

Operating Instructions

Diesel Engine
6R1600Gx0x
6R1600Bx0x

MS15022/04E



Power. Passion. Partnership.

| Engine model | Power | Application group |
|----------------|--------------|---|
| Overview 50 Hz | | |
| 6R1600B30S | 41.5 kW/cyl. | 3B, continuous operation at variable load |
| 6R1600B40S | 45.7 kW/cyl. | 3B, continuous operation at variable load |
| 6R1600G10F | 41.5 kW/cyl. | 3B, continuous operation at variable load |
| 6R1600G20F | 45.7 kW/cyl. | 3B, continuous operation at variable load |
| 6R1600G40F | 41.5 kW/cyl. | 3C, continuous operation, time-limited |
| 6R1600G50F | 45.7 kW/cyl. | 3C, continuous operation, time-limited |
| 6R1600G70F | 45.7 kW/cyl. | 3D, short-time operation, fuel stop |
| 6R1600G80F | 50.2 kW/cyl. | 3D, short-time operation, fuel stop |
| Overview 60 Hz | | |
| 6R1600B30S | 47.3 kW/cyl. | 3B, continuous operation at variable load |
| 6R1600B40S | 52.0 kW/cyl. | 3B, continuous operation at variable load |
| 6R1600G10S | 47.3 kW/cyl. | 3B, continuous operation at variable load |
| 6R1600G20S | 52.0 kW/cyl. | 3B, continuous operation at variable load |
| 6R1600G70S | 52.0 kW/cyl. | 3D, short-time operation, fuel stop |
| 6R1600G80S | 57.2 kW/cyl. | 3D, short-time operation, fuel stop |

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1 Safety

1.1 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. When operating the machine in the EU: The second nameplate must be affixed in a prominent position as described in the accompanying specifications.

Emission regulations and emission labels

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 7).

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.

1.2 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.

1.3 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

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, ear protectors, 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, Authorisation and restriction of CHemicals): We recommend wearing protective gloves at all times in order to reduce risk when working.

1.4 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 ear protectors.
- 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.

1.5 Assembly, maintenance, and repair work – Safety regulations

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 cleanliness (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.

Check that all safeguards have been installed and that all tools and loose parts have been 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.

1.6 Fire and environmental protection, fluids and lubricants

Fire prevention and fire

Fire, naked light 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 steam/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.

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 ear protectors 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 A1, A2 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.

1.7 Standards for warning notices in the text and highlighted information

| | |
|--|---|
| DANGER  | In the event of immediate danger. Consequences: Death, serious or permanent injury! <ul style="list-style-type: none">• Remedial action. |
| WARNING  | In the event of a situation involving potential danger. Consequences: Death, serious or permanent injury! <ul style="list-style-type: none">• Remedial action. |
| CAUTION  | In the event of a situation involving potential danger. Consequences: Minor or moderate injuries! <ul style="list-style-type: none">• Remedial action. |
| NOTICE  | In the event of a situation involving potentially adverse effects on the product. Consequences: Material damage! <ul style="list-style-type: none">• 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.

2 Transport

2.1 Transport

Special tools, Material, Spare parts

| Designation / Use | Part No. | Qty. |
|-------------------|-----------|------|
| Crossbeam | T80092479 | 1 |

DANGER



Suspended load.

Danger to life!

- Use suitable equipment and lifting devices.
- Never stand beneath a suspended load and keep a safe distance.
- Wear personal protective equipment (e.g. protective helmet, safety shoes).

Transport

1. Lift the engine only with the lifting eyes provided.
2. Only use suitable and tested transport and lifting equipment.
3. Use all lifting eyes as shown on the installation drawing to lift the engine .
4. Take the engine's center of gravity into account. For information regarding the center of gravity of the engine, refer to the installation/arrangement drawing of the engine.
5. Always transport the in installation position, do not exceed max. permissible diagonal pull (→ Page 19).
6. Lift engine 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.
7. If the engine is supplied with special aluminum 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).
8. Secure the engine against tipping during transportation.
9. Secure such as to preclude slipping and tipping when driving up or down inclines and ramps.

Setting the engine down after transport

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

2.2 Lifting specifications

Lifting specifications

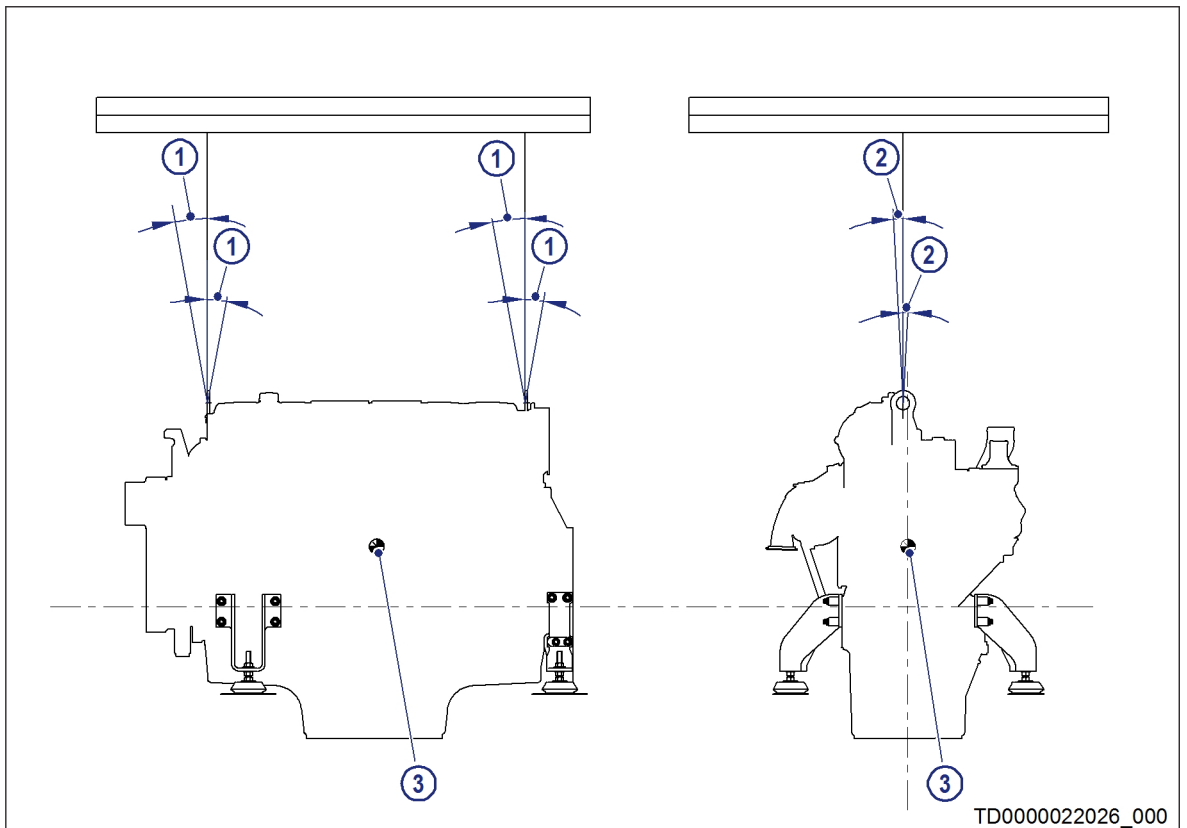
DANGER



Suspended load.

Danger to life!

- Use suitable equipment and lifting devices.
- Never stand beneath a suspended load and keep a safe distance.
- Wear personal protective equipment (e.g. protective helmet, safety shoes).



1 Maximum permissible diagonal pull 10° (*) in longitudinal direction

2 Maximum permissible diagonal pull 3° (*) in transverse direction

3 Center of gravity

(*) Observe max. admissible diagonal pull:

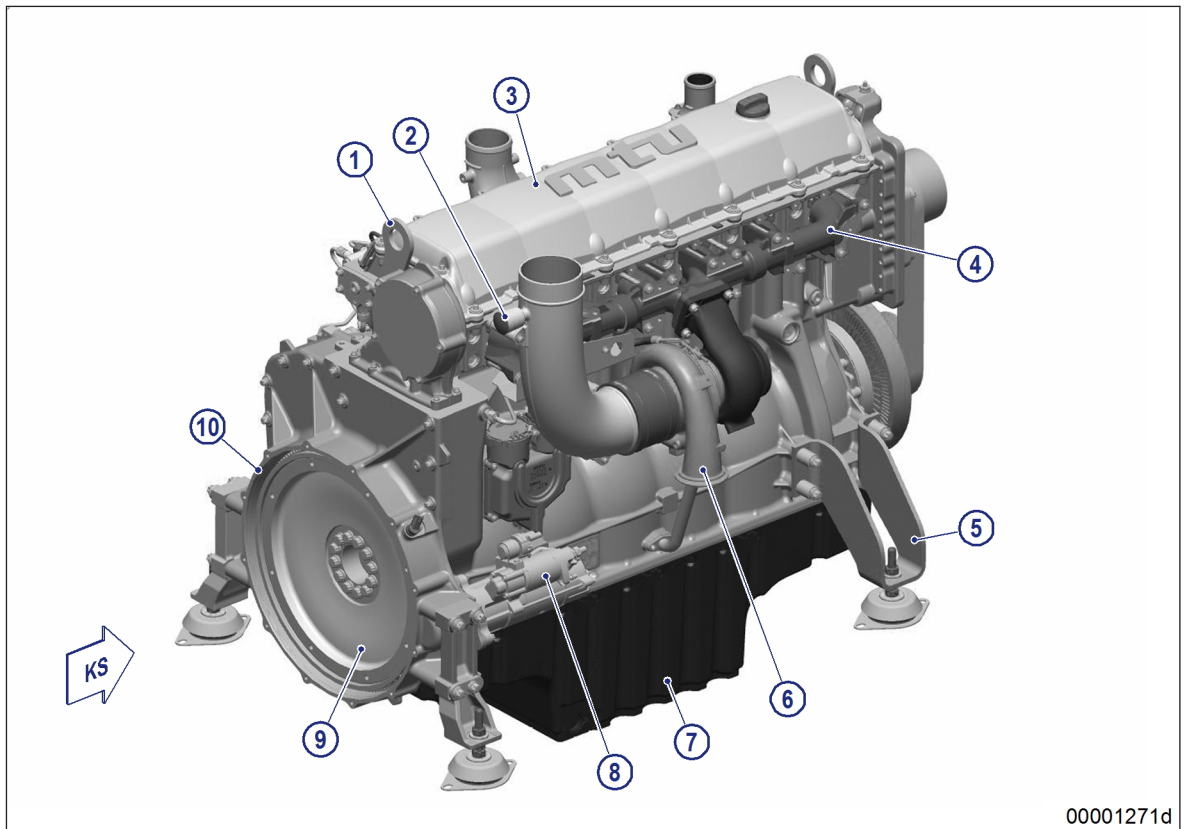
- Max. permissible diagonal pull in longitudinal direction is 10 degrees; no transverse diagonal pull is admissible in this case.
- Max. permissible diagonal pull in longitudinal direction is 3 degrees; no longitudinal diagonal pull is admissible in this case.

Taking note of the engine center of gravity

Refer to the installation/arrangement drawings for details of the center of gravity of the system or engine.

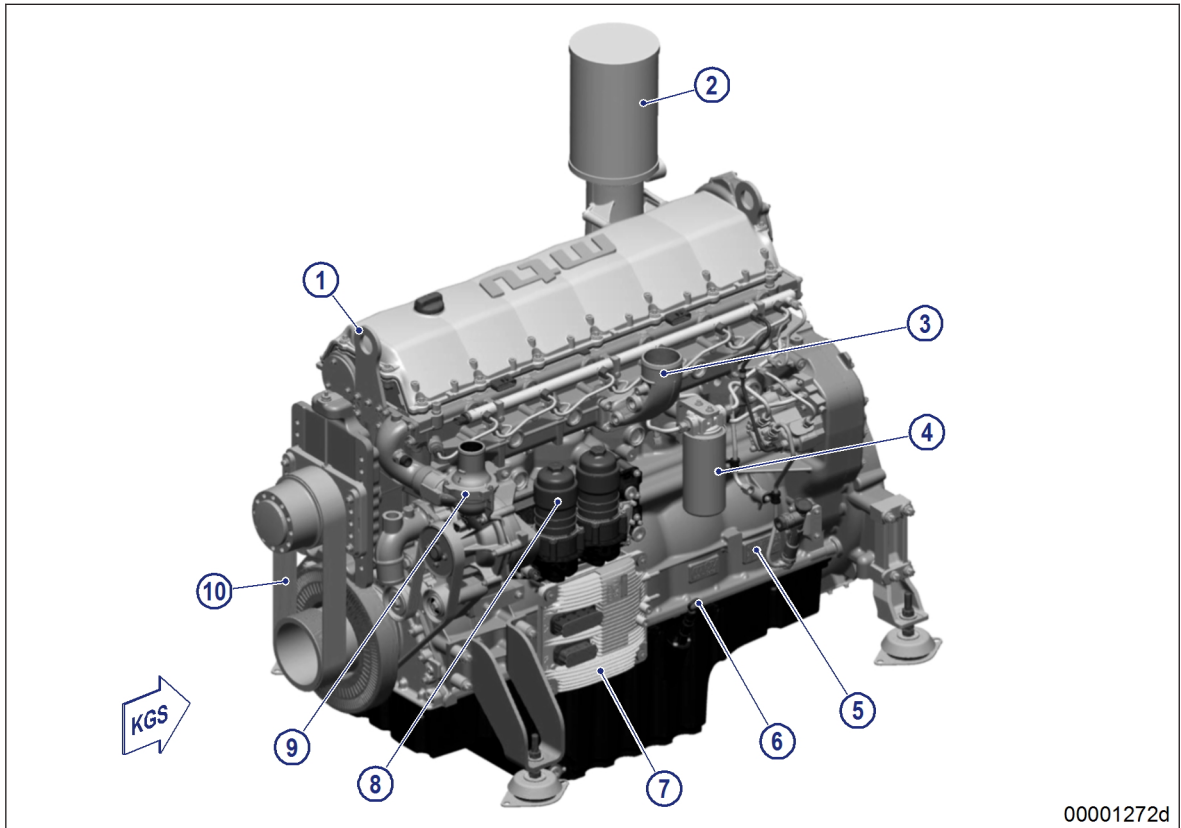
3 General Information

3.1 Engine - Overview



00001271d

- | | | |
|----------------------------|------------------------|---------------------|
| 1 Lifting eye, driving end | 5 Engine mounting | 9 Flywheel |
| 2 Service indicator | 6 Exhaust turbocharger | 10 Flywheel housing |
| 3 Cylinder head | 7 Oil pan | KS Driving end |
| 4 Exhaust elbow | 8 Starter | |



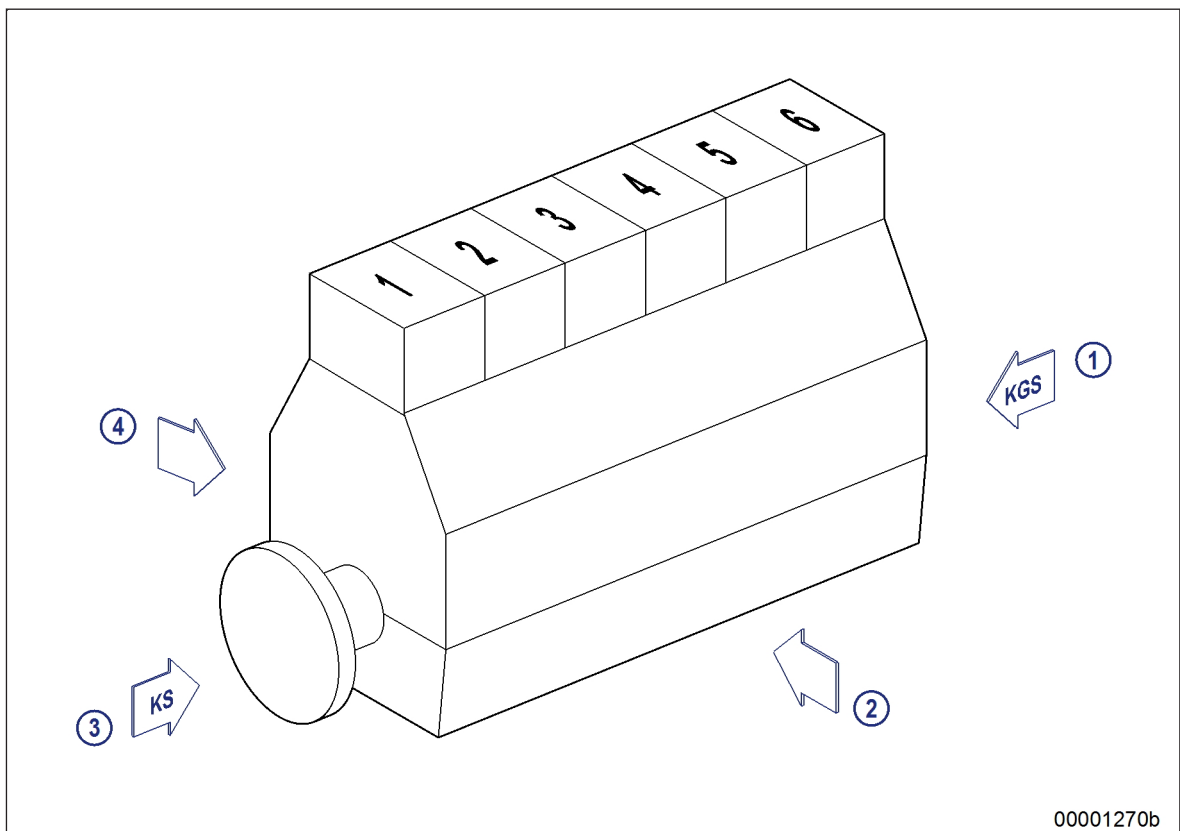
- | | | |
|-------------------------|-------------------|--------------------------------------|
| 1 Lifting eye, free end | 5 Crankcase | 9 Thermostat housing (return cooler) |
| 2 Air filter | 6 Oil pan | 10 Belt drive |
| 3 Air supply pipework | 7 Engine governor | KGS Free end |
| 4 Fuel filter | 8 Oil filter | |

Engine model designation

Key to the engine model designation 6R1600Gxyz / 6R1600Bxyz

| | |
|------|--|
| 6 | Number of cylinders |
| R | Cylinder arrangement: In-line engine |
| 1600 | Series |
| G/B | Application (G/B for Diesel Gendrive) |
| x | Application segment (1, 2, 4, 5, 7, 8) |
| y | Design status |
| z | Frequency (F = 50 Hz, S = 60 Hz) |

3.2 Engine side and cylinder designations



00001270b

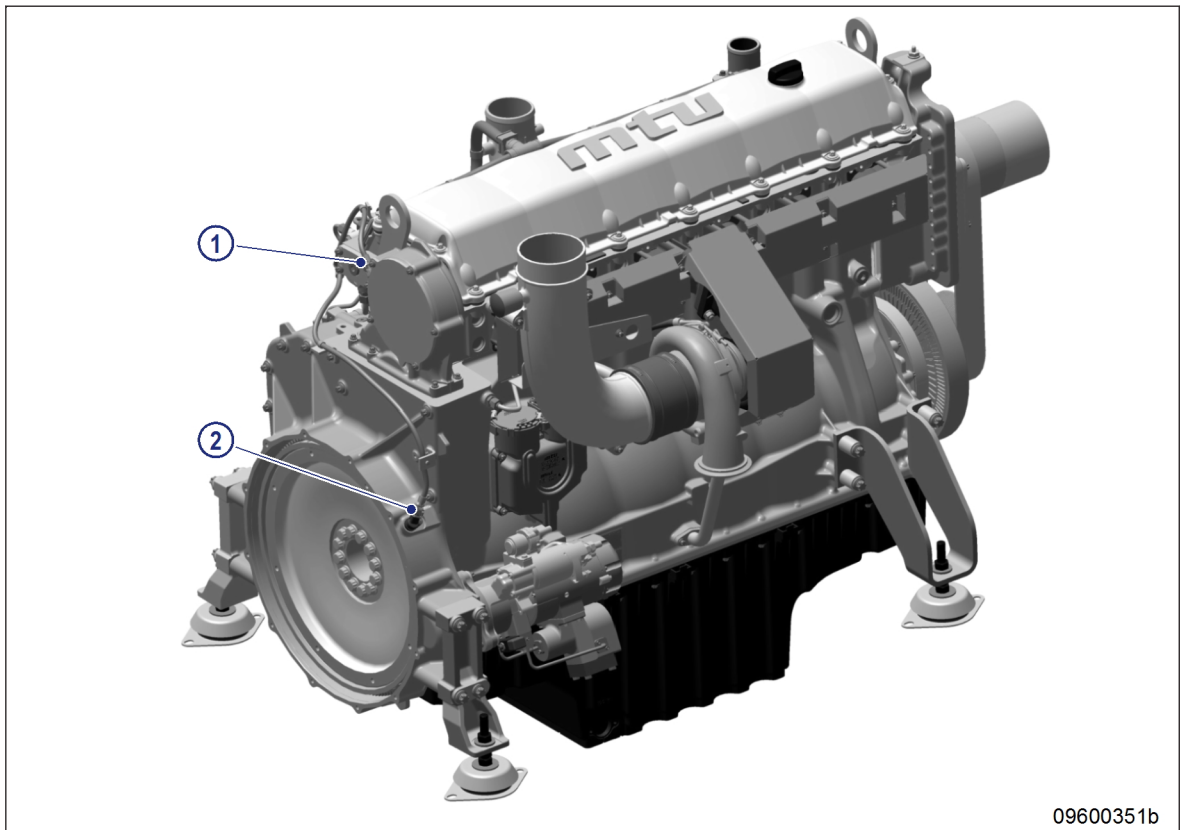
- | | |
|--|--|
| 1 Engine free end in accordance with DIN ISO 1204 (KGS = Kupplungsgegen- seite) | 3 Engine driving end in accordance with DIN ISO 1204 (KS = Kup- plungsseite) |
| 2 Right engine side | 4 Left engine side |

For engine side designation (acc. to DIN ISO 1204), the engine is viewed on driving end (3).

