective action
The OBD system of RA dosing system 2 has signaled one or more hydraulic fault states. The fault may lead to dosing / circulation cooling failure.	▶ Contact Service.

9 Task Description

9.1 Engine

9.1.1 Engine - Barring manually

Preconditions

☑ Engine is stopped and starting disabled.

Special tools, Material, Spare parts

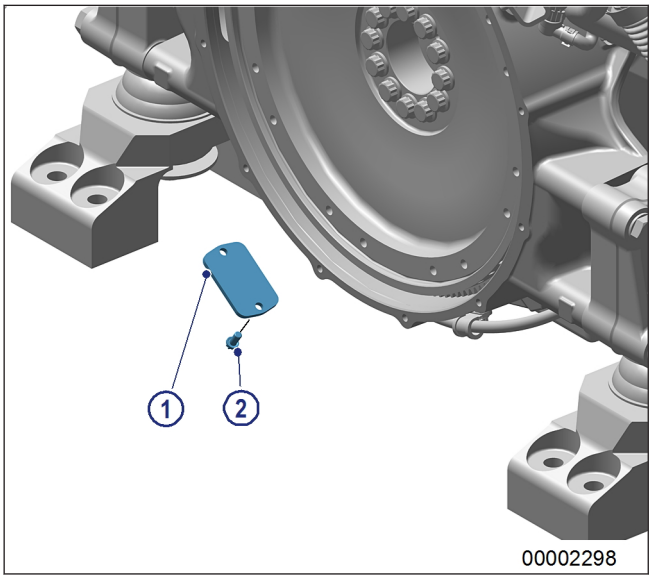
Designation / Use	Part No.	Qty.
Barring device	F6790714	1
Barring device	F6797426	1
Adapter	F30011619	1
Ratchet adapter	F30027340	1

DANGER

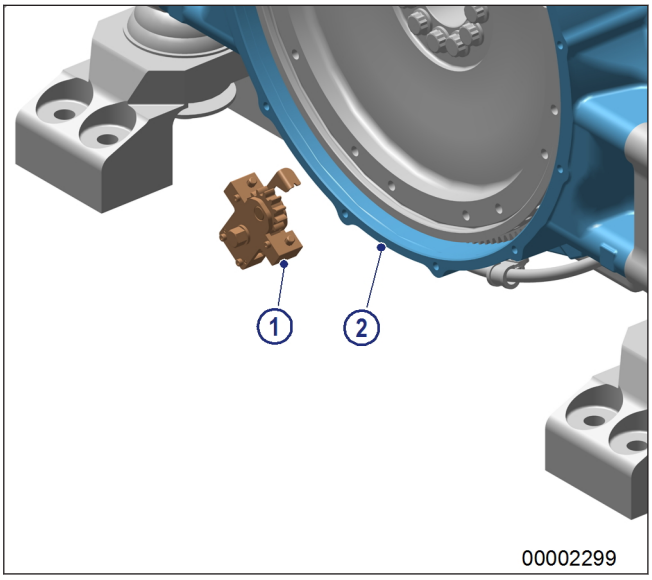
Rotating and moving engine parts.
Risk of crushing, danger of parts of the body being caught or pulled in!
- Before cranking the engine with starter system, make sure that there are no persons in the engine's danger zone.

Barring engine manually – Variant A

1. Remove screw (2) on flywheel housing.
2. Remove end cover (1).



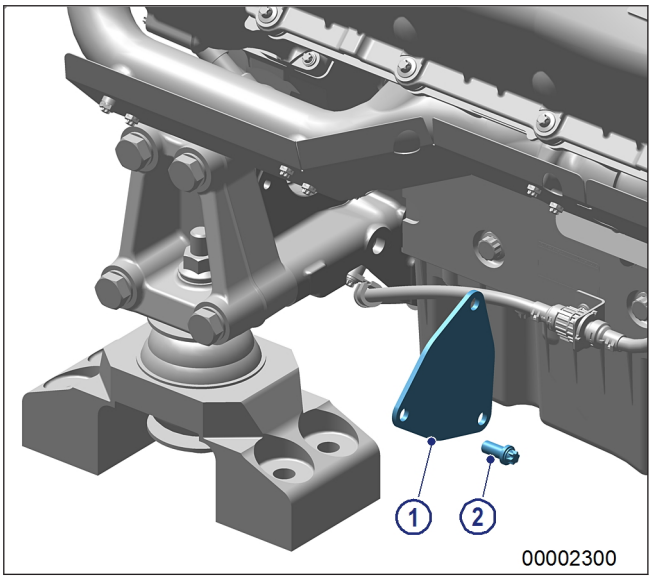
3. Engage barring device (1) in ring gear and install on flywheel housing (2).
4. Fit adapter and ratchet adapter on barring device.
5. Rotate crankshaft in engine direction of rotation. Apart from the normal compression resistance, there should be no resistance.
6. For barring device removal, follow reverse sequence of working steps.



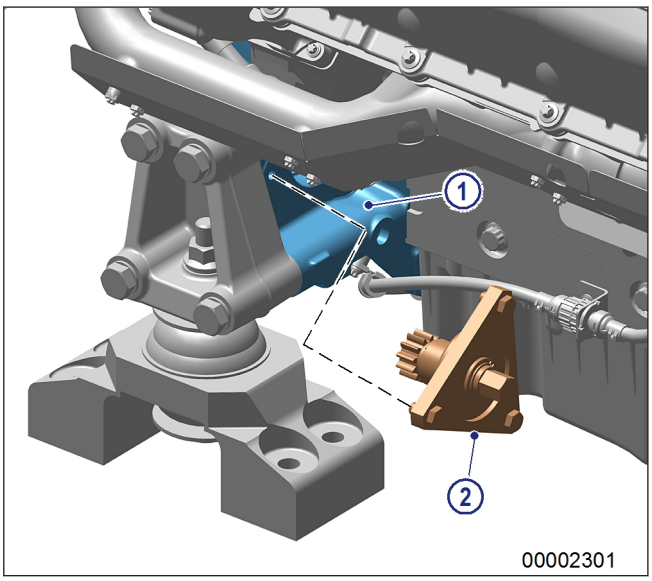
Barring engine manually – Variant B

Note: Remove starter if necessary.

1. Remove screw (2) on flywheel housing.
2. Remove end cover (1).



3. Engage barring device (2) in ring gear and install on flywheel housing (1).
4. Fit adapter and ratchet adapter on barring device.
5. Rotate crankshaft in engine direction of rotation. Apart from the normal compression resistance, there should be no resistance.
6. For barring device removal, follow reverse sequence of working steps.



9.1.2 Engine - Test run

DANGER

Components are moving or rotating.
Risk of crushing, danger of parts of the body being caught or pulled in!
- Operate the engine at low load only. Keep clear of the danger zone of the engine.

WARNING

Exhaust gases are harmful to health and may cause cancer.
Risk of poisoning and suffocation!
- Keep the engine room well-ventilated at all times.
- Repair leaking exhaust pipework immediately.

WARNING

A high level of noise is produced when the engine is running.
Risk of hearing loss!
- Wear suitable hearing protection.

Engine – Test run

1. Start engine (→ Page 41).
2. Perform test run not below 1/3 load and at least until steady-state temperature is reached.
3. Carry out operational checks (→ Page 42).
4. Stop engine (→ Page 43).

9.2 Valve Drive

9.2.1 Cylinder head cover - Removal and installation

Preconditions

☑ Engine is stopped and starting disabled.

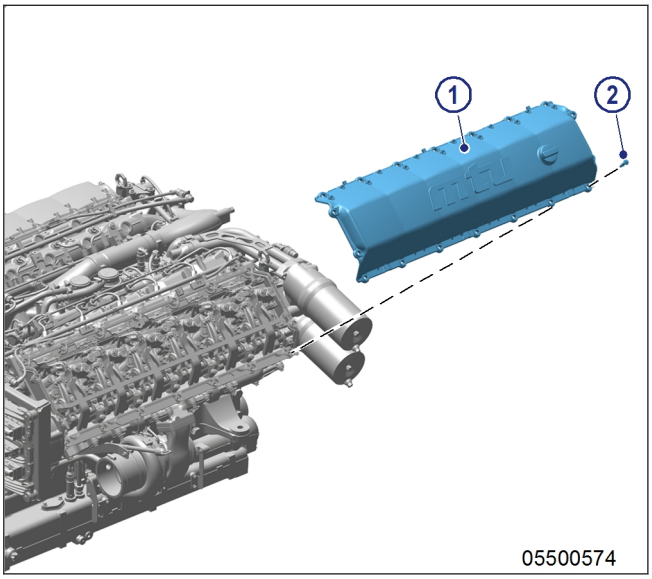
Special tools, Material, Spare parts

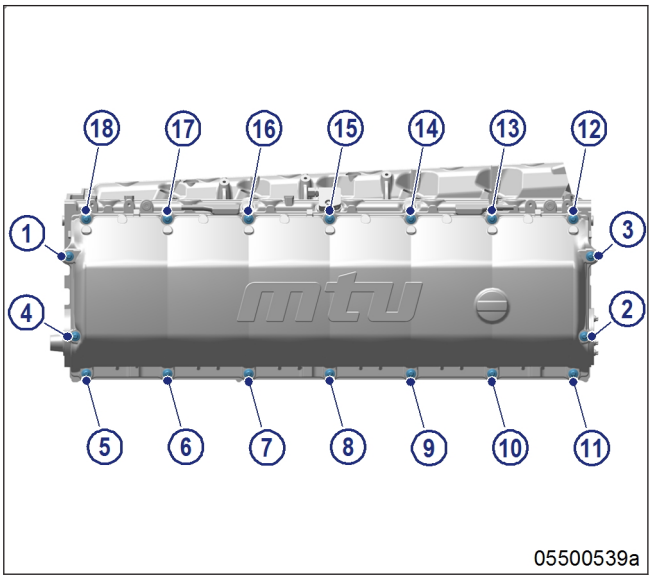
Designation / Use	Part No.	Qty.
Torque wrench, 6–50 Nm	F30027336	1
Ratchet	F30027340	1

Cylinder head cover – Removal and installation

Note: Cover the engine beneath the cylinder head with cloths to collect emerging oil.

1. Install bolts (2).
2. Remove cylinder head cover (1).
3. Clean installation surface.
4. Check condition of profile gasket and replace if required.





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5. Fit cylinder head cover and tighten screws at positions 1 to 4 to specified pretightening torque using a torque wrench.

Name	Size	Type	Lubricant	Value/Standard
Screw with twin collar	M8	Preload torque		10 Nm

6. Tighten screws at positions 1 to 18 to specified tightening torque using a torque wrench.

Name	Size	Type	Lubricant	Value/Standard
Screw with twin collar	M8	Tightening torque		20 Nm ±2 Nm

Consecutive tightening sequence starting at position 1:	1 to 18

9.2.2 Valve clearance - Check and adjustment

Preconditions

☑ Engine is stopped and starting disabled.

☑ Engine coolant temperature is max. 40 °C.

☑ Valves are closed.

Special tools, Material, Spare parts

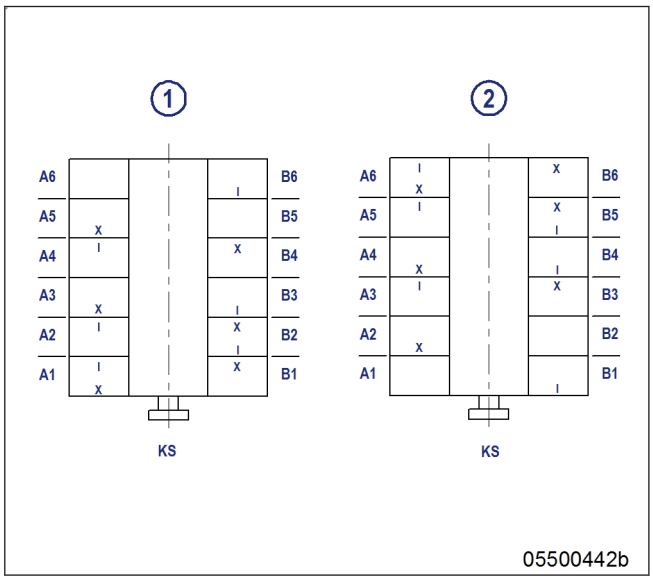
Designation / Use	Part No.	Qty.
Feeler gauge	Y20010128	1
Torque wrench, 20–100 Nm	F30026582	1
Box wrench, 14 mm	F30028346	1
Allen key, 5 mm	F30002815	1
Barring device	F6790714	1

Preparatory steps

▶ Remove cylinder head cover (→ Page 92).

