



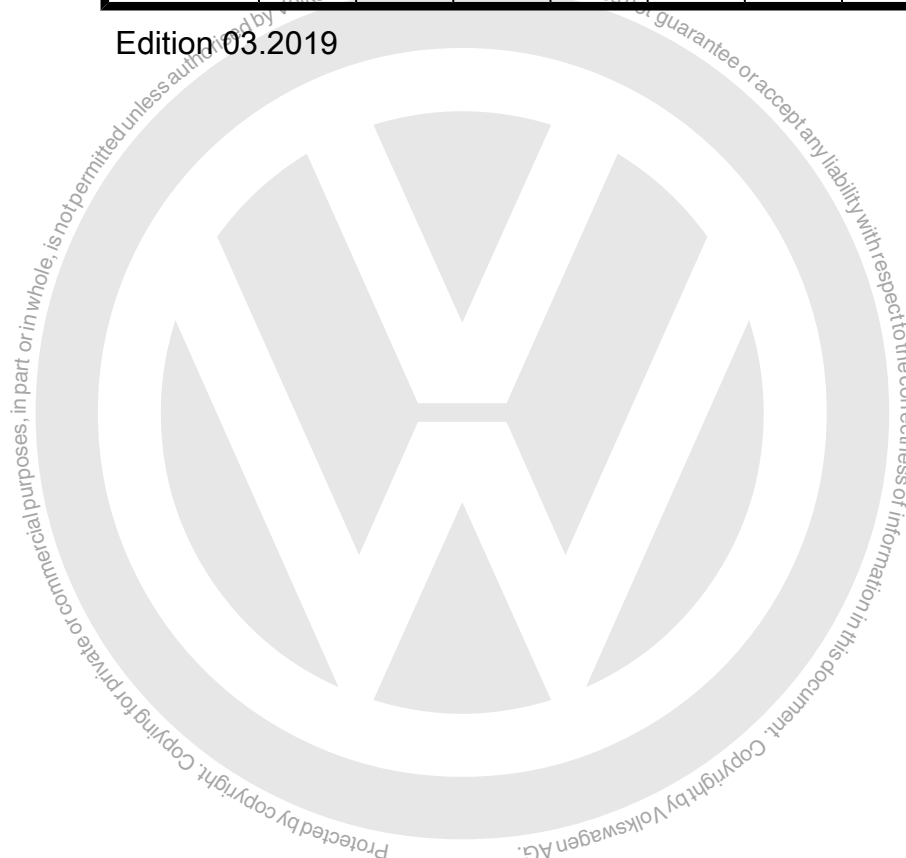
## Workshop Manual

Golf 2013 ➤ , Golf 2017 ➤ ,  
Golf Variant 1998 ➤ ,  
Golf Variant 2014 ➤ ,  
Golf Variant 2017 ➤ , Passat 2006 ➤ ,  
Passat 2011 ➤ , Passat Variant 2006 ➤ ,  
Passat Variant 2011 ➤ , Polo 2018 ➤ ,  
Touran 2003 ➤ , up! 2012 ➤ , up! 2017 ➤

### Gas drive - General information

Engine ID	BEH	BSX	CDG A	CPG A	CPW A	DBY A	DHF A		
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Edition 03.2019





## List of Workshop Manual Repair Groups

### Repair Group

00 - Technical data

20 - Fuel supply system

24 - Mixture preparation - injection

Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.



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## 00 – Technical data

### 1 Safety information

(VRL012852; Edition 03.2019)

#### 1.1 Safety precautions when working on natural gas system

##### **Risk of freezing injury from escaping natural gas**

Natural gas could escape in an uncontrolled manner from the high-pressure area of the natural gas system.

There is a risk of injury on hands and other parts of the body due to freezing.

- Before working on the natural gas system in the high-pressure area, allow the pressure to drop.

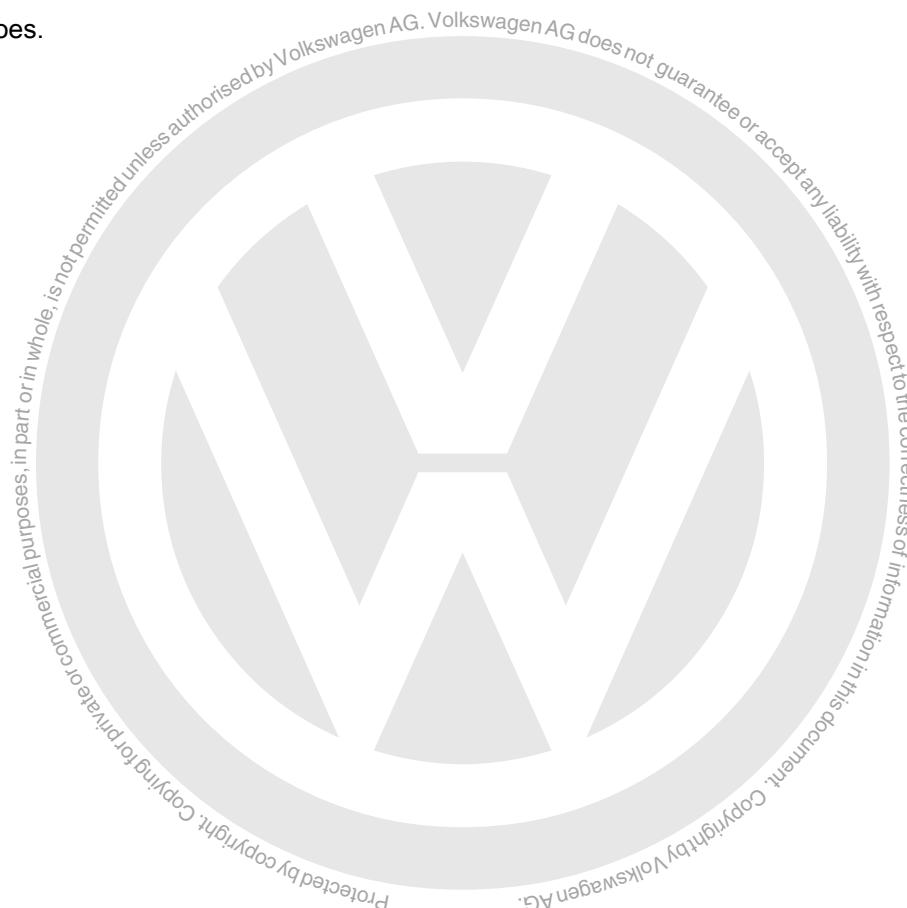
- Release high pressure ➔ [page 37](#) .

##### **Risk of fatal injury and explosion from escaping natural gas**

Risk of fatal injury and explosion from static discharge and sources of ignition near natural gas systems. Escaping natural gas may ignite and cause an explosion.

Risk of explosion leading to loss of life or serious injuries.

- Wear safety clothing with a cotton content of at least 35%.
- Wear safety gloves with a cotton content of at least 35%.
- Wear safety shoes.





## 2 General information

### 2.1 General notes on gas operation

### 2.2 Other reference material

- ◆ Self-study Programme No. 262 CNG.
- ◆ Self-study Programme No. 373 Ecofuel
- ◆ Self-study Programme No. 425 Ecofuel 1.4l TSI
- ◆ Self-study Programme No. 528 Golf TGI





### 3 Induction training/staff qualifications

#### Who requires induction training?

Anyone employed in a workshop who comes into contact with gas-powered vehicles must receive adequate and suitable induction training on how to work safely on or around CNG vehicles.

The induction training must be repeated on an annual basis at least.

#### Why is induction training necessary?

In some countries, all companies have to provide their employees with instructions and induction training on hazards in workshops to meet their duty of care obligations.

Even in countries in which this is not compulsory, we encourage companies to provide induction training.

#### Scope of induction training

How do I identify a gas-powered vehicle?

Which components have gas in them?

On which components that have no gas in them can I perform repairs/activities on the vehicle if I have received induction training?

How do I identify a leaking vehicle?

What action do I take in the event of a leaking vehicle?

Which safety regulations must be observed, e.g. avoiding sources of ignition or covering components.

How do I mark a leaking vehicle?

How can I make a leaking vehicle safe, e.g. by closing the tank valve with the handwheel?

What training do I need to complete that qualifies me to work on components that have gas in them?

What does controlled release of gas and uncontrolled release of gas mean?

- ◆ A controlled release of gas on a repaired and closed gas system means using the handwheel to open the shut-off valve on the fuel tank briefly and closing it again in order to subsequently perform a leakage test. In this case, the maximum amount of gas in the line could escape if a gas system is leaking. This activity may be performed in the gas vehicle work area.
- ◆ An uncontrolled release of gas means that gas is escaping from the fuel tank despite the handwheel being closed or the ignition being switched off. In this case, the vehicle must not be brought into the workshop under any circumstances. The vehicle must be left where it stands and the area around it (10x10 metres) cordoned off and marked.

Induction training must be updated when required, e.g. if new vehicle technology or new legislation is introduced.



#### Note

*In all cases, the country-specific requirements must be observed!*



For any type of work on a gas-powered vehicle, the information in ELSA and the Offboard Diagnostic Information System (ODIS) must be observed and heeded.

#### **Who is permitted to deliver induction training?**

Any person in a dealership who is qualified to work on a gas system is permitted to deliver induction training to the rest of the workforce.

#### **Documentation of induction training**

A written record must be kept in the documentation on which induction training was provided to whom and when. The induction training documentation must be managed by the superior responsible.







## 4 Receiving vehicles for repair

A reliable way to identify whether a vehicle has a gas system is to look for the additional filler neck behind the tank flap.

When taking delivery of gas-powered vehicles, a check must be carried out to determine whether there are any signs of a leaking gas system.

If there are signs of a leaking gas system, additional measures are necessary, or work may only be performed outside or in the work area for gas systems.

If the leak can be stopped by switching off the ignition or by closing the manual lock on the fuel tank, all other measures can be carried out in the gas work area. If the leakage cannot be stopped, the vehicle must be left in the open and placed under observation.

If there are no signs of a leaking system and no work needs to be carried out on the gas system, the vehicle can be repaired/serviced in a normal work area.





## 5 Statutory texts and instructions

### 5.1 Rules and regulations

Country-specific legislation, rules and regulations apply for working with natural gas as well as on or around natural gas systems.

In Germany, for example, TRG, TRGS and TRBS apply among others.

### 5.2 Workplace requirements

A work area for gas-powered vehicles with sufficient ventilation by natural or mechanical means is one in which an air exchange of at least 3 times per hour is assured for the period of controlled gas release.

For natural workplace ventilation, it is recommended to locate it in the vicinity of doors, windows and/or skylights.

It is recommended to install a gas detector in the work area for gas-powered vehicles. By installing a gas detector on the ceiling, assurance is provided that a warning is given before the lower explosion threshold is reached.

In all cases, the country-specific requirements must be observed here, too!





## 6 Fundamentals of technical and physical properties

### 6.1 Physical properties

#### 6.1.1 Physical data of dried natural gas



#### Note

*Dried natural gas does not create methane hydrates. Methane hydrates can cause deposits to form in the components.*

Chemical formula	CH <sub>4</sub>
Methane content	79-99%
Properties	Colourless
Odour	Odourless but could have odorant (odorous substance) added
Boiling point at 1 bar	-161°C
Ignition temperature	approx. 575°C to 625°C
Ignition threshold	Lower explosion threshold (UEG): 4% vol. Upper explosion threshold (OEG): 17% vol.
Relative density (air = 1)	0.55 to 0.75 (lighter than air)
RON	130-140
Energy content	1 kg: approx. 13.5 kWh
Colour	Natural gas is invisible
Effects on metal	Contamination of the gas can corrode certain metals and plastics. This can lead to blockage, leaks or deposits on springs and valves.
Water content	Only very small amounts of water are soluble in liquid gas.
Combustibility	Natural gas is an extremely inflammable gas. Can result in explosive/inflammable vapour/air mixtures forming during use.



