

SERVICE MANUAL

4-Stroke Engine

MPE 850 OFF-ROAD

This service manual is valid for the following engine models:

- 409135 I2 846 UTV NA-80

TD409135_SHB

Rev A

03.08.2015

en_English



Read this service manual thoroughly before operating the engine for the first time.

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1 About this document

This service manual was designed to help you operating the engine safely and reliably.

Observe the following references:

- Read this service manual thoroughly before operating the engine for the first time.
- Always read the vehicle manufacturer's documentation.
- This service manual is for the engine in your vehicle. See the vehicle manufacturer's documentation for vehicle specific information.
- Keep this service manual in a safe place.
- Make sure that all persons using the vehicle have access to this service manual.
- If you sell the vehicle, always pass on this service manual to the new owner.
- The latest version of the servicew manual is available for download in other languages from our web site www.weber-motor.com.
- Some figures in this service manual are general illustrations and may differ from the actual engine.

1.1 Meaning of symbols and signal words

Item	Meaning
<i>NOTICE</i>	The signal word <i>NOTICE</i> indicates potential property damage.
Information	The signal word Information indicates specific features and recommendations.

2 Safety


This engine is state-of-the-art and built according to recognized safety technical and emission regulations. Ignoring the information in this service manual may result in personal injury or property damage.

Read and observe the following safety messages carefully before operating the engine for the first time.

Observe all generally applicable laws and regulations in addition to the information in this service manual:

- Accident prevention
- Environmental protection
- Handling of hazardous materials
- Personal safety equipment
- Traffic laws

2.1 Meaning of safety alert symbol and signal words

Item	Meaning
	The safety alert symbol draws your attention to possible dangers.
WARNING	The signal word WARNING indicates a potentially dangerous situation that may lead to a serious or fatal injury.
CAUTION	The signal word CAUTION indicates a potentially dangerous situation that may lead to a minor or moderately severe injury.

2.2 Important safety messages

Service tasks	<p>In order to keep your engine in a safe operating condition, regular servicing is essential. It is your responsibility to ensure that the engine is serviced correctly.</p> <ul style="list-style-type: none">▶ Perform regular inspections and observe the specified service intervals.
Service tasks in the workshop	<p>All tasks described in chapter 8 Service tasks in the workshop require special technical knowledge of this engine.</p> <ul style="list-style-type: none">▶ Ensure your workshop is qualified to service your engine.▶ All Textron Motors authorized workshops are qualified to service your engine.
Malfunctions	<p>Engine malfunctions pose a safety risk to persons.</p> <ul style="list-style-type: none">▶ Only operate the engine in perfect condition.▶ Perform all service tasks according to the service intervals in this service manual.▶ You must immediately address all malfunctions to a qualified workshop.
Spare parts	<p>All the components in your engine have been carefully tested and fulfill strict quality and safety requirements.</p> <ul style="list-style-type: none">▶ Textron Motors offers spare parts to the highest quality. Ensure that equivalent spare parts corresponds with this quality requirements.
Add-on parts and modifications	<p>Engine modifications may pose a safety risk to persons.</p> <ul style="list-style-type: none">▶ Do not install add-on parts or modify the engine.
Hot engine components	<p>Engine components become extremely hot during operation.</p> <ul style="list-style-type: none">▶ Do not touch any engine components during operation.▶ Turn off the engine and wait until the components have cooled before making contact.
Engine power supply	<p>Some service tasks require disconnection of the engine from the power supply. Starting the engine inadvertently may endanger the safety of persons. Read the vehicle manufacturer's documentation for more information.</p> <ul style="list-style-type: none">▶ Disconnect the engine from the power supply when requested.

Engine exhaust gases

Engine exhaust gases contain carbon monoxide (CO). Inhalation of carbon monoxide can deprive the body of oxygen and result in organ damage or death by asphyxiation.

- ▶ Never operate the engine in enclosed spaces.

Fuel, engine oil and coolant handling

Engine fluids pose a health risk.

- ▶ Always read the manufacturer's instructions.
- ▶ Always wash your hands prior to eating, smoking and using the restroom as well as at the end of the working shift when working with engine fluids.

Engine fluids are hazardous to the environment.

- ▶ Never allow engine fluids to escape into the groundwater, water courses or sewage system. Always dispose of engine fluids according to applicable regulations.

Danger of slipping on spilled fluids.

- ▶ Always use a filler neck or funnel when filling the engine with fluids.
- ▶ Always clean up any spilled engine fluids immediately.

Fuel

Fuel is highly flammable. Vapors may ignite and cause an explosion.

- ▶ Do not smoke in the vicinity of the engine and do not allow open flames or sparks near the engine or the fuel system.
- ▶ Always turn off the engine before fueling.
- ▶ Never fill with fuel while the engine is running.
- ▶ Do not start the engine if you smell fuel or see a fuel leak.
- ▶ Fuel on hot surfaces can cause fires.
- ▶ In the event of a fire, use foam, dry chemical or carbon dioxide fire extinguishers. Do not extinguish with water.

Engine oil

Engine oil is flammable and can emit toxic gases.

- ▶ Do not smoke in the vicinity of the engine and do not allow open flames or sparks near the engine.
- ▶ Engine oil on hot surfaces can cause fires.
- ▶ In the event of a fire, use foam, dry chemical or carbon dioxide fire extinguishers. Do not extinguish with water.

California Proposition 65

This engine and engine exhaust contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

3 Description

3.1 Intended use | 3.2 Identification

3 Description

3.1 Intended use

The engine models I2 846 UTV has been designed for powering off-road vehicles. Any other use is not permissible.

All specifications in this service manual are only valid for the unmodified engine delivered by Textron Motors. Engine modifications are not permissible and in addition, may void the warranty or violate federal laws.

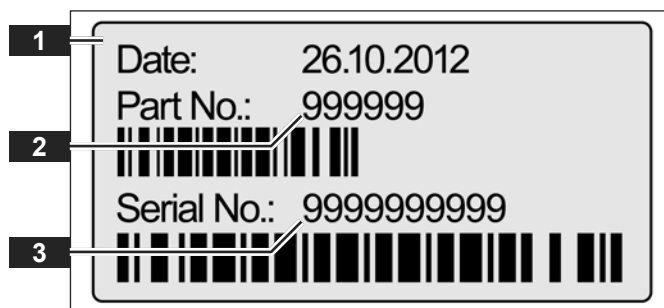
3.2 Identification

Each engine will be clearly identified by two identification numbers. Both numbers are printed on a label **1** affixed to the engine.

The part number “Part No.,” **2** is the number of the engine model.

The serial number “Serial No.,” **3** is an unique number for each individual engine.

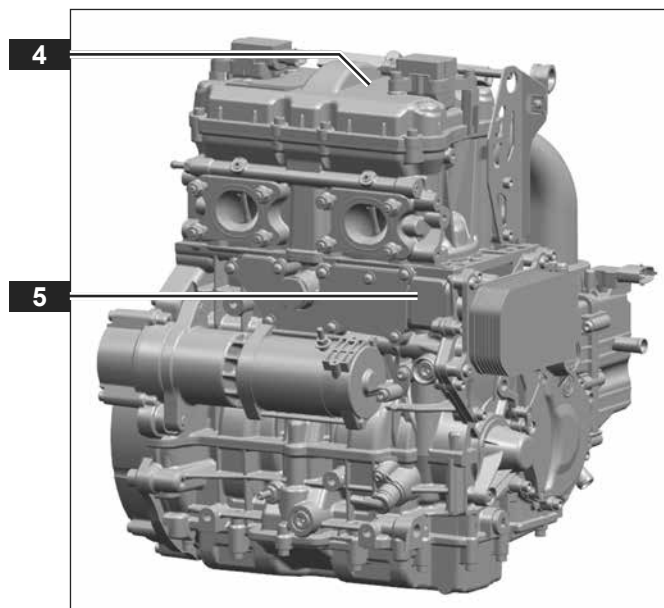
Enter the part number and serial number in chapter 9 **Confirmation of service tasks**. Both numbers are important in questions regarding your engine.



Engine model I2 846 UTV NA-80

The label with the part number and the serial number is located on the valve cover **4**.

The serial number is also engraved on the crankcase **5**.



3.3 Fuel

Engine models I2 846 UTV		NA-80
Fuel		Unleaded gasoline
Recommended fuel quality		95 ROZ or 85 MOZ USA "Premium 91"
Minimum requirement	The minimum requirement is only suitable for using from start of series production. The calibration is provided with a knock control, for engine operation with fuels of lower octane. Observe that using of fuel with minimum requirements can cause loss of power and/or increased fuel consumption.	
		91 ROZ or 82,5 MOZ USA "Regular 87"
Permissible share of ethanol	<i>NOTICE!</i> A greater concentration can deteriorate the engine's fuel system and starting performance.	
		Maximum 10 % (E10)

3.4 Engine oil

Engine models I2 846 UTV		NA-80
Engine oil	<i>NOTICE!</i> Engine damage due to incorrect engine oil grade. Always use the recommended engine oil. Do not mix engine oils of different grades or viscosity.	
		0W 40 completely synthetic, at least API SJ, ACEA A3/B3
Fill quantity	See the vehicle manufacturer's documentation.	

3 Description

3.5 Coolant

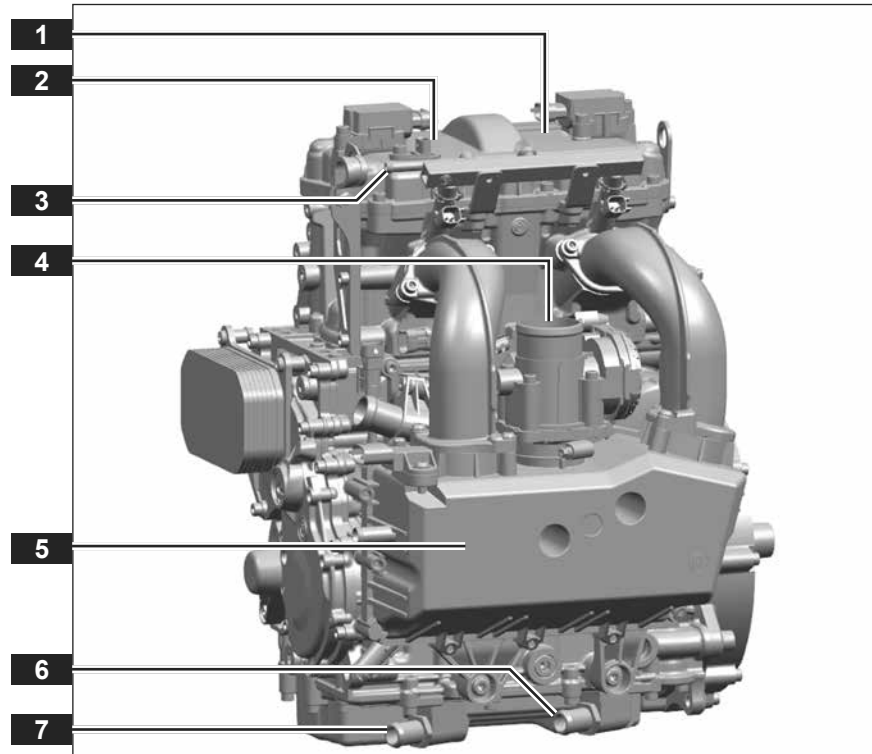
3.5 Coolant

Engine models I2 846 UTV		NA-80
Coolant additive	Coolant additive based on ethylene glycol, silicate- and nitrite- free, suitable for aluminium engines.	
Suggested coolant additives	<p>NOTICE! Insufficient cooling due to incompatibilities of coolant. Combining different coolant additives may trigger a chemical reaction and they may lose their effectiveness. The suggested coolant additives are laboratory tested for compatibility. If you use another coolant additive verify the compatibility previously.</p> <ul style="list-style-type: none">– BASF Glysantin G 30– Chevron Havoline Extended Life Coolant XLC+B– Valvoline Zerex G 30	
Mixing ratio	<p>NOTICE! An incorrect mixing ratio reduces the cooling capacity. When topping up the coolant, do not change the mixing ratio. Use the same coolant throughout the year in the mixing ratio specified.</p> <p>50 % water + 50 % coolant additive</p>	
Fill quantity	See the vehicle manufacturer's documentation.	

3.6 Engine components and information

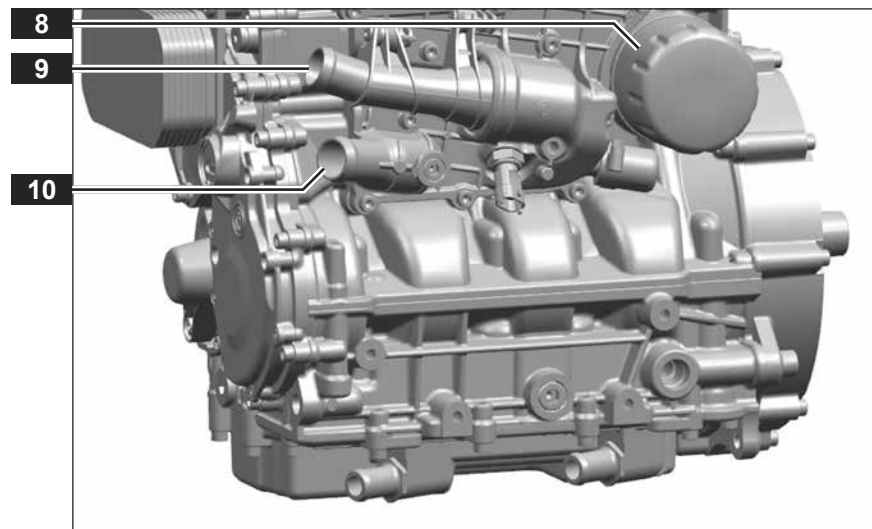
Engine models
I2 846 UTV NA-80

- 1st cylinder **1**
- Sensor camshaft **2** /
2nd cylinder
- Fuel supply **3**
- Throttle body **4** / Air intake
- Intake Manifold **5** / Intake
side
- Engine oil,
oil tank to engine **6**
- Engine oil,
engine to oil tank **7**



The intake manifold is not shown
in the figure.