Diagram for 12V engines (two crankshaft positions)

1 Cylinder A1 is in firing TDC
2 Cylinder A1 is in overlap TDC
I Inlet valve
X Exhaust valve



Checking TDC position of piston in cylinder A1 – Variant (A)

1. Install barring device, variant (A), on flywheel housing, A side bottom (→ Page 89).
2. Rotate crankshaft with barring device in engine direction of rotation until “OT-A1” mark and pointer are aligned.

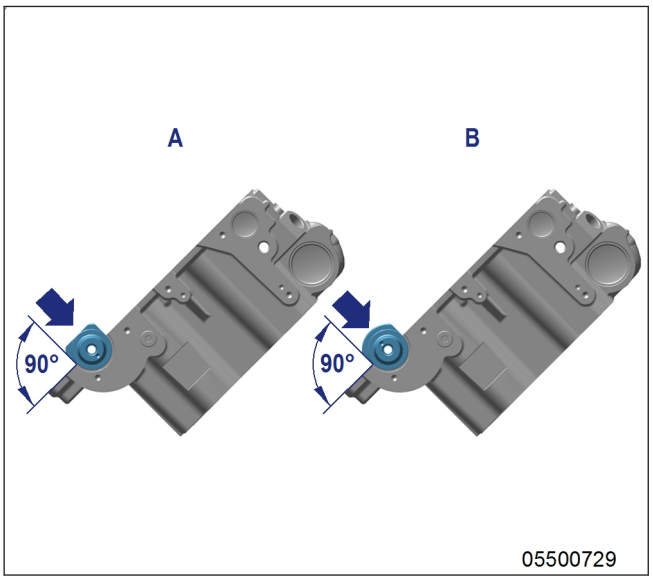
Checking valve clearance – Variant (A)

1. Check TDC position of piston in cylinder A1:
   - If rocker arms on cylinder A1 are unloaded, the piston is in firing TDC.
   - If rocker arms on cylinder A1 are loaded, the piston is in overlap TDC.
2. Check valve clearance with cold engine:
   - Inlet = 0.3 +/- 0.05 mm;
   - Exhaust = 0.6 +/- 0.05 mm.
3. Check all valve clearances in two crankshaft positions (firing TDC and overlap TDC of cylinder A1) as per diagram.
4. Use feeler gauge to determine the distance between valve bridge and rocker arm.
5. If the deviation from the reference value exceeds 0.1 mm, adjust valve clearance.

Checking TDC position of piston in cylinder A1 – Variant (B)

1. Install barring device, variant (B), on starter, B side (→ Page 89).

A Cylinder A1 is in firing TDC
B Cylinder A1 is in overlap TDC



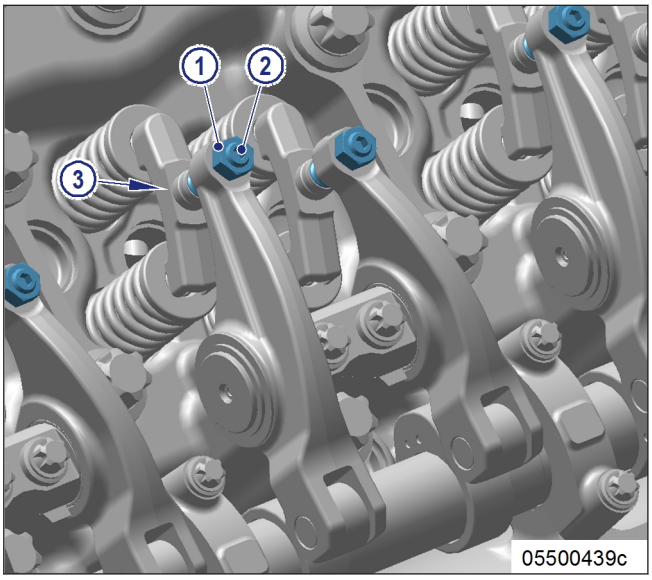
2. Bar engine manually in direction of rotation of the engine until the straight surface (arrow) points upwards and the angle between the adjustment aid and the cylinder head is 90° (Figure A).
3. Continue to turn the crankshaft until the rounded surface (arrow) points upwards and the angle between the adjustment aid and the cylinder head is 90° (Figure B).

Checking valve clearance – Variant (B)

1. Check valve clearance with cold engine:
   - Inlet = 0.3 +/- 0.05 mm;
   - Exhaust = 0.6 +/- 0.05 mm.
2. Check all valve clearances in two crankshaft positions (firing TDC and overlap TDC of cylinder A1) as per diagram.
3. Use feeler gauge to determine the distance between valve bridge and rocker arm.
4. If the deviation from the reference value exceeds 0.1 mm, adjust valve clearance.

Adjusting valve clearance

1. Loosen locknut (1) and unscrew adjusting screw (2) by a few threads.
2. Insert feeler gauge between valve bridge and rocker arm (3).
3. Readjust adjusting screw (2) so that the feeler gauge just passes through the gap.



4. Tighten locknut (1) with torque wrench to specified torque, holding adjusting screw (2) firm with Allen screw.

Name	Size	Type	Lubricant	Value/Standard
Nut	M10 x 1	Tightening torque		43 Nm +4 Nm

5. Check if the feeler gauge just passes through between valve bridge and rocker arm (3).

Result: If not, adjust valve clearance.

Final steps

1. Remove barring device (→ Page 89).
2. Install cylinder head cover (→ Page 92).

9.3 Fuel System

9.3.1 Fuel system - Venting

Preconditions

☑ Engine is stopped and starting disabled.

☑ Engine cooled down to ambient temperature.

Special tools, Material, Spare parts

Designation / Use	Part No.	Qty.
Torque wrench, 4–20 Nm	F30044239	1
Ratchet	F30027340	1

WARNING

Fuels are combustible and explosive.
Risk of fire and explosion!
- Avoid open flames, electrical sparks and ignition sources.
- Do not smoke.
- Wear protective clothing, protective gloves, and safety glasses / facial protection.

Venting fuel prefilter

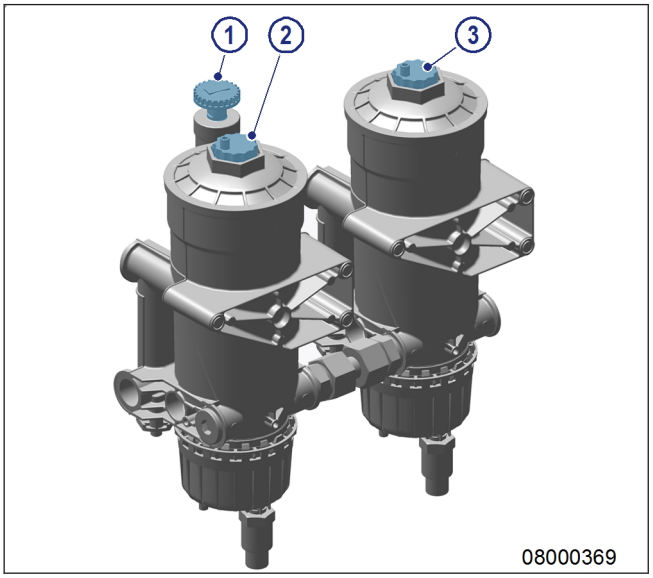
1. Unlock fuel priming pump, screw out handle (1).

Note: Catch emerging fuel with a suitable cloth.

2. Loosen vent plug (2) and screw out approx. 3 to 4 revolutions.
3. Operate the pump with the handle (1) until bubble-free fuel emerges from the vent plug (2).
4. Close vent plug (2) and tighten by hand.

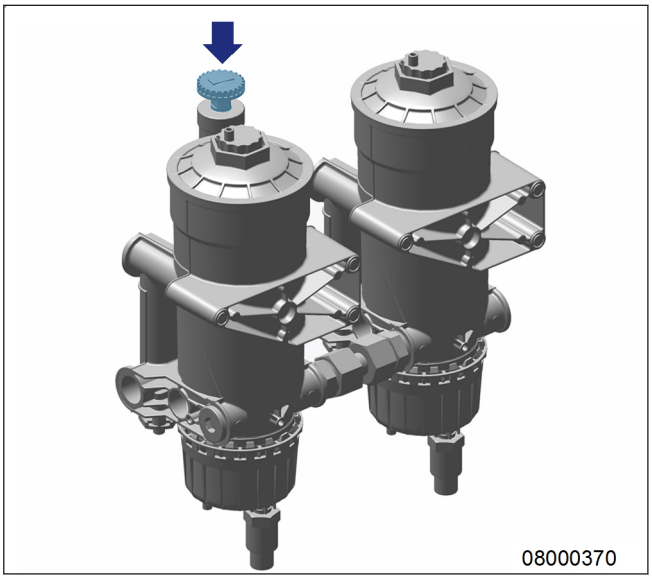
Note: Catch emerging fuel with a suitable cloth.

5. Loosen vent plugs (3) and screw out approx. 3 to 4 revolutions.
6. Operate the pump with the handle (1) until bubble-free fuel emerges from the vent plug (2).
7. Close vent plug (2) and tighten by hand.



Venting fuel filter

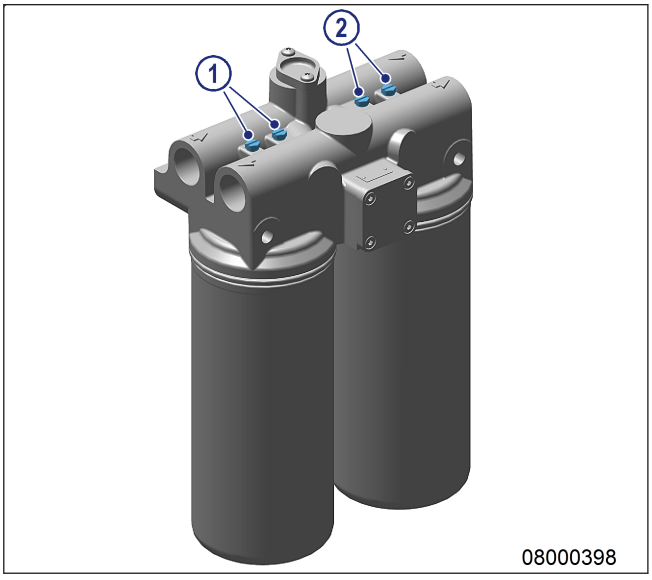
1. Unlock fuel priming pump, unscrew handle (arrow).



2. Provide a suitable container in which to collect the fuel.

Note: Do **not** screw out vent plugs.

3. Open vent plugs (1,2).
4. Operate the pump with the handle until bubble-free fuel emerges at the vent plugs (1,2).



5. Screw in vent plugs (1,2) and use torque wrench to tighten to specified tightening torque.

Name	Size	Type	Lubricant	Value/Standard
Threaded vent plug	10	Tightening torque		6.5 Nm ±1.3 Nm

9.4 Fuel Filter

9.4.1 Fuel filter - Replacement

Preconditions

☑ Engine is stopped and starting disabled.

