

Workshop Manual

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**Air conditioning systems with refrigerant R1234yf -
general information**

Edition 02.2022



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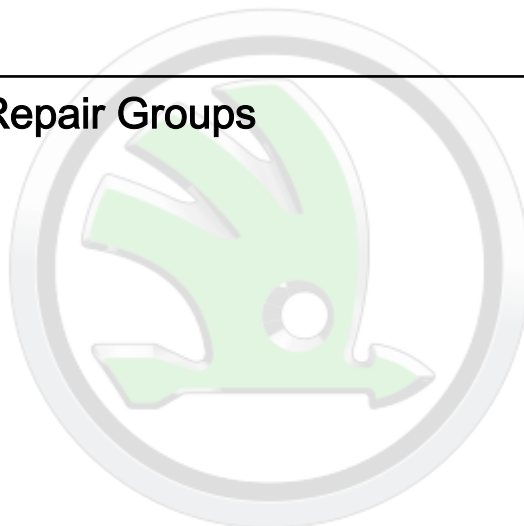


List of Workshop Manual Repair Groups

Repair Group

00 - Technical data

87 - Air conditioning system



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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 instructions

(SRL001959; Edition 02.2022)

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1.1 Safety precautions when working on air Conditioning systems



DANGER!

Risk of death and explosion from ignition sources

Risk of explosion from ignition sources in proximity of air conditioning systems and refrigerant containers. Escaping refrigerant can ignite and cause an explosion. Explosion can cause death or serious injuries.

Risk of fire due to ignition of the refrigerant oil spilled on hot vehicle surfaces (e.g. exhaust pipe, catalytic converter, particulate filter).

- ◆ ***Never bring ignition sources into the proximity of air conditioning systems and refrigerant containers.***
- ◆ ***Check the repair site after the repair and thoroughly clean it of any residues of spills.***
- ◆ ***Avoid electrostatic discharge, sparks from the impact of tools, and hot surfaces.***



Caution

Risk of damage to the refrigerant lines

The refrigerant lines may be destroyed if the inner lining is torn.

- ◆ ***Never bend refrigerant line to a radius less than $r = 100$ mm.***



1.2 Safety precautions when handling refrigerants



DANGER!

Risk of suffocation and poisoning by refrigerant

Refrigerant vapours can cause coughing and nausea, as well as suffocation and poisoning.

- ◆ *Never inhale refrigerant vapours.*
- ◆ *Only work on the refrigerant circuit and store refrigerant containers in well-ventilated spaces.*
- ◆ *Never work in the proximity of basements or above other low-lying areas.*
- ◆ *Switch on the extraction system.*



WARNING

Risk of frostbite from refrigerant!

Refrigerant may be ejected under pressure when you are working on the air conditioning system. This may cause frostbite on the skin and other parts of the body.

- ◆ *Wear protective gloves.*
- ◆ *Wear safety goggles.*
- ◆ *Evacuate the refrigerant circuit and immediately open the refrigerant circuit.*
- ◆ *If more than 10 minutes have elapsed since evacuation and the coolant circuit has not been opened, evacuate the refrigerant again. Pressure builds up in the refrigerant circuit as a result of secondary evaporation.*

1.3 Safety precautions for working on vehicles with start-stop system



WARNING

Risk of injury if engine starts unexpectedly!

The engine may start up unexpectedly on vehicles with activated start-stop system. To activate/deactivate the start-stop system, see the → operating instructions.

- ◆ *Deactivate start/stop system: switch off the ignition.*

1.4 Safety precautions when handling A/C service stations

- Before connecting the AC service station, make sure that the applicable shut-off valves are closed.
- Before disconnecting the AC service station from the air conditioning system, make sure that the filling/extraction process is complete.

- Once the cleaned refrigerant has been filled into an external pressurised gas cylinder from the AC service station/extraction system, the manual shut-off valves on the cylinder and the filling system must be closed.
- Do not expose the AC service station/extraction and filling system to humidity and do not use in a wet environment.
- Before performing maintenance on the AC service station, disconnect the power supply to the extraction and filling system.
- To reduce the risk of fire, avoid using an extension cable. However, if an extension cable is necessary, use a cable with a cross-section of at least 2.5 mm².
- In case of fire, remove the external cylinder.
- If oil forced out of the air conditioning system by the suction accumulator of the AC service station is into tapped off into the supplied beaker, make sure that it is later poured into a sealable container, because the oil contains a small quantity of refrigerant. Refrigerant must not be allowed to enter the environment.
- Always secure the AC service station against rolling away.

A/C service station with refrigerant R1234yf:

- Keep away from heat and direct sunlight and do not store or use at temperatures above 50 °C.
- Do not store or use in the proximity of basements or other low-lying areas.
- Only store and use in areas with adequate ventilation (all air replaced at least once per hour in workshops and three times per hour in low-lying areas, e.g. in assembly pits).

1.5 Safety measures for working on vehicles with high voltage system



DANGER!

Lethal danger due to high voltage

The high-voltage system is under high voltage. Death or severe injuries may result from electric shock.

- ◆ *Persons with electronic/medical life- and health-preserving devices in or on the body, may not work on the high-voltage system. For example, life- and health-maintaining devices include internal pain medication pumps, implanted defibrillators, pacemakers, insulin pumps, and hearing aids.*
- ◆ *Have the high-voltage system disconnected by a suitably qualified person.*

**WARNING**

Risk of injury due to automatic engine start.

With electric and hybrid vehicles, it is difficult to detect an activated readiness to drive. Possibility to clamp and retract parts of the body.

- ◆ *Switch off ignition.*
- ◆ *Place the ignition key outside of the vehicle interior.*

**Caution**

Risk of damage from high-voltage cables

Improper handling can damage the insulation of high-voltage cables or high-voltage connectors.

- ◆ *Never rest on high-voltage cables and high-voltage connectors.*
- ◆ *Never support tools using high-voltage cables and high-voltage connectors.*
- ◆ *Never bend or curve hoses or high-voltage cables.*
- ◆ *When plugging in the high-voltage connectors, observe the coding.*

**WARNING**

Risk of injury due to activated stand-by air conditioning.

For electric and hybrid vehicles with activated stand-by air conditioning, the stand-by air conditioning can switch on unintentionally. Parts of the body can be trapped and drawn in by automatically starting radiator fans.

- ◆ *Deactivate stand-by air conditioning.*

1.6 Safety measures when working in the vicinity of high-voltage components

**DANGER!**

Lethal danger due to high voltage

The high-voltage system is under high voltage. Death or serious physical injury due to electric shock in the event of damage to high-voltage components and high-voltage cables.

- ◆ *Perform a visual inspection of the high-voltage components and high-voltage cables.*
- ◆ *Never use cutting, deforming or sharp-edged tools.*
- ◆ *Never weld, solder, thermally bond or use hot air.*

1.7 Safety precautions when handling pressurised containers



DANGER!

Risk of death and explosion from ignition sources

Risk of death and explosion from ignition sources in proximity of air conditioning systems and refrigerant containers. Escaping refrigerant can ignite and cause an explosion. Explosion can cause death or serious injuries.

- ◆ *Never bring ignition sources into the proximity of air conditioning systems and refrigerant containers.*
- ◆ *Avoid electrostatic discharge, sparks from the impact of tools, and hot surfaces.*

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2 Laws and regulations

⇒ [a2.1 nd directives", page 6](#)

⇒ [a2.2 refrigerant circuit with other refrigerants", page 7](#)

⇒ [a2.3 t work", page 7](#)

2.1 Regulations and directives



Note

- ◆ *The effects of the climate change can now be observed worldwide. The climate protection is therefore one of the most important tasks of mankind. This task presents huge challenges for all the parties concerned.*
- ◆ *The global climate protection goals are defined, among other things, in the so-called Kyoto Protocol. In this protocol are included carbon dioxide reduction targets as well as targets for reducing fluorinated greenhouse gases such as for the refrigerant R134a due to the high greenhouse potential.*
- ◆ *Vehicles type-tested before 2011 may only be brought into circulation for the first time with refrigerant R134a until 31/12/2016 (this applies to countries in the EU – other regulations may apply in countries outside the EU). From 01/01/2017, only vehicles whose refrigerant circuit is filled with a refrigerant with a global warming potential of less than 150 may be brought onto the market in EU countries. The refrigerant R1234yf meets the requirements of Regulation (EC) No. 706/2007.*

A large number of relevant laws have been adopted for the automotive industry, e.g. at European level:

A number of regulations have been adopted by the European Community that apply when handling refrigerants, including:

- ◆ Regulation (EC) No. 1005/2009
- ◆ Regulation (EC) No. 2037/2000
- ◆ Regulation (EU) No. 517/2014
- ◆ Regulation (EC) No. 706/2007
- ◆ Regulation (EC) No. 307/2008
- ◆ Directive 2006/40/EC



Note

Other or additional laws and regulations may apply in other countries.

Maintenance and repairs to the refrigerant circuit of the air conditioning system

The refrigerant circuit of the air conditioning system may only be repaired and serviced by personnel who meet the training requirements of Regulation (EC) No. 307/2008 (applies to countries where the regulation is applicable; other laws or regulations may apply in other countries).

In general the following applies:

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Operation, maintenance, taking out of operation, take-back obligation:

- ◆ During the operation, when carrying out repair work and when taking products out of operation that contain refrigerants, contrary to the state of the art, it is prohibited to let those agents escape into the atmosphere which are contained in these products.
- ◆ Therefore it is recommended to keep records on the initial quantity for the operation and maintenance work so that a proof of use can be submitted at the request of the responsible authority, if required. It is currently no longer a requirement to keep a record sheet in the EC following a 2005 Regulation of the European Parliament. Other regulations may be valid in countries that do not belong to the EC.
- ◆ Distributors of substances and preparations referred to in the above regulations are required to take back such substances and preparations after use or to ensure they are taken back by a third party designated by them.
- ◆ Maintenance work on products and those products which are taken out of operation that contain refrigerants, referred to in the above regulations, as well as take-back of the substances and preparations referred to in these regulations, must only be carried out by personnel with the required expertise (training requirements) and technical equipment.

Recycling and Waste Act (Kreislaufwirtschaftsgesetz - KrWG) and treatment and disposal of contaminated refrigerant and refrigerant oil

The rules and regulations of the applicable country must be complied with.

2.2 Filling a refrigerant circuit with other refrigerants

Air conditioning systems that have been developed and designed for refrigerant R1234yf must not be filled with any other refrigerant, e.g. R134a!



Vehicles that are type-tested with refrigerant R1234yf must not be filled with refrigerant R134a under current law!

2.3 Safety at work

- ◆ General occupational safety regulations according to VBG (Verwaltungs-Berufsgenossenschaft, Employer's Mutual Indemnity Association) e.g. VGB 20. Accident prevention regulations (Unfallverhütungsvorschriften, UVV) for "coolers, heat pumps and cooling systems" and VGB 1. General regulations "General regulations and obligations of the contractor" and "obligations of the insured".
- ◆ The refrigerant circuit of the air conditioning system may only be repaired and serviced by personnel who meet the training requirements of Regulation (EC) No. 307/2008 (applies to countries where the regulation is applicable; other laws or regulations may apply in other countries).
- ◆ Observe the instructions that apply at the workplace.



3 Repair instructions

⇒ [o3.1 f cleanliness", page 8](#)

⇒ [f3.2 or the refrigerant circuit", page 8](#)

⇒ [a3.3 nd refrigerant oil", page 9](#)

⇒ [p3.4 ressurised containers", page 11](#)

⇒ [r3.5 efrigerant", page 13](#)

3.1 Rules of cleanliness

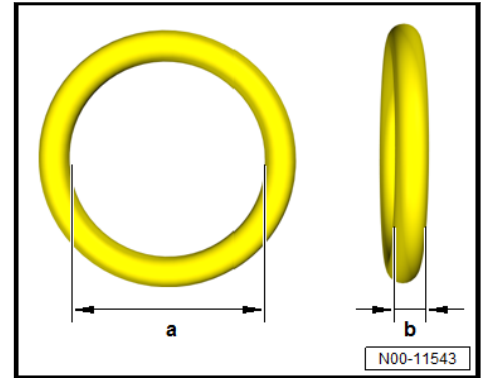
Even slight contamination can lead to defects, so that the following rules for cleanliness must be observed when working on the air conditioning system:

- ◆ Close any open lines and connections immediately using a clean plug, e.g. from the screw plug set for engine -VAS 6122-.
- ◆ Place removed parts on a clean surface and cover, using lint-free cloths.
- ◆ Carefully cover or close opened components if the repair is not completed immediately.
- ◆ Only install clean parts: remove spare parts from their wrapping immediately before fitting. Do not use any parts which have been stored unwrapped (e.g. in tool boxes etc.).
- ◆ When the system is open, do not use compressed air.
- ◆ Protect electrical plug connections from dirt and moisture and only connect them when dry.

3.2 Seals for the refrigerant circuit

- ◆ Only use seals that are resistant to refrigerant R1234yf and applicable refrigerant oils. Seals can no longer be identified by colour. Black and coloured seals are used, so only use seals that can be definitely assigned ⇒ Electronic Catalogue of Original Parts "ETKA"
- ◆ Seals that have been developed for refrigerant R134a are not always suitable for refrigerant R1234yf, so only use seals that can be definitely assigned ⇒ Electronic Catalogue of Original Parts "ETKA"
- ◆ Only use seals once.
- ◆ Replace sealing rings after removal.
- ◆ Moisten sealing rings with the correct refrigerant oil before installation.
- ◆ Make sure that the sealing rings are correctly seated on the pipe or in the groove.
- ◆ Make sure you perform your work cleanly. Even very minor contamination, such as a single hair, may cause the seal to leak.
- ◆ Only install sealing rings that are resistant to refrigerant R1234yf and the applicable refrigerant oil. These sealing rings may be marked with colour to avoid confusion ⇒ Electronic Catalogue of Original Parts "ETKA".

Dimensions -a- and -b- vary depending on where the sealing ring is installed ⇒ Electronic Catalogue of Original Parts "ETKA".



Further information and instructions: ⇒ [1.2.12](#), page 50

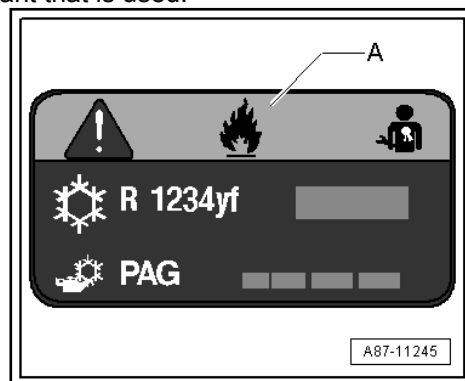
3.3 Refrigerant and refrigerant oil

⇒ [i3.3.1 nstructions for repairs involving refrigerant and refrigerant oil](#), page 9

⇒ [m3.3.2 achine oil](#), page 10

3.3.1 Important instructions for repairs involving refrigerant and refrigerant oil

- You must not fill refrigerant R134a into an air conditioning system designed for refrigerant R1234yf.
- You must not fill refrigerant R1234yf into an air conditioning system designed for refrigerant R134a.
- The refrigerant oils specifically developed for refrigerant circuits with refrigerants R1234yf or R134a may only be used in a refrigerant circuit that is filled with a different refrigerant if the corresponding approvals have been obtained for this purpose ⇒ Electronic Catalogue of Original Parts "ETKA" and ⇒ Heating, Air Conditioning; Rep. gr. 00; Technical data.
- A/C service stations that come into contact with the refrigerant must only be used for the intended refrigerant.
- An information plate -A- is attached in the engine compartment at the lock carrier or in the plenum chamber, which indicates the refrigerant that is used.



- Never mix different refrigerants.
- Depending on design and date of manufacture, this may also indicate the GWP value of the refrigerant that is used.
- To ensure that only refrigerant R1234yf with a specific purity is drawn into the R1234yf AC service station, a gas analysis must be performed before the refrigerant circuit is emptied ⇒ [g2.3 as analysis for the refrigerant](#), page 107 .

**Note**

If the gas analysis shows that the refrigerant R1234yf is contaminated by another gas, it must be extracted from the refrigerant circuit – see ⇒ [c2.13 contaminated refrigerant into a recycling cylinder for analysis, treatment or disposal](#), page 133 – and analysed, treated or disposed of as a gas of unknown composition in accordance with statutory provisions ⇒ [g2.3 as analysis for the refrigerant](#), page 107 .

3.3.2 Refrigerant machine oil**WARNING**

There is a risk of acid burns from atomised refrigerant oil. This may injure the eyes or other parts of the body.

Risk of fire due to ignition of the refrigerant oil spilled on hot vehicle surfaces (e.g. exhaust pipe, catalytic converter, particulate filter).

- ◆ *Wear protective gloves.*
- ◆ *Wear safety goggles.*
- ◆ *Never inhale atomised refrigerant oil.*
- ◆ *Check the repair site after the repair and thoroughly clean it of any spilled oil.*

- ◆ Refrigerant oil mixes (about 10-40 %, depending on the compressor type and refrigerant volume) with the refrigerant, constantly circulates in the circuit and lubricates the moving parts.
- ◆ In combination with R1234yf air conditioning systems, special synthetic refrigerant oils such as poly-alkyl-glycol (PAG) oil are used with additives specifically selected for the refrigerant. This is necessary because, for example, mineral oil does not mix with R1234yf and undesirable reactions may occur with the refrigerant circuit or the parts of the refrigerant circuit if these additives are not added. In addition, the parts of the R1234yf air conditioning system may be attacked if the mixture flows through the refrigerant circuit under pressure and at high temperatures or the lubricating film in the AC compressor tears. The use of non-approved oils may cause the air conditioning system to fail, so only refrigerant oils approved for refrigerant R1234yf may be filled ⇒ Electronic Catalogue of Original Parts "ETKA".
- ◆ Oil type for coolant R124yf in motor vehicles: PAG oil with specific additives for refrigerant R1234yf (poly-alkyl-glycol with specific additives)
- ◆ The main properties are a high dissolving power with refrigerant, good lubricating properties, acid-free and very low water content. For this reason, only very specific oils may be used; A list of approved refrigerant oils and filling capacities can be found in the ⇒ Electronic Catalogue of Original Parts "ETKA" and ⇒ Heating, Air conditioning system; Rep. gr. 00; Technical data (vehicle-specific repairs manual).
- ◆ The PAG oils which are suitable for refrigerant R1234yf are strongly hygroscopic and cannot be always be mixed with other oils. Therefore, only use approved refrigerant oils.
- ◆ Refrigerant oil ages when exposed to humidity and acids; it becomes dark, viscous and corrodes metals. Therefore,

keep containers of refrigerant oil closed to protect against penetrating humidity; re-close opened containers immediately.

- ◆ Because of its chemical properties, refrigerator oil must not be disposed of with engine oil or gearbox oil. Used refrigerant oil of unknown origin must be disposed of (following local regulations) ⇒ Škoda-ServiceNet.
- ◆ For refrigerant circuits with refrigerant R1234yf, only oil approved for the refrigerant and the installed air conditioning compressor may be used ⇒ Electronic Catalogue of Original Parts "ETKA" and ⇒ Heating, Air Conditioning; Rep. gr. 00; Technical data.
- ◆ Refrigerant oil developed for refrigerant R134a is not suitable for refrigerant circuits with refrigerant R1234yf (lacks specific additives).
- ◆ Refrigerant oil developed for refrigerant R1234yf may be suitable for refrigerant circuits with refrigerant R134a - see ⇒ Electronic Catalogue of Original Parts "ETKA" and ⇒ Heating, Air Conditioning; Rep. gr. 00; Technical data.



Note

- ◆ *Usage instructions for the refrigerant oil can be found on the supply cylinder.*
- ◆ *The date can be ignored if the supply cylinder is sealed leak-tight.*
- ◆ *Refrigerant oil from a sealed leak-tight supply cylinder can also be used after the date specified on the supply cylinder.*

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Note

Keeps containers with refrigerant oil and the refrigerant circuit itself closed at all times.

3.4 Handling pressurised containers

Keep containers tightly closed in a well-ventilated and cool location!

The refrigerant is heavier than air and therefore disperses along the floor in particular when gas escapes.

Keep away from heat and direct sunlight and do not store at temperatures above 50 °C.

Do not store in the proximity of basements or other low-lying areas.

Only store in areas with adequate ventilation.

Keep container away from sources of ignition!

Do not smoke where refrigerant R1234yf is present. Also take precautionary measures to prevent static discharge.

Secure container against falling over!

Secure upright cylinders against falling and cylinders that are lying down against rolling away!

Do not throw the reservoir!

When the reservoirs fall, they can become severely deformed causing them to tear open. The refrigerant evaporates abruptly,



thus releasing considerable forces. Bottle parts which go flying can cause serious injuries.

To protect the bottle valves, the bottles may only be transported with the protective cap screwed on.

If improperly transported, the bottle valve can break off.

Do not place near radiators!

Increased temperatures can occur next to the radiators. Higher temperatures also mean higher pressures, whereby the permissible pressure for the reservoir can be exceeded.

Do not heat above 50 °C.

To prevent hazard, the German Pressure Container Regulations stipulate that containers with refrigerant must not be heated above 50 °C.

Do not heat in an uncontrolled manner.

Under no circumstances heat on an open flame. Local overheating may cause structural changes in the material of the container, which reduces the pressure of the container. Moreover, there is the danger of refrigerant decomposition by local overheating.

Close and seal empty containers.

In any case, empty refrigerant reservoirs must be sealed to prevent any humidity from penetrating. Humidity leads to corrosion of reservoirs made of steel. This weakens the wall of the reservoir. In addition, rust particles that get into the refrigerant circuit from the containers cause malfunctions in the circuit.



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3.5 Handling refrigerant

Note

- ◆ *The refrigerant has an almost imperceptible distinctive odour and therefore you normally are not aware of it.*
- ◆ *The refrigerant gas is heavier than air, collect in low-lying areas such as inspection pits, basement rooms and depressions, where it displaces the ambient air and therefore oxygen as well. Storing the refrigerant in low-oxygen environments can be life-threatening.*
- ◆ *If liquid refrigerant escapes e.g. because of a leak, it vaporises at an ambient pressure of approx. 1 bar at around -29.4 °C. If the refrigerant condenses on the skin, it causes cold burns or frostbite. Sensitive parts of the body, such as the cornea of the eyes and the mucous membranes are particularly at risk; serious cold burns can be life-threatening.*
- ◆ *Refrigerant gas is flammable; electrostatic discharge, sparks from the impact of tools, hot surfaces and open flames can ignite a mixture of the refrigerant R1234yf and the ambient air. However, the refrigerant only burns in the present of a supporting flame or in the region of a hot surfaces; the refrigerant flame extinguishes if, for example, the supporting flame is no longer present.*
- ◆ *The refrigerant decomposes at a flame or in contact with a hot surface. There is risk of poisoning if the poisonous products of decomposition are inhaled. If the odour is pungent, then the products of decomposition have already formed. It must be avoided by all means to breathe in these substances, otherwise damage to the respiratory tract, lungs and other organs, could be the consequence.*
- ◆ *Specific risks posed by the refrigerant, material details, etc. can be found in the safety data sheets. Safety data sheets for the refrigerant, refrigerant oil, etc. can be obtained from the ⇒ Škoda ServiceNet.*
- Do not weld, braze or soft-solder any parts of the charged air conditioning system. This rule holds for welding and soldering work where there is the risk that parts of the air conditioning may heat up. During paint repairs, the temperature of the objects placed in the drying oven or in its pre-heating zone must not exceed 80 °C.

Reason

Heat leads to high pressure in the system, which can cause the system's pressure relief valve to open.

Precautions during repair work:

- Empty the refrigerant circuit with the AC service station ⇒ [w2 ith the A/C service station”, page 102](#) .

Note

Damaged or leaky components of the air conditioning system must not be repaired by welding or soldering, but must be replaced.

Containers (e.g. filling cylinders for the A/C service station) with refrigerant must never be overfilled, heated excessively or exposed to direct sunlight.



Reason

Refrigerant expands when heated.

Precautions:

- When filling and storing pressurised gas cylinders (reusable and recycling cylinders etc.), the applicable regulations, technical rules and laws must be observed.
- Never fill the containers completely with liquid refrigerant. With sufficient expansion space (gas blanket) the container will burst as the temperature rises with catastrophic consequences ⇒ [p6.2 roperties", page 21](#) .

Under no circumstances should refrigerant be filled into systems and containers that contain air.

Precautions:

- Evacuate systems and containers before filling with refrigerant ⇒ [w2 ith the A/C service station", page 102](#) .



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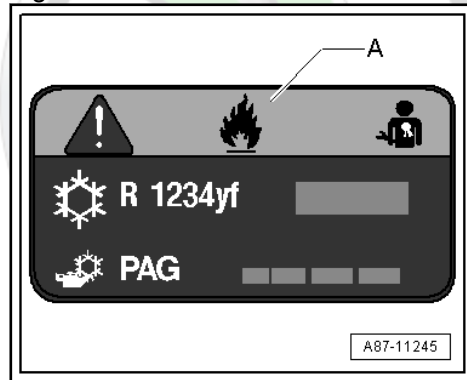
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4 Denomination

⇒ p4.1 late for refrigerant circuit", page 15

4.1 Information plate for refrigerant circuit

- ◆ The information plate -A- provides information about the type of refrigerator that is used, the volume of refrigerant filled in production and the refrigerant oil that is filled.



- ◆ Symbols on the information plate -A- indicates the hazards that may occur when handling the refrigerant and working on the refrigerant circuit.
- ◆ It may also note the test and other standards. SAE J639 describes the safety standards for automotive air conditioning systems. SAE J842 describes that only components and materials approved for refrigerant R1234yf may be used and SAE J2845 states that only trained and certified personnel may perform repair or service operations on the refrigerant circuit of the air conditioning system.
- ◆ Depending on design and date of manufacture, this may also indicate the GWP value of the refrigerant that is used.
- ◆ The filling capacities specified on the information plate -A- and the type of the refrigerant oil indicate the status at the date of vehicle manufacture. The current values must always be taken from the vehicle-specific repairs manual ⇒ Heating, Air conditioning system; Rep. gr. 00; Technical data (vehicle-specific repairs manual).

Note

Regardless of the information on the information plate -A-, country-specific laws, regulations and standard must always be complied with. In the European Union, for example, this means the applicable EC regulations.



5 Technical data

⇒ [c5.1 apacities for refrigerant", page 16](#)

⇒ [c5.2 apacities for refrigerant oil", page 16](#)

⇒ [d5.3 ata sheets", page 16](#)

5.1 Filling capacities for refrigerant

The filling capacities for refrigerant R1234yf are provided in the vehicle-specific repairs manual ⇒ Heating, Air Conditioning; Rep. gr. 00; Technical data.

5.2 Filling capacities for refrigerant oil

The filling capacities for refrigerant oil are provided in the vehicle-specific repairs manual ⇒ Heating, Air Conditioning; Rep. gr. 00; Technical data.

5.3 Safety data sheets

Safety data sheets are currently filed in the ⇒ Škoda-Service-Net.

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6 Technical and physical principles

⇒ [o6.1 f the air-conditioning technology”, page 17](#)

⇒ [p6.2 roperties”, page 21](#)

⇒ [f6.3 eatures”, page 27](#)

⇒ [a6.4 nd purpose of the air conditioning system”, page 28](#)

⇒ [s6.5 ources of information”, page 29](#)

6.1 Principles of the air-conditioning technology

⇒ [p6.1.1 rinciples of the air conditioning system”, page 17](#)

⇒ [a6.1.2 nd boiling point of the refrigerant”, page 18](#)

⇒ [p6.1.3 ressure table for the refrigerant”, page 19](#)

6.1.1 Physical principles of the air conditioning system

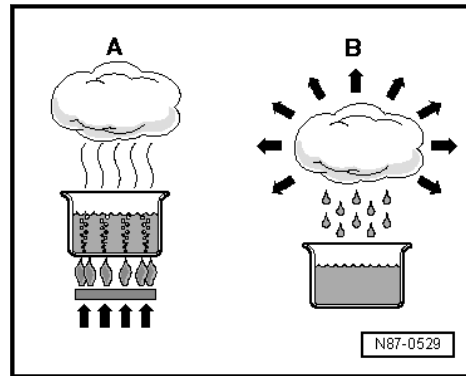
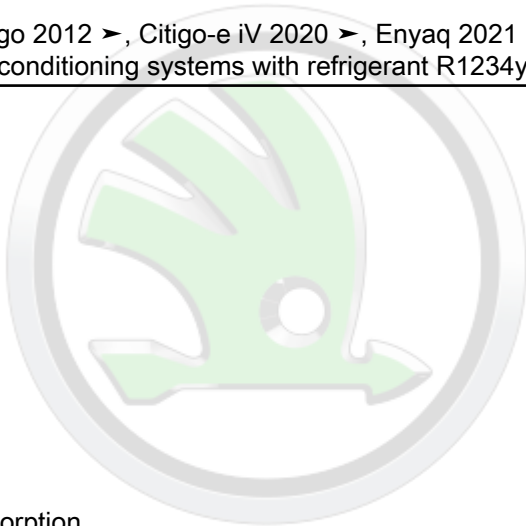
The four known aggregate phases of water also exist for the refrigerants of the air conditioning system.



- 1 - gaseous (not visible)
- 2 - vapor
- 3 - liquid
- 4 - solid

If water is heated in a container (heat absorption) rising water vapour is visible. If the vapour is heated even more through heat absorption, the visible vapour becomes invisible gas. The procedure is reversible. If the heat content is extracted from the gaseous water -A-, this first creates vapour -B-, after which the vapour turns into water and then into ice.

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A - Heat absorption

B - Heat dissipation

Heat always flows from a warmer substance to a colder substance

Each substance consists of a mass of moving molecules. The fast moving molecules of a warmer substance give up a part of their energy to the molecules which are slower and have less heat. This slows down the molecular movement of the warmer substance and the molecular movement of the colder substance is accelerated. This happens until the molecules of both substances move with the same speed. They then have the same temperature and no further heat exchange takes place.

6.1.2 Pressure and boiling point of the refrigerant

The boiling point of a liquid as specified in the tables always refers to the atmospheric pressure (1 bar absolute pressure). If the pressure of a liquid changes, so does its boiling point.



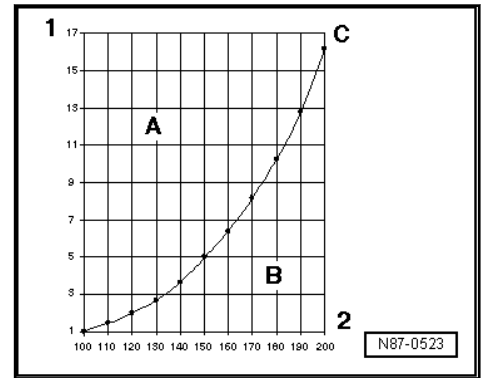
Note

The pressure is stated in different units; 1 MPa (mega Pascal) equals 10 bar overpressure or 145 psi; 1 bar absolute pressure approximately equals the ambient pressure (atmospheric pressure) at 0 bar overpressure.

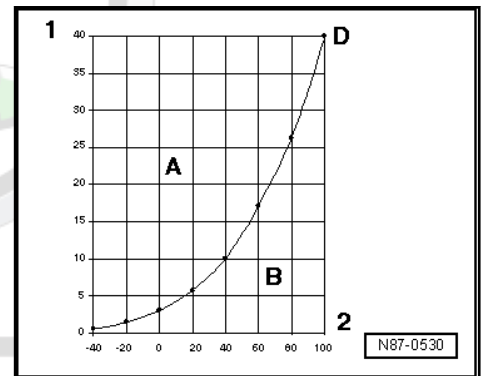
It is known, for example, that water boils at lower temperatures if the pressure is lower.

Based on the vapour pressure curves for water and refrigerant R1234yf, we can see, for example, that while maintaining pressure, by lowering the temperature, the vapour turns to liquid (in the condenser), or that, for example, by reducing the pressure, the refrigerant turns from the liquid state into the vapour state (evaporator).

Vapour pressure curve of water



- A - liquid
 - B - gaseous
 - C - Vapour pressure curve of water
 - 1 - Pressure of the liquid in bar (absolutely)
 - 2 - Temperature in °C
- Vapour pressure curve of refrigerant R1234yf



- A - liquid
- B - gaseous
- D - Vapour pressure curve of refrigerant R1234yf
- 1 - Pressure of the liquid in bar (absolutely)
- 2 - Temperature in °C

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 **Note**

The vapour pressure curves of the two refrigerants R1234yf and R134a are very similar over a wide range of temperatures. The different in pressure between the two refrigerants in the temperature range from 0 °C to +50 °C is just approx. 0.2 bar, for example. It is therefore not possible to distinguish between the two refrigerants according to measured pressures ⇒ [p6.1.3 re-ssure table for the refrigerant](#), page 19 . It is only possible to differentiate by using appropriate sensors that can analyse the chemical structure of the refrigerant ⇒ [o6.2.16 f refrigerant R1234yf](#), page 26 .

6.1.3 Vapour pressure table for the refrigerant

The vapour pressure table is decisive for each refrigerant used in the literature for refrigeration technicians. From this table can



be read which vapour pressure above the liquid column in the vessel pushes when the temperature of the reservoir is known.

As for there is a known, characteristic vapour pressure table for each refrigerant, it is possible to identify the refrigerants that have different vapour pressure over a specific temperature range (not applicable if differentiating R1234yf and R134a, which have very similar vapour pressures ⇒ [a6.1.2 nd boiling point of the refrigerant](#), page 18) by measuring the pressure and temperature.



Note

- ◆ *This method of differentiation only applies to pure refrigerants that have sufficiently different vapour pressures. If different refrigerants are mixed to form a new refrigerant (e.g. 3 different refrigerant to form refrigerant R407C), the vapour pressure is calculated from the vapour pressures of the individual refrigerants and their proportion in the mixture.*
- ◆ *At absolute pressure, "0 bar" corresponds to an absolute vacuum. The normal ambient pressure (overpressure) corresponds to "1 bar" absolute pressure. On the scales of most pressure gauges, "0 bar" corresponds to an absolute pressure of one bar (recognizable by the indication "-1 bar" below "0").*
- ◆ *The pressure is stated in different units; 1 MPa (mega Pascal) equals 10 bar overpressure or 145 psi; 1 bar absolute pressure approximately equals the ambient pressure (atmospheric pressure) at 0 bar overpressure.*
- ◆ *The vapour pressures of the two refrigerants R1234yf and R134a are very similar over a wide range of temperatures. It is therefore not possible to distinguish between the two refrigerants according to measured pressures. It is only possible to differentiate by using appropriate sensors that can analyse the chemical structure of the refrigerant ⇒ [o6.2.16 f refrigerant R1234yf](#), page 26 .*

Temperature in °C	Pressure in bar (overpressure) R1234yf
-40	-0.40
-30	-0.01
-25	0.12
-20	0.50
-15	0.83
-10	1.21
-5	1.65
0	2.15
5	2.72
10	3.36
15	4.09
20	4.90
25	5.81
30	6.82
35	7.93
40	9.17
45	10.52
50	12.01

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Temperature in °C	Pressure in bar (overpressure) R1234yf
55	13.64
60	15.41
65	17.35
70	19.46
75	21.75
80	24.24
85	26.94
90	29.09

6.2 Physical properties

⇒ [R6.2.1 1234yf", page 21](#)

⇒ [h6.2.2 azards of refrigerant R1234yf", page 22](#)

⇒ [a6.2.3 nd chemical properties of refrigerant R1234yf", page 22](#)

⇒ [p6.2.4 oint", page 22](#)

⇒ [a6.2.5 spect of the refrigerant R1234yf", page 23](#)

⇒ [n6.2.6 ames and designations of the refrigerant R1234yf", page 23](#)

⇒ [a6.2.7 nd odour of refrigerant R1234yf", page 24](#)

⇒ [p6.2.8 ressure of refrigerant R1234yf", page 24](#)

⇒ [p6.2.9 roperties of refrigerant R1234yf", page 24](#)

⇒ [o6.2.10 f refrigerant R1234yf in contact with metals and plastics", page 24](#)

⇒ [t6.2.11 emperature/critical pressure of refrigerant R1234yf", page 25](#)

⇒ [o6.2.12 ontent of refrigerant R1234yf", page 25](#)

⇒ [o6.2.13 f refrigerant R1234yf", page 25](#)

⇒ [f6.2.14 actor of refrigerant R1234yf", page 25](#)

⇒ [o6.2.15 f leaks in a refrigerant circuit with refrigerant R1234yf", page 26](#)

⇒ [o6.2.16 f refrigerant R1234yf", page 26](#)

6.2.1 Refrigerant R1234yf

- ◆ The evaporation and condensation process is the procedure used for all air conditioning systems in vehicles. In this process, a substance (the refrigerant) is conveyed in a circuit in a closed system.
- ◆ The process uses a substance with a low boiling point, which is described as a refrigerant – in this case, R1234yf.
- ◆ The refrigerant R1234yf is known by various trade names (e.g. HFO 1234yf, Opteon 1234yf etc.).
- ◆ Only approved refrigerant at the required purity may be used for the air conditioning system ⇒ [o6.2.16 f refrigerant R1234yf", page 26](#) .
- ◆ Refrigerant R1234yf is a halogenated hydrocarbon compound with the chemical designation "2,3,3,3-Tetrafluoroprop-1-ene", which boils at -29.4 °C and a vapour pressure of "1 bar".



6.2.2 Potential hazards of refrigerant R1234yf

- ◆ The refrigerant is flammable at certain mixing ratios with ambient air ⇒ [a6.2.3 nd chemical properties of refrigerant R1234yf", page 22](#) and ⇒ [o6.2.13 f refrigerant R1234yf", page 25](#) .
- ◆ Rapid evaporation of the liquid can cause frostbite.
- ◆ High concentrations of vapour can cause headaches, dizziness, drowsiness, sleepiness and nausea and even loss of consciousness.

6.2.3 Physical and chemical properties of refrigerant R1234yf

The most important properties and safety instructions for refrigerant R1234yf are provided below. Comprehensive information is provided on the applicable safety data sheets.

Chemical formula	CF ₃ CF=CH ₂
Chemical designation	2,3,3,3-Tetrafluoroprop-1-en, HFO-1234yf
Boiling point at 1 bar	-29.4 °C
Solidification point	-152.2 °C
Critical temperature	94.7 °C
Critical pressure	32.82 bar (overpressure) 33.82 bar (absolute pressure)
Self-ignition temperature	405 °C at 1.02 bar (absolute pressure)
Flammability	Flammable gas ◆ Lower explosion limit 6.2% (volume) ◆ Upper explosion limit 12.3% (volume)
Form	Compressed, liquefied gas
Colour	Colourless
Odour	Weak distinctive odour

6.2.4 Critical point

The critical point (critical temperature and critical pressure) means that there is no divide over the same interface between the surface of the liquid and the gas.

A substance is always gaseous when it is above its critical point.

At temperatures below the critical point, all types of refrigerants in pressurised containers have a liquid and a gas phase, which means that there is a gas blanket above the liquid.

As long as gas is still present in the tank aside from liquid, the pressure depends upon the ambient temperature ⇒ [p6.1.3 re-ssure table for the refrigerant", page 19](#) .

 Note

- ◆ *The refrigerants used in motor vehicles must not be substituted for each other. Only the refrigerant specified for the specific air conditioning system may be used.*
- ◆ *The vapour pressures of the two refrigerants R1234yf and R134a are very similar over a wide range of temperatures, so that the vapour pressure cannot be used to differentiate between the two refrigerants. It is only possible to differentiate by using appropriate sensors that can analyse the chemical structure of the refrigerant ⇒ [o6.2.16 f refrigerant R1234yf](#), page 26.*

6.2.5 Environmental aspects of the refrigerant R1234yf

- ◆ R1234yf is a fluorinated hydrocarbon (PFC) and contains no chlorine.
- ◆ R1234yf has a shorter atmospheric life than refrigerant R134a and therefore causes less of a greenhouse effect (has lower global warming potential (GWP)).
- ◆ R1234yf does not attack the ozone layer – its ozone depletion potential (ODP) is zero (as for R134a).
- ◆ The global warming potential (GWP) of R1234yf is 4 (the GWP of carbon dioxide is 1).
- ◆ The contribution of R1234yf to the greenhouse effect is less than the contribution of refrigerant R134a by a factor of approx. “350” (GWP of R134a is approx. 1400).

 Note

The greenhouse effect of substances is calculated in relation to the effect over a period of 100 years using various methods, which produce different results (e.g. a GWP between 1300 and 1450 for R134a).

6.2.6 Trade names and designations of the refrigerant R1234yf

The refrigerant R1234yf is currently available under the following trade names:

- ◆ H-FKW 1234yf
- ◆ HFO 1234yf
- ◆ “Opteon yf” or “Solstice yf” (examples of company names)

 Note

- ◆ *In other countries, other trade names may also be common.*
- ◆ *Among the wide range of different refrigerants, only this refrigerant should be used for automobiles. The designations Frigen or Freon are trade names. They also apply to refrigerants that are not intended to be used for motor vehicles.*

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6.2.7 Colour and odour of refrigerant R1234yf

- ◆ As vapour and liquid, the refrigerant is as colourless as water. As gas, it is invisible. Only the boundary layer between the gas and liquid is visible. (Fluid level in the standpipe of the filling cylinder or bubbles in an inspection glass). In an inspection glass, the liquid of the refrigerant R1234yf may appear coloured (milky). This opacity arises from partially dissolved refrigerant oil and does not indicate an error.
- ◆ The refrigerant is almost odourless. If refrigerant R1234yf escapes, you may notice a slight ether-like odour, depending on ambient conditions.

6.2.8 Vapour pressure of refrigerant R1234yf

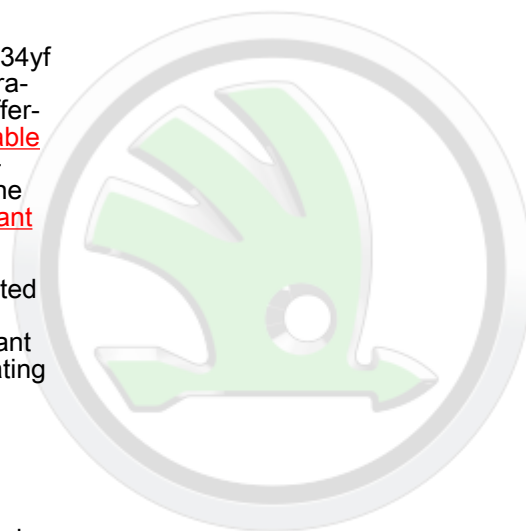
In a partially filled and closed container, the refrigerant vaporises on the surface to the same extent that it liquefies again when the vapour particles concentrate. This balanced status is created under pressure and is frequently called vapour pressure. The vapour pressure is temperature dependent ⇒ [p6.1.3 ressure table for the refrigerant", page 19](#) .

6.2.9 Physical properties of refrigerant R1234yf

- ◆ The vapour pressure curves of the two refrigerants R1234yf and R134a are very similar over a wide range of temperatures, so that the vapour pressure cannot be used to differentiate between the two refrigerants ⇒ [p6.1.3 ressure table for the refrigerant", page 19](#) . It is only possible to differentiate by using appropriate sensors that can analyse the chemical structure of the refrigerant ⇒ [o6.2.16 f refrigerant R1234yf", page 26](#) .
- ◆ The air conditioning compressor with R1234yf is lubricated with special synthetic refrigerant oils, such as PAG oils (poly-alkyl-glycol oils) with specific additives for refrigerant R1234yf, the air conditioning compressor and the operating conditions.