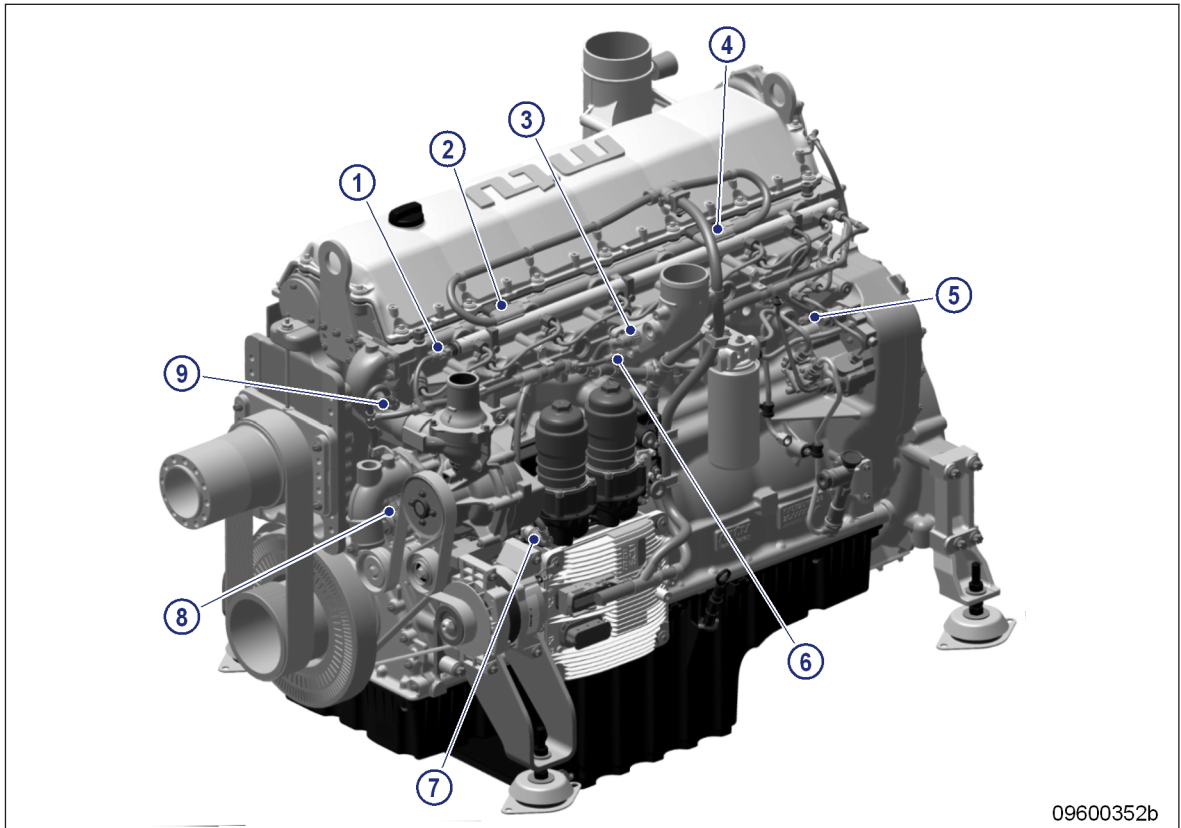
For cylinder designation (acc. to DIN ISO 12041), cylinders are numbered consecutively from engine driving end (3) starting with No. 1.

The numbering of other engine components is also from the driving end (3), starting with No. 1.

3.3 Sensors and actuators



| Item | Name | Monitoring of |
|------|------|------------------|
| 1 | B1 | Camshaft speed |
| 2 | B13 | Crankshaft speed |



09600352b

| Item | Name | Monitoring of |
|------|---------|--------------------------------|
| 1 | B48 | Fuel high pressure |
| 2 | XY39.A2 | Injectors |
| 3 | B10 | Charge-air pressure |
| 4 | XY39.A1 | Injectors |
| 5 | M8 | HP fuel pump (metering unit) |
| 6 | B9 | Charge-air coolant temperature |
| 7 | B5 | Lube oil pressure |
| 8 | B16 | Coolant pressure |
| 9 | B6 | Coolant temperature |

4 Technical Data

4.1 Engine data 6R1600B30S 60 Hz, fuel optimized

Explanation:

- DL Reference value: Continuous power
- BL Reference 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 setting).
- N Not yet defined value
- Not applicable
- X Applicable
- * Value not verified (tolerance $\pm 10\%$)

Reference conditions

| | | | |
|-------------------------------|--|------|----------------|
| Engine model | | | 6R1600B 30S |
| Application group | | | 3B |
| Intake air temperature | | °C | 25 |
| Barometric pressure | | mbar | 1000 |
| Site altitude above sea level | | m | 100 |

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

| | | | |
|--|---|-----|------|
| Number of cylinders | | | 6 |
| Rated engine speed | A | rpm | 1800 |
| Continuous power ISO 3046 (10% overload capability) (power range DIN 6280, ISO 8528) | A | kW | 284 |

Site conditions (for max. power)

| | | | |
|--------------------------------|---|------|-----|
| Number of cylinders | | | 6 |
| Intake depression (new filter) | A | mbar | 25 |
| Intake depression, max. | L | mbar | 50 |
| Exhaust gas overpressure | A | mbar | 85 |
| Exhaust gas overpressure, max. | L | mbar | 150 |

Model-related data (basic design)

| | | | |
|--|--|-----|-----|
| Number of cylinders | | | 6 |
| Number of cylinders | | | 6 |
| Standard housing connecting flange (engine main PTO) | | SAE | 01 |
| Flywheel connection (DISC) | | | 14" |

Air / exhaust gas

| | | | |
|--|---|---------|-----|
| Number of cylinders | | | 6 |
| Charge-air pressure before cylinder – DL | R | bar abs | 3,6 |

Coolant system (HT circuit)

| | | | |
|--|---|-----|-----|
| Number of cylinders | | | 6 |
| Coolant temperature (at engine connection: outlet to cooling system) | A | °C | 95 |
| Coolant temperature after engine, warning | L | °C | 105 |
| Coolant temperature after engine, shutdown | L | °C | 109 |
| Pressure loss in off-engine cooling system, max. | L | bar | 0.7 |

Lube oil system

| | | | |
|---|---|-----|-----|
| Number of cylinders | | | 6 |
| Lube oil pressure before engine, warning | L | bar | 3.2 |
| Lube oil pressure before engine, shutdown | L | bar | 3.0 |

Fuel system

| | | | |
|--|---|-----|------|
| Number of cylinders | | | 6 |
| Fuel pressure at engine supply connection, min. (when engine is started) | L | bar | -0.5 |
| Fuel pressure at engine supply connection, max. (when engine is started) | L | bar | 0.5 |

General operating data

| | | | |
|---|---|-----|-----|
| Number of cylinders | | | 6 |
| Cold start capability: air temperature (w/o start aid, w/o preheating) – (case A) | R | °C | -20 |
| Firing speed, from | R | rpm | 80 |
| Firing speed, to | R | rpm | 120 |

Capacities

| | | | |
|--|---|--------|----|
| Number of cylinders | | | 6 |
| Engine coolant, engine side (w/o cooling equipment) | R | Liters | 45 |
| Total engine oil capacity, initial filling (standard oil system) (option: max. operating inclinations) | R | Liters | 46 |
| Oil change quantity, max. (standard oil system) (option: max. operating inclinations) | R | Liters | 45 |
| Oil pan capacity at dipstick mark “min.” (standard oil system) (option: max. operating inclinations) | L | Liters | 36 |
| Oil pan capacity at dipstick mark “max.” (standard oil system) (option: max. operating inclinations) | L | Liters | 45 |

Masses

| | | | |
|---|---|----|-------|
| Number of cylinders | | | 6 |
| Engine dry weight (with standard accessories installed, w/o coupling) | R | kg | 1185* |
| Engine weight, filled (with standard accessories installed, w/o coupling) | R | kg | 1218 |

Acoustics

| Number of cylinders | | | 6 |
|--|---|-------|-----|
| Exhaust noise, unsilenced - DL (sound power level LW, ISO 6798, +3 dB(A) tolerance) | R | dB(A) | 113 |
| Engine surface noise with attenuated intake noise (filter) - DL (sound power level LW, ISO 6798, +2 dB(A) tolerance) | R | dB(A) | 118 |

4.2 Engine data 6R1600B30S 50 Hz, fuel optimized

Explanation:

- DL Reference value: Continuous power
- BL Reference 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 setting).
- N Not yet defined value
- Not applicable
- X Applicable
- * Value not verified (tolerance $\pm 10\%$)

Reference conditions

| | | | |
|-------------------------------|--|------|----------------|
| Engine model | | | 6R1600B 30S |
| Application group | | | 3B |
| Intake air temperature | | °C | 25 |
| Barometric pressure | | mbar | 1000 |
| Site altitude above sea level | | m | 100 |

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

| | | | |
|--|---|-----|------|
| Number of cylinders | | | 6 |
| Rated engine speed | A | rpm | 1500 |
| Continuous power ISO 3046 (10% overload capability) (power range DIN 6280, ISO 8528) | A | kW | 249 |

Site conditions (for max. power)

| | | | |
|--------------------------------|---|------|-----|
| Number of cylinders | | | 6 |
| Intake depression (new filter) | A | mbar | 25 |
| Intake depression, max. | L | mbar | 50 |
| Exhaust gas overpressure | A | mbar | 85 |
| Exhaust gas overpressure, max. | L | mbar | 150 |

Model-related data (basic design)

| | | | |
|--|--|--------|------|
| Number of cylinders | | | 6 |
| Number of cylinders | | | 6 |
| Cylinder displacement | | Liters | 1,75 |
| Standard housing connecting flange (engine main PTO) | | SAE | 01 |
| Flywheel connection (DISC) | | | 14" |

COMBUSTION AIR / EXHAUST GAS

| | | | |
|--|---|---------|-----|
| Number of cylinders | | | 6 |
| Charge-air pressure before cylinder – DL | R | bar abs | 2.8 |

Coolant system (HT circuit)

| | | | |
|--|---|-----|-----|
| Number of cylinders | | | 6 |
| Coolant temperature (at engine connection: outlet to cooling system) | A | °C | 95 |
| Coolant temperature after engine, warning | L | °C | 105 |
| Coolant temperature after engine, shutdown | L | °C | 109 |
| Coolant antifreeze content, max. | L | % | 50 |
| Pressure loss in off-engine cooling system, max. | L | bar | 0.7 |

Lube oil system

| | | | |
|---|---|-----|-----|
| Number of cylinders | | | 6 |
| Lube oil pressure before engine, warning | L | bar | 2.6 |
| Lube oil pressure before engine, shutdown | L | bar | 2.4 |

Fuel system

| | | | |
|--|---|-----|------|
| Number of cylinders | | | 6 |
| Fuel pressure at engine supply connection, min. (when engine is started) | L | bar | -0.5 |
| Fuel pressure at engine supply connection, max. (when engine is started) | L | bar | 0.5 |

General operating data

| | | | |
|---|---|-----|-----|
| Number of cylinders | | | 6 |
| Cold start capability: air temperature (w/o start aid, w/o preheating) – (case A) | R | °C | -20 |
| Firing speed, from | R | rpm | 80 |
| Firing speed, to | R | rpm | 120 |

Capacities

| | | | |
|--|---|--------|-----|
| Number of cylinders | | | 6 |
| Engine coolant, engine side (w/o cooling equipment) | R | Liters | 45* |
| Total engine oil capacity, initial filling (standard oil system) (option: max. operating inclinations) | R | Liters | 46 |
| Oil change quantity, max. (standard oil system) (option: max. operating inclinations) | R | Liters | 45 |
| Oil pan capacity at dipstick mark “min.” (standard oil system) (option: max. operating inclinations) | L | Liters | 36 |
| Oil pan capacity at dipstick mark “max.” (standard oil system) (option: max. operating inclinations) | L | Liters | 45 |

Masses

| | | | |
|---|---|----|-------|
| Number of cylinders | | | 6 |
| Engine dry weight (with standard accessories installed, w/o coupling) | R | kg | 1185* |
| Engine weight, filled (with standard accessories installed, w/o coupling) | R | kg | 1218 |

Acoustics

| | | | |
|--|---|-------|-----|
| Number of cylinders | | | 6 |
| Exhaust noise, unsilenced - DL (sound power level LW, ISO 6798, +3 dB(A) tolerance) | R | dB(A) | 114 |
| Engine surface noise with attenuated intake noise (filter) - DL (sound power level LW, ISO 6798, +2 dB(A) tolerance) | R | dB(A) | 116 |

4.3 Engine data 6R1600B40S 50 Hz, emissions optimized

Explanation:

- DL Reference value: Continuous power
- BL Reference 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 setting).
- N Not yet defined value
- Not applicable
- X Applicable
- * Value not verified (tolerance $\pm 10\%$)

Reference conditions

| | | | |
|-------------------------------|--|------|----------------|
| Engine model | | | 6R1600B 40S |
| Application group | | | 3B |
| Intake air temperature | | °C | 25 |
| Barometric pressure | | mbar | 1000 |
| Site altitude above sea level | | m | 100 |

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

| | | | |
|--|---|-----|------|
| Number of cylinders | | | 6 |
| Rated engine speed | A | rpm | 1500 |
| Continuous power ISO 3046 (10% overload capability) (power range DIN 6280, ISO 8528) | A | kW | 274 |

Site conditions (for max. power)

| | | | |
|--------------------------------|---|------|-----|
| Number of cylinders | | | 6 |
| Intake depression (new filter) | A | mbar | 25 |
| Intake depression, max. | L | mbar | 50 |
| Exhaust gas overpressure | A | mbar | 85 |
| Exhaust gas overpressure, max. | L | mbar | 150 |

Model-related data (basic design)

| | | | |
|--|--|-----|-----|
| Number of cylinders | | | 6 |
| Number of cylinders | | | 6 |
| Standard housing connecting flange (engine main PTO) | | SAE | 01 |
| Flywheel connection (DISC) | | | 14" |

Coolant system (HT circuit)

| | | | |
|--|---|----|-----|
| Number of cylinders | | | 6 |
| Coolant temperature (at engine connection: outlet to cooling system) | A | °C | 95 |
| Coolant temperature after engine, warning | R | °C | 105 |
| Coolant temperature after engine, shutdown | L | °C | 109 |

| | | | |
|--|---|-----|-----|
| Number of cylinders | | | 6 |
| Coolant antifreeze content, max. | L | % | 50 |
| Pressure loss in off-engine cooling system, max. | L | bar | 0.7 |

Lube oil system

| | | | |
|---|---|-----|-----|
| Number of cylinders | | | 6 |
| Lube oil pressure before engine, warning | R | bar | 2.6 |
| Lube oil pressure before engine, shutdown | L | bar | 2.4 |

Fuel system

| | | | |
|--|---|-----|------|
| Number of cylinders | | | 6 |
| Fuel pressure at engine supply connection, min. (when engine is started) | L | bar | -0.5 |
| Fuel pressure at engine supply connection, max. (when engine is started) | L | bar | 0.5 |

General operating data

| | | | |
|---|---|-----|-----|
| Number of cylinders | | | 6 |
| Cold start capability: air temperature (w/o start aid, w/o preheating) - (case A) | R | °C | -20 |
| Firing speed, from | R | rpm | 80 |
| Firing speed, to | R | rpm | 120 |

Capacities

| | | | |
|--|---|--------|----|
| Number of cylinders | | | 6 |
| Engine oil capacity, initial filling (standard oil system) (option: max. operating inclinations) | R | Liters | 42 |
| Oil change quantity, max. (standard oil system) (option: max. operating inclinations) | R | Liters | 42 |
| Oil pan capacity at dipstick mark "min." (standard oil system) (option: max. operating inclinations) | L | Liters | 33 |
| Oil pan capacity at dipstick mark "max." (standard oil system) (option: max. operating inclinations) | L | Liters | 41 |

Masses

| | | | |
|---|---|----|-------|
| Number of cylinders | | | 6 |
| Engine dry weight (with standard accessories installed, w/o coupling) | R | kg | 1185* |
| Engine weight, filled (with standard accessories installed, w/o coupling) | R | kg | 1218 |

Acoustics

| | | | |
|--|---|-------|-----|
| Number of cylinders | | | 6 |
| Exhaust noise, unsilenced - DL (sound power level LW, ISO 6798, +3 dB(A) tolerance) | R | dB(A) | 115 |
| Engine surface noise with attenuated intake noise (filter) - DL (sound power level LW, ISO 6798, +2 dB(A) tolerance) | R | dB(A) | 117 |

4.4 Engine data 6R1600B40S 50 Hz, fuel optimized

Explanation:

- DL Reference value: Continuous power
- BL Reference 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 setting).
- N Not yet defined value
- Not applicable
- X Applicable
- * Value not verified (tolerance $\pm 10\%$)

Reference conditions

| | | | |
|-------------------------------|--|------|----------------|
| Engine model | | | 6R1600B 40S |
| Application group | | | 3B |
| Intake air temperature | | °C | 25 |
| Barometric pressure | | mbar | 1000 |
| Site altitude above sea level | | m | 100 |

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

| | | | |
|--|---|-----|------|
| Number of cylinders | | | 6 |
| Rated engine speed | A | rpm | 1800 |
| Continuous power ISO 3046 (10% overload capability) (power range DIN 6280, ISO 8528) | A | kW | 274 |

Site conditions (for max. power)

| | | | |
|--------------------------------|---|------|-----|
| Number of cylinders | | | 6 |
| Intake depression (new filter) | A | mbar | 25 |
| Intake depression, max. | L | mbar | 50 |
| Exhaust gas overpressure | A | mbar | 85 |
| Exhaust gas overpressure, max. | L | mbar | 150 |

Model-related data (basic design)

| | | | |
|--|--|-----|-----|
| Number of cylinders | | | 6 |
| Number of cylinders | | | 6 |
| Standard housing connection flange (engine main PTO) | | SAE | 01 |
| Flywheel connection (DISC) | | | 14" |

Coolant system (HT circuit)

| | | | |
|--|---|----|-----|
| Number of cylinders | | | 6 |
| Coolant temperature (at engine connection: outlet to cooling system) | A | °C | 95 |
| Coolant temperature after engine, warning | R | °C | 105 |
| Coolant temperature after engine, shutdown | L | °C | 109 |

| | | | |
|--|---|-----|-----|
| Number of cylinders | | | 6 |
| Coolant antifreeze content, max. | L | % | 50 |
| Pressure loss in off-engine cooling system, max. | L | bar | 0.7 |

Lube oil system

| | | | |
|---|---|-----|-----|
| Number of cylinders | | | 6 |
| Lube oil pressure before engine, warning | L | bar | 2.6 |
| Lube oil pressure before engine, shutdown | L | bar | 2.4 |

Fuel system

| | | | |
|--|---|-----|------|
| Number of cylinders | | | 6 |
| Fuel pressure at engine inlet connection, min. (when engine is starting) | L | bar | -0.5 |
| Fuel pressure at engine inlet connection, max. (when engine is starting) | L | bar | 0.5 |

General operating data

| | | | |
|---|---|-----|-----|
| Number of cylinders | | | 6 |
| Cold start capability: air temperature (w/o start aid, w/o preheating) – (case A) | R | °C | -20 |
| Firing speed, from | R | rpm | 80 |
| Firing speed, to | R | rpm | 120 |

Capacities

| | | | |
|--|---|--------|-----|
| Number of cylinders | | | 6 |
| Engine coolant, engine side (w/o cooling equipment) | R | Liters | 45* |
| Total engine oil capacity, initial filling (standard oil system) (option: max. operating inclinations) | R | Liters | 42 |
| Oil change quantity, max. (standard oil system) (option: max. operating inclinations) | R | Liters | 42 |
| Oil pan capacity at dipstick mark “min.” (standard oil system) (option: max. operating inclinations) | L | Liters | 33 |
| Oil pan capacity at dipstick mark “max.” (standard oil system) (option: max. operating inclinations) | L | Liters | 41 |

Masses

| | | | |
|---|---|----|-------|
| Number of cylinders | | | 6 |
| Engine dry weight (with standard accessories installed, w/o coupling) | R | kg | 1185* |
| Engine weight, filled (with standard accessories installed, w/o coupling) | R | kg | 1218 |

Acoustics

| | | | |
|--|---|-------|-----|
| Number of cylinders | | | 6 |
| Exhaust noise, unsilenced - DL (sound power level LW, ISO 6798, +3 dB(A) tolerance) | R | dB(A) | 115 |
| Engine surface noise with attenuated intake noise (filter) – DL (sound power level LW, ISO 6798, +2 dB(A) tolerance) | R | dB(A) | 117 |

4.5 Engine data 6R1600B40S 60 Hz, fuel optimized

Explanation:

- DL Reference value: Continuous power
- BL Reference 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 setting).
- N Not yet defined value
- Not applicable
- X Applicable
- * Value not verified (tolerance $\pm 10\%$)

Reference conditions

| | | | |
|-------------------------------|--|------|----------------|
| Engine model | | | 6R1600B 40S |
| Application group | | | 3B |
| Intake air temperature | | °C | 25 |
| Barometric pressure | | mbar | 1000 |
| Site altitude above sea level | | m | 100 |

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

| | | | |
|--|---|-----|------|
| Number of cylinders | | | 6 |
| Rated engine speed | A | rpm | 1800 |
| Continuous power ISO 3046 (10% overload capability) (power range DIN 6280, ISO 8528) | A | kW | 312 |

Site conditions (for max. power)

| | | | |
|--------------------------------|---|------|-----|
| Number of cylinders | | | 6 |
| Intake depression (new filter) | A | mbar | 25 |
| Intake depression, max. | L | mbar | 50 |
| Exhaust gas overpressure | A | mbar | 85 |
| Exhaust gas overpressure, max. | L | mbar | 150 |

Model-related data (basic design)

| | | | |
|--|--|-----|-----|
| Number of cylinders | | | 6 |
| Number of cylinders | | | 6 |
| Standard housing connection flange (engine main PTO) | | SAE | 01 |
| Flywheel connection (DISC) | | | 14" |

Air / exhaust gas

| | | | |
|--|---|---------|-----|
| Number of cylinders | | | 6 |
| Charge-air pressure before cylinder – DL | R | bar abs | 3.5 |

Coolant system (HT circuit)

| | | | |
|--|---|-----|-----|
| Number of cylinders | | | 6 |
| Coolant temperature (at engine connection: outlet to cooling system) | A | °C | 95 |
| Coolant temperature after engine, warning | L | °C | 105 |
| Coolant temperature after engine, shutdown | L | °C | 109 |
| Coolant antifreeze content, max. | L | % | 50 |
| Pressure loss in off-engine cooling system, max. | L | bar | 0.7 |

Lube oil system

| | | | |
|---|---|-----|-----|
| Number of cylinders | | | 6 |
| Lube oil operating temperature after engine, to | R | °C | 114 |
| Lube oil pressure before engine, warning | L | bar | 3.2 |
| Lube oil pressure before engine, shutdown | L | bar | 3.0 |