Special tools, Material, Spare parts

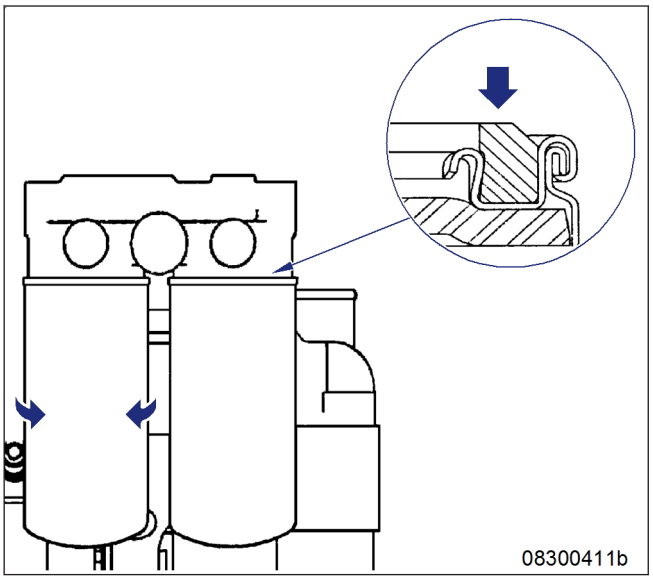
Designation / Use	Part No.	Qty.
Filter wrench	F30379104	1
Diesel fuel		
Easy-change filter	(→ Spare Parts Catalog)	

WARNING

Fuels are combustible and explosive.
Risk of fire and explosion!
- Avoid open flames, electrical sparks and ignition sources.
- Do not smoke.
- Wear protective clothing, protective gloves, and safety glasses / facial protection.

Fuel filter – Replacement

1. Remove easy-change filter using the filter wrench.
2. Clean sealing surface on filter head.
3. Check seal on new easy-change filter and moisten with fuel.
4. Fill the new easy-change filter with clean fuel.
5. Screw on easy-change filter and tighten hand-tight.
6. Replace further fuel filters in the same way.
7. Vent fuel system (→ Page 97).



9.4.2 Fuel prefilter - Draining

Preconditions

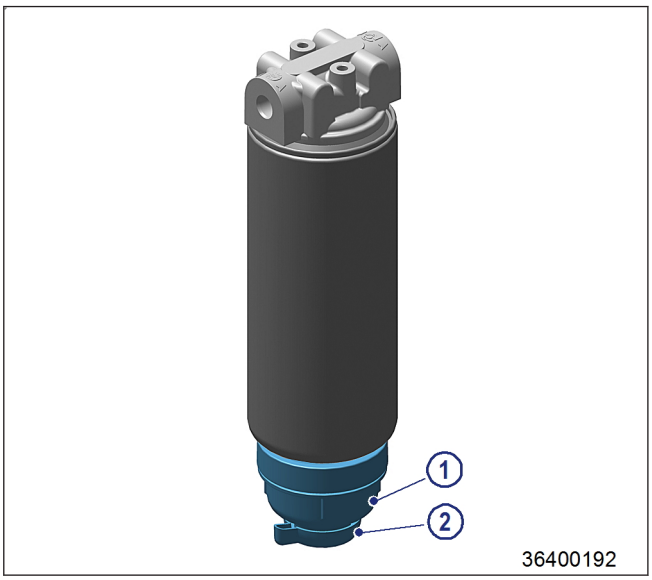
☑ Engine is stopped and starting disabled.

WARNING

Fuels are combustible and explosive.
Risk of fire and explosion!
- Avoid open flames, electrical sparks and ignition sources.
- Do not smoke.
- Wear protective clothing, protective gloves, and safety glasses / facial protection.

Fuel prefilter – Draining

1. Provide a suitable container to collect the water.
2. Open drain valve (2).
3. Drain water and contaminants from the filter bowl (1) until pure fuel emerges.
4. Close drain screw.



9.4.3 Fuel prefilter – Replacement

Preconditions

☑ Engine is stopped and starting disabled.

☑ System is not under pressure.

Special tools, Material, Spare parts

Designation / Use	Part No.	Qty.
Filter wrench	F30379104	1
Engine oil		
Easy-change filter	(→ Spare Parts Catalog)	1

WARNING

Fuels are combustible and explosive.
Risk of fire and explosion!
- Avoid open flames, electrical sparks and ignition sources.
- Do not smoke.
- Wear protective clothing, protective gloves, and safety glasses / facial protection.

WARNING

Tank is pressurized.
Risk of eye injuries resulting from fluid escaping under high pressure!
- Open tank slowly.
- Wear goggles or safety mask.

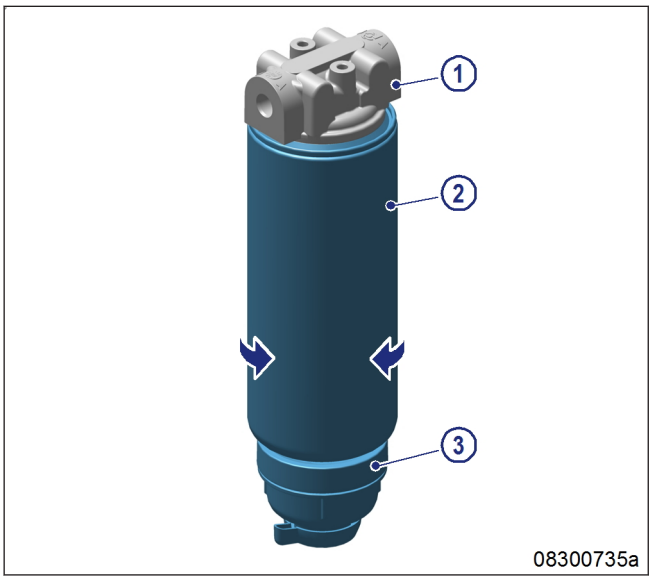
NOTICE

Contamination of components.
Damage to component!
- Observe manufacturer's instructions.
- Check components for special cleanliness.

Fuel prefilter – Replacement

Note: Collect escaping fuel and dispose of.

1. Use filter wrench to screw easy-change filter (2) off and take it off together with sight glass (3).
2. Discard old easy-change filter (2).
3. Clean sealing surface on filter head (1).
4. Coat seal on new easy-change filter (2) with little engine oil.
5. Screw on easy-change filter (2) by hand until the seal makes contact with the filter head and tighten manually.
6. Push on sight glass (3).



9.5 Exhaust Gas Aftertreatment

9.5.1 Regeneration procedure

NOTICE

Accumulation of hydrocarbons in the SCR catalyst in extended low-load or idle operation.
Risk of overheating of the SCR catalyst!

- After more than 20 h of low-load or idle operation, run the engine for minimum 1 h under load.
- The exhaust temperature upstream of the SCR catalyst must not exceed 250 °C in this mode.

9.5.2 Screen filter on reducing agent tank – Replacement

Preconditions

☑ Engine is stopped and starting disabled.

Special tools, Material, Spare parts

Designation / Use	Part No.	Qty.
Silicone grease	000989625110	1
Line fitting	(→ Spare Parts Catalog)	

WARNING

Reducing agent (e.g. AdBlue, DEF) is hot.
Risk of injury and scalding!
- Allow product to cool down.
- Slowly open line connections and closures.
- When opening, ensure that the separation points are covered with cloths.
- Wear protective clothing, protective gloves, and safety goggles / safety mask.

WARNING

Ammonia is created in case of fire or overheating.
Risk of poisoning if reducing agent (e.g. AdBlue, DEF) is swallowed.
Risk of skin irritation and eye injury on contact with reducing agent (e.g. AdBlue, DEF).
Risk of injury and poisoning!
- Avoid contact with eyes or skin.
- Do not inhale vapors or smoke.
- Never eat, drink or smoke when handling reducing agent (e.g. AdBlue, DEF).
- Wear protective clothing, protective gloves and safety goggles / safety mask.

Preparatory step

▶ Provide a suitable container to collect the reducing agent.

Replacing screen filter on screw-fitting union at supply and return connection of reducing agent tank

1. Disconnect supply and return lines at reducing agent tank.
2. Pull lines off pipe unions.
3. Screw out pipe unions.
4. Remove filter (e.g. with a suitable screwdriver).
5. Screw in new filter and tighten it by hand.
6. Screw in pipe unions.
7. Connect lines to pipe unions.

9.5.3 Supply unit - Filter element replacement

Preconditions

☑ Engine is stopped and starting disabled.

Special tools, Material, Spare parts

Designation / Use	Part No.	Qty.
Torque wrench, 80–400 Nm	F30027338	1
Ratchet bit	F30450902	1
Socket, 46 A/F	F30006128	1
Lubricant spray Biolube L Spray		
Filter element	(→ Spare Parts Catalog)	

WARNING

Ammonia is created in case of fire or overheating.
Risk of poisoning if reducing agent (e.g. AdBlue, DEF) is swallowed.
Risk of skin irritation and eye injury on contact with reducing agent (e.g. AdBlue, DEF).
Risk of injury and poisoning!

- Avoid contact with eyes or skin.
- Do not inhale vapors or smoke.
- Never eat, drink or smoke when handling reducing agent (e.g. AdBlue, DEF).
- Wear protective clothing, protective gloves and safety goggles / safety mask.

NOTICE

Contamination of components.
Damage to component!

- Observe manufacturer's instructions.
- Check components for special cleanliness.

Filter element – Replacement

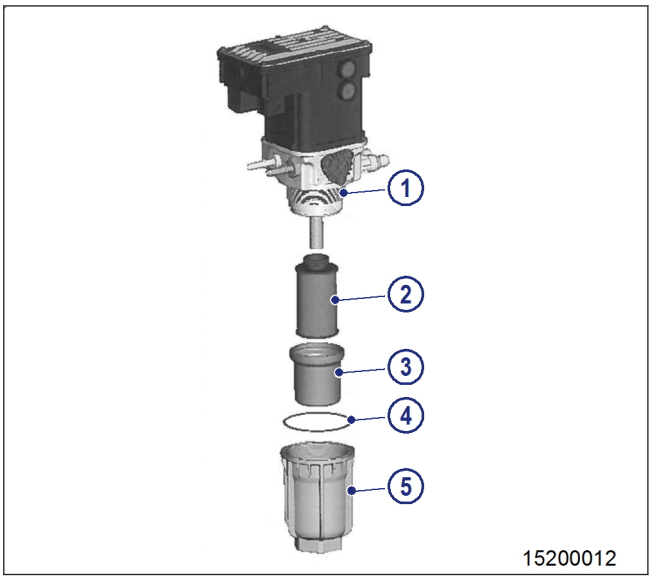
1. Clean supply unit prior to opening.
2. Unscrew filter housing (1) and remove inserted O-ring (4).

Note: Small amounts of reducing agent may emerge when removing the frost compensating diaphragm (3).

3. Remove frost compensating diaphragm (3) from pump housing (1).
4. Remove filter element (2) by turning and pulling from pump housing (1).

Note: No contamination or other foreign bodies must enter the supply unit.

5. Clean supply unit with a dry, clean lint-free cloth.



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Filter – Installation

Note: Only use new parts.

1. Attach filter element (2) via the pin on the pump housing (1).
2. Press in filter element (2) up to the stop.
3. Mount frost compensating diaphragm (3) via the filter element (2) on the pump housing (1).
4. Sealing bead of the frost compensation diaphragm (3) must be seated all-round, completely and firmly in the groove of the pump housing (1).
5. Spray full circumference of frost compensation diaphragm (3) with lubricant spray.
6. Similarly, coat the thread on the pump housing (1) with lubricant spray.

Note: The groove must be free of contamination and foreign bodies.

7. Insert O-ring (4) on filter housing (5).
8. Mount filter housing (5) on pump housing (1) and screw on.
9. Use torque wrench to tighten filter housing (5) to specified tightening torque.