6.2.10 Behaviour of refrigerant R1234yf in contact with metals and plastics

- ◆ In pure form, refrigerant R1234yf is chemically stable and does not attack e.g. iron and aluminium or suitable plastics developed for use with the refrigerant.
- ◆ However, contamination of the refrigerant can cause the components of the refrigerant circuit to be attacked and destroyed.
- ◆ Unsuitable materials (e.g. seals and hoses that have not been developed for refrigerant R1234yf and the refrigerant oil that is used) may also be attacked and damaged by pure refrigerant R1234yf or refrigerant oil.
- ◆ However, if there is contamination of the refrigerant, e.g. with chlorine compounds or from UV light, metals and the plastics developed and tested for this refrigerant and the applicable refrigerant oil are attacked. This may lead to choking, leaks or other deposits on the AC compressor piston.
- ◆ Specific metals may be attacked by refrigerant R1234yf (e.g. finely dispersed aluminium, zinc and magnesium).



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6.2.11 Critical temperature/critical pressure of refrigerant R1234yf

Up to a gas pressure of 32.82 bar overpressure (equivalent to a temperature of 94.7 °C), the refrigerant remains chemically stable and becomes liquid again when the vapour particles concentrate. Above this temperature/pressure, there is no longer a separating layer between liquid and gas.

6.2.12 Water content of refrigerant R1234yf

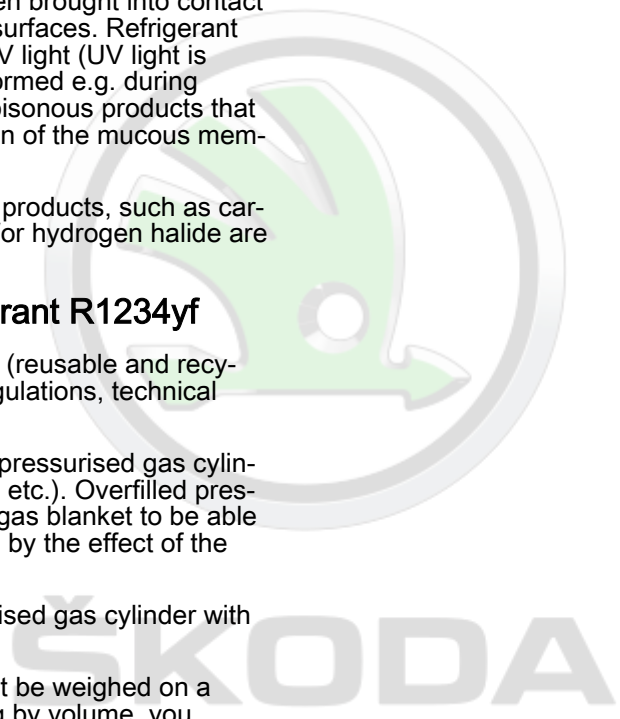
- ◆ Water is only soluble in very small quantities in the liquid refrigerant. In contrast, refrigerant vapour and water vapour mix in any proportion.
- ◆ Any water that is present in the system is conveyed through the refrigerant circuit as droplets, once the desiccator in the fluid reservoir or AC reservoir has become saturated (has already absorbed approx. 7 grams of water). This water flows to the nozzle of the expansion valve or restrictor where it turns to ice, and the air conditioning system ceases to provide cooling.
- ◆ If the water present at the control valve of the air conditioning compressor turns to ice, a range of different problems may be reported, depending on the design of the air conditioning compressor (either the air conditioning system stops cooling or the air conditioning system cools so much that the evaporator ices up).
- ◆ Water destroys the air conditioning system, as acids are produced under high pressures and temperatures in combination with other contamination.

6.2.13 Flammability/decomposition of refrigerant R1234yf

- ◆ Refrigerant R1234yf is flammable within certain concentrations in ambient air.
- ◆ Refrigerant R1234yf decomposes when brought into contact with flames or scorching and red-hot surfaces. Refrigerant also decomposes when exposed to UV light (UV light is a part of normal sunlight, but is also formed e.g. during electrical welding), which produces poisonous products that must not be inhaled. However, irritation of the mucous membranes is sufficient warning in time.
- ◆ On decomposition, certain hazardous products, such as carbon monoxide, hydrogen fluoride and/or hydrogen halide are formed.

6.2.14 Filling factor of refrigerant R1234yf

- ◆ When filling pressurised gas cylinders (reusable and recycling cylinders etc.), the applicable regulations, technical rules and laws must be observed.
- ◆ You must always avoid overfilling the pressurised gas cylinders (reusable and recycling cylinders etc.). Overfilled pressurised gas cylinders have too little a gas blanket to be able to absorb the liquid expansion caused by the effect of the heat. There is a risk of bursting.
- ◆ For your own safety, only use pressurised gas cylinder with a safety valve fitted.
- ◆ Reusable and recycling cylinders must be weighed on a calibrated scale when filling or, if filling by volume, you must make sure that the permitted weight for filling that is specified on the cylinder is not exceeded. The maximum permitted filling capacity is 80% of the maximum refrigerant



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filling capacity of the filling weight specified on the reusable or recycling cylinder or 70% of the maximum filling volume (filling factor; the lower value always applies). Justification: It is always possible that refrigerant oil is also filled into the reusable or recycling cylinder, as well as the refrigerant.

- ◆ The container must also include vapour space in addition to the fluid space. As the temperature rises, the fluid expands (volume increases). The space filled with vapour becomes smaller. At a given moment there will only be fluid left in the reservoir. After this, only a minor temperature increase is required to generate very high pressures in the reservoir as the fluid can no longer expand because there is no more space. The resulting forces are great enough to burst the reservoir. In order to ensure a reservoir is not over-filled, the pressure gas regulations stipulate how many kilos of refrigerant may be filled per litre of inside volume of the reservoir. This filling factor multiplied by the insides volume gives the permitted filling capacity. It is 1.15 kg/litre for the refrigerant used in motor vehicles.
- ◆ As contaminated refrigerant may have a different density than pure refrigerant R1234yf, the maximum permitted filling factor must always be observed.

6.2.15 Evidence of leaks in a refrigerant circuit with refrigerant R1234yf

- ◆ The refrigerant circuit may start leaking because of external damage, use of unsuitable or contaminated refrigerants or untested materials.
- ◆ Because of the small amount of leaked refrigerant, evidence of minor leaks can be detected for example with an electronic leak detector or leak detection additive which is filled into the refrigerant circuit. Leaks with less than 5 grams of refrigerant loss per year can be detected with the electronic leak detector.



Note

For the different refrigerants, leak detectors are used which are designed for the composition of the relevant refrigerant. For example, leak detectors for refrigerant R134a are not suitable for R1234yf, which is why these leak detectors do not always respond. Refrigerant R1234yf has a different chemical structure to R134a, so that the leak detectors do not respond or only respond at higher concentrations of the refrigerant in air (see ⇒ Catalogue of factory equipment).

6.2.16 Analysis of refrigerant R1234yf

The refrigerant that is used must have a certain purity to run the air conditioning system.

 Note

- ◆ *The gas analysis may be incorrect if there is air in the refrigerant hoses or the gas analysis procedure in the operating instructions is not observed.*
- ◆ *Always carefully follow the operating instructions for the gas analyser/AC service station.*
- ◆ *Evacuate the refrigerant hoses of the AC service station before connecting the service couplers to the refrigerant circuit/a gas cylinder with refrigerant R1234yf (see operating instructions for the gas analyser/AC service station) ⇒ [g2.3 as analysis for the refrigerant", page 107](#) .*

Contamination with other refrigerants or gases can cause damage and therefore failure of the air conditioning system and the AC service station.

Contaminated refrigerant must be analysed and then treated (or disposed of) as a gas of unknown composition in accordance with statutory provisions ⇒ [g2.3 as analysis for the refrigerant", page 107](#) .

 Note

Return contaminated refrigerant R1234yf to your refrigerant supplier for analysis.

For gas analysis, the following limits apply to clean refrigerant R1234yf:

- ◆ *The extracted refrigerant gas consists of at least 95% refrigerant R1234yf.*
- ◆ *The proportion of other gases (oxygen, nitrogen, water vapour and other refrigerants) is less than 5%.*

 Note

To make sure that liquid components (e.g. droplets of refrigerant oil) in the extracted refrigerant gas does not cause the gas analysis result to be false, filters are installed in the gas analyser to filter out the droplets of liquid. Replace the filters as specified in the operating instructions for the gas analyser or AC service station ⇒ [Gas analyser operating instructions](#) or ⇒ [AC service station operating instructions](#).

6.3 Product features

The refrigerant R1234yf which is used in the air conditioning systems for motor vehicles is one of the new generation of refrigerants based on chlorine-free hydrofluorocarbons.

In regards to their physical behaviour, this relates to under pressure liquefied refrigerant. They are subject to the German Pressure Container Regulations and must only be filled into approved and marked pressurised gas cylinders.



6.4 Function and purpose of the air conditioning system

⇒ [p6.4.1 principle", page 28](#)

⇒ [6.4.2 , page 28](#)

⇒ [a6.4.3 specs", page 29](#)

6.4.1 Operating principle

- ◆ The temperature in the passenger compartment is influenced by radiant heat through the window and by the contact heat emitted by metallic parts. To provide agreeable temperatures for the passengers on very hot days, some of the ambient heat must be pumped out.
- ◆ As heat dissipates towards colder temperatures, a unit that generates low temperatures is installed in the passenger compartment. Refrigerant is continuously evaporated in this evaporator. The heat required for this operation is drawn from the air flowing through the evaporator.
- ◆ The refrigerant with the absorbed heat is pumped out of the evaporator by the AC compressor. Compression by the AC compressor increases the heat content and the temperature of the refrigerant. The temperature is now considerably higher than the ambient air temperature.
- ◆ The high-temperature refrigerant and its heat content flow to the condenser. As a result of the temperature difference between the refrigerant and the ambient air, the refrigerant releases heat into the ambient air via the condenser.
- ◆ The refrigerant is also a heat conveyor. As it is still needed, it is pumped back to the evaporator.
- ◆ For this reason, the basic principle of all air conditioning systems is a circuit for refrigerants. Differences arise in the composition of the units ⇒ [o1.1 overview - refrigerant circuit", page 31](#) .

6.4.2 Comfort

- ◆ One of the basic requirements for a concentrated and safe driving is the feeling of comfort in the vehicle interior. This comfort is only possible through the use of an air conditioning system, especially in warm temperatures and at high humidity. Open windows, an open sliding sunroof or a higher air flow rate certainly contribute to the comfort, but there are disadvantages for the vehicle interior, such as: additional noise, draught, exhaust, unhindered infiltration of pollen and dust (unpleasant for allergy sufferers).
- ◆ Through a controlled air conditioning system, in combination with a well-designed heating and ventilation system, the feeling of well-being and comfort can be achieved by controlling the indoor temperature, humidity and air movement, according to the external conditions. This is possible when the vehicle is stationary as well as when driving.

Further important advantages of the air conditioning system are:

- ◆ Air is dried in the passenger compartment (the ambient humidity condenses on the cold evaporator and is drained as condensation water; the air is heated again to a preset temperature at the heat exchanger for heating, which reduces the amount of water in the air and the absolute and relative humidity falls).
- ◆ Additional cleaning of the air drawn into the interior (the wet fins of the evaporator, for example, wash out any dust or

pollen that has passed through the dust and pollen filter and extracts the pollen with the condensation water).

- ◆ Temperatures in a medium-class car (example: after a short driving time, outside temperature 30 °C in the shade and vehicle under the sun).

	with air conditioning system	without air conditioning system
Head room	23 °C	42 °C
Chest	24 °C	40 °C
Footwell	30 °C	35 °C

6.4.3 Environmental aspects

- ◆ Refrigerant R134a does not contain chlorine and is therefore ozone-friendly. Because of the high global warming potential (GWP) of approx. 1400, however, it must no longer be used in new type-tested vehicles from 2011. Vehicles type-tested before 2011 may still be brought into circulation for the first time with refrigerant R134a until 31/12/2016 (this applies to countries in the EU – other regulations may apply in countries outside the EU).
- ◆ After 01/01/2011, only vehicles with a refrigerant with a GWP below 150 in the refrigerant circuit of the air conditioning system shall be granted new type approval. Refrigerant R1234yf has a GWP of approx. 4 and therefore is significantly below the required value.
- ◆ From 2011, the air conditioning systems of newly manufactured motor vehicles have been gradually switched from refrigerant R134a to refrigerant R1234yf. This refrigerant has a global warming potential (GWP) of approx. 4. The GWP of carbon dioxide is 1, so this refrigerant has a significantly lower impact on the earth's atmosphere than refrigerant R134a.
- ◆ Vehicles that have been type-tested with refrigerant R134a may still be filled with refrigerant R134a under current law until such vehicles are taken out of service. There are therefore currently no plans to switch air conditioning systems from refrigerant R134a to refrigerant R1234yf.
- ◆ Refrigerant must not be released into the atmosphere, as it damages the environment.
- ◆ Refrigerant R1234yf is chemically stable in a closed system. However, in the earth's atmosphere it rapidly decomposes under the influence of UV lights (within approx. 14 days) into compounds that are not hazardous to the atmosphere (therefore, GWP of 4).

6.5 Further sources of information

- ◆ Workshop manual for type related repair work (vehicle-specific workshop manual) and ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- ◆ Technical Service Handbook with instructions to correct current issues.
- ◆ Self-study and video programmes for occupational training.
- ◆ Specific risks posed by the refrigerant, material details, etc. can be found in the safety data sheets. Safety data sheets for the refrigerant, refrigerant oil, etc. ⇒ Škoda ServiceNet.
- ◆ List of specific special tools and workshop equipment to repair air conditioning systems ⇒ Electronic Catalogue of Original Parts "ETKA" (tools; workshop equipment/tools; air conditioning/heating).



- ◆ Instructions for disposing of refrigerant oil and contaminated refrigerant are provided on → Škoda-ServiceNet.



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87 – Air conditioning system

1 Refrigerant circuit

⇒ [o1.1 overview - refrigerant circuit", page 31](#)

⇒ [d1.2 description – components of the refrigerant circuit", page 34](#)

⇒ [c1.3 complaints", page 58](#)

⇒ [l1.4 leaks", page 62](#)

⇒ [c1.5 components", page 72](#)

⇒ [t1.6 the refrigerant circuit", page 84](#)

⇒ [p1.7 pressures with the pressure gauge", page 98](#)

1.1 System overview - refrigerant circuit

⇒ [o1.1.1 overview - Refrigerant circuit with expansion valve and fluid reservoir", page 31](#)

⇒ [o1.1.2 overview - Refrigerant circuit with electrically driven air conditioning compressor \(with and without a battery cooling module\)", page 32](#)

1.1.1 System overview - Refrigerant circuit with expansion valve and fluid reservoir



Note

- ◆ *The arrows point in the direction of flow of the refrigerant.*
- ◆ *The following illustration shows a refrigerant circuit with 2 evaporators and one internal heat exchanger as an example.*
- ◆ *The layout of the refrigerant circuit is vehicle-specific (vehicle-specific workshop manual).*

HP = High-pressure side

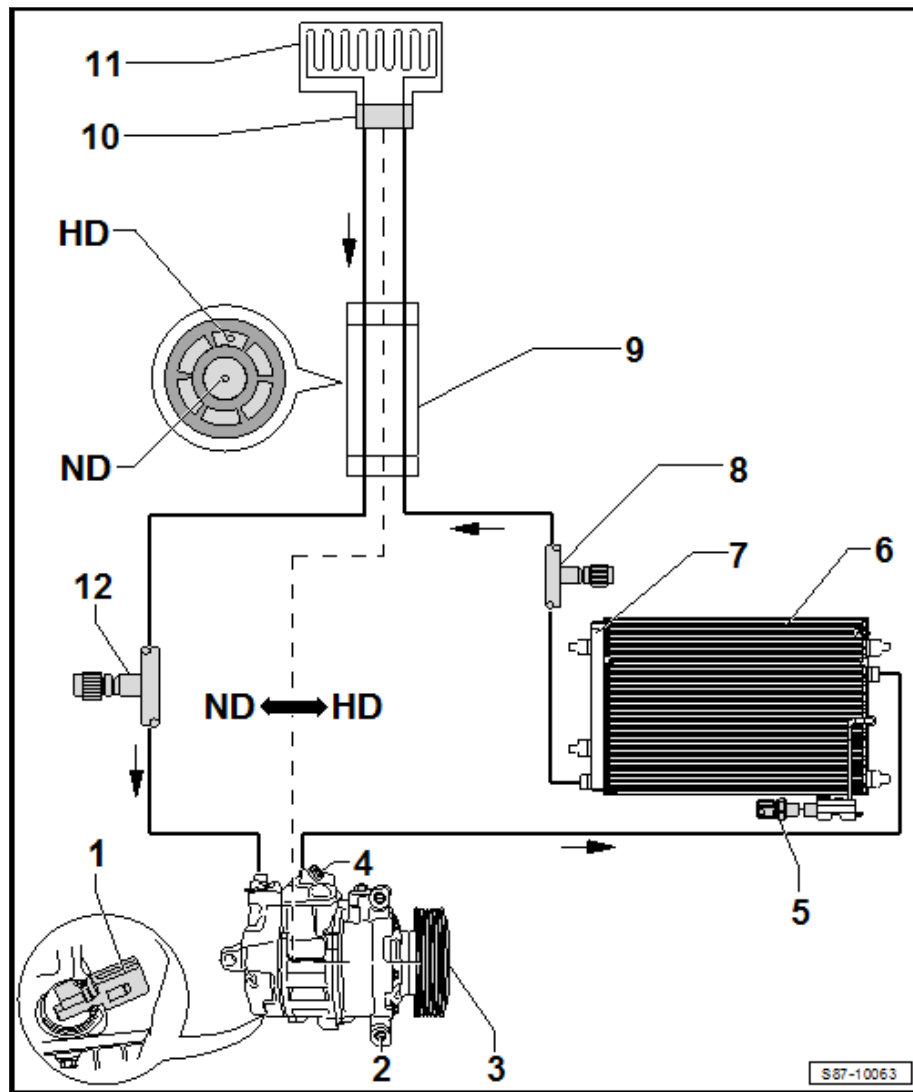
LP = Low-pressure side

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- 1 - Regulating valve for compressor of air conditioning system -N280-
- 2 - AC compressor
- 3 - Belt pulley
- 4 - Pressure relief valve
- 5 - Refrigerant pressure sender
 - Vehicle-specific versions
- 6 - Condenser (with fluid reservoir)
- 7 - Fluid reservoir
 - installed on or in the condenser (vehicle-specific workshop manual)
 - with desiccator cartridge
- 8 - Service connector on high-pressure side
 - with end cap
- 9 - Refrigerant pipe with internal heat exchanger
- 10 - Expansion valve
- 11 - Evaporator
 - Evaporator at the front of the heating and air conditioning unit (installed under the dashboard)
- 12 - Service connector on low-pressure side
 - with end cap



1.1.2 System overview - Refrigerant circuit with electrically driven air conditioning compressor (with and without a battery cooling module)



Note

- ◆ The arrows point in the direction of flow of the refrigerant.
- ◆ The following figure shows an example of a refrigerant circuit with expansion valve and second evaporator for battery cooling and internal heat exchanger.
- ◆ The layout of the refrigerant circuit is vehicle-specific (vehicle-specific workshop manual).

HP = High-pressure side

LP = Low-pressure side



1 - Electrically-driven air conditioning compressor

- with Control unit for air conditioning compressor -J842- and electric air conditioning compressor -V470- (vehicle-specific workshop manual).

2 - Pressure relief valve

3 - Condenser

- with fluid container and desiccator cartridge.

4 - Fluid reservoir

5 - Refrigerant pressure sender

- Vehicle-specific versions (vehicle-specific workshop manual)

6 - Service connector

- High-pressure side

7 - Refrigerant line

- with inner heat exchanger

8 - Coolant shut-off valve

- different names (vehicle-specific workshop manual)
- only for vehicles with a battery cooling module for Hybrid battery unit -AX1-

9 - Expansion valve

- on the evaporator in the heating and air conditioning unit

10 - Evaporator

- in heater and air conditioner unit

11 - Expansion valve with shut-off valve

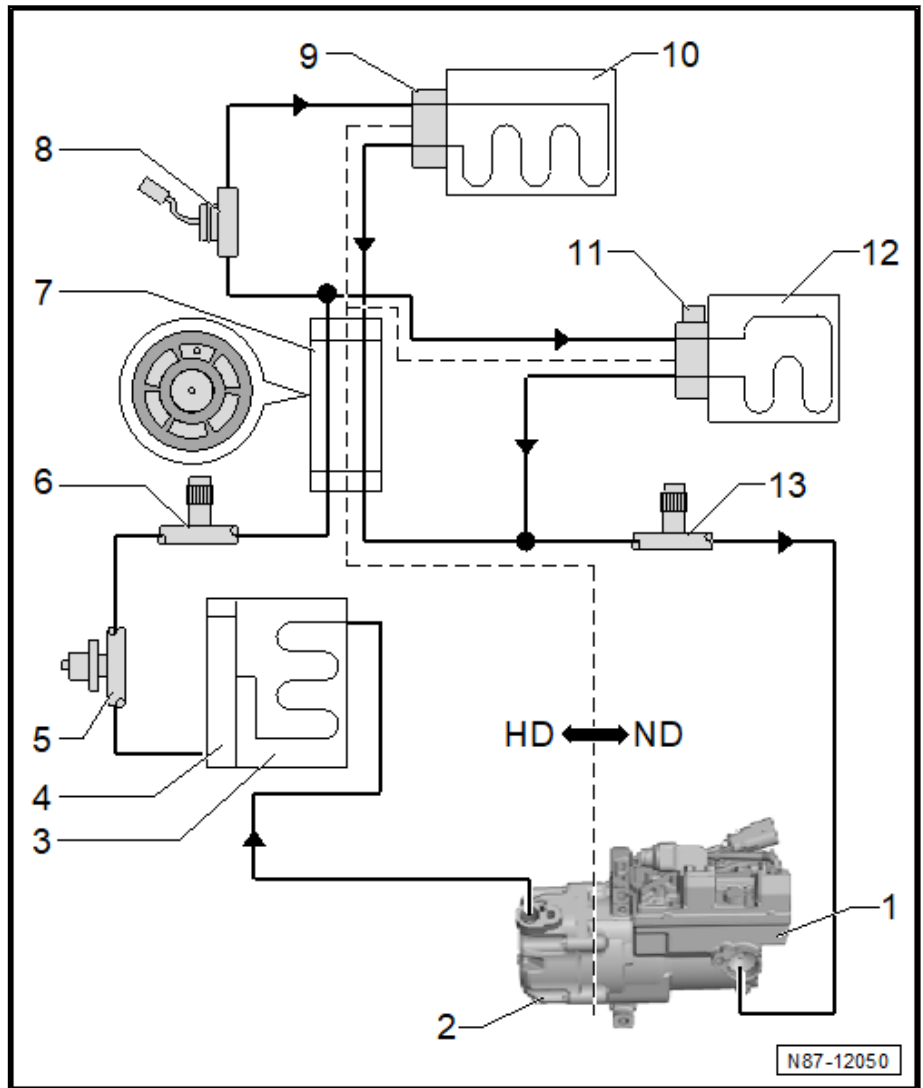
- different names (vehicle-specific workshop manual)
- on the evaporator in the battery cooling module
- only for vehicles with a battery cooling module for Hybrid battery unit -AX1-

12 - Evaporator

- in battery cooling module
- only for vehicles with a battery cooling module for Hybrid battery unit -AX1-

13 - Service connector

- Low-pressure side





1.2 General description – components of the refrigerant circuit

- ⇒ [a1.2.1 nd function of the refrigerant circuit", page 34](#)
- ⇒ [d1.2.2 riven air conditioning compressor", page 35](#)
- ⇒ [d1.2.3 riven air conditioning compressor for hybrid vehicles", page 38](#)
- ⇒ [1.2.4 , page 41](#)
- ⇒ [1.2.5 , page 42](#)
- ⇒ [r1.2.6 eservoir", page 43](#)
- ⇒ [e1.2.7 xchanger for heat pump operation", page 45](#)
- ⇒ [c1.2.8 ollector", page 46](#)
- ⇒ [v1.2.9 alve \(with and without shut-off valve\)", page 46](#)
- ⇒ [s1.2.10 hut-off valves", page 48](#)
- ⇒ [p1.2.11 ipe with internal heat exchanger", page 49](#)
- ⇒ [1.2.12 , page 50](#)
- ⇒ [a1.2.13 nd hoses of the refrigerant circuit", page 50](#)
- ⇒ [r1.2.14 elief valve", page 51](#)
- ⇒ [v1.2.15 alves", page 52](#)
- ⇒ [f1.2.16 or quick couplers on refrigerant circuit", page 53](#)
- ⇒ [w1.2.17 ith valve for switches on refrigerant circuit ", page 55](#)
- ⇒ [s1.2.18 ensorG65", page 56](#)
- ⇒ [s1.2.19 ender and switch on refrigerant circuit", page 57](#)
- ⇒ [v1.2.20 alve for compressor of air conditioning systemN280", page 58](#)

1.2.1 Arrangement and function of the refrigerant circuit

- ◆ The condenser and fluid reservoir are on the high-pressure side, as well as the restrictor or expansion valve separating the high-pressure side (HP liquid side) and the low-pressure side (LP liquid side).
- ◆ The high pressure arises from the fact that the restrictor or expansion valve creates a restriction and the refrigerant dams, which leads to an increase in pressure and temperature.
- ◆ Too much high pressure arises if too much refrigerant or refrigerant oil is added; the condenser is contaminated; the radiator fan is defective; a blockage is present in the system or if there is moisture in the refrigerant circuit (icing of the restrictor or expansion valve).
- ◆ The evaporator and evaporator temperature sensor are on the low-pressure side, as well as the AC compressor separating the low-pressure side (LP gas side) from the high-pressure side (HP gas side).
- ◆ A pressure drop in the system may occur as a result of loss of refrigerant, if the expansion valve (restrictions) is defective or blocked, if the AC compressor is defective or the evaporator is iced up.

1.2.2 Mechanically driven air conditioning compressor

The AC compressor sucks refrigerant gas from the evaporator, compresses it and transfers it to the condenser.



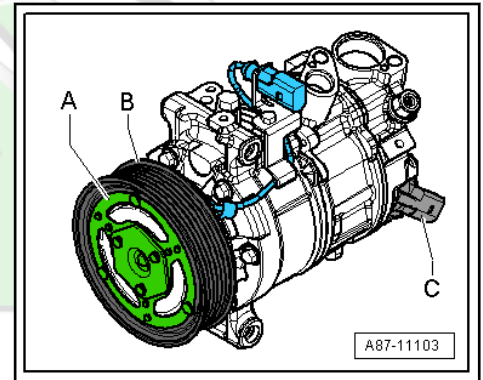
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Note

- ◆ *The AC compressor contains refrigerant oil, which can mix with refrigerant R1234yf at all temperatures.*
- ◆ *The identification plate indicates which refrigerant is suitable for the AC compressor. A control valve regulates the pressure on the low-pressure side within the specified target range (control characteristic).*
- ◆ *Depending on the design of the AC compressor, the AC compressor is filled with different refrigerant oils. Refrigerant oils that have been developed exclusively for refrigerant R134a must not be used for refrigerant R1234yf → Heating, Air Conditioning; Rep. gr. 00; Technical data.*
- ◆ *AC compressors with or without magnetic clutch for AC system -N25- are currently actuated externally via an AC compressor regulating valve for the air conditioning system -N280--C-.*
- ◆ *The identification plate indicates which refrigerant is suitable for the AC compressor.*
- ◆ *The AC compressor regulating valve -N280- controls the pressure on the low-pressure side within the specified target range (control characteristic).*
- ◆ *On a vehicle with an AC compressor without AC magnetic clutch -N25-, the engine must not be started if there is a vacuum in the refrigerant circuit (e.g. when evacuating) ⇒ [w2 ith the A/C service station", page 102](#).*
- ◆ *On a vehicle with an AC compressor without AC magnetic clutch -N25-, the engine may only be started if the refrigerant circuit has been fully assembled.*
- ◆ *To prevent damage to the AC compressor when the refrigerant circuit is empty, the AC compressor control valve, air conditioning system -N280- is not longer activated (the AC compressor runs at idling speed with the engine) if the pressure in the refrigerant circuit is too low (less than approx. 2 bar).*
- ◆ *An AC compressor with AC compressor control valve, air conditioning system -N280- is switched to internal lubrication via a valve if the refrigerant circuit is empty.*
- ◆ *Depending on the design of the AC compressor, a valve may be installed on the high-pressure side of the AC compressor, which prevents liquid refrigerant flowing back into the AC compressor after the air conditioning system has been switched off. If an AC compressor with such a valve is installed in a vehicle with a refrigerant circuit with expansion valve, it may take a relatively long time until the pressure on the high-pressure side falls (the expansion valve is cold and the pressure on the low-pressure side increases rapidly after switching off, the expansion valve closes and the refrigerant circuit can only flow slowly to the low-pressure side). If the AC compressor is switched on, the pressure on the low-pressure side falls, the expansion valve opens and the refrigerant can flow to the low-pressure side.*
- ◆ *For an AC compressor with an electro-magnetic clutch -A- and a control valve -C-, the electromagnetic clutch -A- is normally only activated if the control valve -C- is activated.*

AC compressor with AC magnetic clutch -N25-:



- ◆ When the air conditioning system is switched on, an electromagnetic clutch -A- mounted on the AC compressor generates the traction between the belt pulley -B- and the compressor crankshaft.

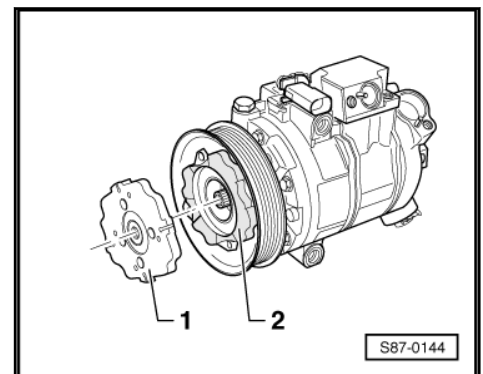
i Note

To prevent damage to the AC compressor when the refrigerant circuit is empty, the AC magnetic clutch -N25- is switched off and the AC compressor regulating valve -N280- -C- is no longer actuated.

AC compressor without magnetic coupling:

- ◆ Overload protection installed on the belt pulley or in the drive unit of the AC compressor is triggered if the AC compressor is difficult to move and thereby protects the belt drive against overload.
- ◆ Externally controlled A/C compressors with variable displacement of piston. The displacement of the AC compressor is controlled via an externally driven regulating valve with PWM signal on the suction side in accordance with the required cooling output.
- ◆ The AC compressor continues operating with a minimum power supply requirement even when the air conditioning system is off.

Belt protection for blocked A/C compressor (AC compressors without magnetic coupling)



The AC compressor operates continuously via a driver clutch -1- and -2- in the belt drive, whether or not the air conditioning system is switched on.



If the AC compressor blocks, the rubber elements -2- will shear off or the driver disc -1- will become deformed depending on the compressor temperature (it depends on the temperature).

In any case the belt pulley of the AC compressor can rotate while the driver disc/A/C compressor shaft is at a standstill.

Replace the AC compressor.



Note

The design of the driver clutch may differ depending on the compressor.

1.2.3 Electrically driven air conditioning compressor for hybrid vehicles

Vehicles with high-voltage system (hybrid vehicles)

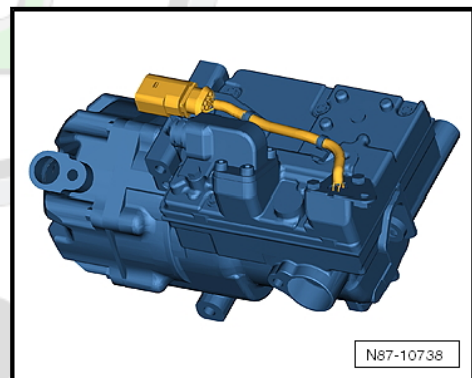
If work is required near components of the high-voltage system, carry out a visual inspection for damage to the high-voltage components and cables.

If work needs to be carried out on components of the high-voltage system, make sure that the high-voltage system is disconnected from the high-voltage system ⇒ Rep. gr. 93; Disconnect the high-voltage system.

Establish voltage-free operation of the high-voltage system and restart the high-voltage system ⇒ Rep. gr. 93; Disconnect the high-voltage system and ⇒ Rep. gr. 93; Restart the high-voltage system.

- In order to minimize the number of automatic engine starts when the vehicle is ready to drive during testing and measurement work, connect a charger to the 12-volt battery in backup mode. Recommended battery chargers, see ⇒ Electrical system - general information; Rep. gr. 27; battery, Chapter “battery charge”.
- For test and measurement work where readiness to drive must be active or ignition must be switched on, set the selector lever to position “P”, activate the parking brake, arrange the necessary tools so that they cannot come into contact with rotating engine components and do not themselves come into contact with components rotating while the engine is running.

Electrically-driven air conditioning compressor





Caution

Risk of destruction of the electrically driven air-conditioning compressor due to short circuit.

- ◆ ***Never touch the air-conditioning compressor when switching on the ignition or when starting the engines.***

- ◆ The AC compressor sucks refrigerant gas from the evaporator, compresses it and transfers it to the condenser.
- ◆ The electric motor of the air compressor is energised, for example by the Power and control electronics for the electric drive -JX1- ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- ◆ The Control unit for the air conditioning compressor -J842- integrated in the air conditioning compressor regulates the speed and thus the performance of the air conditioning compressor (electric air conditioning compressor -V470-) according to the request received via the data bus ⇒ Vehicle diagnostic tester in the “Guided fault finding” function for the air conditioning system and battery control.
- ◆ In the electrically driven air conditioning compressor, no Control valve for air conditioning compressor -N280- is built in.
- ◆ The screw-on points of the air conditioning compressor and the mount must be checked before installation. The contact surfaces must be clean, free of rust and grease. Otherwise, repair the contact surfaces with the contact surface cleaning set -VAS 6410- ⇒ Electrical system - general information; Rep. gr. 97; Repair of cable strands and connectors.

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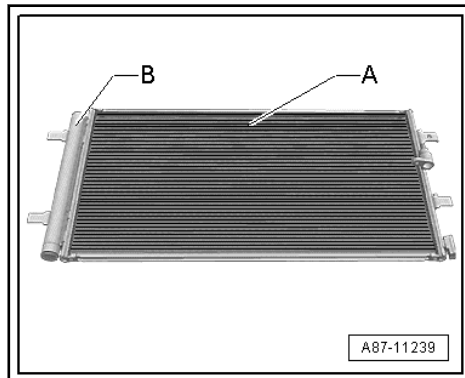


Note

- ◆ *If this Control unit for air conditioning compressor -J842- is defective, the amount of refrigeration oil in the new air conditioning compressor is to be adjusted. The refrigerant circuit does not always have to be cleaned (rinsed) using R1234yf.*
- ◆ *The Control unit for air conditioning compressor -J842- and the electric air conditioning compressor -V470- are one component and cannot currently be separated.*
- ◆ *In the electrically driven air conditioning compressor, -N280- is not installed; the performance of the air conditioning compressor is controlled externally by the speed of the air compressor ⇒ Current flow diagrams, Electrical fault finding and Fitting locations and ⇒ Vehicle diagnostic tester in the function "Guided fault finding" for the air conditioning unit and battery control.*
- ◆ *The electrically driven air-conditioning compressor currently operates on the principle of a spiral loader (similar to a G-loader).*
- ◆ *The AC compressor contains refrigerant oil, which can mix with refrigerant R1234yf at all temperatures.*
- ◆ *The identification plate indicates which refrigerant is suitable for the AC compressor.*
- ◆ *The built-in electronics regulate the power of the air-conditioning compressor (and thus the pressure on the low-pressure side) within the specified target range (control characteristic) via the speed.*
- ◆ *The engine should only be started when the refrigerant circuit is fully assembled.*
- ◆ *So that the AC compressor suffers no damage when the refrigerant circuit is empty, it is fitted with a secured oil supply. This means that approx. 40 to 50 cm³ of refrigerant oil is left in the AC compressor.*
- ◆ *Like the mechanically driven air conditioning compressor, the electrically driven air conditioning compressor also has a pressure relief valve.*
- ◆ *In vehicles with battery cooling, electric or hybrid operation is only possible with a full air-conditioning system in which no fault has been stored for the air-conditioning system ⇒ Vehicle diagnostic tester, in the "Guided troubleshooting" function for the air-conditioning system and battery control.*
- ◆ *After installing the air-conditioning compressor and subsequently filling the refrigerant circuit, first commission the electrically driven air-conditioning compressor using the "compressor inlet" function of the basic setting. If the refrigeration machine oil has accumulated in the compression chamber of the air-conditioning compressor due to unfavourable storage prior to installation, this may result in damage to the air-conditioning compressor ⇒ Vehicle diagnostic tester in the "Guided troubleshooting" function for the air-conditioning system and battery control.*
- ◆ *Only control the electrically driven air conditioning compressor when the refrigerant circuit is full. If the air-conditioning compressor is running when the refrigerant circuit is empty, the air-conditioning compressor may be damaged in ⇒ Vehicle diagnostic tester the "Guided troubleshooting" function.*

1.2.4 Condenser

- ◆ The condenser -A- dissipates heat from the compressed refrigerant gas to the ambient air.



- ◆ During this process the refrigerant gas condenses and liquefies.



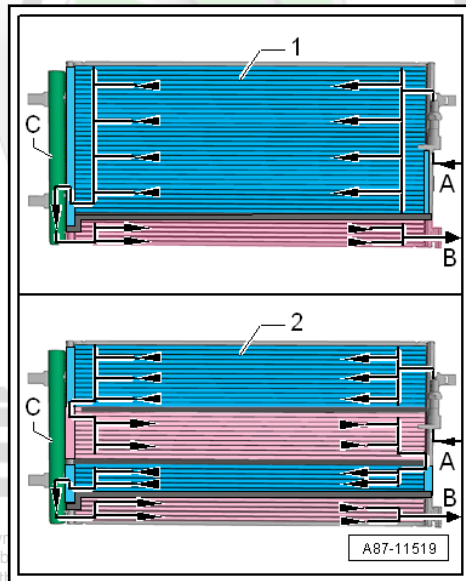
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Note

- ◆ Depending on the design of the refrigerant circuit, the fluid reservoir may be mounted on the condenser or installed (integrated) in the condenser ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic Catalogue of Original Parts "ETKA".
- ◆ There are various different types of condenser that can be identified externally from the part number. In type -1-, the condenser is split into 2 sections "2-pass condenser". In type -2-, the condenser is split into 4 sections "4-pass condenser".



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- ◆ This illustration shows a condenser with attached fluid reservoir -C-.
- ◆ The gaseous refrigerant enters the condenser at the connection -A-, then the refrigerant is cooled in the condenser and becomes liquid.
- ◆ The liquid refrigerant collects in the fluid reservoir -C- (with desiccator) and flows to connection -B- over the cool section beneath.
- ◆ Depending on the condenser design (inner volume, flow etc.), the filling capacity for the refrigerant circuit in a refrigerant circuit may vary. Therefore, always pay attention to the correct design and assignment of the capacitor ⇒ Electronic catalogue of original parts "ETKA".

1.2.5 Evaporator

There are different types of evaporator. Depending on the design and function, the heat required to evaporate the refrigerant (e.g. in the evaporator in the heating and air conditioning unit or in the battery cooling module) is drawn from the air flowing through ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

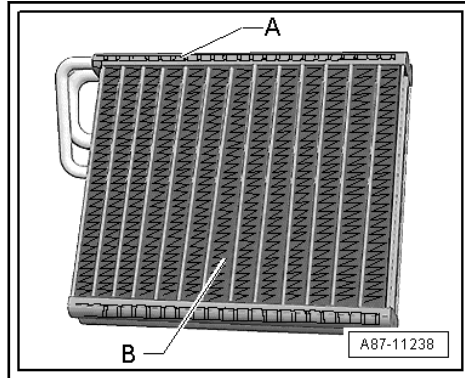


Note

2 types of evaporator are described below.

Evaporator in the heating and air conditioning unit

- ◆ The liquid refrigerant evaporates in the pipes of the evaporator -A-. The heat required for this operation is drawn from the air flowing through the evaporator fins -B-. The refrigerant evaporates and is sucked in with the absorbed heat as gas by the AC compressor.

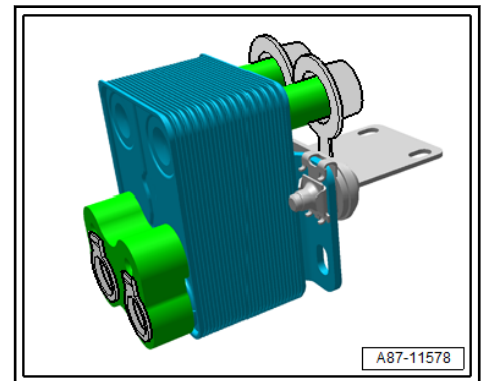


- ◆ An expansion valve (restrictor) supplies the evaporator with a defined volume of refrigerant. In systems with expansion valve, the flow rate is controlled so that refrigerant only comes out of the evaporator's outlet in gas form.
- ◆ Following the introduction of refrigerant R1234yf, the evaporators have been adapted to the refrigerant, so make sure that you select the correct type → Electronic Catalogue of Original Parts "ETKA".

Evaporator/heat exchanger for high-voltage battery (radiator)

The liquid refrigerant evaporates in the evaporator (heat exchanger). The heat required for this operation is drawn from the refrigerant flowing through the evaporator. The coolant cools down and the refrigerant evaporates, and is sucked in with the absorbed heat as gas by the AC compressor.

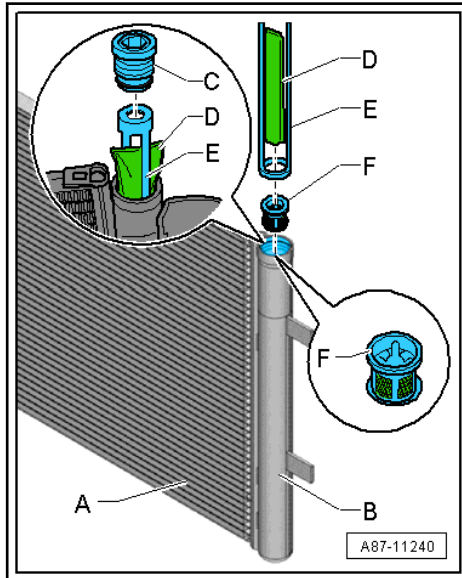
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A defined quantity of refrigerant is supplied to the evaporator through a throttle (or expansion valve) and a shut-off valve. The refrigerant (or coolant) flow rate is controlled in such a way that only gaseous refrigerant escapes at the evaporator outlet → Heating, air conditioning; Rep. gr. 87; Refrigerant circuit; System overview - Refrigerant circuit(vehicle-specific repair guide).

1.2.6 Fluid reservoir

- ◆ The fluid reservoir -B- collects the liquid drops and conveys them to the expansion valve in a constant flow. Humidity that has penetrated into the refrigerant circuit during assembly is collected by a desiccator -D- in the fluid reservoir -B-.



- ◆ Depending on the design of the refrigerant circuit and type of condenser -A-, the fluid reservoir -B- may be mounted on the condenser -A- or installed (integrated) in the condenser ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual) ⇒ Electronic Catalogue of Original Parts “ETKA”.
- ◆ The fluid reservoir -B- contains a desiccator (e.g. a desiccator bag -D-) and a strainer -F- (which collects smaller contaminants).