Fuel system

| | | | |
|--|---|-----|------|
| Number of cylinders | | | 6 |
| Fuel pressure at engine inlet connection, min. (when engine is starting) | L | bar | -0.5 |
| Fuel pressure at engine inlet connection, max. (when engine is starting) | L | bar | 0.5 |

General operating data

| | | | |
|---|---|-----|-----|
| Number of cylinders | | | 6 |
| Cold start capability: air temperature (w/o start aid, w/o preheating) - (case A) | R | °C | -20 |
| Firing speed, from | R | rpm | 80 |
| Firing speed, to | R | rpm | 120 |

Capacities

| | | | |
|--|---|--------|----|
| Number of cylinders | | | 6 |
| Total engine oil capacity, initial filling (standard oil system) (option: max. operating inclinations) | R | Liters | 46 |
| Oil change quantity, max. (standard oil system) (option: max. operating inclinations) | R | Liters | 45 |
| Oil pan capacity at dipstick mark "min." (standard oil system) (option: max. operating inclinations) | L | Liters | 36 |
| Oil pan capacity at dipstick mark "max." (standard oil system) (option: max. operating inclinations) | L | Liters | 45 |

Masses

| | | | |
|---|---|----|-------|
| Number of cylinders | | | 6 |
| Engine dry weight (with standard accessories installed, w/o coupling) | R | kg | 1185* |
| Engine weight, filled (with standard accessories installed, w/o coupling) | R | kg | 1218 |

TIM-ID: 0000026300 - 002

Acoustics

| Number of cylinders | | | 6 |
|--|---|-------|-----|
| Exhaust noise, unsilenced - DL (sound power level LW, ISO 6798, +3 dB(A) tolerance) | R | dB(A) | 113 |
| Engine surface noise with attenuated intake noise (filter) - DL (sound power level LW, ISO 6798, +2 dB(A) tolerance) | R | dB(A) | 118 |

4.6 Engine data 6R1600B40S 60 Hz, emissions optimized

Explanation:

- DL Reference value: Continuous power
- BL Reference 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 setting).
- N Not yet defined value
- Not applicable
- X Applicable
- * Value not verified (tolerance $\pm 10\%$)

Reference conditions

| | | | |
|-------------------------------|--|------|----------------|
| Engine model | | | 6R1600B 40S |
| Application group | | | 3B |
| Intake air temperature | | °C | 25 |
| Barometric pressure | | mbar | 1000 |
| Site altitude above sea level | | m | 100 |

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

| | | | |
|--|---|-----|------|
| Number of cylinders | | | 6 |
| Rated engine speed | A | rpm | 1800 |
| Continuous power ISO 3046 (10% overload capability) (power range DIN 6280, ISO 8528) | A | kW | 312 |

Site conditions (for max. power)

| | | | |
|--------------------------------|---|------|-----|
| Number of cylinders | | | 6 |
| Intake depression (new filter) | A | mbar | 25 |
| Intake depression, max. | L | mbar | 50 |
| Exhaust gas overpressure | A | mbar | 85 |
| Exhaust gas overpressure, max. | L | mbar | 150 |

Model-related data (basic design)

| | | | |
|--|--|-----|-----|
| Number of cylinders | | | 6 |
| Number of cylinders | | | 6 |
| Standard housing connecting flange (engine main PTO) | | SAE | 01 |
| Flywheel connection (DISC) | | | 14" |

Coolant system (HT circuit)

| | | | |
|--|---|----|-----|
| Number of cylinders | | | 6 |
| Coolant temperature (at engine connection: outlet to cooling system) | A | °C | 95 |
| Coolant temperature after engine, warning | R | °C | 105 |
| Coolant temperature after engine, shutdown | L | °C | 109 |

TIM-ID: 000.0026275 - 002

| | | | |
|--|---|-----|-----|
| Number of cylinders | | | 6 |
| Coolant antifreeze content, max. | L | % | 50 |
| Pressure loss in off-engine cooling system, max. | L | bar | 0.7 |

Lube oil system

| | | | |
|---|---|-----|-----|
| Number of cylinders | | | 6 |
| Lube oil pressure before engine, warning | R | bar | 3.2 |
| Lube oil pressure before engine, shutdown | L | bar | 3.0 |

Fuel system

| | | | |
|--|---|-----|------|
| Number of cylinders | | | 6 |
| Fuel pressure at engine supply connection, min. (when engine is started) | L | bar | -0.5 |
| Fuel pressure at engine supply connection, max. (when engine is started) | L | bar | 0.5 |

General operating data

| | | | |
|---|---|-----|-----|
| Number of cylinders | | | 6 |
| Cold start capability: air temperature (w/o start aid, w/o preheating) – (case A) | R | °C | -20 |
| Firing speed, from | R | rpm | 80 |
| Firing speed, to | R | rpm | 120 |

Capacities

| | | | |
|--|---|--------|----|
| Number of cylinders | | | 6 |
| Fuel, engine side | R | Liters | 3* |
| Engine oil capacity, initial filling (standard oil system) (option: max. operating inclinations) | R | Liters | 46 |
| Oil change quantity, max. (standard oil system) (option: max. operating inclinations) | R | Liters | 45 |
| Oil pan capacity at dipstick mark “min.” (standard oil system) (option: max. operating inclinations) | L | Liters | 36 |
| Oil pan capacity at dipstick mark “max.” (standard oil system) (option: max. operating inclinations) | L | Liters | 45 |

Masses

| | | | |
|---|---|----|-------|
| Number of cylinders | | | 6 |
| Engine dry weight (with standard accessories installed, w/o coupling) | R | kg | 1185* |
| Engine weight, filled (with standard accessories installed, w/o coupling) | R | kg | 1218 |

Acoustics

| | | | |
|--|---|-------|-----|
| Number of cylinders | | | 6 |
| Exhaust noise, unsilenced - DL (sound power level LW, ISO 6798, +3 dB(A) tolerance) | R | dB(A) | 113 |
| Engine surface noise with attenuated intake noise (filter) - DL (sound power level LW, ISO 6798, +2 dB(A) tolerance) | R | dB(A) | 118 |

4.7 Engine data 6R1600G10F, G20F, fuel optimized

Explanation:

- DL Reference value: Continuous power
- BL Reference 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 setting).
- N Not yet defined value
- Not applicable
- X Applicable
- * Value not adequately verified (tolerance $\pm 10\%$)

Reference conditions

| Engine model | | | 6R1600 G10F | 6R1600 G20F |
|-------------------------------|--|------|----------------|----------------|
| Application group | | | 3B | 3B |
| Intake air temperature | | °C | 25 | 25 |
| Barometric pressure | | mbar | 1000 | 1000 |
| Site altitude above sea level | | m | 100 | 100 |

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

| Number of cylinders | | | 6 | 6 |
|--|---|-----|------|------|
| Rated engine speed | A | rpm | 1500 | 1500 |
| Continuous power ISO 3046 (10% overload capability) (power range DIN 6280, ISO 8528) | A | kW | 249 | 274 |

Site conditions (for max. power)

| Number of cylinders | | | 6 | 6 |
|--------------------------------|---|------|----|----|
| Intake depression (new filter) | A | mbar | 25 | 25 |
| Intake depression, max. | L | mbar | 50 | 50 |
| Exhaust gas overpressure | A | mbar | 85 | 85 |
| Exhaust gas overpressure, max. | L | mbar | 85 | 85 |

Model-related data (basic design)

| Number of cylinders | | | 6 | 6 |
|--|--|------|-----|-----|
| Cooling method: treated water | | | X | X |
| Direction of rotation: c.c.w. (facing driving end) | | | X | X |
| Standard housing connection flange (engine main PTO) | | SAE | 01 | 01 |
| Flywheel interface | | DISC | 14" | 14" |

Air / exhaust gas

| Number of cylinders | | | 6 | 6 |
|--|---|---------|-----|-----|
| Charge-air pressure before cylinder – DL | R | bar abs | 2.8 | 2.6 |

Coolant system (HT circuit)

| Number of cylinders | | | 6 | 6 |
|--|---|-----|-----|-----|
| Coolant temperature (at engine connection: outlet to cooling system) | A | °C | 95 | 95 |
| Coolant temperature after engine, warning | R | °C | 105 | 105 |
| Coolant temperature after engine, shutdown | L | °C | 109 | 109 |
| Coolant antifreeze content, max. | L | % | 50 | 50 |
| Pressure loss in off-engine cooling system, max. | L | bar | 0.7 | 0.7 |

Lube oil system

| Number of cylinders | | | 6 | 6 |
|--|---|-----|-----|-----|
| Lube oil operating temperature before engine, from | R | °C | 105 | 105 |
| Lube oil operating temperature before engine, to | R | °C | 115 | 115 |
| Lube oil temperature before engine, warning | R | °C | - | - |
| Lube oil temperature before engine, shutdown | L | °C | - | - |
| Lube oil operating pressure before engine, from | R | bar | 4.5 | 4.5 |
| Lube oil operating pressure before engine, to | R | bar | 5.5 | 5.5 |
| Lube oil pressure before engine, warning | L | bar | 2.6 | 2.6 |
| Lube oil pressure before engine, shutdown | L | bar | 2.4 | 2.4 |

Fuel system

| Number of cylinders | | | 6 | 6 |
|--|---|-----|------|------|
| Fuel pressure at engine supply connection, min. (when engine is started) | L | bar | -0.5 | -0.5 |
| Fuel pressure at engine supply connection, max. (when engine is started) | L | bar | 0.5 | 0.5 |

General operating data

| Number of cylinders | | | 6 | 6 |
|---|---|-----|-----|-----|
| Cold start capability: air temperature (w/o start aid, w/o preheating) - (case A) | R | °C | -20 | -20 |
| Firing speed, from | R | rpm | 80 | 80 |
| Firing speed, to | R | rpm | 120 | 120 |

Capacities

| Number of cylinders | | | 6 | 6 |
|--|---|--------|-----|-----|
| Engine coolant, engine side (w/o cooling equipment) | R | Liters | 45* | 45* |
| Total engine oil capacity, initial filling (standard oil system) (option: max. operating inclinations) | R | Liters | 42 | 42 |
| Max. oil change quantity (standard oil system) | R | Liters | - | - |
| Oil change quantity, max. (standard oil system) (option: max. operating inclinations) | R | Liters | 41 | 41 |

| | | | | |
|--|---|--------|----|----|
| Number of cylinders | | | 6 | 6 |
| Oil pan capacity at dipstick mark “min.” (standard oil system) (option: max. operating inclinations) | L | Liters | 32 | 32 |
| Oil pan capacity at dipstick mark “max.” (standard oil system) (option: max. operating inclinations) | L | Liters | 40 | 40 |

Masses

| | | | | |
|---|---|----|-------|-------|
| Number of cylinders | | | 6 | 6 |
| Engine weight, dry (basic engine configuration acc. to scope of supply specification) | R | kg | 1185* | 1185* |
| Engine weight, filled (with standard accessories installed, w/o coupling) | R | kg | 1218 | 1218 |

Acoustics

| | | | | |
|--|---|-------|-----|-----|
| Number of cylinders | | | 6 | 6 |
| Exhaust noise, unsilenced - DL (sound power level LW, ISO 6798, +3 dB(A) tolerance) | R | dB(A) | 114 | 115 |
| Engine surface noise with attenuated intake noise (filter) - DL (sound power level LW, ISO 6798, +2 dB(A) tolerance) | R | dB(A) | 116 | 116 |

4.8 Engine data 6R1600G10F, G20F, emissions optimized

Explanation:

- DL Reference value: Continuous power
- BL Reference 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 setting).
- N Not yet defined value
- Not applicable
- X Applicable
- * Value not adequately verified (tolerance $\pm 10\%$)

Reference conditions

| Engine model | | | 6R1600 G10F | 6R1600 G20F |
|-------------------------------|--|------|----------------|----------------|
| Application group | | | 3B | 3B |
| Intake air temperature | | °C | 25 | 25 |
| Barometric pressure | | mbar | 1000 | 1000 |
| Site altitude above sea level | | m | 100 | 100 |

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

| Number of cylinders | | | 6 | 6 |
|--|---|-----|------|------|
| Rated engine speed | A | rpm | 1500 | 1500 |
| Continuous power ISO 3046 (10% overload capability) (power range DIN 6280, ISO 8528) | A | kW | 249 | 274 |

Site conditions (for max. power)

| Number of cylinders | | | 6 | 6 |
|--------------------------------|---|------|----|----|
| Intake depression (new filter) | A | mbar | 25 | 25 |
| Intake depression, max. | L | mbar | 50 | 50 |
| Exhaust gas overpressure | A | mbar | 85 | 85 |
| Exhaust gas overpressure, max. | L | mbar | 85 | 85 |

Model-related data (basic design)

| Number of cylinders | | | 6 | 6 |
|--|--|------|-----|-----|
| Cooling method: treated water | | | X | X |
| Direction of rotation: c.c.w. (facing driving end) | | | X | X |
| Standard housing connection flange (engine main PTO) | | SAE | 01 | 01 |
| Flywheel interface | | DISC | 14" | 14" |

Air / exhaust gas

| Number of cylinders | | | 6 | 6 |
|--|---|---------|-----|-----|
| Charge-air pressure before cylinder – DL | R | bar abs | 3.0 | 3.3 |

Coolant system (HT circuit)

| Number of cylinders | | | 6 | 6 |
|--|---|-----|-----|-----|
| Coolant temperature (at engine connection: outlet to cooling system) | A | °C | 95 | 95 |
| Coolant temperature after engine, warning | L | °C | 105 | 105 |
| Coolant temperature after engine, shutdown | L | °C | 109 | 109 |
| Coolant antifreeze content, max. | L | % | 50 | 50 |
| Pressure loss in off-engine cooling system, max. | L | bar | 0.7 | 0.7 |

Lube oil system

| Number of cylinders | | | 6 | 6 |
|--|---|-----|-----|-----|
| Lube oil operating temperature before engine, from | R | °C | 105 | 105 |
| Lube oil operating temperature before engine, to | R | °C | 115 | 115 |
| Lube oil temperature before engine, warning | R | °C | - | - |
| Lube oil temperature before engine, shutdown | L | °C | - | - |
| Lube oil operating pressure before engine, from | R | bar | 4.5 | 4.5 |
| Lube oil operating pressure before engine, to | R | bar | 5.5 | 5.5 |
| Lube oil pressure before engine, warning | L | bar | 2.6 | 2.6 |
| Lube oil pressure before engine, shutdown | L | bar | 2.4 | 2.4 |

Fuel system

| Number of cylinders | | | 6 | 6 |
|--|---|-----|------|------|
| Fuel pressure at engine inlet connection, min. (when engine is starting) | L | bar | -0.5 | -0.5 |
| Fuel pressure at engine inlet connection, max. (when engine is starting) | L | bar | 0.5 | 0.5 |

General operating data

| Number of cylinders | | | 6 | 6 |
|---|---|-----|-----|-----|
| Cold start capability: air temperature (w/o start aid, w/o preheating) – (case A) | R | °C | -20 | -20 |
| Firing speed, from | R | rpm | 80 | 80 |
| Firing speed, to | R | rpm | 120 | 120 |

Capacities

| Number of cylinders | | | 6 | 6 |
|---|---|--------|-----|-----|
| Engine coolant, engine side (w/o cooling equipment) | R | Liters | 45* | 45* |
| Total engine oil capacity for initial filling (standard oil system) | R | Liters | 42 | 42 |
| Oil change capacity, max. (standard oil system) | R | Liters | - | - |
| Oil change quantity, max. (standard oil system) (option: max. operating inclinations) | R | Liters | 45 | 45 |

| | | | | |
|--|---|--------|----|----|
| Number of cylinders | | | 6 | 6 |
| Oil pan capacity at dipstick mark "min." (standard oil system) (option: max. operating inclinations) | L | Liters | 32 | 32 |
| Oil pan capacity at dipstick mark "max." (standard oil system) (option: max. operating inclinations) | L | Liters | 40 | 40 |

Masses

| | | | | |
|---|---|----|-------|-------|
| Number of cylinders | | | 6 | 6 |
| Engine dry weight (with standard accessories installed, w/o coupling) | R | kg | 1185* | 1185* |
| Engine weight, filled (with standard accessories installed, w/o coupling) | R | kg | 1218 | 1218 |

Acoustics

| | | | | |
|--|---|-------|-----|-----|
| | | | 6 | 6 |
| Exhaust noise, unsilenced - DL (sound power level LW, ISO 6798, +3 dB(A) tolerance) | R | dB(A) | 114 | 115 |
| Engine surface noise with attenuated intake noise (filter) - DL (sound power level LW, ISO 6798, +2 dB(A) tolerance) | R | dB(A) | 116 | 117 |

4.9 Engine data 6R1600G10F, G20F, Nonroad stage III a

Explanation:

- DL Reference value: Continuous power
- BL Reference 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 setting).
- N Not yet defined value
- Not applicable
- X Applicable
- * Value not adequately verified (tolerance $\pm 10\%$)

Reference conditions

| Engine model | | | 6R1600 G10F | 6R1600 G20F |
|-------------------------------|--|------|----------------|----------------|
| Application group | | | 3B | 3B |
| Intake air temperature | | °C | 25 | 25 |
| Barometric pressure | | mbar | 1000 | 1000 |
| Site altitude above sea level | | m | 100 | 100 |

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

| Number of cylinders | | | 6 | 6 |
|--|---|-----|------|------|
| Rated engine speed | A | rpm | 1500 | 1500 |
| Continuous power ISO 3046 (10% overload capability) (power range DIN 6280, ISO 8528) | A | kW | 249 | 274 |

Site conditions (for max. power)

| Number of cylinders | | | 6 | 6 |
|--------------------------------|---|------|----|----|
| Intake depression (new filter) | A | mbar | 25 | 25 |
| Intake depression, max. | L | mbar | 50 | 50 |
| Exhaust gas overpressure | A | mbar | 85 | 85 |
| Exhaust gas overpressure, max. | L | mbar | 85 | 85 |

Model-related data (basic design)

| Number of cylinders | | | 6 | 6 |
|--|--|------|-----|-----|
| Cooling method: treated water | | | X | X |
| Direction of rotation: c.c.w. (facing driving end) | | | X | X |
| Standard housing connecting flange (engine main PTO) | | SAE | 01 | 01 |
| Flywheel interface | | DISC | 14" | 14" |

Air / exhaust gas

| Number of cylinders | | | 6 | 6 |
|--|---|---------|-----|-----|
| Charge-air pressure before cylinder – DL | R | bar abs | 3.1 | 3.1 |

Coolant system (HT circuit)

| Number of cylinders | | | 6 | 6 |
|--|---|-----|-----|-----|
| Coolant temperature (at engine connection: outlet to cooling system) | A | °C | 95 | 95 |
| Coolant temperature after engine, warning | R | °C | 105 | 105 |
| Coolant temperature after engine, shutdown | L | °C | 109 | 109 |
| Coolant antifreeze content, max. | L | % | 50 | 50 |
| Pressure loss in off-engine cooling system, max. | L | bar | 0.7 | 0.7 |

Lube oil system

| Number of cylinders | | | 6 | 6 |
|--|---|-----|-----|-----|
| Lube oil operating temperature before engine, from | R | °C | 105 | 105 |
| Lube oil operating temperature before engine, to | R | °C | 115 | 115 |
| Lube oil temperature before engine, warning | R | °C | - | - |
| Lube oil temperature before engine, shutdown | L | °C | - | - |
| Lube oil operating pressure before engine, from | R | bar | 4.5 | 4.5 |
| Lube oil operating pressure before engine, to | R | bar | 5.5 | 5.5 |
| Lube oil pressure before engine, warning | R | bar | 2.6 | 2.6 |
| Lube oil pressure before engine, shutdown | L | bar | 2.4 | 2.4 |

Fuel system

| Number of cylinders | | | 6 | 6 |
|--|---|-----|------|------|
| Fuel pressure at engine inlet connection, min. (when engine is starting) | L | bar | -0.5 | -0.5 |
| Fuel pressure at engine inlet connection, max. (when engine is starting) | L | bar | 0.5 | 0.5 |

General operating data

| Number of cylinders | | | 6 | 6 |
|---|---|-----|-----|-----|
| Cold start capability: air temperature (w/o start aid, w/o preheating) - (case A) | R | °C | -20 | -20 |
| Firing speed, from | R | rpm | 80 | 80 |
| Firing speed, to | R | rpm | 120 | 120 |

Capacities

| Number of cylinders | | | 6 | 6 |
|---|---|--------|-----|-----|
| Engine coolant, engine side (w/o cooling equipment) | R | Liters | 45* | 45* |
| Total engine oil capacity for initial filling (standard oil system) | R | Liters | - | - |
| Oil change capacity, max. (standard oil system) | R | Liters | - | - |
| Oil change quantity, max. (standard oil system) (option: max. operating inclinations) | R | Liters | 42 | 42 |

| | | | | |
|--|---|--------|----|----|
| Number of cylinders | | | 6 | 6 |
| Oil pan capacity at dipstick mark “min.” (standard oil system) (option: max. operating inclinations) | L | Liters | 32 | 32 |
| Oil pan capacity at dipstick mark “max.” (standard oil system) (option: max. operating inclinations) | L | Liters | 40 | 40 |

Masses

| | | | | |
|---|---|----|-------|-------|
| Number of cylinders | | | 6 | 6 |
| Engine dry weight (with standard accessories installed, w/o coupling) | R | kg | 1185* | 1185* |
| Engine weight, filled (with standard accessories installed, w/o coupling) | R | kg | 1218 | 1218 |

Acoustics

| | | | | |
|--|---|-------|-----|-----|
| Number of cylinders | | | 6 | 6 |
| Exhaust noise, unsilenced - DL (sound power level LW, ISO 6798, +3 dB(A) tolerance) | R | dB(A) | 114 | 115 |
| Engine surface noise with attenuated intake noise (filter) - DL (sound power level LW, ISO 6798, +2 dB(A) tolerance) | R | dB(A) | 116 | 116 |

4.10 Engine data 6R1600G10S, G20S, EPA stage 3

Explanation:

- DL Reference value: Continuous power
- BL Reference 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 setting).
- N Not yet defined value
- Not applicable
- X Applicable
- * Value not adequately verified (tolerance $\pm 10\%$)
- ** Data not yet available at time of publication

Reference conditions

| Engine model | | | 6R1600 G10S | 6R1600 G20S |
|-------------------------------|--|------|----------------|----------------|
| Application group | | | 3B | 3B |
| Intake air temperature | | °C | ** | 25 |
| Barometric pressure | | mbar | ** | 1000 |
| Site altitude above sea level | | m | ** | 100 |

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

| Number of cylinders | | | 6 | 6 |
|--|---|-----|------|------|
| Rated engine speed | A | rpm | 1800 | 1800 |
| Continuous power ISO 3046 (10% overload capability) (power range DIN 6280, ISO 8528) | A | kW | 284 | 312 |