Name	Size	Type	Lubricant	Value/Standard
Filter housing	46 A/F	Tightening torque	(Lubricant spray Bio-lube L Spray)	80 Nm ± 5 Nm

9.5.4 Reducing agent lines - Replacement

WARNING

Ammonia is created in case of fire or overheating.
Risk of poisoning if reducing agent (e.g. AdBlue, DEF) is swallowed.
Risk of skin irritation and eye injury on contact with reducing agent (e.g. AdBlue, DEF).
Risk of injury and poisoning!

- Avoid contact with eyes or skin.
- Do not inhale vapors or smoke.
- Never eat, drink or smoke when handling reducing agent (e.g. AdBlue, DEF).
- Wear protective clothing, protective gloves and safety goggles / safety mask.

Reducing agent lines – Replacement

1. Take photos or use the spare parts catalog to identify the arrangement of the reducing agent lines.
2. Remove reducing agent lines.
3. Collect escaping reducing agent in a suitable container.
4. Install reducing agent lines.

9.6 Air Filter

9.6.1 Air filter element - Removal and installation (optional)

Preconditions

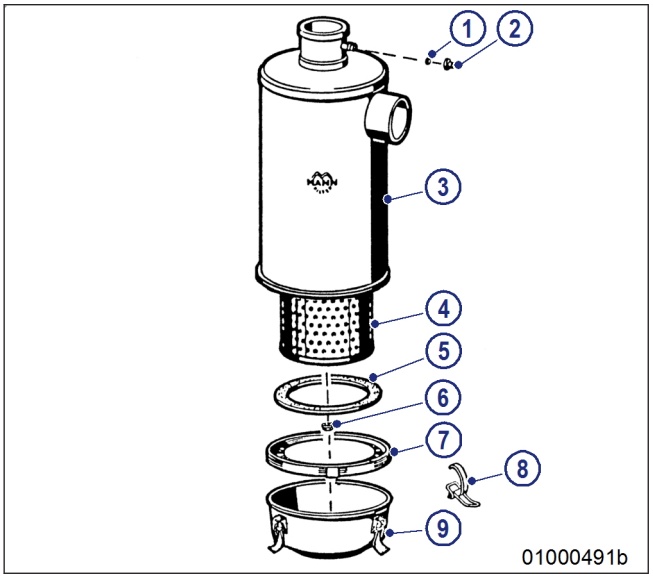
☑ Engine is stopped and starting disabled.

Special tools, Material, Spare parts

Designation / Use	Part No.	Qty.
Gasket	(→ Spare Parts Catalog)	

Removing and installing air filter element

1. Release latches (8).
2. Remove dust bowl (9) and partition (7).
3. Remove collar nut (6).
4. Screw off air filter element (4).
5. Clean housing (3) and dust bowl (9).
6. Check seal (5) for damage and cleanness, replace if necessary.
7. Clean all sealing and contact surfaces.
8. Fit partition (7) and dust bowl (9) according to marking.
9. Secure dust bowl (9) with latches (8).



9.6.2 Air filter element and dust bowl (option) - Cleaning

Preconditions

☑ Engine is stopped and starting disabled.

Special tools, Material, Spare parts

Designation / Use	Part No.	Qty.
Sealing	(→ Spare Parts Catalog)	

WARNING

Compressed air gun ejects a jet of pressurized air.
Risk of injury to eyes and damage to hearing, risk of rupturing internal organs!
- Never direct air jet at people.
- Always wear safety goggles/face mask and hearing protection.

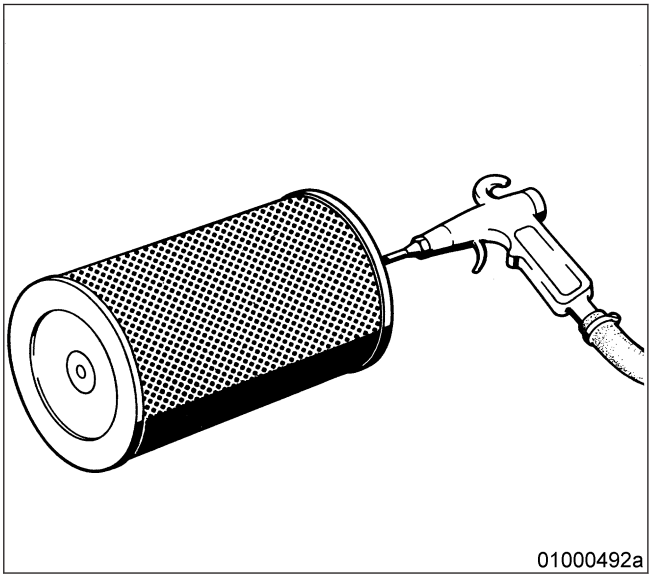
Air filter element – Cleaning

Note: Clean paper filter element dry only.

1. Open air filter and remove filter element (→ Page 107).
2. Check seal for damage and cleanness, replace if necessary.
3. Clean all mating and sealing surfaces.

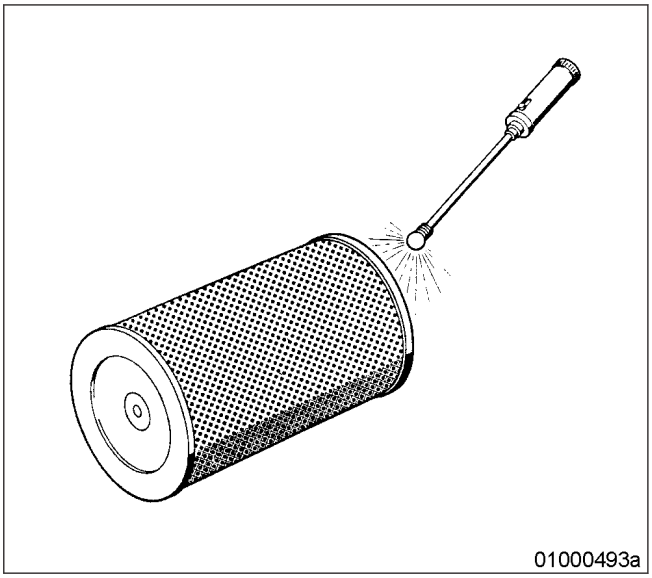
Note: Debris particles must not enter the intake system.

4. Clean dust bowl (if fitted).
5. Blow out filter element with compressed air (max. 3 bar) from inside until all dust has been removed.
6. Fit new filter element if old one is heavily contaminated or damaged (→ Page 109).



Visual inspection

1. Use inspection lamp to check cleaned filter element for damage.
2. Fit new filter element if old one is damaged (→ Page 109).



9.6.3 Air filter - Replacement (option)

Preconditions

☑ Engine is stopped and starting disabled.

Special tools, Material, Spare parts

Designation / Use	Part No.	Qty.
Air filter	(→ Spare Parts Catalog)	

Replacing air filter

1. Remove air filter and install new one (→ Page 107).
2. Reset signal ring of service indicator (→ Page 110).

9.7 Air Intake

9.7.1 Service indicator - Signal ring position check

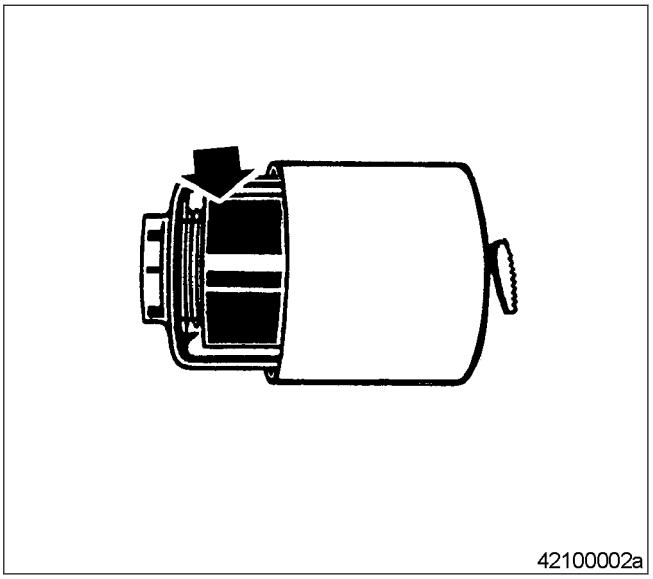
Preconditions

☑ Engine is stopped and starting disabled.

Checking signal ring position

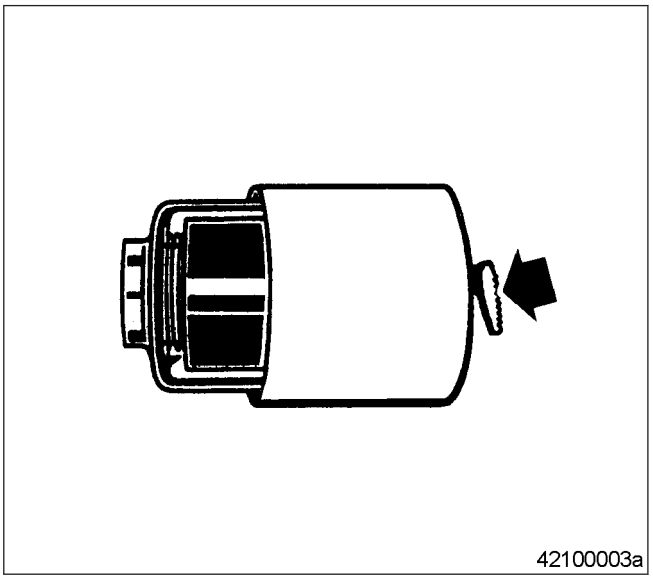
1. After the engine has been stopped, the signal ring is completely visible and remains in this position.

Result: Clean air filter.



2. Actuate the reset button.

Result: The signal ring returns to its normal position.



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9.8 Starting Equipment

9.8.1 Starter – Condition check

Preconditions

☑ Engine is stopped and starting disabled.

Starter – Condition check

1. Check securing screws of starter and nut on cable connection for secure seating and tighten if required.
2. Check cabling (→ Page 135).

9.9 Lube Oil System, Lube Oil Circuit

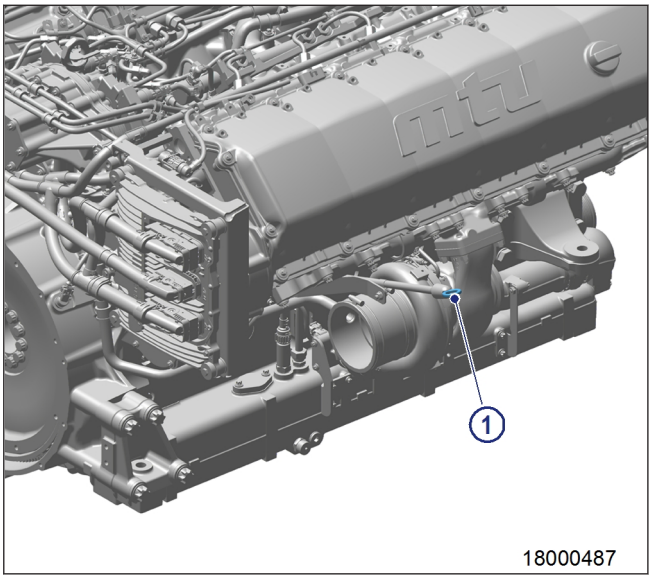
9.9.1 Engine oil level - Check

Preconditions

☑ Engine is stopped and starting disabled.