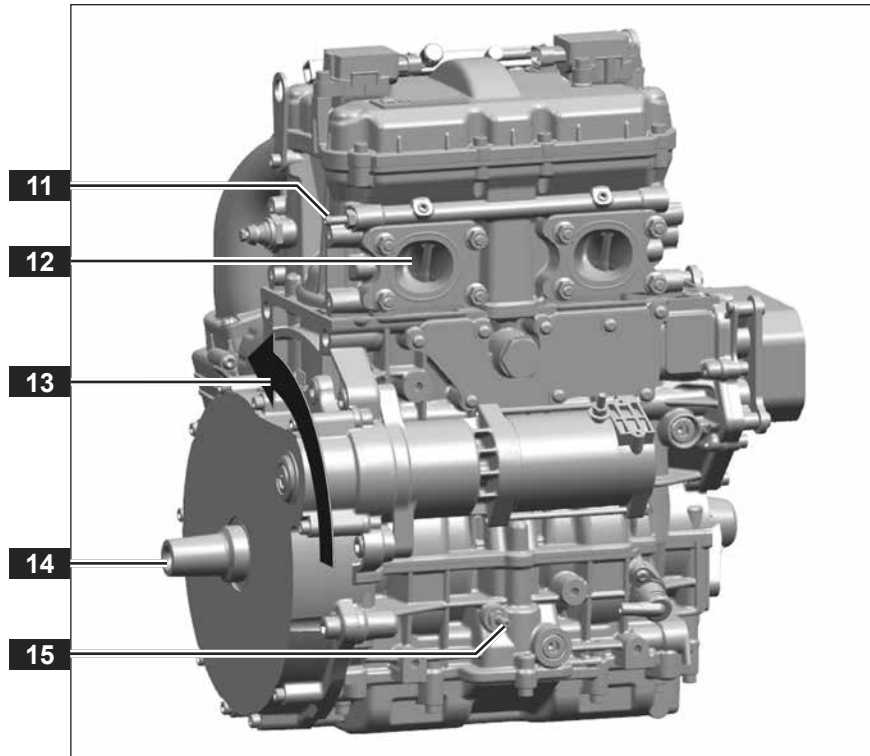
- Oil filter **8**
- Coolant circuit to the heat
exchanger **9**
- Coolant circuit from the heat
exchanger **10**



3 Description

3.6 Engine components and information

- Permanent vent coolant circuit **11**
- Exhaust ports **12** / Exhaust side
- Engine rotation direction **13**
- Stub shaft **14** / Power take off
- Crankcase vent / Engine oil return **15**



3.7 Protective functions

The engine has an engine diagnostics, which monitors various operating parameters. The protection functions described in this chapter are intended for your protection and to protect your engine when the operating parameters exceed defined limits.

Protective function	Description
Coolant temperature	<p>Temperature variations during engine operation are normal. Therefore the protective function will be activated in several stages, to protect the engine from overheating.</p> <p>Coolant temperature 91 – 110 °C The temperature range can occur due to operational temperature variations. The engine output is reduced continuously with increasing temperature to about 60 %. No measures are required.</p> <p>Coolant temperature 111 – 115 °C The temperature warning light illuminates and the engine power is reduced to about 30 %. The critical coolant temperature has almost been reached. Measures are required. (See chapter 3.9.1 Lights in vehicle.)</p> <p>Coolant temperature > 115 °C The temperature warning light and the malfunction indicator light illuminate at the same time. The engine power is reduced to about 25 % and the engine speed is limited. The critical temperature range is reached and an engine damage caused by overheating is imminent. Measures are immediately required. (See chapter 3.9.1 Lights in vehicle.)</p>
Temperature intake air	<p>The protective function is activated when the temperature of the intake air exceeds 35 °C. The engine output is reduced continuously with increasing temperature.</p>
Throttle control pedal / Brake pedal	<p>Observe that the engine power is reduced during vehicle operation when brake pedal and throttle control pedal are actuated at the same time.</p>
Roll over detection	<p>If your vehicle is equipped with a roll over detection, the roll over detection will be activated under specific operating conditions. (See the vehicle manufacturer's documentation.)</p> <p>In this case the ignition, fuel injection and the fuel pump will be switched off immediately.</p> <p>For resetting this protective function, turn off the ignition switch and turn it on again.</p>

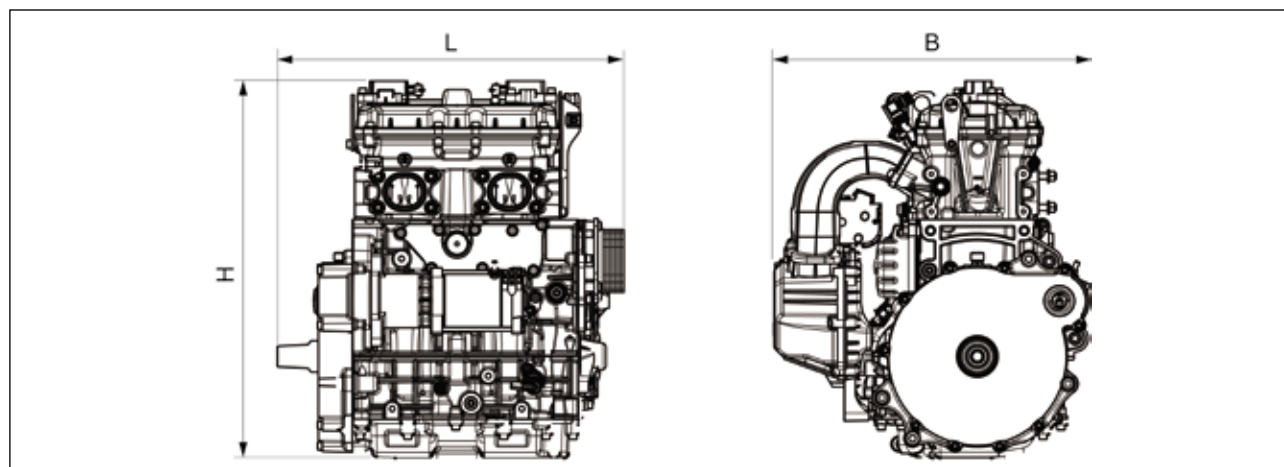
3 Description

3.7 Protective functions

Protective function	Description
Engine speed limitations	<p>If a speed limitation is active the engine speed cannot be exceeded, even at full throttle.</p> <p>In normal operation speed limitations are active for the following operation conditions:</p> <ul style="list-style-type: none">– 6500 min⁻¹ [rpm] The shift control lever is in neutral position– 5500 min⁻¹ [rpm] The shift control lever is in reverse gear– 6000 min⁻¹ [rpm] Overtemperature coolant <p>Speed limitations are active for the following malfunctions:</p> <ul style="list-style-type: none">– 5000 min⁻¹ [rpm] Synchronization fault of sensors camshaft / crankshaft <p>WARNING! Risk of accident. Faults at the pedal value sensor and electronic throttle system (drive-by-wire) can affect the vehicle operation substantially. Contact immediately a qualified workshop. All Textron Motors authorized workshops are qualified to repair your engine.</p> <ul style="list-style-type: none">– 4500 min⁻¹ [rpm] Fault at the pedal value sensor– 4000 min⁻¹ [rpm] Fault in the electronic throttle system (drive-by-wire)

3.8 Technical specifications

Engine models I2 846 UTV	NA-80
Calibration	
Type	4-stroke gasoline engine, parallel twin with balance shaft and single overhead camshaft (SOHC)
Displacement	846 cm ³
Number of cylinders	2
Bore x stroke	89 x 68 mm [3.5 x 2.7 in]w
Compression ratio	11,5 : 1
Engine power SAE J1349	kW @ min ⁻¹ [rpm]
Engine speed limit	min ⁻¹ [rpm]
Idle speed	min ⁻¹ [rpm]
Fuel system	Sequential multipoint manifold injection
Lubrication system	Dry sump
Cooling system	Closed coolant circuit and open sea water cooling circuit
Engine management system	Synerject M3D
Throttle body	Electronically controlled, dia. = 44 mm [1.73 in]
Ignition system	Electronically controlled distributorless ignition system with individual coils
Starter system	Electric starter
Generator, internal	> 450 W @ 4000 min ⁻¹ [rpm]
Weight without engine oil and coolant	58 kg [128 lb]
Dimensions L x B x H	444 mm [17 in] x 405 mm [16 in] x 482 mm [19 in]



3.9 Supported vehicle equipment

3.9.1 Lights in vehicle

The lights described in this chapter are controlled by the engine management system. Observe the information in the vehicle manufacturer's documentation.

Light	Description
Service light	<p>When the service light is illuminating, the next service interval is reached and service tasks are required.</p> <ul style="list-style-type: none"> ► The required service tasks must be performed in a qualified workshop. All Textron Motors authorized workshops are qualified to service your engine. <p>Observe that only the regular operating hours intervals will be indicated. The service light does not indicate the 1st service and the yearly service intervals. (See chapter 4.1 Service intervals.)</p>
Oil pressure light	<p>The oil pressure light illuminates after the engine is started until the required oil pressure is achieved.</p> <p>NOTICE! Serious engine damage due to insufficient lubrication. If the oil pressure light remains on after starting the engine, the required oil pressure is not built up.</p> <ul style="list-style-type: none"> ► Turn off the engine immediately. ► Immediately inspect the cause and repair possible faults by a qualified workshop. All Textron Motors authorized workshops are qualified to repair your engine.
Malfunction indicator light (MIL)	<p>The malfunction indicator light has a self-test function. When you turn on the ignition or start the engine, the malfunction indicator light illuminates for a few seconds. If the malfunction indicator light does not stop illuminating or illuminates during the operation, the engine diagnostics has detected an fault. If the malfunction indicator light is flashing, there is an emission-related fault.</p> <ul style="list-style-type: none"> ► Immediately inspect the cause and repair possible faults by a qualified workshop. All Textron Motors authorized workshops are qualified to repair your engine.

Light	Description
Temperature warning light	<p>If the temperature warning light is illuminating, the coolant temperature has almost been reached the critical temperature range. Further information can be found in chapter 3.7 Protective functions.</p> <p>Depending on equipment of the vehicle observe the chapter 4.3.1 Checking coolant level or the vehicle manufacturer's documentation.</p> <p>CAUTION! Scalding caused by hot steam. Open expansion tank only with a cold engine.</p> <ul style="list-style-type: none"> ▶ Check the coolant level. <p><i>NOTICE!</i> Engine damage caused by overheating. An empty expansion tank may be an indication of a leaking cooling system. Immediately inspect the cause and repair possible faults by a qualified workshop. All Textron Motors authorized workshops are qualified to repair your engine.</p> <ul style="list-style-type: none"> ▶ If the expansion tank is empty, turn off the engine immediately. ▶ If the coolant level is significantly below the MIN-marking, let the engine cool down and refill coolant. ▶ If the coolant level is right, adapt the way you operate. Check the coolant level again after the engine has cooled down. <p><i>NOTICE!</i> Engine damage caused by overheating. If the temperature warning light and the malfunction indicator light illuminate at the same time, the critical temperature range has been reached.</p> <ul style="list-style-type: none"> ▶ Let the engine cool down immediately. ▶ Immediately inspect the cause and repair possible faults by a qualified workshop. All Textron Motors authorized workshops are qualified to repair your engine.

4 Operation

4.1 Service intervals

4 Operation

Familiarize yourself with the vehicle before operating the engine. Read the vehicle manufacturer's documentation.

4.1 Service intervals

Regular service is essential to keep your engine in a safe operating condition. Perform all engine and vehicle related service tasks as described in this service manual and the vehicle manufacturer's documentation.

Following service tasks you can perform yourself. All activities are described in chapter 4 **Operation**.

Activity	Before every use
Checking coolant level	■
Checking oil level	■

The following service tasks require special technical knowledge of this engine. These service tasks must be performed in a qualified workshop. All Textron Motors authorized workshops are qualified to service your engine. All activities are described in chapter 8 **Service tasks in the workshop**.

Activity	1st service	Subsequent service intervals		Preparing for Storage ³
	after 12 h ¹	every 100 h or at least once a year	every 200 h or at least every 2 years	
Changing engine oil and oil filter	■	■		■
Checking and adjusting valve lash	■	■ ²		
Replacing spark plugs			■	
– Checking spark plugs – Fuel stabilizer – Engine internal preservation				■
Changing coolant	See the vehicle manufacturer's documentation.			
Replacing fuel filter	See the vehicle manufacturer's documentation.			

¹ h = Hours of operation

² These service intervals are only required after the specified hours of operation

³ If you do not operate the engine for more than 90 days

4.2 Operation during the break-in period

The way you operate the engine is a major factor in determining engine performance and useful life.

This affects the way you operate in the

- first 5 hours of operation.
- first 5 hours of operation after extensive repairs, where the engine was completely disassembled.
- first minutes until the engine is warm.