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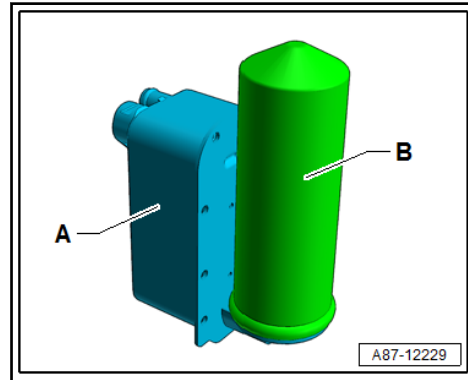


Note

- ◆ *There are different types of fluid reservoir -B- with different designs ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual and ⇒ Electronic Catalogue of Original Parts "ETKA").*
- ◆ *Replace the fluid reservoir -B- or the plastic screw (with seals) -C-, the desiccator cartridge -D-, the filter holder -E- and the strainer -F- if the refrigerant circuit has been open for a longer period of time and humidity has penetrated or if necessary because of a specific issue ⇒ [c1.5 components](#), [page 72](#).*
- ◆ *Remove the plugs on a fluid reservoir only just before installation, because the desiccator bag in an open fluid reservoir is saturated with humidity and becomes unusable after a short time.*
- ◆ *Keep the air-sealed delivery bag with the desiccator cartridge closed for as long as possible. Only open the delivery bag just before you install the desiccator cartridge -D- in the fluid reservoir -B- of the condenser. After the delivery bag is opened, the desiccator cartridge is saturated by the humidity in the ambient air after a short time and is then unusable.*
- ◆ *If necessary, observe the arrow for the direction of flow when installing.*
- ◆ *The procedure in the event of a complaint varies depending on the type of fluid reservoir/desiccator cartridge. If the fluid reservoir is e.g. mounted on the condenser, it can be replaced completely together with the desiccator cartridge. If the fluid reservoir is e.g. integrated onto the condenser, the fluid reservoir and any other additional filter element can be replaced separately for most types of desiccator cartridge. If the fluid reservoir is integrated in the condenser and it is not possible to replace the fluid reservoir or desiccator cartridge separately, the entire condenser must be replaced ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic Catalogue of Original Parts "ETKA".*
- ◆ *Depending on the design of the refrigerant circuit, the fluid reservoir (with desiccator bag or desiccator cartridge) may also be integrated in the refrigerant circuit (it does not always have to be installed on or in the condenser) ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic Catalogue of Original Parts "ETKA".*

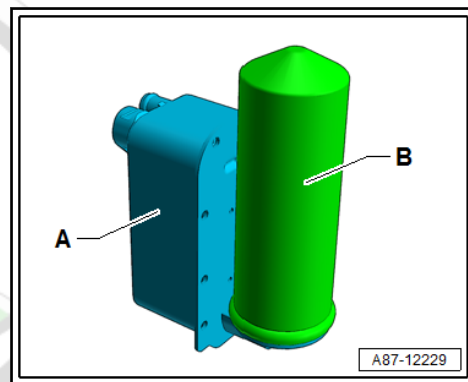
1.2.7 Heat exchanger for heat pump operation

The gaseous or vaporous refrigerant compressed by the air-conditioning compressor is liquefied in heat exchanger -A- and the heat released is transferred to the coolant flowing through ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit; System overview - Refrigerant circuit.



1.2.8 Liquid collector

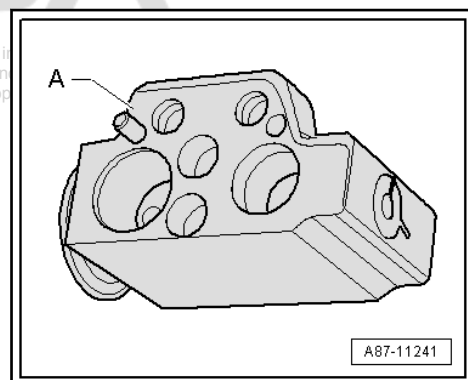
In certain operating conditions (e.g. heat pump operation), the liquid collector (e.g. at the condenser) is not integrated into the refrigerant circuit. The liquid collector -B- collects the refrigerant, stores it if a certain quantity of refrigerant is not needed and then carries it in a continuous flow to the expansion valve (upstream of the evaporator in the heating and air conditioning unit) or to the heat exchanger in the refrigerant circuit of the high-voltage system → Heating, air conditioning; Rep. gr. 87; Refrigerant circuit; System overview - Refrigerant circuit.



1.2.9 Expansion valve (with and without shut-off valve)

The expansion valve -A- atomises incoming refrigerant and regulates the flow so that, depending on the heat conveyed, the vapour does not become a gas until it reaches the outlet of the evaporator.

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i Note

- ◆ Following the introduction of refrigerant R1234yf, the expansion valves have been adapted to the refrigerant (different characteristics), so make sure that you select the correct type ⇒ *Electronic Catalogue of Original Parts "ETKA"*.
- ◆ There are different types of expansion valve because of the different characteristics that are adapted to the specific refrigerant circuit ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ *Electronic Catalogue of Original Parts "ETKA"*.
- ◆ When replacing the expansion valve, make sure that the part number is correct ⇒ *Electronic Catalogue of Original Parts "ETKA"*.
- ◆ Depending on the design of the AC compressor, a valve may be installed on the high-pressure side of the AC compressor, which prevents liquid refrigerant flowing back into the AC compressor after the air conditioning system has been switched off. If an AC compressor with such a valve is installed in a vehicle with a refrigerant circuit with expansion valve, it may take a relatively long time until the pressure on the high-pressure side falls (the expansion valve is cold and the pressure on the low-pressure side increases rapidly after switching off, the expansion valve closes and the refrigerant circuit can only flow slowly to the low-pressure side). If the AC compressor is switched on, the pressure on the low-pressure side falls, the expansion valve opens and the refrigerant can flow to the low-pressure side.

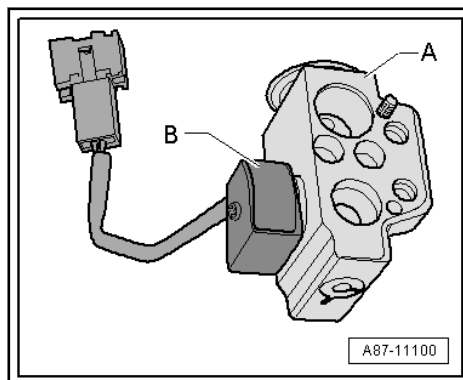
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Expansion valve with shut-off valve for refrigerant

i Note

There are different types of shut-off valve with different functions and different names ⇒ Heating, Air Conditioning; Rep. gr. 87; refrigerant circuit (vehicle-specific workshop manual).

- ◆ The expansion valve -A- with shut-off valve -B- atomises the refrigerant flowing through and regulates the refrigerant flow rate to the evaporator in the battery cooling module of the Hybrid battery unit -AX1-so that, depending on the heat transport, the steam only becomes gaseous at the outlet of the evaporator.



- ◆ If shut-off valve -B- is actuated by the electronics, it is open and allows refrigerant to flow through to expansion valve -A-.
- ◆ If shut-off valve -B- is open, expansion valve -A- allows refrigerant to flow to the evaporator or heat exchanger accord-



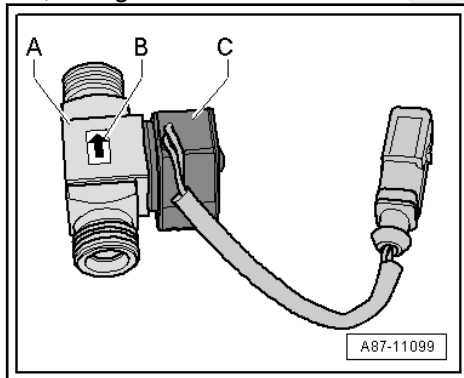
ing to its control characteristic ⇒ Heating, air conditioning;
 Rep. gr. 87; Refrigerant circuit.

- ◆ The solenoid coil -B- attached to the expansion valve -A- is controlled ⇒ Current flow diagrams, Electrical fault finding and Fitting locations by the control unit depending on the vehicle and ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function.
- ◆ If, in a vehicle with two evaporators (one in the heating and air conditioning unit and one in the battery cooling module, e.g. in the Audi Q5 Hybrid), the measured temperature at one evaporator corresponds to the set point or falls below the set point, but the required set point is not reached at the other evaporator, the control system behaves as follows: The Battery control unit -J840- Controls the Power and control electronics for electric drives -JX1- and the Control unit for air conditioning compressor -J842- the electric air-conditioning compressor at a higher speed (this increases the cooling capacity of the air-conditioning system and the pressure on the low-pressure side and the evaporator temperature drop). If the temperature in an evaporator falls below the set point for the temperature, the -J840- that Shut-off valve 1 for hybrid battery refrigerant -N516- or the Shut-off valve 2 for hybrid battery refrigerant -N517- so that the evaporator which is too cold is no longer filled with refrigerant in ⇒ Vehicle diagnostic tester the “Guided troubleshooting” function.

1.2.10 Coolant shut-off valves

Shut-off valves with 2 switching states (open or closed)

- ◆ Shut-off valves are available in different versions, with different functions and with different designations ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit.

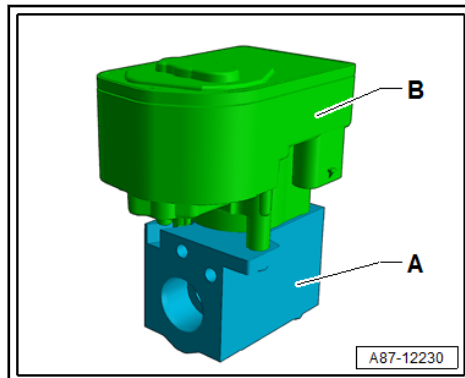


- ◆ If the shut-off valve -B- is not controlled by the electronics, it is open and allows refrigerant to flow through.
- ◆ The shut-off valve -A- is, for example, installed in vehicles with high-voltage systems, it is actuated if no air-conditioning operation is required for the passenger compartment, for which the Hybrid battery unit -AX1- but no battery cooling is necessary.
- ◆ The arrow -B- on the shut-off valve -A- indicates the flow direction of the refrigerant (from the condenser to the evaporator in the heating and air conditioning unit).
- ◆ The solenoid coil -C- attached to the expansion valve -A- is controlled ⇒ Current flow diagrams, Electrical fault finding and Fitting locations by different control units depending on the vehicle and ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function of the air conditioning system and the battery control system.

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Shut-off valves, which are controlled via characteristic curves

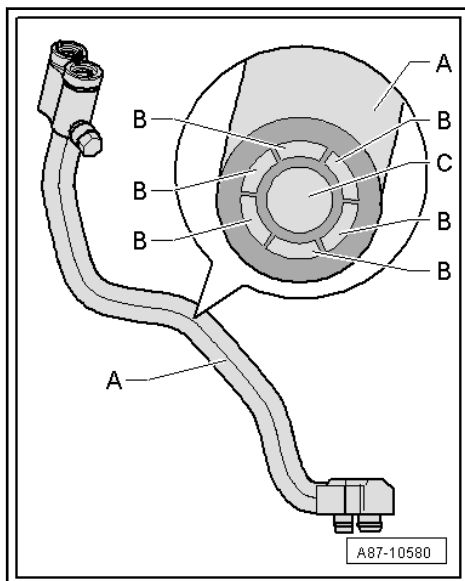
- ◆ The shut-off valve -A- is controlled (opened or closed) by a stepper motor -B- of the respective control unit via characteristic curves.



- ◆ If the shut-off valve operates as a control valve, it is only opened to the extent that the temperature intended for the heat exchanger is reached ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit.
- ◆ The shut-off valves controlled by stepper motors do not have a preset rest position. Therefore, they must be placed in a certain position (open or closed) before carrying out any work on the refrigerant circuit ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit.
- ◆ Depending on the structure of the refrigerant circuit, several shut-off valves can be combined to form one valve block ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit.
- ◆ The stepper motor is connected and controlled via data lines (LIN bus) from the respective control unit according to its installation location ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit and ⇒ Vehicle diagnostic tester in the "Guided Troubleshooting" function.

1.2.11 Refrigerant pipe with internal heat exchanger

- ◆ In this refrigerant line, the liquid warm refrigerant flowing on the high-pressure side loses energy to the cold gaseous refrigerant or refrigerant vapour flowing on the low-pressure side, which increases the efficiency of the air conditioning system.



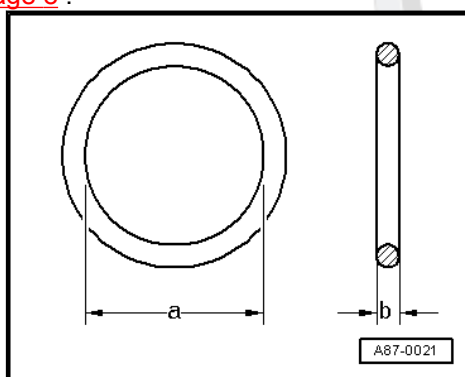
A - Refrigerant pipe with internal heat exchanger

B - Channels in the refrigerant circuit, in which the warm liquid refrigerant flows to the evaporator (high-pressure side of the refrigerant circuit).

C - Channel in the refrigerant line, in which the cold gaseous refrigerant or refrigerant vapour flows to the AC compressor (low-pressure side of the refrigerant circuit)

1.2.12 Seal

- ◆ These seals seal off the connection points between the individual components of the refrigerant circuit ⇒ [f3.2](#) or the [refrigerant circuit](#), [page 8](#).



1.2.13 Pipes and hoses of the refrigerant circuit

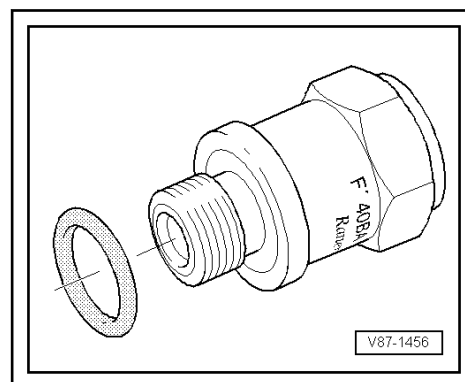
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- ◆ In pure form, refrigerant R1234yf is chemically stable and does not attack e.g. iron and aluminium or suitable plastics developed for use with the refrigerant. The mixture of refrigerant oil and refrigerant R1234yf can attack certain metals (e.g. alloys of copper) and attack/release certain hose materials and plastics. Therefore, only use original spare parts ⇒ Electronic Catalogue of Original Parts "ETKA".
- ◆ Only use components that are resistant to refrigerant R1234yf and applicable refrigerant oils. Do not use components (such as seals and hoses that are made of plastic) that cannot be definitely assigned ⇒ Electronic Catalogue of Original Parts "ETKA".

- ◆ The pipes and hoses are held together by bolted or other types of connection ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- ◆ Replace the sealing elements (e.g. seals) between the components ⇒ Electronic Catalogue of Original Parts "ETKA".
- ◆ For bolted connections, note the specific tightening torques; for plug connections, use the correct release tools ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

1.2.14 Pressure relief valve

The pressure relief valve is attached to the AC compressor or fluid reservoir.



At a pressure of approx. 38 bar (excess pressure), the valve opens, then closes again when the pressure has dropped (at approx. 35 bar).

The refrigerant does not flow out completely.



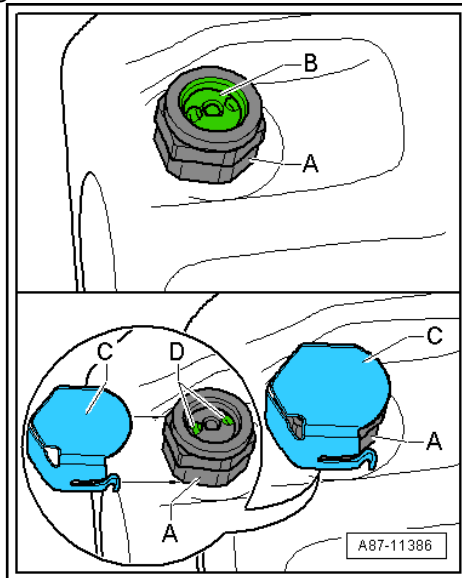
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i Note

Depending on the design, there may be a transparent plastic washer -B- on the pressure relief valve -A-, which pops out as soon as the valve is triggered.

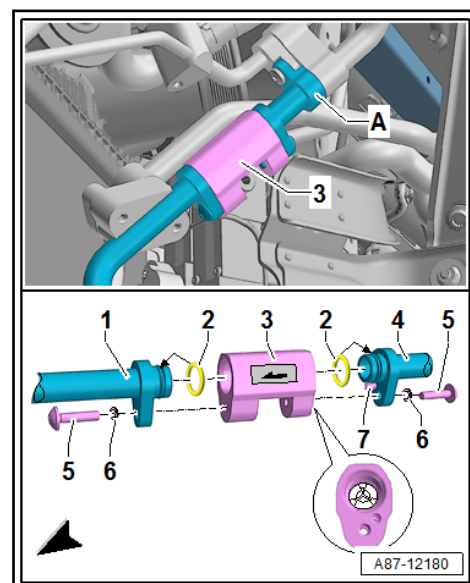


Depending on the design of the pressure relief valve -A-, there may also be a cover -C-, which is slid onto the pressure relief valve -A-. If the pressure in the refrigerant circuit in fact rises above the opening pressure of the pressure relief valve -A- and the pressure relief valve opens, the refrigerant does not escape in one direction, but is divided between the openings -D- under the cover -C- as it escapes.

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1.2.15 Check valves

Check valves -3- divide the refrigerant circuit into several different zones, see vehicle-specific repair guide.

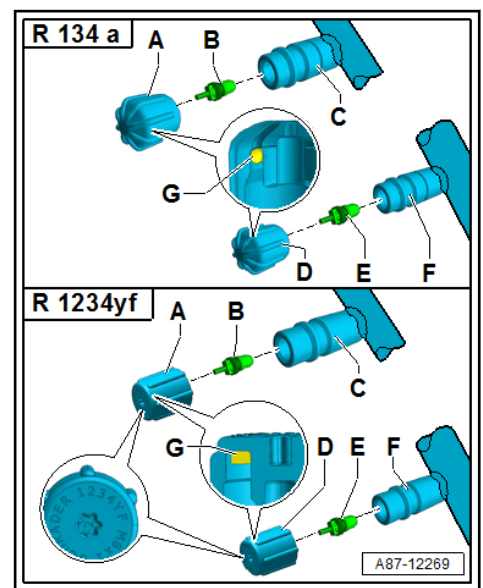
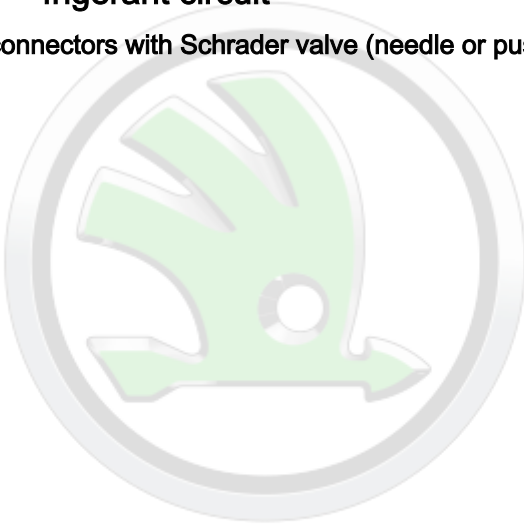


i Note

- ◆ Check valves in the refrigerant circuit have a certain holding pressure in the flow direction (approx. 0.1 bar or 100 mbar). So that the refrigerant circuit can be fully evacuated (residual pressure less than 5 mbar), all electrically controlled valves must therefore be open.
- ◆ Depending on the version, the direction of passage can be marked with a sticker.

1.2.16 Connections for quick couplers on refrigerant circuit

Service connectors with Schrader valve (needle or push pin)



- ◆ Only use valves and connections that are resistant to refrigerant R1234yf and applicable refrigerant oils.

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- ◆ The service connectors -C- and -F- on a R1234yf refrigerant circuit are designed so that service couplers designed for the service connectors of a R134a refrigerant circuit cannot be connected.
- ◆ There are different connections (outside diameter) for the high-pressure and low-pressure side (-C- and -F-).
- ◆ Before removing the valve or valve cores -B- and -E-, empty the refrigerant circuit.
- ◆ Screw on end caps -A- and -D- with seal -G- completely.

Arrangement in the vehicle → Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

- Extract refrigerant before unscrewing and removing the valves.
- ◆ Service connector on low-pressure side -F-
- ◆ Service connector on high-pressure side -C-
- ◆ Valve insert (designation: Schrader or needle valve)
- ◆ End cap for service connector on low-pressure side with seal -A-



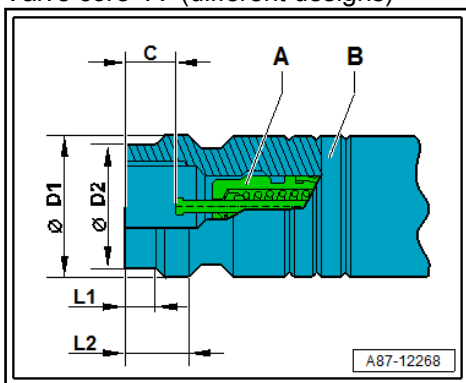
- ◆ End cap for service connector on high-pressure side with seal -D-

i Note

- ◆ *Carefully screw in the handwheel of the service coupler after connecting and only into the quick coupler adapter until the valve in the service connector is definitely open (watch the pressure gauge, do not apply excess pressure to the valve).*
- ◆ *The service connectors on a R1234yf refrigerant circuit are designed so that the service couplers designed for the service connectors of a R134a refrigerant circuit cannot be connected.*
- ◆ *The service connectors, for example, are soldered into the refrigerant line and therefore cannot be replaced individually.*
- ◆ *Use e.g. an adapter from the socket insert -T10364-/-T10364A- to remove and install the valve core on an empty refrigerant circuit.*
- ◆ *Only tighten the valve core slightly, as the required tightening torque is low.*
- ◆ *These valves come in different designs and therefore have different tightening torques: A valve core -C- with a VG5 thread (5.2 x 0.7 mm, tyre valve) has a tightening torque of 0.4±0.1 Nm; a valve core with an M6 x 0.75 mm thread has a tightening torque of 0.9±0.1 Nm and a valve core with an M8 x 1.0 mm thread has a tightening torque of 2.0±0.2 Nm.*
- ◆ *These valve caps come in different designs and therefore have different tightening torques. A valve cap with an M8 x 1 mm or M10 x 1 mm thread has a tightening torque of 0.4 Nm ± 0.1 Nm.*
- ◆ *These valves, valve cores and applicable end caps comes in different designs. Make sure you are using the correct type of valve core and that the screw cap is correct ⇒ Electronic Catalogue of Original Parts "ETKA".*

Dimensions of the service connectors

- ◆ Valve core -A- (different designs)



- ◆ Service connector -B- (different designs for high- and low-pressure sides, depending on refrigerant)

Dimensions of the service connectors -B-	Service connector, Refrigerant R134a		Service connector, Refrigerant R1234yf	
	High-pressure side	Low-pressure side	High-pressure side	Low-pressure side
Outer diameter -D1-	16.0 mm	13.0 mm	17.0 mm	14.0 mm
Outer diameter -D2-	14.0 mm	11.0 mm	13.0 mm	12.0 mm
Shoulder -L1-	4.6 mm	5 mm	9.0 mm	4.75 mm
Shoulder -L2-	8.16 mm	9.16 mm	12.5 mm	7.2 mm
Installation position of valve (unactuated) -C-	-7.1 mm	-7.1 mm	8.3...9.3 mm	8.3...9.3 mm

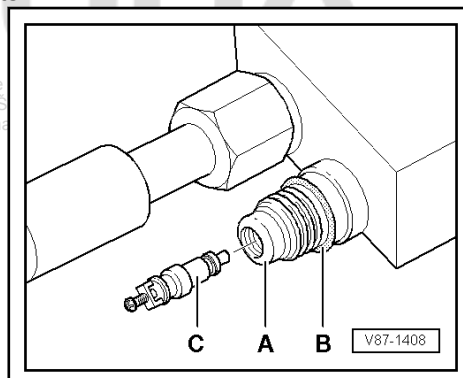
1.2.17 Connections with valve for switches on refrigerant circuit

i Note

For switching pressures, removing and installing switches, as well as switch arrangement and design, see the vehicle-specific refrigerant circuit ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

- There are different threads for switches on high- and low-pressure sides.
- Only use valves and seals that are resistant to refrigerant R1234yf and applicable refrigerant oils ⇒ Electronic Catalogue of Original Parts "ETKA".

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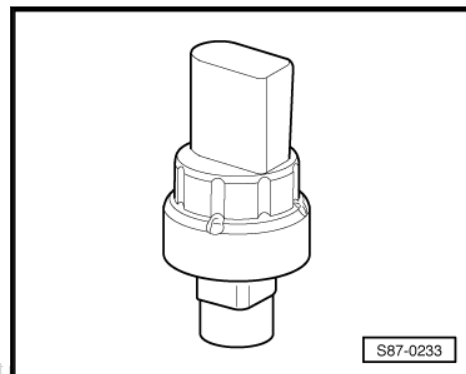
- A - Connection (soldered)
- B - Seal
- C - Valve (with seal)



Note

- ◆ For removing and installing the valve core -C- when the refrigerant circuit is empty, use e.g. an adapter from the socket insert -T10364-/-T10364A- (tightening torque) ⇒ [f1.2.16 or quick couplers on refrigerant circuit](#), page 53.
- ◆ These valves come in different designs and therefore have different tightening torques. A valve core -C- with a VG5 thread (5.2 x 0.7 mm, tyre valve) has a tightening torque of 0.4 ± 0.1 Nm; a valve core with an M6 x 0.75 mm thread has a tightening torque of 0.9 ± 0.1 Nm and a valve core with an M8 x 1.0 mm thread has a tightening torque of 2.0 ± 0.2 Nm.

1.2.18 High-pressure sensor -G65-



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Note

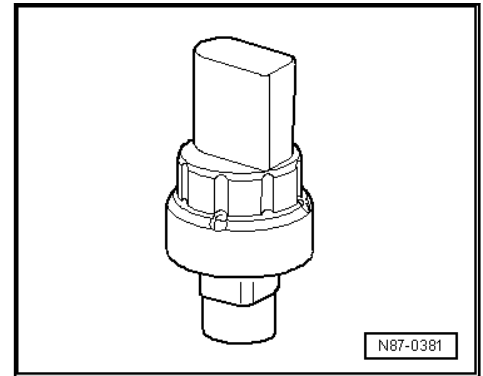
The high pressure sender -G65- (specifically designed for vehicles) can be installed instead of the pressure switch for the air conditioning system -F129-.

The high-pressure sender -G65- determines the pressure in the refrigerant circuit and transmits the values to the Air conditioning system control unit -J301- or to the Climatronic control unit -J255-.

The following are shifted via these control units:

- ◆ The radiator fan -V7- switches to the next speed in the event of a pressure rise in the refrigerant circuit
- ◆ Reduction of the A/C compressor output if the pressure is too high, 3.2 MPa (32 bar), e.g. too little engine cooling
- ◆ Reduction of the AC compressor output if the pressure is too low, 0.2 MPa (2 bar), e.g. after loss of refrigerant

1.2.19 Pressure sender and switch on refrigerant circuit



Note

- ◆ *There are different types of pressure sender and switch with different functions and different names ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- ◆ *For switching pressures, removing and installing switches, as well as switch arrangement and design, see ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- ◆ One of the types of pressure sender generates a square wave signal when a voltage is applied; the signal changes with the pressure in the system. The other type of pressure sender exchanges information with the applicable control unit over the databus when a voltage is applied (e.g. over the "LIN bus") ⇒ Current flow diagrams, Electrical fault finding and Fitting locations and ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system. Therefore, always make sure you use the right type of pressure sender.
- ◆ There are different types of pressure sender that currently can only be distinguished on the outside by part number, so make sure you are using the correct type (part number ⇒ Electronic Catalogue of Original Parts "ETKA"). Justification: these sensors transmit different signals and the applicable control units can only assess the signal they are designed for ⇒ Vehicle diagnostic tester in "Targeted fault-finding" for the air conditioning system and ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- ◆ One of the types of pressure sender only transfers the measured value for the pressure in the refrigerant circuit to the connected control unit. The other type transfers the measured value for the pressure in the refrigerant circuit and the measured temperature to the connected control unit, so make sure you use the correct type ⇒ Electronic Catalogue of Original Parts "ETKA".
- ◆ The downstream control units use this signal to calculate the pressure in the refrigerant circuit and then actuate the radiator fans, the engine and the AC magnetic clutch -N25- accordingly or change the level of actuation of the AC compressor control valve -N280- ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system and ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

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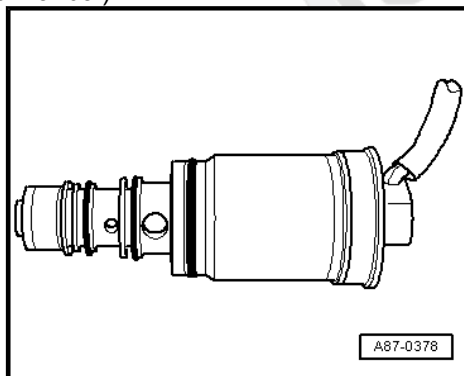
1.2.20 Regulating valve for compressor of air conditioning system -N280-



Note

For switching pressures, removing and installing switches, as well as switch arrangement and design, see the vehicle-specific refrigerant circuit ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

- ◆ The regulating valve is installed in the AC compressor. It is actuated, for example, by the AC control unit -J301-, the AC control and display unit -E87- or the Climatronic control unit -J255- (depending on vehicle, this may be via the databus and an additional control unit) ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system and ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).



- ◆ The pressure on the low-pressure side is influenced by the regulating valve and thus the temperature in the evaporator is regulated.



Note

The AC compressor regulating valve -N280- is part of the air conditioner compressor and is supplied as a separate spare part for some air conditioner compressors, see ⇒ Electronic Catalogue of Original Parts "ETKA".

Removing and installing air conditioning compressor control valve →, see ⇒ [a1.5.8 nd installing, replacing air conditioning compressor control valveN280", page 80](#)

1.3 Possible complaints

⇒ [f1.3.1 or investigating a complaint", page 58](#)

⇒ [c1.3.2 omplaints", page 59](#)

⇒ [f1.3.3 rom the heating and air conditioning unit", page 60](#)

1.3.1 Requirements for investigating a complaint

- Fault finding has not identified a fault in the electrical system, the vacuum system and the air guides ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function of the air conditioning system (and the battery control)⇒ Current flow diagrams, Electrical fault finding and Fitting locations

- Self-diagnosis in the “Targeted fault-finding” function of the air conditioning system, e.g. with the ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function of the air conditioning system) does not detect any events for a complaint.
- No switch-off condition for the AC compressor is displayed in the measured values from the AC control unit ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function for the air conditioning system.

1.3.2 Possible complaints



For all complaints marked with an * ⇒ [p2.14 ressure](#)”, page 139.

- ◆ The radiator has failed completely. *
- ◆ Insufficient cooling capacity for all vehicle speeds or engine speeds. *
- ◆ No cooling or insufficient cooling after a few kilometres of driving. *
- ◆ No cooling or insufficient cooling at the evaporator. *
- ◆ Actuation of the AC compressor (via the AC magnetic clutch -N25- or the AC compressor regulating valve --) is switched off by the applicable control unit (e.g. the AC control and display unit -E87-, the AC control unit -J301- or the Climatronic control unit -J255-) as a result of too high or too low pressure in the refrigerant circuit * ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function for the air conditioning system.
- ◆ There is no fresh air supply or there is a strong decrease of fresh air supply after a few kilometres of driving (evaporator ices up) * ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function for the air conditioning system.

In addition, the following complaints may still arise:

The AC compressor makes noises.

- Tighten the securing bolts for the AC compressor and the AC compressor bracket with a torque wrench ⇒ Heating, Air Conditioning; Rep. gr. 87.
- Check the routing of the refrigerant lines, which must not be in contact with other components and must be installed free of tension (align if necessary) ⇒ Heating, Air Conditioning; Rep. gr. 87.

Immediately after switching on the air conditioning system and/or when cornering or braking, noises occur (refrigerant hammering):

- Drain, evacuate and fill refrigerant circuit again (too much refrigerant or refrigerant oil in the circuit) ⇒ [w2 ith the A/C service station](#)”, page 102 and ⇒ [p2.14 ressure](#)”, page 139.



This complaint may also arise if there is too much refrigerant oil in the circuit (when changing the AC compressor, for example, the quantity of refrigerant oil was not modified) ⇒ [c1.5 ompo-nents](#)”, page 72.



On an air conditioning system which otherwise functions perfectly, water sprays out of the vents (the dash panel or in the footwell):

- Check that the condensation water drain is has been laid correctly; it must not be crushed or bent ⇒ Heating, Air Conditioning; Rep. gr. 87.
- Check the condensation water drain valve; it must not be stuck with wax or underbody sealant and must open and close correctly ⇒ Heating, Air Conditioning; Rep. gr. 87.
- Check the plenum chamber cover; it must not be damaged and must be installed correctly (no water may flow into the evaporator) ⇒ Heating, Air Conditioning; Rep. gr. 87.
- Check the water drainage openings of the plenum chamber; they must not be blocked (e.g. by leaves) ⇒ Heating, Air Conditioning; Rep. gr. 87.

**Note**

*Installation location and other notes for these components
⇒ Heating, Air Conditioning; Rep. gr. 87.*

1.3.3 Odour from the heating and air conditioning unit

Is the odour coming from the evaporator or heat exchanger?

- ◆ Fishy odour
 - Due to leak tightness at the cooling system of the engine or the heat exchanger in the heating and air conditioning unit.

**Note**

If a weak fishy odour can be detected when the temperature is set to "cold" or a stronger odour occurs when the temperature is set to "warm", check the heat exchanger for leak tightness.

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- ◆ Odours after the clutch is burnt
- ◆ Evaporations from footmats, subsequently fitted protective seat covers etc.
- ◆ Foul, mouldy odour
 - Due to accumulation and deposit of leaves, tree needles, etc. in the plenum chamber.

**Note**

Clean plenum chamber.

- Use water which cannot drain out the plenum chamber.

**Note**

Check the installation location: in the water box.

- ◆ Odour from the heating and air conditioning unit

 **Note**

Odours which can occur in the heating and air conditioning unit, can be detected in the fresh as well as re-circulating air mode.

- Due to excessive condensation water in the heating and air conditioning unit.

 **Note**

Check condensation water drain.

- Caused by an old or heavily soiled dust and pollen filter.

 **Note**

Check dust and pollen filter.

- Due to deposits on the fins of the evaporator

 **Note**

Clean the evaporator with the ultrasonic air conditioning system cleaning device or the suction-feed spray gun and applicable spray lance.

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Ultrasonic air conditioning system cleaning device

- The ultrasonic air conditioning system cleaning device is placed in the footwell on the front passenger side and atomises the Aeroclean agent. Aeroclean neutralises microbes and bacteria in the heating and air conditioning unit.

Operating instructions come with the device.

For the latest equipment, see ⇒ Electronic Catalogue of Original Parts "ETKA"/

Spraying the evaporator with the suction-feed spray gun and spray lance

The evaporator is sprayed directly with Contra Sept using the spray lance (approx. 10 bar). Aeroclean neutralises microbes and bacteria directly in the evaporator.

To access the evaporator, preparation and various spray lances are required.

There are vehicle-specific operating instructions with the cleaning solution for the evaporator ⇒ Electronic Catalogue of Original Parts "ETKA".



1.4 Identifying leaks

⇒ [1.4.1 nformation about finding leaks in the refrigerant circuit”, page 62](#)

⇒ [1.4.2 eaks on refrigerant circuits with an electronic leak detector”, page 63 .](#)

⇒ [1.4.3 eaks with the UV leak detection system”, page 65 .](#)

⇒ [1.4.4 eaks by means of vacuum testing with the AC service station or pressure testing”, page 71](#)

1.4.1 General information about finding leaks in the refrigerant circuit



Note

- ◆ *Minor leaks can be detected for example with an electronic leak detector or a UV lamp.*
- ◆ *There are 2 different procedures to search for leaks in the refrigerant circuit in this workshop manual. Both procedures have been tested and are reliable under different operating conditions if followed correctly and depending on the problem.*
- ◆ *There are many procedures available on the market to find leaks in refrigerant circuits. However, they are not always reliable and, if they are not carried out according to the instructions, they may also identify leaks in various components of the refrigerant circuit, even though they are leak tight. In addition, during certain procedures, components of the refrigerant circuit can be damaged or initially damaged.*
- ◆ *If leaks are found on some components, the components must not be repaired, but have to be replaced with original parts.*
- ◆ *A leaking refrigerant circuit must not be filled with refrigerant, so evacuate an empty refrigerant circuit and check it for leaks before filling with refrigerant ⇒ [t2.5 he refrigerant circuit.”, page 112 .](#)*

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Caution

- ◆ *Chemical agents must not be used to seal leaks on a refrigerant circuit.*
- ◆ *If it is suspected that chemical agents have been filled into the vehicle refrigerant circuit to seal leaks, do not connect the AC service station and do not drain the refrigerant.*
- ◆ *Chemical agents (leak stop additives) used to seal leaks on a refrigerant circuit usually react with the ambient air and the humidity in air to form deposits.*
- ◆ *Deposits of these chemical substances in the refrigerant circuit cause functional problems in the valves and other components with which they come into contact, and in the AC service station. These deposits cannot be completely removed from the components again (even by cleaning/flushing). The refrigerant circuit can therefore only be repaired by replacing all components that have come into contact with the substance.*
- ◆ *The Škoda company does not use chemicals to seal leaks on refrigerant circuits.*

1.4.2 Detecting leaks on refrigerant circuits with an electronic leak detector

Special tools and workshop equipment required

- ◆ Electronic leak detector or commercially available



Note

- ◆ *Leaks on an R1234yf refrigerant circuit can only be found with electronic leak detectors that have been designed for refrigerant R1234yf.*
- ◆ *The different refrigerants have a different molecular structure. The sensors of the electronic leak detectors are specifically designed for the molecules. If an electronic leak detector is used that is not specifically designed for refrigerant R1234yf, it does not detect refrigerant R1234yf or only when there is a large concentration of the refrigerant R1234yf near to the leak points. Therefore, electronic leak detectors that are only designed for refrigerant R134a must not be used to detect leaks in an R1234yf refrigerant circuit.*
- ◆ *Depending on the design of the heating and air conditioning unit, it is also possible to find a leak on the evaporator by holding the test probe of the leak detector into the heating and air conditioning unit through the connection for the glove compartment cooling or, if the condensation water drain has been detached, by holding the test probe at the open connection for the condensation water drain of the heating and air conditioning unit.*



Detecting leaks in a refrigerant circuit that is completely empty because of leaking



Note

When detecting leaks, proceed as follows to ensure that only as much refrigerant escapes into the atmosphere as is absolutely necessary to detect leak points in a completely empty refrigerant circuit:

- Evacuate the refrigerant circuit with the A/C service station ⇒ [t2.5 he refrigerant circuit.](#), page 112 .



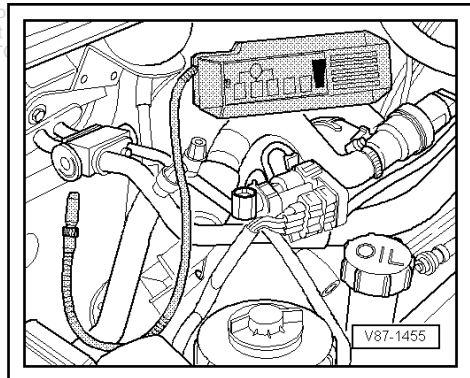
Note

- ◆ *If a more significant leak is found during evacuation, locate and eliminate it as described in ⇒ [t2.5 he refrigerant circuit.](#), page 112 .*
- ◆ *If no leak is found during evacuation or there is a leak that is so small that the leak point cannot be found by means of vacuum testing, then proceed as follows:*
 - If the refrigerant circuit is completely empty, fill approx. 10% of the filling capacity of refrigerant and perform leak detection as for a refrigerant circuit filled with refrigerant ⇒ [page 64](#) .

Performing leak detection on a refrigerant circuit filled with refrigerant

- Switch off ignition.
- Operate the leak detector according to the relevant operating instructions.
- Always hold the test prod below the suspected leakage.

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If the number of knocking noises increases or a whining tone occurs, as a result of the design, the leak point has been found ⇒ Leak detector operating instructions



Note

- ◆ *Refrigerant gas quickly floats away with the movement of the air. Therefore avoid any draught during leak detection.*
- ◆ *Refrigerant gas is heavier than air and therefore sinks down where it escapes from the circuit.*

1.4.3 Finding leaks with the UV leak detection system



Note

- ◆ *Some leaks are difficult to detect with an electric leak detector or even cannot be found with an electric leak detector. To detect these leaks, perform leak detection with the leak detection system → Electronic Catalogue of Original Parts "ETKA".*
- ◆ *If there is a leak on the refrigerant circuit, refrigerant oil also escapes with the refrigerant. This oil normally stays near the leak point. For this oil to be visible under UV light, a small amount of fluorescent liquid must be put into the refrigerant circuit. This liquid (PAG oil with an additive that fluoresces under UV light) is put into the refrigerant circuit and distributes through the system with the refrigerant oil when the air conditioning system is switched on.*
- ◆ *The air conditioning system must be operated for at least 60 minutes so that the added additive is distributed throughout the refrigerant circuit (the AC compressor must run). Depending on the size of the leak, the leak point will already be visible under UV light in this time.*
- ◆ *The refrigerant oil with the additive that fluoresces under UV light can be applied directly when the circuit is open or forced in via the service connector after the circuit has been emptied using the AC service station.*
- ◆ *If the leak detection additive is put into the refrigerant circuit via the service connector, a small quantity of leak detection additive is left in the service connector. Carefully remove the remaining amount so that it is not mistaken for a leak point during subsequent leak detection.*
- ◆ *If a component in the circuit that is filled with the leak detection additive is replaced, clean the connections to other components after you have assembled the refrigerant circuit. During subsequent leak detection, the residue of the leak detection additive at the connections could be mistaken for a leak point.*
- ◆ *When emptying the refrigerant circuit, refrigerant oil and therefore leak detection additive also enters the AC service station. The refrigerant oil is separated from the refrigerant in the oil separator of the AC service station and removed from the AC service station using the draining device. The drained refrigerant oil must not be refilled. It must be replaced with fresh refrigerant oil.*
- ◆ *If leak detection fluid has already been filled in a refrigerant circuit during an earlier repair, the following must be observed: only add new leak detection fluid if the refrigeration machine oil is replaced. If only some of the refrigerant oil has been replaced, only a corresponding amount of leak detection liquid must be added. For example, if 100 ml of refrigerant oil has been replaced for a vehicle with a 250 ml-capacity, only top up with 1 ml (cm³) of leak detection additive.*
- ◆ *Certain materials and their compounds (e.g. oxidation products on components made of aluminium, anti-corrosion waxes etc.) also fluoresce under UV light.*
- ◆ *Depending on the design of your AC service station, the leak detection additive can also be added directly via the service*

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station; follow the operating instructions for the AC service station ⇒ AC service station operating instructions.