## 7 Repair instructions

### 7.1 Rules for cleanliness

When working on the fuel supply and injection system, pay careful attention to the following rules:

- ◆ Thoroughly clean all connections and adjacent areas before disconnecting.
- ◆ Place removed parts on a clean surface and cover them over. Use lint-free cloths only.
- ◆ Carefully cover opened components or seal them if repairs cannot be carried out immediately.
- ◆ Install only clean parts; do not remove new parts from packaging until immediately before installing. Do not use parts that have been kept unpackaged (for example in toolboxes).
- ◆ When the system is open: Do not work with compressed air.
- ◆ Do not move the vehicle.
- ◆ Immediately seal open lines and unions with clean plugs, for example from engine bung set - VAS 6122- .
- ◆ Protect disconnected electrical connectors from dirt and water, and reconnect them only when dry.





## 8 Checking gas system

### 8.1 Test prerequisites for gas systems

#### 8.1.1 Testing with self-diagnosis



#### Note

*The fuel tanks must be pressurised to at least 160 bar.*

- Self-diagnosis of the gas system using vehicle diagnosis, testing and information system - VAS 5051A- in "Guided Fault Finding" does not flag up any errors. In the measured value block, no switch off condition for the gas system is displayed.

⇒ Rep. gr. 20

### 8.2 Checking gas system for leaks



#### Note

- ◆ *Different processes are described in this workshop manual for leak detection in the gas system. These processes have been tested. They lead to a positive result under the different conditions of use if the application is carried out correctly and in accordance with the complaint.*
- ◆ *Small leaks can be detected e.g. with an electronic leak detector or leak detector spray.*
- ◆ *A wide range of processes are offered on the open market for finding leaks in gas systems. These processes do not always produce conclusive results. It is even possible for components of the gas system to be identified as leaking even though they are not. Furthermore, certain processes can cause preliminary or permanent damage to the components of the gas system.*
- ◆ *Components that are found to be leaking must not be repaired. They have to be replaced with genuine parts.*
- ◆ *A leaking gas system must not be charged with gas.*

### 8.3 Searching for leaks in gas system using gas leak detector

Observe safety precautions when working on natural gas system  
⇒ [page 1](#) .



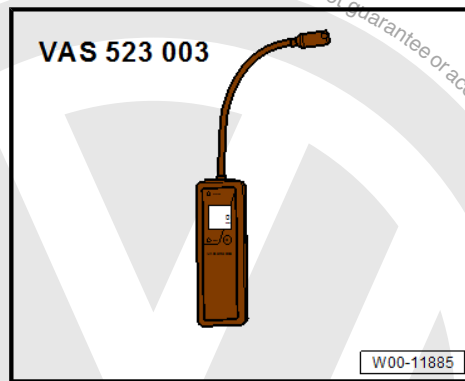
#### Note

- ◆ *With the gas leak detector - VAS 523 003- it is only possible to determine whether gas is present in the air immediately surrounding the area being tested.*
- ◆ *If the green LED does not light up, the leak detector spray must be used as a definitive means of testing the area. No bubbles may form in the sprayed area during the 3 minute testing time.*

**Special tools and workshop equipment required**



◆ Gas leak detecting system - VAS 523 003-



- ◆ Mirror
- ◆ Battery lamp - VAS 6901-

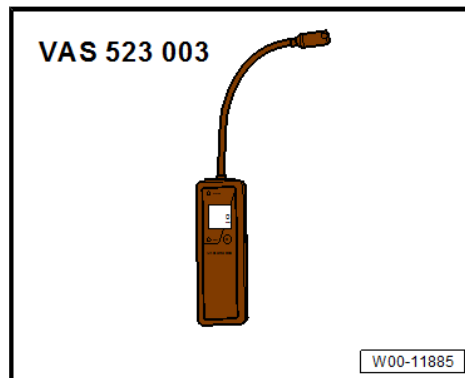
Conditions for testing:

- ◆ All parts of the natural gas system to be checked must be easily accessible.
- ◆ The exhaust emissions warning lamp in the dash panel insert must not light up
- ◆ There should be no gas-relevant entries in the event memory of the engine control unit
- ◆ Any draught of air stronger than 1.8 km/h (slight gust of wind) will falsify the reading. Therefore, it is essential to work in a draught-free environment.

**Leak detection:**

- Start the leak detector according to the operating instructions.
- Always hold the test probe at several points for 5 seconds respectively above the area of the suspected leak.

If the frequency of the acoustic signal increases (design feature), a warning sounds or the LEDs light up, the leakage has been localised. See the operating instructions of the leak detection device.



## 8.4 Searching for leaks in gas system using leak detector spray

Observe safety precautions when working on natural gas system  
⇒ [page 1](#) .

Spray the leak detector spray all around the joints and observe the area for several minutes. If small bubbles form, the leakage has been localised.



## 20 – Fuel supply system

### 1 Fuel

#### 1.1 Handling natural gas fuel tanks

- Secure tanks to prevent them from falling over.
- Lay down unsecured cylinders and take measures to prevent them from rolling away
- Tanks must not be thrown.
- Shield tanks against thermal radiation above 60°C.

If they fall over, tanks could become severely deformed and break open. The pressure and also considerable force are released rapidly in the process. Flying fragments of cylinders can cause severe injuries.

Valves may break off if cylinders are not properly transported. To protect cylinder valves, cylinders are only to be transported with appropriate tensioning straps.

#### 1.2 Storing natural gas tanks

##### Where should they be stored?

Charged natural gas fuel tanks may only be stored in well ventilated areas that have restricted access. Storing in the open, e.g. in a wire cage is ideal for this purpose. The gas must be able to dissipate upwards without restriction.

Should it be necessary in exceptional circumstances to store them in a building, the area is to be engineered in such a way that no explosive atmosphere can develop at any time.

##### How should they be stored?

When removed, natural gas fuel tanks are to be secured to prevent them from falling over or down. Through the type of storage, assurance must be provided that no damage can be caused to the fuel tank.

##### Marking of storage area

The wire cage should not be located in an area in which temperatures in excess of 60°C are experienced in the shade.

The storage area (e.g. wire cage) is to be marked as follows.





GHS pictogram "Flame"

GHS pictogram "Gas cylinder"

With the following safety notices:

- ◆ F+: R12
- ◆ Highly inflammable
- ◆ Can cause suffocation in higher concentrations.
- ◆ Compressed gas



#### Note

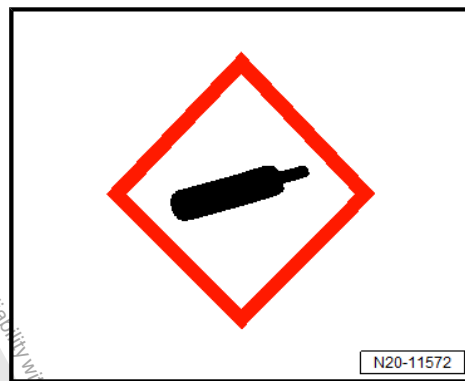
- ◆ *If natural gas fuel tanks have to be stored for extended periods of time, they should be emptied and rendered inert (flushed with nitrogen).*
- ◆ *In the event of a fire, charged fuel tanks are especially hazardous. For this reason, they must either be removed from the fire area or sprayed with water. The fire brigade is to be informed in any case about the presence of natural gas fuel tanks.*

In Germany, the following applies:



#### Note

*Charged and gas-tight natural gas fuel tanks that are removed from a vehicle and are installed back in the vehicle on the same day (8 hours), may be kept alongside the vehicle during this period. When removed, natural gas fuel tanks are to be secured to prevent them from falling over or down. Through the type of storage, assurance must be provided that no damage can be caused to the fuel tank.*



### Marking of natural gas fuel tanks

Removed fuel tanks that have not been rendered inert are to be clearly marked (e.g. with a hanging sign) as follows:

- ◆ Fuel tank (natural gas/CNG)
- ◆ Fill level of fuel tank
- ◆ Vehicle code or vehicle identification number

## 1.3 Damage assessment catalogue for natural gas fuel tanks

Procedure for assessing accident damage to steel and carbon fibre fuel tanks.



#### Note

*Observe country-specific specifications.*

As long as the fundamental structure of the vehicle (e.g. longitudinal members) is intact, the gas system/fuel tank should be inspected in accordance with the damage assessment catalogue and specified visual checks in the maintenance manual, e.g. Passat Estate 2006 ➤ Maintenance ; Booklet 2.1 Visual check natural gas fuel tank for corrosion and leak-tightness. If the result is OK, no components of the gas system will need to be renewed.





If the vehicle structure (e.g. longitudinal members) is damaged, the fuel tanks must be removed, inspected and/or renewed as necessary.

If it is found that the structural elements of the gas system (rack, tensioning straps) are deformed, the fuel tank must always be replaced.

- If the stainless steel lines are bent or damaged, the relevant components must be renewed.



#### Note

- ◆ *These images (applicable to carbon fibre fuel tanks only) serve as a means of assessing whether the damage requires replacement of the fuel tank. No repair measures may be carried out on the fuel tank.*
- ◆ *Thermal influences could have a negative influence on the structure of the fuel tank.*

### 1.3.1 Damage assessment of steel fuel tanks



#### Note

- ◆ *The fuel tank must be renewed even if it exhibits the smallest amount of damage or rust. No repair measures may be carried out on the fuel tank.*
- ◆ *There must be a layer of wax between the fuel tank (steel) and tank shut-off valve to protect against corrosion.*

### 1.3.2 Damage assessment of carbon fibre fuel tank (composition fibre reinforced fuel tank)



#### Note

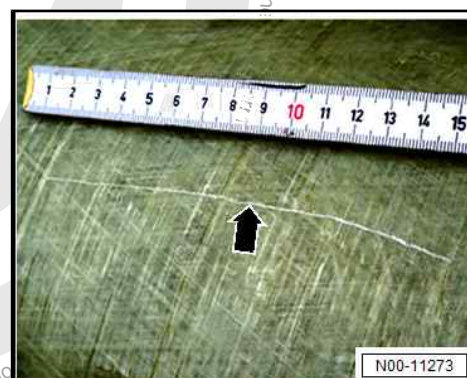
*The ingress of salt and water causes irreparable damage to the fuel tank.*

The following criteria are used in the damage catalogue.

green	Fuel tank OK until next inspection provided no other damage occurs.
red	Fuel tank is not OK and must be replaced

**Scratches and scrapes are of no concern (no damage to the fibres)**

Rating: green





### Minor marks on the surface from storage are of no concern

Rating: green



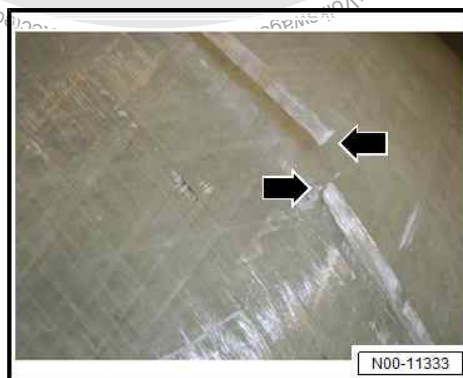
### Notch critical

Rating: red



### Torn fibre critical

Rating: red



### Abrasion critical

Rating: red





**Dent/bump critical**

Rating: red



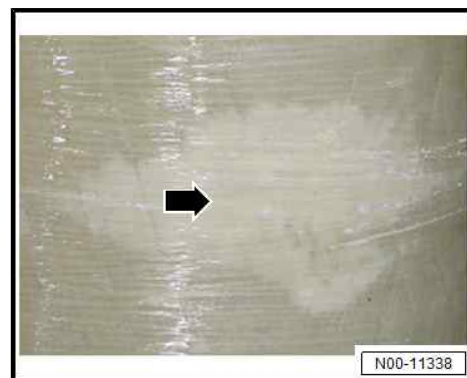
**Temperature critical**

Rating: red



**Disbonding e.g. air, water, critical**

Rating: red



## 1.4 Emptying natural gas fuel tanks

Marking of drainage area



- Marking of explosive areas and spaces
- Gas cylinder
- Unauthorised access to explosive areas must be prevented
- Prohibition sign: Mobile phones prohibited
- Prohibition sign: Fire, naked lights and smoking prohibited
- Prohibition sign: Smoking prohibited



#### Basic conditions for releasing natural gas from natural gas fuel tank

- ◆ Outside temperature between -10 to 40°C
- ◆ Wind speed less than 15 m/s
- ◆ No stormy weather expected.