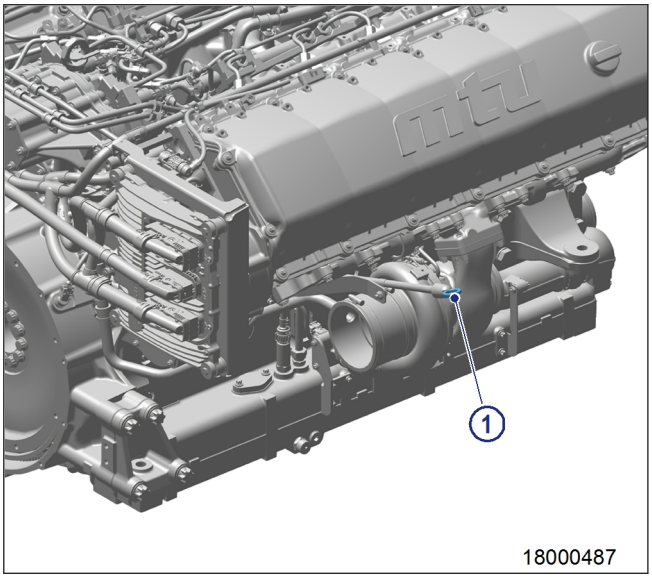
Oil level check prior to engine start

1. Remove oil dipstick (1) from guide tube and wipe it.
2. Insert oil dipstick (1) into guide tube up to the stop, pull out after approx. 10 seconds and check oil level.
3. Oil level must be between 'min.' and 'max.' marks.
4. If necessary, top up to 'max.' mark (→ Page 118).
5. Insert oil dipstick (1) in guide tube up to the stop.



Checking oil level after the engine is stopped

1. 5 minutes after stopping the engine, remove oil dipstick (1) from the guide tube and wipe it.
2. Insert oil dipstick (1) into guide tube up to the stop, pull out after approx. 10 seconds and check oil level.
3. Oil level must be between 'min.' and 'max.' marks.
4. If necessary, top up to 'max.' mark (→ Page 114).
5. Insert oil dipstick (1) in guide tube up to the stop.



9.9.2 Engine oil - Change

Preconditions

☑ Engine is stopped and starting disabled.

☑ Engine is at operating temperature.

Engine oil – Draining

▶ (→ Page 114)

Engine oil filter – Replacement

▶ (→ Page 116)

Engine oil – Filling

▶ (→ Page 118)

9.9.3 Engine oil - Draining

Preconditions

☑ Engine is stopped and starting disabled.

☑ Engine is at operating temperature.

Special tools, Material, Spare parts

Designation / Use	Part No.	Qty.
Sealing ring	(→ Spare Parts Catalog)	

WARNING

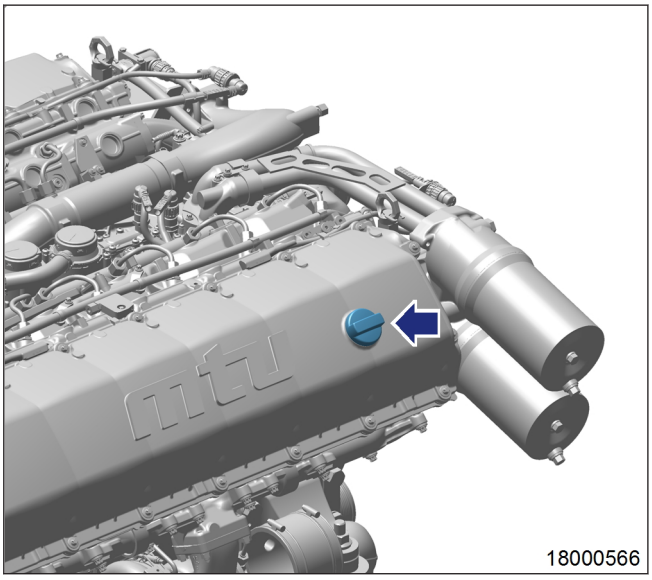
Oil is hot.
Oil can contain residue/substances which are harmful to health.
Risk of injury and poisoning!
- Allow the product to cool to below 50 °C before beginning work.
- Wear protective clothing, protective gloves and goggles/safety mask.
- Avoid contact with skin.
- Do not inhale oil vapor.

Preparatory step

▶ Provide a suitable container in which to collect the engine oil.

Engine oil – Draining

1. Remove cap (arrow) on cylinder head cover.



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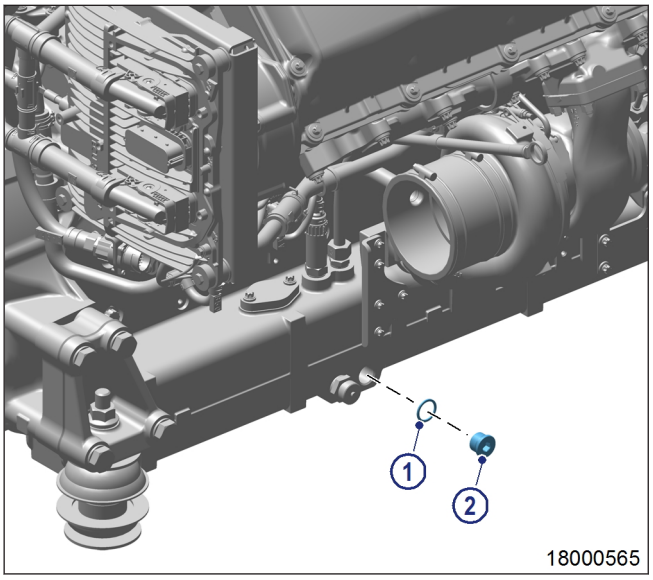
2. Remove plug screw (2), and catch engine oil in a suitable container.
3. Install plug screw (2) with new sealing ring (1).
4. Close cap on cylinder head cover.



9.9.4 Engine oil filter - Replacement

Preconditions

☑ Engine is stopped and starting disabled.

Special tools, Material, Spare parts

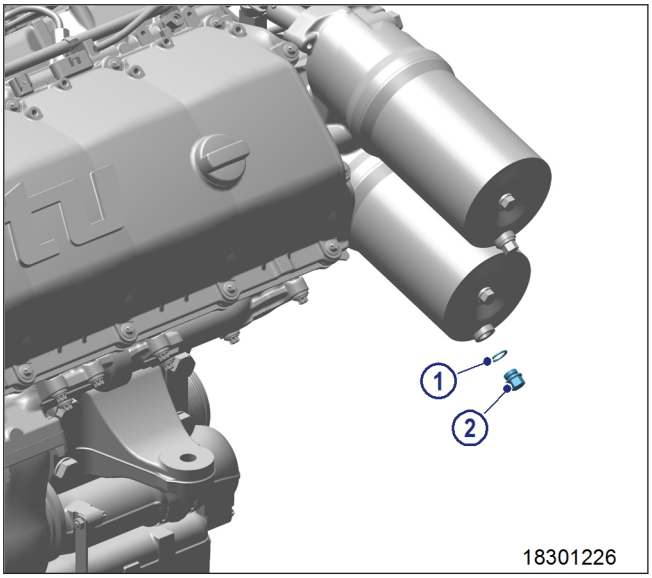
Designation / Use	Part No.	Qty.
Torque wrench, 10–60 Nm	F30510423	1
Ratchet	F30027340	1
Engine oil		
Oil filter element	(→ Spare Parts Catalog)	

WARNING

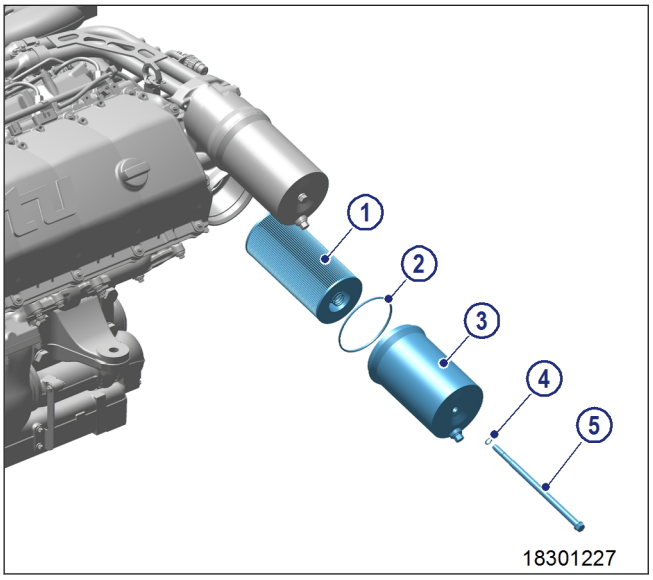
Oil is hot.
Oil can contain residue/substances which are harmful to health.
Risk of injury and poisoning!
- Allow the product to cool to below 50 °C before beginning work.
- Wear protective clothing, protective gloves and goggles/safety mask.
- Avoid contact with skin.
- Do not inhale oil vapor.

Engine oil filter – Replacement

1. Provide a suitable container to collect the oil.
2. Remove drain plug (2) and drain oil.
3. Install drain plug (2) with new sealing ring (1).
4. Check condition of sealing ring (2) on cover.
5. Tighten drain plug (2).



6. Remove screw (5).
7. Remove filter bowl (3).
8. Remove oil filter element (1).
9. Insert new oil filter element (1) in oil filter bowl (3).
10. Position filter bowl (1) on filter head.
11. Install screw (5) with new sealing ring (4).



12. Use torque wrench to tighten screw (5) to specified tightening torque .

Name	Size	Type	Lubricant	Value/Standard
Screw		Tightening torque	(Engine oil)	40 Nm ±5 Nm

13. Replace other engine oil filters in the same way.
14. Check oil level (→ Page 112)

9.9.5 Engine oil - Filling

Preconditions

☑ Engine is stopped and starting disabled.

☑ MTU Fluids and Lubricants Specifications (A001063/..) are available.

Special tools, Material, Spare parts

Designation / Use	Part No.	Qty.
Engine oil		

WARNING

Oil is hot.
Oil can contain residue/substances which are harmful to health.
Risk of injury and poisoning!
- Allow the product to cool to below 50 °C before beginning work.
- Wear protective clothing, protective gloves and goggles/safety mask.
- Avoid contact with skin.
- Do not inhale oil vapor.

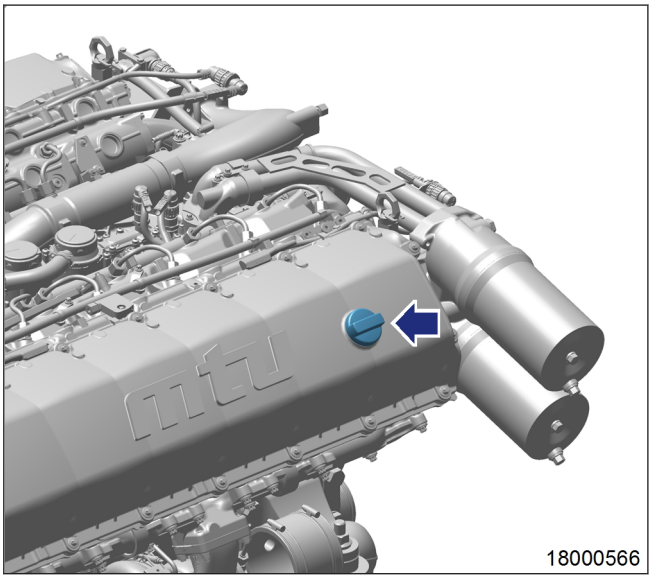
Engine oil – Filling

Note: Observe engine oil level (→ Page 112)

1. Determine the amount of engine oil required for an oil change (→ Page 37).
2. Remove cover (arrow) on filler neck.
3. Fill in appropriate quantity of oil through filler neck.
4. Close cap (arrow) on filler neck.

Note: After oil change and oil filter replacement, bar engine with starting system (→ Page 91).

5. Check engine oil level (→ Page 112).



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9.10 Coolant Circuit, General, High-Temperature Circuit

9.10.1 Engine coolant – Level check

Preconditions

☑ Engine is stopped and starting disabled.

☑ MTU Fluids and Lubricants Specifications (A001063/..) are available.

WARNING

Coolant is hot and under pressure.
Risk of injury and scalding!
- Let the engine cool down.
- Wear protective clothing, gloves, and goggles / safety mask.

Checking engine coolant level

Note: Observe the instructions of the vehicle manufacturer when checking coolant level.

1. Check coolant level (the coolant level must be between the MIN and MAX marks on the coolant level indicator of the expansion tank).
2. Top up with treated coolant as necessary (→ Page 123).