Leak detection on an empty, leaking refrigerant circuit

- When detecting leaks, proceed as follows to ensure that only as much refrigerant escapes into the atmosphere as is absolutely necessary to detect leak points in a completely empty refrigerant circuit:
- Evacuate the refrigerant circuit with the A/C service station ⇒ [t2.5 he refrigerant circuit.](#), [page 112](#) .



Note

If a more significant leak is found during evacuation, locate and eliminate it as described in ⇒ [t2.5 he refrigerant circuit.](#), [page 112](#) and ⇒ [I1.4.4 eaks by means of vacuum testing with the AC service station or pressure testing](#), [page 71](#) .

If no leak is found during evacuation or there is a leak that is so small that the leak point cannot be found during evacuation, then proceed as follows:



Note

- ◆ *Only use UV leak detection additive that is approved for refrigerant R1234yf.*
- ◆ *The UV leak detection additive partly consists of refrigerant oil. Only use UV leak detection additives that use the refrigerant oil for refrigerant R1234yf as vehicle. The refrigerant oil with UV leak detection additive developed for refrigerant R134a must not be used.*
- ◆ *Different refrigerant oils (PAG oils) are used for refrigerant circuits with refrigerants R1234yf and R134a, so always check you are using the right leak detection additive (PAG oil) with an additive that fluoresces under UV light.*
- ◆ *Add UV leak detection additive to the refrigerant circuit using the AC service station ⇒ [page 66](#) .*
- ◆ *Add UV leak detection additive to the refrigerant circuit using the leak detection system ⇒ [page 69](#) .*
- Fill the refrigerant circuit with the specified quantity of UV leak detection additive and refrigerant ⇒ [page 66](#) , ⇒ [t2.6 he refrigerant circuit](#), [page 118](#) and ⇒ heating, air conditioning; Rep. gr. 00; Technische specifications.
- Operate the air conditioning system for at least 60 minutes with the AC compressor switched on.
- Find leak with the UV leak detection system ⇒ [page 69](#) .

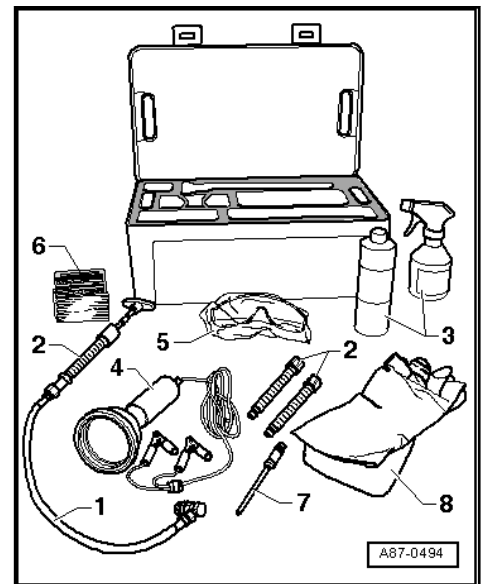
Adding UV leak detection additive using the AC service station

- Fill UV leak detection additive and the specified quantity of refrigerant into the refrigerant circuit using the AC service station ⇒ [t2.6 he refrigerant circuit](#), [page 118](#) and ⇒ Heating, Air Conditioning; Rep. gr. 00; Technical specification.

i Note

- ◆ The quantity of UV leak detection additive that is filled for a refrigerant circuit with a refrigerant oil volume of up to 150 cm³ is 3.0 ± 0.5 ml (cm³). If the volume of refrigerant oil in the refrigerant circuit is greater, more UV leak detection additive must be added, as appropriate, e.g. 5.0 ± 0.5 ml (cm³) for a refrigerant circuit with a volume of refrigerant oil of 250 cm³. When adding the UV leak detection additive using an AC service station, the quantity set on the AC service station may be different, so always follow the applicable operating instructions → AC service station operating instructions.
- ◆ The volume of refrigerant oil in the refrigerant circuit is noted in the vehicle-specific instructions → Heating, Air Conditioning; Rep. gr. 00; Technical data.
- ◆ If leak detection fluid has already been filled in a refrigerant circuit during an earlier repair, the following must be observed: only add new leak detection additive if the refrigeration machine oil is replaced. If only part of the refrigerant oil has been replaced, only top up a corresponding amount of UV leak detection additive. For example, if 50 ml of refrigerant oil has been replaced for a vehicle with a 150 ml-capacity, only top up with 1.0 ml (cm³) of leak detection additive.

The leak detection system consists of the following components:



- ◆ Cleaning agent -3-
- ◆ UV leak detection lamp -4-
- ◆ UV absorbing goggles -5-
- ◆ Stickers -6-
- ◆ Protective gloves -8-

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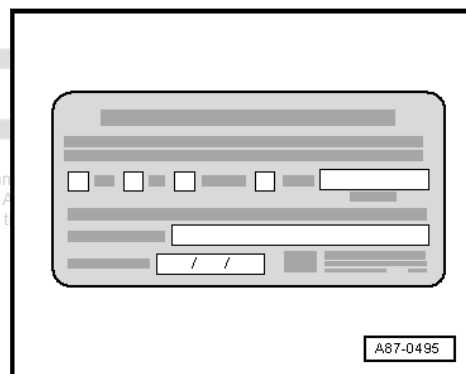
Note

Items -1-, -2- and -7- can be ignored.

Special tools and workshop equipment required

- ◆ Leak detection system
- ◆ AC service station with the ability to add UV leak detection additive to the refrigerant circuit ⇒ Electronic Catalogue of Original Parts “ETKA”
- ◆ Approved leak detection additive ⇒ Electronic Catalogue of Original Parts “ETKA”
- Evacuate refrigerant circuit and fill with UV leak detection additive ⇒ [t2.5 he refrigerant circuit”, page 112](#) and ⇒ [t2.6 he refrigerant circuit”, page 118](#) .
- Wait until the pressures on the high- and low-pressure sides have equalised.
- Disconnect the A/C service station from the refrigerant circuit and switch off ⇒ [o2.8 ff the A/C service station and disconnecting it from the refrigerant circuit”, page 123](#) .
- Attach a sticker near the service connectors with a note that UV leak detection additive has been added to this refrigerant circuit.

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- Remove the residues of the UV leak detection additive from the service connector, e.g. using absorbent paper, and clean the area with cleaning agent -VAS 6201/3-.
- Close the service connector with the screw cap.
- Start up the air conditioning system.



Note

- ◆ *The air conditioning system must be operated for at least 60 minutes so that the added additive is distributed throughout the refrigerant circuit (the AC compressor must run). Depending on the size of the leak, the leak point will already be visible under UV light in this time.*
- ◆ *Depending on the size and the location of the leak, it might take several days until enough refrigerant oil escapes with the UV leak detection additive escapes and the leak point can be detected.*
- Search for a leak on the refrigerant circuit using the UV lamp ⇒ [page 69](#) .

Adding UV leak detection additive to the refrigerant circuit using the leak detection system

- Remove the residues of the UV leak detection additive from the service connector, e.g. using absorbent paper, and clean the area with cleaning agent.
- Close the service connector with the screw cap.
- Start up the air conditioning system.

Note

- ◆ *The air conditioning system must be operated for at least 60 minutes so that the added additive is distributed throughout the refrigerant circuit (the AC compressor must run). Depending on the size of the leak, the leak point will already be visible under UV light in this time.*
- ◆ *Depending on the size and the location of the leak, it might take several days until enough refrigerant oil with the additive escapes and the leak point can be detected.*
- Search for a leak on the refrigerant circuit using the UV lamp ⇒ [page 69](#).

Searching for leaks from the refrigerant circuit using the UV lamp



WARNING

Risk of eye injury from UV light.

- ◆ *Wear safety goggles.*
- ◆ *Never look directly at the UV lamp.*
- ◆ *Never point the UV lamp at other people.*

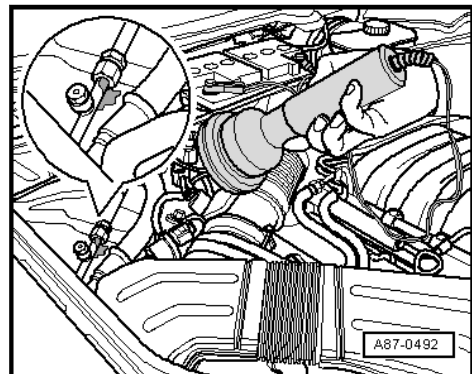
- For vehicles with a high-voltage system, switch off (deactivate) the “stand-by air conditioning” function ⇒ Owner’s Manual for the Vehicle.
- Switch off ignition.



Note

- ◆ *After adding the UV leak detection additive, the air conditioning system must be operated for at least 60 minutes so that the added additive is distributed throughout the refrigerant circuit (the AC compressor must run). Depending on the size of the leak, the leak point will already be visible under UV light in this time.*
 - ◆ *Depending on the size and the location of the leak, it might take several days until enough refrigerant oil with the additive escapes and the leak point can be detected.*
 - ◆ *In case of leaks on the evaporator, the additive may be washed away with the condensation water and flows out via the condensation water drain. On most vehicles the evaporator is not accessible without extensive preliminary work, therefore if a test is carried out e.g. on the condensation water drain, this could provide an indication of a leaking evaporator. In this case, however, the additive has to have been in the refrigerant circuit for a longer period of time (several days).*
 - ◆ *The safety goggles protect the eyes and increase the fluorescence of the UV leak detection additive when exposed to UV light.*
 - ◆ *Depending on the accessibility of various parts of the refrigerant circuit, it may be necessary to remove certain parts of the vehicle (e.g. the bumper or the air filter).*
 - ◆ *Only small amounts of refrigerant oil reach certain points of the refrigerant circuit when the air conditioning system is operated (e.g. a filler cap installed on the top of a fluid reservoir mounted on the condenser). If there is a leak at these points, it may take longer until enough refrigerant with refrigerant oil and additive escapes to fluoresce under the UV lamp and indicate a leak. It may therefore be appropriate to use an electronic leak detector to detect leaks at these points ⇒ [11.4.2 eaks on refrigerant circuits with an electronic leak detector](#), page 63 .*
- Park the vehicle in a darker area of the workshop (in daylight or under strong lighting the effect of the UV light is reduced).

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- Check that the various parts of the refrigerant circuit are accessible and remove the parts around the refrigerant circuit that obstruct the view of the parts of the refrigerant circuit (e.g. the noise insulation and the bumper).
- Wear safety goggles to protect your eyes.
- Connect the UV lamp to a 12 V battery (vehicle battery). Check the polarity of the connections is correct.

- Switch on the UV lamp and point it at the parts of the refrigerant circuit. Points where refrigerant, refrigerant oil and therefore UV leak detection additive has escaped will glow under UV light (fluoresce).

1.4.4 Detecting leaks by means of vacuum testing with the AC service station or pressure testing

All vehicles



WARNING

Risk of frostbite through refrigerant escaping under pressure.

This may cause frostbite on the skin and other parts of the body.

- ◆ *Wear protective gloves.*
- ◆ *Wear safety goggles.*
- ◆ *Evacuate the refrigerant circuit and immediately open the refrigerant circuit.*
- ◆ *If more than 10 minutes have elapsed since evacuation and the coolant circuit has not been opened, evacuate the refrigerant again. Pressure builds up in the refrigerant circuit as a result of secondary evaporation.*

- Switch off ignition.
- ◆ Detecting leaks by means of vacuum testing with the AC service station or pressure testing ⇒ [t2.5 he refrigerant circuit.](#), page 112



Note

- ◆ *Minor leaks from the refrigerant circuit (less than 100 g refrigerant lost per year) cannot normally be detected by means of vacuum testing or pressure testing. The incoming volume of air or escaping volume of nitrogen is too small to detect the defects from noise.*
- ◆ *Minor leaks from the refrigerant circuit (less than 100 g refrigerant lost per year) cannot normally be detected by means of vacuum testing or pressure testing, depending on local conditions (local noise, location of the leak etc.). The incoming volume of air or escaping volume of nitrogen may be too small to make a noise that would allow the defects to be detected.*
- ◆ *Major leaks from the refrigerant circuit (e.g. chipped condenser, loss of more than 100 g of refrigerant per day) can be detected – depending on local conditions – from the noise that is generated during vacuum testing or pressure testing at the point of defect ⇒ [t2.5 he refrigerant circuit.](#), page 112.*

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1.5 Replace components

- ⇒ [1.5.1 Instructions for replacing components", page 72](#)
- ⇒ [1.5.2 Leaking or damaged components; empty refrigerant circuit \(except AC compressor and fluid reservoir\)", page 74](#)
- ⇒ [1.5.3 Leaking or damaged components; filled refrigerant circuit \(except AC compressor and fluid reservoir\)", page 76](#)
- ⇒ [1.5.4 Recharge AC compressor without needing to clean the refrigerant circuit", page 76](#) .
- ⇒ [1.5.5 Recharge AC compressor because of a leak or internal damage", page 77](#)
- ⇒ [1.5.6 Recharge dryer cartridge after cleaning the refrigerant circuit.", page 78](#)
- ⇒ [1.5.7 Recharge drying cartridge without needing to clean the refrigerant circuit", page 79](#)
- ⇒ [1.5.8 Recharge and installing, replacing air conditioning compressor control valve N280", page 80](#)

1.5.1 General instructions for replacing components

- All the parts of the refrigerant circuit that are sent in for quality monitoring must be closed (use original screw caps of the spare part).
- Replace damaged or leaking components of the refrigerant circuit ⇒ [1.5.1 Instructions for replacing components", page 72](#) .
- All the components of the refrigerant circuit that are sent in for quality monitoring must be closed (use original screw caps of the spare part).
- The spare parts (AC compressor, fluid reservoir, evaporator and condenser) used to be filled with nitrogen gas. This filling of nitrogen gas escapes uniformly, more specifically, the pressure of the nitrogen filling is now so low that when opening for the first time, it is no longer noticeable that gas escapes.
- On vehicles with an AC compressor without magnetic clutch, the engine must only be started if the refrigerant circuit is fully assembled (the AC compressor always runs when the engine is running).
- The AC compressor with AC compressor regulating valve -- (without AC magnetic clutch -N25-) is switched to internal lubrication if the refrigerant circuit is empty, so that only a very small quantity of oil is pumped out of the AC compressor into the circuit.



Note

- ◆ *The following spare parts (AC compressor, AC reservoir, evaporator and condenser) may be filled with nitrogen gas, but not always. When unscrew the plugs from the spare part, therefore, there may be no audible or only a scarcely audible equalisation of pressure.*
- ◆ *Depending on where and for how long they have been stored, there may also be no audible or only a scarcely audible equalisation of pressure when you unscrew the plugs on components that were filled with nitrogen by the manufacturer, so that it is not possible to determine whether the component is leaking. For example, the nitrogen in the component may escape through the shaft seal of a spare part AC compressor over time, although the AC compressor is not leaking.*
- ◆ *As spare parts are stored for long periods of time and at different location, gas may or may not escape when the component is opened for the first time (even for spare parts with the same number). You should therefore always remove the caps on the connections of spare parts with care and allow the nitrogen to dissipate slowly.*
- ◆ *An expansion valve and a fluid reservoir with desiccator cartridge are installed in the refrigerant circuit ⇒ Heating, Air Conditioning; Rep. gr. 87.*
- ◆ *Replace the desiccator cartridge or components with a desiccator bag (fluid reservoir) after cleaning the refrigerant circuit (flushing with refrigerant R1234yf ⇒ [t1.6 he refrigerant circuit", page 84](#)); keep the new desiccator closed for as long as possible, to minimise the absorption of moisture.*
- ◆ *Replace the desiccator cartridge or components with a desiccator bag (fluid reservoir), if required for specific plans or if the refrigerant circuit has been open for longer period of time and moisture has got into the desiccator (e.g. after an accident) ⇒ [11.5.2 eaking or damaged components; empty refrigerant circuit \(except AC compressor and fluid reservoir\)", page 74](#).*
- ◆ *The length of time that a refrigerant circuit may be open without having to replace the component with the desiccator bag (fluid reservoir) depends substantially on local environmental conditions. At a high ambient temperature and high humidity, or if the vehicle e.g. has been outside or transported while exposed (subject to rain and mist), the period is significantly shorter than for a vehicle that has been in a heated, dry warehouse. The size of the opening through which any humidity can enter the circuit also has an influence on the period of time that an open refrigerant circuit may be left until the component with the desiccator bag must be replaced ⇒ [11.5.2 eaking or damaged components; empty refrigerant circuit \(except AC compressor and fluid reservoir\)", page 74](#).*
- ◆ *Close open connections and lines (prevent moisture absorption).*



Note

Contaminated refrigerant oil must be disposed of as used oil of unknown origin (according to local regulations) ⇒ Skoda-ServiceNet.

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1.5.2 Replacing leaking or damaged components; empty refrigerant circuit (except AC compressor and fluid reservoir)

The refrigerant circuit is completely empty (e.g. because of a major leak or a burst hose line)

- ◆ Follow the general instructions for replacing components ⇒ [1.5.1 instructions for replacing components](#), page 72 .

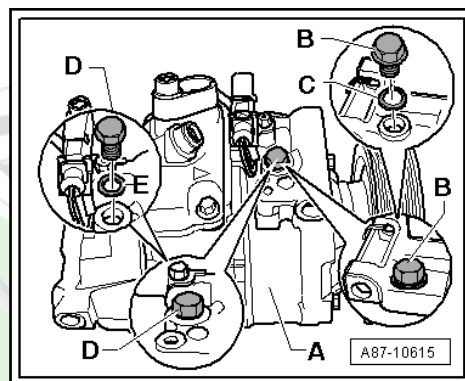


Note

- ◆ *If there is only a minor leak and the refrigerant has only escaped slowly (e.g. through a small leak point), not enough refrigerant oil escapes and not enough moisture enters the circuit to prevent the air conditioning system functioning correctly after repair.*
- ◆ *Only perform the steps marked with a * if there is a major leak (e.g. after an accident).*

AC compressor

- Remove the defective component * ⇒ Heating, Air Conditioning; Rep. gr. 87.
- Remove the air conditioning compressor. * ⇒ Heating, Air conditioning; Rep. gr. 87.
- Remove the oil drain plug -B- / -D- from the AC compressor -A-. *



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 Note

- ◆ The type of oil drain plug -B- / -D- and seal -C- / -E- varies (depending on the manufacture of the AC compressor) ⇒ Heating, Air Conditioning; Rep. gr. 87.
- ◆ When you install the oil drain plug -B- / -D-, note the correct typing for (depending on the manufacture of the AC compressor and the type of oil drain plug) ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- ◆ On a Denso AC compressor, for example, there is a sealing ring -E- installed on the oil drain plug -D-; replace it ⇒ Heating, Air Conditioning; Rep. gr. 87 and ⇒ Electronic Catalogue of Original Parts "ETKA".
- ◆ On a Denso AC compressor, for example, there is a sealing ring -E- installed on the oil drain plug -D-; replace it ⇒ Heating, Air Conditioning; Rep. gr. 87 and ⇒ Electronic Catalogue of Original Parts "ETKA". Tightening torque ⇒ Heating, Air Conditioning; Rep. gr. 87.
- ◆ If the seals (sealing ring or O-ring) installed on the oil drain plug are not available as spare parts, the removed sealing elements may be reused here in exceptional circumstances (but check for damage before installation). If the removed sealing element is damaged or deformed, it may need to be replaced by a commercially available component.
- ◆ To speed up evacuation of the refrigerant oil, rotate the AC compressor e.g. using the belt pulley or clutch disk of the magnetic clutch.
- ◆ Tip used refrigerant oil out of the AC compressor * ⇒ [t1.5.4 he AC compressor without needing to clean the refrigerant circuit", page 76](#) (for disposal, see ⇒ Skoda-Service-Net).

All vehicles

 Note

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- ◆ Then add the volume of new refrigerant oil to the AC compressor that corresponds to the refrigerant oil volume in the replacement compressor * ⇒ Heating, Air Conditioning; Rep. gr. 00; Technical data.
 - ◆ Use different refrigerant oils and quantities for different AC compressors ⇒ Heating, Air Conditioning; Rep. gr. 00; Technical data.
 - ◆ To ensure that the AC compressor is lubricated for first use, at least 40 cm³ of refrigerant oil must be added to the AC compressor, the rest can be added e.g. to the new AC/fluid reservoir or a refrigerant line ⇒ Heating, Air Conditioning; Rep. gr. 87.
 - ◆ If dirt has penetrated into the AC compressor when the refrigerant circuit was open (e.g. during an accident), the AC compressor must be replaced ⇒ Heating, Air Conditioning; Rep. gr. 87.
 - ◆ Cleaning refrigerant circuit (flushing with refrigerant R1234yf)* ⇒ [t1.6 he refrigerant circuit", page 84](#).
- Replace desiccator cartridge ⇒ Heating, Air Conditioning; Rep. gr. 87.



- Assemble the refrigerant circuit, evacuate and fill again ⇒ [w2 ith the A/C service station”, page 102](#) .

1.5.3 Replacing leaking or damaged components; filled refrigerant circuit (except AC compressor and fluid reservoir)

Refrigerant is still in the refrigerant circuit (e.g. in the case of a minor leak)

- ◆ Follow the general instructions for replacing components ⇒ [i1.5.1 nstructions for replacing components”, page 72](#) .
- Drain refrigerant circuit ⇒ [w2 ith the A/C service station”, page 102](#) .
- Remove defective component, blow through with compressed air and collect any refrigerant oil which flows out.
- The quantity of refrigerant oil that has been blown out (plus 20 cm³ for evaporator, plus 10 cm³ for condenser, refrigerant lines and refrigerant hoses) must be added as fresh refrigerant oil to the new component.



Note

Dispose of used refrigerant oil (according to local regulations) ⇒ Skoda-ServiceNet.

- Assemble the refrigerant circuit, evacuate and fill ⇒ [w2 ith the A/C service station”, page 102](#) .

1.5.4 Replacing the AC compressor without needing to clean the refrigerant circuit

- ◆ Follow the general instructions for replacing components ⇒ [i1.5.1 nstructions for replacing components”, page 72](#) .

For example, in the event of external damage following an accident

- Emptying a refrigerant circuit ⇒ [t1.6 he refrigerant circuit”, page 84](#)
- Remove AC compressor ⇒ Heating, Air Conditioning; Rep. gr. 87.
- Remove the oil drain plug from the AC compressor ⇒ Heating, Air Conditioning; Rep. gr. 87.



Note

There are different types of oil drain plug and seal (a seal or a sealing ring may be installed; it must be replaced) ⇒ [I1.5.2 eaking or damaged components; empty refrigerant circuit \(except AC compressor and fluid reservoir\)”, page 74](#) and ⇒ [Electronic Catalogue of Original Parts “ETKA”](#).

- To speed up evacuation of the refrigerant oil, rotate the AC compressor e.g. using the clutch disc of the magnetic clutch.
- Tip used refrigerant oil out of the AC compressor and dispose of it ⇒ Skoda-ServiceNet (according to local regulations).
- Remove the oil drain plug from the replacement compressor, take out the refrigerant oil and only add a quantity fresh refrigerant oil equal to the quantity of oil that you have tipped

out (from the defective AC compressor) ⇒ [11.5.2 eaking or damaged components; empty refrigerant circuit \(except AC compressor and fluid reservoir\)](#), page 74 .

Note

- ◆ *For example, 50 cm³ of refrigerant oil has been tipped out of the defective AC compressor and 100 cm³ of refrigerant oil has been tipped out of the replacement AC compressor (a small amount of refrigerant oil remains in the AC compressor). In this case, add 50 cm³ of refrigerant oil to the AC compressor to be installed (the refrigerant oil tipped out of the replacement compressor must not be used).*
 - ◆ *Use different refrigerant oils and quantities for different AC compressors ⇒ Heating, Air Conditioning; Rep. gr. 00; Technical data.*
 - ◆ *If a larger quantity of refrigerant oil (more than approx./ 50 cm³) has been tipped out of the defective AC compressor, the rest of the refrigerant oil can also be added to the evaporator or AC/fluid reservoir/internal heat exchanger ⇒ Heating, Air Conditioning; Rep. gr. 87.*
- Assemble the refrigerant circuit, evacuate and fill ⇒ [w2 ith the A/C service station](#), page 102 .

1.5.5 Replacing the AC compressor because of a leak or internal damage

- ◆ Follow the general instructions for replacing components ⇒ [i1.5.1 nstructions for replacing components](#), page 72 .

Vehicles with high-voltage system (hybrid vehicles)

- Observe the hazard classification of the high-voltage system ⇒ Engine; Rep. gr. 00; Hazard classification of the high-voltage system.
- Observe safety measures when working on the high-voltage system ⇒ [m1.5 easures for working on vehicles with high voltage system](#), page 3 .
- Note any safety measures when working in the vicinity of high-voltage components ⇒ [m1.6 easures when working in the vicinity of high-voltage components](#), page 4 .

All vehicles

Replacing the AC compressor e.g. because of noise from the AC compressor or lack of power of the AC compressor

- Drain refrigerant circuit ⇒ [w2 ith the A/C service station](#), page 102 .
- Remove AC compressor ⇒ Heating, Air Conditioning; Rep. gr. 87.
- Clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit](#), page 84 .

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**Note**

- ◆ *If there is internal damage (to the AC compressor), check the refrigerant hoses and condenser. If, for example, swarf has got into the compressor, clean the refrigerant hoses and condenser (flush with refrigerant R1234yf ⇒ [t1.6 he refrigerant circuit](#), [page 84](#)) and if necessary replace the refrigerant hoses.*
- ◆ *In the event of a fault in the electronics of an electrically driven air conditioning compressor (e.g Control unit for air conditioning compressor -J842-defective), the refrigerant circuit does not have to be flushed. In this case, the air conditioning compressor must be replaced ⇒ [t1.5.4 he AC compressor without needing to clean the refrigerant circuit](#), [page 76](#) without having to clean the refrigerant circuit.*
- Replace desiccator cartridge ⇒ Heating, Air Conditioning; Rep. gr. 87.
- Check the expansion valve for contamination or corrosion and replace if necessary ⇒ Heating, Air Conditioning; Rep. gr. 87.
- Assemble the refrigerant circuit, evacuate and fill ⇒ [w2 ith the A/C service station](#), [page 102](#) .

1.5.6 Replace the dryer cartridge after cleaning the refrigerant circuit.

Follow the general instructions for replacing components ⇒ [t1.5.1 nstructions for replacing components](#), [page 72](#) .

**Note**

Cleaning the refrigerant circuit means that the circuit is flushed with R1234yf refrigerant.

For example, due to moisture penetration (refrigerant circuit was open for a long time) or due to contamination

- Drain refrigerant circuit ⇒ [r2.4 efrigerant circuit](#), [page 109](#) .
- Remove AC compressor ⇒ Heating, Air Conditioning; Rep. gr. 87.
- Eliminate fault cause.
- Clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit](#), [page 84](#) .

Electrically-driven air conditioning compressor

- Cleaning the electrically driven air conditioning compressor ⇒ [t2.11 he electrically driven air conditioning compressor](#), [page 126](#) .

Mechanically driven air conditioning compressor

- Remove AC compressor ⇒ Heating, Air Conditioning; Rep. gr. 87.
- Remove the oil drain plug from the AC compressor ⇒ Heating, Air Conditioning; Rep. gr. 87.

 Note

*There are different types of oil drain plug and seal (a seal or a sealing ring may be installed; it must be replaced) ⇒ [1.5.2 eaking or damaged components; empty refrigerant circuit \(except AC compressor and fluid reservoir\)](#), [page 74](#) and ⇒ *Electronic Catalogue of Original Parts "ETKA"*.*

- To speed up evacuation of the refrigerant oil, rotate the AC compressor e.g. using the clutch disc of the magnetic clutch.
- Tip used refrigerant oil out of the AC compressor and dispose of it ⇒ Škoda-ServiceNet (according to local regulations).
- Assemble the refrigerant circuit, evacuate and fill ⇒ [w2 ith the A/C service station](#), [page 102](#) .

All air conditioning compressors

- Check the expansion valve for contamination or corrosion and replace if necessary ⇒ Heating, Air Conditioning; Rep. gr. 87.

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- ◆ *Then add the volume of new refrigerant oil to the AC compressor that corresponds to the refrigerant oil volume in the replacement compressor * ⇒ Heating, Air Conditioning; Rep. gr. 00; Technical data.*
- ◆ *Use different refrigerant oils and quantities for different AC compressors ⇒ Heating, Air Conditioning; Rep. gr. 00; Technical data.*
- ◆ *To ensure that the AC compressor is lubricated for first use, at least 40 cm³ of refrigerant oil must be added to the AC compressor, the rest can be added e.g. to the new AC/fluid reservoir or a refrigerant line ⇒ Heating, Air Conditioning; Rep. gr. 87.*
- ◆ *If dirt has penetrated into the AC compressor when the refrigerant circuit was open (e.g. during an accident), the AC compressor must be replaced ⇒ Heating, Air Conditioning; Rep. gr. 87.*
- ◆ *Cleaning refrigerant circuit (flushing with refrigerant R1234yf)* ⇒ [1.6 he refrigerant circuit](#), [page 84](#) .*
- Replace desiccator cartridge ⇒ Heating, Air Conditioning; Rep. gr. 87.
- Assemble the refrigerant circuit, evacuate and fill again ⇒ [w2 ith the A/C service station](#), [page 102](#) .

1.5.7 Replacing the drying cartridge without needing to clean the refrigerant circuit

For example, refrigerant appeared when there was a leak, but no dirt got into the refrigerant circuit.

If it was determined during the gas analysis that contaminated refrigerant was present in the circuit but there was no complaint regarding the functioning of the air conditioning system.

Follow the general instructions for replacing components ⇒ [1.5.1 nstructions for replacing components](#), [page 72](#) .



- Drain refrigerant circuit ⇒ [r2.4 efrigerant circuit.”, page 109](#) .
- Replace desiccator cartridge ⇒ Heating, Air Conditioning;
Rep. gr. 87.
- Assemble the refrigerant circuit, evacuate and fill again ⇒
[w2 ith the A/C service station”, page 102](#) .

1.5.8 Removing and installing, replacing air conditioning compressor control valve -N280-

Air conditioning compressor control valve -N280-, further only - valve -N280-.

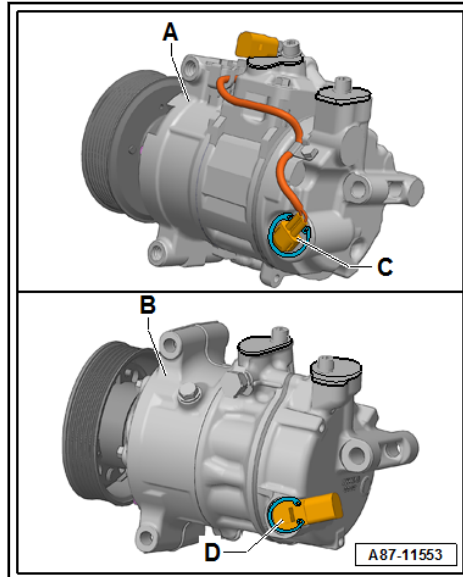


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 Note

Certain valve malfunctions of the valve -N280- (e.g. a sticking valve or an open circuit in the coil) can lead to an issue with the air conditioning compressor (air conditioning not cooling, evaporator iced up, etc.). If the cause is the valve -N280- (and not on the air conditioning compressor itself), the air conditioning compressor can be repaired by replacing valve -N280-, item -C- and -D-.



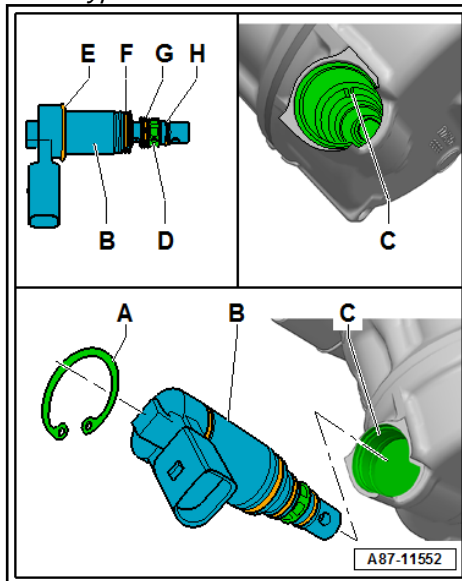
- ◆ Valve -N280-, items -C- and -D-, is not available as a spare part for all air conditioning compressors. Is valve -N280- is not available as an individual part for an air conditioning compressor, the entire air conditioning compressor must be replaced, see → Electronic catalog of original parts "ETKA".
- ◆ The valve -N280- is available in different versions and configurations → Electronic parts catalogue. With the air conditioning compressor -A- (here an air conditioning compressor from the manufacturer "Denso"), the connector for the connection to the vehicle wiring harness is attached to valve -N280-, item -C-, with a short wiring harness. With air conditioning compressor -B- (here an air conditioning compressor from the manufacturer "Sanden"), the connector for the connection to the vehicle wiring harness directly on the valve -N280-, item -D-. Removing and installing the valve -N280-, item -C-, -D- in other air conditioning compressors (different type, different manufacturer) is essentially the same, it usually differs only slightly from the procedure described below.
- ◆ If, after removing the valve -N280-, it is determined that the cause of the fault on the valve -N280- is dirt, chips or other abrasion from the air conditioning compressor, clean the refrigerant circuit and replace the air conditioning compressor, ⇒ [t1.6 he refrigerant circuit", page 84](#) and ⇒ [t1.5.5 he AC compressor because of a leak or internal damage", page 77](#).

Removing

- Remove air conditioning compressor, see vehicle-specific workshop manual.


Note

This and the following illustrations show the valve -N280- item -B- on a "Sanden" air conditioning compressor of type "6 SEU 14". With these air conditioning compressors, the connector for the connection to the vehicle wiring harness is directly to the valve -N280- item -B-. Removing and installing the valve -N280- item -B- in other air conditioning compressors (e.g. "Denso" with a short cable harness to the trigger) may deviate from this. However, the procedure is the same as below for the "Sanden" air conditioning compressor of type "6 SEU 14".



- Thoroughly clean the air conditioning compressor in the area of the valve -N280-.
- Remove locking ring -A-.
- Carefully pull the valve -N280-, item -B- out of the installation opening -C- in the air conditioning compressor.
- Check the removed valve -N280- and the installation opening -C- for contamination.


Note

If screen -D- on valve -N280- or the installation opening is heavily soiled (e.g. with shavings or dark, sticky debris), this indicates damage to the air conditioning compressor. In this case, the refrigerant circuit must be cleaned and the air conditioning compressor replaced ⇒ [t1.6 he refrigerant circuit", page 84](#) and ⇒ [t1.5.5 he AC compressor because of a leak or internal damage", page 77](#).

Installing

- Check the installation opening -C- for dirt; if necessary, clean carefully and thoroughly with a clean, lint-free cloth.



Caution

Contamination of the open air conditioning compressor or damage to the sealing surfaces in the mount.

Danger of renewed failure of the valve -N280- or the air conditioning compressor!

- ◆ ***Carefully clean the installation opening of the -N280- carefully with a clean, lint-free cloth (do not use compressed air).***
- ◆ ***When cleaning the mount, make sure that no dirt gets into the area under the sealing surface for the sealing ring or into the channels there, and that none of the sealing surfaces of the installation opening are damaged.***

- Check the installation opening -C- for damage (also check for small scratches on the surface, replace the air conditioning compressor if damaged).
- Check the seals -E-, -F-, -G- and -H- of the valve -N280- for damage.
- Lightly lubricate seals -E-, -F-, -G- and -H- of the valve -N280- with refrigeration oil and check for proper seating.
- **Insert valve -N280- into installation opening -C- as far as it will go.**
- Install locking ring -A-.
- Re-install all the removed parts in the reverse order.
- Assemble the refrigerant circuit and fill again ⇒ [t2.6 he refrigerant circuit", page 118](#) .
- Check functions of the air conditioning system.

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1.6 Clean the refrigerant circuit

⇒ [1.6.1 Information about cleaning the refrigerant circuit", page 84](#)

⇒ [1.6.2 How to clean the refrigerant circuit \(to flush with refrigerant R1234yf\)", page 86](#)

⇒ [1.6.3 How to clean the refrigerant circuit", page 89](#)

⇒ [1.6.4 Diagrams for cleaning \(circuits to be flushed\) - refrigerant circuit with expansion valve and fluid reservoir", page 89](#)

⇒ [1.6.5 How to set up the rinsing cycles", page 93](#)

⇒ [1.6.6 Information about blowing through with compressed air or nitrogen", page 95](#)

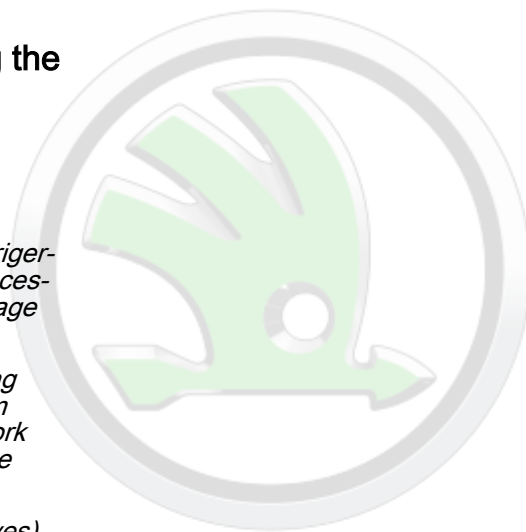
⇒ [1.6.7 How to blow through the refrigerant circuit with compressed air and nitrogen", page 97](#)

1.6.1 General information about cleaning the refrigerant circuit



Note

- ◆ *Work with the Air conditioning service station on the refrigerant circuit can usually be carried out without it being necessary to establish voltage-free operation of the high-voltage system.*
- ◆ *Since certain components must be removed for cleaning (flushing) the refrigerant circuit, the high-voltage system must be disconnected from the power supply before work can begin ⇒ Rep. gr. 93; Disconnecting the high-voltage system from the power supply.*
- ◆ *If it is suspected that chemical agents (leak stop additives) have been added to the refrigerant circuit that you want to flush to seal leaks, do not connect the AC service station to the refrigerant circuit and do not flush the refrigerant circuit.*
- ◆ *Chemical agents (leak stop additives) used to seal leaks form deposits in the refrigerant circuit which impair the function of the air conditioning system and lead to a failure of the air conditioning system (and the A/C service station).*
- ◆ *The customer must be informed that there are agents present in the air conditioning system that are not approved by Škoda Auto and you therefore cannot flush this air conditioning system or repair it.*



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Note

- ◆ Škoda Auto does not use chemicals (leak stop additives) to seal leaks on refrigerant circuits.
- ◆ Chemical agents (leak stop additives) used to seal leaks on a refrigerant circuit usually react with the ambient air and the humidity in air to form deposits in the refrigerant circuit (and in the A/C service station), which cause valves and other components that come into contact with the deposits to malfunction. These deposits cannot be completely removed from the components again (even by flushing). The refrigerant circuit can therefore only be repaired by replacing all components that have come into contact with the substance.
- ◆ Chemical agents (leak stop additives) used to seal leaks on a refrigerant circuit normally cannot be identified from the outside. The applicable labels that are supposed to be attached to show they have been added are also typically not present. Therefore, be careful with a vehicle, whose past you are not familiar with.
- ◆ If the gas analysis shows that the refrigerant R1234yf is contaminated by another gas, it must be extracted from the refrigerant circuit and disposed of as a gas of unknown composition in accordance with statutory provisions ⇒ [c2.13 contaminated refrigerant into a recycling cylinder for analysis, treatment or disposal](#), page 133.
- ◆ When refrigerant is contaminated, decomposition products can form and collect in the refrigerant oil, which cannot be drained with the refrigerant. The contaminated refrigerant oil must be removed in this case by flushing the refrigerant circuit with refrigerant.
- To remove moisture, contamination (e.g. grit from a defective AC compressor) as well as used refrigerant oil in a clean refrigerant-saving and environmentally friendly manner without extensive disassembly and reassembly work, the refrigerant circuit is cleaned with refrigerant R1234yf (flushed with refrigerant R1234yf).

The refrigerant circuit must be cleaned (flushed) with refrigerant R1234yf:

- If there is dirt or other contamination in the circuit.
- If, when evacuating a leak-tight refrigerant circuit, the vacuum is not maintained at the gauge (there is moisture in the refrigerant circuit and this generates pressure).
- if the refrigerant circuit has been left open for longer than the standard assembly time (e.g. following an accident).
- If pressure and temperature measurements in the circuit indicate that there is humidity in the refrigerant circuit.
- There is doubt about the volume of refrigerant oil in the refrigerant circuit.
- Under certain conditions, if contaminated refrigerant R1234yf has been added to the refrigerant circuit ⇒ [c1.5 components](#), page 72 and ⇒ [g2.3 as analysis for the refrigerant](#), page 107

**Note**

If contaminated refrigerant has been identified and the components of the refrigerant circuit exhibit internal damage (e.g. corrosion on the inside of the refrigerant lines or inner layer of the refrigerant hoses has become detached), flushing the refrigerant circuit may not be adequate. In this case, you must replace all the components of the refrigerant circuit (a gas was added that has seriously damaged components).

- The AC compressor has to be replaced because of internal damage (e.g. noise or lack of power) ⇒ [c1.5 omponents", page 72](#) .
- It is required in the vehicle-specific workshop manual after replacing certain components.

Required tools

- ◆ AC service station with flushing device (this AC service station has the additional "flush refrigerant circuit" function and the applicable flushing device for refrigerant circuits) ⇒ Electronic Catalogue of Original Parts "ETKA".
- ◆ Adapter case of the motor car set -VAS 6338/1- ⇒ [f1.6.5 or setting up the rinsing cycles", page 93](#) and ⇒ Electronic Catalogue of Original Parts "ETKA".

1.6.2 Preparing to clean the refrigerant circuit (to flush with refrigerant R1234yf)

- Drain refrigerant circuit ⇒ [r2.4 efrigerant circuit.", page 109](#) .
- Remove AC compressor ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- Remove the desiccator cartridge from the fluid reservoir and close the reservoir again ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

**Note**

Depending on the design, there may be an additional filter element in the fluid reservoir with desiccator cartridge, which must be replaced, if necessary, with the desiccator cartridge ⇒ Electronic Catalogue of Original Parts "ETKA".

- Remove the expansion valve ⇒ Heating, Air Conditioning; Rep. gr. 87 and install an applicable adapter from the adapter case of the motor car set -VAS 6338/1-.

**Note**

If there is no adapter in the adapter case of the motor car set -VAS 6338/1- for the expansion valve, the removed expansion valve can also be drilled out (the old expansion valve normally has to be replaced and is therefore no longer required).

- ◆ Clean the refrigerant circuit (flush) ⇒ [t2.12 he refrigerant circuit", page 129](#) .

Drill out the expansion valve:

- You must not damage the sealing surfaces of the expansion valve. Refrigerant may escape if the sealing surfaces are damaged.