#### DANGER

Risk of fatal injury and explosion from sources of ignition and static discharge.

Risk of explosion leading to loss of life or serious injuries.

- Never empty natural gas fuel tanks in enclosed spaces.
- Never empty natural gas fuel tanks in stormy weather.
- Cordon off an area of 10x10 m.
- Permanently man the cordoned off area.
- Never bring sources of ignition into the cordoned off area.

Before releasing the natural gas, the following precautions must be taken against static discharge:

- ◆ Workwear or safety clothing should not be changed in the work area (no dressing and undressing).



- ◆ The mechanic must wear electrically conductive shoes and gloves.
- ◆ Before setting up the gas extractor VAS 523001, equalise the potential between the mechanic and natural gas fuel tank.

The drain opening must be at least 3 metres above ground level.

Cordon off an area around the drain opening with a radius of 5 metres. Within the cordoned off area, there should be:

- ◆ no buildings
- ◆ no activated mobile telephones
- ◆ no effective sources of ignition (e.g. naked flames, hot surfaces or statically charged objects)
- ◆ and no unauthorised persons.

Measures should be taken to ensure that no gas can make its way under shelters/shelves, in adjacent buildings, through open windows, doors or other openings.

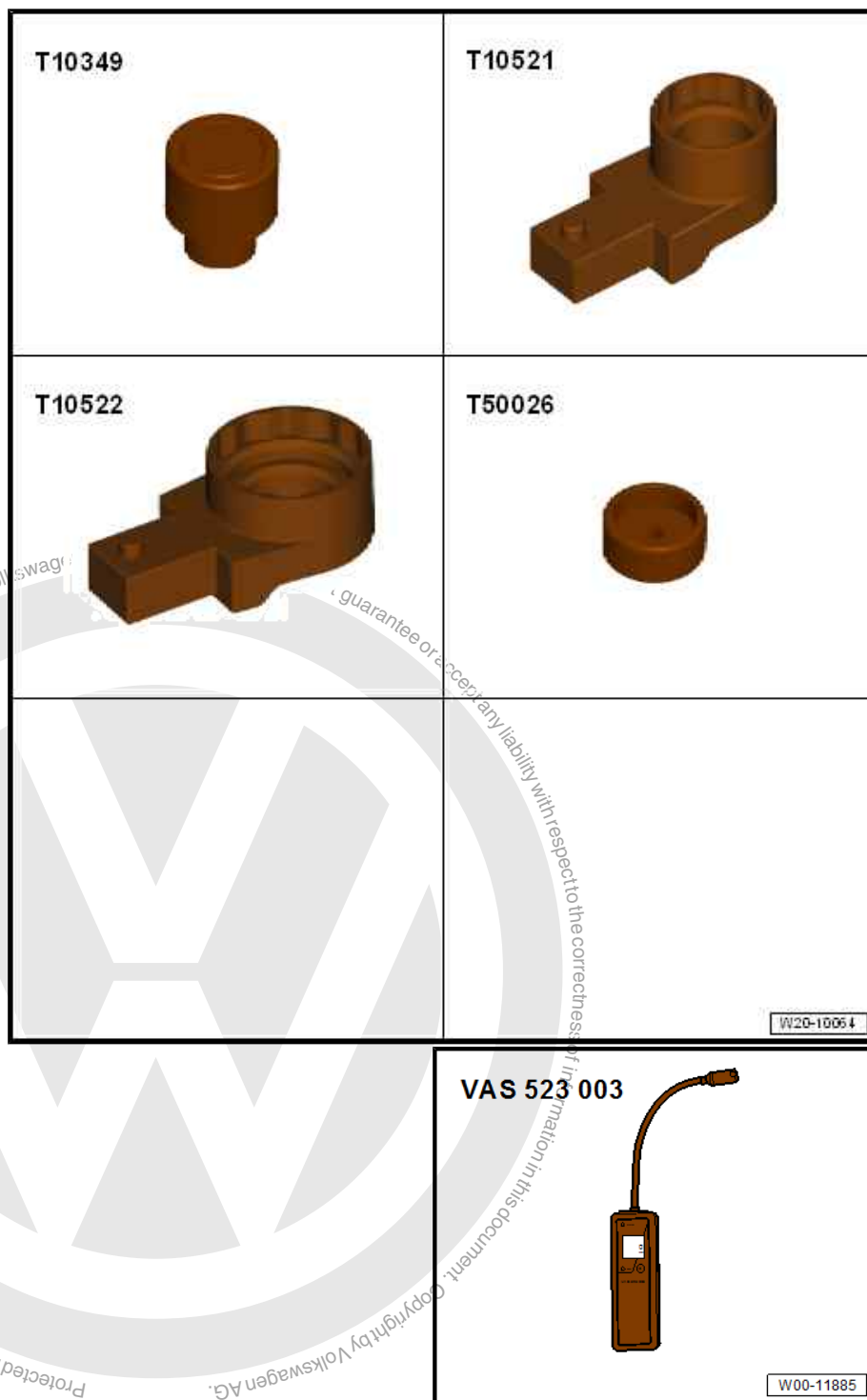
Gas from natural gas fuel tanks may only be released via the dedicated gas extractor VAS 523 001.

Once the gas has been released, ensure with a counterpressure check that the fuel tank has been emptied to a safe residual pressure ➔ [page 27](#) .





**Special tools and workshop  
equipment required**

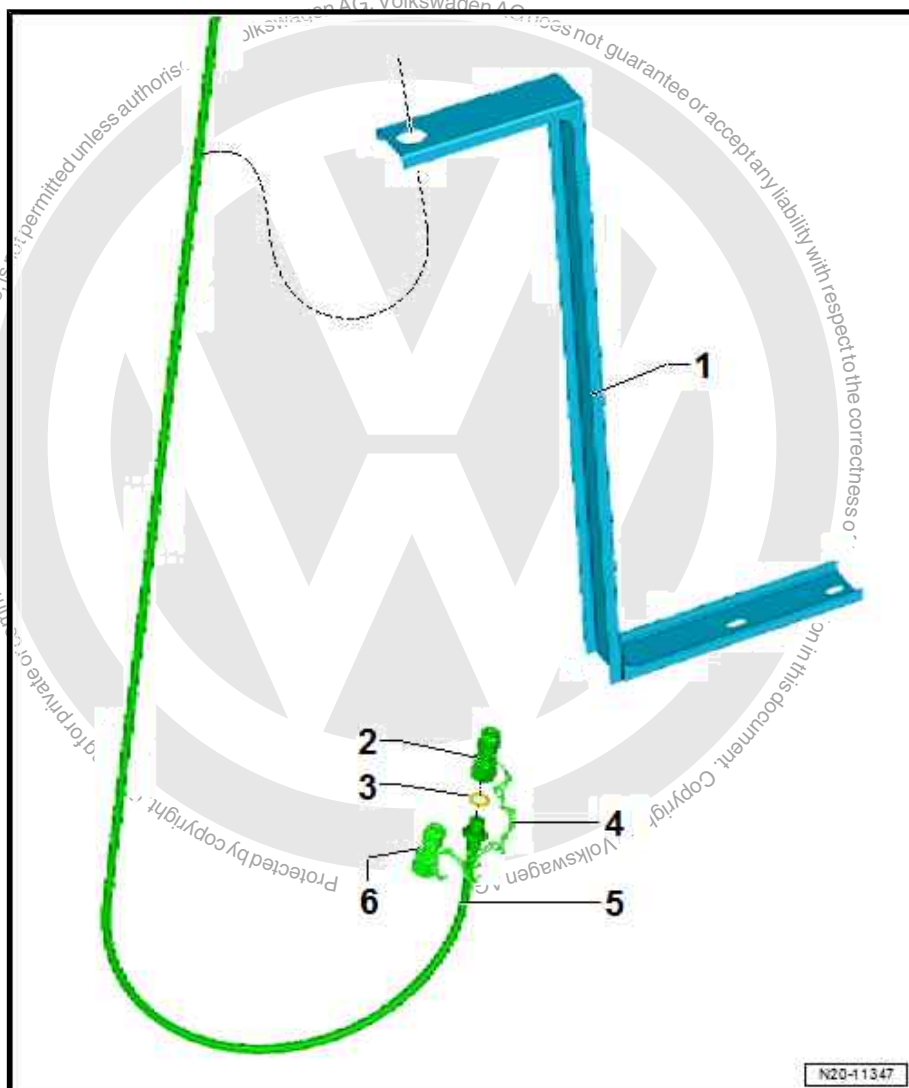


- ◆ Magnetic release tool - T10349-
- ◆ Special wrench - T10521-
- ◆ Special wrench - T10522-
- ◆ Handwheel - T50026-
- ◆ Gas leak detecting system - VAS 523 003-
- ◆ Leak detector spray (commercially available)





- 1 - Bracket - VAS 523 001/6-
- 2 - Adapter - VAS 523 001/2-
- 3 - Seal
- 4 - Retaining chain
- 5 - Gas discharge pipe - VAS 523 001/1-
- 6 - Adapter - VAS 523 001/3-



- ◆ Qty. 2 M8 × 30 bolts with 2 washers and a nut.

#### Procedure



#### Note

- ◆ *Natural gas tanks made of composite material must not be stored without pressure for longer periods of time.*
- ◆ *Following repairs, immediately refill the system and check it for leaks.*

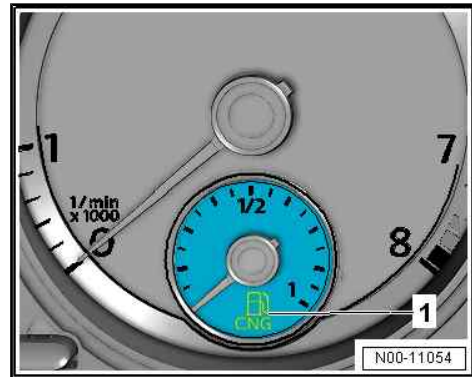


Fuel tanks made of composite material must not be drained unless refilled within 24 hours.



#### Note

- ◆ The fuel tank must be run empty, provided that the vehicle is fully functional and fit for the road.
- ◆ When the gauge for natural gas -1- shows "Tank empty", and the engine control unit has switched to petrol mode, there is still a pressure of up to 12 bar in the fuel tank.
- ◆ The natural gas mode is indicated by the symbol -1- in the left fuel gauge.
- ◆ The remaining natural gas in the fuel tank must now be drained from the fuel tank via the manual shut-off mechanism in the fuel tank shut-off valve.
- ◆ The emptying process must be carried out outdoors.



#### DANGER

Risk of fatal injury and explosion from sources of ignition and static discharge.

Risk of explosion leading to loss of life or serious injuries.

- Never empty natural gas fuel tanks in enclosed spaces.
- Never empty natural gas fuel tanks in stormy weather.
- Cordon off an area of 10x10 m.
- Permanently man the cordoned off area.
- Never bring sources of ignition into the cordoned off area.

- Determine pressure in natural gas system.
- To do this, connect ⇒ Vehicle diagnostic tester.
- Switch on ignition.
- Connect vehicle diagnostic tester , and start vehicle self-diagnosis using »ODIS«.

#### Basic characteristics of vehicle

- Select engine code **CPWA**, and confirm
- ☐ 01 Engine electronics

#### Measured values

- ☐ IDE06792 Tank pressure sensor
- Release pressure in high-pressure line ⇒ [page 37](#) .
- Disconnect battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .
- Remove respective fuel tank, see vehicle-specific workshop manual ⇒ Rep. gr. 20 .