Observe the following guidance to achieve optimal break-in:

Avoid	<ul style="list-style-type: none">– engine speeds over 6000 min⁻¹ [rpm].– long periods of idle operation.– long periods of operation at low engine speeds.– long periods of operation at the same engine speed.– long periods of operation at full load.
Perform	<ul style="list-style-type: none">– vary engine speed.– momentary bursts of acceleration, when the engine is warm.

4 Operation

4.3 Operating engine

4.3 Operating engine

4.3.1 Checking coolant level

The following procedure is the practice with a Textron Motors expansion tank. However, the expansion tank is not always in scope of supply of the engine. If the vehicle equipment is different, observe strictly the vehicle manufacturer's documentation.

Check the coolant level with a cold engine.

- ▶ Check the coolant level in the expansion tank **1**.

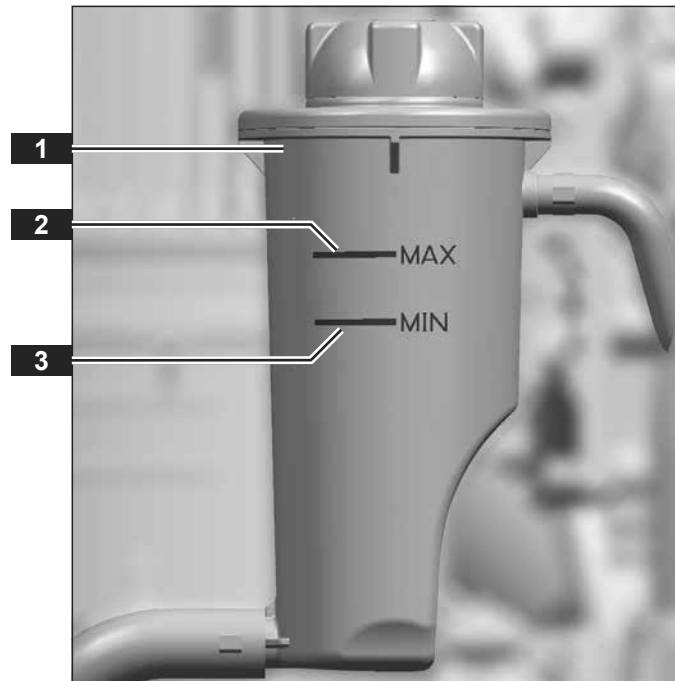
The coolant level must be between the MIN-marking **3** and the MAX-marking **2**.

NOTICE! Overheating damage caused by too low coolant level.

- ▶ If coolant level is below the MIN-marking, follow instructions in **Refilling coolant** section.

NOTICE! Overfilled coolant increases the cooling system pressure and may cause leaks in hoses.

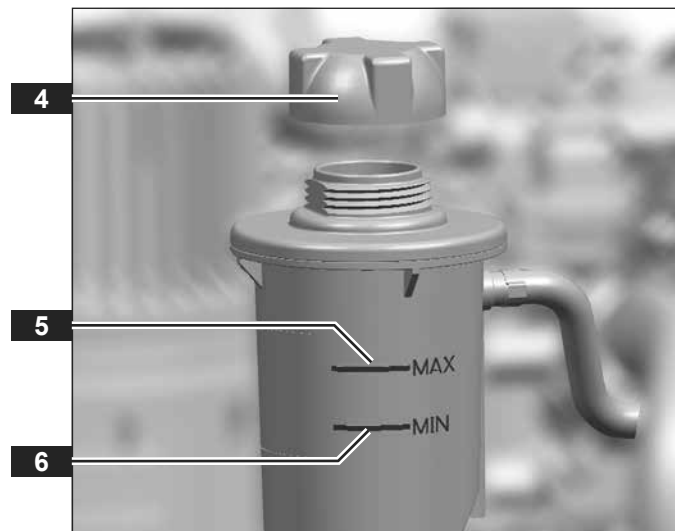
- ▶ If coolant level exceeds the MAX-marking, pump out excessive coolant using a suction pump.



Refilling coolant

CAUTION! Scalding caused by hot steam. Open expansion tank only with a cold engine.

- ▶ Unscrew the expansion tank cover **4**.
- ▶ Refill coolant, until the coolant level is between the MIN-marking **6** and the MAX-marking **5**.
- ▶ Close the expansion tank.
- ▶ Allow the engine to run at idle for 10 seconds.
- ▶ Check the coolant level.



4.3.2 Put the engine into operation

The following procedure is not a complete description of the commissioning, it describes only the engine-specific requirements. Observe strictly the vehicle manufacturer's documentation.

- ▶ Put the shift control lever in neutral position.
- ▶ Actuate the brake pedal.
- ▶ Turn on ignition and press the starter button.
- or
- ▶ Turn the ignition switch in the START position.
The engine will start.
- ▶ Warm up the engine. (See chapter 4.2 Operation during the break-in period.)
- ▶ Check the oil level. (See chapter 4.3.3 Checking oil level.)

4 Operation

4.3 Operating engine

4.3.3 Checking oil level

The following procedure is the practice with a Textron Motors oil tank. However, the oil tank is not always in scope of supply of the engine. If the vehicle equipment is different, observe strictly the vehicle manufacturer's documentation.

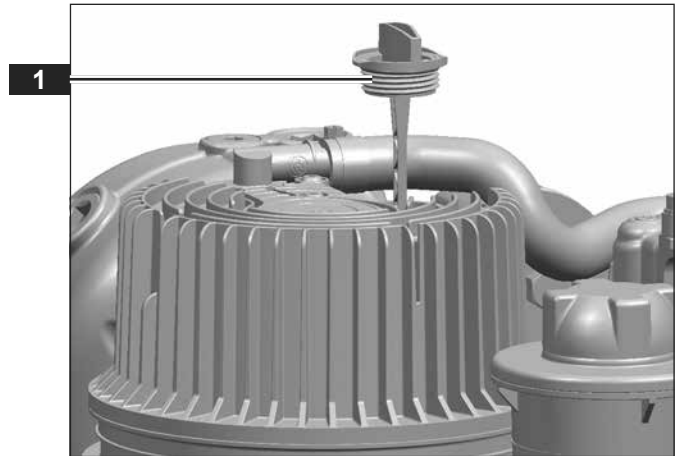
Information! Your engine features a dry sump lubrication system. Engine oil is pumped from the engine into the oil tank while the engine is operating. When the engine is switched off, some engine oil flows slowly from the oil tank back into the engine. Therefore inspect the oil level immediately after turning off the engine.

Check the oil level with a warm engine.

- ▶ Warm up the engine. (See chapter 4.2 Operation during the break-in period.)
- ▶ Turn off the engine.

CAUTION! Scalding caused by hot engine oil. Wear protective gloves.

- ▶ Unscrew the oil dipstick **1** from the oil tank.
- ▶ Wipe the oil dipstick and insert into the oil tank. Do not screw in.



- ▶ Remove the oil dipstick **2** and check oil level.

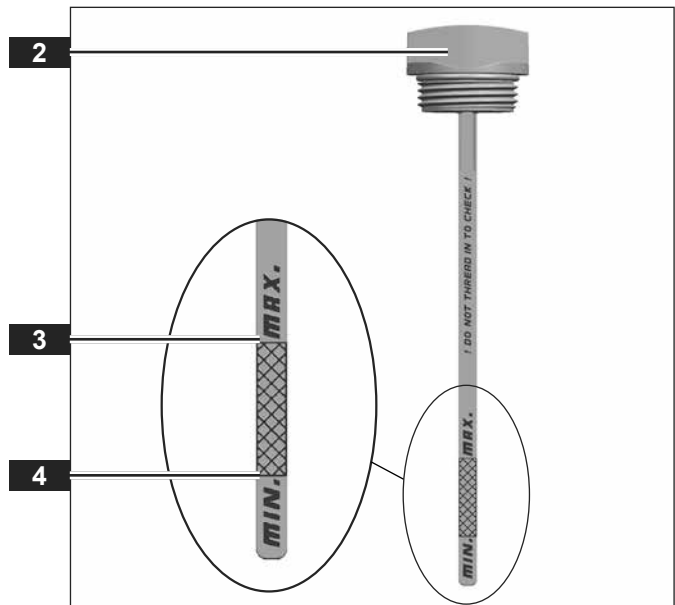
The oil level must be between the MIN-marking **4** and the MAX-marking **3**.

NOTICE! Engine damage caused by a lack of engine oil.

- ▶ If oil level is below the MIN-marking, follow instructions in **Refilling engine oil** section.

NOTICE! Engine damage caused by too much engine oil.

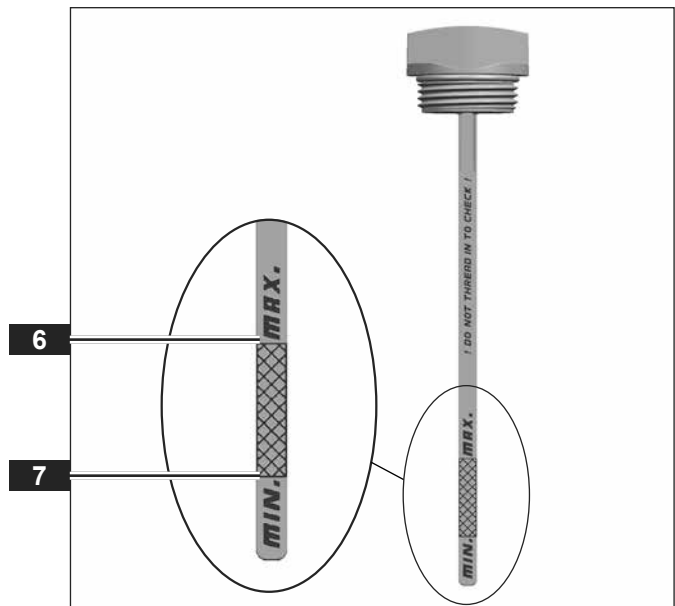
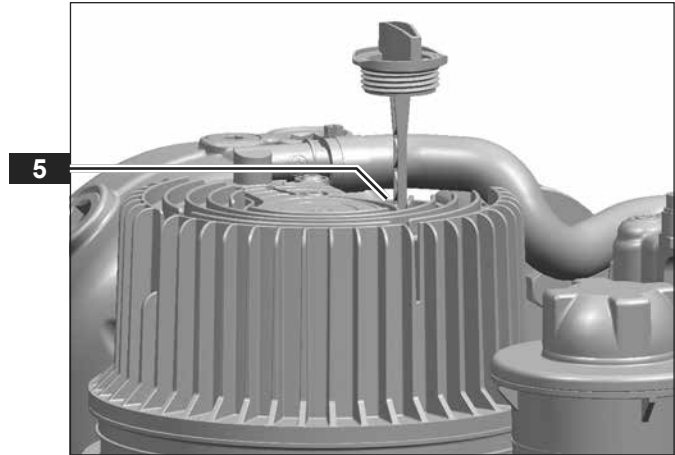
- ▶ If oil level exceeds the MAX-marking, pump out excessive engine oil using an oil suction pump.
- ▶ Screw in the oil dipstick.



Refilling engine oil

NOTICE! Engine damage caused by too much engine oil. Refill engine oil in small quantities with repeatedly checking. The difference between the MIN-marking **7** and the MAX-marking **6** is approximately 0,5 liter [0.5 qt (US)] engine oil.

- ▶ Fill engine oil through the opening **5** of the oil dipstick until the oil level is between the MIN-marking and the MAX-marking.
- ▶ Check the oil level.



4.3.4 Take the engine out of operation

The following procedure is not a complete description of the decommissioning, it describes only the engine-specific requirements. Observe strictly the vehicle manufacturer's documentation.

- ▶ Actuate the brake pedal.
- ▶ Put the shift control lever in park position.
- ▶ Turn off ignition.
or
- ▶ Turn the ignition switch in the OFF position.

4.3.5 Transport and storage of the vehicle

If you intend to transport or place the vehicle in storage, read the following instructions:

- ▶ If you do not intend to operate the engine for 90 days or more, prepare the engine for storage. (See chapter 5.1 Engine storage for more than 90 days.)
- ▶ Transport and store the vehicle on a preferably stable and flat surface.
- ▶ Store the vehicle in a clean, dry place with an ambient temperature of -30 – 45 °C [-22 – 113 °F].

5 Special scenarios

5.1 Engine storage for more than 90 days



5 Special scenarios

5.1 Engine storage for more than 90 days

Prepare the engine if you plan to store the engine for 90 days or more. Preparing the engine for storage will prevent the cylinder from corroding and ensure the engine starts again correctly at the end of the storage period.

Preparation for storage requires special technical knowledge of this engine. These tasks must be performed in a qualified workshop. All Textron Motors authorized workshops are qualified to prepare your engine for storage.

6 Malfunctions

6.1 Malfunctions table

Follow the remedy guidance or contact a qualified workshop if you cannot correct a malfunction yourself. All Textron Motors authorized workshops are qualified to repair your engine.

Observe the chapter 3.9.1 **Lights in vehicle**.

Malfunction	Possible cause	Remedy
The engine does not crank.	The ignition is turned off.	Turn on ignition.
	The shift control lever is not in neutral position.	Put the shift control lever in neutral position. (See chapter 4.3.2 Put the engine into operation.)
	When starting the engine, brake pedal is not operated.	Actuate the brake pedal. (See chapter 4.3.2 Put the engine into operation.)
	The power supply of vehicle is disconnected for safety reasons.	Depending on equipment of the vehicle there are several options. Read the vehicle manufacturer's documentation for more information.
	A fuse is defective.	Check the fuses located in the vehicle. (See the vehicle manufacturer's documentation.)
	The battery has been discharged or is defective.	Contact a qualified workshop. All Textron Motors authorized workshops are qualified to repair your engine.
	The roll over detection of the vehicle is active.	A protective function is activated. (See chapter 3.7 Protective functions.)