9.10.2 Engine coolant - Change

Observe the information of the vehicle manufacturer when changing engine coolant.

Drain engine coolant.

▶ (→ Page 121)

Fill with engine coolant.

▶ (→ Page 123)

9.10.3 Engine coolant – Draining

Preconditions

☑ Engine is stopped and starting disabled.

☑ Coolant temperature is max. 40 °C.

Special tools, Material, Spare parts

Designation / Use	Part No.	Qty.
Torque wrench 60–320 Nm	F30047446	1
Ratchet	F30027341	1
Sealing ring	(→ Spare Parts Catalog)	

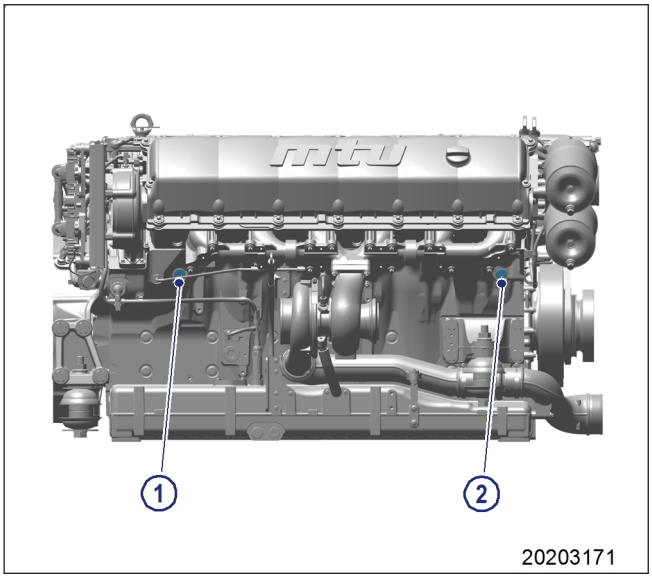
WARNING

Coolant is hot and under pressure.
Risk of injury and scalding!
- Let the engine cool down.
- Wear protective clothing, gloves, and goggles / safety mask.

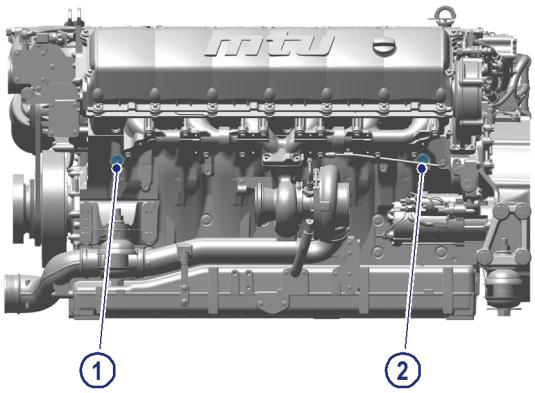
Engine coolant – Draining

Note: Observe the instructions of the vehicle manufacturer when draining coolant.

1. Turn breather valve of coolant expansion tank counterclockwise until the first stop and allow pressure to escape.
2. Continue to turn breather valve counterclockwise and remove.
3. Draw off separated corrosion inhibitor oil in expansion tank through the filler neck.
4. Remove plug screw (1) and drain coolant into a suitable container.
5. Remove plug screw (2) and drain coolant into a suitable container.



6. Remove plug screw (1) and drain coolant into a suitable container.
7. Remove plug screw (2) and drain coolant into a suitable container.
8. Install all plug screws with new sealing ring.



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9. Use torque wrench to tighten plug screws to the specified tightening torque.

Name	Size	Type	Lubricant	Value/Standard
Plug screws		Tightening torque		100 Nm +10 Nm

10. Drain off residual coolant according to vehicle manufacturer's instructions.
11. Fill with coolant (→ Page 123).
12. Place breather valve on filler neck and close it.

9.10.4 Engine coolant – Filling

Preconditions

☑ Engine is stopped and starting disabled.

☑ MTU Fluids and Lubricants Specifications (A001063/..) are available.

Special tools, Material, Spare parts

Designation / Use	Part No.	Qty.
Engine coolant		

WARNING

Coolant is hot and under pressure.
Risk of injury and scalding!
- Let the engine cool down.
- Wear protective clothing, gloves, and goggles / safety mask.

WARNING

High level of engine noise when the engine is running.
Risk of damage to hearing!
- Wear suitable hearing protection.

NOTICE

Cold coolant in hot engine can cause thermal stress.
Possible formation of cracks in the engine!
- Fill / top up coolant only into cold engine.

Engine coolant – Filling

1. Provide a suitable container to catch the coolant.
2. Turn breather valve of coolant expansion tank counterclockwise until the first stop and allow pressure to escape.
3. Continue to turn breather valve counterclockwise and remove.
4. Fill with coolant according to (→ vehicle manufacturer's instructions).
5. Set breather valve onto coolant expansion tank and close it.
6. Start the engine and operate it at idle for some minutes.
7. Check coolant level (→ Page 119), top up if required.

9.11 Low-Temperature Circuit

9.11.1 Charge-air coolant – Level check

Preconditions

☑ Engine is stopped and starting disabled.

☑ MTU Fluids and Lubricants Specifications (A001063/..) are available.

WARNING

Coolant is hot and under pressure.
Risk of injury and scalding!
- Let the engine cool down.
- Wear protective clothing, gloves, and goggles / safety mask.

Charge-air coolant – Level check

Note: Observe the instructions of the vehicle manufacturer when checking coolant level.

1. Check coolant level (the coolant level must be between the MIN and MAX marks on the coolant level indicator of the expansion tank).
2. Top up with treated coolant as necessary (→ Page 127).

9.11.2 Charge-air coolant - Change

Special tools, Material, Spare parts

Designation / Use	Part No.	Qty.
Coolant		

Charge-air coolant – Change

1. Drain charge-air coolant (→ Page 126).
2. Fill with charge-air coolant (→ Page 127).

9.11.3 Charge-air coolant – Draining

Preconditions

☑ Engine is stopped and starting disabled.

WARNING

Coolant is hot and under pressure.
Risk of injury and scalding!
- Let the engine cool down.
- Wear protective clothing, gloves, and goggles / safety mask.

Charge-air coolant – Draining

Note: Observe the instructions of the vehicle manufacturer when draining coolant.

1. Turn breather valve of coolant expansion tank counterclockwise until the first stop and allow pressure to escape.
2. Continue to turn breather valve counterclockwise and remove.
3. Draw off separated corrosion inhibitor oil in expansion tank through the filler neck.
4. Drain coolant according to vehicle manufacturer's instructions.
5. Fill with coolant (→ Page 127).
6. Place breather valve on filler neck and close it.

9.11.4 Charge-air coolant - Filling

Preconditions

☑ Engine is stopped and starting disabled.

☑ MTU Fluids and Lubricants Specifications (A001063/..) are available.

Special tools, Material, Spare parts

Designation / Use	Part No.	Qty.
Coolant		
Sealing ring	(→ Spare Parts Catalog)	

WARNING

Coolant is hot and under pressure.
Risk of injury and scalding!
- Let the engine cool down.
- Wear protective clothing, gloves, and goggles / safety mask.

WARNING

High level of engine noise when the engine is running.
Risk of damage to hearing!
- Wear suitable hearing protection.

NOTICE

Cold coolant in hot engine can cause thermal stress.
Possible formation of cracks in the engine!
- Fill / top up coolant only into cold engine.

Charge-air coolant – Filling

1. Provide a suitable container to catch the coolant.
2. Turn breather valve of coolant expansion tank counterclockwise until the first stop and allow pressure to escape.
3. Continue to turn breather valve counterclockwise and remove.
4. Fill with coolant according to (→ vehicle manufacturer's instructions).
5. Place breather valve on coolant expansion tank and close it.
6. Start the engine and operate it at idle for some minutes.
7. Check coolant level (→ Page 119), top up if required.

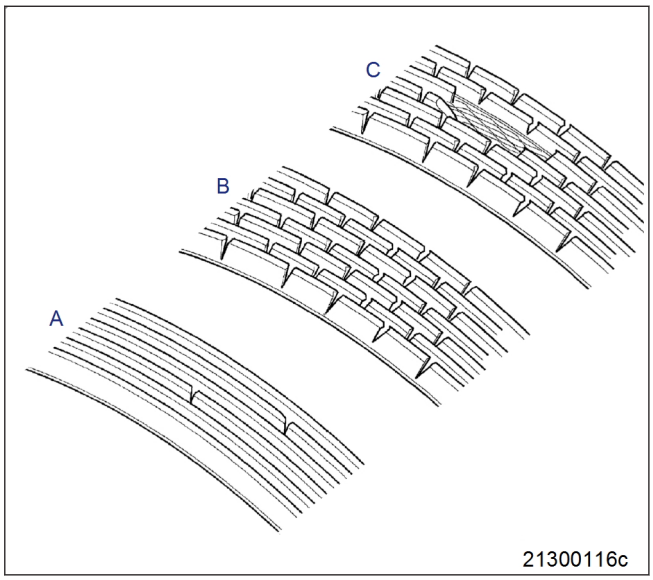
9.12 Belt Drive

9.12.1 Drive belt - Condition check

Preconditions

☑ Engine is stopped and starting disabled.

Drive belt – Condition check



Item	Findings	Measure
Drive belt A	Singular cracks	None
Drive belt B	Cracks on entire circumference	Replace (→ Page 129)
Drive belt C	Chunking	
Drive belt	Oily, overheating	

9.12.2 Coolant pumps - Drive belt replacement

Preconditions

☑ Engine is stopped and starting disabled.

Special tools, Material, Spare parts

Designation / Use	Part No.	Qty.
Assembly jig	F6794712	1
Poly-V-belt	(→ Spare Parts Catalog)	

DANGER

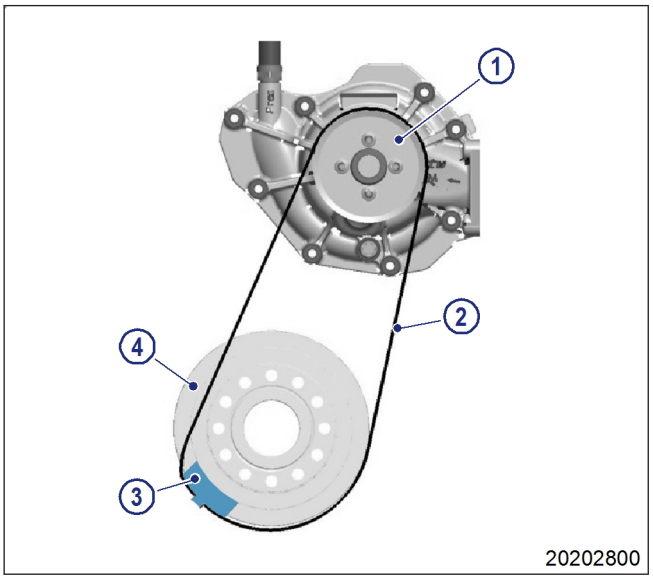
Rotating and moving engine parts.
Risk of crushing, danger of parts of the body being caught or pulled in!
- Before barring the engine, make sure that there are no persons in the engine's danger zone.
- After finishing work on the engine, make sure that all safety devices are put back in place and all tools are removed from the engine.

Preparatory steps

1. Install barring device (→ Page 89).
2. Remove coupling (→ Page 132).
3. Cut poly-vee belt of charge-air pump if necessary.