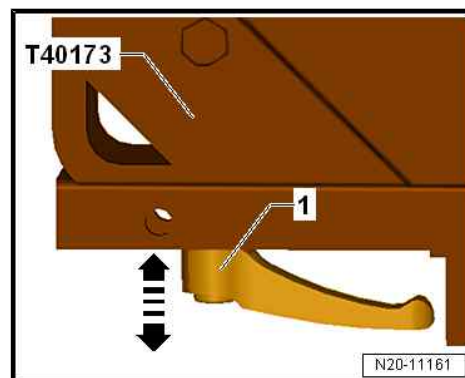




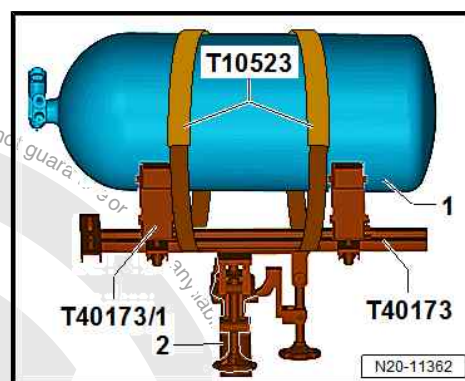
**i Note**

- ◆ *The fuel tank must always be securely lashed to the engine and gearbox jack .*
- ◆ *This is necessary to prevent the fuel tank from falling down while work is being carried out.*
- ◆ *If the fuel tank is not securely lashed to the engine and gearbox jack, any work on the fuel tank is prohibited.*

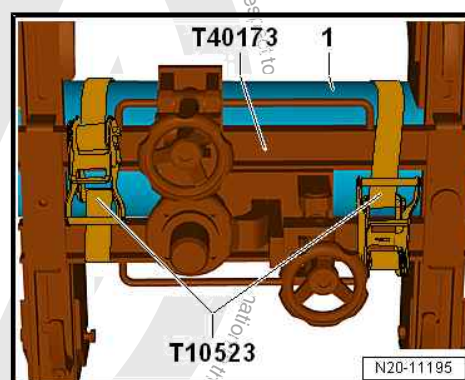
- Align adjustable supports of gearbox support - T40173- relative to fuel tank, and secure them.
- In order to properly secure adjustable supports, pull lever -1- downwards, and position it such that the fuel tank can be properly secured.



- Fit fuel tank -1- to gearbox support - T40173- with tensioning strap - T10523- as shown in illustration.
- Secure fuel tank against falling using tensioning strap T10523- .
- Make sure that fuel tank shut-off valve is flush with rigid mounting.
- Turn fuel tank so that connection for fuel line on fuel tank shut-off valve points vertically downwards.

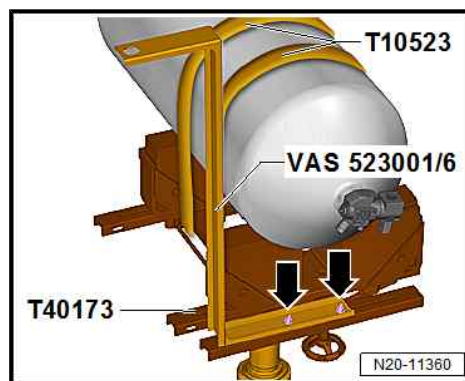


- Ensure that the ratchets of the tensioning straps are offset, as shown in illustration.
- Securely lash fuel tank -1- to gearbox support - T40173- using the two tensioning straps - T10523- .
- When lashing, do not damage surface of fuel tank.
- If necessary, protect surface with suitable workshop equipment.

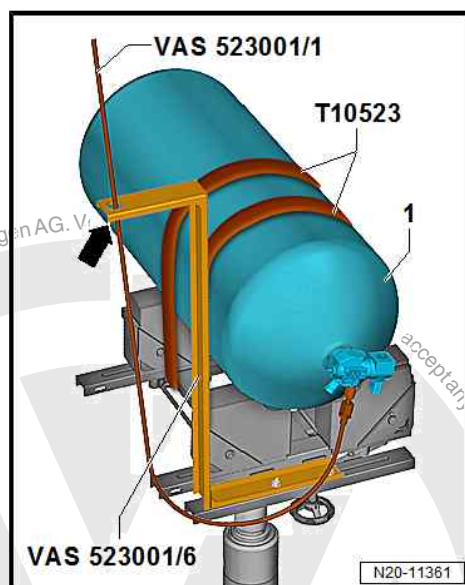




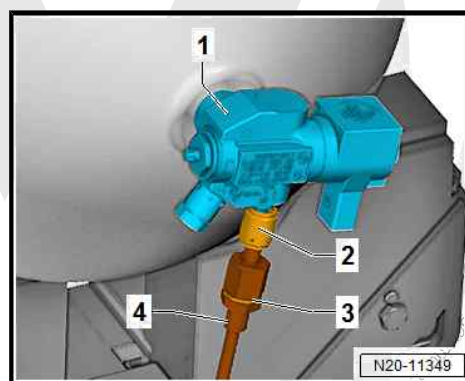
- Secure bracket - VAS 523 001/6- on gearbox support - T40173- as shown in illustration.
- To do this, use threaded connection points -arrows-.



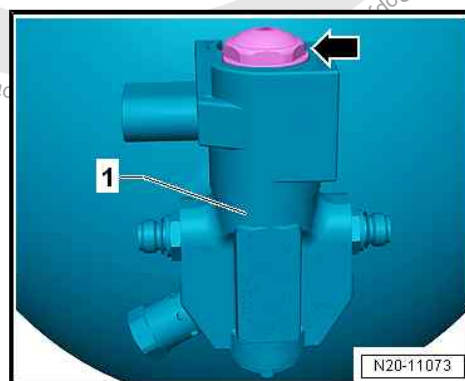
- Insert gas discharge pipe - VAS 523 001/1- into guide -arrow- of bracket - VAS 523 001/6- .



- Screw suitable adapter - VAS 523 001- onto gas discharge pipe -4-.
- Ensure that seal -3- is seated correctly.
- Screw adapter -2- onto fuel tank shut-off valve -1-.
- Adapter only needs to be screwed on hand-tight. Do not use any tools for this purpose, e.g. pliers or similar.

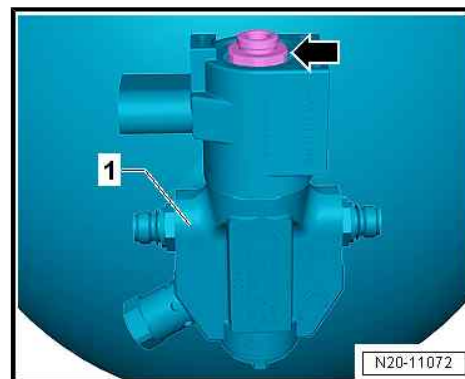


- Unscrew plug -arrow- on fuel tank shut-off valve -1-.

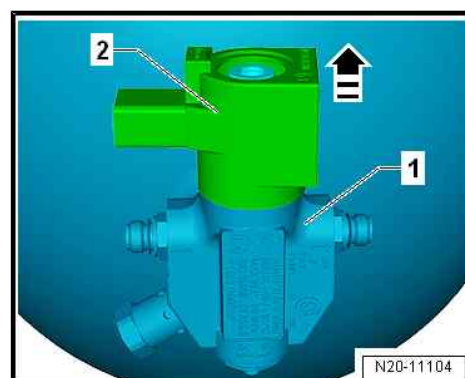




- Unscrew nut -arrow- on fuel tank shut-off valve -1- and remove it.



- Pull off solenoid -2- inc. spring washer from fuel tank shut-off valve -1- in direction of -arrow-.



- Fit magnetic release tool - T10349- onto valve -1-. There should be a metallic clicking noise. If not, pull off magnetic release tool - T10349- and fit again.



#### Note

- ◆ The magnetic release tool - T10349- must remain fitted onto the valve during the entire emptying process.
- ◆ It prevents the valve from becoming jammed.



#### CAUTION

Risk of freezing injury from tank shut-off valves icing up.  
Hands may sustain cold burns.

- Wear safety gloves with a cotton content of at least 35%.

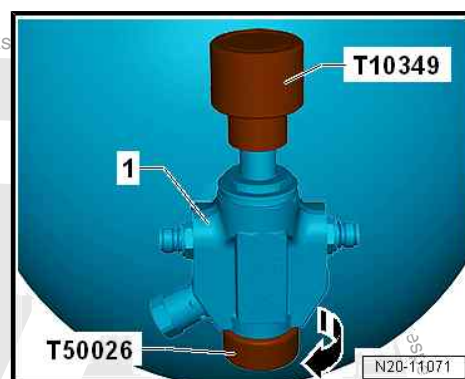
- Establish a safety zone around the fuel tank (10x10 metres), which must not be entered while the fuel tank is emptied. Leave the safety zone after you have opened the manual shut-off valve.
- Fit hand wheel - T50026- to manual shut-off mechanism -arrow- on fuel tank shut-off valve.



#### Note

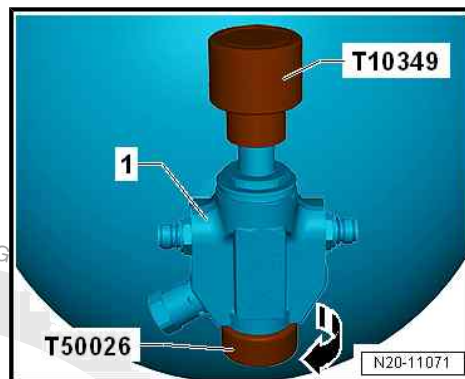
When no more natural gas escapes from the fuel tank, perform a counterpressure check ➔ [page 27](#).

Checking for leaks at connections:





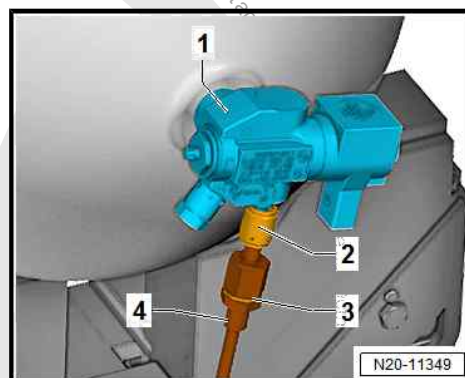
- Carefully open fuel tank shut-off valve in -direction of arrow- using hand wheel - T50026- until natural gas escapes.



- After 1 or 2 seconds, close fuel tank shut-off valve .
- Check connections between gas discharge pipe -4- and fuel tank shut-off valve -1- for leaks.
- Use gas leak detector - VAS 523 003- and commercially available leak detector spray.

**If leaks are found:**

- Check seal -3- for damage, and renew it if necessary.
- Check connection between gas discharge pipe -4- and fuel tank shut-off valve -1- for soiling, and tighten it if necessary.
- If the leak cannot be rectified, do not use the gas discharge pipe.





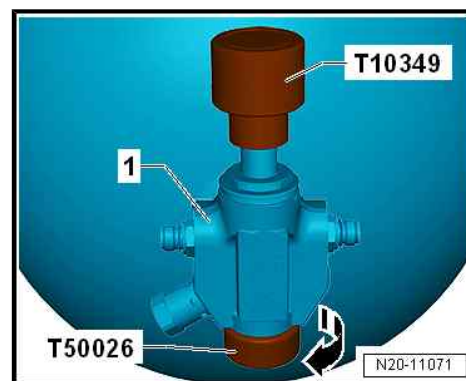
If no leaks could be found, or if a leak was found but rectified:

- Carefully open fuel tank shut-off valve in -direction of arrow- using hand wheel - T50026- until natural gas escapes.
- Carefully open fuel tank shut-off valve as far as possible without triggering the »restrictor valve«.
- The fuel tank shut-off valve must not be opened completely.



#### Note

- ◆ Depending on the tank pressure, the fuel tank shut-off valve can be opened completely.
- ◆ Fully opening will trigger the "restrictor valve". Then only a small amount of gas can escape.



If the valve has been opened too far, thus triggering the »restrictor valve«:

- To reset the restrictor valve, the pressure must be equalised by closing the »manual shut-off«.
- Close the valve and then open only enough to allow a suitable amount of gas to flow without triggering the restrictor valve.