6 Malfunctions

6.1 Malfunctions table

Malfunction	Possible cause	Remedy
The engine cranks, but does not start.	A fuse is defective or the service fuse is unplugged.	Check the fuses. (See the vehicle manufacturer's documentation.)
	Lack of fuel.	Fill up fuel. (See the vehicle manufacturer's documentation.)
	The battery has been discharged or is defective.	Contact a qualified workshop. All Textron Motors authorized workshops are qualified to repair your engine.
The engine stalls, but can be started again.	Lack of fuel.	Fill up fuel. (See the vehicle manufacturer's documentation.)
The engine stalls and cannot be started again.	No fuel.	Fill up fuel. (See the vehicle manufacturer's documentation.)
The engine does not reach full engine speed.	The coolant temperature is increased.	A protective function is activated. (See chapter 3.7 Protective functions.)
	The temperature of the intake air is increased.	
	The throttle control pedal and the brake pedal are actuated at the same time.	
	The shift control lever is in neutral position.	
	The shift control lever is in reverse gear.	
	There is a malfunction.	
	Bad fuel quality.	Refuel a suitable fuel quality. (See chapter 3.3 Fuel.)

7 Dealer and servicing network

7.1 Locating a workshop

An extensive global dealer and servicing network is available. The dealer and servicing network provides assistance with any queries relating to the engine. Visit our web site www.weber-motor.com for a list of all authorized Textron Motors workshops.

7.2 Tools and parts

Textron Motors offers a selection of accessories to prepare you for the most important situations. Visit your local vehicle dealer or our web site www.weber-motor.com for more information.

7.3 Repairs

Repairs require special technical knowledge of this engine. All Textron Motors authorized workshops are qualified to repair your engine.

8 Service tasks in the workshop






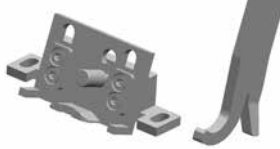

8.1 Safety messages workshop

Service tasks in the workshop	<p>All service tasks described in the following chapter require special technical knowledge of this engine.</p> <ul style="list-style-type: none">▶ Ensure your workshop is qualified to service your engine.▶ All Textron Motors authorized workshops are qualified to service your engine.
Service manual	<p>Before reading chapter 8 Service tasks in the workshop, you must have read and understood all other information in the service manual.</p> <ul style="list-style-type: none">▶ Read the entire service manual carefully before performing any service tasks.▶ Pay particular attention to the safety messages.
Engine power supply	<p>All service tasks require disconnection of the engine from the power supply. Starting the engine inadvertently may endanger the safety of persons.</p> <ul style="list-style-type: none">▶ Read the vehicle manufacturer's documentation for more information.▶ Disconnect the engine from the power supply before performing any servicing tasks.▶ Only reconnect the power supply to the engine once all service tasks are complete and all protective equipment is correctly fitted.
Protective equipment	<p>Missing protective equipment poses a safety risk to persons.</p> <ul style="list-style-type: none">▶ Attach all protective equipment after completing the service tasks.
Tools	<p>Unsuitable tools pose a safety risk to persons.</p> <ul style="list-style-type: none">▶ Use tools listed in chapter 8.2 Tools and accessories or equivalent tools.

8.2 Tools and accessories

8.2.1 Service parts

Textron Motors offers a service case that contains the following service parts. Visit your local vehicle dealer or our web site www.weber-motor.com for more information.

Figure	Description	Figure	Description
	Oil filter		Valve adjustment shims in different sizes
	Spark plug Champion RC7PYCBX		Serrated lock washer
	Feeler gauge 0,05 – 2 mm		Valve adjustment kit
	Sealing kit valve cover		

8.2.2 Diagnostic case

Textron Motors offers a diagnostic case that contains the Textron Motors Diagnostic Tool. The Textron Motors Diagnostic Tool is designed for fault diagnostics and service tasks for Textron engines using a Synerject engine management system. Visit your local vehicle dealer or our web site www.weber-motor.com for more information.



8.2.3 Equipment workshop

In addition to the service case, you will require the following tools and accessories for service tasks. The figures are only examples of suitable tools. All tools and accessories are available from specialist retailers.













Figure	Description
	Hexagon screwdriver 5
	Torque wrench 8 – 32 Nm [5 – 24 lbf ft] with extension and insert adapter
	Reversible ratchet with extension and insert adapter
	Hexagon screwdriver socket 5
	Caliper Measuring accuracy 0.05 mm
	Bar magnet

Figure	Description
	Spark plug wrench Wrench size 16 mm [5/8"] Diameter: maximum 22 mm [0.87 in]
	Spark plug brush
	Universal strap wrench
	Universal pliers
	Oil suction pump
	Drain tray

8.2.4 Supplies

You will require the following supplies or equivalents to perform service tasks. Unless otherwise specified, use the products as directed by the manufacturer.

Supplies	Recommended products
Anti-Seize assembly paste for lubricating threaded connections	<ul style="list-style-type: none">– Weicon Anti-Seize "High-Tech" ASW 040 P– Loctite 8150
Engine internal preservative	<ul style="list-style-type: none">– Liqui Moly, Germany
Fuel stabilizer	<ul style="list-style-type: none">– Liqui Moly, Germany
Sealing surface cleaner	<ul style="list-style-type: none">– Liqui Moly brake and parts cleaner AIII, Germany

8.3 Changing engine oil and oil filter

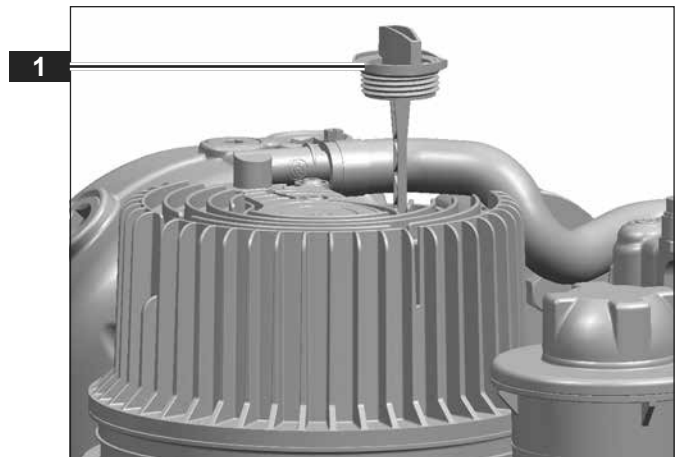
The following procedure is the practice with a Textron Motors oil tank. However, the oil tank is not always in scope of supply of the engine. If the vehicle equipment is different, observe strictly the vehicle manufacturer's documentation.

The engine oil will be pumped out in two stages.

- ▶ Warm up the engine. (See chapter 4.2 Operation during the break-in period.)
- ▶ Turn off the engine.

CAUTION! Scalding caused by hot engine oil. Wear protective gloves.

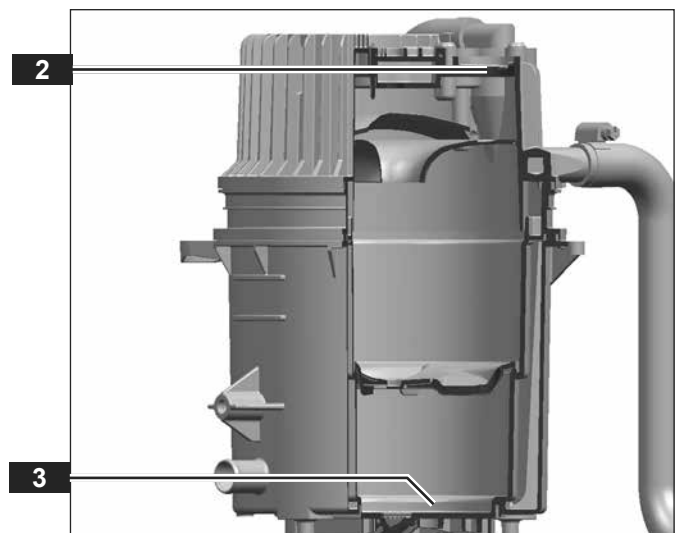
- ▶ Unscrew the oil dipstick **1** from the oil tank.



Draining engine oil

- ▶ Insert the suction hose of the oil suction pump through the opening of the oil dipstick **2** until the hose reaches the oil tank bottom **3** and pump out as much as possible engine oil from oil tank.

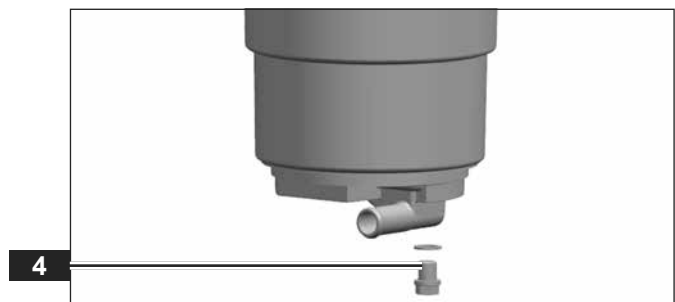
or



- ▶ Place the drain tray under and unscrew the oil drain plug **4** at oil tank.
- ▶ Replace the seal.
- ▶ Screw in the oil drain plug.

Tightening torque:

18 Nm +2 Nm [13.3 lbf ft +1.5 lbf ft]



The remaining engine oil will be pumped out with the suction pump in the dry sump.

- ▶ Disconnect the power supply of the ignition coils and injectors. (See the vehicle manufacturer's documentation.)

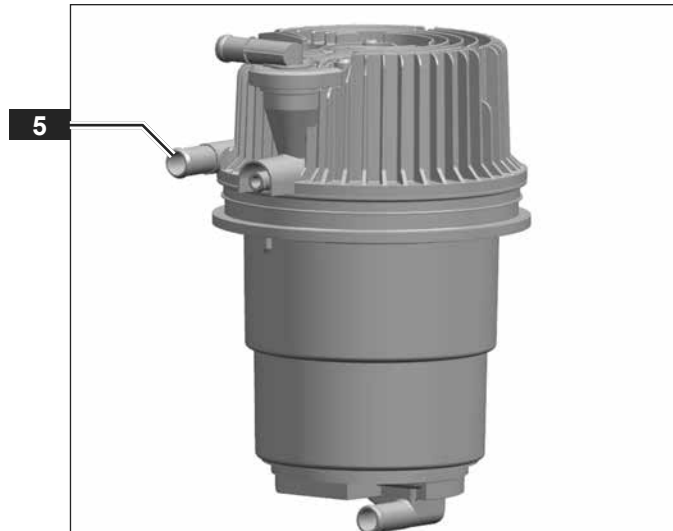
When the starter is operated, the engine cranks, but will not start.

- ▶ Disconnect the hose at the oil tank **5** and hold the hose over a drain tray.

- ▶ Actuate the starter.

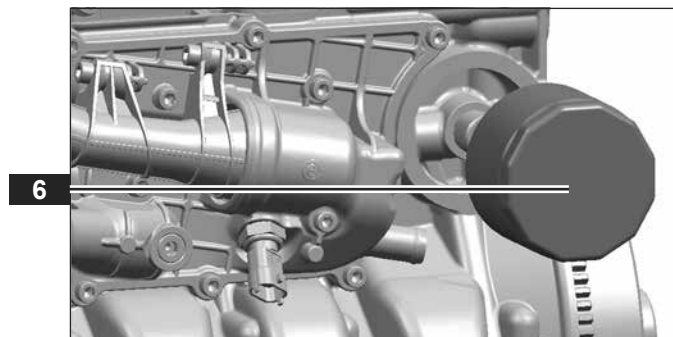
The engine cranks and the engine oil will be pumped out of the engine.

- ▶ When no more engine oil is being pumped out, install the hose.



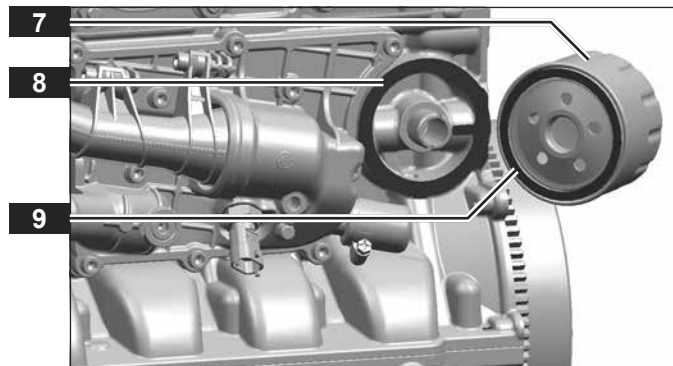
Replacing oil filter

- ▶ Unscrew the oil filter **6** using a universal strap wrench.



- ▶ Replace the oil filter **7**.
- ▶ Clean the sealing surface **8** with sealing surface cleaner.
- ▶ Coat the oil filter seal **9** lightly with engine oil.
- ▶ Screw in the oil filter by hand.