Site conditions (for max. power)

| Number of cylinders | | | 6 | 6 |
|--------------------------------|---|------|----|----|
| Intake depression (new filter) | A | mbar | 25 | 25 |
| Intake depression, max. | L | mbar | 50 | 50 |
| Exhaust gas overpressure | A | mbar | 85 | 85 |
| Exhaust gas overpressure, max. | L | mbar | 85 | 85 |

Model-related data (basic design)

| Number of cylinders | | | 6 | 6 |
|--|--|------|-----|-----|
| Cooling method: treated water | | | X | X |
| Direction of rotation: c.c.w. (facing driving end) | | | X | X |
| Standard housing connection flange (engine main PTO) | | SAE | 01 | 01 |
| Flywheel interface | | DISC | 14" | 14" |

Air / exhaust gas

| Number of cylinders | | | 6 | 6 |
|--|---|---------|-----|-----|
| Charge-air pressure before cylinder – DL | R | bar abs | 3,6 | 3,6 |

Coolant system (HT circuit)

| Number of cylinders | | | 6 | 6 |
|--|---|-----|-----|-----|
| Coolant temperature (at engine connection: outlet to cooling system) | A | °C | 95 | 95 |
| Coolant temperature after engine, warning | R | °C | 105 | 105 |
| Coolant temperature after engine, shutdown | L | °C | 109 | 109 |
| Coolant antifreeze content, max. | L | % | ** | 50 |
| Pressure loss in off-engine cooling system, max. | L | bar | 0.7 | 0.7 |

Lube oil system

| Number of cylinders | | | 6 | 6 |
|--|---|-----|-----|-----|
| Lube oil operating temperature before engine, from | R | °C | 105 | 105 |
| Lube oil operating temperature before engine, to | R | °C | 115 | 115 |
| Lube oil temperature before engine, warning | R | °C | - | - |
| Lube oil temperature before engine, shutdown | L | °C | - | - |
| Lube oil operating pressure before engine, from | R | bar | 4.5 | 4.5 |
| Lube oil operating pressure before engine, to | R | bar | 5.5 | 5.5 |
| Lube oil operating pressure before engine, warning (speed-dependent value, consult MTU) | R | bar | 3.2 | 3.2 |
| Lube oil operating pressure before engine, shutdown (speed-dependent value, consult MTU) | L | bar | 3.0 | 3.0 |

Fuel system

| Number of cylinders | | | 6 | 6 |
|--|---|-----|------|------|
| Fuel pressure at engine inlet connection, min. (when engine is starting) | L | bar | -0.5 | -0.5 |
| Fuel pressure at engine inlet connection, max. (when engine is starting) | L | bar | 0.5 | 0.5 |

General operating data

| Number of cylinders | | | 6 | 6 |
|---|---|-----|-----|-----|
| Cold start capability: air temperature (w/o start aid, w/o preheating) – (case A) | R | °C | -20 | -20 |
| Firing speed, from | R | rpm | 80 | 80 |
| Firing speed, to | R | rpm | 120 | 120 |

Capacities

| Number of cylinders | | | 6 | 6 |
|---|---|--------|----|-----|
| Engine coolant, engine side (w/o cooling equipment) | R | Liters | 45 | 45* |
| Total engine oil at initial filling (standard oil system) | R | Liters | 42 | 42 |
| Max. oil change quantity (standard oil system) | R | Liters | - | - |
| Oil change quantity, max. (standard oil system) (option: max. operating inclinations) | R | Liters | 41 | 41 |

| | | | | |
|--|---|--------|----|----|
| Number of cylinders | | | 6 | 6 |
| Oil pan capacity at dipstick mark “min.” (standard oil system) (option: max. operating inclinations) | L | Liters | 32 | 32 |
| Oil pan capacity at dipstick mark “max.” (standard oil system) (option: max. operating inclinations) | L | Liters | 40 | 40 |

Masses

| | | | | |
|---|---|----|-------|-------|
| Number of cylinders | | | 6 | 6 |
| Engine dry weight (with standard accessories installed, w/o coupling) | R | kg | 1185* | 1185* |
| Engine weight, filled (with standard accessories installed, w/o coupling) | R | kg | 1218 | 1218 |

Acoustics

| | | | | |
|--|---|-------|-----|-----|
| | | | 6 | 6 |
| Exhaust noise, unsilenced - DL (sound power level LW, ISO 6798, +3 dB(A) tolerance) | R | dB(A) | 113 | 113 |
| Engine surface noise with attenuated intake noise (filter) - DL (sound power level LW, ISO 6798, +2 dB(A) tolerance) | R | dB(A) | 118 | 118 |

4.11 Engine data 6R1600G40F, G50F, fuel optimized

Explanation:

- DL Reference value: Continuous power
- BL Reference 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 setting).
- N Not yet defined value
- Not applicable
- X Applicable
- * Value not adequately verified (tolerance $\pm 10\%$)

Reference conditions

| Engine model | | | 6R1600 G40F | 6R1600 G50F |
|-------------------------------|--|------|----------------|----------------|
| Application group | | | 3C | 3C |
| Intake air temperature | | °C | 25 | 25 |
| Barometric pressure | | mbar | 1000 | 1000 |
| Site altitude above sea level | | m | 100 | 100 |

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

| Number of cylinders | | | 6 | 6 |
|--------------------------|---|-----|------|------|
| Rated engine speed | A | rpm | 1500 | 1500 |
| Fuel stop power ISO 3046 | A | kW | 274 | 301 |

Site conditions (for max. power)

| Number of cylinders | | | 6 | 6 |
|--------------------------------|---|------|-----|-----|
| Intake depression (new filter) | A | mbar | 25 | 25 |
| Intake depression, max. | L | mbar | 50 | 50 |
| Exhaust gas overpressure | A | mbar | 85 | 85 |
| Exhaust gas overpressure, max. | L | mbar | 150 | 150 |

Model-related data (basic design)

| Number of cylinders | | | 6 | 6 |
|--|--|------|-----|-----|
| Cooling method: treated water | | | X | X |
| Direction of rotation: c.c.w. (facing driving end) | | | X | X |
| Standard housing connection flange (engine main PTO) | | SAE | 01 | 01 |
| Flywheel interface | | DISC | 14" | 14" |

Air / exhaust gas

| Number of cylinders | | | 6 | 6 |
|--|---|---------|-----|-----|
| Charge-air pressure before cylinder – DL | R | bar abs | 3.0 | 2.9 |

TIM-ID: 0000010921 - 002

Coolant system (HT circuit)

| Number of cylinders | | | 6 | 6 |
|--|---|-----|-----|-----|
| Coolant temperature (at engine connection: outlet to cooling system) | A | °C | 95 | 95 |
| Coolant temperature after engine, warning | L | °C | 105 | 105 |
| Coolant temperature after engine, shutdown | L | °C | 109 | 109 |
| Coolant antifreeze content, max. | L | % | 50 | 50 |
| Pressure loss in off-engine cooling system, max. | L | bar | 0.7 | 0.7 |

Lube oil system

| Number of cylinders | | | 6 | 6 |
|--|---|-----|-----|-----|
| Lube oil operating temperature before engine, from | R | °C | 105 | 105 |
| Lube oil operating temperature before engine, to | R | °C | 115 | 115 |
| Lube oil temperature before engine, warning | R | °C | - | - |
| Lube oil temperature before engine, shutdown | L | °C | - | - |
| Lube oil operating pressure before engine, from | R | bar | 4.5 | 4.5 |
| Lube oil operating pressure before engine, to | R | bar | 5.5 | 5.5 |
| Lube oil pressure before engine, warning | R | bar | 2.6 | 2.6 |
| Lube oil pressure before engine, shutdown | L | bar | 2.4 | 2.4 |

Fuel system

| Number of cylinders | | | 6 | 6 |
|--|---|-----|------|------|
| Fuel pressure at engine supply connection, min. (when engine is started) | L | bar | -0.5 | -0.5 |
| Fuel pressure at engine supply connection, max. (when engine is started) | L | bar | 0.5 | 0.5 |

General operating data

| Number of cylinders | | | 6 | 6 |
|---|---|-----|-----|-----|
| Cold start capability: air temperature (w/o start aid, w/o preheating) - (case A) | R | °C | -20 | -20 |
| Firing speed, from | R | rpm | 80 | 80 |
| Firing speed, to | R | rpm | 120 | 120 |

Capacities

| Number of cylinders | | | 6 | 6 |
|---|---|--------|-----|-----|
| Engine coolant, engine side (w/o cooling equipment) | R | Liters | 45* | 45* |
| Total engine oil at initial filling (standard oil system) | R | Liters | 42 | 42 |
| Max. oil change quantity (standard oil system) | R | Liters | - | - |
| Oil change quantity, max. (standard oil system) (option: max. operating inclinations) | R | Liters | 41 | 41 |

| | | | | |
|--|---|--------|----|----|
| Number of cylinders | | | 6 | 6 |
| Oil pan capacity at dipstick mark “min.” (standard oil system) (option: max. operating inclinations) | L | Liters | 32 | 32 |
| Oil pan capacity at dipstick mark “max.” (standard oil system) (option: max. operating inclinations) | L | Liters | 40 | 40 |

Masses

| | | | | |
|---|---|----|-------|-------|
| Number of cylinders | | | 6 | 6 |
| Engine dry weight (with standard accessories installed, w/o coupling) | R | kg | 1185* | 1185* |
| Engine weight, filled (with standard accessories installed, w/o coupling) | R | kg | 1218 | 1218 |

Acoustics

| | | | | |
|--|---|-------|-----|-----|
| | | | 6 | 6 |
| Exhaust noise, unsilenced - DL (sound power level LW, ISO 6798, +3 dB(A) tolerance) | R | dB(A) | 114 | 115 |
| Engine surface noise with attenuated intake noise (filter) - DL (sound power level LW, ISO 6798, +2 dB(A) tolerance) | R | dB(A) | 116 | 116 |

4.12 Engine data 6R1600G40F, G50F, emissions optimized

Explanation:

- DL Reference value: Continuous power
- BL Reference 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 setting).
- N Not yet defined value
- Not applicable
- X Applicable
- * Value not adequately verified (tolerance $\pm 10\%$)
- ** Data not yet available at time of publication

Reference conditions

| Engine model | | | 6R1600 G40F | 6R1600 G50F |
|-------------------------------|--|------|----------------|----------------|
| Application group | | | 3C | 3C |
| Intake air temperature | | °C | 25 | 25 |
| Barometric pressure | | mbar | 1000 | 1000 |
| Site altitude above sea level | | m | 100 | 100 |

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

| Number of cylinders | | | 6 | 6 |
|--------------------------|---|-----|------|------|
| Rated engine speed | A | rpm | 1500 | 1500 |
| Fuel stop power ISO 3046 | A | kW | 274 | 301 |

Site conditions (for max. power)

| Number of cylinders | | | 6 | 6 |
|--------------------------------|---|------|----|----|
| Intake depression (new filter) | A | mbar | 25 | 25 |
| Intake depression, max. | L | mbar | 50 | 50 |
| Exhaust gas overpressure | A | mbar | 85 | 85 |
| Exhaust gas overpressure, max. | L | mbar | 85 | 85 |

Model-related data (basic design)

| Number of cylinders | | | 6 | 6 |
|--|--|------|-----|-----|
| Cooling method: treated water | | | X | X |
| Direction of rotation: c.c.w. (facing driving end) | | | X | X |
| Standard housing connection flange (engine main PTO) | | SAE | 01 | 01 |
| Flywheel interface | | DISC | 14" | 14" |

Air / exhaust gas

| Number of cylinders | | | 6 | 6 |
|--|---|---------|-----|-----|
| Charge-air pressure before cylinder – DL | R | bar abs | 3.0 | 3.3 |

Coolant system (HT circuit)

| Number of cylinders | | | 6 | 6 |
|--|---|-----|-----|-----|
| Coolant temperature (at engine connection: outlet to cooling system) | A | °C | 95 | 95 |
| Coolant temperature after engine, warning | L | °C | 105 | 105 |
| Coolant temperature after engine, shutdown | L | °C | 109 | 109 |
| Coolant antifreeze content, max. | L | % | 50 | 50 |
| Pressure loss in off-engine cooling system, max. | L | bar | 0.7 | 0.7 |

Lube oil system

| Number of cylinders | | | 6 | 6 |
|--|---|-----|-----|-----|
| Lube oil operating temperature before engine, from | R | °C | 105 | 105 |
| Lube oil operating temperature before engine, to | R | °C | 115 | 115 |
| Lube oil temperature before engine, warning | R | °C | - | - |
| Lube oil temperature before engine, shutdown | L | °C | - | - |
| Lube oil operating pressure before engine, from | R | bar | 4.5 | 4.5 |
| Lube oil operating pressure before engine, to | R | bar | 5.5 | 5.5 |
| Lube oil operating pressure before engine, warning (speed-dependent value, consult MTU) | L | bar | 2.6 | 2.6 |
| Lube oil operating pressure before engine, shutdown (speed-dependent value, consult MTU) | L | bar | 2.4 | 2.4 |

Fuel system

| Number of cylinders | | | 6 | 6 |
|--|---|-----|------|------|
| Fuel pressure at engine inlet connection, min. (when engine is starting) | L | bar | -0.5 | -0.5 |
| Fuel pressure at engine inlet connection, max. (when engine is starting) | L | bar | 0.5 | 0.5 |

General operating data

| Number of cylinders | | | 6 | 6 |
|---|---|-----|-----|-----|
| Cold start capability: air temperature (w/o start aid, w/o preheating) – (case A) | R | °C | -20 | -20 |
| Firing speed, from | R | rpm | 80 | 80 |
| Firing speed, to | R | rpm | 120 | 120 |

General operating data

| Number of cylinders | | | 6 | 6 |
|--|---|--------|-----|-----|
| Engine coolant, engine side (w/o cooling equipment) | R | Liters | 45* | 45* |
| Total engine oil capacity, initial filling (standard oil system) (option: max. operating inclinations) | R | Liters | 42 | 42 |
| Max. oil change quantity (standard oil system) | R | Liters | - | - |
| Oil change quantity, max. (standard oil system) (option: max. operating inclinations) | R | Liters | 41 | 41 |

| | | | | |
|--|---|--------|----|----|
| Number of cylinders | | | 6 | 6 |
| Oil pan capacity at dipstick mark “min.” (standard oil system) (option: max. operating inclinations) | L | Liters | 32 | 32 |
| Oil pan capacity at dipstick mark “max.” (standard oil system) (option: max. operating inclinations) | L | Liters | 40 | 40 |

Masses

| | | | | |
|---|---|----|-------|-------|
| Number of cylinders | | | 6 | 6 |
| Engine dry weight (with standard accessories installed, w/o coupling) | R | kg | 1185* | 1185* |
| Engine weight, filled (with standard accessories installed, w/o coupling) | R | kg | 1218 | 1218 |

Acoustics

| | | | | |
|--|---|-------|-----|-----|
| | | | 6 | 6 |
| Exhaust noise, unsilenced - DL (sound power level LW, ISO 6798, +3 dB(A) tolerance) | R | dB(A) | 114 | 115 |
| Engine surface noise with attenuated intake noise (filter) - DL (sound power level LW, ISO 6798, +2 dB(A) tolerance) | R | dB(A) | 116 | 117 |

4.13 Engine data 6R1600G40F, G50F, Nonroad stage III a

Explanation:

- DL Reference value: Continuous power
- BL Reference 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 setting).
- N Not yet defined value
- Not applicable
- X Applicable
- * Value not adequately verified (tolerance $\pm 10\%$)

Reference conditions

| Engine model | | | 6R1600 G40F | 6R1600 G50F |
|-------------------------------|--|------|----------------|----------------|
| Application group | | | 3C | 3C |
| Intake air temperature | | °C | 25 | 25 |
| Barometric pressure | | mbar | 1000 | 1000 |
| Site altitude above sea level | | m | 100 | 100 |

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

| Number of cylinders | | | 6 | 6 |
|--------------------------|---|-----|------|------|
| Rated engine speed | A | rpm | 1500 | 1500 |
| Fuel stop power ISO 3046 | A | kW | 274 | 301 |

Site conditions (for max. power)

| Number of cylinders | | | 6 | 6 |
|--------------------------------|---|------|----|----|
| Intake depression (new filter) | A | mbar | 25 | 25 |
| Intake depression, max. | L | mbar | 50 | 50 |
| Exhaust gas overpressure | A | mbar | 85 | 85 |
| Exhaust gas overpressure, max. | L | mbar | 85 | 85 |

Model-related data (basic design)

| Number of cylinders | | | 6 | 6 |
|--|--|------|-----|-----|
| Cooling method: treated water | | | X | X |
| Direction of rotation: c.c.w. (facing driving end) | | | X | X |
| Standard housing connection flange (engine main PTO) | | SAE | 01 | 01 |
| Flywheel interface | | DISC | 14" | 14" |

Air / exhaust gas

| Number of cylinders | | | 6 | 6 |
|--|---|---------|-----|-----|
| Charge-air pressure before cylinder – DL | R | bar abs | 3.1 | 3.3 |

Coolant system (HT circuit)

| Number of cylinders | | | 6 | 6 |
|--|---|-----|-----|-----|
| Coolant temperature (at engine connection: outlet to cooling system) | A | °C | 95 | 95 |
| Coolant temperature after engine, warning | R | °C | 105 | 105 |
| Coolant temperature after engine, shutdown | L | °C | 109 | 109 |
| Coolant antifreeze content, max. | L | % | 50 | 50 |
| Pressure loss in off-engine cooling system, max. | L | bar | 0.7 | 0.7 |

Lube oil system

| Number of cylinders | | | 6 | 6 |
|--|---|-----|-----|-----|
| Lube oil operating temperature before engine, from | R | °C | 105 | 105 |
| Lube oil operating temperature before engine, to | R | °C | 115 | 115 |
| Lube oil temperature before engine, warning | R | °C | - | - |
| Lube oil temperature before engine, shutdown | L | °C | - | - |
| Lube oil operating pressure before engine, from | R | bar | 4.5 | 4.5 |
| Lube oil operating pressure before engine, to | R | bar | 5.5 | 5.5 |
| Lube oil operating pressure before engine, warning (speed-dependent value, consult MTU) | L | bar | 2.6 | 2.6 |
| Lube oil operating pressure before engine, shutdown (speed-dependent value, consult MTU) | L | bar | 2.4 | 2.4 |

Fuel system

| Number of cylinders | | | 6 | 6 |
|--|---|-----|------|------|
| Fuel pressure at engine inlet connection, min. (when engine is starting) | L | bar | -0.5 | -0.5 |
| Fuel pressure at engine inlet connection, max. (when engine is starting) | L | bar | 0.5 | 0.5 |

General operating data

| Number of cylinders | | | 6 | 6 |
|---|---|-----|-----|-----|
| Cold start capability: air temperature (w/o start aid, w/o preheating) - (case A) | R | °C | -20 | -20 |
| Firing speed, from | R | rpm | 80 | 80 |
| Firing speed, to | R | rpm | 120 | 120 |

Capacities

| Number of cylinders | | | 6 | 6 |
|--|---|--------|-----|-----|
| Engine coolant, engine side (w/o cooling equipment) | R | Liters | 45* | 45* |
| Total engine oil capacity, initial filling (standard oil system) (option: max. operating inclinations) | R | Liters | 42 | 42 |
| Max. oil change quantity (standard oil system) | R | Liters | - | - |
| Oil change quantity, max. (standard oil system) (option: max. operating inclinations) | R | Liters | 41 | 41 |

| | | | | |
|--|---|--------|----|----|
| Number of cylinders | | | 6 | 6 |
| Oil pan capacity at dipstick mark “min.” (standard oil system) (option: max. operating inclinations) | L | Liters | 32 | 32 |
| Oil pan capacity at dipstick mark “max.” (standard oil system) (option: max. operating inclinations) | L | Liters | 40 | 40 |

Masses

| | | | | |
|---|---|----|-------|-------|
| Number of cylinders | | | 6 | 6 |
| Engine dry weight (with standard accessories installed, w/o coupling) | R | kg | 1185* | 1185* |
| Engine weight, filled (with standard accessories installed, w/o coupling) | R | kg | 1218 | 1218 |

Acoustics

| | | | | |
|--|---|-------|-----|-----|
| | | | 6 | 6 |
| Exhaust noise, unsilenced - DL (sound power level LW, ISO 6798, +3 dB(A) tolerance) | R | dB(A) | 114 | 115 |
| Engine surface noise with attenuated intake noise (filter) - DL (sound power level LW, ISO 6798, +2 dB(A) tolerance) | R | dB(A) | 116 | 116 |

4.14 Engine data 6R1600G70F, G80F, fuel optimized

Explanation:

- DL Reference value: Continuous power
- BL Reference 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 setting).
- N Not yet defined value
- Not applicable
- X Applicable
- * Value not adequately verified (tolerance $\pm 10\%$)

Reference conditions

| Engine model | | | 6R1600 G70F | 6R1600 G80F |
|-------------------------------|--|------|----------------|----------------|
| Application group | | | 3D | 3D |
| Intake air temperature | | °C | 25 | 25 |
| Barometric pressure | | mbar | 1000 | 1000 |
| Site altitude above sea level | | m | 100 | 100 |

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

| Number of cylinders | | | 6 | 6 |
|--------------------------|---|-----|------|------|
| Rated engine speed | A | rpm | 1500 | 1500 |
| Fuel stop power ISO 3046 | A | kW | 274 | 301 |

Site conditions (for max. power)

| Number of cylinders | | | 6 | 6 |
|--------------------------------|---|------|----|----|
| Intake depression (new filter) | A | mbar | 25 | 25 |
| Intake depression, max. | L | mbar | 50 | 50 |
| Exhaust gas overpressure | A | mbar | 85 | 85 |
| Exhaust gas overpressure, max. | L | mbar | 85 | 85 |

Model-related data (basic design)

| Number of cylinders | | | 6 | 6 |
|--|--|------|-----|-----|
| Cooling method: treated water | | | X | X |
| Direction of rotation: c.c.w. (facing driving end) | | | X | X |
| Standard housing connection flange (engine main PTO) | | SAE | 01 | 01 |
| Flywheel interface | | DISC | 14" | 14" |

Air / exhaust gas

| Number of cylinders | | | 6 | 6 |
|--|---|---------|-----|-----|
| Charge-air pressure before cylinder – BL | R | bar abs | 3.2 | 3.4 |