Continued for all:

- When natural gas no longer escapes from fuel tank, the manual shut-off valve must be closed again.
- Perform counterpressure check to ensure that the gas tank has been sufficiently emptied ➔ [page 27](#).



#### Note

- ◆ Natural gas tanks made of composite material must not be stored without pressure for longer periods of time.
- ◆ If the fuel tank shut-off valve was removed, then it must be reinstalled immediately after repairs to the fuel tank shut-off valve have been completed.
- ◆ After installation of the fuel tank shut-off valve, the fuel tank must be filled with natural gas or nitrogen at low pressure within 24 hours.

## 1.5 Rendering natural gas tanks insert



### DANGER

Risk of fatal injury and explosion from sources of ignition and static discharge.

Risk of explosion leading to loss of life or serious injuries.

- Never empty natural gas fuel tanks in enclosed spaces.
- Never empty natural gas fuel tanks in stormy weather.
- Cordon off an area of 10x10 m.
- Permanently man the cordoned off area.
- Never bring sources of ignition into the cordoned off area.





### 1.5.1 With water:

#### DANGER

Risk of fatal injury and explosion from sources of ignition and static discharge.

Risk of explosion leading to loss of life or serious injuries.

- Never empty natural gas fuel tanks in enclosed spaces.
- Never empty natural gas fuel tanks in stormy weather.
- Cordon off an area of 10x10 m.
- Permanently man the cordoned off area.
- Never bring sources of ignition into the cordoned off area.

Since gas is released when rendering a tank inert or filling with water, this must be done outside only. In this case, the same safety precautions must be observed as those for releasing natural gas. ⇒ [page 1](#)

- Stand the fuel tank up so that it is vertical and fill to the brim with water, ensuring that no pockets of gas form in the fuel tank. Leave the fuel tank to stand for 24 hours.

### 1.5.2 With nitrogen:

#### DANGER

Risk of fatal injury and explosion from sources of ignition and static discharge.

Risk of explosion leading to loss of life or serious injuries.

- Never empty natural gas fuel tanks in enclosed spaces.
- Never empty natural gas fuel tanks in stormy weather.
- Cordon off an area of 10x10 m.
- Permanently man the cordoned off area.
- Never bring sources of ignition into the cordoned off area.

Since gas is released when rendering a tank inert or filling with water, this must be done outside only. In this case, the same safety precautions must be observed as those for releasing natural gas. ⇒ [page 1](#)

- Stand the fuel tank up so that it is vertical and insert a hose or a lance in the fuel tank opening until it reaches the bottom. Then fill the fuel tank with nitrogen. In this way, any gas is forced to the top and out through the fuel tank opening.

### 1.6 Disposing of natural gas fuel tanks

#### DANGER

Risk of fatal injury and explosion from sources of ignition and static discharge.

Risk of explosion leading to loss of life or serious injuries.

- Never empty natural gas fuel tanks in enclosed spaces.
- Never empty natural gas fuel tanks in stormy weather.
- Cordon off an area of 10x10 m.
- Permanently man the cordoned off area.
- Never bring sources of ignition into the cordoned off area.

Before natural gas fuel tanks are transported and disposed of, they must be completely emptied. Rendering them inert (charging with nitrogen) or filling them with water is a way to empty them



completely. ➔ [page 25](#) The fuel tank can then be emptied and transported or disposed of safely. After emptying, drill a 10 mm hole in the fuel tank made of composite material.

## 1.7 Determining residual pressure in natural gas fuel tank

➔ ["1.7.1 Checking and converting adapter for counterpressure check on natural gas tank", page 27](#)

➔ ["1.7.2 Checking \(self test\) cooling system tester", page 28](#)

➔ ["1.7.3 Determining residual pressure in natural gas fuel tank", page 32](#)

### 1.7.1 Checking and converting adapter for counterpressure check on natural gas tank



#### Note

- ◆ *Before using the adapter for counterpressure check on natural gas tank, always check if it is the latest version.*
- ◆ *Older versions of the adapter for counterpressure check on natural gas tank must not be used unless converted accordingly.*
- ◆ *The only adapter that may be used is the adapter - V.A.G 1274B/12 A- . All other adapters need to be converted accordingly.*
- ◆ *Adapters with pressure relief valve must be retrofitted.*  
➔ [page 28](#)
- ◆ *Distinguishing between different versions ➔ [page 27](#) .*
- ◆ *Converting adapter for counterpressure check on natural gas tank ➔ [page 28](#) .*

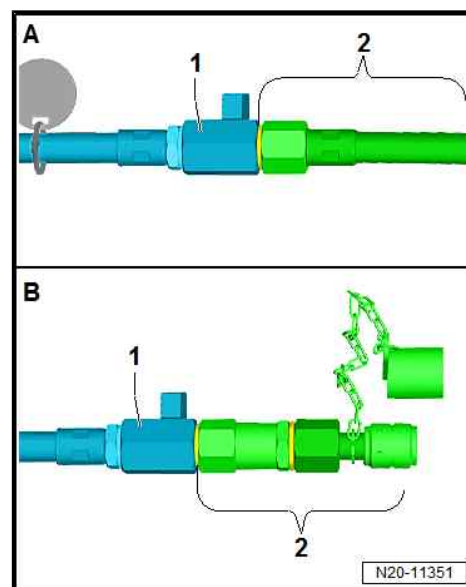
#### Distinguishing between different versions:

A - Old version without pressure relief valve in connection piece -2-

B - Adapter - V.A.G 1274B/12 A- new version with pressure relief valve in connection piece -2-

The older version -A- of the adapter has no pressure relief valve and has to be converted. Located after connection piece -1- is a flexible hose.

The newer version -B- of the adapter is distinctly longer in area -2-. This is the area where the pressure relief valve is located.





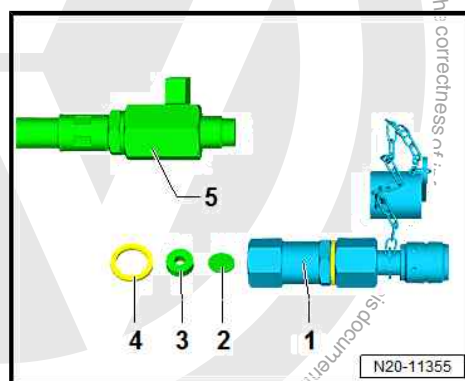
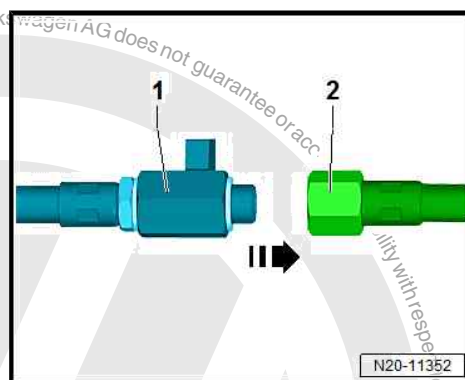
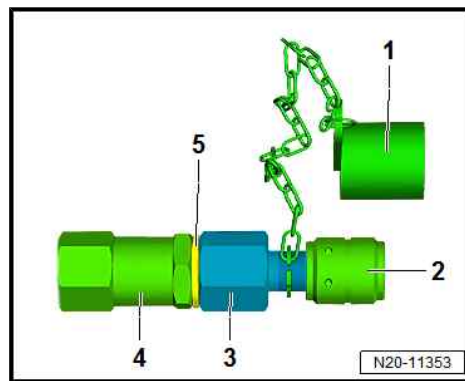
### Adapter - V.A.G 1274B/12 A-1-

- 1 - Cap
- 2 - Threaded union for fuel tank shut-off valve
- 3 - Connection piece
- 4 - Pressure relief valve
- 5 - Seal

Use adapter - V.A.G 1274B/12 A-1- to convert from old to new version.

#### Converting from old to new version:

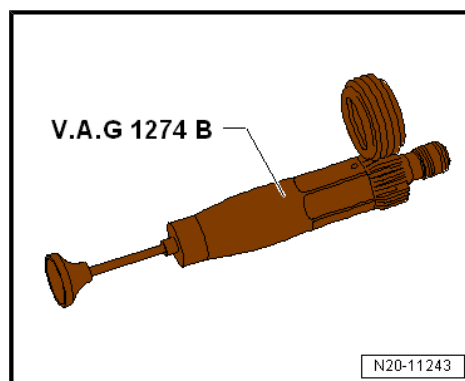
- Carefully loosen and unscrew union nut -2-.
- When doing so, counterhold on union -1- with suitable tool.
- Remove spacer ring from union -1-.
- Insert filter strainer -2- into adapter -1-.
- Insert supplied seal -3- in adapter -1-.
- Fit spacer ring -4- onto threaded piece of adapter -5-.
- Screw adapter - V.A.G 1274B/12 A-1- -15- onto adapter -5-, and tighten to 20 Nm.
- Counterhold using a suitable tool while doing so.
- Connect converted adapter for counterpressure test on natural gas tank to fuel tank shut-off valve and perform leakage test  
⇒ [page 28](#) .



## 1.7.2 Checking (self test) cooling system tester

### Special tools and workshop equipment required

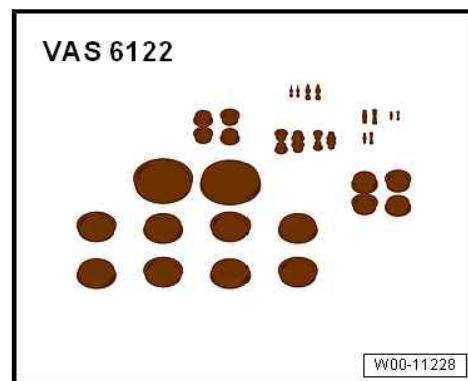
- ◆ Cooling system tester - V.A.G 1274 B-



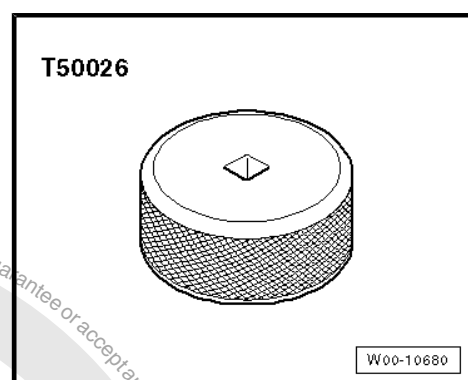




◆ Engine bung set - VAS 6122-



◆ Handwheel - T50026-



**Original design of adapter for counterpressure check on natural gas tank requires adaptation:**

- ◆ Adapter for counterpressure check on natural gas tank (6 mm thread) - V.A.G 1274 B/12-
- ◆ Adapter with pressure relief valve
- ◆ Determine version of adapter for counterpressure check on natural gas tank ➔ [page 27](#) .
- ◆ This adapter for counterpressure check on natural gas tank (6 mm thread) - V.A.G 1274 B/12- needs to be converted ➔ [page 27](#) .

**Adapter for counterpressure check on natural gas tank after conversion:**

- ◆ Adapter for counterpressure check on natural gas tank - V.A.G 1274 B/12 A-
- ◆ Determine version of adapter for counterpressure check on natural gas tank ➔ [page 27](#) .



**Note**

- ◆ *The counterpressure check is used to verify that the pressure in the fuel tank is below 1.0 bar.*
- ◆ *If no counterpressure test has been performed, any work on the fuel tank and the fuel tank shut-off valve is prohibited.*
- ◆ *Seal open connections using suitable plugs from engine bung set - VAS 6122- .*



### Test precondition:

- Check adapter for counterpressure check on natural gas tank and convert it accordingly if necessary.
- Remove fuel tank.
- Perform a leakage test in the area around the fuel tank shut-off valve before emptying the fuel tank ⇒ Rep. gr. 24 ; Checking natural gas supply system for leaks .
- Drain fuel tank ⇒ [page 15](#) .
- The counterpressure check must be performed after the fuel tank has been emptied.