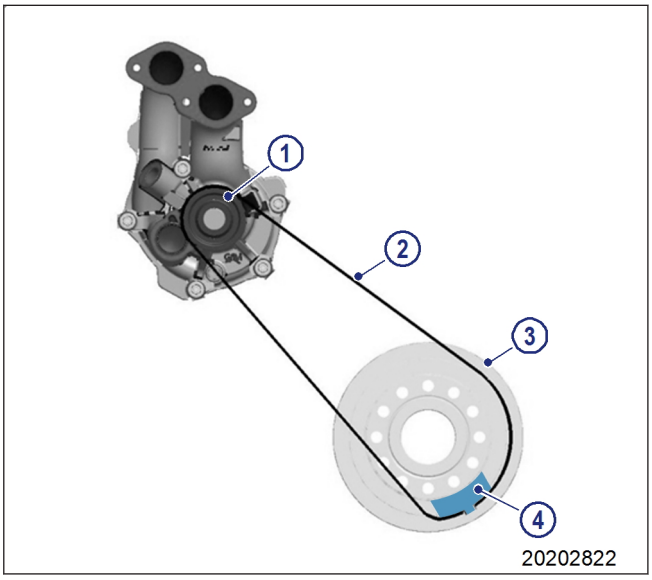
Replacing drive belt of engine coolant pump (HT circuit)

1. Cut poly-vee belt (2).
2. Place new poly-vee belt (2) onto the rear four grooves of belt pulley (1).
3. Place poly-vee belt (2) onto the four rear grooves of belt pulley (4) and pretension with assembly device (3).
4. Bar engine with barring device until poly-vee belt (2) lies completely on belt pulley (4).
5. Remove assembly device.



Replacing drive belt of charge-air coolant pump (LT circuit)

1. Place new poly-vee belt (2) onto the front three grooves of belt pulley (1).
2. Place poly-vee belt (2) onto the front three grooves of belt pulley (3) and pretension with assembly device (4).
3. Bar engine with barring device until poly-vee belt (2) lies completely on belt pulley (3).
4. Remove assembly device (4).



Final steps

1. Install coupling (→ Page 133).
2. Remove barring device (→ Page 89).

9.13 Drive Systems, Driving End and Free End (Coupling)

9.13.1 Torsionally resilient coupling on free end (KGS) – Check

Preconditions

☑ Engine is stopped and starting disabled.

Checking coupling condition

1. Remove coupling (→ Page 132).
2. Wipe rubber elements with a dry cloth.
3. Visually inspect rubber elements for cracks and deformation.

Result: Hairline cracks are admissible; if a considerable number of deeper cracks or places with detached rubber are found, replace coupling.

4. Install coupling (→ Page 133).

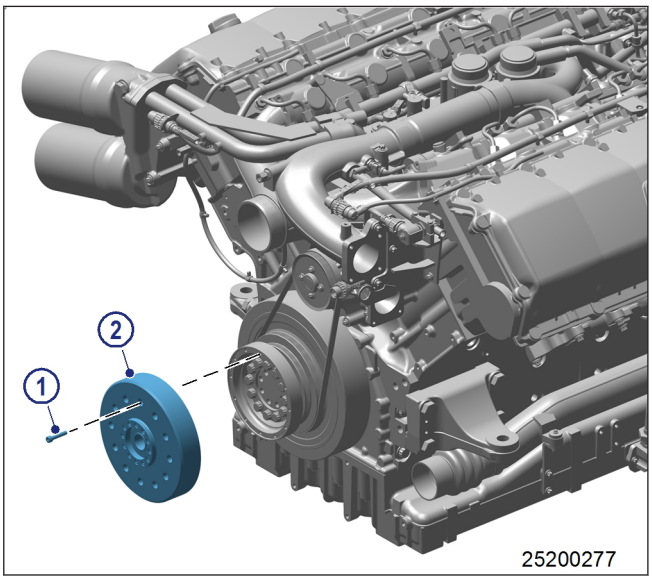
9.13.2 Torsionally resilient coupling on free end (KGS) - Removal

Preconditions

☑ Engine is stopped and starting disabled.

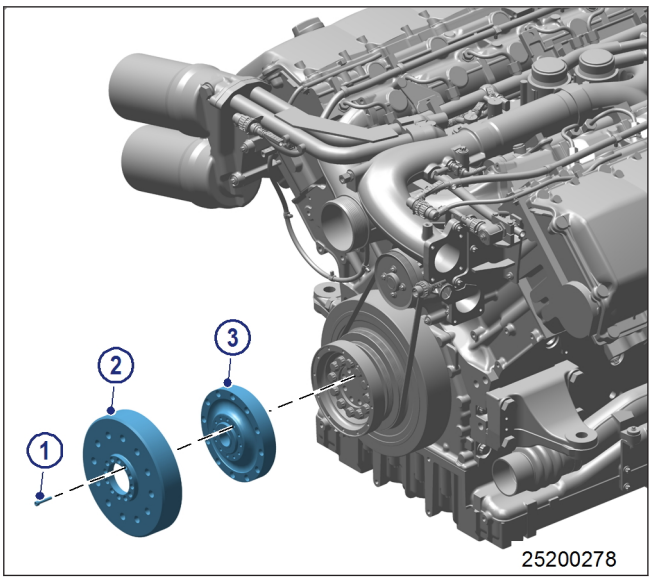
Torsionally resilient coupling on free end (KGS) – Removal

1. Remove screws (1).
2. Remove coupling (2).



Torsionally resilient coupling on free end (KGS) – Disassembly

1. Remove screws (1).
2. Remove inertia component (2) from inner part of coupling (3).



9.13.3 Torsionally resilient coupling on free end (KGS) - Installation

Preconditions

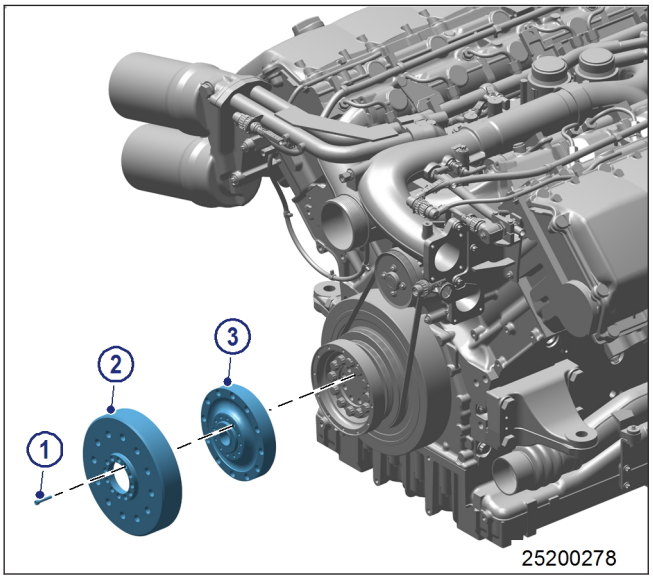
☑ Engine is stopped and starting disabled.

Special tools, Material, Spare parts

Designation / Use	Part No.	Qty.
Torque wrench, 6–50 Nm	F30027336	1
Ratchet	F30027340	1

Torsionally resilient coupling on free end (KGS) – Assembly

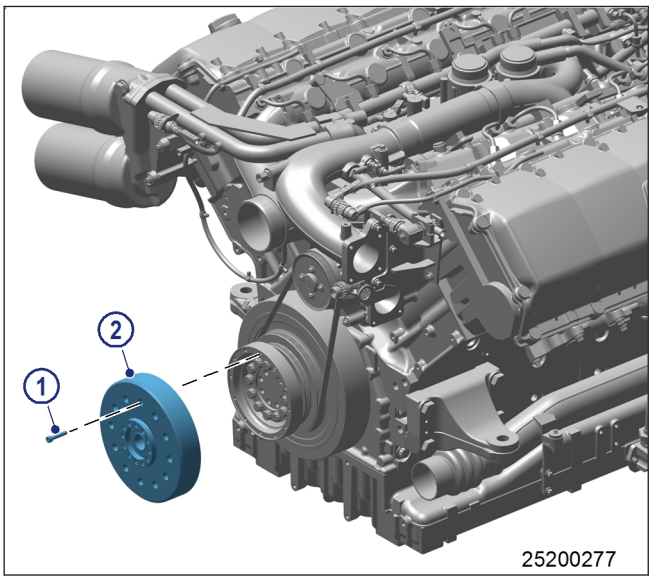
1. Assemble inertia component (2) and inner part of coupling (3) with screws (1).



2. Tighten screws (1) with torque wrench to the specified tightening torque.

Name	Size	Type	Lubricant	Value/Standard
Screw	M6 X 35	Tightening torque		12 Nm +2 Nm

3. Install coupling (2) with screws (1) on engine.



4. Tighten screws (1) with torque wrench to the specified tightening torque.

Name	Size	Type	Lubricant	Value/Standard
Screw	M8 X 40	Tightening torque		25 Nm +3 Nm

9.14 Wiring (General) for Engine/Gearbox/Unit

9.14.1 Engine wiring - Check

Preconditions

☑ Engine is stopped and starting disabled.

Special tools, Material, Spare parts

Designation / Use	Part No.	Qty.
Isopropyl alcohol	X00058037	1

Engine wiring – Check

1. Check securing screws of cable clamps on the engine and tighten loose screw connections.
2. Make certain that cables are securely seated in clamps and cannot move freely.
3. Check that cable clamps are secure, tighten loose clamps.
4. Replace faulty cable clamps.
5. Visually inspect the following electrical line components for damage:
   - Connector housings;
   - Contacts;
   - Sockets;
   - Cable and connection terminals;
   - Terminal contacts.
6. If cable conductors are damaged, (→ Contact Service).
7. Clean dirty connector housings, sockets and contacts with isopropyl alcohol.
8. Ensure that all connecting plugs of the sensors are correctly engaged.

9.15 Accessories for (Electronic) Engine Governor / Control System

9.15.1 Engine governor and connector – Cleaning

Preconditions

☑ Engine is stopped and starting disabled.

Special tools, Material, Spare parts

Designation / Use	Part No.	Qty.
Solvent (isopropyl alcohol)	X00058037	1

NOTICE

Insertion of unsuitable test probe, e.g. test prod.
The contacts in the plug connection can be bent!
- Carry out check of plug connection only with test connectors.

Engine governor and connector – Cleaning

1. Use isopropyl alcohol to remove coarse dirt from housing surface.
2. Use isopropyl alcohol to remove dirt from the connector and cable surfaces.
3. Check legibility of cable labels. Clean or replace illegible labels.

Heavily contaminated connectors on engine governor – Cleaning

Note: Close connectors that are not plugged in with the protective cap supplied.

1. Release latches of connectors and withdraw connectors.
2. Clean connector housings, connector socket housings and all contacts with isopropyl alcohol.
3. When connectors, sockets and all contacts are dry: Fit connectors and latch them.

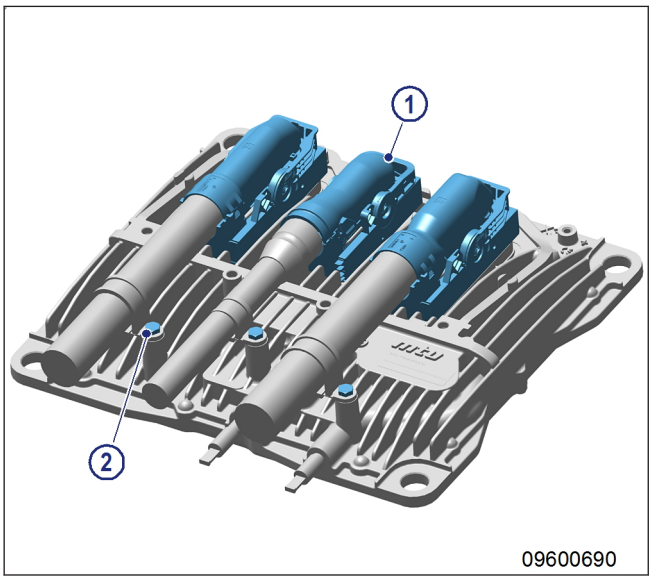
9.15.2 Engine governor - Checking plug-in connections

Preconditions

☑ Engine is stopped and starting disabled.

Checking plug-in connections on engine governor

1. Check firm seating of all connectors on the engine governor. Ensure that the clips (1) are engaged.
2. Check firm seating of all screws (2) on engine governor cable clamps. Make sure that cable clamps are not defective.