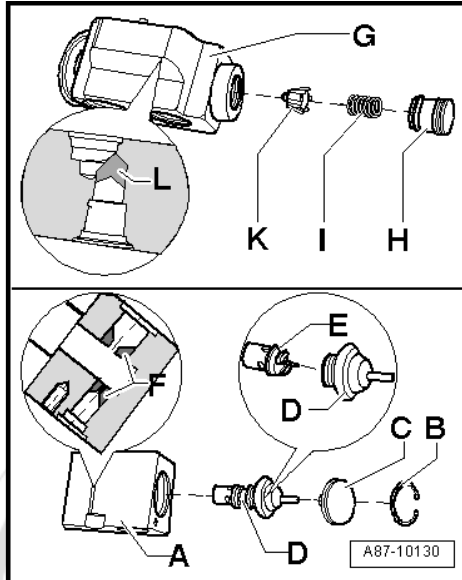
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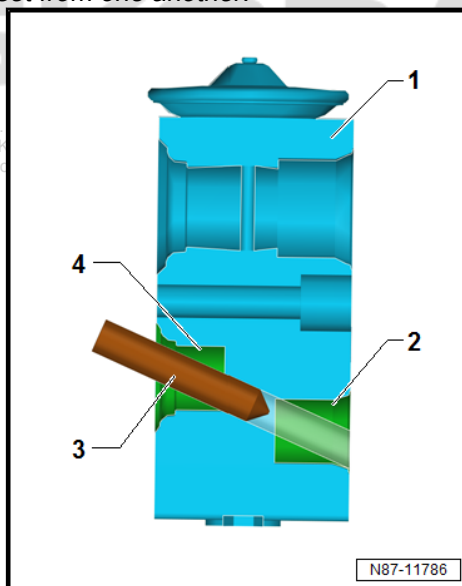


Note

Before drilling out, remove the control element and drill out the expansion valve e.g. with a suitable drill (drill diameter e.g. 6.0 mm).



- ◆ Before drilling out, some parts may have to be removed from the expansion valve, depending on design.
- ◆ Expansion valves come in various different designs and with different configurations. For type -A-, for example, -B-, -C- and -D- have to be removed. Then disconnect the part -E- (the control element) from the component -D-. After doing so, use a suitable drill to drill out the expansion valve in the area of -F-.
- ◆ For type -G-, for example, remove parts -H-, -I- and -K-, then drill out the area -L- with a suitable drill.
- ◆ When drilling -3- note that the holes -4- and -2- in the expansion valve -1- are offset from one another.



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- Clean the drilled out expansion valve from machining residues (swarf).

- Re-install parts -B-, -C- and -D- for type -A- or part -H- for type -G-.

1.6.3 Procedure for cleaning the refrigerant circuit



Note

The procedure is automatic according to the program on the AC service station ⇒ AC service station operating instructions.

- ◆ After switching on, the circuit to be flushed (refrigerant circuit with connection hoses and the flushing device for refrigerant circuits) is evacuated first, while the refrigerant circuit is tested for leaks as well (depending on the type of AC service station, it may be necessary to continue to the next step manually).
- ◆ Once the refrigerant circuit has been checked for leaks by evacuating the circuit, the system then checks that the refrigerant circuit has been assembled correctly by adding a small amount of refrigerant (pressure testing).
- ◆ After pressure testing, the refrigerant is extracted, the refrigerant circuit is evacuated again if necessary and the cleaning process (flushing process) begins.
- ◆ A specific volume of refrigerant (e.g. 3 kg, depending on internal volume of the circuit to be flushed) or enough refrigerant so that the refrigerant circuit and the inspection glasses of the flushing device for refrigerant circuits are completely filled with liquid refrigerant (depending on the design of the AC service station, you can see that e.g. no more refrigerant is flowing in after a certain time) is added to the refrigerant circuit via the high-pressure side of the AC service station (opposite to the normal flow direction of the air conditioning system and therefore on the low-pressure side of the refrigerant circuit of the vehicle).
- ◆ After adding the specified volume of refrigerant, for example, the heating of the flushing device for refrigerant circuits is switched on, depending on the version of the AC service station and the flushing device for refrigerant circuits (only if the refrigerant is drained off as a gas from the flushing device for refrigerant circuits).
- ◆ After the refrigerant has been drained off, the heating of the flushing device for refrigerant circuits (if present) is switched off, the refrigerant circuit is again briefly evacuated depending on the version and, after the evacuation, the refrigerant oil drained out of the refrigerant circuit is removed by the AC service station.
- ◆ The sequence of filling with refrigerant and draining off (and evacuating) is repeated three times (altogether it is performed four times).
- ◆ After extracting for the fourth time, the circuit to be flushed is evacuated depending on the design of the AC service station.

1.6.4 Schematic diagrams for cleaning (circuits to be flushed) - refrigerant circuit with expansion valve and fluid reservoir

- ◆ Without and with high-voltage system

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Note

- ◆ *The arrows in the following figures point in the flow direction of the refrigerant when flushing (the refrigerant flows out opposite to the flow direction in the air conditioning system when flushing, therefore the high-pressure side of the AC service station is connected to the low-pressure connection of the refrigerant circuit to the AC compressor).*
- ◆ *This schematic diagram shows a refrigerant circuit with expansion valve and condenser. The condenser includes a reservoir with desiccator cartridge (currently, no Škoda vehicle with refrigerant R1234yf has a separately installed fluid reservoir).*
- ◆ *The expansion valve is removed and is replaced by an adapter from the adapter case of the motor car set -VAS 6338/1- (other adapters are added gradually to the set).*
- ◆ *Depending on the design of the AC service station, non-return valves may be installed between the refrigerant circuit and the AC service station (to ensure the correct flow direction of the refrigerant when flushing).*
- ◆ *Vehicles with high-voltage systems are fitted with electrically operated valves in the refrigerant circuit, which must be removed for cleaning (flushing) and replaced by manual shut-off valves or adapters ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit.*

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1 - A/C service station

- ❑ with electronics and a program for flushing, AC service station with flushing device ⇒ (Tools; workshop equipment/tools; air conditioning/heating)
- ❑ If an AC service station without a program for flushing is used, the procedure must be performed manually (evacuate, flush at least 4 times with at least 3 kg of refrigerant each time and then drain and evacuate the refrigerant again).

2 - Refrigerant hose on the AC service station

- ❑ From the high-pressure side of the AC service station (usually red in colour) to the connection for the low-pressure side of the AC compressor on the refrigerant circuit (larger diameter)

3 - Adapter to connect to the low-pressure side on the refrigerant circuit

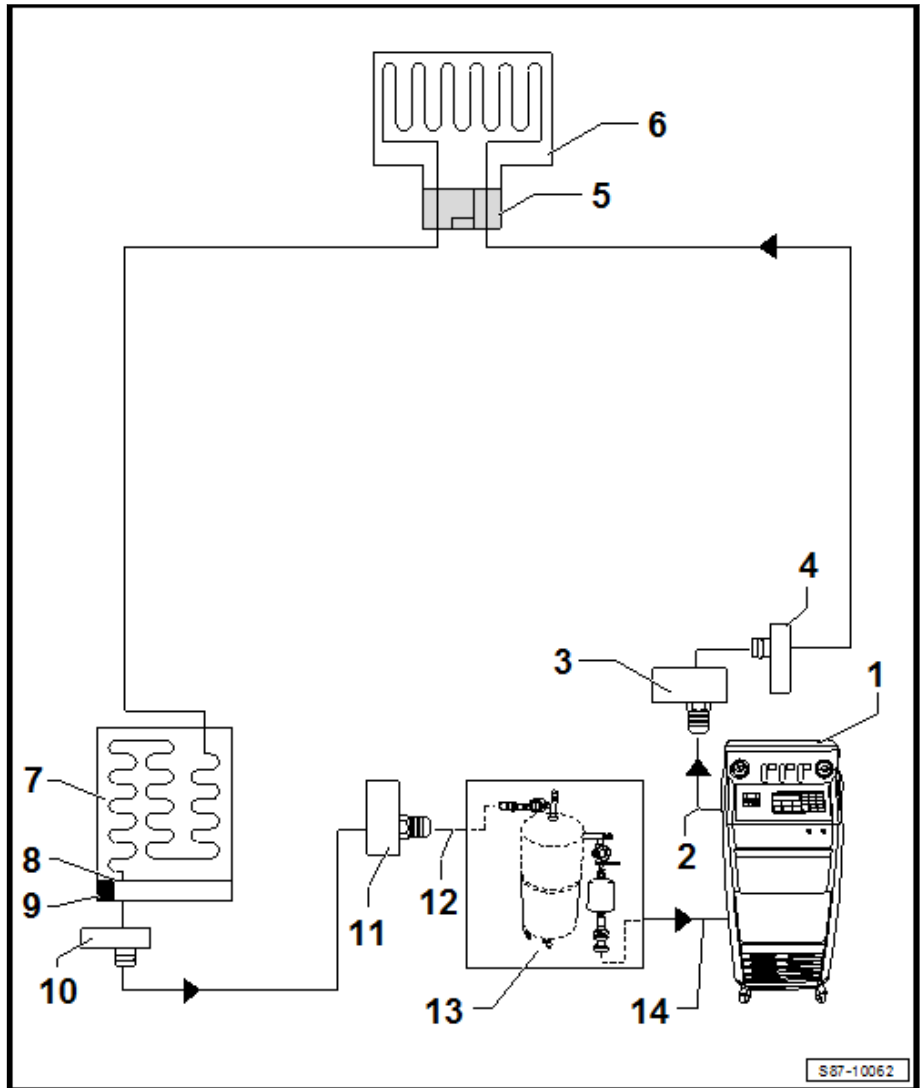
- ❑ Different designs depending on the vehicle ⇒ [f1.6.5 or setting up the rinsing cycles](#), [page 93](#)

- ❑ from adapter case of the motor car set -VAS 6338/1-
- ❑ the adapter -VAS 6338/48- must be used between the refrigerant hose -2- and the adapter -3-
- ❑ Depending on the design of the adapter, an additional adapter is required to connect the filler hose of the AC service station

Note

- ◆ *The filler hose of the AC service station has an SAE J639 M12 x 1.5-6G external thread; the adapter to connect to the low-pressure side has a 5/8 -18 UNF external thread. To be able to connect the two components, therefore, an additional adapter is therefore required ⇒ [Electronic Catalogue of Original Parts "ETKA"](#) (Tools, workshop equipment/tools; air conditioning/heating).*

- ◆ *To achieve as rapid a flow velocity as possible, the service coupler of the filler hose is removed for flushing (there are restrictions in the service cou-*





pler, which significantly reduce the flow velocity).

4 - Connection to the low-pressure side on the refrigerant circuit

- Different designs depending on the vehicle ⇒ [f1.6.5 or setting up the rinsing cycles](#), page 93

5 - Adapter for the installed expansion valve

- Different designs depending on the vehicle ⇒ [f1.6.5 or setting up the rinsing cycles](#), page 93
- from adapter case of the motor car set -VAS 6338/1-

6 - Evaporator

7 - Condenser

- with reservoir and desiccator cartridge (close the fluid reservoir again after removing the desiccator cartridge) ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual)

8 - Fluid reservoir with desiccator cartridge and strainer

- Remove the desiccator cartridge and strainer from the reservoir before flushing the refrigerant circuit ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual)

9 - Plug of the fluid reservoir

- different versions depending on the vehicle and the type of condenser ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual)

10 - Connection to the high-pressure side on the refrigerant circuit

- Different designs depending on the vehicle ⇒ [f1.6.5 or setting up the rinsing cycles](#), page 93

11 - Adapter to connect to the high-pressure side on the refrigerant circuit

- Different designs depending on the vehicle ⇒ [f1.6.5 or setting up the rinsing cycles](#), page 93
- from adapter case of the motor car set -VAS 6338/1-

12 - Filler hose of the flushing device for refrigerant circuits

- from the connection to the high-pressure side of the AC compressor on the refrigerant circuit (smaller diameter) to inlet of flushing device for the refrigerant circuits

13 - Flushing device for the refrigerant circuits

- For different versions and different design, e.g. the flushing device for refrigerant circuits, see ⇒ Electronic Catalogue of Original Parts "ETKA" (Tools; workshop equipment/tools; air conditioning/heating)
- with filter, inspection glass, safety valve, heating, refrigerant cylinder etc. (depending on the version)
- Depending on the design of the AC service station and the flushing device for refrigerant circuits, a non-return valve may be installed on the outlet of the flushing device for refrigerant circuits (to ensure the correct flow direction of the refrigerant when flushing).
- Depending on the flushing device, there may be a 5/8-18 UNF external thread or a high-pressure service coupler for R1234yf at the outlet to the AC service station



Note

- ◆ *To connect the flushing device to the AC service station, flushing devices with an 5/8-18 UNF external thread require additional adapters to connect the R1234yf low-pressure service coupler or the filler hose for the AC service station (with an SAE J639 M12 x 1.5-6G external thread) to the outlet of the flushing device, see ⇒ Electronic catalogue of Original Parts "ETKA".*
- ◆ *The filler hose of the AC service station has an SAE J639 M12 x 1.5-6G external thread. Depending on the design, there may be a service connector for an SAE J639 low-pressure*

service coupler for refrigerant R1234yf, an SAE J639 M12 x 1.5-6G internal thread, or a 5/8 -18 UNF external thread on the flushing device for refrigerant circuits. To be able to connect the two components, therefore, an additional adapter is therefore required, see ⇒ Electronic Catalogue of Original Parts "ET-KA".

- ◆ *As the refrigerant is only drawn from the AC service station at low flow velocity, the low-pressure service coupler can be used in this case.*

14 - Refrigerant hose on the AC service station

- From the low-pressure side of the AC service station (usually blue in colour) to the outlet of the flushing device for refrigerant circuits.

1.6.5 Adapter for setting up the rinsing cycles

- ◆ The table below lists various adapters which are necessary for connecting the AC service station to the refrigerant circuit for flushing and to bridge the removed fluid reservoir or AC reservoir and the expansion valve (vehicle-specific).
- ◆ If a flushed refrigerant circuit is not reassembled immediately after flushing, leave the adapters on the connections and close the connections on the adapters with the screw caps -VAS 6338/30-/-VAS 6338/30A-.

Octavia III; Octavia IV; Superb III; Yeti; Kodiaq; Karoq; Scala; Kamiq; Fabia IV

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Adapters for the connections to the AC compressor	Condenser with integrated reservoir with desiccator	Flush adapter of the expansion valve
<ul style="list-style-type: none"> ◆ Adapter -VAS 6338/3-/-VAS 6338/3A- high-pressure side ◆ Adapter -VAS 6338/12-/-VAS 6338/12A- low-pressure side ◆ Adapter -VAS 6338/48- - Air conditioning service station 	<ul style="list-style-type: none"> - Remove the desiccator cartridge and strainer from the reservoir. Screw in the screw cap again and flush the circuit with condenser. After the flushing, install a new desiccator cartridge and a strainer. 	<ul style="list-style-type: none"> - Replace the expansion valve with adapter -VAS 6338/38-/-VAS 6338/38A- or -VAS 6338/18-/-VAS 6338/18A- or a reworked (drilled out) expansion valve, see ⇒ t1.6.2 o clean the refrigerant circuit (to flush with refrigerant R1234yf), page 86 . - Check expansion valve after flushing (corrosion, dirt), replace if necessary.



Fabia III; Rapid

Adapters for the connections to the AC compressor	Condenser with integrated reservoir with desiccator	Flush adapter of the expansion valve
<ul style="list-style-type: none"> ◆ High-pressure side (except 6Q0 820 808) adapter -VAS 6338/3-/-VAS 6338/3A- ◆ High-pressure side - A/C compressors 6Q0 820 808 - adapter -VAS 6338/2-/-VAS 6338/2A- ◆ Low-pressure side - adapter -VAS 6338/12-/-VAS 6338/12A- ◆ Adapter -VAS 6338/48- - Air conditioning service station 	<ul style="list-style-type: none"> - Before flushing remove the desiccator cartridge, on the condensers "Modine" also the strainer and the container. - After the flushing, install a new desiccator cartridge and a strainer (condensers Modine). 	<ul style="list-style-type: none"> - Replace the expansion valve with adapter -VAS 6338/34-/-VAS 6338/34A-, -VAS 6338/38-/-VAS 6338/38A- or -VAS 6338/39- (compare the adapter with the removed expansion valve), or a reworked (drilled out) expansion valve, see ⇒ t1.6.2 o clean the refrigerant circuit (to flush with refrigerant R1234yf)", page 86 . - Check expansion valve after flushing (corrosion, dirt), replace if necessary.

Superb iV PHEV; Enyaq

Adapters for the connections to the AC compressor	Flush adapter of the expansion valve	other adapters
<ul style="list-style-type: none"> ◆ Low-pressure side Adapter -VAS 6338/12-/-VAS 6338/12A- ◆ High-pressure side Adapter -VAS 6338/3-/-VAS 6338/3A- ◆ Adapter -VAS 6338/48-to the Air conditioning service station electrically driven air conditioning compressor ◆ Adapter -VAS 6338/40-/-VAS 6338/40A- and adapter -VAS 6338/41-/-VAS 6338/41A- 	<p>Before flushing, remove the dryer cartridge and the sieve (if this is installed) and close the container.</p> <p>After flushing, install a new dryer cartridge and the sieve (if this was installed).</p> <ul style="list-style-type: none"> ◆ Adapter -VAS 6338/38-/-VAS 6338/38A- or ◆ Drilled expansion valve 	<p>Shut-off valves -N541- and -N542- replace</p> <ul style="list-style-type: none"> ◆ 2x stopcock -VAS 6338/42- <p>Remove throttle in refrigerant pipe to heat exchanger for high-voltage battery and drill open</p>

Citigo, Citigo iV

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Adapters for the connections to the AC compressor	Condenser with integrated reservoir with desiccator	Flush adapter of the expansion valve
<ul style="list-style-type: none"> ◆ Adapter -VAS 6338/3-/-VAS 6338/3A- high-pressure side ◆ Adapter -VAS 6338/12-/-VAS 6338/12A- low-pressure side ◆ Adapter -VAS 6338/48- - Air conditioning service station, ◆ electrically driven air conditioning compressor adapter -VAS 6338/40-/-VAS 6338/40A- and adapter -VAS 6338/41-/-VAS 6338/41A- 	<ul style="list-style-type: none"> - Before flushing, remove the dryer cartridge and the sieve (if this is installed) and close the container. - After flushing, install a new dryer cartridge and the sieve (if this was installed). 	<ul style="list-style-type: none"> - Replace the expansion valve with adapter -VAS 6338/36-/-VAS 6338/36A- or -VAS 6338/34-/-VAS 6338/34A- or a reworked (drilled out) expansion valve, see ⇒ t1.6.2 o clean the refrigerant circuit (to flush with refrigerant R1234yf)", page 86 . - Check expansion valve after flushing (corrosion, dirt), replace if necessary.

1.6.6 General information about blowing through with compressed air or nitrogen

To remove moisture, contamination (e.g. grit from a defective AC compressor) as well as used refrigerant oil in a clean refrigerant-saving and environmentally friendly manner without extensive disassembly and reassembly work, the refrigerant circuit is cleaned with refrigerant R1234yf (flushed with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit", page 84](#) .

The refrigerant circuit must be blown through with compressed air and nitrogen, for example, if only individual parts are to be cleaned.



Note

- ◆ *The refrigerant circuit should only be blown through with compressed air and then with nitrogen if there is no way to flush the refrigerant circuit or the effort to flush individual components would be too great (e.g. minor contamination and humidity can be blown out of the refrigerant lines quickly).*
- ◆ *Blowing through the entire refrigerant circuit with compressed air and nitrogen requires considerably more work than cleaning (flushing) with refrigerant R1234yf. When flushing with refrigerant R1234yf, the components are also cleaned significantly better, therefore, flushing should always be performed for any issue (blowing through should only be performed for specific issues and single components).*
- ◆ *Under certain conditions, it may be sufficient to blow through specific components (e.g. specific refrigerant lines or refrigerant hoses) with compressed air (e.g. to force out old refrigerant oil from specific remove components) or with nitrogen (to dry specific components).*
- ◆ *Certain types of contamination cannot be removed or can only be removed partially from the refrigerant circuit with compressed air; these types of contamination can be removed e.g. by cleaning (flushing) with refrigerant R1234yf. ⇒ [t1.6 he refrigerant circuit", page 84](#) .*
- ◆ *The maximum working pressure when blowing through (with compressed air or nitrogen) must not be greater than 15 bar (this is the pressure in a full refrigerant circuit at an ambient temperature of approximately 60°C; if necessary also use a pressure reducer for compressed air).*
- ◆ *If the gas analysis shows that the refrigerant R1234yf is contaminated by another gas, it must be extracted from the refrigerant circuit and disposed of as a gas of unknown composition in accordance with statutory provisions ⇒ [c2.13 contaminated refrigerant into a recycling cylinder for analysis, treatment or disposal", page 133](#) .*
- ◆ *When refrigerant is contaminated, decomposition products can form and collect in the refrigerant oil, which cannot be drained with the refrigerant. The contaminated refrigerant oil must be removed in this case by flushing the refrigerant circuit with refrigerant ⇒ [t1.6 he refrigerant circuit", page 84](#) .*

**WARNING**

Risk of injury from fuel escaping under high pressure.

- ◆ *Use the pressure reducer for the nitrogen cylinder.*

- Always clean the components in direction opposite to flow of the refrigerant.
- Extract the mixture of refrigerant, refrigerant oil and compressed air/nitrogen that comes out of the components using an extraction system.

**Note**

Compressed air and nitrogen cannot be blown through the expansion valve and AC compressor.

- In the case of condensers that have a desiccator cartridge in the integrated fluid reservoir, the desiccator cartridge must be removed.

**Note**

Depending on the design, there may be an additional filter element in fluid reservoirs where the desiccator cartridge can be replaced separately, which must be replaced, if necessary, along with the desiccator cartridge.

- First, blow out old refrigerant oil and dirt using compressed air, then blow through the components with nitrogen (clean, blow out old refrigerant oil or dehumidify).
- Adapter to connect the pressure hose to the refrigerant circuit adapter case of the motor car set -VAS 6338/1-.

To ensure no oil or moisture is transferred from the compressed air system into the refrigerant circuit, note the following.

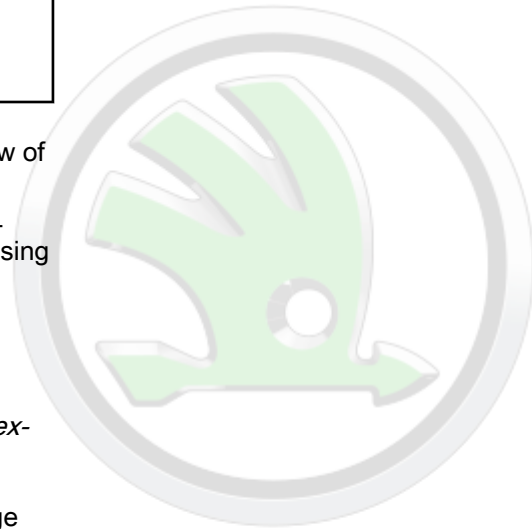
- ◆ The compressed air must pass through a compressed-air cleaning system to be cleaned and dried. You must therefore use a filter and desiccator for compressed air (scope of delivery same as tool for paint work) ⇒ Electronic Catalogue of Original Parts "ETKA".
- ◆ For refrigerant lines without thread or union nut at the connection (to connect adapters), use adapters from the adapter case of the motor car set -VAS 6338/1- or commercially available air gun with rubber mouthpiece.

**Note**

Compressed air or nitrogen coming out of components must be extracted by a suitable system (e.g. workshop extraction system).

The refrigerant circuit (or individual parts) must be blown through:

- ◆ if it is not possible to flush with refrigerant R1234yf or flushing is not the best option



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- ◆ if there is dirt or other contamination in specific parts of the circuit
- ◆ if, during evacuation of a leak-tight refrigerant circuit, the vacuum is not maintained at the gauge (there is moisture in the refrigerant circuit and this generates pressure)
- ◆ if the refrigerant circuit has been left open for longer than the standard assembly time (e.g. following an accident)
- ◆ if pressure and temperature measurements in the circuit indicate that there is humidity in the refrigerant circuit
- ◆ there is any doubt about the oil volume in the refrigerant circuit
- ◆ the AC compressor needed to be replaced because of internal damage (in this case it is preferable to flush with refrigerant R1234yf)
- ◆ it is required in the workshop manual after replacing certain components

 **Note**

Certain types of contamination and old refrigerant oil cannot be removed or can only be removed partially from the refrigerant circuit with compressed air or nitrogen; these types of contamination can be removed e.g. by flushing with refrigerant R1234yf ⇒ [t1.6 he refrigerant circuit", page 84](#) .

- ◆ Blowing through the refrigerant circuit with compressed air and nitrogen ⇒ [t1.6.7 hrough the refrigerant circuit with compressed air and nitrogen", page 97](#)

1.6.7 Blowing through the refrigerant circuit with compressed air and nitrogen

 **Note**

- ◆ *The evaporator must be blown through via the low-pressure line connection (large diameter) once the expansion valve or the restrictor has been removed.*
- ◆ *Always blow through the components against the flow direction of the refrigerant.*
- ◆ *Check expansion valve; replace if corroded or contaminated.*
- ◆ *If there are dark, sticky deposits in the components and the deposits cannot be removed with compressed air, flush these components with refrigerant R1234yf or replace them.*
- ◆ *Thin, light grey deposits on the inside (of the pipe) do not hinder the operation of the components.*

After blowing through the refrigerant circuit:

- Replace the desiccator cartridge and strainer in the fluid reservoir ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic Catalogue of Original Parts "ETKA".
- Depending on the issue, replace the AC compressor ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic Catalogue of Original Parts "ETKA" or drain the remaining refrigerant oil from the removed AC compressor ⇒ [c1.5 omponents", page 72](#) and re-fill with the specified quantity of fresh refrigerant oil ⇒ Heating, Air



Conditioning; Rep. gr. 87 (vehicle-specific workshop manual)
and ⇒ and Heating, Air Conditioning; Rep. gr. 87.



Note

- ◆ *There is a specific quantity of refrigerant oil in the replacement compressor.*
- ◆ *If the AC compressor is not to be replaced, add refrigerant oil to the AC compressor as per the specified filling volume (tip out refrigerant oil and add the specific volume to the AC compressor or the refrigerant circuit again) ⇒ [c1.5 components](#), [page 72](#), ⇒ Heating, Air Conditioning; Rep. gr. 00; Technical data.*
- Assemble the entire refrigerant circuit again ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- Evacuate and fill the refrigerant circuit as specified ⇒ [t2.5 he refrigerant circuit](#), [page 112](#) and ⇒ [t2.6 he refrigerant circuit](#), [page 118](#).
- Operate the air conditioning system as specified ⇒ Heating, Air Conditioning; Rep. gr. 87 and ⇒ [t2.7 he air conditioning system after filling](#), [page 121](#).

1.7 Checking pressures with the pressure gauge

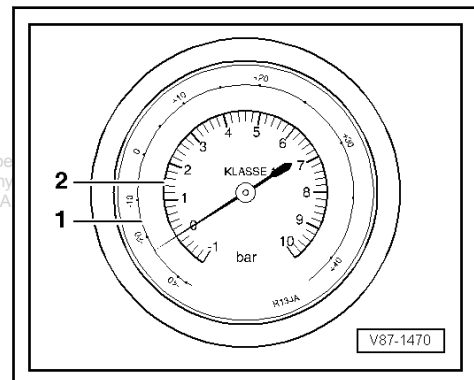
⇒ [o1.7.1 n pressure gauges](#), [page 98](#)

⇒ [g1.7.2 auges allow to carry out the following inspection and measurement work](#), [page 99](#)

1.7.1 Indicator on pressure gauges

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- 1 - Temperature scale for refrigerant R1234yf (CF₃CF = CH₂) in °C
- 2 - Pressure scale in bar overpressure

 Note

- ◆ *The pressure is stated in different units; 1 MPa (mega Pascal) equals 10 bar overpressure or 145 psi; 1 bar absolute pressure approximately equals the ambient pressure (atmospheric pressure) at 0 bar overpressure.*
- ◆ *This illustration shows a pressure gauge showing the pressure on the low-pressure side; the indicator is in bar overpressure (which you can see from “-1” on the scale).*

The pressure gauges can have one or more temperature scales in addition to the pressure scale. The values of the scale for R1234yf are assigned to the relevant vapour pressure table. As various refrigerants build up different vapour pressures at the same temperature, every temperature scale is marked for the corresponding refrigerant.

- ◆ Pressure gauges allow the following inspection and measurements to be performed ⇒ [g1.7.2 auges allow to carry out the following inspection and measurement work”, page 99](#) .

1.7.2 Pressure gauges allow to carry out the following inspection and measurement work

Pressure and temperature measurement on the refrigerant circuit

- ◆ The high-pressure gauge measures the pressure (and the temperature), which spreads uniformly from the outlet of the AC compressor via the condenser up to the restriction (restrictor or expansion valve) when the air conditioning system is switched on.
- ◆ The low-pressure gauge measures the pressure (and the temperature), which spreads uniformly from the restriction (restrictor or expansion valve) via the evaporator up to the inlet of the AC compressor when the air conditioning system is switched on.

 Note

The interdependence described on the pressure gauges, between pressure and temperature, only exists where liquid or vapour is contained in the refrigerant circuit, however not gas. In the gaseous condition, the temperature is around 10 °C to 30 °C higher than the pressure gauge indicates.

Evidence of refrigerants in a closed reservoir

In a closed reservoir or in the refrigerant circuit, the refrigerant R1234yf is present if the temperature reading of the pressure gauge corresponds to the temperature of the refrigerant (liquid is at ambient temperature).

A closed reservoir or a switched off refrigerant circuit is empty if the temperature reading of the pressure gauge lies below the temperature of the refrigerant.



Note

- ◆ *The interdependence described on the pressure gauges, between pressure and temperature, does no longer exist if no liquid is contained and the pressure only builds up through gas.*
- ◆ *As a pressures of refrigerant R1234yf and R134a are very close to each other across a large range of temperatures, it is not possible to distinguish between the refrigerants by measuring the pressure. It is possible to distinguish between the refrigerants e.g. by gas analysis ⇒ [o6.2.16 f refrigerant R1234yf](#), page 26 .*



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2 Working with the A/C service station

- ⇒ [p2.1 oints on working with the A/C service station”, page 103](#)
- ⇒ [t2.2 he A/C service station to the refrigerant circuit”, page 105](#)
- ⇒ [g2.3 as analysis for the refrigerant”, page 107](#)
- ⇒ [r2.4 efrigerant circuit.”, page 109](#)
- ⇒ [t2.5 he refrigerant circuit.”, page 112](#)
- ⇒ [t2.6 he refrigerant circuit”, page 118](#)
- ⇒ [t2.7 he air conditioning system after filling”, page 121](#)
- ⇒ [o2.8 ff the A/C service station and disconnecting it from the refrigerant circuit”, page 123](#)
- ⇒ [r2.9 efrigerant into the reservoir”, page 125](#)
- ⇒ [t2.10 he A/C service station”, page 126](#)
- ⇒ [t2.11 he electrically driven air conditioning compressor”, page 126](#)
- ⇒ [t2.12 he refrigerant circuit”, page 129](#)
- ⇒ [c2.13 ontaminated refrigerant into a recycling cylinder for analysis, treatment or disposal”, page 133](#)
- ⇒ [p2.14 ressures”, page 139](#)



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2.1 General points on working with the A/C service station



Note

- ◆ *If it is suspected that chemical agents (leak stop additives) have been added to the refrigerant circuit that you want to extract from, do not connect the AC service station to the refrigerant circuit and do not flush the refrigerant circuit.*
- ◆ *Chemical agents (leak stop additives) used to seal leaks form deposits in the refrigerant circuit which impair the function of the air conditioning system and lead to a failure of the air conditioning system (and the A/C service station).*
- ◆ *The customer must be informed that there are agents present in the air conditioning system that have not been approved by Volkswagen/Audi and the air conditioning system can therefore not be emptied and repaired.*
- ◆ *Commercially available chemicals (leak stop additives) to seal leaks on refrigerant circuits are not approved by Škoda Auto. There are no tests for the long-term endurance, effectiveness or material compatibility of these chemicals, so that it is not possible to guarantee that the air conditioning system or the AC service station will not be damaged or malfunction.*
- ◆ *Commercially available leak stop additives have different physical and chemical properties, which can permanently reduce the ability the air conditioning system and the AC service station to function and even cause the system to fail completely.*
- ◆ *Škoda Auto does not use chemicals (leak stop additives) to seal leaks on refrigerant circuits.*
- ◆ *Chemical agents (leak stop additives) used to seal leaks on a refrigerant circuit usually react with the ambient air and the humidity in air to form deposits in the refrigerant circuit (and in the A/C service station), which cause valves and other components that come into contact with the deposits to malfunction. These deposits can no longer be completely removed from the components (even by flushing).*
- ◆ *Chemical agents (leak stop additives) used to seal leaks on a refrigerant circuit normally cannot be identified from the outside. The applicable labels that are supposed to be attached to show they have been added are also typically not present. Therefore, be careful with a vehicle, whose past you are not familiar with.*
- ◆ *Reservoirs are available on the accessories market with integrated filters that are supposed to remove these chemical agents (leak stop additives to seal leaks). Since Škoda Auto does not know the composition and therefore the physical and chemical properties of these agents, it is not possible to comment on the effectiveness and the deposition rate of these filters.*

If the refrigerant circuit if the air conditioning system needs to be repaired on a vehicle with a refrigerant circuit that contains chemical agents (leak stop additives) that have been added to seal leaking components (or even if you only suspect that such agents have been added), inform the customer (vehicle owner) of the following:

- ◆ The refrigerant in the air conditioning system cannot be extracted because chemicals (leak stop additives) have been added, which may damage the AC service station. To ex-



tract the refrigerant, the refrigerant can be drained into a recycling cylinder, as for contaminated refrigerant ⇒ [c2.13 on-contaminated refrigerant into a recycling cylinder for analysis, treatment or disposal](#), page 133 . If that is not possible, a company must be employed to extract the contaminated refrigerant with suitable equipment and then treat (or dispose of) the refrigerant from the refrigerant circuit (e.g. a local waste disposal company that disposes of refrigerants).

- ◆ To repair the air conditioning system properly, all parts of the refrigerant circuit that have come into contact with the leak stop additive must be replaced. Specific parts of the refrigerant circuit (e.g. the AC compressor regulating valve -N280-) may already have been damaged by the leak stop additive or may be damaged once the system is operated again and then fail after a short period of time. Deposits of leak stop additive in the parts of the refrigerant circuit may also detach at a later time and then may cause the air conditioning system to fail again (it is currently not possible to clean these components completely with workshop equipment).
- ◆ Contaminated refrigerant may make all the liquid added to your AC service station unusable.
- ◆ Before extracting with a suitable testing device, check the composition of the refrigerant in the refrigerant circuit ⇒ [g2.3 as analysis for the refrigerant](#), page 107 .
- ◆ Extract contaminated refrigerant into a recycling cylinder and send the cylinder back to your gas supplier for analysis, treatment or disposal.



Note

- ◆ *Contaminated refrigerant may change the way in which the air conditioning system functions and/or destroy parts of the refrigerant circuit.*
- ◆ *Mixtures of different types of refrigerants (e.g. refrigerant R1234yf with an unknown proportion of refrigerant Ra) must not be added to a vehicle that has been type-tested with refrigerant R1234yf.*

Further instructions for working with the AC Service station

Note the following information when operating the A/C service station (currently available A/C service station ⇒ Electronic Catalogue of Original Parts "ETKA"):

- ◆ The installed filters and desiccators must be replaced at the latest after reaching the operating time specified in the related operating instructions.
- ◆ If an AC service station is also used to clean (flush) the refrigerant circuit, the installed filters and desiccators must be replaced sooner.
- ◆ Only add refrigerant oils to the reservoir that are approved for the vehicle-specific refrigerant circuit (if necessary, add the refrigerant oil directly to the refrigerant circuit) ⇒ Electronic Catalogue of Original Parts "ETKA".
- ◆ Depending on the design of the AC service station and the work to be performed, a specific minimum quantity of refrigerant, refrigerant oil and UV leak detection additive must be present in the reservoirs of the AC service station ⇒ AC service station operating instructions.

If there is any doubt about the composition of the refrigerant extracted from the refrigerant circuit, it must not be re-used even

after it has been cleaned in the AC service station ⇒ [g2.3 as analysis for the refrigerant](#), [page 107](#) .

- ◆ If the wrong refrigerant has been added to the AC service station by mistake, it must be emptied ⇒ [r2.4 efrigerant circuit](#)., [page 109](#) and ⇒ [t2.2 he A/C service station to the refrigerant circuit](#)., [page 105](#) ; if necessary the system must be cleaned and the filters and the desiccators as well as the added refrigerant oil must be replaced.
- ◆ Contaminated refrigerant can be returned to the supplier of the refrigerant in recycling cylinders for treatment or ecological disposal (different or additional directives may apply in specific countries).

2.2 Connecting the A/C service station to the refrigerant circuit

Connect

- Depending on the type of the selected tools, the work procedure may vary. Therefore, follow the tool-specific operating instructions.



Note

The work procedure must always be carried out as described in the operating instructions for the A/C service station ⇒ A/C service station operating instructions.

To ensure that no air or humidity can pass through the filling hoses into the refrigerant circuit, they must be connected according to the following work procedure:

- For vehicles with a high-voltage system, switch off (deactivate) the “stand-by air conditioning” function ⇒ Owner’s Manual for the Vehicle.
- Switch off ignition.
- Connect the A/C service station to the voltage supply.
- Switch on the A/C service station and operate according to the relevant operating instructions ⇒ A/C service station operating instructions.
- Unscrew the screw caps from the service connectors (see vehicle-specific refrigerant circuit) ⇒ Heating, Air Conditioning; Rep. gr. 87.
- If necessary, evacuate the filling hoses.
- Connect the quick couplers to the service connectors of the refrigerant circuit.



Caution

There is a risk of damaging the AC compressor or the A/C service station.

When the air conditioning system is switched on, a short-circuit may occur between the high- and low-pressure sides when the valves are opened.

- ◆ *When the air conditioning system is switched on, never open the valves on the high- or low-pressure sides.*

- Carefully turn in the handwheel of the on the low-pressure side just until the valve of the service connector is definitely



open (observe the pressure gauge, do not apply excess pressure to the valve).

- Perform gas analysis with the AC service station (only necessary if refrigerant is to be extracted or the pressures in the refrigerant circuit are to be checked) ⇒ [g2.3 as analysis for the refrigerant”, page 107](#) .



Note

Connect the gas analyser or the AC service station to the refrigerant circuit as per the applicable operating instructions, then operate ⇒ Gas analyser operating instructions ⇒ [t2.2 he A/C service station to the refrigerant circuit”, page 105](#) and /or ⇒ AC service station operating instructions.

If gas analysis shows that the refrigerant in the circuit does not comply with the specifications:

- Carefully turn in the handwheel of the on the high-pressure side just until the valve of the service connector is definitely open (observe the pressure gauge, do not apply excess pressure to the valve).
- Complete the relevant work on the refrigerant circuit with the A/C service station.



Note

- ◆ *If the gas analysis shows that the refrigerant R1234yf is contaminated, extract the refrigerant from the refrigerant circuit and send it back e.g. to your gas supplier for treatment (or disposal) ⇒ [c2.13 contaminated refrigerant into a recycling cylinder for analysis, treatment or disposal”, page 133](#) , ⇒ [o6.1 f the air-conditioning technology”, page 17](#) .*

- ◆ *If it is not possible to transfer the contaminated refrigerant immediately from the refrigerant circuit of the vehicle to a recycling cylinder: Unscrew the handwheel of the quick coupler adapter on the low-pressure side (close) and switch off the AC service station (if necessary, also disconnect from the power supply). Then disconnect the quick coupler adapter on the low-pressure side from the vehicle. Finally, disconnect the quick coupler adapter on the low-pressure side from the filler hose for the AC service station e.g. from an extraction hose of the workshop extraction system and allow the contaminated refrigerant to flow out of the filler hose into the extraction hose of the workshop extraction system. To prepare the AC service station for operation again, re-attach the quick coupler adapter of the low-pressure side to the filler hose on the AC service station and evacuate with the AC service station as per the applicable operating instructions ⇒ AC service station operating instructions.*

- Complete the relevant work on the refrigerant circuit with the A/C service station.

- ◆ ⇒ [g2.3 as analysis for the refrigerant”, page 107](#)
- ◆ ⇒ [r2.4 efrigerant circuit.”, page 109](#)
- ◆ ⇒ [t2.5 he refrigerant circuit.”, page 112](#)
- ◆ ⇒ [t2.6 he refrigerant circuit”, page 118](#)
- ◆ ⇒ [o2.8 ff the A/C service station and disconnecting it from the refrigerant circuit”, page 123](#)

- ◆ ⇒ [r2.9 efrigerant into the reservoir](#)", page 125
- ◆ ⇒ [t2.10 he A/C service station](#)", page 126
- ◆ ⇒ [p2.14 ressure](#)", page 139

2.3 Performing gas analysis for the refrigerant

Note

- ◆ *The refrigerant that is used must have a certain purity to run the air conditioning system.*
 - ◆ *Contamination with other refrigerants or gases can cause damage and therefore failure of the air conditioning system.*
 - ◆ *Contaminated refrigerant must be returned e.g. to your gas supplier to be treated (or disposed of) as a gas of unknown composition in accordance with statutory provisions.*
 - ◆ *To make sure that liquid components (e.g. droplets of refrigerant oil) in the extracted refrigerant gas does not cause the gas analysis result to be false, filters are installed in the gas analyser to filter out the droplets of liquid. Replace the filters as specified in the operating instructions for the gas analyser or AC service station ⇒ [Gas analyser operating instructions](#) or ⇒ [AC service station operating instructions](#).*
- Connect the gas analyser or the AC service station to the refrigerant circuit as per the applicable operating instructions, then operate ⇒ [Gas analyser operating instructions](#) ⇒ [t2.2 he A/C service station to the refrigerant circuit](#)", page 105 and /or ⇒ [AC service station operating instructions](#).
- Perform gas analysis as per the operating instructions.

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Note

- ◆ *The gas analysis may be incorrect if there is air in the refrigerant hoses or the gas analysis procedure in the operating instructions is not observed.*
- ◆ *Always carefully follow the operating instructions for the gas analyser/AC service station.*
- ◆ *Evacuate the refrigerant hoses of the AC service station before connecting the service couplers to the refrigerant circuit/a gas cylinder with refrigerant R1234yf (see operating instructions for the gas analyser/AC service station) ⇒ [g2.3 as analysis for the refrigerant](#)", page 107 .*

The gas analysis may provide the following results:

- ◆ The analysed refrigerant R1234yf complies with the specifications; the planned work can be performed with the AC service station.
- ◆ An error occurred during the gas analysis. The error must be identified and corrected, then the gas analysis must be repeated.
- ◆ The analysed refrigerant R1234yf does not comply with the specifications. The analysed refrigerant must be extracted as a gas of unknown composition and returned e.g. to your gas supplier to be treated (or disposed of).