Tightening torque:
10 Nm [7.4 lbf ft]

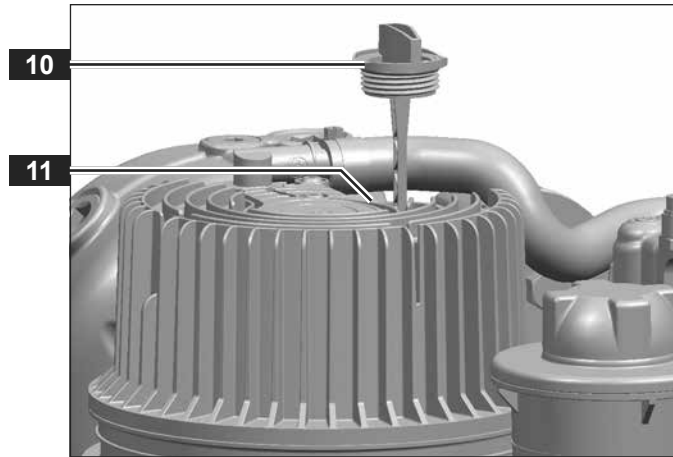


8 Service tasks in the workshop

8.3 Changing engine oil and oil filter

Filling engine oil

- ▶ Fill in the minimum quantity of new engine oil through the opening of the oil dipstick **11**. (See the vehicle manufacturer's documentation.)
- ▶ Screw in the oil dipstick **10**.
- ▶ Connect the power supply of the ignition coils and injectors.
- ▶ Check the oil level. (See chapter 4.3.3 Checking oil level.)
- ▶ Update the engine control unit calibration. (See the Textron Motors Diagnostic Tool manual.)
- ▶ Clear the service counter for service light. (See the Textron Motors Diagnostic Tool manual.)
- ▶ Clear the trouble codes. (See the Textron Motors Diagnostic Tool manual.)
- ▶ Test-drive the vehicle.

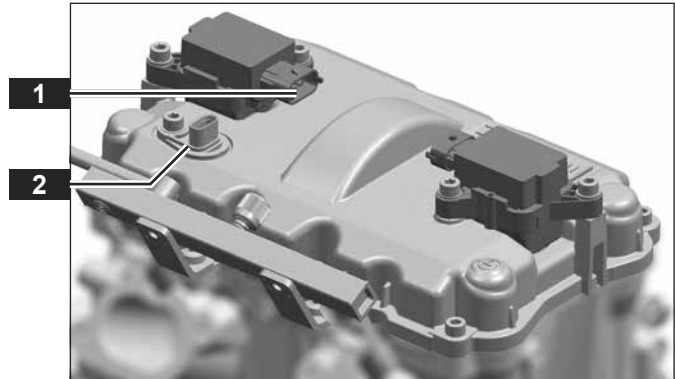


8.4 Checking and adjusting valve lash**8.4.1 Checking valve lash**

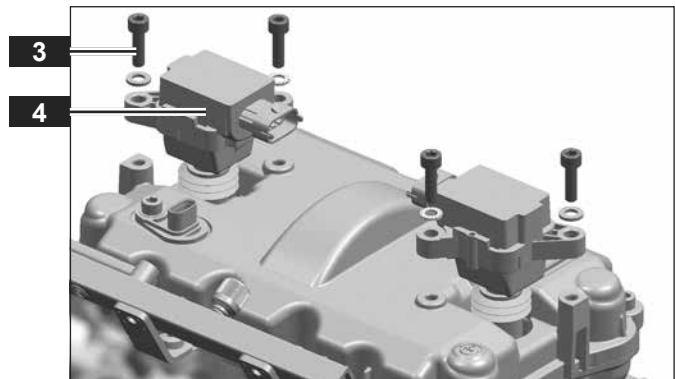
Check valve lash with a cold engine.

WARNING! Danger of serious cuts from the gear on the camshaft when the engine is started. Disconnect the engine from the power supply.

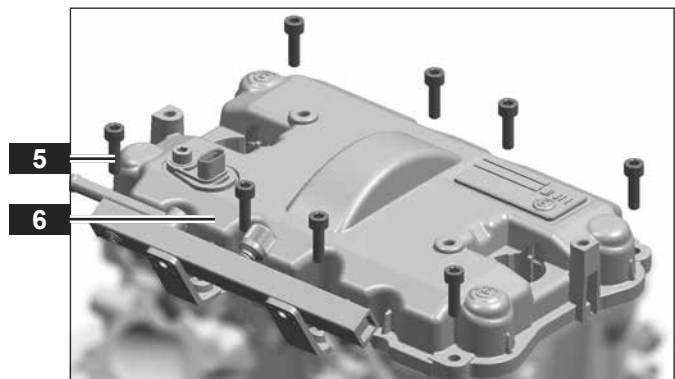
- ▶ Disconnect the wire harness connectors from the ignition coils **1** and sensor camshaft **2**.



- ▶ Unscrew the bolts **3**.
- ▶ Pull the ignition coils **4** out.



- ▶ Unscrew the bolts **5**.
- ▶ Remove the valve cover **6**.



Information! The camshaft is turned by turning the crankshaft. Read the vehicle manufacturer's documentation for instructions. Always turn the crankshaft in the same direction as the engine rotates. (See chapter 3.6 Engine components and information.) Two rotations of the crankshaft correspond to one rotation of the camshaft.

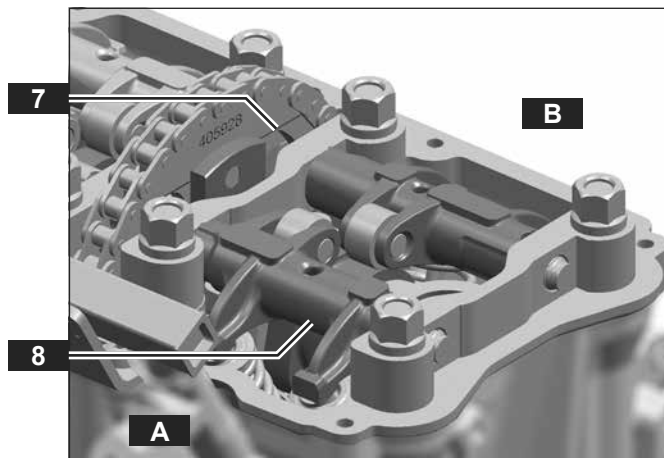
Checking valve lash on the 1st cylinder

- ▶ Turn the crankshaft in the same direction as the engine rotates until the position of the camshaft is as illustrated. (See the vehicle manufacturer's documentation.)

The camshaft is marked at the 1st cylinder end only.

The marking **7** ends flush with the cross bar.

All rocker arms **8** on the cylinder have a certain amount of play.



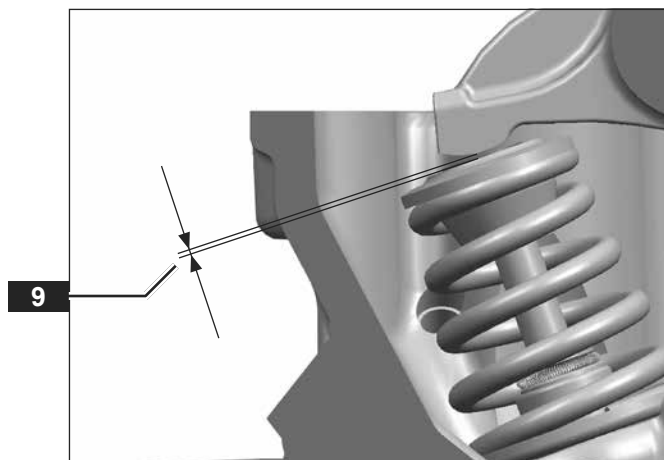
- ▶ Check the valve lash **9** of all valves on the cylinder using a feeler gauge.

Required valve lash:

A Intake side 0,1 – 0,2 mm

B Exhaust side 0,2 – 0,3 mm

- ▶ If the valve lash of one or more valves is not right, continue with chapter 8.4.2 **Adjusting valve lash**.



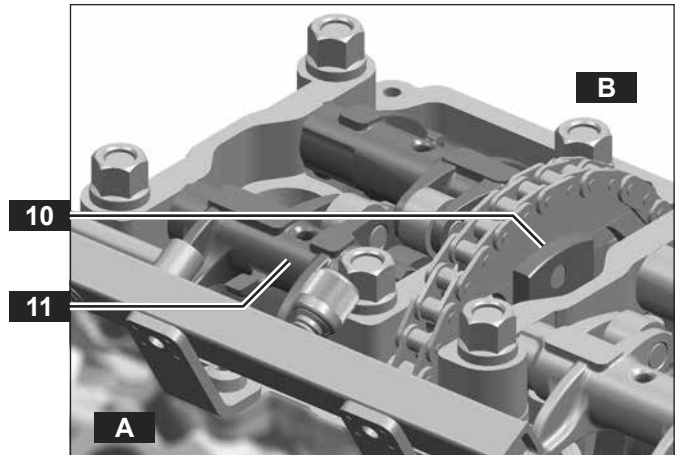
Checking valve lash on the 2nd cylinder

- ▶ Turn the crankshaft in the same direction as the engine rotates until the position of the camshaft is as illustrated. (See the vehicle manufacturer's documentation.)

The camshaft is marked at the 1st cylinder end only.

The inscription **10** is not visible.

All rocker arms **11** on the cylinder have a certain amount of play.



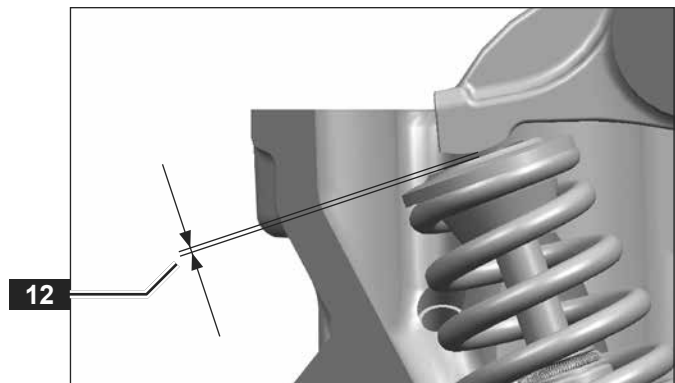
- ▶ Check the valve lash **12** of all valves on the cylinder using a feeler gauge.

Required valve lash:

A Intake side 0,1 – 0,2 mm

B Exhaust side 0,2 – 0,3 mm

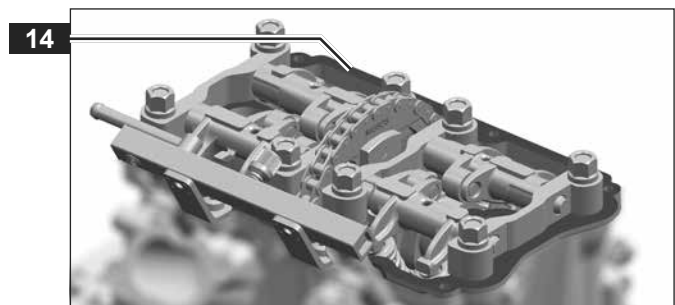
- ▶ If the valve lash of one or more valves is not right, continue with chapter 8.4.2 **Adjusting valve lash**.



- ▶ Replace the valve cover seals **13**.



- ▶ Clean the sealing surface **14** with sealing surface cleaner.



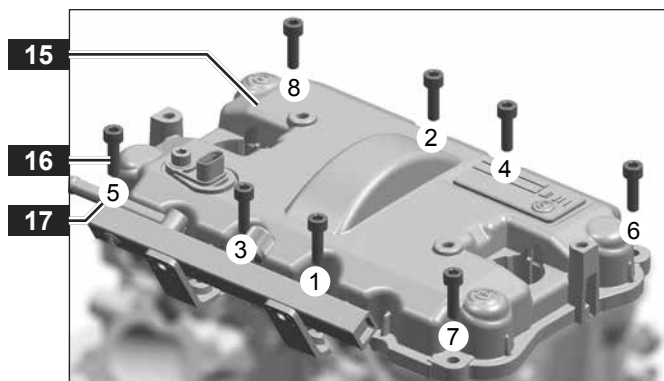
8 Service tasks in the workshop

8.4 Checking and adjusting valve lash

- ▶ Put the valve cover **15** on.
- ▶ Apply Anti-Seize assembly paste to all bolts **16**.
- ▶ Screw in the bolts in the sequence as illustrated **17**.

Tightening torque:

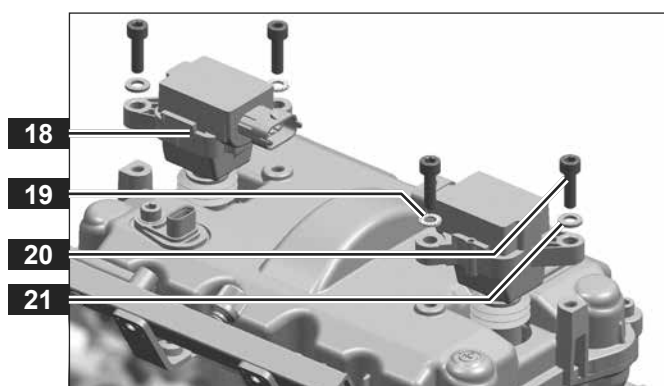
8 Nm +2 Nm [5.9 lbf ft +1.5 lbf ft]



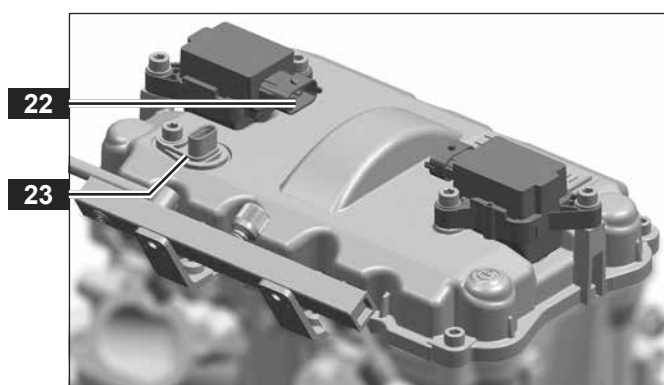
- ▶ Insert the ignition coils **18**.
- ▶ Replace the serrated lock washers **19**. Assemble the bolts **20**, washers **21** and serrated lock washers as illustrated.