10 Appendix A

10.1 Abbreviations

Abbreviation	Meaning	Explanation
A/D	Analog/Digital	Transformer: transforms sensor voltages into numeric values
AC	Alternating Current	
AdBlue	-	Brand name of the German Association of the Automotive Industry (VDA) Urea solution with 32.5% urea content
AFRS	Air Filter Restriction Sensor	
AL	Alarm	
ANSI	American National Standards Institute	Association of American standardization organizations
ATL	Abgasturbolader	Exhaust turbocharger (ETC)
ATS	Air Temperature Sensor	
BR	Baureihe	Series
BV	Betriebsstoffvorschrift	MTU Fluids and Lubricants Specifications, publication No. A001063/..
CAN	Controller Area Network	Data bus system, bus standard
CaPoS	Capacitor Power System	Capacitor-based starting system
CEL	Check Engine Light	Stop engine light 1st function: Warning lamp (rectify fault as soon as possible) 2nd function: Read out fault codes
CLS	Coolant Level Sensor	
CPS	Coolant Pressure Sensor	
CTS	Coolant Temperature Sensor	
DC	Direct Current	
DDL	Diagnostic Data Link	Diagnostic lines
DDR	Diagnostic Data Reader	Diagnostic unit
DEF	Diesel Exhaust Fluid	Urea solution with 32.5% urea content Name used in Northern America
DIN	Deutsches Institut für Normung e. V.	At the same time identifier of German standards (DIN = “Deutsche Industrie-Norm”)
DL	Default Lost	Alarm: Default CAN bus failure
DT	Diagnostic Tool	Diagnostic unit
EEPROM	Electrically Erasable Programmable Read Only Memory	
ETK	Ersatzteilkatalog	Spare Parts Catalog (SPC)
FPS	Fuel Pressure Sensor	
FRS	Fuel Restriction Sensor	
FTS	Fuel Temperature Sensor	
GND	Ground	

Abbreviation	Meaning	Explanation
HI	High	Alarm: Measured value exceeds 1st maximum limit
HIHI	High High	Alarm: Measured value exceeds 2nd maximum limit value
HT	High Temperature	
IDM	Interface Data Module	Memory module for interface data
INJ	Injector	
ISO	International Organization for Standardization	International umbrella organization for all national standardization institutes
KGS	Kupplungsgegenseite	Engine free end in accordance with DIN ISO 1204
KS	Kupplungsseite	Engine driving end in accordance with DIN ISO 1204
LED	Light Emitting Diode	
LO	Low	Alarm: Measured value lower than 1st minimum limit value
LOLO	Low Low	Alarm: Measured value lower than 2nd minimum limit value
LSG	Limiting Speed Governor	Maximum-speed governor
MG	Message	
N/A	Not Available/Applicable	
OEM	Original Equipment Manufacturer	
OI	Optimized Idle	
OLS	Oi Level Sensor	
OPS	Oil Pressure Sensor	
OTS	Oil Temperature Sensor	
OT	Oberer Totpunkt	Top Dead Center (TDC)
PAN	Panel	Control panel
PIM	Peripheral Interface Module	
PWM	Pulse Width Modulation	
P-xyz	Pressure-xyz	Pressure measuring point xyz
RL	Redundancy Lost	Alarm: Redundant CAN bus failure
SCR	Selective Catalytic Reduction	
SD	Sensor Defect	Alarm: Sensor failure
SEL	Stop Engine Light	Stop engine light 1st function: Warning lamp (stop engine and rectify fault) 2nd function: Read out fault codes
SID	System Identifier	
SRS	Synchronous Reference Sensor	Camshaft angle sensor
SS	Safety System	Safety system alarm
TBS	Turbocharger Boost Sensor	
TCI	Turbo Compressor Inlet	
TCO	Turbo Compressor Outlet	
TD	Transmitter Deviation	Alarm: Sensor comparison fault

Abbreviation	Meaning	Explanation
TRS	Timing Reference Sensor	Crankshaft angle sensor
T-xyz	Temperature-xyz	Temperature measuring point xyz
UT	Unterer Totpunkt	Bottom Dead Center (BDC)
VSG	Variable-Speed Governor	
VSS	Vehicle Speed Sensor	
WB	Wire Break	Cabling damage
WZK	Werkzeugkatalog	Tool Catalog (TC)

10.2 MTU Contact/Service Partners

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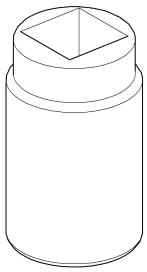
11 Appendix B

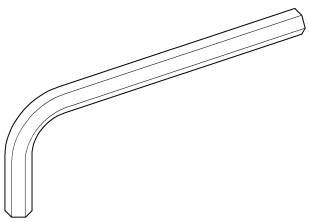
11.1 Special Tools

Adapter



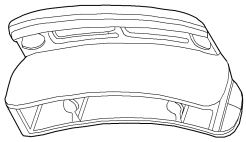
Part No.:	F30011619
Qty.:	1
Used in:	9.1.1 Engine – Barring manually (→ Page 89)

Allen key, 5 mm



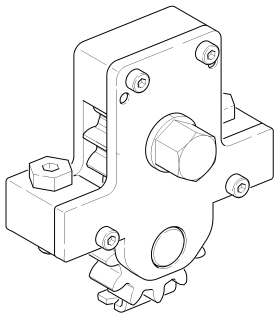
Part No.:	F30002815
Qty.:	1
Used in:	9.2.2 Valve clearance – Check and adjustment (→ Page 94)

Assembly jig



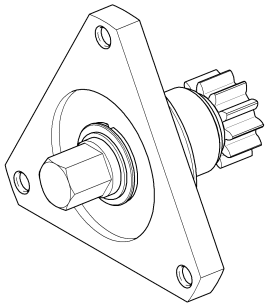
Part No.:	F6794712
Qty.:	1
Used in:	9.12.2 Coolant pumps – Drive belt replacement (→ Page 129)

Barring device



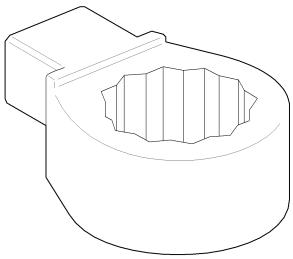
Part No.:	F6790714
Qty.: Used in:	1 9.1.1 Engine – Barring manually (→ Page 89)
Qty.: Used in:	1 9.2.2 Valve clearance – Check and adjustment (→ Page 94)

Barring device



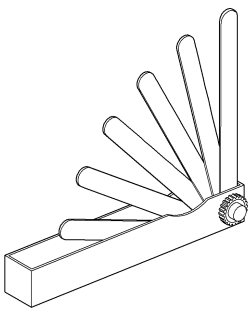
Part No.:	F6797426
Qty.: Used in:	1 9.1.1 Engine – Barring manually (→ Page 89)

Box wrench, 14 mm



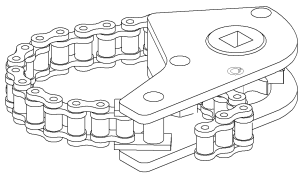
Part No.:	F30028346
Qty.: Used in:	1 9.2.2 Valve clearance – Check and adjustment (→ Page 94)

Feeler gauge



Part No.:	Y20010128
Qty.: Used in:	1 9.2.2 Valve clearance – Check and adjustment (→ Page 94)

Filter wrench

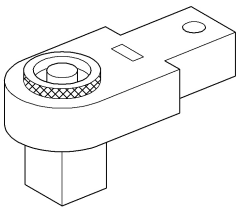


Part No.:	F30379104
Qty.: Used in:	1 9.4.1 Fuel filter – Replacement (→ Page 99)
Qty.: Used in:	1 9.4.3 Fuel prefilter – Replacement (→ Page 101)

High-pressure cleaner

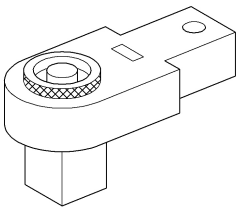
Part No.:	
Qty.: Used in:	1 6.7 Plant – Cleaning (→ Page 45)

Ratchet



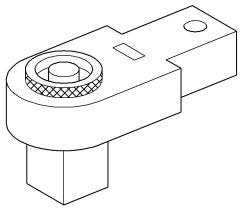
Part No.:	F30027340
Qty.: Used in:	1 9.2.1 Cylinder head cover – Removal and installation (→ Page 92)
Qty.: Used in:	1 9.3.1 Fuel system – Venting (→ Page 97)
Qty.: Used in:	1 9.9.4 Engine oil filter – Replacement (→ Page 116)
Qty.: Used in:	1 9.13.3 Torsionally resilient coupling on free end (KGS) – Installation (→ Page 133)

Ratchet



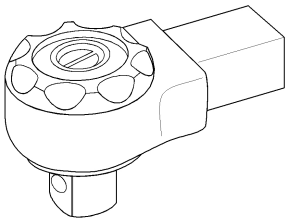
Part No.:	F30027341
Qty.: Used in:	1 9.10.3 Engine coolant – Draining (→ Page 121)

Ratchet adapter



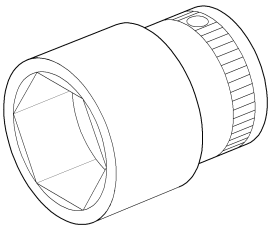
Part No.:	F30027340
Qty.:	1
Used in:	9.1.1 Engine – Barring manually (→ Page 89)

Ratchet bit



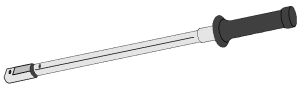
Part No.:	F30450902
Qty.:	1
Used in:	9.5.3 Supply unit – Filter element replacement (→ Page 104)

Socket, 46 A/F



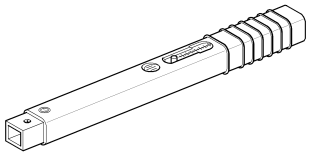
Part No.:	F30006128
Qty.:	1
Used in:	9.5.3 Supply unit – Filter element replacement (→ Page 104)

Torque wrench 60–320 Nm



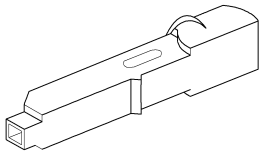
Part No.:	F30047446
Qty.:	1
Used in:	9.10.3 Engine coolant – Draining (→ Page 121)

Torque wrench, 20–100 Nm



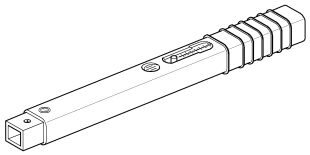
Part No.:	F30026582
Qty.: Used in:	1 9.2.2 Valve clearance – Check and adjustment (→ Page 94)

Torque wrench, 4–20 Nm



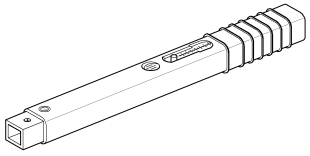
Part No.:	F30044239
Qty.: Used in:	1 9.3.1 Fuel system – Venting (→ Page 97)

Torque wrench, 6–50 Nm



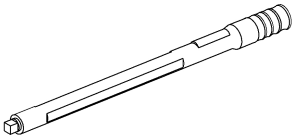
Part No.:	F30027336
Qty.: Used in:	1 9.2.1 Cylinder head cover – Removal and installation (→ Page 92)
Qty.: Used in:	1 9.13.3 Torsionally resilient coupling on free end (KGS) – Installation (→ Page 133)

Torque wrench, 80–400 Nm



Part No.:	F30027338
Qty.: Used in:	1 9.5.3 Supply unit – Filter element replacement (→ Page 104)

Torque wrench, 10–60 Nm



Part No.:	F30510423
Qty.:	1
Used in:	9.9.4 Engine oil filter – Replacement (→ Page 116)

11.2 Index