Note

- ◆ *If contamination is identified when analysing refrigerant that e.g. is to be extracted from a vehicle refrigerant circuit: You may also perform a gas analysis e.g. with refrigerant from a supply cylinder from your gas supplier to verify the results.*
- ◆ *Because of the purity required for refrigerant R1234yf, even small amounts of ambient air in the filling hoses of the AC service station can lead to incorrect results. Therefore, there is a procedure for most AC service stations which involves repeating gas analysis twice more before OK result is shown → AC service station operating instructions.*
- ◆ *You can easily check that your gas analyser is working correctly e.g. by using ambient air (unscrew the service coupler from the refrigerant hose that is to be used for gas analysis and perform gas analysis with an open refrigerant hose). The analyser should then indicate that the analysed gas is not OK.*
- ◆ *This gas analysis procedure has been developed for the automotive workshop; it does not provide definite information about the specific composition of the refrigerant. This gas analysis can therefore only provide information about the proportion of refrigerant R1234yf in the analysed refrigerant. If the proportion of R1234yf is less than 95%, the refrigerant no longer complies with the specifications and may damage parts of the refrigerant circuit. There is currently no gas analysis available for workshops that can also identify the exact composition of the analysed refrigerant. Gas analyses that can be used to determine the exact composition of gases involve expensive devices and costly procedures and can typically only be performed in dedicated test environments.*

If contaminated refrigerant is identified by the gas analysis, sneak to the customer before any other work and inform the customer following:

There is contaminated refrigerant or refrigerant of unknown composition in the refrigerant circuit of the customer's vehicle, which does not comply with the vehicle manufacturers specifications. This refrigerant:

- ◆ Must be extracted as a refrigerant of unknown composition and returned e.g. to your gas supplier to be analysed and treated (or disposed of).
- ◆ May be the cause of a malfunction or already have damaged the refrigerant circuit so much that a malfunction may occur in the near future.
- ◆ Depending on its composition, using contaminated refrigerant may invalidate the vehicle's approval certificate.
- ◆ If the contaminated refrigerant causes internal damage to the refrigerant circuit (e.g. if the products of decomposition of the contaminated refrigerant have attacked parts of the refrigerant circuit ⇒ [c1.5 components*, page 72](#)), the refrigerant circuit can only be repaired 100% if all parts that have come into contact with the contaminated refrigerant are replaced. You can assess the internal condition of the refrigerant circuit e.g. by visually inspecting specific components (e.g. the condition of the internal surface of removed refrigerant lines and refrigerant hoses, of the internal surface of the fluid reservoir and the condition of the removed desiccator cartridge).
- ◆ If the contaminated refrigerant has damaged the inside of the refrigerant circuit (e.g. the AC compressor has failed because of damaged control elements or as a result of

overheating, the refrigerant oil has discoloured more than normal, but the parts conveying refrigerant have not been attacked ⇒ [c1.5 omponents", page 72](#)), the refrigerant circuit can be re-filled after the circuit has been flushed (replace AC compressor, desiccator and expansion valve). However, because it is not possible to assess the long-term effect of the contaminated refrigerant on the refrigerant oil or the parts of the refrigerant circuit, it is also not possible in these circumstances to guarantee that the parts of the refrigerant circuit will continue to function in future.

- ◆ If the contaminated refrigerant has not damaged the inside of the refrigerant circuit (e.g. the refrigerant oil has not discoloured more than normal, the parts of the refrigerant circuit have not been attacked), the refrigerant circuit can be re-filled after replacing the desiccator and flushing the refrigerant circuit for a longer time (at least 1 hour). However, because it is not possible to assess the long-term effect of the contaminated refrigerant on the refrigerant oil or the parts of the refrigerant circuit, it is also not possible in these circumstances to guarantee that the parts of the refrigerant circuit will continue to function in future ⇒ [c1.5 omponents", page 72](#) .



Note

- ◆ *If there is an issue that has been caused by the contaminated refrigerant (e.g. leaking seals and hoses, damage to the AC compressor, or contaminated refrigerant oil), the refrigerant circuit must be flushed, and all parts that have been damaged by the contaminated refrigerant (seals, hoses, fluid reservoir and/or desiccator cartridge, expansion valve and AC compressor) must be replaced. It is found that the contaminated refrigerant has also attacked other parts (e.g. the internal surfaces of the refrigerant pipes and refrigerant hoses), the entire refrigerant circuit must be replaced. Then re-fill the refrigerant circuit with clean refrigerant. Finally, check that the air conditioning system is functioning correctly. Inform the customer of the fact that the refrigerant circuit was filled with contaminated refrigerant, including to protect yourself against liability.*
- ◆ *If there is an issue that has been caused by the contaminated refrigerant (e.g. no or limited cooling capacity) and no other issues are identified on the refrigerant circuit or the refrigerant has to be extracted for work in the area of the refrigerant circuit, proceed as follows after extracting the refrigerant. Remove the desiccator and check the desiccator for contamination; also check the refrigerant oil that is on or in the desiccator. If the refrigerant oil is contaminated, dark or viscous or if there is dirt deposited on the desiccator, flush the refrigerant circuit and replace the parts as described above (damage which may cause the air conditioning system to fail soon may already have occurred). If the refrigerant oil is OK and the desiccator is also not contaminated more than from normal operation, replace the desiccator. Evacuate the refrigerant circuit for longer than normal (at least 1 hour) and then re-fill with clean refrigerant. Check operation of the air conditioning system. Inform the customer of the fact that the refrigerant circuit was filled with contaminated refrigerant, including to protect yourself against liability.*

2.4 Exhaust refrigerant circuit.

- Depending on the type of the selected tools, the work procedure may vary. Therefore, follow the tool-specific operating instructions ⇒ A/C service station operating instructions.
- The refrigerant circuit must be drained if parts of the refrigerant circuit are to be removed, if there is any doubt about the



volume of refrigerant in the circuit, if contaminated refrigerant is identified by gas analysis or if required for other safety precautions.

- All the essential operating instructions for work with the A/C service station for refrigerant are provided in the operating instructions for the A/C service station ⇒ A/C service station operating instructions.

Empty

- Switch off ignition.
- For vehicles with a high-voltage system, switch off (deactivate) the “stand-by air conditioning” function ⇒ Owner’s Manual for the Vehicle.
- Connect the A/C service station to the voltage supply.

Additionally for vehicles with electrically operated valves in the refrigerant circuit, which are not open when there is no current:



Note

In vehicles with a high-voltage system and additional air conditioning functions” (heat pump operation” or “cooling of the high-voltage battery”), valves can be installed in the refrigerant circuit which are not open when currentless. These valves are opened and closed by stepper motors, for example, and are no longer activated after the ignition is switched off. For complete draining, correct evacuation and filling of the refrigerant circuit, however, no areas must be shut off, so these valves must be opened prior to this work. The function is active and must not be terminated until the refrigerant circuit has been evacuated or filled with refrigerant from the A/C service station. ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit; System overview - Refrigerant circuit and ⇒ Vehicle diagnostic tester in the “Guided function” functionality.

- Open the electrically actuated valves with ⇒ Vehicle diagnostic tester, which are not open when de-energised.

All vehicles

- Operate the A/C service station according to the relevant operating instructions.
- Unscrew the screw caps from the service connectors of the refrigerant circuit (see vehicle-specific refrigerant circuit) ⇒ Heating, Air Conditioning; Rep. gr. 87.
- Connect the A/C service station to the refrigerant circuit ⇒ [t2.2 he A/C service station to the refrigerant circuit”, page 105](#) .
- Use the AC service station to perform a gas analysis ⇒ [g2.3 as analysis for the refrigerant”, page 107](#) .



Note

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- ◆ *If the gas analysis shows that the refrigerant R1234yf is contaminated, extract the refrigerant from the refrigerant circuit and send it back e.g. to your gas supplier for analysis, treatment or disposal.*
- ◆ *Drain off contaminated refrigerant into a recycling cylinder and send it back e.g. to your gas supplier for analysis, treatment or disposal.*

- Empty the refrigerant circuit with the aid of the A/C service station according to the relevant operating instructions.



Caution

There is a risk of damaging the AC compressor when the refrigerant circuit is empty.

- ◆ *Never start the engine when the refrigerant circuit is empty.*



Note

- ◆ *It is always possible that some refrigerant oil will be extracted from the refrigerant circuit with the refrigerant. To ensure that the AC compressor is lubricated, the refrigerant oil in the circuit must be topped up with fresh oil ⇒ [t2.6 the refrigerant circuit](#), page 118 .*
- ◆ *On vehicles with an AC compressor without magnetic clutch (with AC compressor regulating valve -N280-) the engine should only run with an empty refrigerant circuit when the refrigerant circuit has been installed completely. Only run the engine for as long as absolutely necessary and avoid high engine speeds (the AC compressor always runs with the engine).*
- ◆ *Depending on the design of the AC compressor, a valve may be installed on the high-pressure side of the AC compressor, which prevents liquid refrigerant flowing back into the AC compressor after the air conditioning system has been switched off. If an AC compressor with such a valve is installed in a vehicle with a refrigerant circuit with expansion valve, it may take a relatively long time until the pressure on the high-pressure side falls (the expansion valve is cold and the pressure on the low-pressure side increases rapidly after switching off, the expansion valve closes and the refrigerant circuit can only flow slowly to the low-pressure side). If the AC compressor is switched on (or the refrigerant circuit is emptied via the low-pressure side), the pressure on the low-pressure side falls, the expansion valve opens and the refrigerant can flow to the low-pressure side.*

If work is to be performed on the vehicle after emptying and the A/C service station is required for the work:

- Disconnect the A/C service station from the refrigerant circuit and switch off ⇒ [o2.8 ff the A/C service station and disconnecting it from the refrigerant circuit](#), page 123 .
- Open the refrigerant circuit at the connection point.

**WARNING**

Risk of frostbite through refrigerant escaping under pressure.

This may cause frostbite on the skin and other parts of the body.

- ◆ ***Wear protective gloves.***
- ◆ ***Wear safety goggles.***
- ◆ ***Evacuate the refrigerant circuit and immediately open the refrigerant circuit.***
- ◆ ***If more than 10 minutes have elapsed since evacuation and the coolant circuit has not been opened, evacuate the refrigerant again. Pressure builds up in the refrigerant circuit as a result of secondary evaporation.***

– Complete the planned work on the refrigerant circuit.

If the refrigerant circuit is to be evacuated and re-filled after emptying ⇒ [t2.5 he refrigerant circuit.](#), [page 112](#) :

**Note**

- ◆ ***After opening connection points on the refrigerant circuit, the open lines and part connections must be closed so that humidity and dirt cannot get into these parts.***
- ◆ ***It is always possible that some refrigerant oil will be extracted from the circuit with the refrigerant. To ensure that the AC compressor is lubricated, the refrigerant oil in the circuit must be topped up with fresh oil .***
- ◆ ***On vehicles with an AC compressor with AC compressor regulating valve -N280- the engine should only run when the refrigerant circuit has been installed completely. Only run the engine with empty refrigerant circuit for as long as absolutely necessary and avoid high engine speeds (the AC compressor always runs with the engine).***

2.5 Evacuating the refrigerant circuit.

- The work procedure must always be carried out as described in the operating instructions for the A/C service station ⇒ A/C service station operating instructions.
- The volume of refrigerant oil in the A/C service station has been checked and corrected if necessary ⇒ A/C service station operating instructions.

Before the refrigerant circuit is filled with refrigerant, it must be evacuated, i.e. under negative pressure. In addition, humidity is drawn out of the circuit at the same time.

When the refrigerant circuit is evacuated, leaks may be identified ⇒ [11.4 eaks](#), [page 62](#) .

**Caution**

There is a risk of damaging the AC compressor when there is a vacuum in the refrigerant circuit.

- ◆ ***Never start the engine when there is a vacuum in the refrigerant circuit.***

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Evacuating

- The refrigerant circuit is fully assembled.
- For vehicles with a high-voltage system, switch off (deactivate) the “stand-by air conditioning” function ⇒ Owner’s Manual for the Vehicle.
- Switch off ignition.
- Connect the A/C service station to the voltage supply.

Additionally for vehicles with electrically operated valves in the refrigerant circuit, which are not open when there is no current:



Note

- ◆ *In vehicles with a high-voltage system and additional air conditioning functions“ (heat pump operation” or “cooling of the high-voltage battery”), valves can be installed in the refrigerant circuit which are not open when currentless. These valves are opened and closed by stepper motors, for example, and are no longer activated after the ignition is switched off. For complete draining, correct evacuation and filling of the refrigerant circuit, however, no areas must be shut off, so these valves must be opened before this work is carried out ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide) and ⇒ Vehicle diagnostic tester in the “Guided Troubleshooting” function.*
- ◆ *Check valves in the refrigerant circuit have a certain holding pressure in the flow direction (approx. 0.1 bar or 100 mbar). So that the refrigerant circuit can be fully evacuated (residual pressure less than 5 mbar), all electrically controlled valves must therefore be open.*
- Use the vehicle diagnostic tester to open the electrically controlled valves, which are not normally open ⇒ Vehicle diagnostic tester in the function “Guided Troubleshooting”.

All vehicles

- Operate the A/C service station according to the relevant operating instructions ⇒ A/C service station operating instructions.
- Unscrew the screw caps from the service connectors of the refrigerant circuit (see vehicle-specific refrigerant circuit) ⇒ Heating, Air Conditioning; Rep. gr. 87.
- Connect the A/C service station to the refrigerant circuit ⇒ [t2.2 he A/C service station to the refrigerant circuit”, page 105](#) .
- Switch on the AC service station, evacuate the refrigerant circuit and perform the vacuum test.

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Note

- ◆ *The vacuum at the end of the evacuation procedure (vacuum pump of the AC service station running) must be less than 5 mbar absolute pressure. If the pressure in the refrigerant circuit does not fall below 5 mbar during evacuation, there are various possible causes. These include e.g. a leak in the refrigerant circuit or in the connection to the AC service station, the time set for the evacuation procedure is too short, or the vacuum pump of the AC service station is not generating the required vacuum.*
- ◆ *An absolute pressure of 5 mbar is equivalent to a vacuum of 975 mbar e.g. at an ambient pressure of 980 mbar.*
- ◆ *At the end of the vacuum/isolation test, the pressure in the refrigerant circuit must not be greater than 20 mbar absolute pressure. If the pressure in the refrigerant circuit increases to more than 20 mbar during the vacuum/isolation test, the vacuum pump is switched on and the procedure starts again from the beginning ⇒ A/C service station operating instructions. If the pressure in the refrigerant circuit still does not fall below 20 mbar when the procedure is repeated for a second time, there are various possible causes. These include e.g. a leak in the refrigerant circuit or in the connection from the refrigerant circuit to the AC service station or in the AC service station itself, the time set for the evacuation procedure is too short and the time set for the vacuum/isolation test is too long.*
- ◆ *If you suspect that there is a leak in the refrigerant circuit, switch off the AC service station and leave it to stand for as long as possible (e.g. at least 1 hour for the refrigerant circuit leak test) ⇒ AC service station operating instructions.*
- ◆ *Depending on the design of the A/C service station, the pressure in the refrigerant circuit is displayed directly, but the station may also only display the current pressure when the vacuum pump is running ⇒ A/C service station operating instructions. If an A/C service station only display the ambient pressure, the indicator for the pressure in the refrigerant circuit depends on ambient pressure when the station is switched on (if the ambient pressure is 980 mbar, a vacuum of 975 mbar is equivalent to a residual pressure of 5 mbar absolute pressure).*
- ◆ *If the refrigerant circuit has been opened, small amounts of humidity may have got into the refrigerant circuit with the ambient air. In this case, the refrigerant circuit must be evacuated for at least 30 minutes (pressure in refrigerant circuit before filling is less than 20 mbar).*
- ◆ *If the refrigerant has been extracted (to check the filling capacity) and the refrigerant circuit is only being evacuated to be then re-filled (the refrigerant circuit has not been opened and is leak-tight), you only need to evacuate the refrigerant circuit for 5 minutes and do not need to set any time or only a short time (e.g. 1 minutes) for the vacuum/isolation test (no air or humidity has got into the refrigerant circuit).*
- ◆ *Depending on the volume of refrigerant oil in the refrigerant circuit, the age and the service life of the vehicle, the type of refrigerant circuit etc., it may also be the case that, on a leak-tight refrigerant circuit, the specified absolute pressure in the circuit rises above the specified 20 mbar during the vacuum test as a result of refrigerant (potentially also humidity) that evaporates from the refrigerant oil. If this is the case, repeat the procedure if necessary and/or adjust the set times accordingly.*

If the vacuum indicator does not change (and the pressure remains below 20 mbar), the system is leak-tight and can be filled.



Note

- ◆ *Depending on the type of A/C service station, the current pressure in the refrigerant circuit is constantly displayed or only displayed e.g. after the "Evacuate" function is switched off ⇒ A/C service station operating instructions.*
- ◆ *The extensive evacuation may result in the refrigerant evaporating from the refrigerant oil increasing the pressure in the refrigerant circuit to 20-40 mbar (absolute pressure) during the vacuum test. This does not indicate a leak in the refrigerant circuit, but – depending on the type of A/C service station – may cause an error to be displayed. If necessary, evacuate the refrigerant circuit again and observe the vacuum indicator for an extended period of time; the system may only be filled once the vacuum persists and you are sure that the refrigerant circuit is leak-tight.*

- Fill the refrigerant circuit using the A/C service station ⇒ [t2.6 he refrigerant circuit", page 118](#)

If the vacuum does not persist or an adequate vacuum cannot be generated, proceed as follows:

- ◆ If the pressure in the refrigerant circuit increase only slowly after evacuating e.g. because of refrigerant (or humidity) evaporating from the refrigerant oil, evacuate the refrigerant circuit again and observe the vacuum indicator for an extended period of time.
- If you are not sure whether the refrigerant circuit is really leak-tight, evacuate it again and observe the vacuum indicator for a longer period. Only fill the system if the vacuum remains constant.
- You should only fill the system if you are really sure that the refrigerant circuit is leak-tight ⇒ [t2.6 he refrigerant circuit", page 118](#) .

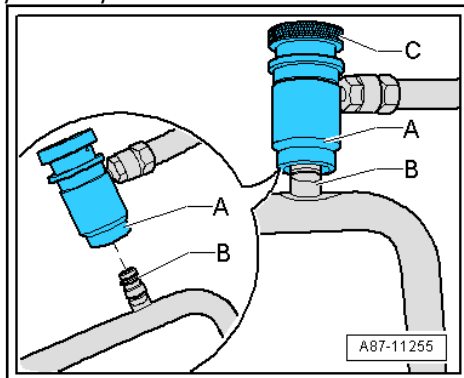
If a leak is identified when evacuating, proceed as follows:

- ◆ If there is a leak that is so large that so much air enters the circuit when it is evacuated that the A/C service station cannot generate a sufficient vacuum or the vacuum indicator, immediately after the A/C service station is switched off, indicates that air is entering and the vacuum is dissipating:
- Identify the leak point on the refrigerant circuit as follows:

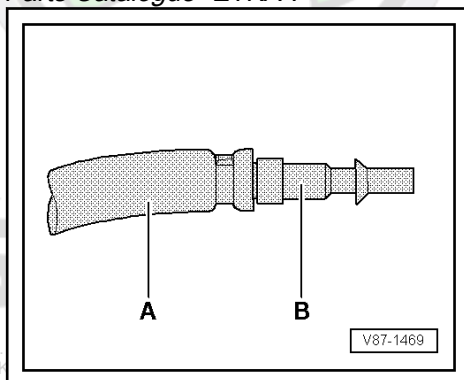


Note

- ◆ A major leak can be identified, for example, by generating a pressure of maximum 15 bar in the refrigerant circuit with clean and dried compressed air or with nitrogen ⇒ [1.6.7 through the refrigerant circuit with compressed air and nitrogen](#), page 97. If the leak is large enough, noise can be heard at the leak point, which is produced by the escaping air or gas.
- ◆ The compressed air or nitrogen can be introduced into the closed, empty refrigerant circuit via service connector -B- by attaching a quick coupler adapter -A-.



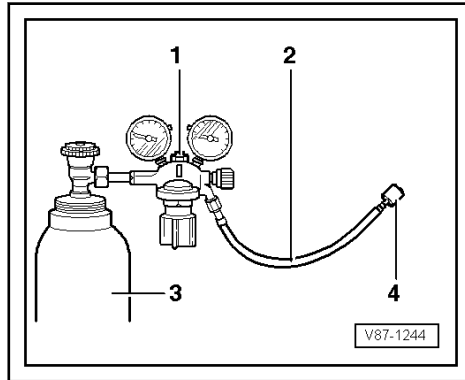
- ◆ Carefully turn in the handwheel -C- of the -A- until the valve of the service connector -B- is definitely open (do not apply excess pressure to the valve).
- ◆ The quick coupler adapter for the service connectors can be connected to the workshop compressed air system, for example, with a modified filler hose -A- (e.g. with a SAE J639 M12 x 1.5-6G thread), depending on the thread on the quick coupler adapter and with a suitable adapter -B- ⇒ [e3 equipment and tools](#), page 219. So that no moisture, no oil or dirt from the workshop air system enters the refrigerant circuit of the air conditioning system. For example, use a combination fine filter unit for compressed air systems with oil, dirt and water separators, as is customary for paint shops, install it between the compressed air system and the filling hose -A- ⇒ Electronic Original Parts Catalogue "ETKA".



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A pressurised gas cylinder can be connected via a pressure gauge with pressure reducer for nitrogen (maximum reducing pressure: 15 bar) -1- via a filling hose-3- -2- (e.g. with a SAE J639 M12 x 1.5-6G thread) to the service connector (to which you have connected for service connectors) on the closed refrigerant circuit ⇒ [e3 equipment and tools](#), page 219.



- Slowly increase the pressure in the refrigerant circuit to max. 15 bar.



WARNING

Risk of injury from fuel escaping under high pressure.

- ◆ *Use the pressure reducer for the nitrogen cylinder.*

- Identify the leak point from the gas that escapes and causes noise.
- Eliminate the leak point.
- Drain the refrigerant circuit and observe the vacuum indicator again for several hours. Only fill the system if the vacuum remains constant.
- ◆ If there is a leak that is so small that no air or only a small volume of air enters the evacuated refrigerant circuit and the AC service station can generate a sufficient vacuum (the vacuum indicator does not change or rises only very slowly after the AC service station is switched off, indicating that air is entering and the vacuum is dissipating through a small leak only):
 - Add 100 grams of refrigerant to the circuit and look for any leak point with an electronic leak detector ⇒ [11.4.2 eaks on refrigerant circuits with an electronic leak detector](#), page 63 or add refrigerant with UV dye and look for the leak point on the refrigerant circuit with e.g. the leak detection system -VAS 6201A- and eliminate the leak ⇒ [11.4.3 eaks with the UV leak detection system](#), page 65 .
 - If necessary, drain the refrigerant circuit ⇒ [12.4 efrigerant circuit.](#), page 109 .
 - Repair the refrigerant circuit ⇒ Heating, Air Conditioning; Rep. gr. 87.
 - Evacuate the refrigerant circuit and observe the vacuum indicator again for an extended period of time. Only fill the system if the vacuum remains constant ⇒ [12.5 he refrigerant circuit.](#), page 112 .

If work is to be performed on the vehicle after evacuating and the A/C service station is required for the work:

- Disconnect the A/C service station from the refrigerant circuit and switch off ⇒ [02.8 ff the A/C service station and disconnecting it from the refrigerant circuit](#), page 123 .

**Caution**

There is a risk of damaging the AC compressor when there is a vacuum in the refrigerant circuit.

- ◆ *Never start the engine when there is a vacuum in the refrigerant circuit.*

- Make sure that the engine cannot be started until the refrigerant circuit is filled.

If the refrigerant circuit is to be evacuated and re-filled after emptying and evacuating ⇒ [t2.6 he refrigerant circuit](#), page 118 .

2.6 Filling the refrigerant circuit

**Note**

- ◆ *The entire filling volume of refrigerant can be added either to the high-pressure side (recommended) or to the low-pressure side; filling the refrigerant circuit via the high-pressure side is described below.*
- ◆ *Filling quantities for refrigerant and refrigerant oil ⇒ Heating, Air conditioning system; Rep. gr. 00; Technical data.*
- The work procedure must always be carried out as described in the operating instructions for the A/C service station ⇒ A/C service station operating instructions.
- Before adding refrigerant, the volume of refrigerant oil in the refrigeration machine must be corrected ⇒ Heating, Air Conditioning System; Rep. gr. 00; Technical data.
- When filling the refrigerant circuit, make sure that the A/C service station is on the same level surface as the vehicle with the refrigerant circuit to be filled (max. difference of 50 cm). If the difference in height is too great, there may be discrepancies between the displayed volume of refrigerant and the actual volume that has been added, depending on the design of the A/C service station. The filling accuracy of the A/C service station may vary.
- The refrigerant circuit is fully assembled.
- For vehicles with a high-voltage system, switch off (deactivate) the “stand-by air conditioning” function ⇒ Owner’s Manual for the Vehicle.
- Switch off ignition.
- Connect the A/C service station to the voltage supply.
- Check the volume of refrigerant, refrigerant oil and UV additive for leak detection in the AC service station and top up if necessary ⇒ AC service station operating instructions.

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Additionally for vehicles with electrically operated valves in the refrigerant circuit, which are not open when there is no current:

 **Note**

In vehicles with a high-voltage system and additional air conditioning functions“ (heat pump operation” or “cooling of the high-voltage battery”), valves can be installed in the refrigerant circuit which are not open when currentless. These valves are opened and closed by stepper motors, for example, and are no longer activated after the ignition is switched off. In order to completely empty the refrigerant circuit or to properly evacuate or fill it, no areas must be shut off. For this reason, these valves must be opened before this work ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circulation (vehicle specific workshop manual) and ⇒ Vehicle diagnostic tester in the function “Guided Troubleshooting”,

- Use the vehicle diagnostic tester to open the electrically controlled valves, which are not normally open ⇒ Vehicle diagnostic tester in the function “Guided Troubleshooting”.

All vehicles

- Operate the A/C service station according to the relevant operating instructions ⇒ A/C service station operating instructions.
- Unscrew the screw caps from the service connectors of the refrigerant circuit (see vehicle-specific refrigerant circuit) ⇒ Heating, Air Conditioning; Rep. gr. 87.
- Connect the to the service connectors of the refrigerant circuit ⇒ [t2.2 he A/C service station to the refrigerant circuit”, page 105](#) .
- Evacuate the refrigerant circuit with the A/C service station ⇒ [t2.5 he refrigerant circuit.”, page 112](#) .
- Set the specified volume of refrigerant, if applicable the volume of refrigerant oil to be topped up, and the volume of UV additive for leak detection on the AC service station ⇒ AC service station Operating Instructions, ⇒ Heating, Air Conditioning; Rep. gr. 00; Technical data.
- Set the refrigerant to be added on the high-pressure side on the AC service station ⇒ AC service station operating instructions.

When filling the refrigerant circuit on the low-pressure side, liquid refrigerant can collect in the compression chamber of the AC compressor.

- If it is necessary to fill the refrigerant circuit on the low-pressure side, turn the AC compressor by hand through 10 rotates after filling before first use (if necessary, remove e.g. the V-ribbed belt to do so).

**Note**

- ◆ *The refrigerant and refrigerant oil are added to the refrigerant circuit on the high-pressure side.*
- ◆ *If there is no service connector on a vehicle on the high-pressure side of the refrigerant circuit, the refrigerant may also be added via the service connector on the low-pressure side. However, always note the settings and operating instructions for the AC service station.*
- ◆ *If the direction of filling cannot be set on an AC service station, if necessary unscrew the handwheel on the quick coupler adapter on the low-pressure side (close).*
- Fill the refrigerant circuit with the specified volume of refrigerant, if applicable the volume of refrigerant oil to be topped up, and the volume of UV additive.
- Operate the air conditioning system after filling ⇒ Heating, Air Conditioning ; Rep. gr. 87 and ⇒ [t2.7 he air conditioning system after filling](#), page 121 .

Starting up an air conditioning system with an electrically driven air conditioning compressor

- Air conditioning compressor via the “basic setting, compressor inlet” function of the guided troubleshooting function ⇒ **Vehicle diagnostic tester**.

Additionally for vehicles with electrically operated valves in the refrigerant circuit, which are not open when there is no current:

- Use the vehicle diagnostic tester to open the electrically controlled valves, which are not normally open for the operation of the air conditioning system, enable the actuation of these valves via the respective control unit (for opening or closing) ⇒ Vehicle diagnostic tester in the function “Guided troubleshooting”.

**Note**

In vehicles with a high-voltage system and additional air conditioning functions“ (heat pump operation” or “cooling of the high-voltage battery”), valves can be installed in the refrigerant circuit which are not open when currentless. These valves are opened and closed by stepper motors, for example, and are no longer activated after the ignition is switched off. For complete draining, correct evacuation and filling of the refrigerant circuit, however, no areas must be shut off, so these valves must be opened prior to this work. After completion of the work, the control of these valves is enabled again via the respective control unit ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide) and ⇒ Vehicle diagnostic tester in the “Guided Troubleshooting” function.

2.7 Operate the air conditioning system after filling

Note

- ◆ *If the mechanically drive AC compressor has been removed, it must be turned by approx. 10 rotations by hand before it is first operated (when being installed or after installation e.g. before positioning the belt) so that it is not damaged by the impact of fluid after the system is switched on for the first time (if there is refrigerant oil in the AC compressor's cylinder, it is pushed out by rotating the compressor) ⇒ Heating, Air Conditioning; Rep. gr. 87.*
- ◆ *If the electrically driven air-conditioning compressor has been removed, the guided "troubleshooting" function of the air-conditioning system and the battery control system must be started ⇒ Vehicle diagnostic tester before the air-conditioning system is put into operation for the first time and after the air-conditioning compressor has been filled using the "basic setting" function, compressor inlet. This prevents the air-conditioning compressor from being damaged, e.g. by a hit of liquid when it is switched on for the first time (if there is refrigerant oil in the compression chamber of the air-conditioning compressor, it is pressed out).*

Starting up an air conditioning system with a mechanical driven air conditioning compressor

- Switch on ignition.
- Set the air conditioning system to the lowest possible performance (e.g. "AC off" mode).
- Switch of the AC compressor (e.g. "AC off" mode).
- Start the engine while the AC compressor is switched off (e.g. "AC off" mode).
- Wait until the idling speed has stabilised.
- Switch on the AC compressor and operate the system for at least 2 minutes at idle speed.
- If necessary, check the pressures in the refrigerant circuit with the AC service station ⇒ [w2 ith the A/C service station", page 102](#) .
- Switch off engine.
- Disconnect the A/C service station from the refrigerant circuit and switch off ⇒ [o2.8 ff the A/C service station and disconnecting it from the refrigerant circuit", page 123](#) .

Starting up an air conditioning system with an electrically driven air conditioning compressor

- Switch on ignition.
- Air conditioning compressor about the function "Basic setting, compressor inlet" Commission the guided troubleshooting ⇒ Vehicle diagnostic tester in the function "Guided troubleshooting" for the air conditioning and battery control system.

Additionally for vehicles with electrically operated valves in the refrigerant circuit, which are not open when there is no current:

- Use the vehicle diagnostic tester to open the electrically controlled valves, which are not normally open for the operation of the air conditioning system, enable the actuation of these valves via the respective control unit (for opening or closing)



⇒ Vehicle diagnostic tester in the function “Guided troubleshooting”.



Note

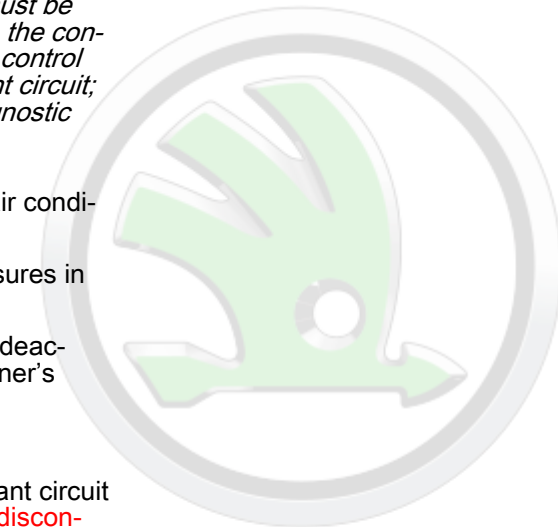
In vehicles with a high-voltage system and additional air conditioning functions“ (heat pump operation” or “cooling of the high-voltage battery”), valves can be installed in the refrigerant circuit which are not open when currentless. These valves are opened and closed by stepper motors, for example, and are no longer activated after the ignition is switched off. For complete draining, correct evacuation and filling of the refrigerant circuit, however, no areas must be shut off, so these valves must be opened prior to this work. After completion of the work, the control of these valves is enabled again via the respective control unit ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit; System overview, refrigerant circuit and ⇒ Vehicle diagnostic tester in the “Guided Troubleshooting” function.

All air conditioning systems with an electrically driven air conditioning compressor

- If necessary, after the basic setting, check the pressures in the refrigerant circuit with the AC service station.
- For vehicles with a high-voltage system, switch off (deactivate) the “stand-by air conditioning” function ⇒ Owner’s Manual for the Vehicle.
- Switch off ignition.
- Disconnect the A/C service station from the refrigerant circuit and switch off ⇒ [o2.8 ff the A/C service station and disconnecting it from the refrigerant circuit”, page 123](#) .

Air conditioning systems with an electrically driven air conditioning compressor

- The engine may only be started if the refrigerant circuit is fully assembled.
- In vehicles with battery cooling, hybrid operation is only possible ⇒ Vehicle diagnostic tester with a full air-conditioning system in which no fault has been stored for the air-conditioning system in the “Guided troubleshooting” function for the air-conditioning system and battery control system.
- After installing the air-conditioning compressor and subsequently filling the refrigerant circuit, first commission the electrically driven air-conditioning compressor using the “compressor inlet” function of the basic setting. If the refrigeration machine oil has accumulated in the compression chamber of the air-conditioning compressor due to unfavourable storage prior to installation, this may result in damage to the air-conditioning compressor ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function for the air-conditioning system and battery control.
- Only control the electrically driven air conditioning compressor when the refrigerant circuit is full. If the air-conditioning compressor is running when the refrigerant circuit is empty, the air-conditioning compressor may be damaged in ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function of the air conditioning system and the battery control system.
- In order to minimize the number of automatic engine starts when the vehicle is ready to drive during testing and measurement work, connect a charger to the 12-volt battery in backup mode. Recommended battery chargers, see ⇒ Elec-



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trical system - general information; Rep. gr. 27; battery, Chapter "battery charge".

- For test and measurement work where readiness to drive must be active or ignition must be switched on, set the selector lever to position "P", activate the parking brake, arrange the necessary tools so that they cannot come into contact with rotating engine components and do not themselves come into contact with components rotating while the engine is running.

2.8 Switching off the A/C service station and disconnecting it from the refrigerant circuit

- Finish working with the A/C service station.
- Switch off ignition.
- Unscrew the handwheel on the quick coupler adapter (close).



WARNING

Risk of frostbite through refrigerant escaping under pressure.

This may cause frostbite on the skin and other parts of the body.

- ◆ ***Wear protective gloves.***
- ◆ ***Wear safety goggles.***
- ◆ ***If refrigerant escapes from the refrigerant line for more than 1 second after turning out the handwheel of the service coupler, turn in the handwheel and replace the defective valve.***
- ◆ ***Evacuate the refrigerant circuit and immediately open the refrigerant circuit.***
- ◆ ***If more than 10 minutes have elapsed since evacuation and the coolant circuit has not been opened, evacuate the refrigerant again. Pressure builds up in the refrigerant circuit as a result of secondary evaporation.***

Different types of service couplers

- ◆ On one type of service couplers, the space between the valve in the service connector of the refrigerant circuit and the valve in the service coupler is vented out when the handwheel is unscrewed. On these service couplers, the valve in the service connector of the vehicle and the valve in the service coupler for the filler hose to the AC service station are only closed when the handwheel of the service coupler is unscrewed. If unscrewed further, the pressure is then dissipated (approx. 2 cm³ of refrigerant) via another valve that is also located in the space between the two valves. If one of these two valves (the valve on the vehicle's service connector or the valve in the service coupler for the filler hose) does not close correctly, all the refrigerant can escape from the refrigerant circuit or the filler hose.
- ◆ On the other type of service couplers, the space between the valve in the service connector of the refrigerant circuit and the valve in the service coupler is not vented out when the handwheel is unscrewed. For this design, there is a valve that is closed when the service coupler is open, so that the pressure can equalise between the chamber for the valve in the refrigerant circuit's service connector and the



filler hose connected to the service coupler. For this design, screwing the handwheel of the service coupler back in does not mean that refrigerant escapes, so that the refrigerant in this can has to be extracted back into the AC service station from the filler hoses before the service couplers are uncoupled. If in this case e.g. a larger volume of refrigerant is recovered after pressure testing or after filling the refrigerant circuit (more than approx. 50 g), this indicates that a valve in one of the service connectors of the refrigerant circuit may not be leak-tight and refrigerant is escaping from the vehicle's refrigerant circuit (extract refrigerant and replace the defective valve).

Before extracting the refrigerant back out of the filling hoses into the AC service station, unscrew the hand wheels of both service couplers to the stop.



Note

- ◆ *The AC service station has a function that can be used to put the station in a defined operating state when it is switched off. This function is used to extract all the refrigerant from the filling hoses back into the AC service station.*
- ◆ *If, when this function is active, the hand wheels of both service couplers are not unscrewed, refrigerant may be extracted from the vehicle's refrigerant circuit.*
- Extract refrigerant from the two filling hoses with the AC service station according to the relevant operating instructions ⇒ AC service station operating instructions.



Note

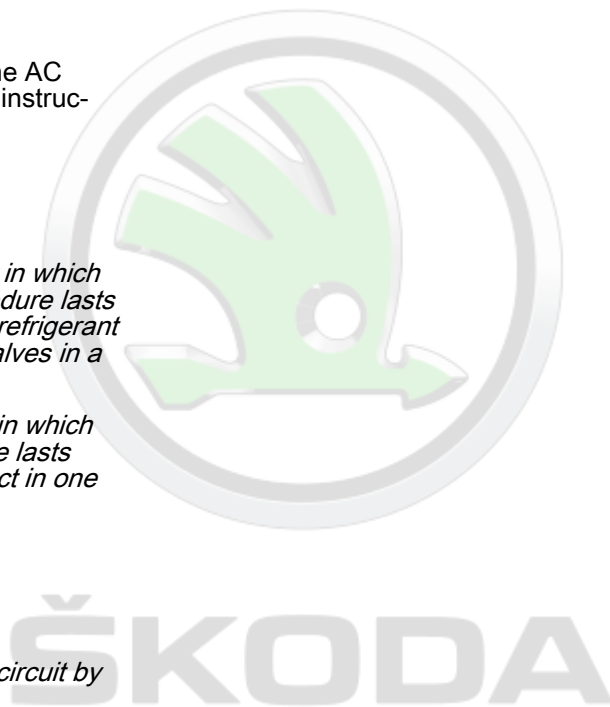
- ◆ *If, on an A/C service station with a service coupler in which pressure is not dissipated to the outside this procedure lasts more than approx. 2 minutes or a large volume of refrigerant is extracted, this indicates a defect in one of the valves in a service connector.*
- ◆ *If, on an AC service station with a service coupler in which pressure is dissipated to the outside this procedure lasts more than approx. 2 minutes, this indicates a defect in one of the valves in a service coupler.*



Note

Refrigerant is extracted from the vehicle's refrigerant circuit by mistake

- First, unscrew the hand wheels on the quick coupler adapter (close).
- Then extract refrigerant from the two filling hoses with the AC service station.
- Switch off the A/C service station (if necessary, also disconnect from the power supply) ⇒ A/C service station operating instructions.
- Disconnect the from the service connectors of the refrigerant circuit.



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- Screw on the screw caps of the service connectors (see vehicle-specific refrigerant circuit) ⇒ Heating, Air Conditioning; Rep. gr. 87.

2.9 Filling refrigerant into the reservoir

- Connect the supply cylinder with fresh refrigerant R1234yf to the service coupler on the low-pressure side to the AC service station ⇒ AC service station operating instructions.
- Use the AC service station to perform gas analysis of the refrigerant to be filled (from the supply cylinder) ⇒ [g2.3 as analysis for the refrigerant](#), page 107 .
- The work procedure must always be carried out as described in the operating instructions for the A/C service station ⇒ A/C service station operating instructions.



Caution

There is a risk of explosion if refrigerant containers are overfilled.

Refrigerant can expand and the refrigerant container can explode if overfilled.

- ◆ *Use refrigerant container with safety valve.*
- ◆ *Never exceed the permitted filling capacity of the refrigerant container.*



Note

Depending on the design of the AC service station and the work to be performed, a specific minimum quantity of refrigerant, refrigerant oil and UV leak detection additive must be present in the reservoirs of the AC service station ⇒ AC service station operating instructions.



2.10 Draining the A/C service station



Note

- ◆ *If it is necessary to drain the AC service station (e.g. because contaminated refrigerant has been extracted), always replace all the filters and desiccators (shortly before installing, remove the filters and desiccators from the airtight sealed transport packaging in order to keep the increase of humidity as low as possible).*
- ◆ *If it is necessary to empty the AC service station (e.g. because specific work has to be done on the AC service station) and the refrigerant that has been extracted from the AC service station or will be extracted complies with the specification (it is not contaminated), it can be drained into a recycling cylinder and the re-used ⇒ AC service station operating instructions.*
- ◆ *Refrigerant cylinders which are filled with contaminated and used refrigerant are designated "recycling cylinders" or "R cylinders".*
- ◆ *Always evacuate recycling cylinders thoroughly before filling with refrigerant for the first time (refrigerant cylinders that contain air must not be filled with refrigerant).*
- ◆ *Different types of refrigerants must not be mixed with each other (refrigerant mixtures can no longer be recycled yet they must be disposed of). If there is any doubt about the composition of the cylinder content, the gas treatment/disposal company must be notified ⇒ [c2.13 contaminated refrigerant into a recycling cylinder for analysis, treatment or disposal](#)", page 133.*



Caution

There is a risk of explosion if refrigerant containers are overfilled.

Refrigerant can expand and the refrigerant container can explode if overfilled.

- ◆ ***Use refrigerant container with safety valve.***
- ◆ ***Never exceed the permitted filling capacity of the refrigerant container.***

There are various ways to empty an AC service station – see the operating instructions of the AC service station ⇒ AC service station operating instructions.

- Siphon refrigerant from the AC service station to be emptied into another AC service station, as per the operating instructions of the AC service station ⇒ AC service station operating instructions ⇒ [c2.13 contaminated refrigerant into a recycling cylinder for analysis, treatment or disposal](#)", page 133.

2.11 Cleaning the electrically driven air conditioning compressor

Vehicles with a high-voltage system

For all work on vehicles with high-voltage systems, observe the additional warnings for these vehicles ⇒ Rep. gr. 00; Safety

instructions; safety measures when working on the high-voltage system.

If work is required near components of the high-voltage system, carry out a visual inspection for damage to the high-voltage components and cables and observe the warning notices
⇒ Rep. gr. 00; Safety instructions.

If work is required on components of the high-voltage system, disconnect the high-voltage system from the power supply
⇒ Rep. gr. 93; Establish voltage-free high-voltage system and “observe general warnings for work on the high-voltage system”
⇒ Rep. gr. 00; Safety instructions; safety measures when working on the high-voltage system.