Tightening torque:

8 Nm +2 Nm [5.9 lbf ft +1.5 lbf ft]



- ▶ Connect the wire harness connectors to the ignition coils **22** and sensor camshaft **23**.
- ▶ Update the engine control unit calibration. (See the Textron Motors Diagnostic Tool manual.)
- ▶ Clear the service counter to reset service light. (See the Textron Motors Diagnostic Tool manual.)
- ▶ Clear the trouble codes. (See the Textron Motors Diagnostic Tool manual.)
- ▶ Test-drive the vehicle.



8.4.2 Adjusting valve lash with valve adjustment kit

Information! The camshaft is turned by turning the crankshaft. Read the vehicle manufacturer's documentation for instructions. Always turn the crankshaft in the same direction as the engine rotates. (See chapter 3.6 Engine components and information.) Two rotations of the crankshaft correspond to one rotation of the camshaft.

Adjusting the valve lash on the 1st cylinder

WARNING! Danger of serious cuts from the gear on the camshaft when the engine is started. Disconnect the engine from the power supply.

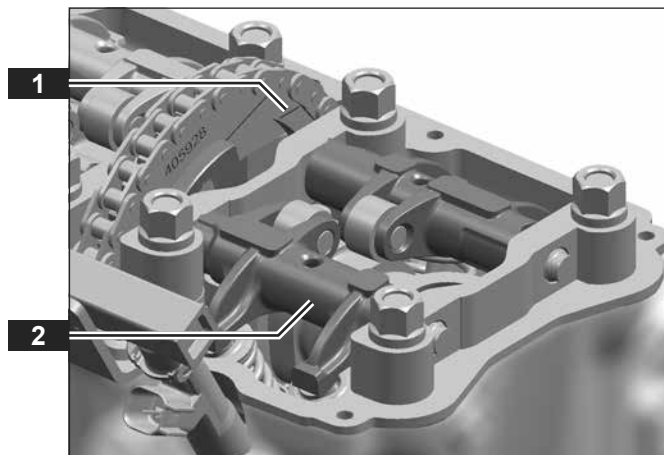
- ▶ Turn the crankshaft in the same direction as the engine rotates until the position of the camshaft is as illustrated. (See the vehicle manufacturer's documentation.)

The camshaft is marked at the 1st cylinder end only.

The marking **1** ends flush with the cross bar.

All rocker arms **2** on the cylinder have a certain amount of play.

- ▶ Continue with the section **Replacing valve adjustment shim**.

**Adjusting the valve lash on the 2nd cylinder**

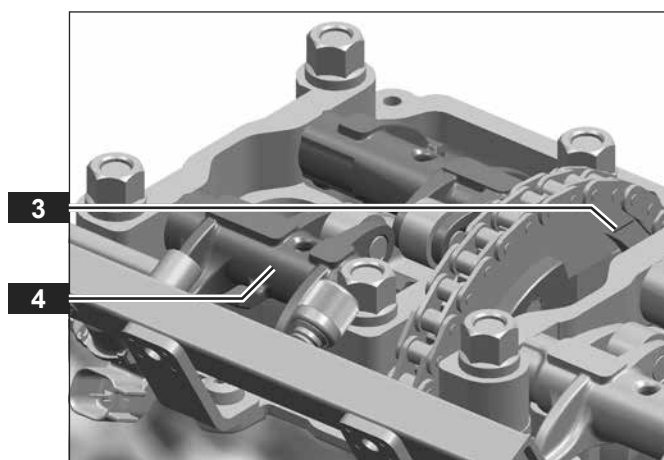
- ▶ Turn the crankshaft in the same direction as the engine rotates until the position of the camshaft is as illustrated. (See the vehicle manufacturer's documentation.)

The camshaft is marked at the 1st cylinder end only.

The marking **3** ends flush with the cross bar. Otherwise, no inscription is visible.

All rocker arms **4** on the cylinder have a certain amount of play.

- ▶ Continue with the section **Replacing valve adjustment shim**.



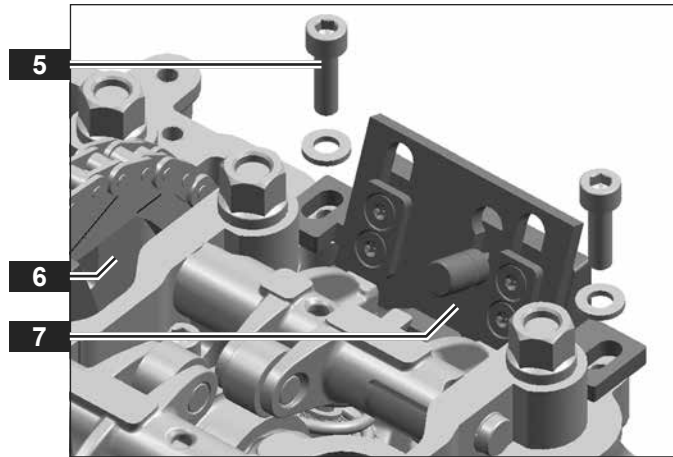
Replacing valve adjustment shim

NOTICE! Engine damage from small components in the engine or cylinder head. Operating the engine when there are small components in the crankcase and cylinder head can result in serious damage and cause the crank drive to seize.

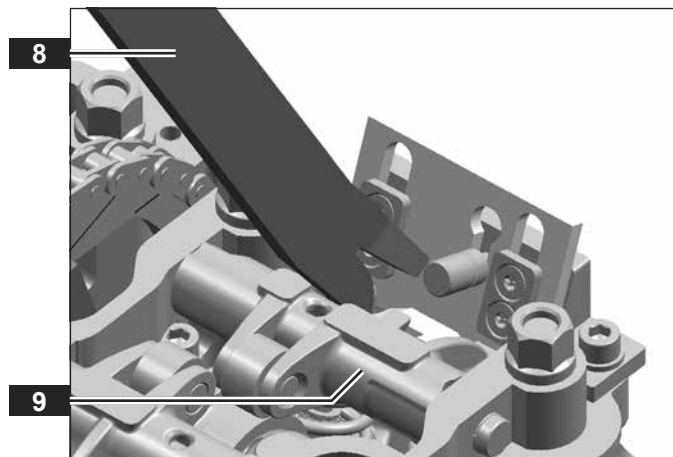
- ▶ Cover the chain channel **6**.
- ▶ Hold the valve adjustment tool **7** in position.
- ▶ Screw in the bolts **5**.

Tightening torque:

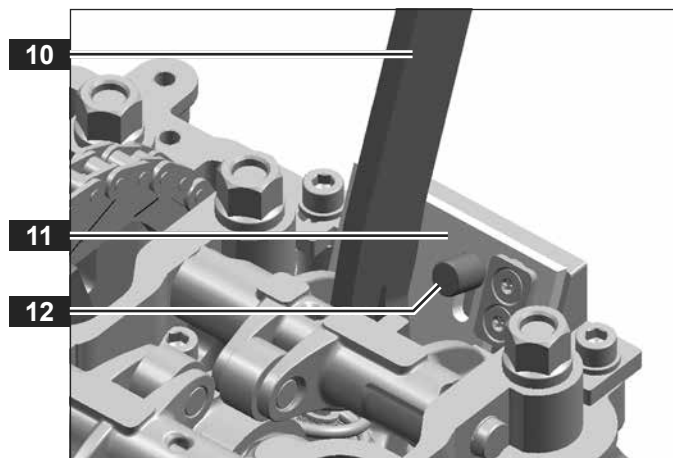
8 Nm +2 Nm [5.9 lbf ft +1.5 lbf ft]



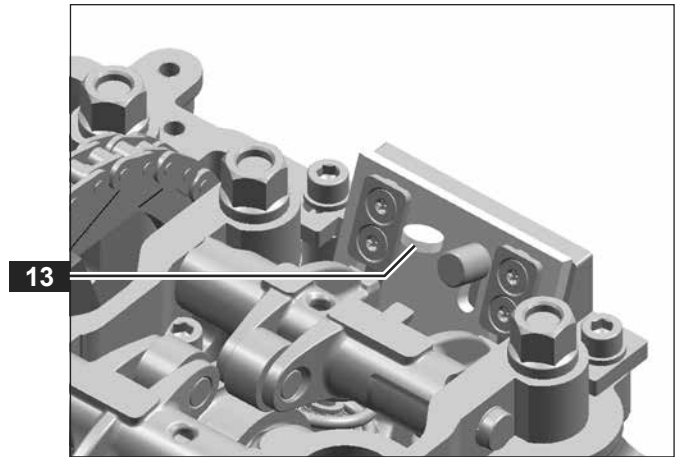
- ▶ Position the rocker arm pusher **8** on the rocker arm **9**.



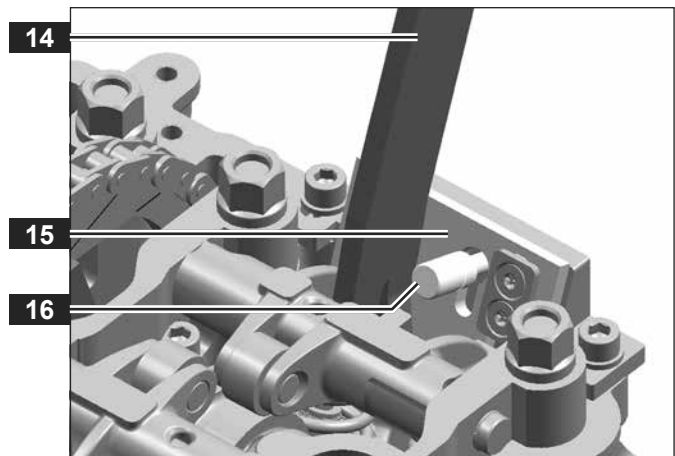
- ▶ Press down on the slide plate **11** using the rocker arm pusher **10** until the pin **12** engages.



- ▶ Remove the valve adjustment shim **13** using a bar magnet.
- ▶ Measure the valve adjustment shim using a caliper.
- ▶ Insert the new valve adjustment shim.



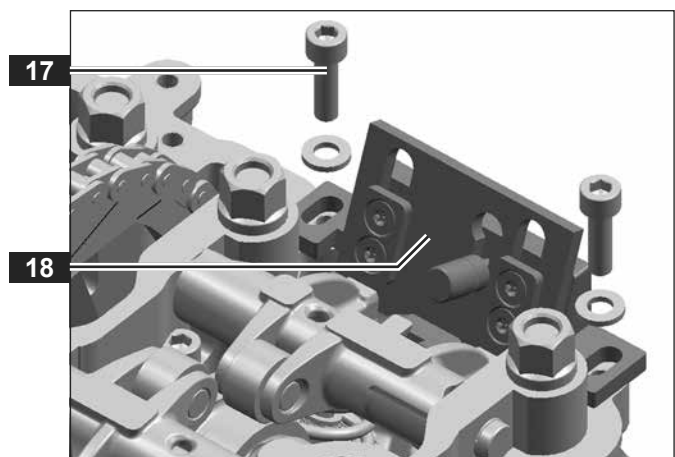
- ▶ Hold the rocker arm pusher **14** in position.
 - ▶ Press down on the slide plate **15** slightly using the rocker arm pusher.
 - ▶ Slide the pin **16** forward by hand.
 - ▶ Slowly release the rocker arm pusher.
- The valve spring slides the slide plate upwards again.



- ▶ Unscrew the bolts **17**.
- ▶ Remove the valve adjustment tool **18**.
- ▶ Remove the cover from the chain channel.

NOTICE! Valve breakage due to insufficient valve lash.

- ▶ Check the valve lash.
- ▶ Continue with chapter 8.4.1 **Checking valve lash**.



8.4.3 Adjusting valve lash without special tool

Information! The camshaft is turned by turning the crankshaft. Read the vehicle manufacturer's documentation for instructions. Always turn the crankshaft in the same direction as the engine rotates. (See chapter 3.6 Engine components and information.) Two rotations of the crankshaft correspond to one rotation of the camshaft.

Adjusting the valve lash on the 1st cylinder

WARNING! Danger of serious cuts from the gear on the camshaft when the engine is started. Disconnect the engine from the power supply.

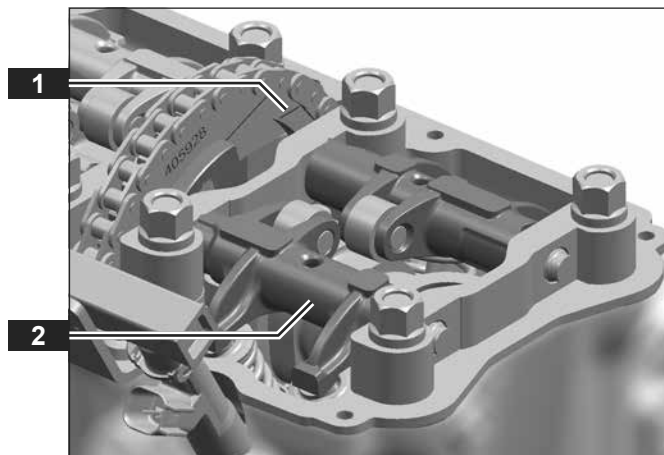
- ▶ Turn the crankshaft in the same direction as the engine rotates until the position of the camshaft is as illustrated. (See the vehicle manufacturer's documentation.)

The camshaft is marked at the 1st cylinder end only.

The marking **1** ends flush with the cross bar.

All rocker arms **2** on the cylinder have a certain amount of play.