Never leave the fuel tank unattended when the tester is connected.



### Note

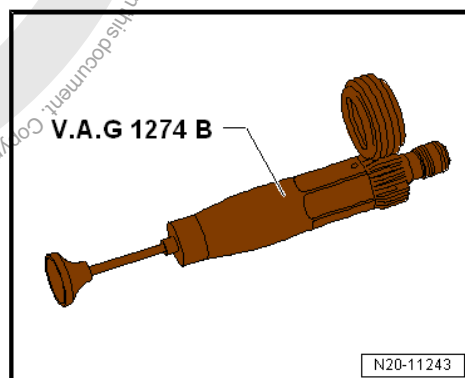
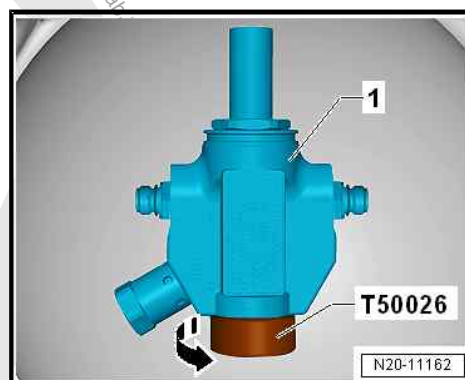
- ♦ *Different fuel tank shut-off valves may be installed.*
- ♦ *Depending on the version of the fuel tank shut-off valve installed, 1 or 2 line connections may be present.*
- ♦ *In the case of fuel tank shut-off valves with 2 connections, each of the connections must be sealed using the adapter for counterpressure check on natural gas tank and an additional sealing cap.*
- Close mechanical shut-off valve on fuel tank shut-off valve -1- using hand wheel - T50026- .
- Close shut-off valves by turning hand wheel in clockwise direction.
- To ensure that the counterpressure check is performed correctly, always check the cooling system tester - V.A.G 1274 B- and the adapter for counterpressure check on natural gas tank (self test) beforehand.



### Note

*If the self test fails, the tools must not be used.*

- Disconnect adapter lines from cooling system tester - V.A.G 1274 B- .
- Operate cooling system tester - V.A.G 1274 B- several times.





- Build up a pressure of 3.0 bar on cooling system tester - V.A.G 1274 B- .
- Observe pressure on pressure gauge of cooling system tester - V.A.G 1274 B- for 30 seconds.

If no pressure builds up or if the pressure drops again:

The cooling system tester - V.A.G 1274 B- is not OK and must not be used for counterpressure check.

If pressure builds up, and if the pressure does not drop:

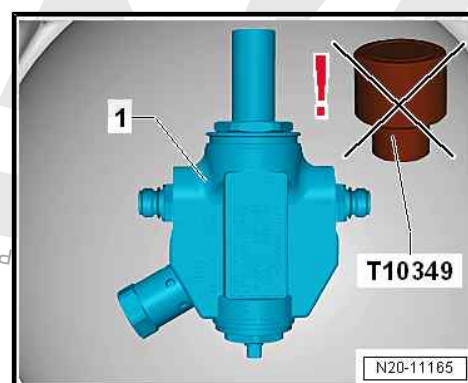
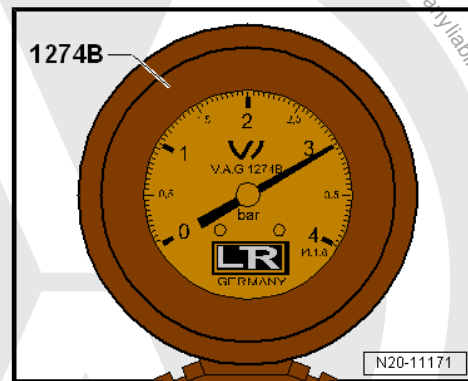
The cooling system tester - V.A.G 1274 B- is OK and can be used for counterpressure check.

Check adapter for counterpressure check on natural gas tank as described below.

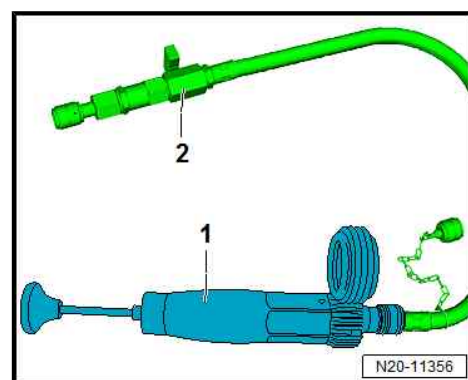
#### Self-test on adapter for counterpressure check on natural gas tank :

Ensure that the magnetic release tool - T 10349- is not placed on the fuel tank shut-off valve -1-.

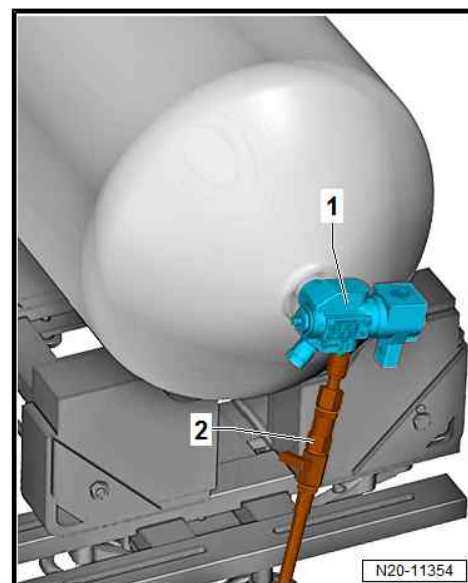
- Check threads on fuel tank shut-off valve and on adapter for counterpressure check on natural gas tank for soiling, and clean them if necessary.



- Connect adapter for counterpressure check on natural gas tank -2- to cooling system tester - V.A.G 1274 B- -1-.
- Open shut-off tap on adapter for counterpressure check on natural gas tank .
- Lever is then in line with direction of flow.



- Connect adapter for counterpressure check on natural gas tank -2- to fuel tank shut-off valve -1-.
- Operate cooling system tester - V.A.G 1274 B- several times.





- Build up a pressure of 3.0 bar on cooling system tester - V.A.G 1274 B- .
- Observe pressure on pressure gauge of cooling system tester - V.A.G 1274 B- for 30 seconds.

If no pressure builds up or if the pressure drops again:

- Check connection between fuel tank shut-off valve and adapter for counterpressure check on natural gas tank , and tighten it if necessary.
- Repeat self test [page 31](#) .

If no pressure builds up or if the pressure drops again:

Adapter for counterpressure check on natural gas tank is not OK and must not be used for counterpressure check.

If pressure builds up, and if the pressure does not drop:

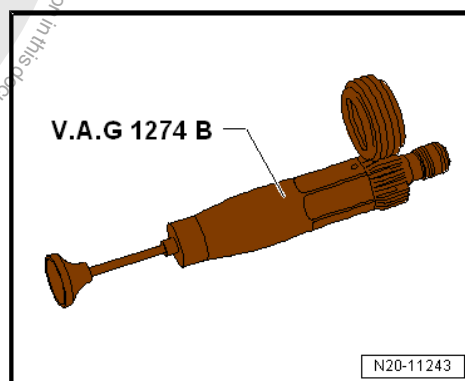
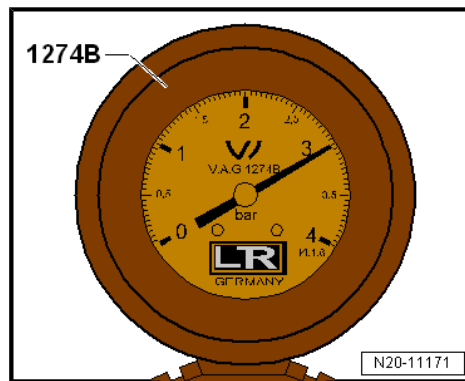
Cooling system tester - V.A.G 1274 B- and adapter for counterpressure check on natural gas fuel tank can be used for counterpressure check.

- Press the pressure compensation button on the cooling system tester - V.A.G 1274 B- . This will cause the pressure in the cooling system tester - V.A.G 1274 B- and the adapter for counterpressure check on natural gas fuel tank to be released.

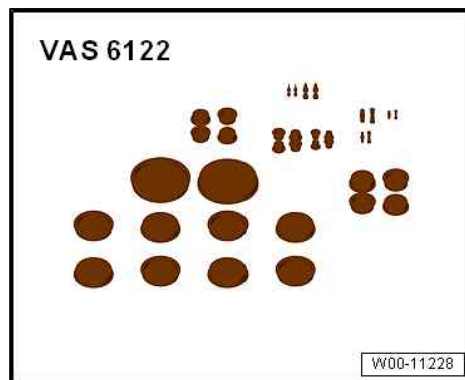
### 17.3 Determining residual pressure in natural gas fuel tank

#### Special tools and workshop equipment required

- ♦ Cooling system tester - V.A.G 1274 B-

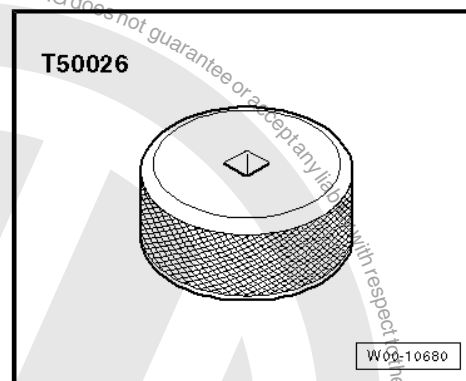


- ♦ Engine bung set - VAS 6122-





◆ Handwheel - T50026-



**Adapter for counterpressure check on natural gas tank before conversion:**

- ◆ Adapter for counterpressure check on natural gas tank (6 mm thread) - V.A.G 1274 B/12-
- ◆ Adapter with pressure relief valve
- ◆ Determine version of adapter for counterpressure check on natural gas tank ⇒ [page 27](#) .
- ◆ This adapter for counterpressure check on natural gas tank (6 mm thread) - V.A.G 1274 B/12- needs to be converted ⇒ [page 27](#) .

**Adapter for counterpressure check on natural gas tank after conversion:**

- ◆ Adapter for counterpressure check on natural gas tank - V.A.G 1274 B/12 A-
- ◆ Determine version of adapter for counterpressure check on natural gas tank ⇒ [page 27](#) .



**Note**

- ◆ *The counterpressure check must be performed after the fuel tank has been emptied.*
- ◆ *The counterpressure check is used to verify that the pressure in the fuel tank is below 1.0 bar.*
- ◆ *If no counterpressure test has been performed, any work on the fuel tank and the fuel tank shut-off valve is prohibited.*
- ◆ *Seal open connections using suitable plugs from engine bung set - VAS 6122- .*
- ◆ *The only adapter that may be used is the adapter for counterpressure check on natural gas tank - V.A.G 1274 B/12 A- . Older versions must be converted accordingly.*

**Test precondition:**

- Remove fuel tank ⇒ [page 37](#) .



**Note**

*Perform a leakage test in the area around the fuel tank shut-off valve before emptying the fuel tank ⇒ Rep. gr. 24 ; Checking natural gas supply system for leaks .*



- Drain fuel tank ➔ [page 15](#) .
- Check adapter for counterpressure check on natural gas tank , and convert it to new version, if necessary ➔ [page 27](#) .
- Perform self test of cooling system tester - V.A.G 1274 B- ➔ [page 28](#) .