Flush out the air conditioning compressor



Note

- ◆ *With the electrically driven air-conditioning compressor, the refrigerant oil cannot be dumped (there is no oil drain plug), due to the design, no oil can be dumped.*
- ◆ *The refrigerant oil must be removed from the electrically driven air conditioning compressor by flushing in the direction of flow (flushing against the direction of flow is not possible due to the built-in valves).*
- ◆ *For flushing, the air-conditioning compressor must be arranged so that the connection for the refrigerant line on the high-pressure side is as low as possible.*

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1 - A/C service station

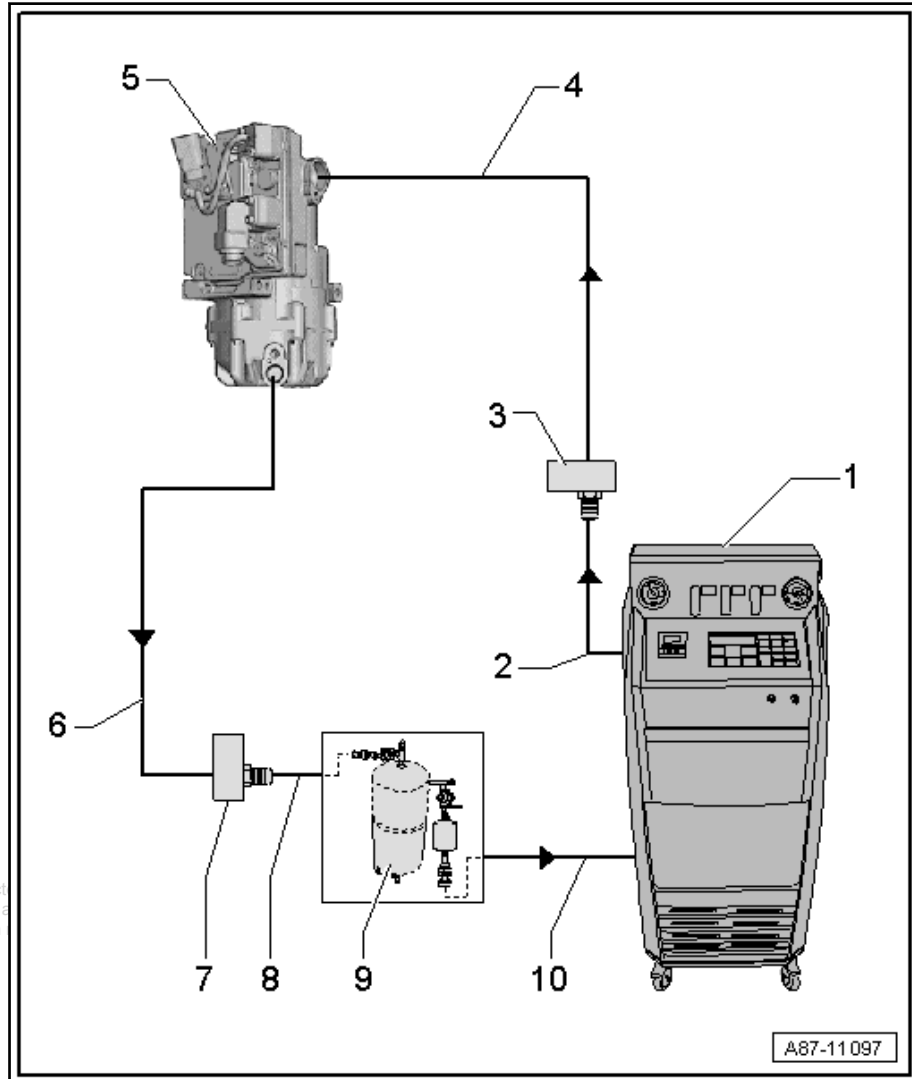
- ❑ Using electronics and a programme for flushing, e.g Air conditioning service station with flushing device ⇒ Electronic catalogue of original parts “ETKA”.
- ❑ If an AC service station without a program for flushing is used, the procedure must be performed manually (evacuate, flush at least 4 times with at least 2 kg of refrigerant each time and then drain and evacuate the refrigerant again).

2 - Refrigerant hoses on the AC service station

- ❑ From the high-pressure side of the AC service station (usually red in colour) to the connection for the low-pressure side of the AC compressor on the refrigerant circuit (larger diameter)

3 - Adapter to connect to the low-pressure side on the air conditioning compressor

- ❑ Different designs depending on the vehicle ⇒ [f1.6.5 or setting up the rinsing cycles](#), page 93



- ❑ the adapter -VAS 6338/48- must be used between the refrigerant hose -2- and the adapter -3-
- ❑ From adapter case of the motor car set -VAS 6338/1-

4 - Refrigerant line

- ❑ To connect the air conditioning compressor to the adapter ⇒ [Item 3 \(page 128\)](#)

5 - Electrically-driven air conditioning compressor

- ❑ The air conditioning compressor is flushed in the direction of flow (from the low-pressure inlet to the high-pressure outlet)
- ❑ In order to flush as much refrigerant oil as possible from the air conditioning compressor, the air conditioning compressor must be positioned during flushing so that the outlet on the high-pressure side is as low as possible



Note

- ◆ Depending on the air conditioning compressor, a larger quantity of refrigerant oil can be filled into a new air conditioning compressor (see manufacturer's label on the air conditioning compressor and ⇒ [c5.2 apacities for refrigerant oil](#), page 16).
- ◆ With a new air-conditioning compressor filled with more than 150 cm³, empty as much

refrigerant oil as possible before rinsing.

- ◆ *Reason: Depending on the execution of the Air conditioning service station the amount of oil that can be separated in one step may be limited.*

 **Note**

If the clean refrigerant oil from a new air-conditioning compressor is tipped into a clean container and this is then sealed airtight, this can be reused to adjust the amount of refrigerant oil in the circuit.



6 - Refrigerant line

- To connect the air conditioning compressor to the adapter ⇒ [Item 7 \(page 129\)](#)
- Use a refrigerant pipe with part number 7L6 820 721 BF to set up the flushing circuit ⇒ Electronic catalogue of original parts "ETKA"

7 - Adapter to connect to the high-pressure side on the AC compressor

- Different designs depending on the vehicle ⇒ [f1.6.5 or setting up the rinsing cycles", page 93](#)
- From adapter case of the motor car set -VAS 6338/1-

8 - Filler hose of the flushing device for refrigerant circuits

- from the connection to the high-pressure side of the AC compressor on the refrigerant circuit (smaller diameter) to inlet of flushing device for the refrigerant circuits

9 - Flushing device for the refrigerant circuits

- For different versions and different design, of the flushing device for refrigerant circuits, ⇒ Electronic Catalogue of Original Parts "ETKA" (Tools; workshop equipment/tools; air conditioning/heating)
- With filter, inspection glass, safety valve, heating, refrigerant cylinder etc. (depending on the version)
- Depending on the structure of the Air conditioning service station and the flushing device for refrigerant circuits, there may be a connection for a service coupling for refrigerant circuits at the outlet and possibly also at the inlet of the flushing device. If a service connection with a valve is installed at the outlet of the flushing device, this valve must be completely open when the service coupling is connected. A valve that is not fully open is a bottleneck.
- If there is a connection for a service coupling at the inlet of the flushing device, the inlet must be modified so that the refrigerant hose coming from the vehicle can be connected directly.

 **Note**

A service coupling and a valve at the inlet of the flushing device is a bottleneck that obstructs the flow of refrigerant from the vehicle into the flushing device.

10 - Refrigerant hoses on the AC service station

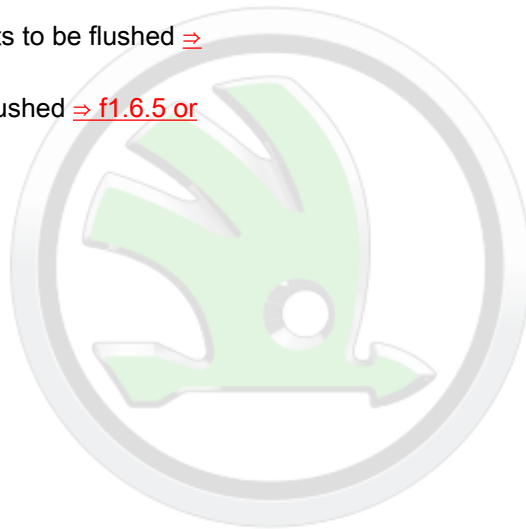
- From the low-pressure side of the AC service station (usually blue in colour) to the outlet of the flushing device for refrigerant circuits.

2.12 Clean the refrigerant circuit

- Prepare for cleaning (flushing with refrigerant R1234yf) ⇒ [t1.6.2 o clean the refrigerant circuit \(to flush with refrigerant R1234yf\)", page 86](#) .



- Check volume of refrigerant in the AC service station; there must be at enough refrigerant R1234yf ⇒ AC service station operating instructions.
- Empty the container for the used oil of the AC service station ⇒ AC service station operating instructions
- Connect the intake hose (high-pressure side) of the AC service station to the low-pressure line which leads to the AC compressor with an adapter (line with the larger diameter) ⇒ [f1.6.5 or setting up the rinsing cycles", page 93](#) .
- Connect the return-flow hose (low-pressure side or suction side) of the AC service station to the outlet of the flushing device for refrigerant circuits.
- Connect the inlet of the flushing device for refrigerant circuits to the high-pressure line which leads to the AC compressor with an adapter (line with smaller diameter) ⇒ [f1.6.5 or setting up the rinsing cycles", page 93](#) .
- ◆ Basic circuit diagrams for various circuits to be flushed ⇒ [f1.6.5 or setting up the rinsing cycles", page 84](#)
- ◆ Adapters for connecting circuits to be flushed ⇒ [f1.6.5 or setting up the rinsing cycles", page 93](#)



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Note

- ◆ *The components are always flushed opposite to the flow direction of the refrigerant when the air conditioning system is running ⇒ [f1.6 he refrigerant circuit", page 84](#) .*
- ◆ *When flushing, contamination moves from the refrigerant circuit into the flushing device for refrigerant circuits and into the AC service station and is retained in those unit in the installed filters and desiccators. Depending on contamination, these components must be changed at short intervals as per the operating instructions of the AC service station or the flushing device for refrigerant circuits ⇒ AC service station operating instructions.*
- ◆ *Depending on the type and intensity of the contamination of the flushed refrigerant circuit, the filter in the flushing device for refrigerant circuits must be replaced no later than after 5 to 10 flushing cycles (flushed vehicles). If a heavily contaminated refrigerant circuit is flushed (the refrigerant oil from the refrigerant circuit is black and viscous or there is a lot of swarf in the refrigerant circuit), the filter must be replaced after only flushing the one refrigerant circuit. If the refrigerant circuit is heavily contaminated, it is also worth flushing the refrigerant circuit again after changing the filter.*
- ◆ *Depending on the type of contamination, dirt (used refrigerant oil and grit from the AC compressor) is deposited on the inspection glass of the flushing device for refrigerant circuits. Clean the inspection glass if necessary after flushing and flush the refrigerant circuit again by performing one flush to check the results (a single flush is sufficient).*
- ◆ *Liquid refrigerant cannot be directed through the expansion valve, the restrictor and the desiccator bag of certain fluid reservoirs at the required speed; you should therefore remove these components and, if necessary, replace them with adapters ⇒ [f1.6 he refrigerant circuit", page 84](#) and ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- ◆ *Adapters to connect the AC service station and bridge certain parts of the refrigerant circuit ⇒ [f1.6.5 or setting up the rinsing cycles", page 93](#) .*

Perform the flushing procedure (the procedure is automatic according to the program on the AC service station ⇒ AC service station operating instructions).

- Switch on the AC service station ⇒ AC service station operating instructions.
- Select the flushing program on the AC service station ⇒ AC service station operating instructions.
- Flush the refrigerant circuit (a flushing cycle with 4 flushes last approx. 1 to 1.5 hours) ⇒ AC service station operating instructions.



Note

- ◆ *Flushing procedure* ⇒ [f1.6.3 or cleaning the refrigerant circuit](#), [page 89](#).
 - ◆ *The flushing procedure must be performed according to the operating instructions of the AC service station* ⇒ AC service station operating instructions.
 - ◆ *Depending on the type of AC service station, the container for used oil only stores 125 cm³ of refrigerant oil. If a system with a greater volume of refrigerant oil has to be flushed, it may be necessary to empty the used oil container after the first flush of a flushing cycle.*
 - ◆ *Observe the refrigerant that flows back from the refrigerant circuit into the AC service station. Only when the refrigerant that flows into the AC service station is clear and completely colourless in the inspection glasses of the flushing device for refrigerant circuits is the refrigerant circuit clean.*
 - ◆ *When flushed, all the refrigerant oil is washed out of the refrigerant circuit (except minor residues e.g. in the evaporator, which can be ignored).*
 - ◆ *If the contamination is particularly heavy, it may be necessary to remove flushing a second time (two flushing cycles with 4 flushing processes each).*
- After flushing is complete, check the inspection glass or the inspection glasses of the flushing device for refrigerant circuits. If they are contaminated, clean them as per the operating instructions for the or the AC service station and flush again to check the results (a single flush is sufficient, for approx. 30 minutes) ⇒ AC service station operating instructions.
 - Check the pressure in the refrigerant circuit (there must not be any overpressure present in the refrigerant circuit; if necessary briefly evacuate the refrigerant circuit once again).
 - Disconnect the connections to the AC service station from the refrigerant circuit of the vehicle (there must not be any overpressure present in the refrigerant circuit).
 - Replace these components for the vehicle (expansion valve and fluid reservoir or desiccator cartridge in the fluid reservoir, strainer) ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic Catalogue of Original Parts "ETKA".
 - Replace the air conditioning compressor depending on the complaint ⇒ Heating, air conditioning; Rep. gr. 87 (vehicle-specific repairs manual) and ⇒ Electronic Catalogue of Original Parts "ETKA" or drain the remaining refrigerant oil from the removed air conditioning compressor ⇒ [c1.5 components](#), [page 72](#) and refill the specified amount of fresh refrigerant oil. ⇒ Heating, air conditioning; Rep. gr. 00; Technical data (vehicle-specific repairs manual) and ⇒ Heating, air conditioning; Rep. gr. 00; Technical data.

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Note

- ◆ *There is a specific quantity of refrigerant oil in the replacement compressor ⇒ Heating, Air Conditioning; Rep. gr. 00; Technical data.*
- ◆ *If the AC compressor is not to be replaced, add refrigerant oil in the air conditioning compressor as per the specified filling volume (tip out refrigerant oil and add the specific volume to the AC compressor or the refrigerant circuit again) ⇒ [c1.5 omponents", page 72](#) and ⇒ Heating, Air Conditioning; Rep. gr. 00; Technical data.*
- Assemble the entire refrigerant circuit again ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- Evacuate and fill the refrigerant circuit as specified ⇒ [t2.5 he refrigerant circuit.", page 112](#) , ⇒ [t2.6 he refrigerant circuit", page 118](#) and ⇒ Heating, Air Conditioning; Rep. gr. 00; Technical data.
- Operate the air conditioning system as specified ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ [t2.7 he air conditioning system after filling", page 121](#) .

2.13 Filling contaminated refrigerant into a recycling cylinder for analysis, treatment or disposal



Note

- ◆ *To ensure that you can transfer contaminated refrigerant into an evacuated recycling cylinder without equipment, the cylinder must be cooled substantially.*
- ◆ *Use an insulated container and dry ice to cool the evacuated recycling cylinder.*
- ◆ *Dry ice is solid carbon dioxides (CO₂) that sublimates directly from solid to gaseous form at -78 °C.*
- ◆ *Most gases used as refrigerant only have a low vapour pressure at very low temperatures (less than 0.6 bar absolute pressure at -50 °C). If a deep-cooled recycling cylinder is connected to a refrigerant circuit, the refrigerant liquefies in the cold recycling cylinder and the pressure in the refrigerant circuit falls below the ambient pressure ⇒ [p6.1.3 ressure table for the refrigerant", page 19](#) .*
- ◆ *Commercially available recycling cylinders typically are made of standard steel, which is not always designed for low temperatures (in this case, as low as -78 °C). You should therefore only use recycling cylinders specifically approved for this purposes and allow the cylinder to warm up slowly to ambient temperature (e.g. by storing the insulated container with the recycling cylinder in a secure, well-ventilated location where the dry ice can evaporate reliably).*

Special tools and workshop equipment required

- ◆ 10 kg of dry ice (as pellets or granules) - commercially available
- ◆ Evacuated recycling cylinder for contaminated R1234yf that is suitable for low temperatures (e.g. with an approved filling



volume greater than 3.0 kg). Commercially available from the gas supplier. No recycling bottles made of light metal alloys, since chemical reactions with refrigerant components are possible.

- ◆ Suction device (for the refrigerant R1234yf) - dry ice box - or a commercially available device (e.g. suction device -VAS 581 007-, suction device -VAS 581 011-)
- ◆ Cylinder connector with seal (to connect the filler hose to the recycling cylinder, SAE J639 W 21.8 x 1/14 LH (left hand) and M 12 x 1.5-6G internal thread) or commercially available
- ◆ Filler hose for refrigerant R1234yf with seals (2m-long filler hose with SAE J639 M12 x 1.5-6G external thread) or commercially available
- ◆ SAE J639 service coupler for low-pressure side - commercially available

**Note**

Dry ice evaporates at ambient temperature, even from the insulated container (approx. 20 to 30% per day, depending on ambient conditions). Therefore, only order dry ice once all other required tools are available and the work is to be performed immediately after receipt of the dry ice (for example, do not order dry ice for a Friday afternoon if the work will not be done on Saturday or Sunday).

**DANGER!**

There is a risk of frostbite and suffocation from the dry ice.

This may cause frostbite on the skin and other parts of the body and, in gaseous form, may cause suffocation.

- ◆ ***Wear protective gloves.***
- ◆ ***Wear safety goggles.***
- ◆ ***Only use dry ice in well-ventilated areas.***
- ◆ ***Never work in the proximity of basements or above other low-lying areas.***

**Caution**

There is a risk of explosion if dry ice is stored incorrectly.

As dry ice evaporates, the pressure rises in the container. Unsuitable containers may explode.

- ◆ ***Only transport and store dry ice in the containers provided.***

Siphoning refrigerant using a supercooled recycling cylinder

- All the tools, equipment and dry ice that you need are available in sufficient quantities
- Remove sealing from the recycling cylinder and unscrew end cap from the connection.

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 Note

- ◆ *Recycling cylinders provided by your gas supplier are normally sealed and already evacuated.*
 - ◆ *If the recycling cylinder is not evacuated, evacuate the cylinder with a vacuum pump or an AC service station.*
 - ◆ *Recycling cylinders are clearly identified as such. In contrast to refrigerant supply cylinders, they do not have a non-return valve and can therefore be filled.*
 - ◆ *If an absolute pressure above 100 mbar but below 900 mbar is measured in the recycling cylinder, evacuate the recycling cylinder with a vacuum pump (or an AC service station) to a residual pressure of less than 50 mbar ⇒ [t2.5 he refrigerant circuit.](#), [page 112](#).*
 - ◆ *If an absolute pressure above 900 mbar is measured in the recycling cylinder, there are a number of possibilities. The manual shut-off valve has been opened and not closed again correctly or the recycling cylinder has already been used to store refrigerant temporarily and then has not been evacuated properly ⇒ [t2.10 he A/C service station](#), [page 126](#) (evacuate recycling cylinder). The recycling cylinder is not leak-tight (return recycling cylinder to the supplier).*
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- Connect the vacuum gauge (or AC service station) to the recycling cylinder.
 - Carefully open the manual shut-off valve of the recycling cylinder to check the vacuum and check the vacuum in the cylinder.
 - If necessary, evacuate the recycling cylinder with the AC service station.
 - The residual pressure in the recycling cylinder is less than 10 mbar absolute pressure.

 Note

- ◆ *Recycling cylinders are evacuated by the supplier before delivery, but it is not always possible to ensure that the vacuum is maintained.*
 - ◆ *To be able to determine reliably the nature and extent of contamination in the siphoned refrigerant when analysing contaminated refrigerant, the recycling cylinder must be evacuated to a residual pressure of 50 mbar before you start siphoning.*
- Switch off the ignition/deactivate readiness to drive.
 - Ensure that the work area is well-ventilated; if available, also switch on the workshop ventilation systems.
 - Connect the filler hose to the evacuated recycling cylinder with a suitable adapter.



Caution

There is a risk of explosion if refrigerant containers are overfilled.

Refrigerant can expand and the refrigerant container can explode if overfilled.

- ◆ *Use refrigerant container with safety valve.*
- ◆ *Never exceed the permitted filling capacity of the refrigerant container.*



Note

If contaminated refrigerant is filled into a recycling cylinder e.g. from an AC service station, it is necessary to make sure that the recycling cylinder, as the volume is usually large. Use a recycling cylinder with a large enough approved filling capacity and, when siphoning, weigh the cylinder to make sure that the maximum approved filling capacity is not exceeded.



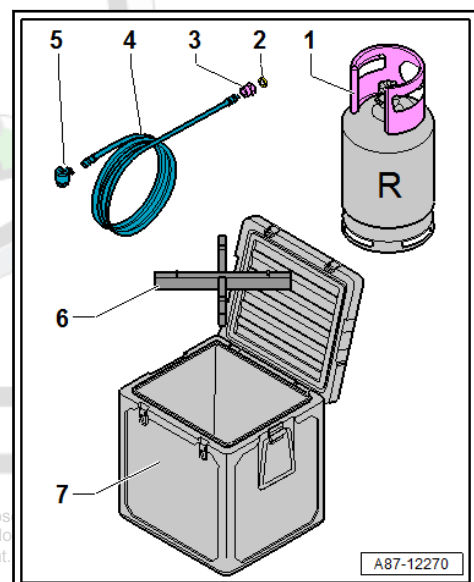
WARNING

If gases of unknown composition mix together, various chemical reactions may occur.

There is a risk of injury.

- ◆ *Never mix refrigerants from different sources.*

- Connect the service coupler for refrigerant R1234yf, Pos. -5- to the filler hose -4-.



- Connect filler hose -4- with bottle connector -3- (and sealant -2-) to the recycling bottle -1-.
- Place spacers -6- in the insulated container -7-.
- Cover the bottom of the insulated container -7- with dry ice.
- Place recycling bottle -1- in the insulated container -7-.

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- Fill the insulated container -7- with dry ice.
- Cool recycling container -1- with dry ice for approx. 15 min.
- Connect the recycling cylinder -1- with the service coupling -5- to the A/C service station (or to the vehicle's refrigerant circuit).
- Open the recycling cylinder's -1- manual shut-off valve.

 **Note**

Recycled cylinders are intended for international use, that's why "O" on the wheel stands for "Open" (to open the cylinder valve) and not for "0" (zero for closed).

- Connect the pressure gauge to the refrigerant circuit (or use the pressure indicator on the AC service station) and check the pressure in the refrigerant circuit.
- Carefully open the service coupler -5- on the filler hose to the recycling cylinder and allow the refrigerant to flow slowly into the recycling cylinder -1-.
- Wait until the refrigerant in the recycling cylinder -1- has liquefied (watch the pressure indicator on the connected pressure gauge).

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 **Note**

- ◆ *When emptying a refrigerant circuit, you can use e.g. a separate pressure gauge or the pressure indicator on the AC service station.*
- ◆ *If the indicated pressure after approx. 60 minutes is lower than 0.3 bar absolute pressure, you can assume that all the refrigerant in the recycling cylinder is now liquid.*
- ◆ *Complete evaporation of the contaminated refrigerant from the refrigerant circuit lasts a while; after 60 minutes, you can assume that all the refrigerant has evaporated.*
- Close the recycling cylinder's -1- service coupler -5- and manual shut-off valve.
- Disconnect the filler hose -4- and connector -3- and close the recycling cylinder's connection with the end cap.



WARNING

There is a risk of the recycling bottle bursting if it is subjected to repeated shocks and impacts when it is frozen.

- ◆ ***Prevent shocks and impacts in the frozen state.***
- ◆ ***Recycled bottles that have been subjected to shock or impact while frozen may not be reused.***
- ◆ ***The supplier of the recycled bottle must be informed and the further procedure must be coordinated with him.***

- Complete all the paperwork (disposal certificate, acceptance certificate etc.) for analysis, treatment (or disposal) of contaminated refrigerant.



Note

- ◆ *You can obtain all the information and documents required for analysis, treatment (or disposal) from you gas treatment/disposal company.*
- ◆ *A form is kept with the recycling cylinder, which must be filled in as necessary and attached to the recycling cylinder.*
- ◆ *If it is not possible to weigh the recycling cylinder before and after filling it with contaminated refrigerant, the filling capacity for the applicable vehicles may be entered as the volume of refrigerant filled into the recycling cylinder. This is allowed, because only the volume of refrigerant in the vehicle is filled into the recycling cylinder.*
- Take the insulated container with recycling cylinder and dry ice to a secure, well-ventilated location outside the building.
- Open or remove the cover of the insulated container -7- and allow the dry ice to evaporate.
- Take the recycling cylinder out of the container with the dry ice.
- Take the recycling cylinder to a suitable location for storage until it is collected by your gas treatment/disposal company.
- Evacuate the refrigerant circuit with the AC service station for at least 1 hour ⇒ [t2.5 he refrigerant circuit.](#), [page 112](#) .



Note

- ◆ *The last residues of contaminated refrigerant that may still be in the refrigerant oil are removed at an absolute pressure below 10 mbar during subsequent evacuation.*
- ◆ *The following work depends on the issues in the refrigerant circuit ⇒ [g2.3 as analysis for the refrigerant](#)., [page 107](#) .*

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2.14 Check pressures

⇒ [i2.14.1 nstructions for checking pressures in a refrigerant circuit](#), page 139

⇒ [a2.14.2 nd temperatures in a refrigerant circuit](#), page 141

⇒ [i2.14.3 n a refrigerant circuit when the ignition is switched off](#), page 143

⇒ [p2.14.4 ressures with air conditioning switched on for vehicles with mechanically driven air conditioning compressor](#), page 148 .

⇒ [p2.14.5 ressures with air conditioning switched on for vehicles with electrically driven air conditioning compressor](#), page 167

2.14.1 General instructions for checking pressures in a refrigerant circuit



Note

Work with the Air conditioning service station on the refrigerant circuit can usually be carried out without it being necessary to establish voltage-free operation of the high-voltage system.

Vehicles with electrically operated valves in the refrigerant circuit, which are not open when there is no current:



Note

In vehicles with a high-voltage system and additional air conditioning functions" (heat pump operation" or "cooling of the high-voltage battery"), valves can be installed in the refrigerant circuit which are not open when currentless. These valves are opened and closed by stepper motors, for example, and are no longer activated after the ignition is switched off. To check the pressures in the refrigerant circuit when the air conditioning system is switched off, however, no areas must be shut off, so these valves must be opened before this work ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit; System overview - Refrigerant circuit ⇒ Vehicle diagnostic tester in the "Guided Troubleshooting" function.

- Use the vehicle diagnostic tester to open the electrically controlled valves, which are not normally open ⇒ Vehicle diagnostic tester in the function "Guided Troubleshooting".

All vehicles



Caution

There is a risk of damaging the AC compressor or the A/C service station.

When the air conditioning system is switched on, a short-circuit may occur between the high- and low-pressure sides when the valves are opened.

- ◆ *When the air conditioning system is switched on, never open the valves on the high- or low-pressure sides.*



Note

- ◆ *Certain test requirements are vehicle-specific and are described in the workshop manual for the vehicle.*
- ◆ *Check cooling capacity ⇒ Heating, Air Conditioning; Rep. gr. 00 (vehicle-specific workshop manual).*
- ◆ *Connection with valve and service connectors for measurement and testing ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- ◆ *Depending on the design of the AC compressor, a valve may be installed on the high-pressure side of the AC compressor, which prevents liquid refrigerant flowing back into the AC compressor after the air conditioning system has been switched off. If an AC compressor with such a valve is installed in a vehicle with a refrigerant circuit with expansion valve, it may take a relatively long time until the pressure on the high-pressure side falls (the expansion valve is cold and the pressure on the low-pressure side increases rapidly after switching off, the expansion valve closes and the refrigerant circuit can only flow slowly to the low-pressure side). If the AC compressor is switched on, the pressure on the low-pressure side falls, the expansion valve opens and the refrigerant can flow to the low-pressure side.*

Under certain conditions, residual moisture in the refrigerant circuit can cause ice to form on the AC compressor control valve. The ice inhibits control of the AC compressor and the evaporator is cooled too much and ices up. An iced up evaporator can cause the following issues:

- ◆ After a long journey, the air conditioning system fails repeatedly or sporadically (no cooling or heat output); the air conditioning system functions OK again after switching off the vehicle and waiting for a short period.
- ◆ After a long journey, the windows mist up on the inside and even pressing the **Defrost** button does not clear the windows; the air conditioning system functions OK again after switching off the vehicle or switching off the air conditioning system and waiting for a short period.

Precautions:

- Check the measured values of the evaporator -N280- vent temperature sender on vehicles with an AC compressor with AC compressor regulating valve -G263- (using the “Read measured values” function). If the value measured by the sender under the conditions described by the customer is too low (at an ambient temperature above 0 °C, colder than 0 °C for a long time, although the -N280- is not currently actuated) or too high (higher than approx. 10 °C, although the air conditioning system is functioning correctly), the evaporator can ice up as a result of the incorrect measurement value ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function of the air conditioning system and ⇒ Heating, Air Conditioning; Rep. gr. 00 (vehicle-specific workshop manual).
- For vehicles with shut-off valves in the refrigerant circuit, check ⇒ Vehicle diagnostic tester the function and control of these valves in the “Guided troubleshooting” function Air conditioning system, ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit; System overview - Refrigerant circuit and ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; check cooling capacity (vehicle-specific repair guide).
- Check the refrigerant line from the evaporator (or from internal heat exchanger) to the AC compressor (thick pipe, low-

pressure side) while the engine is running. If this line is badly iced up when the issue occurs (a thin layer of ice is OK), this also indicates that the temperature in the evaporator is too low ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

- Empty the refrigerant circuit, replace the desiccator cartridge and then evacuate the refrigerant circuit for at least 3 hours ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ [w2 ith the A/C service station", page 102](#) .
- ◆ ⇒ [i2.14.3 n a refrigerant circuit when the ignition is switched off", page 143](#)
- ◆ ⇒ [p2.14.4 ressure with air conditioning switched on for vehicles with mechanically driven air conditioning compressor", page 148](#)
- ◆ ⇒ [p2.14.5 ressure with air conditioning switched on for vehicles with electrically driven air conditioning compressor", page 167](#)

2.14.2 Pressures and temperatures in a refrigerant circuit

General information about pressures and temperatures in the refrigerant circuit

- ◆ The pressures and temperatures in the refrigerant circuit are dependent on current operating conditions (e.g. engine speed, radiator fan at level 1, 2 or 3, engine temperature, AC compressor on or off) as well as on environmental conditions (e.g. ambient temperature, humidity, required cooling capacity).
- ◆ On vehicles with AC compressor regulating valve -N280-, the pressure on the low-pressure side is changed by actuation of the -N280-.
- ◆ This is why the indicated values in the following table are only reference points. They are set after approx. 20 min and at an engine speed of 1500 to 2000 rpm and an ambient temperature of 20 °C.
- ◆ The pressure measurement connections for the pressure gauge battery can be found on the vehicle-specific refrigerant circuit ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- ◆ At 20 °C and if the engine is not running, a pressure of 4.7 bar is generated in the refrigerant circuit ⇒ [p6.1.3 ressure table for the refrigerant", page 19](#) (vapour pressure table).

Note

The pressure is stated in different units; 1 MPa (mega Pascal) equals 10 bar pressure or 145 psi; 1 bar absolute pressure roughly equals ambient pressure (atmospheric pressure).

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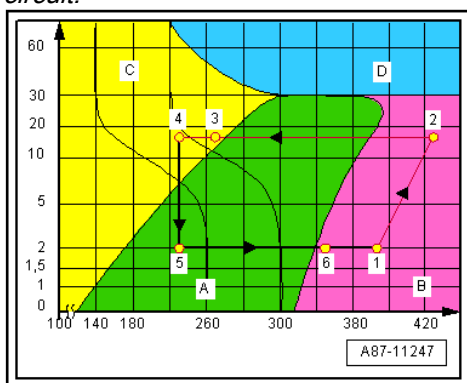


Pressures and temperatures in a refrigerant circuit with expansion valve



Note

- ◆ In the log p - h diagram below (logarithmic pressure enthalpy diagram), you can see the processes in the refrigerant circuit for a specific operating state. These values vary depending on the environmental conditions (engine speed, ambient temperature, required cooling capacity etc.).
- ◆ The log p - h diagram shows the pressure (0 to 60 bar absolute pressure) and the energy content (100 to 420, specific enthalpy in kilojoules per kg of refrigerant R1234yf) in the cycle of a refrigerant circuit.



The arrows point in the direction of flow of the refrigerant in the refrigerant circuit.

A - Range with vaporous refrigerant

B - Range with gaseous refrigerant

C - Range with liquid refrigerant

D - Outside critical range of pressure and temperature; the overall state of the refrigerant is undetermined (there is no longer a division between liquid and gaseous refrigerant).

- 1 - Low-pressure side: outlet of internal heat exchanger, inlet of AC compressor; the refrigerant has completely evaporated and is gaseous; the temperature of the refrigerant is approx. $-4\text{ }^{\circ}\text{C}$.
- 2 - Outlet of AC compressor, inlet of condenser; the refrigerant has compressed and is gaseous; the temperature of the refrigerant is up to approx. $80\text{ }^{\circ}\text{C}$
- 3 - High-pressure side: outlet of condenser (fluid reservoir), inlet of internal heat exchanger; the refrigerant has cooled and is liquid; the temperature of the refrigerant is approx. $55\text{ }^{\circ}\text{C}$
- 4 - High-pressure side: outlet of internal heat exchanger, inlet of expansion valve; the liquid refrigerant has cooled further; the temperature of the refrigerant is approx. $50\text{ }^{\circ}\text{C}$
- 5 - Low-pressure side: expansion valve on evaporator side, inlet of evaporator; the liquid refrigerant relaxes and starts to evaporate; the temperature of the refrigerant is approx. $-7\text{ }^{\circ}\text{C}$
- 6 - Low-pressure side: outlet of evaporator, expansion valve, inlet of internal heat exchanger; the refrigerant has largely evaporated, but a small proportion is still vapour; the temperature of the refrigerant is approx. $-6\text{ }^{\circ}\text{C}$

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Note

- ◆ *The given temperatures are for the refrigerant in the refrigerant circuit. As a result of heat absorption and heat dissipation, the temperatures at the surface of the parts carrying refrigerant may be different.*
- ◆ *The pressure (and therefore the temperature) in refrigerant circuits with regulated AC compressor is maintained at approx. 3 bar absolute pressure (equivalent to approx. 2 bar overpressure) despite the varying heat transfer and different engine speeds. However, this is only true within the performance range of the AC compressor; in the event the performance range of the AC compressor is exceeded, the pressure rises (and therefore the temperature also) ⇒ [p2.14 re-ssures](#), [page 139](#).*
- ◆ *On AC compressors which do not regulate their own output, the pressure on the low-pressure side and therefore the evaporator temperature are controlled by the applicable control unit via the AC compressor regulating valve -N280-. Depending on the design and setup, if an air temperature lower than approx. 2 °C is measured downstream of the evaporator, the output of the AC compressor is reduced and actuation of the -N280- is disabled under 0 °C. This prevents the evaporator being cooled too much and icing up.*
- ◆ *Depending on the design of the refrigerant circuit, a part with internal heat exchanger may be installed. In the internal heat exchanger, the liquid warm refrigerant flowing on the high-pressure side transfers energy to the cold gaseous refrigerant or flowing vaporous or liquid refrigerant on the low-pressure side, which increases the efficiency of the air conditioning system ⇒ [p1.2.11 ipe with internal heat exchanger](#), [page 49](#).*
- ◆ *Depending on the type of control unit (e.g. the control and display unit for air conditioning system -E87- or the Climatronic control unit -J255-), the measured ambient conditions (outside temperature, humidity in the passenger compartment etc.) and the settings on the control unit (passenger compartment temperature, mode etc.), the pressure and therefore the temperature at the outlet of the evaporator can also be adjusted to a higher value ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system.*

2.14.3 Pressure in a refrigerant circuit when the ignition is switched off

Checking pressures when the ignition is switched off ⇒ [page 146](#)

Test requirements:



Note

Certain test requirements are vehicle-specific and are described in the workshop manual for the vehicle ⇒ Heating, Air Conditioning; Rep. gr. 00.

- ◆ Check cooling capacity ⇒ Heating, Air Conditioning; Rep. gr. 00 (vehicle-specific workshop manual).



- ◆ Connection with valve and service connectors for measurement and testing ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- ◆ Connect A/C service station ⇒ [t2.2 he A/C service station to the refrigerant circuit](#), page 105 .

Under certain conditions, residual moisture in the refrigerant circuit can cause ice to form on the AC compressor control valve. The ice inhibits control of the AC compressor and the evaporator is cooled too much and ices up. An iced up evaporator can cause the following issues:

- ◆ After a long journey, the air conditioning system fails repeatedly or sporadically (no cooling or heat output); the air conditioning system functions OK again after switching off the vehicle and waiting for a short period.
- ◆ After a long journey, the windows mist up on the inside and even pressing the **Defrost** button does not clear the windows; the air conditioning system functions OK again after switching off the vehicle or switching off the air conditioning system and waiting for a short period.

Precautions:

- Check the measured values of the evaporator -N280- vent temperature sender on vehicles with an AC compressor with AC compressor regulating valve -G263- (using the “Read measured values” function). If the value measured by the sender under the conditions described by the customer is too low (at an ambient temperature above 0 °C, colder than 0 °C for a long time, although the -N280- is not currently actuated) or too high (higher than approx. 10 °C, although the air conditioning system is functioning correctly), the evaporator can ice up as a result of the incorrect measurement value ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function of the air conditioning system and ⇒ Heating, Air Conditioning; Rep. gr. 00 (vehicle-specific workshop manual).
- Check the refrigerant line from the evaporator (or from internal heat exchanger) to the AC compressor (thick pipe, low-pressure side) while the engine is running. If this line is badly iced up when the issue occurs (a thin layer of ice is OK), this also indicates that the temperature in the evaporator is too low ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- Empty the refrigerant circuit, replace the desiccator cartridge and then evacuate the refrigerant circuit for at least 3 hours ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ [w2 ith the A/C service station](#), page 102 .

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Test requirements:

- ◆ Follow the general instructions for checking pressures in a refrigerant circuit ⇒ [i2.14.1 nstructions for checking pressures in a refrigerant circuit](#), page 139 .



Note

*All test requirements marked with a * are vehicle-specific and are described in the workshop manual for the vehicle ⇒ Heating, Air Conditioning; Rep. gr. 00 (vehicle-specific workshop manual).*

General test requirements (these only affect the reading on the pressure gauge for this measurement when the air conditioning system is switched on):

- The radiator and condenser are clean (if necessary clean). *
- The heat-protection insulation on the expansion valve is O.K. and is correctly installed. *
- The V-ribbed belt is OK and correctly tensioned. / The belts for the AC compressor and AC generator are OK and are correctly tensioned. *
- The drive unit for the AC compressor is OK and is correctly installed. *
- All the air guides, covers and seals are O.K. and are correctly installed. *
- Diagnosis for the air conditioning system does not detect an error (while engine is running and air conditioning system is switched on) and no compressor shut-off condition is displayed in the measured values (only for vehicles with "air conditioning system" diagnostics). * ⇒ Vehicle diagnostic tester in the air conditioning system's "targeted fault-finding" function.
- The air flow rate through the dust and pollen filter is not impaired by contamination. *
- All the dash panel vents are opened. *



Note

- ◆ *The AC compressor is driven by the belt. To protect the belt and the engine, overload protection is installed in the belt pulley or the AC compressor's drive unit, which is triggered if the AC compressor is sluggish ⇒ Heating, Air Conditioning; Rep. gr. 87.*
- ◆ *On certain versions, the fan is only switched on after the pressure in the refrigerant circuit has exceeded a given value ⇒ Vehicle diagnostic tester in "Targeted fault-finding" function for the air conditioning system.*

Other test requirements (these affect the reading on the pressure gauge for this measurement):

- The vehicle should not be exposed to sunlight ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- The ambient temperature is higher than 15°C.
- Ignition is switched off.
- The AC service station is connected to the refrigerant circuit ⇒ [t2.2 he A/C service station to the refrigerant circuit", page 105](#).
- ◆ ⇒ [p2.14.4 ressures with air conditioning switched on for vehicles with mechanically driven air conditioning compressor", page 148](#).

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Checking pressures when the ignition is switched off



Note

- ◆ *The switching pressures to actuate the AC compressor control valve -N280-, the AC magnetic clutch -N25- (if present) and the radiator fans (e.g. radiator fan -V7-/radiator fan 2 -V177-) are vehicle-specific ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system.*
- ◆ *The pressures must be measured at the service connectors and the location of these connections is vehicle-specific ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- ◆ *After completing the task, disconnect the AC service station from the refrigerant circuit and switch off ⇒ [02.8 ff the A/C service station and disconnecting it from the refrigerant circuit", page 123](#).*
- The engine is at operating temperature (at an ambient temperature below 25 °C).



Note

- ◆ *If the engine is not at operating temperature, test drive the vehicle.*
- ◆ *To check the cooling capacity, the engine does not have to be at operating temperature, but to draw a certain cooling capacity from the air conditioning system at an ambient temperature below 25 °C the engine must be at operating temperature if ambient temperatures are low.*
- ◆ Observe test requirements ⇒ [page 143](#).
- Switch off ignition.
- Connect A/C service station ⇒ [t2.2 he A/C service station to the refrigerant circuit", page 105](#).
- Check pressure in a refrigerant circuit while engine is not running.
- Read the pressures on the pressure gauges of the AC service station, while can display two results:
- ◆ The pressure in the refrigerant circuit is lower than specified in the table ⇒ [page 148](#).
- ◆ The pressure in the refrigerant circuit corresponds to the following table or is higher ⇒ [page 148](#).



Note

- ◆ *Vapour pressure table for refrigerant R1234yf ⇒ [p6.1.3 re-ssure table for the refrigerant", page 19](#).*
- ◆ *The pressures in the following table are slightly lower than from the vapour pressure table for refrigerant R1234yf. The vapour pressure of the refrigerant in the refrigerant circuit depends on the coldest component and therefore can be slightly lower than the vapour pressure given in the vapour pressure table for refrigerant R1234yf, even if the refrigerant circuit has been filled correctly.*

Ambient temperature (in Celsius)	Pressure in the refrigerant circuit in bar overpressure
+15 °C	3.5
+20 °C	4.4
+25 °C	5.3
+30 °C	6.3
+35 °C	7.4
+40 °C	8.6
+45 °C	10.0



Note

- ◆ *The temperature of the components of the refrigerant circuit should be equal to the ambient temperature. If individual components of the refrigerant circuit are warmer or colder, the pressure deviates from the values in the table.*
- ◆ *At absolute pressure, 0 bar corresponds to an absolute vacuum. The normal ambient pressure (overpressure) corresponds to 1 bar absolute pressure. On the scales of most pressure gauges, 0 bar corresponds to an absolute pressure of one bar (which you can see from -1 below 0 on the scale)*
- ◆ *On vehicles with pressure senders (high pressure sender -G65-, refrigerant circuit pressure sender -G805-, refrigerant pressure and refrigerant temperature sender -G395- etc.) that display the measured pressure as measured diagnostic values, the measured pressure should correspond to the values in the table (or be slightly higher) ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function of the air conditioning system and ⇒ Heating, Air Conditioning; Rep. gr. 00 (vehicle-specific workshop manual).*
- ◆ *The pressure is stated in different units; 1 MPa (mega Pascal) equals 10 bar pressure or 145 psi; 1 bar absolute pressure roughly equals ambient pressure (atmospheric pressure).*

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If the measured values are OK and there is no issue:

- Unscrew the handwheel on the quick coupler adapter (close) ⇒ AC service station operating instructions.
- Extract refrigerant from the two filling hoses with the AC service station according to the relevant operating instructions ⇒ AC service station operating instructions.
- Switch off the AC service station (if necessary, also disconnect from the power supply) ⇒ [o2.8 ff the A/C service station and disconnecting it from the refrigerant circuit", page 123](#) .