- ▶ Continue with the section **Replacing valve adjustment shim**.



Adjusting the valve lash on the 2nd cylinder

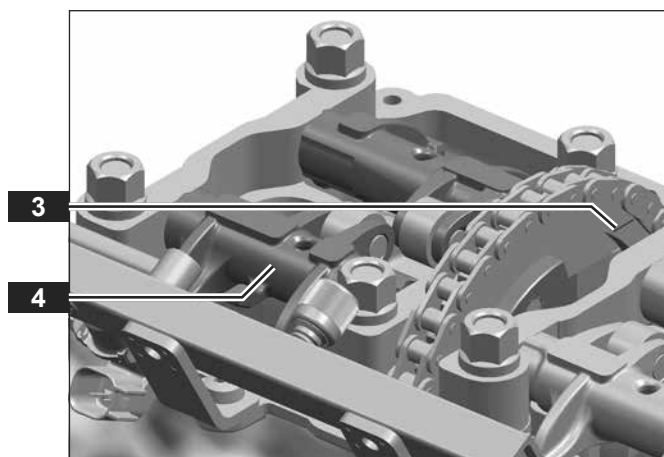
- ▶ Turn the crankshaft in the same direction as the engine rotates until the position of the camshaft is as illustrated. (See the vehicle manufacturer's documentation.)

The camshaft is marked at the 1st cylinder end only.

The marking **3** ends flush with the cross bar. Otherwise, no inscription is visible.

All rocker arms **4** on the cylinder have a certain amount of play.

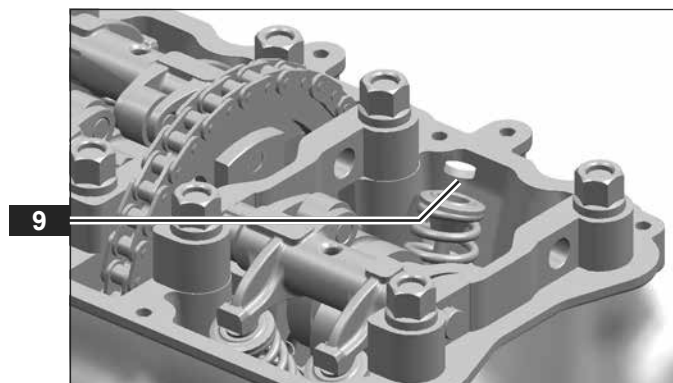
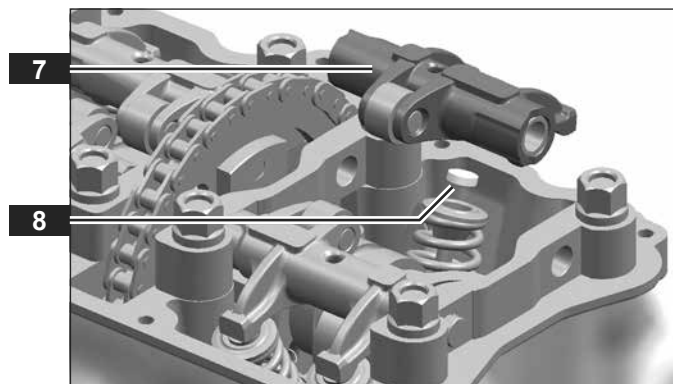
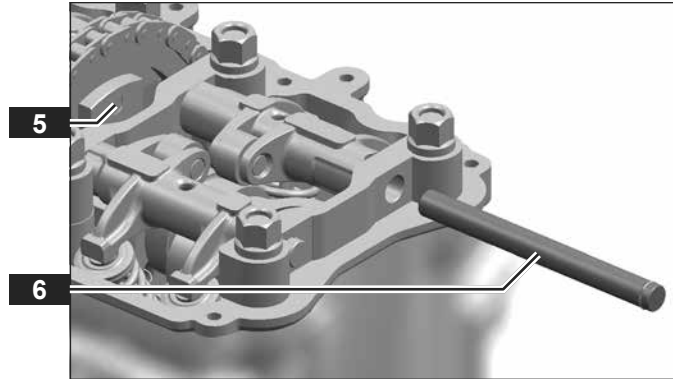
- ▶ Continue with the section **Replacing valve adjustment shim**.



Replacing valve adjustment shim

NOTICE! Engine damage from small components in the engine or cylinder head. Operating the engine when there are small components in the crankcase and cylinder head can result in serious damage and cause the crank drive to seize.

- ▶ Cover the chain channel **5**.
- ▶ Remove the rocker axle **6** using a universal pliers.
- ▶ Remove the rocker arm **7**.
- ▶ Remove the valve adjustment shim **8** using a bar magnet.
- ▶ Measure the valve adjustment shim using a caliper.
- ▶ Insert the new valve adjustment shim **9**.



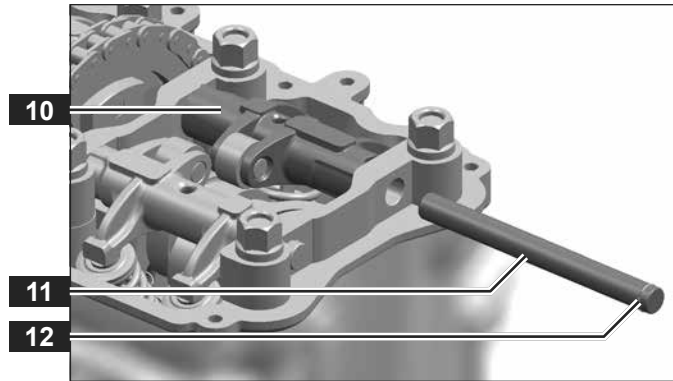
8 Service tasks in the workshop

8.4 Checking and adjusting valve lash

- ▶ Hold the rocker arm **10** in position.
- ▶ Check if the circlip **12** is installed.
- ▶ Slide in the rocker axle **11**.
- ▶ Remove the cover from the chain channel.

NOTICE! Valve breakage due to insufficient valve lash.

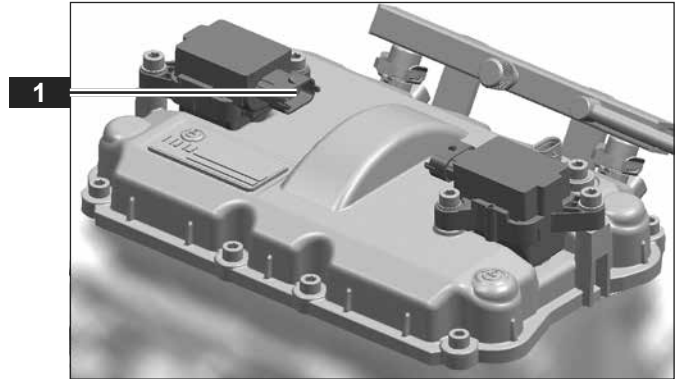
- ▶ Check the valve lash.
- ▶ Continue with chapter 8.4.1 **Checking valve lash**.



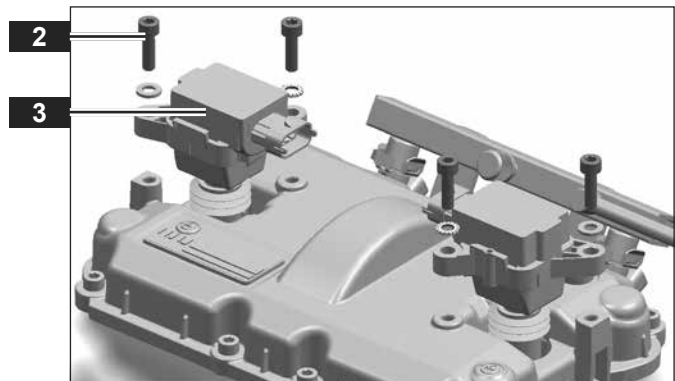
8.5 Replacing spark plugs

Remove spark plugs with a cold engine.

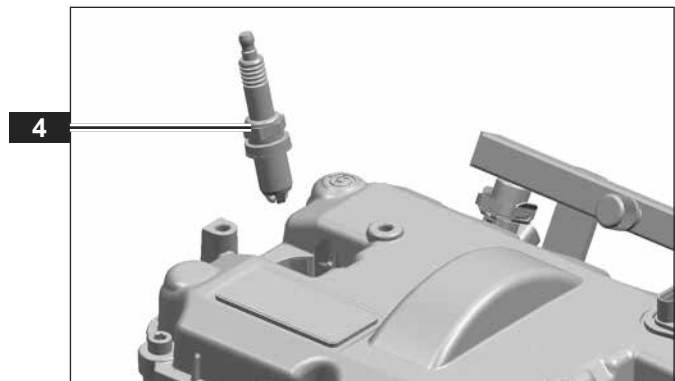
- ▶ Disconnect the wire harness connectors from the ignition coils **1**.



- ▶ Unscrew bolts **2**.
- ▶ Unplug ignition coils **3**.



- ▶ Unscrew the spark plugs **4** using a spark plug wrench.
- ▶ Replace the spark plugs.
- ▶ Screw in the spark plugs using a spark plug wrench.



Tightening torque:

22 Nm +10 Nm [16.2 lbf ft +7.4 lbf ft]

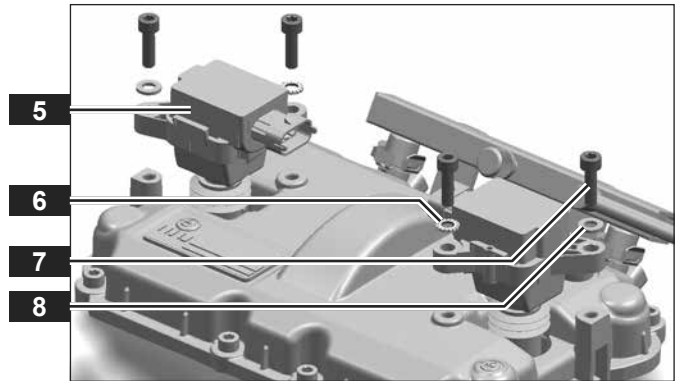
8 Service tasks in the workshop

8.5 Replacing spark plugs

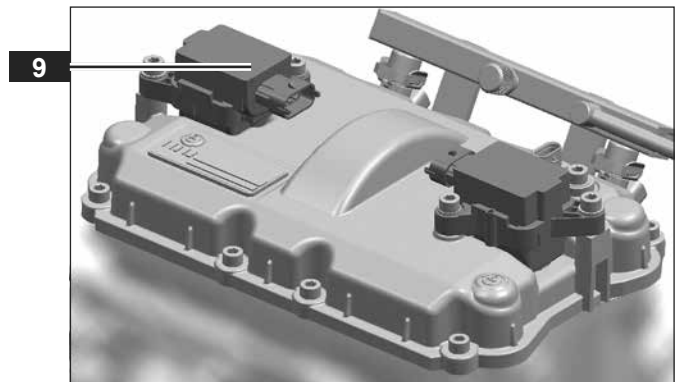
- ▶ Insert the ignition coils **5**.
- ▶ Replace serrated lock washers **6**.
Assemble the bolts **7**, washers **8** and serrated lock washers as illustrated.

Tightening torque:

8 Nm +2 Nm [5.9 lbf ft +1.5 lbf ft]



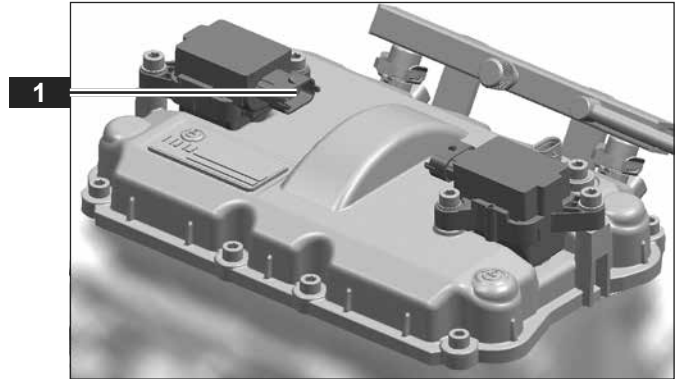
- ▶ Connect the wire harness connectors to the ignition coils **9**.
- ▶ Test-drive the vehicle.



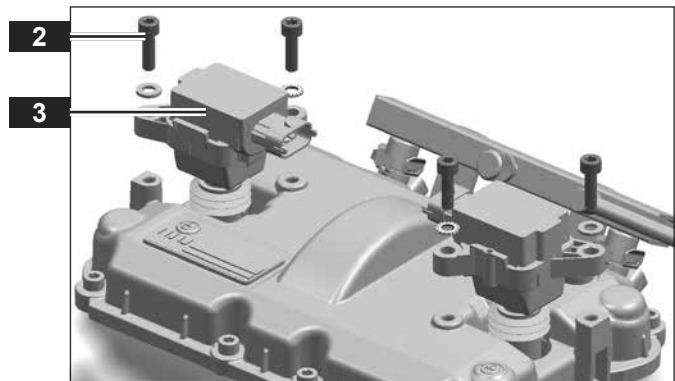
8.6 Checking spark plugs

Remove spark plugs with a cold engine.

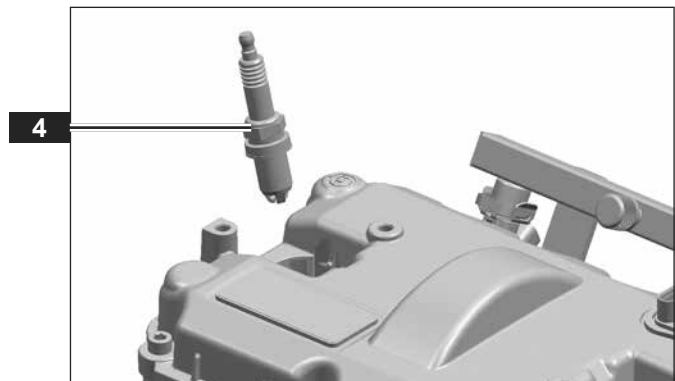
- ▶ Disconnect the wire harness connectors from the ignition coils **1**.