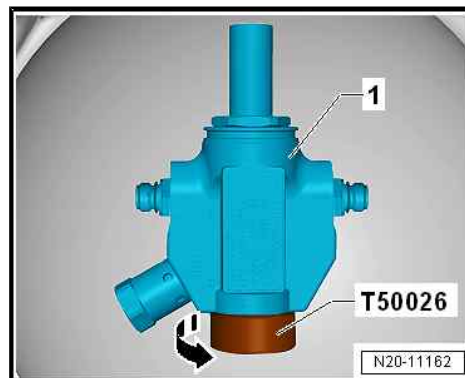
#### Note

- ◆ *Never leave the fuel tank unattended when the tester is connected.*
- ◆ *To ensure that the counterpressure check is performed correctly, always check the cooling system tester - V.A.G 1274 B- and the adapter for counterpressure check on natural gas tank (self test) beforehand.*
- ◆ *If the self test fails, the tools must not be used.*



#### Note

- ◆ *Different fuel tank shut-off valves may be installed.*
  - ◆ *Depending on the version of the fuel tank shut-off valve installed, 1 or 2 line connections may be present.*
  - ◆ *In the case of fuel tank shut-off valves with 2 connections, each of the connections must be sealed using the adapter for counterpressure check on natural gas tank and an additional sealing cap.*
- Close mechanical shut-off valve on fuel tank shut-off valve -1- using hand wheel - T50026-
  - Close shut-off valves by turning hand wheel in clockwise direction.

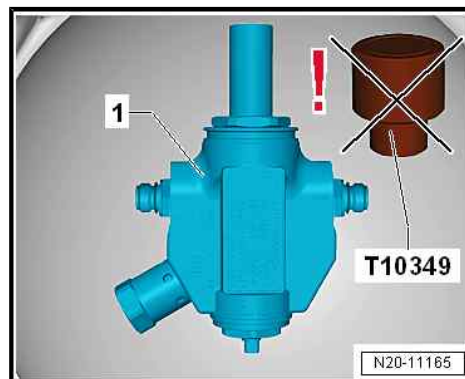


#### Performing counterpressure check:



#### Note

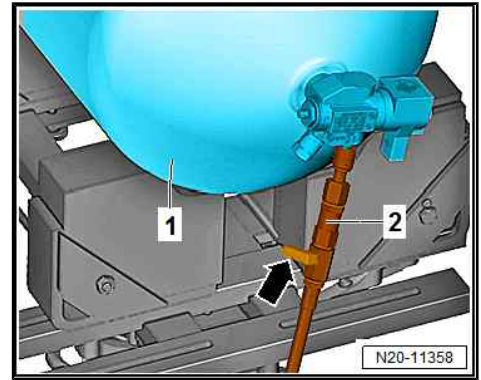
*Ensure that the magnetic release tool - T10349- is not placed on the fuel tank shut-off valve .*



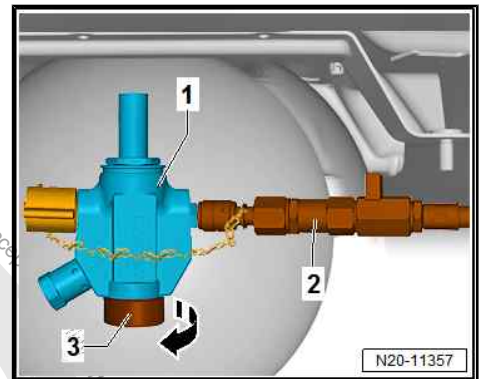




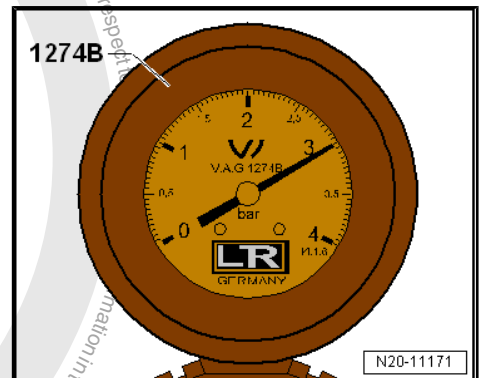
- Close shut-off tap -arrow- on adapter for counterpressure check on natural gas tank -2-. Lever is then at right angle to direction of flow.



- Use hand wheel - T50026- -3- to carefully open mechanical shut-off valve on fuel tank shut-off valve -1-.



- Operate cooling system tester - V.A.G 1274 B- several times.
- Build up a pressure of 3.0 bar on cooling system tester - V.A.G 1274 B- .





- Open shut-off tap -arrow- on adapter for counterpressure check on natural gas tank -2-.
- Lever is then in line with direction of flow.
- Observe pressure on pressure gauge of cooling system tester - V.A.G 1274 B- for 30 seconds.

**If pressure does not drop below 1.0 bar immediately:**

The pressure in the fuel tank is too high because the fuel tank has not been emptied completely.



**Note**

*If the pressure does not drop due to excessive pressure in the fuel tank, the fuel tank must be emptied again and the counter-pressure check must be repeated before continuing work on the system.*

- Empty fuel tank again ➔ [page 15](#) .
- Repeat fuel pressure test ➔ [page 34](#) .

If pressure still does not drop below 1.0 bar:

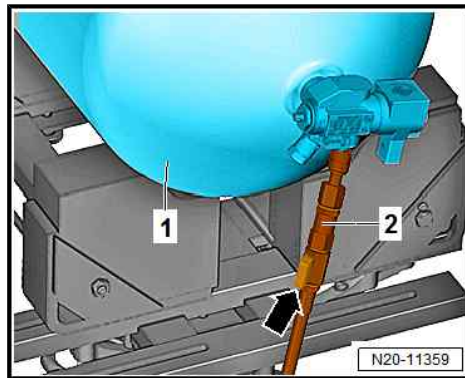
- Empty fuel tank again ➔ [page 15](#) .
- Repeat fuel pressure test ➔ [page 34](#) .

If pressure still does not drop below 1.0 bar:

Do not continue work on fuel tank.

**If pressure drops very slowly:**

- Check connection between fuel tank shut-off valve and adapter for counterpressure check on natural gas tank , and tighten it if necessary.
- Check connection between sealing cap of adapter for back pressure check on natural gas tank (6 mm thread) - V.A.G 1274 B/12- and fuel tank shut-off valve , and tighten it if necessary.
- Repeat self test ➔ [page 31](#) .
- Repeat fuel pressure test ➔ [page 34](#) .







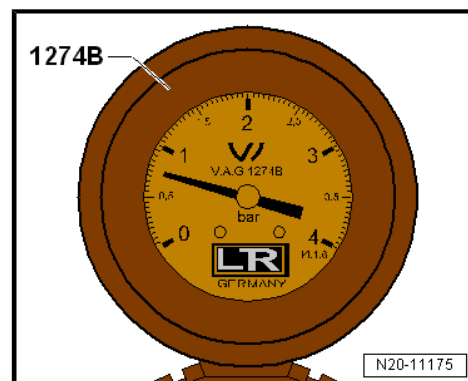
If pressure drops below 1.0 bar immediately:

- Repeat counterpressure check to verify that the previous counterpressure check has been performed correctly  
⇒ [page 34](#) .



#### Note

- ◆ Upon completion of the counterpressure check, operate the cooling system tester - V.A.G 1274 B- several times.
- ◆ No pressure must build up while doing so.
- ◆ Air can be heard to flow into the fuel tank.
- ◆ If pressure builds up, repeat the counterpressure check  
⇒ [page 34](#) .



The fuel tank has been emptied sufficiently, and the pressure has been released.

The fuel tank shut-off valve can be removed.



#### Note

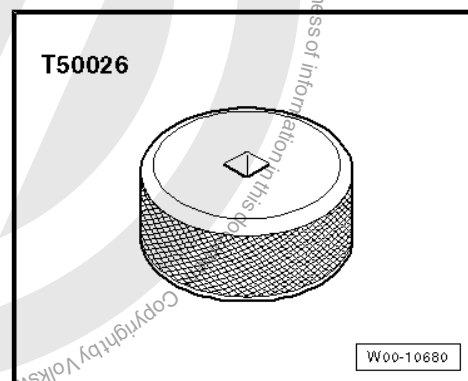
- ◆ Work on the fuel tank may only be performed if the counter-pressure check was successful.
- ◆ Natural gas tanks made of composite material must not be stored without pressure for longer periods of time.
- ◆ If the fuel tank shut-off valve was removed, then it must be reinstalled immediately after repairs to the fuel tank shut-off valve have been completed.
- ◆ After installation of the fuel tank shut-off valve , the fuel tank must be filled with natural gas or nitrogen within 24 hours (not, under any circumstances, with compressed air).

## 1.8 Releasing high pressure in fuel system

### 1.8.1 Releasing high pressure in fuel system

Special tools and workshop equipment required

- ◆ Handwheel - T50026-



- ◆ Vehicle diagnostic tester
- Remove underbody cladding beneath fuel tanks ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody cladding; Assembly overview – underbody cladding .



- Close mechanical shut-off valves on fuel tank shut-off valves -N361/N362- of all fuel tanks (natural gas).
- Connect vehicle diagnostic tester .
- Use vehicle diagnostic tester to release pressure in high-pressure line ⇒ Vehicle diagnostic tester.
- Switch on ignition.



#### Note

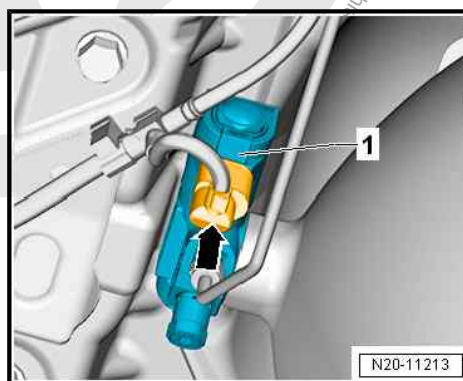
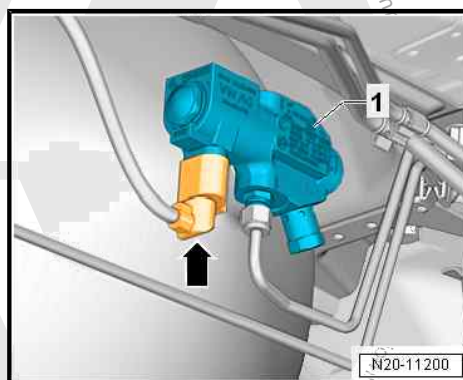
Only applies to Golf 2013, general description for all others

- Connect vehicle diagnostic tester , and start vehicle self-diagnosis using »ODIS«.
- Select engine code **CPWA**, and confirm.
- Select **01 Engine electronics**
- Select option **Release pressure in natural gas high-pressure line** in **Guided functions**.
- Follow instructions on vehicle diagnostic tester .
- Release and pull off connectors -arrow- on fuel tank shut-off valve 2 - N362- -1-.

Basic characteristics of vehicle

- Release and pull off connectors -arrow- on fuel tank shut-off valve 1 - N361- -1-.

This procedure is to prevent an accidental system start.





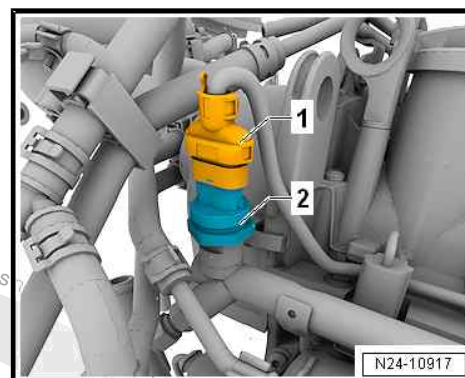
## 2 Senders and sensors



### Note

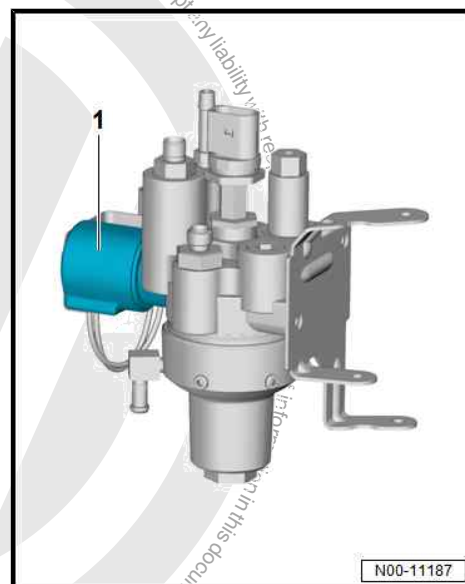
*Different versions ➔ Vehicle-specific workshop manual ➔ Rep. gr. 24 .*

**Gas rail temperature and pressure sensor - GX21- -2-, comprising gas rail sensor - G401- and temperature sender for alternative fuel system - G876- and electrical connector -1-**



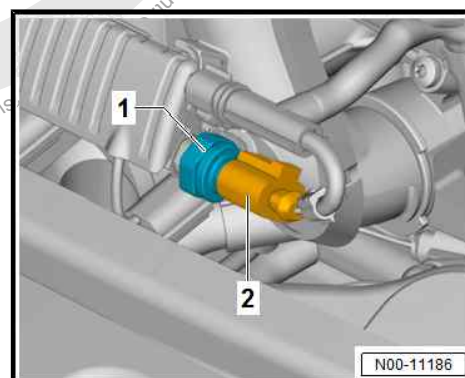
### 2.1 High-pressure valve for gas mode - N372-

The high-pressure valve for gas mode - N372- -1- is located on the gas pressure regulator. It opens the natural gas line from the natural gas tank via the 13 bar and then 9 bar regulator to the gas rail with gas injection valves N366-N369.