Coolant system (HT circuit)

| Number of cylinders | | | 6 | 6 |
|--|---|-----|-----|-----|
| Coolant temperature (at engine connection: outlet to cooling system) | A | °C | 95 | 95 |
| Coolant temperature after engine, warning | R | °C | 105 | 105 |
| Coolant temperature after engine, shutdown | L | °C | 109 | 109 |
| Coolant antifreeze content, max. | L | % | 50 | 50 |
| Pressure loss in off-engine cooling system, max. | L | bar | 0.7 | 0.7 |

Lube oil system

| Number of cylinders | | | 6 | 6 |
|--|---|-----|-----|-----|
| Lube oil operating temperature before engine, from | R | °C | 105 | 105 |
| Lube oil operating temperature before engine, to | R | °C | 115 | 115 |
| Lube oil temperature before engine, warning | R | °C | - | - |
| Lube oil temperature before engine, shutdown | L | °C | - | - |
| Lube oil operating pressure before engine, from | R | bar | 4.5 | 4.5 |
| Lube oil operating pressure before engine, to | R | bar | 5.5 | 5.5 |
| Lube oil operating pressure before engine, warning (speed-dependent value, consult MTU) | L | bar | 2.6 | 2.6 |
| Lube oil operating pressure before engine, shutdown (speed-dependent value, consult MTU) | L | bar | 2.4 | 2.4 |

Fuel system

| Number of cylinders | | | 6 | 6 |
|--|---|-----|------|------|
| Fuel pressure at engine inlet connection, min. (when engine is starting) | L | bar | -0.5 | -0.5 |
| Fuel pressure at engine inlet connection, max. (when engine is starting) | L | bar | 0.5 | 0.5 |

General operating data

| Number of cylinders | | | 6 | 6 |
|---|---|-----|-----|-----|
| Cold start capability: air temperature (w/o start aid, w/o preheating) – (case A) | R | °C | -20 | -20 |
| Firing speed, from | R | rpm | 80 | 80 |
| Firing speed, to | R | rpm | 120 | 120 |

Capacities

| Number of cylinders | | | 6 | 6 |
|--|---|--------|-----|-----|
| Engine coolant, engine side (w/o cooling equipment) | R | Liters | 45* | 45* |
| Total engine oil capacity, initial filling (standard oil system) (option: max. operating inclinations) | R | Liters | 42 | 42 |
| Max. oil change quantity (standard oil system) | R | Liters | - | - |
| Oil change quantity, max. (standard oil system) (option: max. operating inclinations) | R | Liters | 41 | 41 |

| Number of cylinders | | | 6 | 6 |
|--|---|--------|----|----|
| Oil pan capacity at dipstick mark "min." (standard oil system) (option: max. operating inclinations) | L | Liters | 32 | 32 |
| Oil pan capacity at dipstick mark "max." (standard oil system) (option: max. operating inclinations) | L | Liters | 40 | 40 |

Masses

| Number of cylinders | | | 6 | 6 |
|---|---|----|-------|-------|
| Engine dry weight (with standard accessories installed, w/o coupling) | R | kg | 1185* | 1185* |
| Engine weight, filled (with standard accessories installed, w/o coupling) | R | kg | 1218 | 1218 |

Acoustics

| | | | 6 | 6 |
|--|---|-------|-----|-----|
| Exhaust noise, unsilenced - BL (sound power level LW, ISO 6798, +3 dB(A) tolerance) | R | dB(A) | 115 | 115 |
| Engine surface noise with attenuated intake noise (filter) - BL (sound power level LW, ISO 6798, +2 dB(A) tolerance) | R | dB(A) | 116 | 116 |

4.15 Engine data 6R1600G70F, G80F, emissions optimized

Explanation:

- DL Reference value: Continuous power
- BL Reference 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 setting).
- N Not yet defined value
- Not applicable
- X Applicable
- * Data not yet available at time of publication

Reference conditions

| Engine model | | | 6R1600 G70F | 6R1600 G80F |
|-------------------------------|--|------|----------------|----------------|
| Application group | | | 3D | 3D |
| Intake air temperature | | °C | 25 | 25 |
| Barometric pressure | | mbar | 1000 | 1000 |
| Site altitude above sea level | | m | 100 | 100 |

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

| Number of cylinders | | | 6 | 6 |
|--------------------------|---|-----|------|------|
| Rated engine speed | A | rpm | 1500 | 1500 |
| Fuel stop power ISO 3046 | A | kW | 274 | 301 |

Site conditions (for max. power)

| Number of cylinders | | | 6 | 6 |
|--------------------------------|---|------|-----|-----|
| Intake depression (new filter) | A | mbar | 25 | 25 |
| Intake depression, max. | L | mbar | 50 | 50 |
| Exhaust gas overpressure | A | mbar | 85 | 85 |
| Exhaust gas overpressure, max. | L | mbar | 150 | 150 |

Model-related data (basic design)

| Number of cylinders | | | 6 | 6 |
|--|--|------|-----|-----|
| Cooling method: treated water | | | X | X |
| Direction of rotation: c.c.w. (facing driving end) | | | X | X |
| Standard housing connecting flange (engine main PTO) | | SAE | 01 | 01 |
| Flywheel interface | | DISC | 14" | 14" |

Air / exhaust gas

| Number of cylinders | | | 6 | 6 |
|--|---|---------|-----|-----|
| Charge-air pressure before cylinder – BL | R | bar abs | 3.3 | 3.4 |

Coolant system (HT circuit)

| Number of cylinders | | | 6 | 6 |
|--|---|-----|-----|-----|
| Coolant temperature (at engine connection: outlet to cooling system) | A | °C | 95 | 95 |
| Coolant temperature after engine, warning | R | °C | 105 | 105 |
| Coolant temperature after engine, shutdown | L | °C | 109 | 109 |
| Coolant antifreeze content, max. | L | % | 50 | 50 |
| Pressure loss in off-engine cooling system, max. | L | bar | 0.7 | 0.7 |

Lube oil system

| Number of cylinders | | | 6 | 6 |
|--|---|-----|-----|-----|
| Lube oil operating temperature before engine, from | R | °C | 85 | 88 |
| Lube oil operating temperature before engine, to | R | °C | 100 | 94 |
| Lube oil temperature before engine, warning | R | °C | - | - |
| Lube oil temperature before engine, shutdown | L | °C | - | - |
| Lube oil operating pressure before engine, from | R | bar | * | 4,2 |
| Lube oil operating pressure before engine, to | R | bar | * | 4,8 |
| Lube oil operating pressure before engine, warning (speed-dependent value, consult MTU) | R | bar | | |
| Lube oil operating pressure before engine, shutdown (speed-dependent value, consult MTU) | L | bar | | |

Fuel system

| Number of cylinders | | | 6 | 6 |
|--|---|-----|------|------|
| Fuel pressure at engine supply connection, min. (when engine is started) | L | bar | -0.5 | -0.5 |
| Fuel pressure at engine supply connection, max. (when engine is started) | L | bar | 0,0 | 0,0 |

General operating data

| Number of cylinders | | | 6 | 6 |
|---|---|-----|-----|-----|
| Cold start capability: air temperature (w/o start aid, w/o preheating) - (case A) | R | °C | -20 | -20 |
| Firing speed, from | R | rpm | 80 | 80 |
| Firing speed, to | R | rpm | 120 | 120 |

Capacities

| Number of cylinders | | | 6 | 6 |
|---|---|--------|----|----|
| Engine coolant, engine side (w/o cooling equipment) | R | Liters | 45 | 45 |
| Total engine oil capacity for initial filling (standard oil system) | R | Liters | - | - |
| Oil change capacity, max. (standard oil system) | R | Liters | - | - |
| Oil change quantity, max. (standard oil system) (option: max. operating inclinations) | R | Liters | 45 | 45 |

| | | | | |
|--|---|--------|----|----|
| Number of cylinders | | | 6 | 6 |
| Oil pan capacity at dipstick mark “min.” (standard oil system) (option: max. operating inclinations) | L | Liters | 36 | 36 |
| Oil pan capacity at dipstick mark “max.” (standard oil system) (option: max. operating inclinations) | L | Liters | 45 | 45 |

Masses

| | | | | |
|---|---|----|-------|-------|
| Number of cylinders | | | 6 | 6 |
| Engine dry weight (with standard accessories installed, w/o coupling) | R | kg | 1185* | 1185* |
| Engine weight, filled (with standard accessories installed, w/o coupling) | R | kg | 1218 | 1218 |

Acoustics

| | | | | |
|--|---|-------|-----|-----|
| Number of cylinders | | | 6 | 6 |
| Exhaust noise, unsilenced - BL (sound power level LW, ISO 6798) | R | dB(A) | 115 | 116 |
| Engine surface noise with attenuated intake noise (filter) - BL (sound power level LW, ISO 6798) | R | dB(A) | 117 | 116 |

4.16 Engine data 6R1600G70F, G80F, Nonroad stage III a

Explanation:

- DL Reference value: Continuous power
- BL Reference 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 setting).
- N Not yet defined value
- Not applicable
- X Applicable
- * Value not adequately verified (tolerance $\pm 10\%$)

Reference conditions

| Engine model | | | 6R1600 G70F | 6R1600 G80F |
|-------------------------------|--|------|----------------|----------------|
| Application group | | | 3D | 3D |
| Intake air temperature | | °C | 25 | 25 |
| Barometric pressure | | mbar | 1000 | 1000 |
| Site altitude above sea level | | m | 100 | 100 |

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

| Number of cylinders | | | 6 | 6 |
|--------------------------|---|-----|------|------|
| Rated engine speed | A | rpm | 1500 | 1500 |
| Fuel stop power ISO 3046 | A | kW | 274 | 301 |

Site conditions (for max. power)

| Number of cylinders | | | 6 | 6 |
|--------------------------------|---|------|----|----|
| Intake depression (new filter) | A | mbar | 25 | 25 |
| Intake depression, max. | L | mbar | 50 | 50 |
| Exhaust gas overpressure | A | mbar | 85 | 85 |
| Exhaust gas overpressure, max. | L | mbar | 85 | 85 |

Model-related data (basic design)

| Number of cylinders | | | 6 | 6 |
|--|--|------|-----|-----|
| Cooling method: treated water | | | X | X |
| Direction of rotation: c.c.w. (facing driving end) | | | X | X |
| Standard housing connection flange (engine main PTO) | | SAE | 01 | 01 |
| Flywheel interface | | DISC | 14" | 14" |

Air / exhaust gas

| Number of cylinders | | | 6 | 6 |
|--|---|---------|-----|-----|
| Charge-air pressure before cylinder – BL | R | bar abs | 3.5 | 3.5 |

Coolant system (HT circuit)

| Number of cylinders | | | 6 | 6 |
|--|---|-----|-----|-----|
| Coolant temperature (at engine connection: outlet to cooling system) | A | °C | 95 | 95 |
| Coolant temperature after engine, warning | R | °C | 105 | 105 |
| Coolant temperature after engine, shutdown | L | °C | 109 | 109 |
| Coolant antifreeze content, max. | L | % | 50 | 50 |
| Pressure loss in off-engine cooling system, max. | L | bar | 0.7 | 0.7 |

Lube oil system

| Number of cylinders | | | 6 | 6 |
|--|---|-----|-----|-----|
| Lube oil operating temperature before engine, from | R | °C | 105 | 105 |
| Lube oil operating temperature before engine, to | R | °C | 115 | 115 |
| Lube oil temperature before engine, warning | R | °C | - | - |
| Lube oil temperature before engine, shutdown | L | °C | - | - |
| Lube oil operating pressure before engine, from | R | bar | 4.5 | 4.5 |
| Lube oil operating pressure before engine, to | R | bar | 5.5 | 5.5 |
| Lube oil operating pressure before engine, warning (speed-dependent value, consult MTU) | L | bar | 2.6 | 2.6 |
| Lube oil operating pressure before engine, shutdown (speed-dependent value, consult MTU) | L | bar | 2.4 | 2.4 |

Fuel system

| Number of cylinders | | | 6 | 6 |
|--|---|-----|------|------|
| Fuel pressure at engine inlet connection, min. (when engine is starting) | L | bar | -0.5 | -0.5 |
| Fuel pressure at engine inlet connection, max. (when engine is starting) | L | bar | 0.5 | 0.5 |

General operating data

| Number of cylinders | | | 6 | 6 |
|---|---|-----|-----|-----|
| Cold start capability: air temperature (w/o start aid, w/o preheating) – (case A) | R | °C | -20 | -20 |
| Firing speed, from | R | rpm | 80 | 80 |
| Firing speed, to | R | rpm | 120 | 120 |

Capacities

| Number of cylinders | | | 6 | 6 |
|--|---|--------|-----|-----|
| Engine coolant, engine side (w/o cooling equipment) | R | Liters | 45* | 45* |
| Total engine oil capacity, initial filling (standard oil system) (option: max. operating inclinations) | R | Liters | 42 | 42 |
| Max. oil change quantity (standard oil system) | R | Liters | - | - |
| Oil change quantity, max. (standard oil system) (option: max. operating inclinations) | R | Liters | 41 | 41 |

TIM-ID: 0000010979 - 002

| | | | | |
|--|---|--------|----------|----------|
| Number of cylinders | | | 6 | 6 |
| Oil pan capacity at dipstick mark “min.” (standard oil system) (option: max. operating inclinations) | L | Liters | 32 | 32 |
| Oil pan capacity at dipstick mark “max.” (standard oil system) (option: max. operating inclinations) | L | Liters | 40 | 40 |

Masses

| | | | | |
|---|---|----|----------|----------|
| Number of cylinders | | | 6 | 6 |
| Engine dry weight (with standard accessories installed, w/o coupling) | R | kg | 1185* | 1185* |
| Engine weight, filled (with standard accessories installed, w/o coupling) | R | kg | 1218 | 1218 |

Acoustics

| | | | | |
|--|---|-------|----------|----------|
| | | | 6 | 6 |
| Exhaust noise, unsilenced - BL (sound power level LW, ISO 6798, +3 dB(A) tolerance) | R | dB(A) | 115 | 115 |
| Engine surface noise with attenuated intake noise (filter) - BL (sound power level LW, ISO 6798, +2 dB(A) tolerance) | R | dB(A) | 116 | 116 |

4.17 Engine data 6R1600G70S, G80S, EPA stage 3

Explanation:

- DL Reference value: Continuous power
- BL Reference 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 setting).
- N Not yet defined value
- Not applicable
- X Applicable
- * Value not adequately verified (tolerance $\pm 10\%$)
- ** Data not yet available at time of publication

Reference conditions

| Engine model | | | 6R1600 G70S | 6R1600 G80S |
|-------------------------------|--|------|----------------|----------------|
| Application group | | | 3D | 3D |
| Intake air temperature | | °C | 25 | 25 |
| Barometric pressure | | mbar | 1000 | 1000 |
| Site altitude above sea level | | m | 100 | 100 |

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

| Number of cylinders | | | 6 | 6 |
|--------------------------|---|-----|------|------|
| Rated engine speed | A | rpm | 1800 | 1800 |
| Fuel stop power ISO 3046 | A | kW | 312 | 343 |

Site conditions (for max. power)

| Number of cylinders | | | 6 | 6 |
|--------------------------------|---|------|----|----|
| Intake depression (new filter) | A | mbar | 25 | 25 |
| Intake depression, max. | L | mbar | 50 | 50 |
| Exhaust gas overpressure | A | mbar | 85 | 85 |
| Exhaust gas overpressure, max. | L | mbar | 85 | 85 |

Model-related data (basic design)

| Number of cylinders | | | 6 | 6 |
|--|--|------|-----|-----|
| Cooling method: treated water | | | X | X |
| Direction of rotation: c.c.w. (facing driving end) | | | X | X |
| Standard housing connection flange (engine main PTO) | | SAE | 01 | 01 |
| Flywheel interface | | DISC | 14" | 14" |

Air / exhaust gas

| Number of cylinders | | | 6 | 6 |
|--|---|---------|-----|-----|
| Charge-air pressure before cylinder – BL | R | bar abs | 3.7 | 3.7 |

Coolant system (HT circuit)

| Number of cylinders | | | 6 | 6 |
|--|---|-----|-----|-----|
| Coolant temperature (at engine connection: outlet to cooling system) | A | °C | 95 | 95 |
| Coolant temperature after engine, warning | L | °C | 105 | 105 |
| Coolant temperature after engine, shutdown | L | °C | 109 | 109 |
| Coolant antifreeze content, max. | L | % | 50 | 50 |
| Pressure loss in off-engine cooling system, max. | L | bar | 0.7 | 0.7 |

Lube oil system

| Number of cylinders | | | 6 | 6 |
|--|---|-----|-----|-----|
| Lube oil operating temperature before engine, from | R | °C | 105 | 105 |
| Lube oil operating temperature before engine, to | R | °C | 115 | 115 |
| Lube oil temperature before engine, warning | R | °C | - | - |
| Lube oil temperature before engine, shutdown | L | °C | - | - |
| Lube oil operating pressure before engine, from | R | bar | 4.5 | 4.5 |
| Lube oil operating pressure before engine, to | R | bar | 5.5 | 5.5 |
| Lube oil operating pressure before engine, warning (speed-dependent value, consult MTU) | L | bar | 3.2 | 3.2 |
| Lube oil operating pressure before engine, shutdown (speed-dependent value, consult MTU) | L | bar | 3.0 | 3.0 |

Fuel system

| Number of cylinders | | | 6 | 6 |
|--|---|-----|------|------|
| Fuel pressure at engine inlet connection, min. (when engine is starting) | L | bar | -0.5 | -0.5 |
| Fuel pressure at engine inlet connection, max. (when engine is starting) | L | bar | 0.5 | 0.5 |

General operating data

| Number of cylinders | | | 6 | 6 |
|---|---|-----|-----|-----|
| Cold start capability: air temperature (w/o start aid, w/o preheating) - (case A) | R | °C | -20 | -20 |
| Firing speed, from | R | rpm | 80 | 80 |
| Firing speed, to | R | rpm | 120 | 120 |

Capacities

| Number of cylinders | | | 6 | 6 |
|--|---|--------|-----|-----|
| Engine coolant, engine side (w/o cooling equipment) | R | Liters | 45* | 45* |
| Total engine oil capacity, initial filling (standard oil system) (option: max. operating inclinations) | R | Liters | 42 | 42 |
| Max. oil change quantity (standard oil system) | R | Liters | - | - |
| Oil change quantity, max. (standard oil system) (option: max. operating inclinations) | R | Liters | 41 | 41 |

| | | | | |
|--|---|--------|----|----|
| Number of cylinders | | | 6 | 6 |
| Oil pan capacity at dipstick mark “min.” (standard oil system) (option: max. operating inclinations) | L | Liters | 32 | 32 |
| Oil pan capacity at dipstick mark “max.” (standard oil system) (option: max. operating inclinations) | L | Liters | 40 | 40 |

Masses

| | | | | |
|---|---|----|-------|-------|
| Number of cylinders | | | 6 | 6 |
| Engine dry weight (with standard accessories installed, w/o coupling) | R | kg | 1185* | 1185* |
| Engine weight, filled (with standard accessories installed, w/o coupling) | R | kg | 1218 | 1218 |

Acoustics

| | | | | |
|--|---|-------|-----|-----|
| | | | 6 | 6 |
| Exhaust noise, unsilenced - BL (sound power level LW, ISO 6798, +3 dB(A) tolerance) | R | dB(A) | 113 | 117 |
| Engine surface noise with attenuated intake noise (filter) - BL (sound power level LW, ISO 6798, +2 dB(A) tolerance) | R | dB(A) | 118 | 117 |

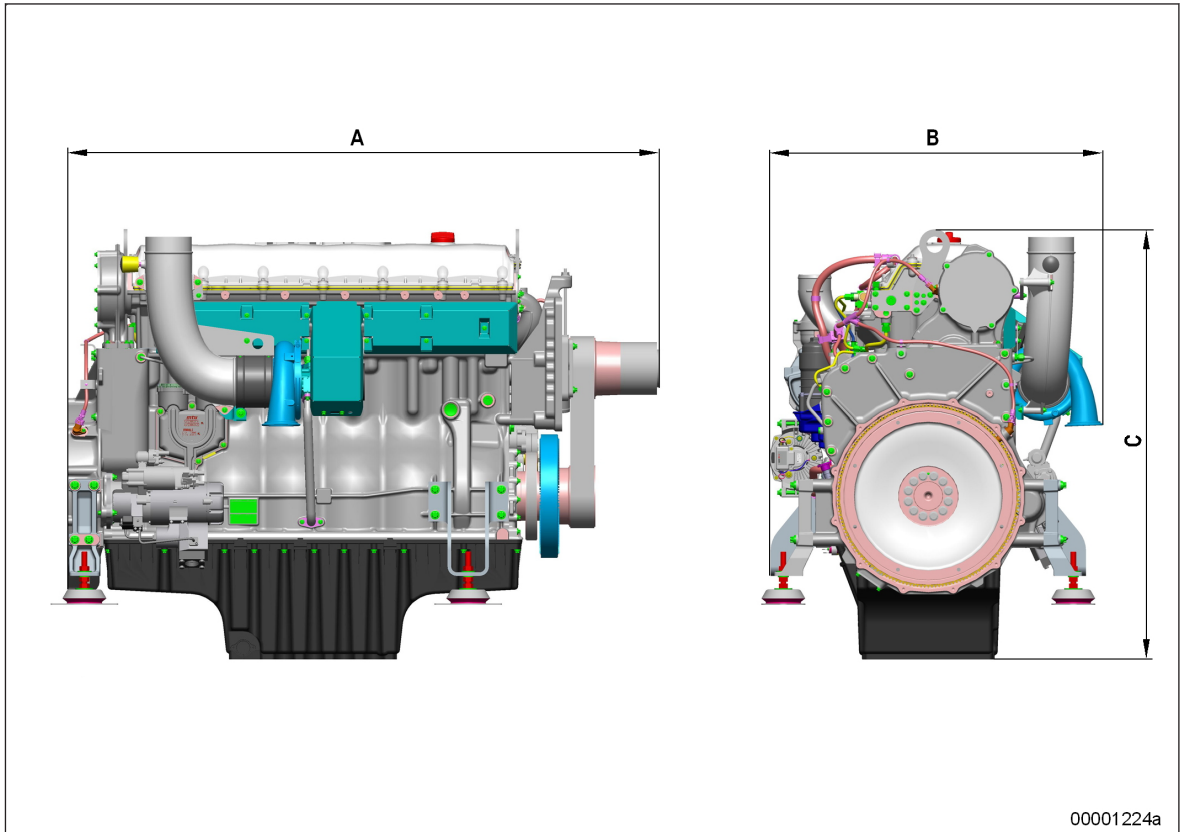
4.18 Firing order

Firing order

| Number of cylinders | Firing order |
|---------------------|--------------|
| 6R | 2-4-1-5-3-6 |

4.19 Engine - Main dimensions

Engine - Main dimensions



| | |
|------------|-----------------|
| Length (A) | approx. 1630 mm |
| Width (B) | approx. 920 mm |
| Height (C) | approx. 1185 mm |

5 Operation

5.1 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/..) available.