- ▶ Unscrew bolts **2**.
- ▶ Unplug ignition coils **3**.



- ▶ Unscrew the spark plugs **4** using a spark plug wrench.

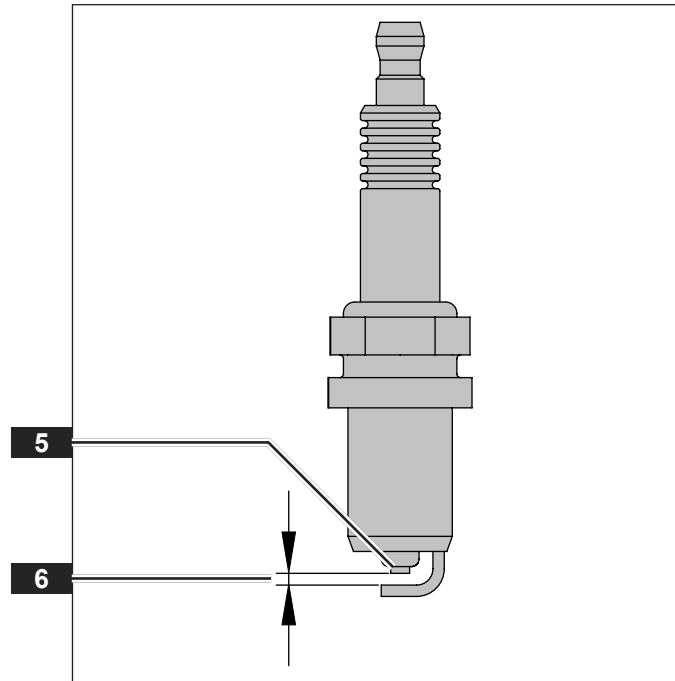


- ▶ If the electrodes **5** are extremely sooty, clean carefully using a spark plug brush.
- ▶ Check the spark plug gap **6** using a feeler gauge.

Required spark plug gap:

0,69 – 0,84 mm [0.028 – 0.032 in]

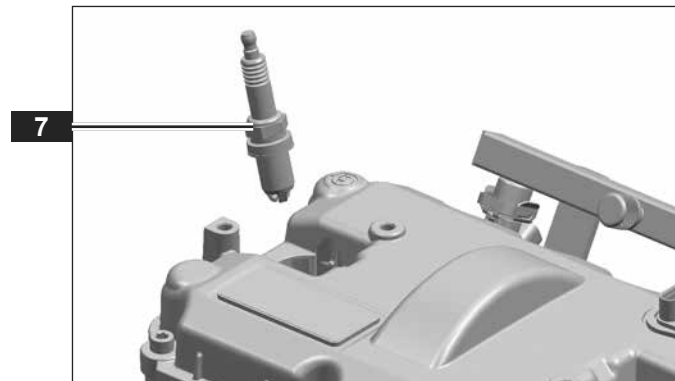
- ▶ If the spark plug gap is not satisfactory, replace the spark plug. Always replace spark plugs in pairs.



- ▶ Screw in the spark plugs **7** using a spark plug wrench.

Tightening torque:

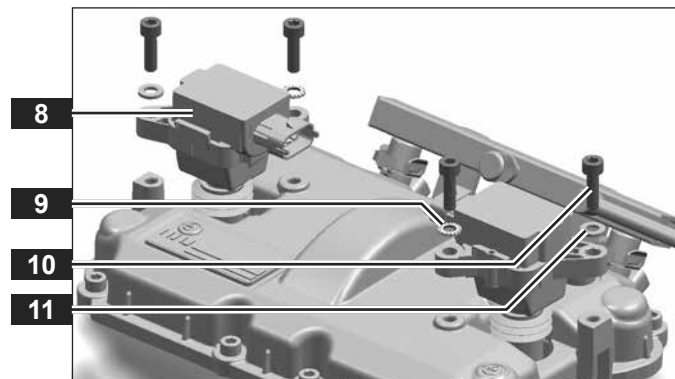
22 Nm +10 Nm [16.2 lbf ft +7.4 lbf ft]



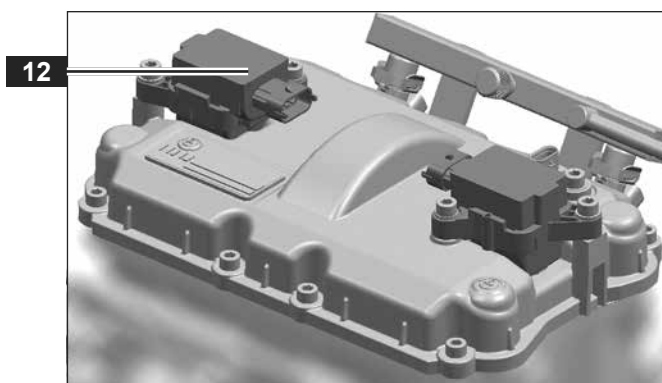
- ▶ Insert the ignition coils **8**.
- ▶ Replace serrated lock washers **9**. Assemble the bolts **10**, washers **11** and serrated lock washers as illustrated.

Tightening torque:

8 Nm +2 Nm [5.9 lbf ft +1.5 lbf ft]



- ▶ Connect the wire harness connectors to the ignition coils **12**.
- ▶ Test-drive the vehicle.



8.7 Changing coolant

The following procedure is the practice with a Textron Motors expansion tank. However, the expansion tank is not always in scope of supply of the engine. If the vehicle equipment is different, observe strictly the vehicle manufacturer's documentation.

Drain the coolant with a cold engine.

- ▶ Unscrew the expansion tank cover **1**.

The vehicle manufacturer has provided a drain device. (See the vehicle manufacturer's documentation.)

- ▶ Place the drain tray under.
- ▶ Open the drain device.

Coolant drains off.



- ▶ Fill the expansion tank **2** with clean fresh water.

Water drains off of the drain device.

- ▶ Repeat the procedure until only clear water drains off.
- ▶ When no more water drains off, close the drain device.



- ▶ Fill coolant to the expansion tank until the MAX-marking **3**.
- ▶ Close the expansion tank.
- ▶ Warm up the engine. (See chapter 4.2 Operation during the break-in period.)
- ▶ Turn off the engine.
- ▶ Check the coolant level.

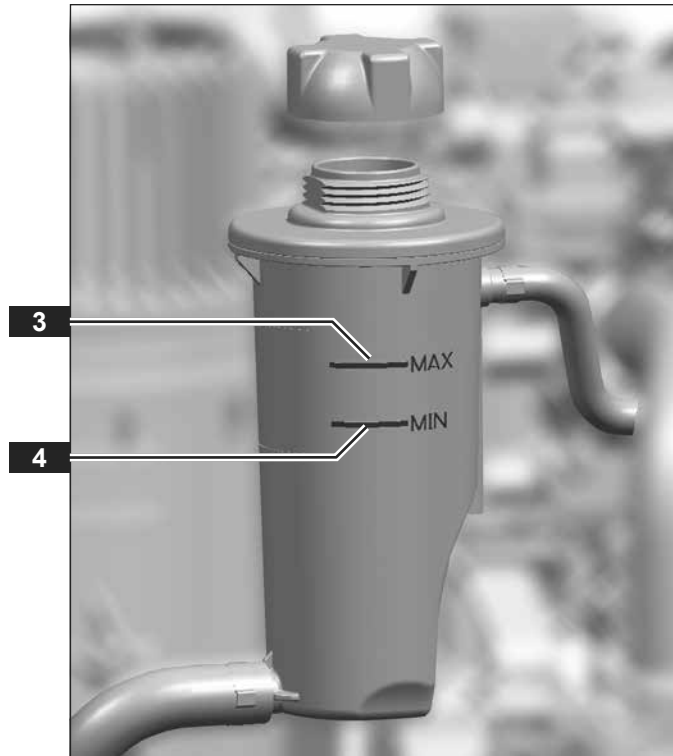
CAUTION! Scalding caused by hot steam. Open expansion tank only with a cold engine.

NOTICE! Damage from overheating caused by a lack of coolant.

- ▶ When coolant level is below the MIN-marking **4**, wait until the engine has cooled down.
- ▶ Refill coolant, until the coolant level is between the MIN-marking and the MAX-marking.

NOTICE! Leaks in the hoses due to increased pressure.

- ▶ When the MAX-marking is exceeded, pump out excessive coolant with a suction pump.
- ▶ Update the engine control unit calibration. (See the Textron Motors Diagnostic Tool manual.)
- ▶ Clear the service counter for service light. (See the Textron Motors Diagnostic Tool manual.)
- ▶ Clear the trouble codes. (See the Textron Motors Diagnostic Tool manual.)
- ▶ Test-drive the vehicle.



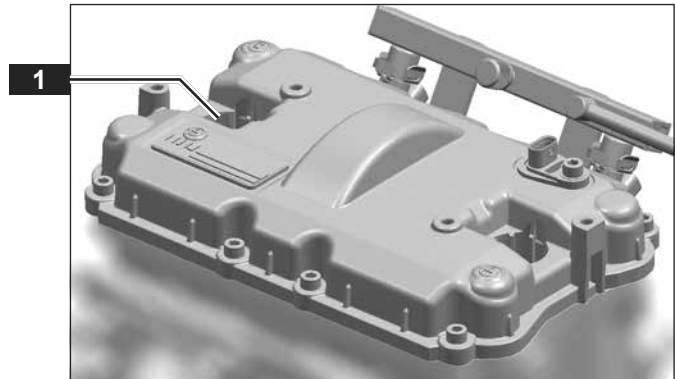
8.8 Replacing fuel filter

See the vehicle manufacturer's documentation.

8.9 Preparing the engine for storage

- ▶ Change engine oil and oil filter (See chapter 8.3 Changing engine oil and oil filter.)
- ▶ Fill up the fuel tank. Add a fuel stabilizer according to the manufacturer's instructions.
- ▶ Check spark plugs. (See chapter 8.6 Checking spark plugs.)
- ▶ Spray engine internal preservative into the cylinder through the spark plug bores **1** according to the manufacturer's instructions.

Do not start the engine again.



8.10 Disposal

When disposing of engine fluids, replaced parts or the whole engine, always comply with the relevant applicable national laws and guidelines.

9 Confirmation of service tasks

Have the workshop personnel provide certification confirming that your engine was serviced. You can use the following documents.

Engine model (6-digit) _____

Date of initial registration _____

Serial number (10-digit) _____

Date:	Work carried out:
	<input type="checkbox"/> Engine oil and oil filter changed <input type="checkbox"/> Valve lash checked <input type="checkbox"/> Spark plugs replaced <input type="checkbox"/> Coolant changed <input type="checkbox"/> Fuel filter replaced
Status	
hours of operation:

Company seal, signature

Date:	Work carried out:
	<input type="checkbox"/> Engine oil and oil filter changed <input type="checkbox"/> Valve lash checked <input type="checkbox"/> Spark plugs replaced <input type="checkbox"/> Coolant changed <input type="checkbox"/> Fuel filter replaced
Status	
hours of operation:

Company seal, signature

Date:	Work carried out:
	<input type="checkbox"/> Engine oil and oil filter changed <input type="checkbox"/> Valve lash checked <input type="checkbox"/> Spark plugs replaced <input type="checkbox"/> Coolant changed <input type="checkbox"/> Fuel filter replaced
Status	
hours of operation:

Company seal, signature

Date:	Work carried out:
	<input type="checkbox"/> Engine oil and oil filter changed <input type="checkbox"/> Valve lash checked <input type="checkbox"/> Spark plugs replaced <input type="checkbox"/> Coolant changed <input type="checkbox"/> Fuel filter replaced
Status	
hours of operation:

Company seal, signature

Date:	Work carried out:
	<input type="checkbox"/> Engine oil and oil filter changed <input type="checkbox"/> Valve lash checked <input type="checkbox"/> Spark plugs replaced <input type="checkbox"/> Coolant changed <input type="checkbox"/> Fuel filter replaced
Status	
hours of operation:

Company seal, signature

Date:	Work carried out:
	<input type="checkbox"/> Engine oil and oil filter changed <input type="checkbox"/> Valve lash checked <input type="checkbox"/> Spark plugs replaced <input type="checkbox"/> Coolant changed <input type="checkbox"/> Fuel filter replaced
Status	
hours of operation:

Company seal, signature

Date:	Work carried out:
	<input type="checkbox"/> Engine oil and oil filter changed <input type="checkbox"/> Valve lash checked <input type="checkbox"/> Spark plugs replaced <input type="checkbox"/> Coolant changed <input type="checkbox"/> Fuel filter replaced
Status	
hours of operation:

Company seal, signature

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hours of operation:

Company seal, signature

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Status	
hours of operation:

Company seal, signature

Date:	Work carried out:
	<input type="checkbox"/> Engine oil and oil filter changed <input type="checkbox"/> Valve lash checked <input type="checkbox"/> Spark plugs replaced <input type="checkbox"/> Coolant changed <input type="checkbox"/> Fuel filter replaced
Status	
hours of operation:

Company seal, signature

Appendix

Engine manufacturer

Engine manufacturer	Textron Motors GmbH Kautexstraße 52 53229 Bonn Germany www.weber-motor.com
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