### 2.2 Gas rail sensor - G401- (low-pressure side)

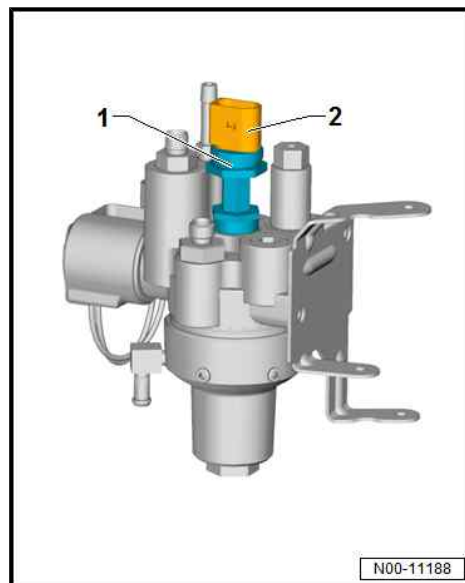
The gas rail sensor - G401- -1- determines the pressure on the low-pressure side. The engine control unit needs the signal to determine and adjust the injection time of the gas injection valves N366-N369. Item -2- shows the electrical connector.





## 2.3 Tank pressure sensor - G400-

The tank pressure sensor - G400- -1- determines the gas pressure on the high-pressure side. The signal is needed for the natural gas gauge and for natural gas operation. Item -2- shows the electrical connector.





## 24 – Mixture preparation - injection

### 1 Mixture preparation - injection

#### 1.1 Distinguishing between pressure sections of natural gas supply system

- The pressure sections are defined by the components of the natural gas system.
- The pressure system comprises the high-pressure section and the low-pressure section.
- Once the repair work is complete, different measures are necessary during the leakage test depending on the pressure section that has been worked on [⇒ page 9](#) .
- The allocation does not depend on the actual pressure in the respective section.
- Example: if the actual pressure in the high-pressure section is below 5 bar, proceed according to instructions described here [⇒ "1.1.1 High-pressure section", page 41](#) .

##### 1.1.1 High-pressure section

The high-pressure section comprises the following:

- ◆ All gas-conducting components from filler neck to (and including) pressure regulator.
- ◆ All components that belong to high-pressure section are marked »blue« in illustration.





### 1 - Natural gas tank

- ☐ Made of steel or fibre composite material, depending on type and version

### 2 - Tank shut-off valve with solenoid valve

- ☐ Number depends on type and vehicle model

### 3 - High-pressure line

### 4 - Natural gas tank

- ☐ Made of steel or fibre composite material, depending on type and version

### 5 - Tank shut-off valve with solenoid valve

- ☐ Number depends on type and vehicle model

### 6 - High-pressure line

### 7 - Manifold



#### Note

*Different designs possible depending on vehicle type*

- ☐ Connecting piece with 2 connections
- ☐ T-piece design
- ☐ Cross-piece design

### 8 - Filling connection with filler line

### 9 - High-pressure line

### 10 - Pressure regulator

- ☐ Pressure regulator serves as transition between

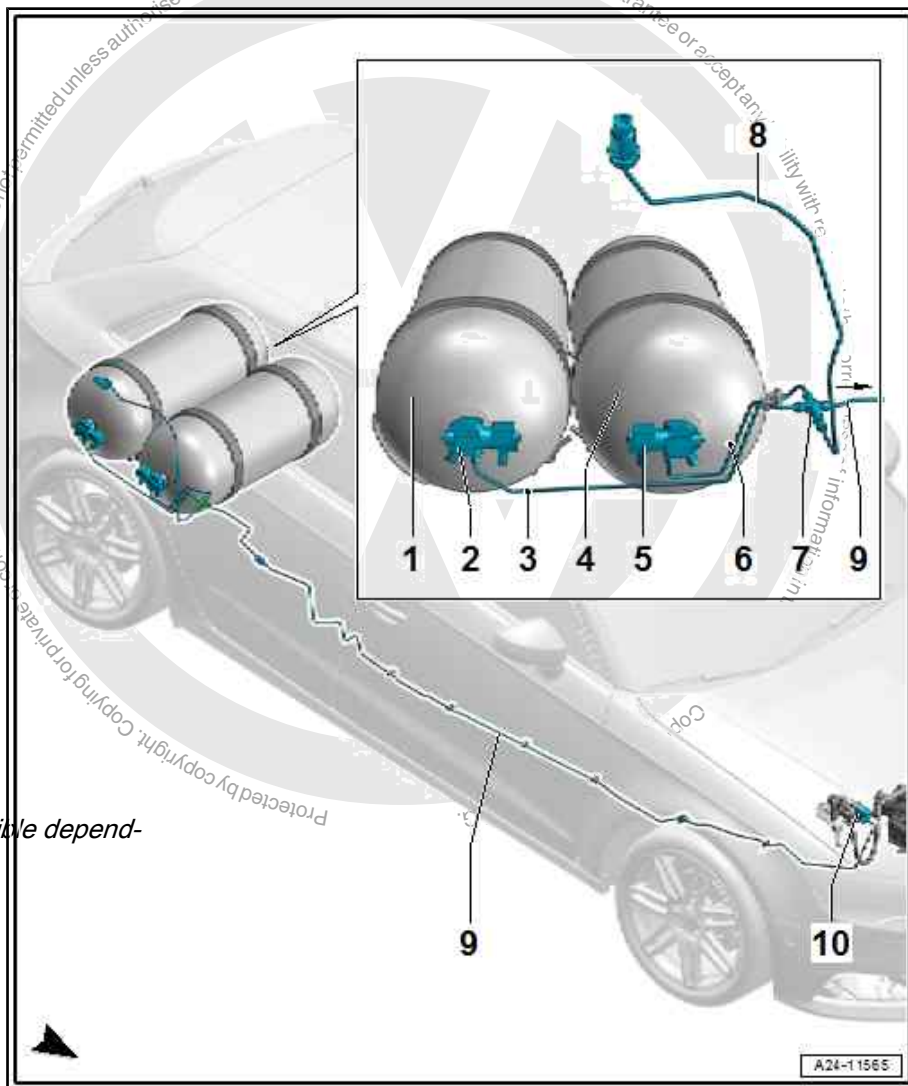
- ◆ High-pressure section and
- ◆ Low-pressure section

### Leakage test to be performed

- After working on gas system, perform leakage test. ⇒ [page 9](#)

## 1.1.2 Low-pressure section

The low-pressure section comprises all gas-conducting components from the pressure regulator and up to the gas injection valves »green«







## 9 - High-pressure line

- After working on gas system, perform leakage test. ➔ [page 9](#)

❑ (High-pressure section)

## 10 - Pressure regulator

- After working on gas system, perform leakage test. ➔ [page 9](#)
- ❑ Pressure regulator serves as transition between high-pressure and low-pressure section

## 11 - Low-pressure line

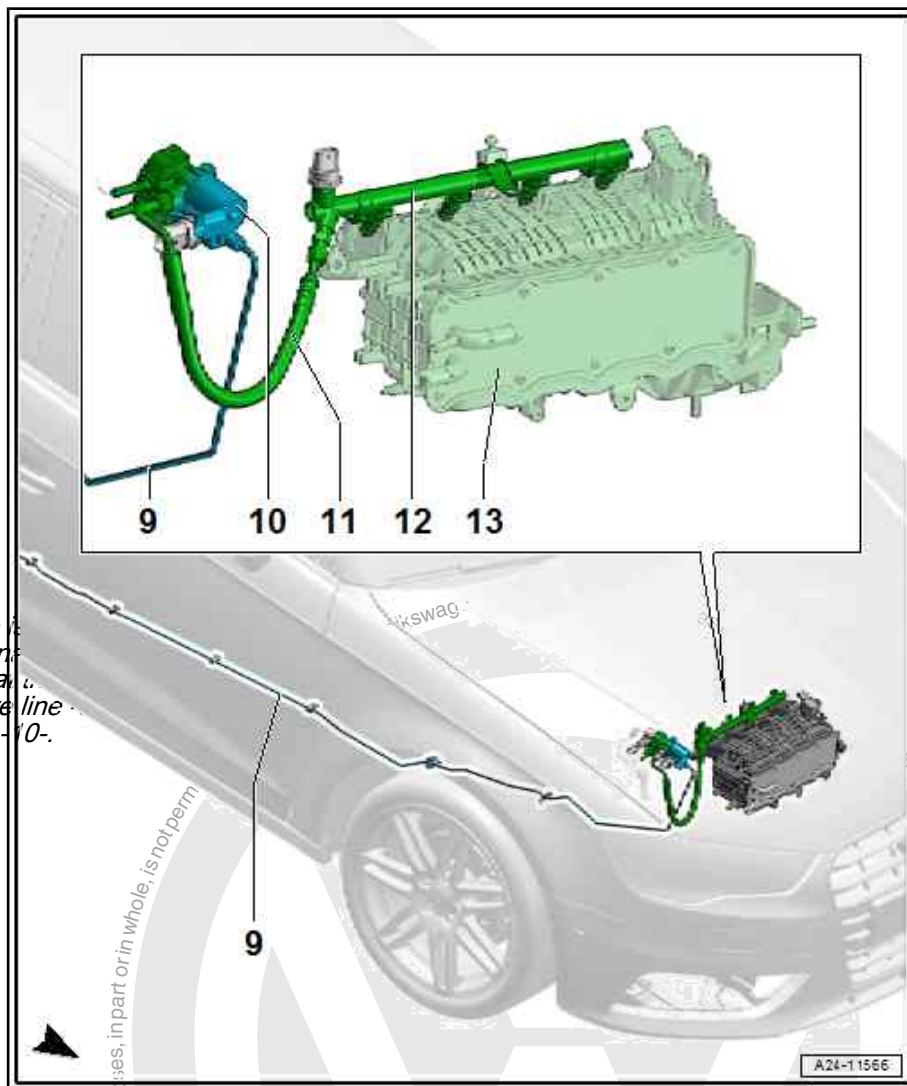


### Note

*If the low-pressure line is renewed, an additional test will be necessary at the outlet of the high-pressure line at the pressure regulator - 10-.*

## 12 - Gas rail with gas injection valves and pressure and temperature sender

## 13 - Intake manifold



## Leakage test to be performed

- After working on low pressure section, perform leakage test. ➔ [page 9](#)

## 1.2 High-pressure injectors N30 - N33

- All components of the gas system that were submitted for quality monitoring must always be sealed (use the original sealing caps from the genuine part).
- Replace damaged or leaking components of gas system ➔ Vehicle-specific workshop manual.

High-pressure injectors are cooled as fuel passes through them. This kind of cooling does not work with gas. Two measures have been developed to avoid unacceptably high temperatures.

The illustration shows the version for a Passat.



- ◆ A second Teflon ring with high thermal conductivity -1-.
- ◆ A heat sink made of aluminium that radiates the heat from the high-pressure injectors to the cylinder head -2-.