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

| Item | Action |
|---------------------------------|---|
| Engine | Depreserve (→ MTU Preservation and Represervation Specifications A001070/..). |
| Lube oil system | Check engine oil level (→ Page 101). |
| Fuel system | Vent (→ Page 93). |
| Engine coolant circuit | If engine is out of service for more than one year, change engine coolant (→ Page 105). |
| Engine coolant circuit | Check engine coolant level (→ Page 104). |
| Engine coolant circuit | Preheat engine coolant with coolant preheater (if applicable). |
| Engine governor | Check plug connections (→ Page 117). |
| Monitoring system | Carry out lamp test (see manufacturer's documentation). |
| Engine/generator control system | Switch on; Select operating mode, e.g. MANUAL OPERATION, AUTOMATIC OPERATION. |

5.2 Putting into operation after scheduled out-of-service-period

Preconditions

Engine is stopped and starting disabled.




Putting into operation

| Item | Action |
|---------------------------------|--|
| Lube oil system | Check engine oil level (→ Page 101). |
| Engine coolant circuit | Check engine coolant level (→ Page 104). |
| Engine coolant circuit | Preheat engine coolant with coolant preheater (if applicable). |
| Fuel prefilter | Drain fuel prefilter (→ Page 95). |
| Monitoring system | Carry out lamp test (see manufacturer's documentation). |
| Engine/generator control system | Switch on; Select operating mode, e.g. MANUAL OPERATION, AUTOMATIC OPERATION. |

5.3 Starting the engine in manual mode (test run)

Preconditions

- Generator is not connected to the mains.
- External start interlock is not activated.

| | |
|---------|---|
| DANGER |  <p>Rotating and moving engine parts. Risk of crushing, danger of parts of the body being caught or pulled in!</p> <ul style="list-style-type: none"> • Before cranking the engine with starter system, make sure that there are no persons in the engine's danger zone. |
| WARNING |  <p>High level of engine noise when the engine is running. Risk of damage to hearing!</p> <ul style="list-style-type: none"> • Wear ear protectors. |
| NOTICE |  <p>Re-starting the engine following an automatic safety shutdown. Risk of severe engine damage!</p> <ul style="list-style-type: none"> • Before starting the engine, make sure the root cause of the safety shutdown was eliminated. • If the root cause cannot be identified or eliminated, contact Service. |

Preparation

| Item | Action |
|-----------------------------------|------------------------|
| Operating mode switch (if fitted) | Change to manual mode. |

Starting the engine

| Item | Action |
|--|--|
| Control cabinet, operator station etc. (depending on manufacturer) | Press start button. <ul style="list-style-type: none"> • Automatic starting sequence is performed; • Engine speed display instrument indicates increasing crankshaft speed; • After the starting sequence is completed, engine is running at rated speed. |

Connecting the generator to network, running the engine to reach operating temperature

| Item | Action |
|--|--|
| Control cabinet, operator station etc. (depending on manufacturer) | Close the generator circuit breaker. |
| Engine | Apply full load only after engine has reached operating temperature (coolant temperature approx. 60 °C). |

5.4 Safety system – Override

| | |
|--------|--|
| NOTICE | <p>Safety functions and engine shutdown alarms will be disregarded.</p> <p>Severe material damage!</p> <ul style="list-style-type: none"> Initiate emergency start only in emergency situations. |
|--------|--|

| | |
|--------|--|
| NOTICE | <p>Inadmissible operating status.</p> <p>Severe damage to property!</p> <ul style="list-style-type: none"> Use override function only in hazardous situations to ensure full capability in the event of engine faults. |
|--------|--|

Preparation

Note: This function is only available when a pushbutton is provided.

Safety system – Override

| Item | Action |
|--|---|
| Switchgear cabinet, control panel etc. (depending on manufacturer) | Activate pushbutton for Override input of the ECU. <ul style="list-style-type: none"> Certain shutdown criteria and/or starting prerequisites are ignored. |
| Switchgear cabinet, control panel etc. (depending on manufacturer) | Actuate start button, for further starting sequence, refer to engine start (→ Page 77). |
| Control and display panels | During operation, check the displayed operational data (speed, temperature, pressures). Constantly monitor plant limit values. |

5.5 Operational monitoring

| | |
|--------|--|
| DANGER | <p>Components are moving or rotating.</p> <p>Risk of crushing, danger of parts of the body being caught or pulled in!</p> <ul style="list-style-type: none"> Operate the engine at low load only. Keep clear of the danger zone of the engine. |
|--------|--|



| | |
|---------|---|
| WARNING | <p>High level of engine noise when the engine is running.</p> <p>Risk of damage to hearing!</p> <ul style="list-style-type: none"> Wear ear protectors. |
|---------|---|



Operational monitoring

| Item | Action |
|--|---|
| Engine under load Engine at nominal speed | Visually inspect engine for leaks and general condition; Check for abnormal running noises and vibration; Check exhaust gas color (→ Page 86). |
| Air filter | Check signal ring position of service indicator (→ Page 99). Replace air filter (→ Page 97), if the signal ring is completely visible in the service indicator control window. |
| Coolant pump | Check relief bore for oil and coolant discharge and contamination (→ Page 109). |
| Engine oil | Check engine oil level(→ Page 101) |

5.6 Emission label – Check

Emission label – Check

Note: If there are any irregularities, notify your MTU contact person/service partner without delay.

1. Check that emission labels are present (there can be more than one).
2. Check emission label for intactness.
3. Check that emission label is fully legible.
4. Check content of emission label:
 - Does the label on the engine match the label document in the Business Portal/Equipment?
 - Does the engine number on the emission label match the engine identification plate?
 - Does the Manufacturing Date match the year of manufacture on the identification plate?

5.7 Engine stop in manual operation (trials)

Preconditions

- Generator is not connected to network.
- Engine is running in manual mode.

Preparation

| Item | Task |
|--------|--|
| Engine | After the generator breaker has been opened, allow the engine to cool down by running it idle for approx. 5 minutes. |

Stop engine

| Item | Task |
|--|---|
| Switchgear cabinet, control panel etc. (depending on manufacturer) | Press stop button. <ul style="list-style-type: none">• Automatic stopping sequence is performed;• engine is stopped. |

5.8 Emergency engine shutdown

NOTICE



An emergency stop subjects the engine system to an extremely high load.

Risk of overheating, damage to components!

- Trigger an emergency stop only in emergency situations.

Emergency engine shutdown

| Item | Action |
|---------------------------|--|
| Emergency stop pushbutton | Press pushbutton. <ul style="list-style-type: none">• Engine is stopped by disconnecting the power supply to the ECU;• Signalization (e.g. by horn, beacon) is activated. |

After emergency engine shutdown

| Item | Action |
|--|--|
| Control cabinet, operator station etc. (depending on manufacturer) | Press pushbutton for alarm acknowledgment. <ul style="list-style-type: none">• Audible and visual alarm output stops |

5.9 After stopping the engine - Engine remains ready for operation

After stopping the engine

| Item | Action |
|-------------------------------|--|
| Engine/generator/pump control | Select operating mode, e.g. MANUAL, AUTOMATIC OPERATION. |

5.10 After stopping the engine – Putting the engine out of operation

Preconditions

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

After stopping the engine

| Item | Task |
|-------------------------------|---|
| Coolant circuit | Drain engine coolant (→ Page 106) if: <ul style="list-style-type: none">• the engine room is not heated;• the engine coolant is not maintained 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/generator/pump control | Switch OFF. |

6 Maintenance

6.1 Maintenance task reference table [QL1]

The required maintenance tasks and intervals for this product are defined in the Maintenance Schedule. The Maintenance Schedule is a separate 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 101) |
| W0501 | | Visually inspect engine for leaks and general condition. | (→ Page 79) |
| W0502 | X | Check intercooler condensate drain. | (This is not applicable to your system.) |
| W0507 | X | Drain water and contamination from fuel prefilter. | (→ Page 95) |
| W0521 | | Check signal ring position of maintenance indicator, replace air filter if necessary. | (→ Page 99) |
| W0800 | | Check if emissions label is present, legible and content-wise correct. | (→ Page 80) |
| W1001 | | Replace fuel filter or fuel filter element. | (→ Page 94) |
| W1003 | | Check belt condition and tension, replace if necessary. | (→ Page 112), (→ Page 113) |
| W1005 | | Replace air filter. | (→ Page 97) |
| W1008 | | Replace engine oil filter when changing engine oil, or when the interval (years) is reached, at the latest. | (→ Page 103) |
| W1010 | | Check exterior of cooler elements for dirt. | (→ Page 110) |
| W1207 | | Check valve clearance, adjust as necessary. IMPORTANT! First adjustment after 1,000 operating hours. | (→ Page 90) |
| W1483 | | Replace poly-Vee drive belt of fan. | (→ Page 114) |
| W1505 | X | Replace drive belts of battery-charging generator and coolant pump. | (→ Page 114) |
| W1675 | | Replace fuel prefilter or filter element of fuel prefilter. | (→ Page 96) |

Table 1: Maintenance task reference table [QL1]

7 Troubleshooting

7.1 Troubleshooting

Engine does not turn when starter is actuated

| Cause | Corrective action |
|---|--|
| Battery low or defective | ▶ Charge or replace (→ manufacturer's documentation). |
| Cable connections defective | ▶ Check cable connections for secure seating (→ manufacturer's documentation). |
| Starter: Engine cabling or starter defective | ▶ Check if cable connections are properly secured, contact Service. |
| Engine cabling defective | ▶ Check (→ Page 115). |
| Engine / generator control: Assemblies or connectors possibly loose | ▶ Carry out visual inspection (→ manufacturer's documentation). |
| Engine governor: Plug-in connections loose | ▶ Check plug connections (→ Page 117). |
| Running gear blocked (engine cannot be barred manually) | ▶ Contact Service. |

Engine turns on starting but does not fire

| Cause | Corrective action |
|--|---|
| Poor rotation by starter: Battery low or defective | ▶ Charge or replace battery (→ manufacturer's documentation). |
| Engine cabling defective | ▶ Check (→ Page 115). |
| Air in fuel system | ▶ Vent fuel system (→ Page 93). |
| Engine governor defective | ▶ Contact Service. |

Engine fires unevenly

| Cause | Corrective action |
|---------------------------|--------------------------------|
| Injector defective | ▶ Contact Service. |
| Engine cabling defective | ▶ Check (→ Page 115) |
| Air in fuel system | ▶ Vent fuel system (→ Page 93) |
| Engine governor defective | ▶ Contact Service. |

Engine does not reach nominal speed

| Cause | Corrective action |
|--------------------------|--|
| Fuel filter clogged | ▶ Replace (→ Page 94). |
| Air filter clogged | ▶ Check, replace if necessary (→ Page 99). |
| Injector defective | ▶ Contact Service. |
| Engine cabling defective | ▶ Check (→ Page 115). |
| Engine: Overload | ▶ Contact Service. |

Engine speed not steady

| Cause | Corrective action |
|---------------------------|---------------------------------|
| Injector defective | ▶ Contact Service. |
| Speed sensor defective | ▶ Contact Service. |
| Air in fuel system | ▶ Vent fuel system (→ Page 93). |
| Engine governor defective | ▶ Contact Service. |

Charge-air temperature too high

| Cause | Corrective action |
|--|--|
| Engine room: Air-intake temperature too high | ▶ Check fans and intake/exhaust lines. |

Charge-air pressure too low

| Cause | Corrective action |
|--------------------------------|--|
| Air filter clogged | ▶ Check, replace if necessary (→ Page 99). |
| Exhaust turbocharger defective | ▶ Contact Service. |

Black exhaust gas

| Cause | Corrective action |
|--------------------|--|
| Air filter clogged | ▶ Check, replace if necessary (→ Page 99). |
| Injector defective | ▶ Contact Service. |
| Engine: Overload | ▶ Contact Service. |

Blue exhaust gas

| Cause | Corrective action |
|---|----------------------------------|
| Too much engine oil in the engine | ▶ Drain engine oil (→ Page 102). |
| Exhaust turbocharger, cylinder head, piston rings or cylinder liner defective | ▶ Contact Service. |

White exhaust gas

| Cause | Corrective action |
|--|------------------------------------|
| Engine is not at operating temperature | ▶ Run up to operating temperature. |

8 Task Description

8.1 Engine

8.1.1 Engine - Barring with starting system

Preconditions

- External pushbutton 'Bar engine without starting' is provided.

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.

Engine – Barring with starting system

1. Press pushbutton 'Bar engine without starting' and keep depressed.
2. Let the crankshaft rotate until oil pressure is indicated, but not longer than 10 seconds.
3. Repeat procedure after approx. 20 seconds if necessary.

8.1.2 Engine - Test run

| | |
|--|--|
| <p>DANGER</p>  | <p>Components are moving or rotating. Risk of crushing, danger of parts of the body being caught or pulled in!</p> <ul style="list-style-type: none">• Operate the engine at low load only. Keep clear of the danger zone of the engine. |
| <p>WARNING</p>  | <p>Exhaust gases are harmful to health and may cause cancer. Risk of poisoning and suffocation!</p> <ul style="list-style-type: none">• Keep the engine room well-ventilated at all times.• Repair leaking exhaust pipework immediately. |
| <p>WARNING</p>  | <p>High level of engine noise when the engine is running. Risk of damage to hearing!</p> <ul style="list-style-type: none">• Wear ear protectors. |

Engine - Test run

1. Start engine (→ Page 77).
2. Perform test run not below 1/3 load and at least until steady-state temperature is reached.
3. Carry out operational checks (→ Page 79).
4. Stop engine (→ Page 81).

8.2 Valve Drive

8.2.1 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

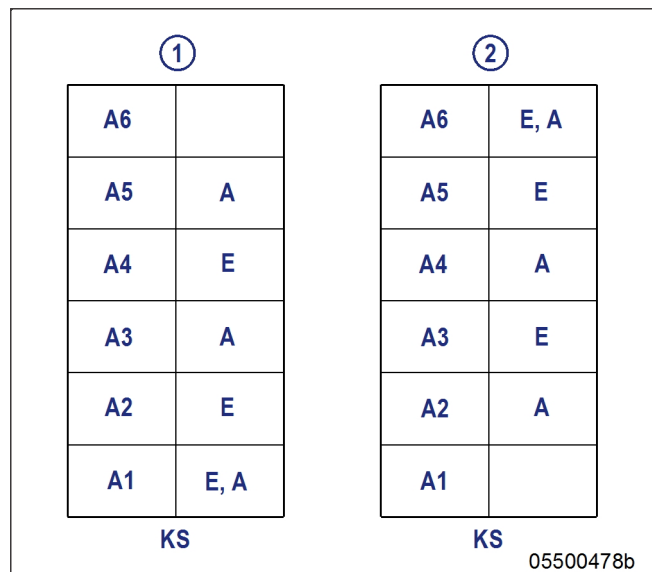
| Designation / Use | Part No. | Qty. |
|-----------------------------------|-----------|------|
| Feeler gage | Y20098771 | 1 |
| Torque wrench, 20–100 Nm | F30026582 | 1 |
| Box wrench, 14 mm | F30028346 | 1 |
| Angular screw driver, set 2–10 mm | F30453050 | 1 |

Preparatory steps

1. Remove cylinder head cover (→ Page 92).
2. Bar engine manually in engine direction of rotation to bring the A1 piston to top dead center position.

Diagram: Two crankshaft positions

- 1 Cylinder A1 is in firing TDC
 - 2 Cylinder A1 is in overlap TDC
- E Inlet valve
A Exhaust valve

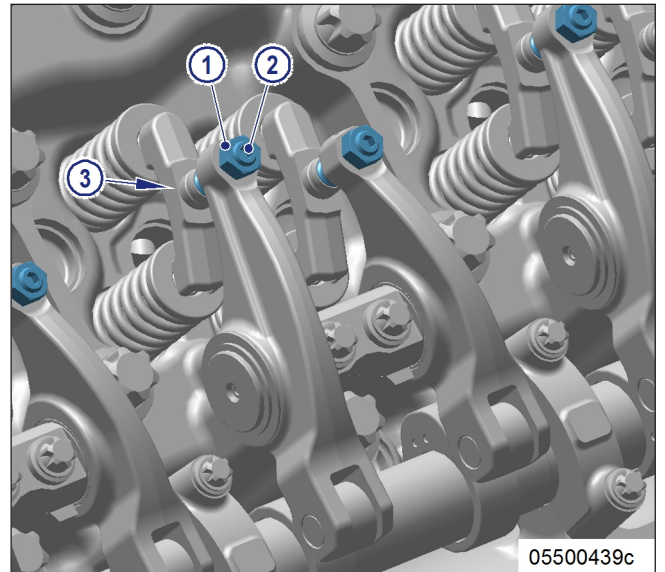


Checking valve clearance at two crankshaft positions

1. Check TDC position of piston in cylinder A1:
 - If the rocker arms are unloaded on cylinder A1, the piston is in firing TDC.
 - If the rocker arms are under load on cylinder A1, the piston is in overlap TDC.
2. Check valve clearance with cold engine:
 - Inlet = 0.3 mm;
 - Exhaust = 0.6 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.

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. Install cylinder head cover (→ Page 92).
2. Install plug.

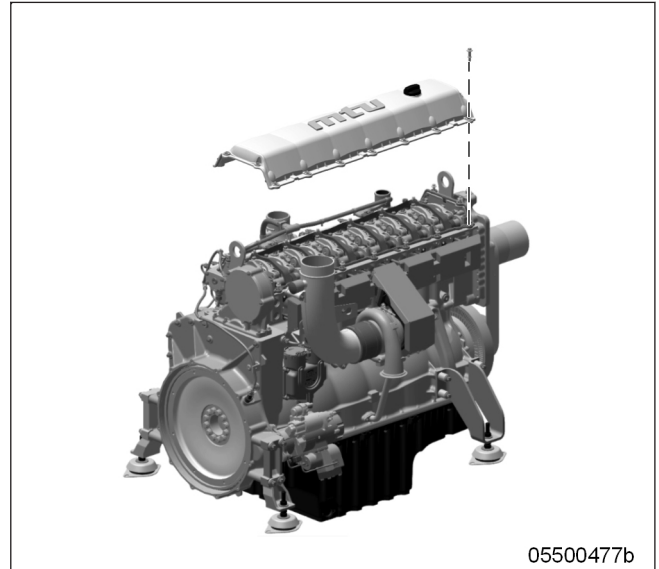
8.2.2 Cylinder head cover – Removal and installation

Preconditions

- Engine is stopped and starting disabled.

Cylinder head cover – Removal and installation

1. Loosen and remove screws.
2. Remove cylinder head cover.
3. Clean installation surface.
4. Check condition of profile gasket and replace if required.



5. Fit cylinder head cover and tighten screws with torque wrench to specified tightening torque.

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

6. Tighten screws to specified torque using a torque wrench.

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

8.3 Fuel System

8.3.1 Fuel system - Venting

Preconditions

- Engine is stopped and starting disabled.

WARNING



Fuels are combustible and explosive.

Risk of fire and explosion!

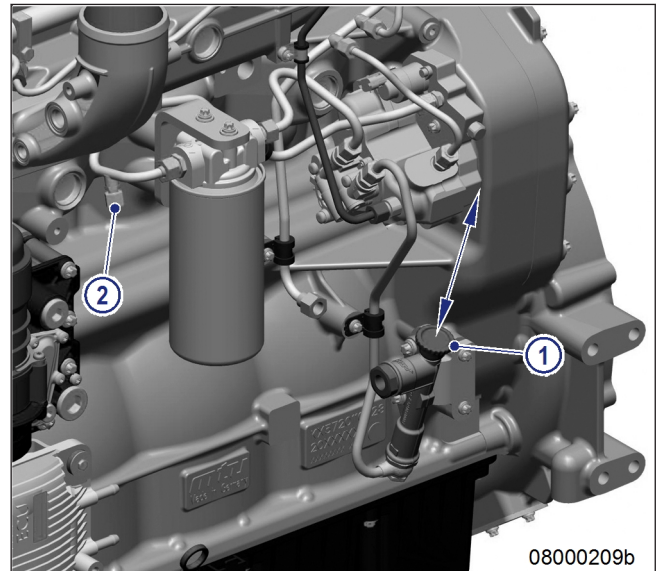
- Avoid open flames, electrical sparks and ignition sources.
- Do not smoke.
- Wear protective clothing, protective gloves, and safety glasses / facial protection.

Fuel system - Venting

1. Unlock fuel priming pump, screw out handle (1).
2. Loosen nut (2) on banjo union.

Note: Catch emerging fuel with a suitable cloth.

3. Operate the pump with the handle (1) until bubble-free fuel emerges.
4. Tighten nut (2) on banjo union.
5. Lock fuel priming pump, screw in handle (1).



8.4 Fuel Filter

8.4.1 Fuel filter - Replacement

Preconditions

- ☑ Engine is stopped and starting disabled.

Special tools, Material, Spare parts

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

WARNING



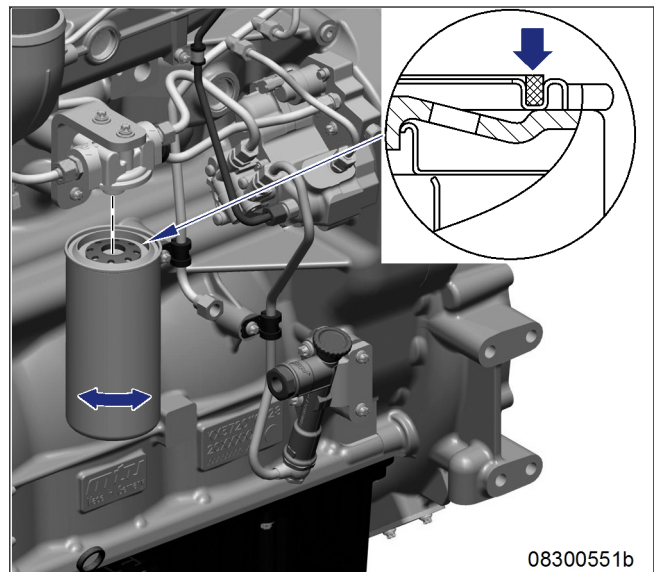
Fuels are combustible and explosive.

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.

Fuel filter – Replacement

1. Use filter wrench to remove easy-change filter.
2. Clean sealing surface on filter head.
3. Slightly lubricate seal on easy-change filter.
4. Screw on easy-change filter by hand until the seal makes contact and then tighten by hand.



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8.4.2 Fuel prefilter – Draining

Preconditions

- ☑ Engine is stopped and starting disabled.

WARNING



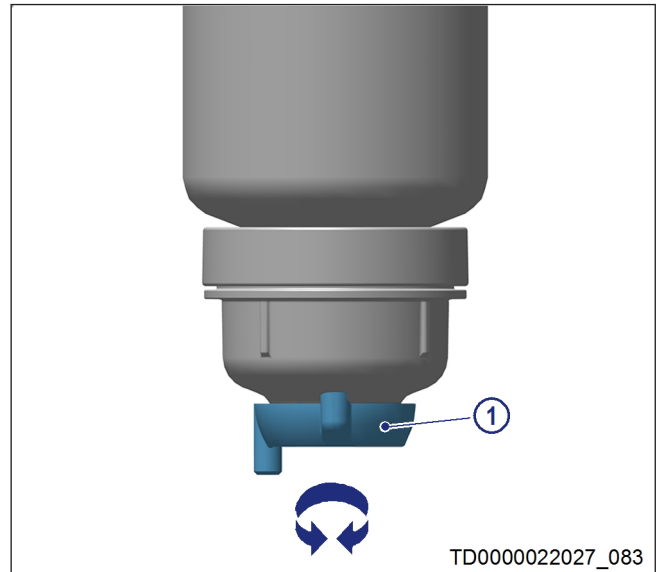
Fuels are combustible and explosive.

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 plug (1).
3. Allow the water to drain off.
4. Close drain plug (1) again.



8.4.3 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.

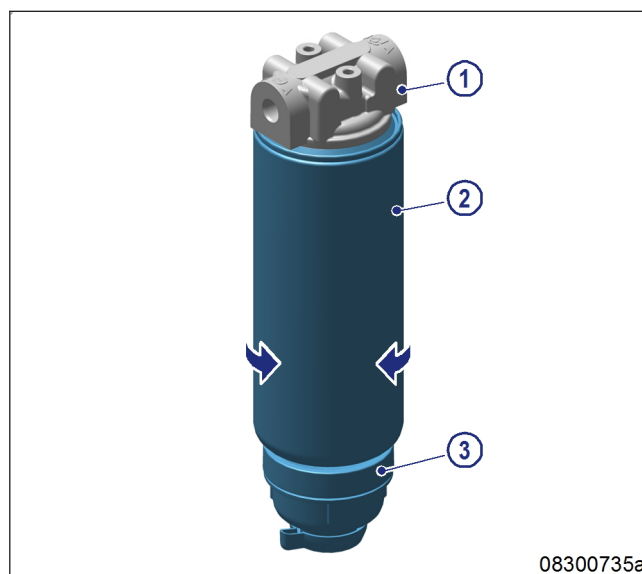
Damage to component!

- 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).



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TIM-ID: 0000036955 - 005

8.5 Air Filter

8.5.1 Air filter - Replacement

Special tools, Material, Spare parts

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

Air filter – Replacement

1. Remove air filter and install new one (→ Page 98).
2. Reset signal ring of service indicator (→ Page 99).

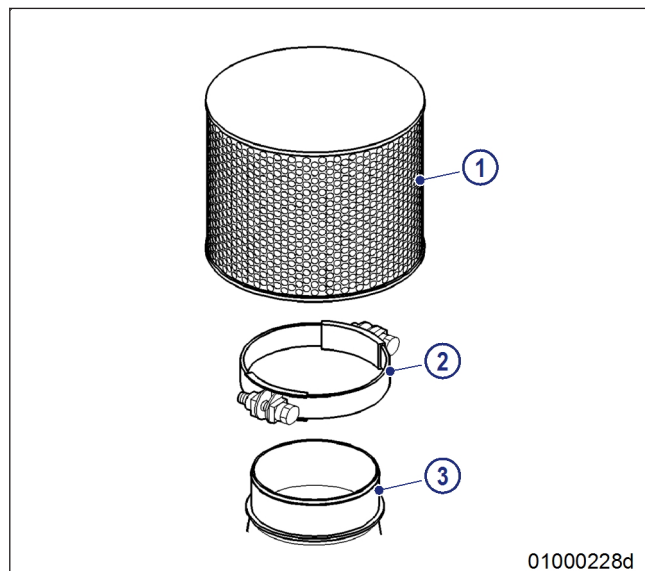
8.5.2 Air filter – Removal and installation

Preconditions

- Engine is stopped and starting disabled.

Air filter – Removal and installation

1. Loosen clamp (2).
2. Remove air filter (1) and clamp (2) from connecting flange of intake housing (3).
3. Verify that there are no objects in the flange of the intake housing (3) and clean it.
4. Place new air filter (1) with clamp (2) onto intake housing (3).
5. Tighten clamp (2).



8.6 Air Intake

8.6.1 Service indicator - Signal ring position check

Preconditions

- ☑ Engine is stopped and starting disabled.

Checking signal ring position

1. Replace air filter if the signal ring (2) is completely visible in the red area of the observation window (3) (→ Page 97).
2. After installation of new filter, press reset button (1).

Result: Signal ring returns to initial position.



8.7 Starting Equipment

8.7.1 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 115).

8.8 Lube Oil System, Lube Oil Circuit

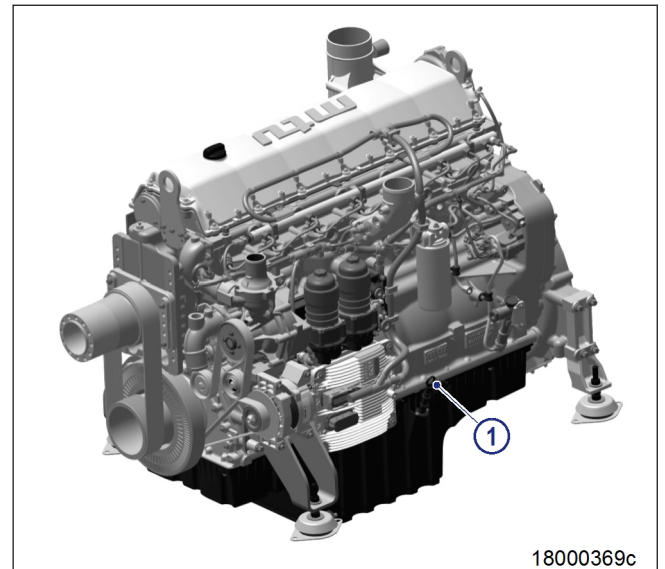
8.8.1 Engine oil level - Check

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, withdraw 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 102).
5. Insert oil dipstick (1) in guide tube up to the stop.



Oil level check 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, withdraw 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 102).
5. Insert oil dipstick (1) in guide tube up to the stop.

8.8.2 Engine oil - Change

Preconditions

- Engine is stopped and starting disabled.
- Engine is at operating temperature.
- MTU Fluids and Lubricants Specifications (A001063/..) are available.

Special tools, Material, Spare parts

| Designation / Use | Part No. | Qty. |
|-------------------|----------|------|
| Engine oil | | |

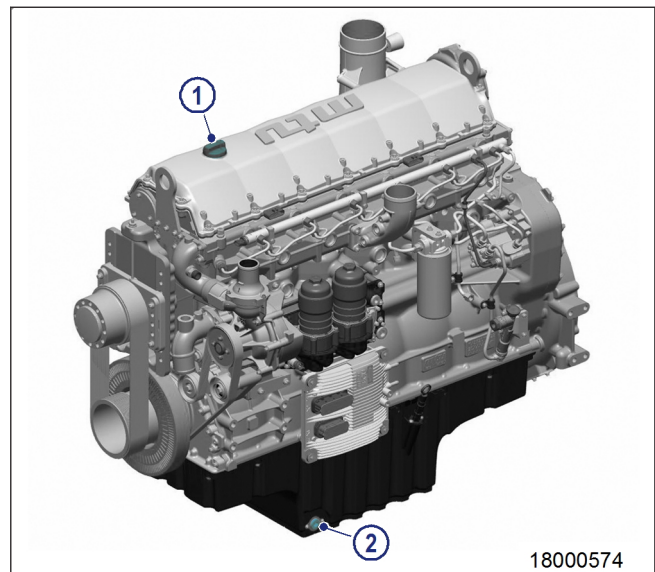
WARNING



- 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 – Draining at drain plug on oil pan

1. Provide a suitable container to collect the oil.
2. Remove drain plug(s) (2) and drain oil.



3. Insert drain plug (2) with new sealing ring and use torque wrench to tighten to specified tightening torque.

| Name | Size | Type | Lubricant | Value/Standard |
|------------|------|-------------------|--------------|----------------|
| Drain plug | | Tightening torque | (Engine oil) | 100 Nm ± 10 Nm |

4. Replace engine oil filter (→ Page 103).

Filling with new oil

1. Open cap (1) on cylinder head cover.
2. Fill with oil, oil filling capacity (→ Product Summary - Technical Data).
3. Close cap (1) on cylinder head cover.
4. Check engine oil level (→ Page 101).

8.9 Oil Filtration / Cooling

8.9.1 Engine oil filter - Replacement

Preconditions

- Engine is stopped and starting disabled.

Special tools, Material, Spare parts

| Designation / Use | Part No. | Qty. |
|------------------------|-------------------------|------|
| Torque wrench, 8–40 Nm | F30043446 | 1 |
| Ratchet bit | F30027340 | 1 |
| Socket, 32 mm | F30006120 | 1 |
| Engine oil | | |
| Oil filter element | (→ Spare Parts Catalog) | |

WARNING



Oil is hot.

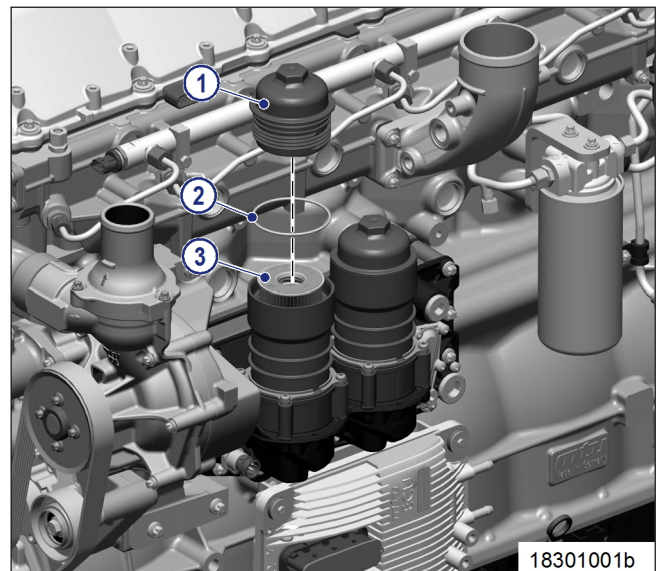
Oil can contain residue/substances which are harmful to health.

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. Unscrew oil filter covers (1) approx. 3 to 4 revolutions.
2. Wait 10 minutes until the oil has drained from the filter housings.
3. Remove cover (1) with oil filter element (3) and remove oil filter element (3) by pressing on the bottom edge from the side.
4. Check condition of sealing ring (2) on cover.
5. Replace sealing ring (2) if damaged.
6. Coat sealing ring (2) with oil.
7. Insert new oil filter element (3) in cover (1) and press in until it locks in place.



8. Screw on cover (1) with oil filter element (3) and use a torque wrench to tighten to the specified tightening torque.

| Name | Size | Type | Lubricant | Value/Standard |
|-------|------|-------------------|--------------|----------------|
| Cover | | Tightening torque | (Engine oil) | 35 Nm |

9. Replace other engine oil filters in the same way.
10. Check oil level (→ Page 101)

8.10 Coolant Circuit, General, High-Temperature Circuit

8.10.1 Engine coolant – Level check

Preconditions

- ☑ Engine is stopped and starting disabled.
- ☑ MTU Fluids and Lubricants Specifications (A001063/..) are available.

WARNING



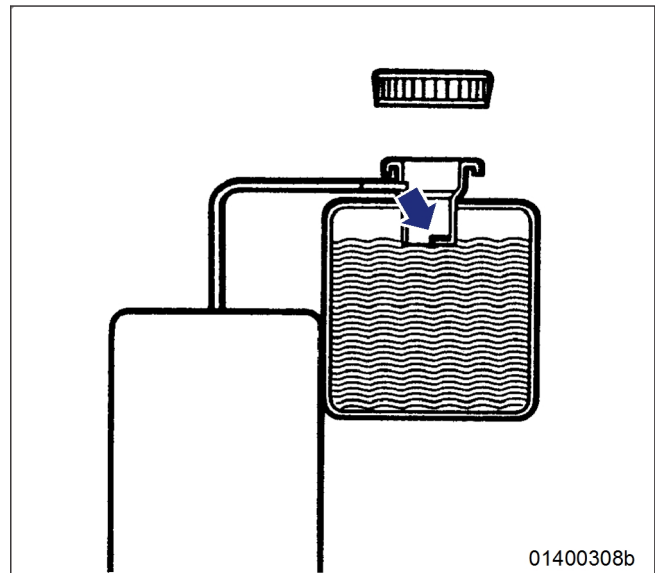
Coolant is hot and under pressure.

Risk of injury and scalding!

- Let the engine cool down.
- Wear protective clothing, gloves, and goggles / safety mask.

Checking engine coolant level at filler neck

1. Turn breather valve on coolant expansion tank counterclockwise to the first stop and allow pressure to escape.
2. Continue to turn breather valve counterclockwise and remove.
3. Check coolant level (coolant must be visible at the lower edge of the cast-in eye or at the marking plate).
4. Top up with treated coolant as necessary (→ Page 107).
5. Check breather valve (visual inspection) and clean if necessary.
6. Position breather valve on filler neck and close.



Checking engine coolant level by means of level sensor

1. Switch on engine control system and check readings on the display.
2. Top up with treated coolant as necessary (→ Page 107).

8.10.2 Engine coolant - Change

Special tools, Material, Spare parts

| Designation / Use | Part No. | Qty. |
|-------------------|----------|------|
| Coolant | | |

Engine coolant change

1. Drain engine coolant (→ Page 106).
2. Fill with engine coolant (→ Page 107).

8.10.3 Engine coolant – Draining

Preconditions

- Engine is stopped and starting disabled.

Special tools, Material, Spare parts

| Designation / Use | Part No. | Qty. |
|-------------------|-------------------------|------|
| Engine oil | | |
| Sealing ring | (→ Spare Parts Catalog) | |

WARNING



Coolant is hot and under pressure.

Risk of injury and scalding!

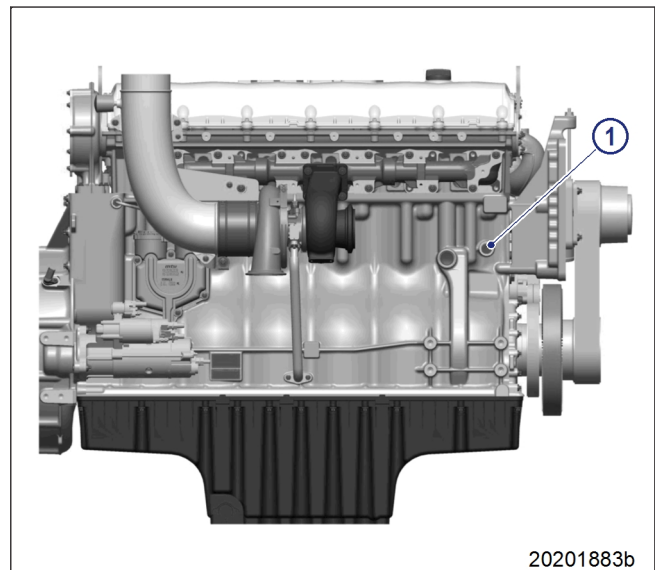
- Let the engine cool down.
- Wear protective clothing, gloves, and goggles / safety mask.

Preparatory steps

1. Provide a suitable container to catch the coolant.
2. Switch off preheater, if installed.

Engine coolant – Draining

1. Turn breather valve of filler neck on coolant expansion tank counterclockwise to 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 drain plug (1) and drain coolant.



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5. Insert drain plug with new sealing ring and use torque wrench to tighten to specified tightening torque.

| Name | Size | Type | Lubricant | Value/Standard |
|-------------|------|-------------------|--------------|----------------|
| Drain screw | | Tightening torque | (Engine oil) | 70 Nm |

6. Place breather valve on filler neck and close.





8.10.4 Engine coolant – Filling

Preconditions

- ☑ Engine is stopped and starting disabled.
- ☑ MTU Fluids and Lubricants Specifications (A001063/..) are available.

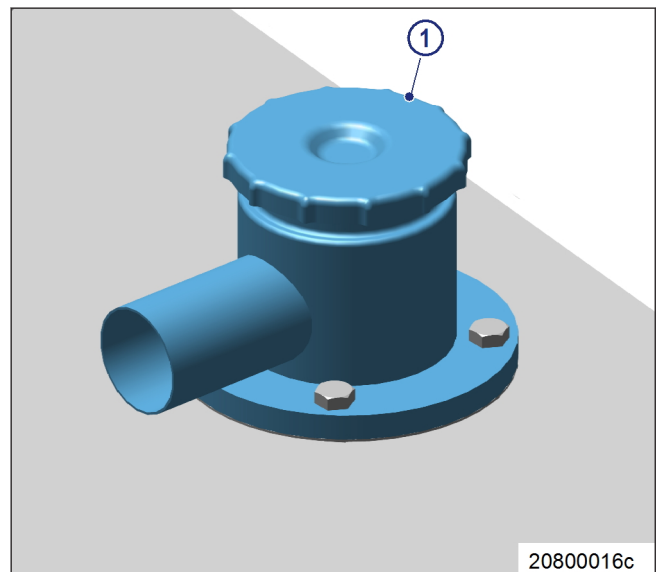
Special tools, Material, Spare parts

| Designation / Use | Part No. | Qty. |
|-------------------|----------|------|
| Coolant | | |

| | |
|---|---|
| DANGER  | Components are moving or rotating. Risk of crushing, danger of parts of the body being caught or pulled in! <ul style="list-style-type: none">• Operate the engine at low load only. Keep clear of the danger zone of the engine. |
| WARNING  | Coolant is hot and under pressure. Risk of injury and scalding! <ul style="list-style-type: none">• 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! <ul style="list-style-type: none">• Wear ear protectors. |
| NOTICE  | Cold coolant in hot engine can cause thermal stress. Possible formation of cracks in the engine! <ul style="list-style-type: none">• Fill / top up coolant only into cold engine. |

Preparatory steps

1. Turn valve cover (1) on coolant expansion tank counterclockwise to the first stop and allow pressure to escape.
2. Continue to turn valve cover (1) counterclockwise and remove.



Filling coolant

1. Fill coolant through filler neck on expansion tank or through filling line until coolant level reaches lower edge of cast-in eye or marking plate.
2. Check proper condition of valve cover (1), clean sealing faces if required.
3. Fit valve cover (1) and close it.

Final steps

1. Start engine and run at idle speed for some minutes.
2. Check coolant level (→ Page 104), top up with coolant if required.

8.10.5 Engine coolant pump – Relief bore check

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



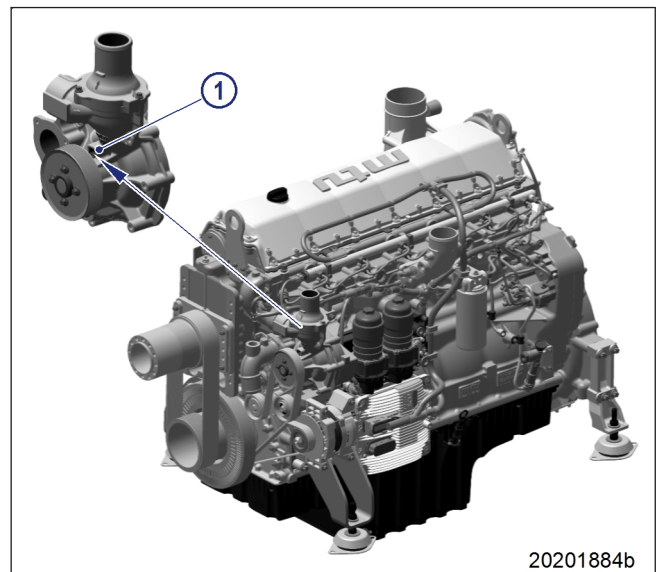
High level of engine noise when the engine is running.

Risk of damage to hearing!

- Wear ear protectors.

Engine coolant pump – Relief bore check

1. Check relief bore (1) for engine coolant discharge.
 - Permissible engine coolant discharge: Up to 0.1 ml per operating hour respectively 100 ml per 1,000 operating hours.
2. If discharge exceeds the specified limits, contact Service.
3. If relief bore is dirty (1):
 - Stop engine (→ Page 81) and disable engine start.
 - Clean relief bore (1) with wire.



8.11 Cooling System

8.11.1 Coolant cooler - Check

NOTICE



Contamination of components.

Damage to component!

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

Coolant cooler - Check

1. Check coolant cooler for external contamination (visual inspection) and clean surfaces.
2. Check coolant cooler for leaks (visual inspection).
3. If a large amount of coolant is continuously discharged, the coolant cooler is leaking. Contact Service.

8.12 Belt Drive

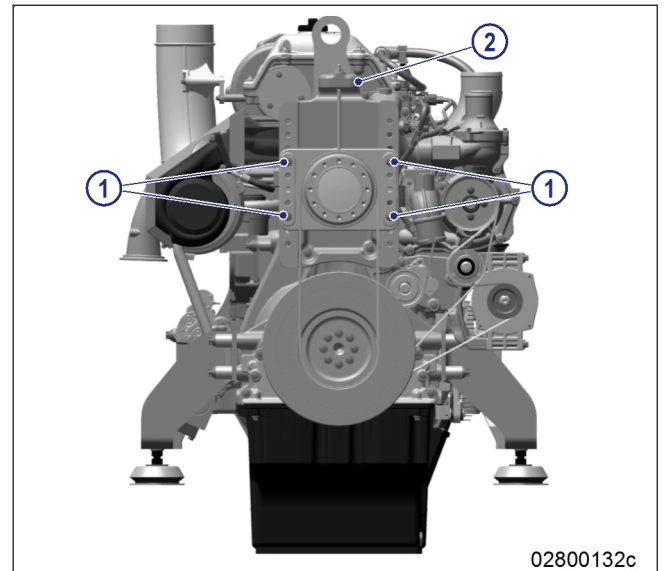
8.12.1 Drive belt - Adjustment

Preconditions

- ☑ Engine is stopped and starting disabled.

Fan drive - Adjusting belt tension

1. Loosen screws (1).
2. Screw in nut (2) to set the required belt tension.
3. Tighten screws (1).
4. Check drive belt tension for compliance with specifications (→ Page 113).

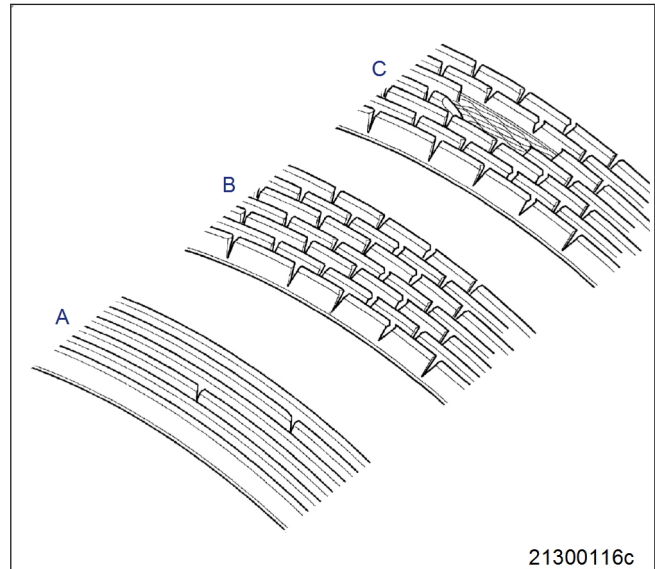


8.12.2 Drive belt - Condition check

Preconditions

- Engine is stopped and starting disabled.

Checking condition



| Item | Findings | Action |
|--------------|--------------------------------|---------------------------|
| Drive belt A | Singular cracks | None |
| Drive belt B | Cracks on entire circumference | Fit new part (→ Page 114) |
| Drive belt C | Chunking | |
| Drive belt | Fouling by oil, overheating | |

8.12.3 Drive belt – Tension check

Preconditions

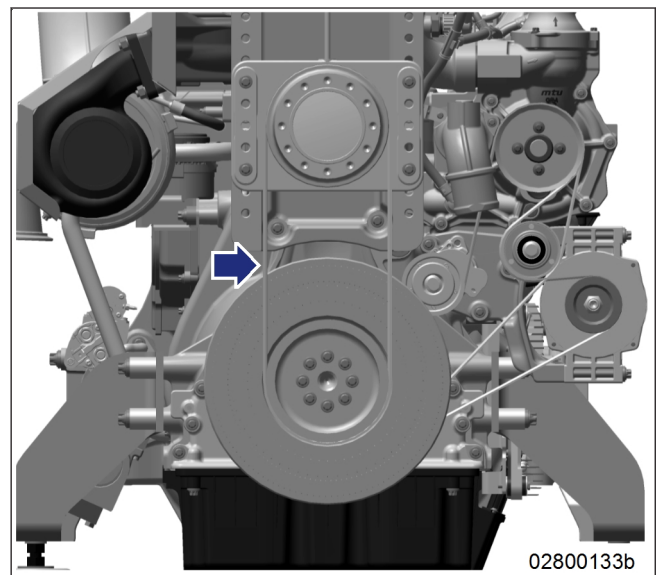
- Engine is stopped and starting disabled.

Special tools, Material, Spare parts

| Designation / Use | Part No. | Qty. |
|----------------------------------|-----------|------|
| Tester | Y4345711 | 1 |
| Belt tension tester, 500–1400 N | Y20097430 | 1 |
| Belt tension tester, 1300–3100 N | Y20097431 | 1 |

Fan drive – Checking belt tension

1. Remove protective cover.
2. Set belt tension tester onto the drive belt in the middle between the belt pulleys (arrow).
3. Actuate pushbutton to press the tester uniformly on the drive belt surface until the spring disengages.
4. Do not press any further, otherwise the display value will be falsified.
5. Take off tension tester without changing the position of the display arm.
6. Read off measured value at the intersection of display arm and "KG" scale. For specifications, refer to table below.



| Application | Spec. value Initial assembly | Spec. value Operating tension after 1 hour | Spec. value Minimum operating tension |
|----------------|------------------------------|--|---------------------------------------|
| Fan drive belt | 2250 N | 1620 N | 1080 N |

7. If the measured values deviate from the specifications above, adjust drive belt tension (→ Page 111).
8. Install protective cover.

8.12.4 Drive belt - Replacement

Preconditions

- ☑ Engine is stopped and starting disabled.

Special tools, Material, Spare parts

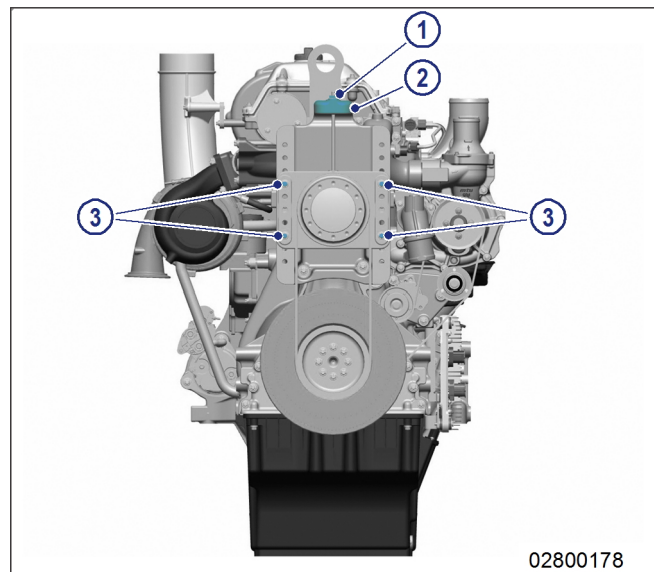
| Designation / Use | Part No. | Qty. |
|-------------------|-------------------------|------|
| Drive belt | (→ Spare Parts Catalog) | |

Replacing fan drive belt

1. Remove protective cover from radiator.
2. Remove fan.
3. Loosen securing screws (3).
4. Screw out tension nut (1) as far as necessary to allow drive belt removal.
5. Check belt pulley on cooler bearing mount and crankshaft for contamination and clean if necessary.

Note: When placing the drive belt in the grooves, no force must be applied.

6. Fit new drive belt.
7. The fan bearing mount must be in contact with the retainer (2) to allow belt tensioning.
8. Adjust and check drive belt tension (→ Page 111).
9. Install fan.
10. Install protective cover.

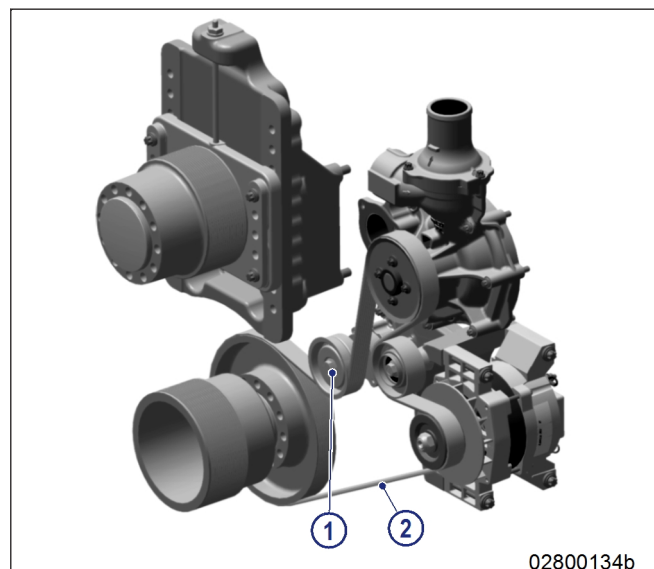


Replacing drive belts of battery-charging generator and coolant pump

1. Remove protective cover.
2. Remove drive belt from fan drive (→ Step 1).
3. Use appropriate tool to release the automatic belt tensioner at hexagon (1) and take off drive belt (2).

Note: When placing the drive belt in the grooves, no force must be applied.

4. Fit new drive belt (2) and unload belt tensioner.
5. Install drive belt on fan drive (→ Step 1).
6. Install protective cover.



8.13 Wiring (General) for Engine/Gearbox/Unit

8.13.1 Engine cabling - Check

Preconditions

- Engine is stopped and starting disabled.

Special tools, Material, Spare parts

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

Engine cabling - Check

1. Check securing screws of cable clamps on engine and tighten loose screw connections.
2. Ensure that cables are securely seated in clamps and cannot move freely.
3. Check if all cable clips are closed and intact.
4. Replace faulty cable clips.
5. Check cable clamps for secure fit, tighten loose clamps.
6. Replace faulty cable clamps.
7. Visually inspect the following electrical components for damage:
 - Connector housings
 - Contacts
 - Plug connectors
 - Cables and terminals
 - Plug-in contacts

Result: If cable conductors are damaged, contact Service.

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

8. Use isopropyl alcohol to clean dirty connector housings, plug connectors and contacts.
9. Ensure that all connecting plugs of the sensors are correctly engaged.

8.14 Accessories for (Electronic) Engine Governor / Control System

8.14.1 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.

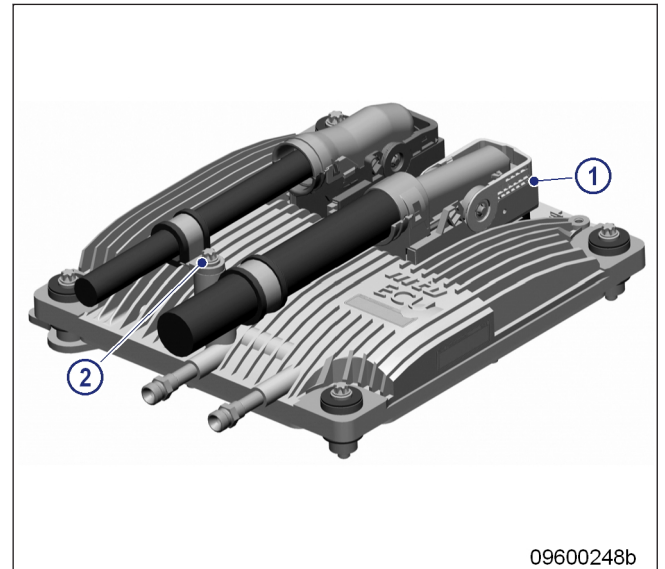
8.14.2 Engine governor – Checking plug connections

Preconditions

- ☑ Engine is stopped and starting disabled.

Checking engine governor plug connections

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.



9 Appendix A

9.1 Abbreviations

| Abbreviation | Meaning | Explanation |
|--------------|---------------------------------------|--|
| A/D | Analog/Digital converter | Converter: converts sensor voltages into digital values |
| ADEC | Advanced Diesel Engine Controller | Engine management system |
| AFRS | Air Filter Restriction Sensor | |
| AL | alarm | |
| ANSI | American National Standards Institute | Association of American standardization organizations |
| ATS | Air Temperature Sensor | |
| BR | Series | |
| BV | Betriebsstoffvorschrift | Fluids and Lubricants Specifications, MTU Publication No. A001061/.. |
| CAN | Controller Area Network | Data bus system, bus standard |
| CDC | Calibration Drift Compensation | Drift correction setting with DiaSys in engine governor |
| CEL | Check Engine Lamp | 1st function: Warning lamp (rectify fault as soon as possible) 2nd function: Read out fault codes |
| CKT | Circuit | |
| CLS | Coolant level sensor | Monitors coolant level |
| CM | Current Measurement | Current measured value |
| CPS | Coolant pressure sensor | Monitors coolant pressure |
| CR | Common Rail | |
| CTS | Coolant temperature sensor | Monitors coolant temperature |
| DDEC | Detroit Diesel Electronic Controls | Engine control system made by Detroit Diesel |
| DDL | Diagnostic Data Link | Diagnostic lines |
| DDR | Diagnostic Data Reader | Diagnostic unit |
| Dia-Sys® | Electronic dialog system | |
| 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 |
| DMC | Data Matrix Code | |
| DOC | Diesel Oxidation Catalyst | Oxidation catalyst upstream of the diesel particulate filter |
| DPF | Diesel Particulate Filter | |
| DT | Diagnostic Tool | Diagnostic unit |
| ECM | Electronic Control Module | Electronic control unit of the DDEC system |
| ECU | Engine Control Unit | Engine governor |
| EDM | Engine Data Module | Memory module for engine data |

TIM-ID: 0000000558 - 016

| Abbreviation | Meaning | Explanation |
|--------------|--|---|
| EE-PROM | Electrically Erasable Programmable Read Only Memory | |
| EFPA | Electronic Foot Pedal Assembly | Electronic accelerator pedal |
| EGR | Exhaust Gas Recirculation | |
| EIL | Engine Ident Label | |
| EIM-ID | Emission Identification Number | |
| EMU | Engine Monitoring Unit | |
| ESCM | Extreme Site Condition Management | Power reduction for operation in extreme conditions |
| ESD | Einzelspeicherdruck | Injector accumulator pressure |
| ETC | Exhaust turbocharger/exhaust turbocharging | |
| EUI | Electronic Unit Injector | Electronic injection nozzle unit |
| FO | Frequency Output | |
| FPS | Fuel Pressure Sensor | Monitors fuel pressure |
| FRS | Fuel Restriction Sensor | Monitors differential fuel pressure |
| FTS | Fuel Temperature Sensor | Monitors fuel temperature |
| FWCP | Fire Water Control Panel | Control cabinet |
| GND | Ground | |
| HP | High Pressure | |
| HI | High | Alarm: Measured value exceeds 1st maximum limit |
| HIHI | High High | Alarm: Measured value exceeds 2nd maximum limit |
| HT | High Temperature | |
| IDM | Interface Data Module | Memory module for interface data |
| IIG | Initial injector equalization | Initial input of injector code in Engine Control Unit with DiaSys |
| 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 |
| L1 | Limit 1 | Limit value, limit 1 |
| L2 | Limit 2 Reference surface for heights above sea level | Limit value, limit 2 |
| LED | Light Emitting Diode | Light emitting diode |
| LLK | Ladeluftkühlung | Charge-air cooling |
| LO | Low | Alarm: Measured value lower than 1st minimum limit value |
| LOLO | Low Low | Alarm: Measured value lower than 2nd minimum limit value |
| LP | Low Pressure | |
| LSG | Limit Speed Governor | Maximum-speed governor |
| LSU | Lambda Sonde Universal | Universal Lambda probe |
| LT | Low Temperature | |

| Abbreviation | Meaning | Explanation |
|--------------|-----------------------------------|--|
| MCR | Maximum Continuous Rating | Torque limitation curve |
| N/A | Not Applicable | |
| NN | Normal Null | Reference surface for heights above sea level |
| OEM | Original Equipment Manufacturer | |
| OI | Optimized Idle | |
| OLS | Oil Level Sensor | Monitors oil level |
| OPS | Oil pressure sensor | Monitors oil pressure |
| OTS | Oil Temperature Sensor | Monitors oil temperature |
| OT | Oberer Totpunkt | Top Dead Center (TDC) |
| PAN | Panel | Control panel |
| PIM | Peripheral Interface Module | |
| PWM | Pulse Width Modulation | Modulated signal |
| P-xyz | Pressure-xyz | Pressure measuring point xyz |
| RL | Redundancy Lost | Alarm: Redundant CAN bus failure |
| rpm | Revolutions per minute | |
| SAE | Society of Automotive Engineers | U.S. standardization organization |
| SD | Sensor Defect | Alarm: Sensor failure |
| SEL | Stop Engine Lamp | 1st function: Warning lamp (stop engine and rectify fault); 2nd function: Read out fault codes |
| SID | System Identifier | |
| SPC | Spare Parts Catalog | |
| SRS | Synchronous Reference Sensor | TDC cylinder 1 |
| SS | Safety System / Security Shutdown | Safety system alarm |
| TBS | Turbocharger Boost Sensor | Monitors charge-air pressure |
| TC | Tool Catalog | |
| TCI | Turbo Compressor Inlet | |
| TCO | Turbo Compressor Outlet | |
| TD | Transmitter Deviation | Alarm: Sensor comparison fault |
| TPS | Throttle Position Sensor | |
| TRS | Timing Reference Sensor | |
| T-xyz | Temperature-xyz | Temperature measuring point xyz |
| U_PDU | Voltage Power Driver Unit | Distribution voltage for solenoid valve output stages |
| UDV | Überdruckventil | Pressure relief valve |
| UT | Unterer Totpunkt | Bottom Dead Center (BDC) |
| VNT | Variable nozzle turbine | |
| VSG | Variable-speed governor | |
| VSS | Vehicle Speed Sensor | |
| ZKP | Zuordnung - Kategorie - Parameter | A number allocated to a parameter describing its function and assignment |

9.2 MTU Contact/Service Partners

The worldwide network of the sales organization with subsidiaries, sales offices, representatives and customer service centers ensure fast and direct support on site and ensure the high availability of our products.

Local Support

Experienced and qualified specialists place their knowledge and expertise at your disposal.

For locally available support, go to the MTU Internet site: <http://www.mtu-online.com>

24h Hotline

With our 24h hotline and high flexibility, we're your contact around the clock: during each operating phase, preventive maintenance and corrective operations in case of a malfunction, for information on changes in conditions of use and for supplying spare parts.

Your contact person in our Customer Assistance Center:

E-mail: info@mtu-online.com

Tel.: +49 7541 9077777

Fax.: +49 7541 9077778

Asia/Pacific: +65 6100 2688

North and Latin America: +1 248 560 8000

Spare Parts Service

Fast, simple and correct identification of spare parts for your drive system or vehicle fleet. The right spare part at the right time at the right place.

With this aim in mind, we can call on a globally networked spares logistics system, a central warehouse at headquarters and on-site stores at our subsidiary companies, agencies and service workshops.

Your contact at Headquarters:

E-mail: spare.parts@mtu-online.com

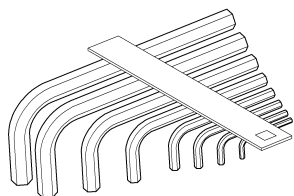
Tel.: +49 7541 9077777

Fax.: +49 7541 9077778

10 Appendix B

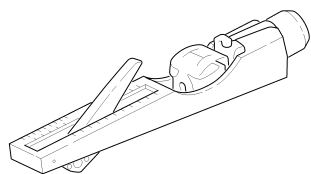
10.1 Special Tools

Angular screw driver, set 2–10 mm



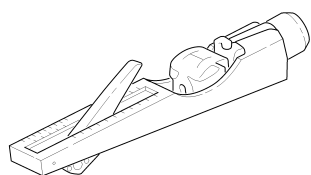
| | |
|-----------|---|
| Part No.: | F30453050 |
| Qty.: | 1 |
| Used in: | 8.2.1 Valve clearance - Check and adjustment (→ Page 90) |

Belt tension tester, 1300–3100 N



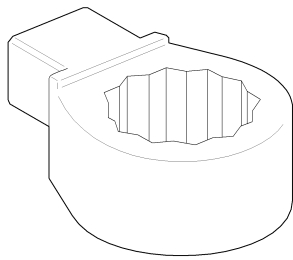
| | |
|-----------|--|
| Part No.: | Y20097431 |
| Qty.: | 1 |
| Used in: | 8.12.3 Drive belt - Tension check (→ Page 113) |

Belt tension tester, 500–1400 N



| | |
|-----------|--|
| Part No.: | Y20097430 |
| Qty.: | 1 |
| Used in: | 8.12.3 Drive belt - Tension check (→ Page 113) |

Box wrench, 14 mm

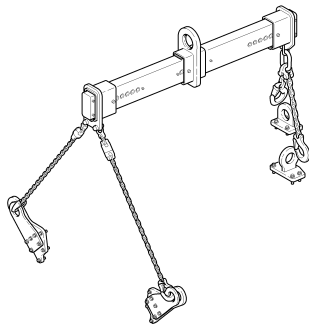


Part No.: F30028346

Qty.: 1

Used in: 8.2.1 Valve clearance – Check and adjustment
(→ Page 90)

Crossbeam

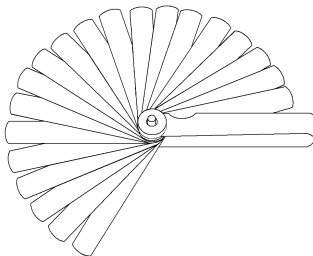


Part No.: T80092479

Qty.: 1

Used in: 2.1 Transport (→ Page 18)

Feeler gage

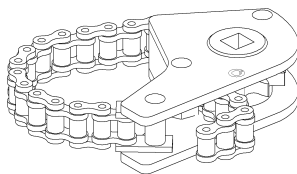


Part No.: Y20098771

Qty.: 1

Used in: 8.2.1 Valve clearance – Check and adjustment
(→ Page 90)

Filter wrench



Part No.: F30379104

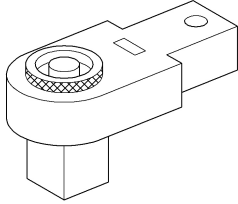
Qty.: 1

Used in: 8.4.1 Fuel filter – Replacement (→ Page 94)

Qty.: 1

Used in: 8.4.3 Fuel prefilter – Replacement (→ Page 96)

Ratchet bit

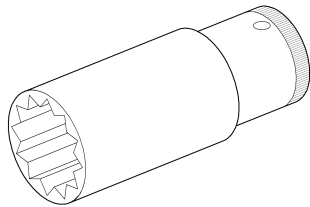


Part No.: F30027340

Qty.: 1

Used in: 8.9.1 Engine oil filter – Replacement (→ Page 103)

Socket, 32 mm

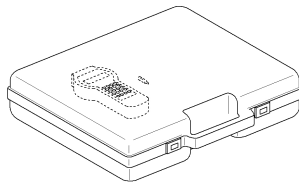


Part No.: F30006120

Qty.: 1

Used in: 8.9.1 Engine oil filter – Replacement (→ Page 103)

Tester

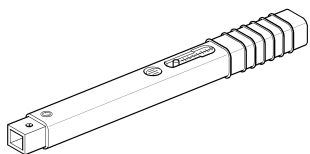


Part No.: Y4345711

Qty.: 1

Used in: 8.12.3 Drive belt – Tension check (→ Page 113)

Torque wrench, 8–40 Nm



Part No.: F30043446

Qty.: 1

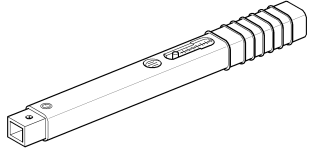
Used in: 8.9.1 Engine oil filter – Replacement (→ Page 103)

Torque wrench, 20-100 Nm

Part No.: F30026582

Qty.: 1

Used in: 8.2.1 Valve clearance - Check and adjustment
(→ Page 90)



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