If the measured values are OK and there is an issue:

- Check the cooling capacity of the air conditioning system ⇒ Heating, Air Conditioning; Rep. gr. 00, while monitoring the pressures in the refrigerant circuit.
- ◆ ⇒ [p2.14.4 ressures with air conditioning switched on for vehicles with mechanically driven air conditioning compressor", page 148](#)

If the measured values are not OK:

- Identify and eliminate the cause of deviation.

**Note**

- ◆ *If the pressures are too low, there may be too little refrigerant in the circuit ⇒ Heating, Air Conditioning; Rep. gr. 00 and ⇒ [r2.4 efrigerant circuit.](#), [page 109](#) .*
- ◆ *If the pressures are too high, then maybe too much refrigerant or refrigerant oil in the circuit. Use the AC service station to empty the refrigerant circuit ⇒ [r2.4 efrigerant circuit.](#), [page 109](#) ; if the extracted volume of refrigerant is larger than the specified filling volume for refrigerant R1234yf ⇒ Heating, Air Conditioning; Rep. gr. 00, evacuate the refrigerant circuit and re-fill with the correct quantity of refrigerant R1234yf. Then repeat the test. If the extracted volume of refrigerant is approximately the same as the specified filling volume for refrigerant R1234yf, clean the refrigerant circuit with refrigerant ⇒ [t1.6 he refrigerant circuit](#), [page 84](#) . Then add the specified volume of refrigerant oil, evacuate the refrigerant circuit, re-filled with the correct volume of refrigerant R1234yf and then repeat the test.*
- ◆ *If the pressures are too low or too high and contaminated refrigerant is identified during gas analysis, this may be the cause of the deviation (different refrigerants have different vapour pressures); empty the refrigerant circuit and then clean with refrigerant R1234yf ⇒ [r2.4 efrigerant circuit.](#), [page 109](#) , ⇒ [g2.3 as analysis for the refrigerant](#), [page 107](#) and ⇒ [t1.6 he refrigerant circuit](#), [page 84](#) .*

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The pressure in the refrigerant circuit is lower than given in the table

Too little refrigerant in the circuit.

- Detecting leaks on the refrigerant circuit ⇒ [t1.4 eaks](#), [page 62](#) .
- Check pressure relief valve ⇒ [r1.2.14 elief valve](#), [page 51](#) .
- Check that the radiator fans or the radiator fan are being actuated ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function for the air conditioning system.
- Check refrigerant lines and refrigerant hoses for constrictions of the cross-section, for external damage and for bending radii that may be too small ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- If no fault is found, clean refrigerant circuit ⇒ [t1.6 he refrigerant circuit](#), [page 84](#) .

The pressure in the refrigerant circuit corresponds to the table or is higher

- ◆ ⇒ [p2.14.4 ressure with air conditioning switched on for vehicles with mechanically driven air conditioning compressor](#), [page 148](#)

2.14.4 Check pressures with air conditioning switched on for vehicles with mechan-

Electrically driven air conditioning compressor

Set values for pressures in a refrigerant circuit ⇒ [page 152](#)

Check pressures

Refrigerant circuit with expansion valve, with or without AC magnetic clutch -N25- and AC compressor regulating valve -N280- (with AC compressor regulated externally).



Note

- ◆ *Connect A/C service station ⇒ [t2.2 he A/C service station to the refrigerant circuit](#), [page 105](#).*
- ◆ *⇒ [i2.14.3 n a refrigerant circuit when the ignition is switched off](#), [page 143](#)*

Test requirements:

- The AC service station is connected to the refrigerant circuit ⇒ [t2.2 he A/C service station to the refrigerant circuit](#), [page 105](#).
- Note the test requirements for testing pressures in the refrigerant circuit when the ignition is switched off ⇒ [page 143](#).
- The pressures in a refrigerant circuit when the ignition is switched off correspond to the set values ⇒ [i2.14.3 n a refrigerant circuit when the ignition is switched off](#), [page 143](#).
- Note the test requirements for testing the cooling capacity ⇒ Heating, Air Conditioning; Rep. gr. 00 (vehicle-specific workshop manual).



Note

- ◆ *The switching pressures to actuate the AC compressor control valve -N280-, the AC magnetic clutch -N25- (if present) and the radiator fans -V7- are vehicle-specific ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system.*
- ◆ *The pressures must be measured at the service connectors and the location of these connections is vehicle-specific ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*



Note

- ◆ *To draw a certain cooling capacity from the air conditioning system at an ambient temperature below 25 °C the engine must be at operating temperature to test the cooling capacity.*
- ◆ *If the engine is not at operating temperature, test drive the vehicle.*
- Start the engine.
- Set air conditioning system to maximum cooling capacity ⇒ Heating, Air Conditioning; Rep. gr. 00 (vehicle-specific workshop manual).



- The AC compressor is actually driven when the engine is running (visual inspection ⇒ Heating, Air Conditioning; Rep. gr. 87) (vehicle-specific workshop manual).
- The AC compressor regulating valve -N280- is actuated ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function for the air conditioning system.

**Note**

- ◆ *The AC compressor is driven by the belt. To protect the belt and the engine, overload protection is installed in the belt pulley or the AC compressor's drive unit, which is triggered if the AC compressor is sluggish ⇒ Heating, Air Conditioning; Rep. gr. 87.*
- ◆ *On vehicles with AC compressor regulating valve -N280-, the control current can be read from the measured values ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function for the air conditioning system.*

If the AC compressor is not driven while the engine is running or the control valve is not actuated:

- The cause can be identified and eliminated e.g. by querying the event memory of the air conditioning system ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function for the air conditioning system.
- If present, test the voltage supply for the AC magnetic clutch -N25-. If it is OK, repair the magnetic clutch ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- Check that the AC compressor control valve -N280- is being actuated ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function for the air conditioning system.

**Note**

- ◆ *In the case of AC compressors with an AC magnetic clutch -N25-, the AC compressor will only operate (convey refrigerant) if the -N280- is also actuated in addition to the AC compressor regulating valve -N25- ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function for the air conditioning system.*
- ◆ *The -N280- (and the -N25-) is actuated by the AC control unit -J301-, the AC control and display unit -E87- or the Climatronic control unit -J255- or a downstream control unit ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function for the air conditioning system and ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- ◆ *All test requirements marked with a * are vehicle-specific and are described in the workshop manual for the vehicle ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- The radiator and condenser are clean (if necessary, clean them).* ⇒ Heating, Air Conditioning; Rep. gr. 87.
- The heat-protection insulation on the expansion valve is OK and is correctly installed. * ⇒ Heating, Air Conditioning; Rep. gr. 87.

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- The V-ribbed belt is OK and correctly tensioned. / The belts for the AC compressor and AC generator are OK and are correctly tensioned. *
- All the air guides, covers and seals are OK and are correctly installed. * ⇒ Heating, Air Conditioning; Rep. gr. 87.
- Diagnosis for the air conditioning system does not detect an error (while engine is running and air conditioning system is switched on) and no compressor shut-off condition is shown in the measured values of the respective control unit (only for vehicles with "air conditioning system" diagnostics). *
⇒ Vehicle diagnostic tester in the air conditioning system's "targeted fault-finding" function.
- The air flow rate through the dust and pollen filter is not impaired by contamination * ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- The heating and air conditioning unit does not draw any secondary air at the highest fresh air blower speed. The evaporator and heating does not draw secondary air * ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- The air guide flaps in the heating and air conditioning unit, in the heating and in the evaporator reach their final position * ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- The fresh air intake ducts under the front flap and in the passenger compartment as well as the related water drain valves are OK * ⇒ Heating, Air Conditioning; Rep. gr. 87. (See vehicle-specific workshop manual).
- The engine is at operating temperature.
- The vehicle should not be exposed to the sun.
- The ambient temperature is higher than 15°C.
- All the dash panel vents are opened. *

Settings e.g. on the AC control and display unit -E87-, the Climatronic control unit -J255- or the AC control unit -J301-:

- Pre-select operating mode "auto" (AC compressor switched on).
- Set pre-selected temperature to "cold" or "LO" for the driver's and the front passenger's side (and rear left and right in vehicles with two heating and air conditioning units).

Settings on -J301- *:

- Press the AC button and recirculation button.
- Turn the temperature rotary switch to the stop for "cold".
- Put the rotary switch for fresh air blower at position "4" (maximum fresh air blower speed).

Then the following test conditions should be met by the system:

- The radiator fan -V7- is running or the radiator fan -V7- and radiator fan 2 -V177- are running (at least at level 1)
* ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).



Note

On certain versions, the fan is only switched on after the pressure in the refrigerant circuit has exceeded a given value ⇒ Vehicle diagnostic tester in "Targeted fault-finding" function for the air conditioning system.

Set values for pressures in a refrigerant circuit

- ◆ Follow the test requirements and check the pressures ⇒ [page 149](#).

Checking

- Bring the engine speed to 2000 rpm.
- Observe the pressure indicator (e.g. pressure gauge) of the AC service station ⇒ AC service station operating instructions.



Note

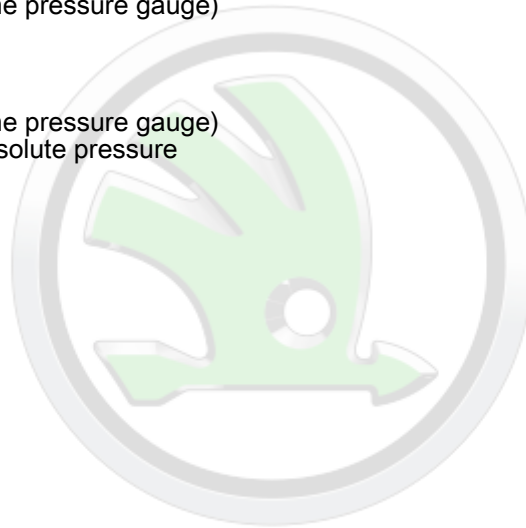
- ◆ *The switching pressures to actuate the AC compressor control valve -N280- and the radiator fan -V7- are vehicle-specific ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system.*
- ◆ *The pressures must be measured at the service connectors; the location of these connections is vehicle-specific ⇒ Heating, Air Conditioning; Rep. gr. 87.*

High-pressure side

From the initial pressure (when connecting the pressure gauge) rising up to maximum 20 bar overpressure.

Low-pressure side

From the initial pressure (when connecting the pressure gauge) falling to a value between 1.5 and 2.3 bar absolute pressure (depending on required cooling capacity).



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Note

- ◆ *At very high demand for cooling capacity (e.g. high outside temperature and a high fresh air blower speed while engine speed is low), the AC compressor may not initially be able to bring the pressure on the low-pressure side to the set value (e.g. for a certain time after switching on the air conditioning system). The AC compressor is started with the maximum specified control current, but the volume delivered by the AC compressor is not adequate under these ambient conditions and at this engine speed to reduce the pressure on the low-pressure side to the set value. To test the control behaviour of the AC compressor under these conditions, only start the fresh air blower e.g. at approx. 40% of maximum performance (voltage) and check the pressures at reduced fresh air blower speed ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system and ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- ◆ *If the demand for cooling capacity is very high (e.g. at an outside temperature of 20 °C and a low fresh air blower speed), the pressure on the high-pressure side may only rise to a value of 6 to 7 bar (the energy exchange is low and the refrigerant is rapidly cooled in the condenser). To test the control behaviour of the AC compressor and the pressures in the refrigerant circuit under these conditions, start the fresh air blower at maximum voltage and set the air conditioning system to maximum heat output and recirculation mode ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system and ⇒ Heating, Air Conditioning; Rep. gr. 00.*
- ◆ *The pressure on the high-pressure side can rise to maximum 29 bar under unfavourable conditions (very high ambient temperatures, high humidity).*
- ◆ *The target operating current for the AC compressor regulating valve -N280- is displayed as a measured value by the AC control and display unit -E87-, the AC control unit -J301- or the Climatronic control unit -J255- ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system.*
- ◆ *The high pressure measured by the high pressure sender -G65-, by the refrigerant circuit pressure sender -G805- or the refrigerant pressure and refrigerant temperature sender -G395- is displayed as measured value by the -E87-, the -J301- or the -J255- ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system.*
- ◆ *The low pressure adjusts within the tolerance range, depending the control current for the AC compressor control valve -N280- and the control characteristic of the expansion valve within the performance range of the AC compressor ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system.*
- ◆ *Under unfavourable conditions (very high ambient temperatures, high air humidity), the output of the AC compressor may not always be enough to reach the specified pressure within the specified time (it may take slightly longer to reach the specified low pressure, depending on the engine speed).*
- ◆ *If the AC compressor load is greater than 90%, the pressure on the low-pressure side may be above and outside the given tolerance range. Under prevailing ambient conditions (ambient temperature, air humidity, settings of the air conditioning system, engine speed etc.), the AC compressor*



output is no longer enough to bring the pressure on the low-pressure side to approx. 2 bar.

- ◆ The target operating current for the AC compressor regulating valve -N280- must be greater than 0.3 A for the -N280- to be actuated reliably ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function of the air conditioning system.
- ◆ If set to "maximum cooling capacity", the control current for the AC compressor regulating valve -N280- is adjusted to approx. 0.65 A (up to 0.85 A). This measured value is vehicle-specific and is displayed in the ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system.
- ◆ At absolute pressure, 0 bar corresponds to an absolute vacuum. The normal ambient pressure corresponds to 1 bar absolute pressure. On the scales of most pressure gauges, 0 bar corresponds to an absolute pressure of one bar (which you can see from -1 below 0 on the scale) Depending on the design of the control unit, the measured pressure may be displayed as absolute or relative pressure (difference is 1 bar) ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system and ⇒ Heating, Air Conditioning; Rep. gr. 00 Check the cooling capacity (vehicle-specific workshop manual)
- ◆ The temperature of the air downstream of the evaporator, the current AC compressor speed and the pressure of the refrigerant on the high-pressure side, as well as the target operating current for the AC compressor regulating valve -N280-, is displayed as a measured value e.g. by the AC control and display unit or the Climatronic control unit -J255- ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system.

Possible deviations from the set value, causes and elimination

Possible deviation from the set value during pressure testing
<ul style="list-style-type: none"> ◆ The required cooling capacity is not reached. ◆ The high pressure remains constant or increases only slightly (above the pressure while engine is not running). ◆ The low pressure does not fall or drops only slightly.
Possible causes for deviation from set value and how to eliminate them
<ul style="list-style-type: none"> ◆ Actuation of the AC compressor control valve -N280- is defective. <ul style="list-style-type: none"> – Check that the AC compressor control valve -N280- is being actuated; if necessary, repair ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system. ◆ AC compressor control valve -N280- or AC compressor defective <ul style="list-style-type: none"> – Check that the -N280- is functioning correctly; if necessary, remove the -N280- and check for contamination ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system. – Replace AC compressor if necessary ⇒ c1.5 omponents", page 72 . – If there is contamination in the refrigerant circuit, clean the refrigerant circuit (flush with refrigerant R1234yf) and replace the expansion valve and desiccator bag/desiccator cartridge ⇒ c1.5 omponents", page 72 and ⇒ t1.6 he refrigerant circuit", page 84 .
Final steps
<ul style="list-style-type: none"> – Re-fill the refrigerant circuit with new refrigerant ⇒ t2.6 he refrigerant circuit", page 118 . – Repeat check ⇒ p2.14.4 ressure with air conditioning switched on for vehicles with mechanically driven air conditioning compressor", page 148 .



Note

- ◆ *In this case, make sure that the AC compressor (shaft of the AC compressor) is in fact being driven by the belt pulley/drive unit ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- ◆ *If you cannot find a problem causing this issue, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit](#), page 84 .*
- ◆ *Check the measured values of the evaporator vent temperature sender -G263- and the actuation of the AC compressor control valve -N280-. If the measured value of the -G263- is incorrect, the evaporator may ice up and the cooling capacity is not achieved ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system.*
- ◆ *If the function of the air conditioning system is not OK when the test is repeated after replacing the expansion valve (switch back old expansion valve), clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit](#), page 84 . Then replace the AC compressor and desiccator bag/desiccator cartridge.*
- ◆ *If this fault occurs, it can happen that the evaporator ices up although the volume of refrigerant in the circuit is O.K.*
- ◆ *If the expansion valve is defective (it is closed constantly or it does not open up wide enough) the -N280- is set to maximum performance and the low pressure drops to the chart value or lower (the AC compressor sucks the refrigerant out of the low pressure side) ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system. As no refrigerant can flow through the expansion valve, the cooling capacity is not achieved, the high pressure also may not increase or only increases slightly, because there is no energy exchange.*

Possible deviation from the set value during pressure testing
<ul style="list-style-type: none"> ◆ The required cooling capacity is not reached. ◆ The high pressure remains constant or increases only slightly (above the pressure while engine is not running). ◆ The low pressure drops quickly to set value or lower.
Possible causes for deviation from set value and how to eliminate them
<ul style="list-style-type: none"> ◆ There is too little refrigerant in the refrigerant circuit. <ul style="list-style-type: none"> – Extract the refrigerant from the refrigerant circuit ⇒ r2.4 efrigerant circuit., page 109 . – If the extracted volume of refrigerant is significantly less than the specified filling volume (more than 100 g less) ⇒ Heating, Air Conditioning; Rep. gr. 00, find and correct any leaks ⇒ 11.4 eaks, page 62 . ◆ The expansion valve is defective – replace. <ul style="list-style-type: none"> – Replace the expansion valve ⇒ Heating, Air Conditioning; Rep. gr. 87.
Final steps
<ul style="list-style-type: none"> – Re-fill the refrigerant circuit with new refrigerant ⇒ t2.6 he refrigerant circuit, page 118 . – Repeat check ⇒ p2.14.4 ressure with air conditioning switched on for vehicles with mechanically driven air conditioning compressor, page 148 .



Note

- ◆ *In this case, make sure that the AC compressor (shaft of the AC compressor) is in fact being driven by the belt pulley/drive unit ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- ◆ *If you cannot find a problem causing this issue, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit](#), page 84 .*
- ◆ *Check the measured values of the evaporator vent temperature sender -G263- and the actuation of the AC compressor control valve -N280-. If the measured value of the -G263- is incorrect, the evaporator may ice up and the cooling capacity is not achieved ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system.*
- ◆ *If the function of the air conditioning system is not OK when the test is repeated after replacing the expansion valve (switch back old expansion valve), clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit](#), page 84 . Then replace the AC compressor and desiccator bag/desiccator cartridge.*
- ◆ *If this fault occurs, it can happen that the evaporator ices up although the volume of refrigerant in the circuit is O.K.*
- ◆ *If the expansion valve is defective (it is closed constantly or it does not open up wide enough) the AC compressor control valve -N280- is set to maximum performance and the low pressure drops to the chart value or lower (the AC compressor sucks the refrigerant out of the low pressure side) ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function of the air conditioning system. As no refrigerant can flow through the expansion valve, the cooling capacity is not achieved, the high pressure also may not increase or only increases slightly, because there is no energy exchange.*

Possible deviation from the set value during pressure testing

- ◆ The required cooling capacity is not reached.
- ◆ The high pressure is at the set value.
- ◆ The low pressure is at the set value or is too low.

Possible causes for deviation from set value and how to eliminate them

- ◆ There is too little refrigerant in the refrigerant circuit.
 - Extract the refrigerant from the refrigerant circuit ⇒ [r2.4 efrigerant circuit](#), page 109 .
 - If the extracted volume of refrigerant is significantly less than the specified filling volume (by more than 100 g) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data, find and eliminate leakage ⇒ [l1.4 eaks](#), page 62 .
- ◆ The expansion valve is defective.
 - Replace the expansion valve ⇒ Heating, Air Conditioning; Rep. gr. 87.

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit](#), page 118 .
- Repeat check ⇒ [p2.14.4 ressure with air conditioning switched on for vehicles with mechanically driven air conditioning compressor](#), page 148 .



Note

- ◆ Check the measured values of the evaporator vent temperature sender -G263- and the actuation of the AC compressor control valve -N280-. If the measured value of the -G263- is incorrect, the evaporator may ice up and the cooling capacity is not achieved ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system.
- ◆ If the function of the air conditioning system is not OK when the test is repeated after replacing the expansion valve (switch back old expansion valve), clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit](#), [page 84](#) . Then replace the AC compressor and desiccator bag/desiccator cartridge.

Possible deviation from the set value during pressure testing

- ◆ The required cooling capacity is not achieved.
- ◆ The high pressure does not increase or increases only slightly above the pressure while engine is not running.
- ◆ The low pressure does not fall or drops only slightly.

Possible causes for deviation from set value and how to eliminate them

- ◆ The AC compressor is not driven or is not driven at the set speed.
 - Check the drive system for the AC compressor (by belt or drive unit) ⇒ Heating, Air Conditioning; Rep. gr. 87.
- ◆ Actuation of the AC compressor control valve -N280- (of the AC magnetic clutch -N25-) is defective.
 - Check that the AC compressor control valve -N280- (and the AC magnetic clutch -N25-) is being actuated; if necessary, repair ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system.
- ◆ AC compressor control valve -N280- or AC compressor defective.
 - Check that the AC compressor control valve -N280- is functioning; if necessary, remove it and check for contamination ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system ⇒ [c1.5 omponents](#), [page 72](#) .
 - Replace AC compressor if necessary ⇒ [c1.5 omponents](#), [page 72](#) .
 - If there is contamination in the refrigerant circuit, clean the refrigerant circuit (flush with refrigerant R1234yf) and replace the expansion valve and desiccator bag/desiccator cartridge ⇒ [c1.5 omponents](#), [page 72](#) and ⇒ [t1.6 he refrigerant circuit](#), [page 84](#) .
- ◆ Restriction or blockage in the refrigerant circuit (e.g. in refrigerant line between "low-pressure side" service connector and the AC compressor).
 - Feel the temperature gradient of the refrigerant circuit by hand ⇒ Heating, Air Conditioning; Rep. gr. 87. If a temperature gradient is identified for a component, where a hose line or a pipe is bent or constricted, replace this component. If there is a blockage or no fault is identified, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit](#), [page 84](#) .
 - Replace desiccator cartridge ⇒ [c1.5 omponents](#), [page 72](#) and ⇒ Heating, Air Conditioning; Rep. gr. 87.

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit](#), [page 118](#) .
- Repeat check ⇒ [p2.14.4 ressures with air conditioning switched on for vehicles with mechanically driven air conditioning compressor](#), [page 148](#) .

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**Note**

- ◆ *In this case, make sure that the AC compressor (shaft of the AC compressor) is in fact being driven by the belt pulley/drive unit (note the overload protection) ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- ◆ *Some engines have AC compressors with an AC magnetic clutch -N280- installed on the belt pulley in addition to the AC compressor regulating valve -N25-. In this case, make sure that the AC magnetic clutch -N25- is in fact being actuated and the AC compressor (the shaft of the AC compressor) is being driven by the belt pulley ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic Catalogue of Original Parts "ETKA".*
- ◆ *If you cannot find a problem causing this issue, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit](#), [page 84](#) .*
- ◆ *Check the measured values of the evaporator vent temperature sender -G263- and the actuation of the AC compressor control valve -N280-. If the measured value of the -G263- is incorrect, the evaporator may ice up and the cooling capacity is not achieved ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system.*
- ◆ *If the function of the air conditioning system is not OK when the test is repeated after replacing the expansion valve (switch back old expansion valve), clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit](#), [page 84](#) . Then replace the AC compressor and desiccator bag/desiccator cartridge.*
- ◆ *If the expansion valve is defective (it is closed constantly or it does not open up wide enough) the AC compressor control valve -N280- is set to maximum performance and the low pressure drops to the chart value or lower (the AC compressor sucks the refrigerant out of the low pressure side) ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function of the air conditioning system. As no refrigerant can flow through the expansion valve, the cooling capacity is not achieved, the high pressure also may not increase or only increases slightly, because there is no energy exchange.*

Possible deviation from the set value during pressure testing

- ◆ The required cooling capacity is not achieved.
- ◆ The high pressure increases above the set value.
- ◆ The low pressure drops quickly to set value or lower.

Possible causes for deviation from set value and how to eliminate them

Possible deviation from the set value during pressure testing

- ◆ Actuation of the AC compressor control valve -N280- is defective.
 - Check that the AC compressor control valve -N280- is being actuated and the measured value of the evaporator vent temperature sender -G263-; if necessary, repair ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function for the air conditioning system.
- ◆ Constriction or blockage in the refrigerant circuit.
- ◆ The expansion valve is defective.
 - Feel the temperature gradient of the refrigerant circuit by hand ⇒ Heating, Air Conditioning; Rep. gr. 87. If a temperature gradient is identified for a component, where a hose line or a pipe is bent or constricted, replace this component. If there is a blockage or no fault is identified, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit”, page 84](#) .
 - Replace expansion valve and desiccator cartridge ⇒ [c1.5 omponents”, page 72](#) and ⇒ Heating, Air Conditioning; Rep. gr. 87.

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#) .
- Repeat check ⇒ [p2.14.4 ressure with air conditioning switched on for vehicles with mechanically driven air conditioning compressor”, page 148](#) .

Note

- ◆ *If the air conditioning system is not functioning OK when you repeat the test, replace expansion valve and desiccator cartridge ⇒ Heating, Air Conditioning; Rep. gr. 87.*
- ◆ *If this fault occurs, it can happen that the evaporator ices up although the volume of refrigerant in the circuit is O.K.*
- ◆ *If the expansion valve is defective (it is closed constantly or it does not open up wide enough) the AC compressor control valve -N280- is actuated to maximum performance and the low pressure drops to the chart value or lower (the AC compressor sucks the refrigerant out of the low pressure side). As no refrigerant can flow through the expansion valve, the cooling capacity is not achieved, the high pressure also may not increase or only increases slightly, because there is no energy exchange ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function for the air conditioning system ⇒ Heating, Air Conditioning; Rep. gr. 87.*
- ◆ *If there is too much refrigerant oil in the circuit, the AC compressor must be emptied and the desiccator bag/desiccator cartridge must be replaced. After cleaning the refrigerant circuit (flushing with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit”, page 84](#) , fill the correct quantity of refrigerant oil and refrigerant into the refrigerant circuit ⇒ Heating, Air Conditioning; Rep. gr. 00; Technical data.*

Possible deviation from the set value during pressure testing

- ◆ The required cooling capacity is not achieved.
- ◆ The high pressure increases above the set value.
- ◆ The low pressure drops quickly to set value or lower.

Possible causes for deviation from set value and how to eliminate them


Possible deviation from the set value during pressure testing

- ◆ Actuation of the AC compressor control valve -N280- is defective.
 - Check that the -N280- is being actuated and the measured value of the evaporator vent temperature sender -G263-; if necessary, repair ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function for the air conditioning system.
- ◆ Constriction or blockage in the refrigerant circuit.
- ◆ The expansion valve is defective.
 - Feel the temperature gradient of the refrigerant circuit by hand ⇒ Heating, Air Conditioning; Rep. gr. 87. If a temperature gradient is identified for a component, where a hose line or a pipe is bent or constricted, replace this component. If there is a blockage or no fault is identified, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit”, page 84](#) .
 - Replace expansion valve and desiccator cartridge ⇒ [c1.5 omponents”, page 72](#) and ⇒ Heating, Air Conditioning; Rep. gr. 87.

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#) .
- Repeat check ⇒ [p2.14.4 ressure with air conditioning switched on for vehicles with mechanically driven air conditioning compressor”, page 148](#) .


Note

- ◆ *If the air conditioning system is not functioning OK when you repeat the test, replace expansion valve and desiccator cartridge ⇒ Heating, Air Conditioning; Rep. gr. 87.*
- ◆ *If this fault occurs, it can happen that the evaporator ices up although the volume of refrigerant in the circuit is O.K.*
- ◆ *If the expansion valve is defective (it is closed constantly or it does not open up wide enough) the AC compressor control valve -N280- is actuated to maximum performance and the low pressure drops to the chart value or lower (the AC compressor sucks the refrigerant out of the low pressure side). As no refrigerant can flow through the expansion valve, the cooling capacity is not achieved, the high pressure also may not increase or only increases slightly, because there is no energy exchange. ⇒ Vehicle diagnostic tester in the air-conditioning’s “guided fault-finding” function and ⇒ Heating, air conditioning; Rep. gr. 87,*
- ◆ *If there is too much refrigerant oil in the circuit, the AC compressor must be emptied and the desiccator bag/desiccator cartridge must be replaced. After cleaning the refrigerant circuit (flushing with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit”, page 84](#) , fill the correct quantity of refrigerant oil and refrigerant into the refrigerant circuit ⇒ Heating, Air Conditioning; Rep. gr. 00; Technical data.*
- ◆ *If the set value is not reached when you repeat the test, but you cannot find an problem on the refrigerant circuit, clean the refrigerant circuit if you have not already done so (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit”, page 84](#) .*



Possible deviation from the set value during pressure testing

- ◆ The required cooling capacity is achieved initially, but after a while the cooling capacity is no longer adequate.
- ◆ The high pressure and the low pressure are normal initially.
- ◆ After a while, the high pressure rises above the set value, the low pressure is still at the set value or drops below the set value.

Possible causes for deviation from set value and how to eliminate them

- ◆ Coolant radiator or condenser contaminated or actuation of the radiator fan not OK.
 - Check that the radiator fan is being actuated; if necessary, repair ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function for the air conditioning system.
 - Check the condenser and coolant radiator for contamination and clean if necessary ⇒ Heating, Air Conditioning; Rep. gr. 87.
- ◆ Actuation of the AC compressor control valve -N280- is defective.
 - Check that the -N280- is being actuated and the measured value of the evaporator vent temperature sender -G263-; if necessary, repair ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function for the air conditioning system.
- ◆ Too much refrigerant in the refrigerant circuit
 - Extract the refrigerant from the refrigerant circuit ⇒ [r2.4 efrigerant circuit.”, page 109](#) .
 - If the extracted volume of refrigerant is significantly more than the specified filling volume (more than 100 g more) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data, there was too much refrigerant in the refrigerant circuit.
- ◆ AC compressor control valve -N280- or AC compressor defective.
 - Check that the AC compressor control valve -N280- is functioning; if necessary, remove it and check for contamination ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function for the air conditioning system ⇒ [c1.5 omponents”, page 72](#) .
 - Replace AC compressor if necessary ⇒ [c1.5 omponents”, page 72](#) .
 - If there is contamination in the refrigerant circuit, clean the refrigerant circuit (flush with refrigerant R1234yf) and replace the expansion valve and desiccator bag/desiccator cartridge ⇒ [c1.5 omponents”, page 72](#) and ⇒ Heating, Air Conditioning; Rep. gr. 87, ⇒ [t1.6 he refrigerant circuit”, page 84](#) .
- ◆ Too much refrigerant oil in the refrigerant circuit
- ◆ Humidity in the refrigerant circuit.
 - Extract the refrigerant from the refrigerant circuit ⇒ [r2.4 efrigerant circuit.”, page 109](#) .
 - If the extracted volume of refrigerant matches the specified filling volume or is only slightly less (max. 100 g less) ⇒ Heating, Air Conditioning; Rep. gr. 00; Technical data, there is too much refrigerant oil in the refrigerant circuit.
 - Clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit”, page 84](#) .
 - Replace expansion valve and desiccator cartridge ⇒ [c1.5 omponents”, page 72](#) and ⇒ Heating, Air Conditioning; Rep. gr. 87.

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#) .
- Repeat check ⇒ [p2.14.4 ressure with air conditioning switched on for vehicles with mechanically driven air conditioning compressor”, page 148](#) .

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Note

- ◆ *If there is too much refrigerant oil in the circuit, the AC compressor must be emptied and the desiccator bag/desiccator cartridge must be replaced. After cleaning the refrigerant circuit (flushing with refrigerant R1234yf), fill the correct quantity of refrigerant oil and refrigerant into the refrigerant circuit ⇒ Heating, Air Conditioning; Rep. gr. 00; Technical data.*
- ◆ *If this fault occurs, it can happen that the evaporator ices up although the volume of refrigerant in the circuit is O.K.*
- ◆ *A fault at the evaporator vent temperature sender -G263- can also cause the refrigerant circuit to ice up. In this case, also note the measured value from the -G263- ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system and ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*

Possible deviation from the set value during pressure testing

- ◆ The required cooling capacity is achieved initially, but the required cooling capacity is no longer achieved after a while.
- ◆ The high pressure and the low pressure are normal initially; after a while, the high pressure rises above the set value and the low pressure falls to the set value or lower.
- ◆ The high pressure and the low pressure are normal initially; after a while driving, the low pressure falls to the set value or lower and the evaporator ices up.

Possible causes for deviation from set value and how to eliminate them

- ◆ Coolant radiator or condenser contaminated or actuation of the radiator fan not OK.
 - Check that the radiator fan is being actuated; if necessary, repair ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system.
 - Check the condenser and coolant radiator for contamination and clean if necessary ⇒ Heating, Air Conditioning; Rep. gr. 87.
- ◆ Measured value of the evaporator vent temperature sender -G263- is incorrect.
 - Checking the measured value and installation of the -G263- ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function of the air conditioning system and ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- ◆ Actuation of the AC compressor control valve -N280- is defective.
 - Check that the AC compressor control valve -N280- is being actuated; if necessary, repair ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system.
- ◆ AC compressor control valve -N280- or AC compressor defective.
 - Check that the AC compressor control valve -N280- is functioning; if necessary, remove it and check for contamination ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system ⇒ [c1.5 omponents", page 72](#) .
 - Replace AC compressor if necessary ⇒ [c1.5 omponents", page 72](#) .
 - If there is contamination in the refrigerant circuit, clean the refrigerant circuit (flush with refrigerant R1234yf) and replace the expansion valve and desiccator bag/desiccator cartridge ⇒ [c1.5 omponents", page 72](#) and ⇒ Heating, Air Conditioning; Rep. gr. 87, ⇒ [t1.6 he refrigerant circuit", page 84](#) .
- ◆ Humidity in the refrigerant circuit.
 - Extract the refrigerant from the refrigerant circuit ⇒ [r2.4 efrigerant circuit.", page 109](#) .
 - Clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit", page 84](#) .
 - Replace expansion valve and desiccator cartridge ⇒ [c1.5 omponents", page 72](#) and ⇒ Heating, Air Conditioning; Rep. gr. 87.

Final steps

Possible deviation from the set value during pressure testing

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit](#), page 118 .
- Repeat check ⇒ [p2.14.4 ressure with air conditioning switched on for vehicles with mechanically driven air conditioning compressor](#), page 148 .

Note

- ◆ *If this fault occurs, it can happen that the evaporator ices up although the volume of refrigerant in the circuit is O.K.*
- ◆ *A fault at the evaporator vent temperature sender -G263- can cause the refrigerant circuit to ice up. In this case, also observe the measured value of the -G263-.*
- ◆ *If there is too much humidity in the circuit, the AC compressor must be emptied and the desiccator bag/desiccator cartridge must be replaced. After cleaning the refrigerant circuit (flushing with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit](#), page 84 , fill the correct quantity of refrigerant oil and refrigerant into the refrigerant circuit ⇒ Heating, Air Conditioning; Rep. gr. 00; Technical data.*

Possible deviation from the set value during pressure testing

- ◆ the required cooling capacity is reached.
- ◆ The high pressure is at the set value.
- ◆ The low pressure is too low (less than the set value).

Possible causes for deviation from set value and how to eliminate them

- ◆ Measured value of the evaporator vent temperature sender -G263- is incorrect.
 - Checking the measured value and installation of the -G263- ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function of the air conditioning system and ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- ◆ Actuation of the AC compressor control valve -N280- is defective.
 - Check that the AC compressor control valve -N280- is being actuated; if necessary, repair ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system.
- ◆ AC compressor control valve -N280- or AC compressor defective.
 - Check that the AC compressor control valve -N280- is functioning; if necessary, remove it and check for contamination ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system ⇒ [c1.5 omponents](#), page 72 .
 - Replace AC compressor if necessary ⇒ [c1.5 omponents](#), page 72 .
 - If there is contamination in the refrigerant circuit, clean the refrigerant circuit ⇒ [t1.6 he refrigerant circuit](#), page 84 .

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit](#), page 118 .
- Repeat check ⇒ [p2.14.4 ressure with air conditioning switched on for vehicles with mechanically driven air conditioning compressor](#), page 148 .


Note

- ◆ *In the event of a “High pressure normal, low pressure too low” error, please note the following: This error may cause the evaporator to freeze even though the amount of refrigerant in the circuit is OK.*
- ◆ *If there is a fault in the AC compressor regulating valve -N280- (the control valve is not actuated, but the AC compressor keeps running anyway), you do not need to clean the refrigerant circuit (flush with refrigerant R1234yf ⇒ [t1.6 he refrigerant circuit”, page 84](#)). If this fault occurs, you only need to replace the AC compressor (note the volume of refrigerant oil in the AC compressor).*
- ◆ *If the expansion valve is defective (it is closed constantly or it does not open up wide enough) the AC compressor control valve -N280- is actuated to maximum performance and the low pressure drops to the chart value or lower (the AC compressor sucks the refrigerant out of the low pressure side). As no refrigerant can flow through the expansion valve, the cooling capacity is not always achieved, the high pressure also may not increase or only increases slightly, because there is no energy exchange. In this case, you do not need to clean the refrigerant circuit (flush with refrigerant R1234yf ⇒ [t1.6 he refrigerant circuit”, page 84](#)); replacing the expansion valve is sufficient.*
- ◆ *Check the measured values of the evaporator vent temperature sender -G263- and the actuation of the AC compressor control valve -N280-. If the measured value of the -G263- is incorrect, the evaporator may ice up and the cooling capacity is not achieved ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function for the air conditioning system.*

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Possible deviation from the set value during pressure testing
<ul style="list-style-type: none"> ◆ The AC compressor makes noises (especially after it is switched on). ◆ the required cooling capacity is reached. ◆ High pressure is normal or too high. ◆ Low pressure is normal or too high (the set value is not always achieved).
Possible causes for deviation from set value and how to eliminate them

Possible deviation from the set value during pressure testing

- ◆ Actuation of the AC compressor control valve -N280- is defective.
 - Check that the AC compressor control valve -N280- is being actuated; if necessary, repair ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function for the air conditioning system.
- ◆ Check that the AC compressor control valve -N280- is functioning; if necessary, remove it and check for contamination ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function for the air conditioning system ⇒ [c1.5 omponents”, page 72](#) .
- ◆ Replace AC compressor if necessary ⇒ [c1.5 omponents”, page 72](#) .
- ◆ If there is contamination in the refrigerant circuit, clean the refrigerant circuit ⇒ [t1.6 he refrigerant circuit”, page 84](#) .
- ◆ Too much refrigerant or refrigerant oil in the refrigerant circuit
 - Extract the refrigerant from the refrigerant circuit ⇒ [r2.4 efrigerant circuit.”, page 109](#) .
 - If the extracted volume of refrigerant is significantly more than the specified filling volume (more than 50 g more) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data, there was too much refrigerant in the refrigerant circuit.
 - If the drained volume of refrigerant matches the specified filling volume or is only slightly less (max. 100 g less) ⇒ Heating, Air Conditioning; Rep. gr. 00; Technical data, there is too much refrigerant oil in the refrigerant circuit.
 - Clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit”, page 84](#) .
 - Replace desiccator bag/desiccator cartridge.
- ◆ The expansion valve is defective.
 - Replace expansion valve and desiccator cartridge ⇒ [c1.5 omponents”, page 72](#) and ⇒ Heating, Air Conditioning; Rep. gr. 87.
- ◆ The AC compressor is defective.
 - If you cannot find a problem on any part and the drained volume of refrigerant is correct, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit”, page 84](#) . If the volume of refrigerant oil is not excessive when you clean the refrigerant circuit, replace the AC compressor ⇒ [c1.5 omponents”, page 72](#) and ⇒ Heating, Air Conditioning; Rep. gr. 87.

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#) .
- Repeat check ⇒ [p2.14.4 ressure with air conditioning switched on for vehicles with mechanically driven air conditioning compressor”, page 148](#) .

Note

- ◆ *This fault may be caused by too much refrigerant oil in the refrigerant circuit. Over-filling with refrigerant oil can occur if, for example, the AC compressor has been replaced without matching the volume of refrigerant oil. If there is too much refrigerant oil in the refrigerant circuit, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit”, page 84](#) .*
- ◆ *If the expansion valve is permanently closed or does not open wide enough, the AC compressor control valve -N280- is actuated to maximum performance and the low pressure drops to the chart value or lower (the AC compressor sucks the refrigerant out of the low-pressure side). As no refrigerant can flow through the expansion valve, the cooling capacity is not achieved, the high pressure also may not increase or only increases slightly, because there is no energy exchange ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function for the air conditioning system ⇒ Heating, Air Conditioning; Rep. gr. 87.*


Possible deviation from the set value during pressure testing

- ◆ The required cooling capacity is not reached.
- ◆ The high pressure and the low pressure are at the set values.

Possible causes for deviation from set value and how to eliminate them

- ◆ Measured value of the evaporator vent temperature sender -G263- is incorrect.
 - Checking the measured value and installation of the -G263- ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function of the air conditioning system and ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- ◆ Actuation of the AC compressor control valve -N280- is defective.
 - Check that the AC compressor control valve -N280- is being actuated; if necessary, repair ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function for the air conditioning system.
- ◆ Expansion valve is defective or there is a constriction/blockage in the refrigerant circuit
 - Feel the temperature gradient of the refrigerant circuit by hand ⇒ Heating, Air Conditioning; Rep. gr. 87. If a temperature gradient is identified for a component, where a hose line or a pipe is bent or constricted, replace this component. If there is a blockage or no fault is identified, clean the refrigerant circuit ⇒ [t1.6 he refrigerant circuit”, page 84](#) .
 - Replace expansion valve and desiccator cartridge ⇒ [c1.5 omponents”, page 72](#) and ⇒ Heating, Air Conditioning; Rep. gr. 87.
- ◆ Too much refrigerant oil in the refrigerant circuit
 - Extract the refrigerant from the refrigerant circuit ⇒ [r2.4 efrigerant circuit.”, page 109](#) .
 - If the extracted volume of refrigerant matches the specified filling volume or is only slightly less (max. 100 g less) ⇒ Heating, Air Conditioning; Rep. gr. 00; Technical data, there is too much refrigerant oil in the refrigerant circuit.
 - Clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit”, page 84](#) .
 - Replace desiccator cartridge ⇒ [c1.5 omponents”, page 72](#) and ⇒ Heating, Air Conditioning; Rep. gr. 87.

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#) .
- Repeat check ⇒ [p2.14.4 ressure with air conditioning switched on for vehicles with mechanically driven air conditioning compressor”, page 148](#) .

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Note

- ◆ Check the measured values of the evaporator vent temperature sender -G263- and the actuation of the AC compressor control valve -N280-. If the measured value of the -G263- is incorrect, the evaporator may ice up and the cooling capacity is not achieved ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system and ⇒ Heating, Air Conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- ◆ Over-filling with refrigerant oil can occur if, for example, the AC compressor has been replaced without matching the volume of refrigerant oil.
- ◆ If the expansion valve is defective (always open), the evaporator temperature is no longer regulated in such a way that only gaseous refrigerant leaves the evaporator. Under certain operating conditions, liquid drops can then be sucked into the AC compressor, this then leads to noises (liquid cannot be compressed).
- ◆ If there is too much refrigerant oil in the circuit, the AC compressor must be emptied. After cleaning the refrigerant circuit (flushing with refrigerant R1234yf) ⇒ [1.6 the refrigerant circuit](#), page 84, fill the correct quantity of refrigerant oil and refrigerant into the refrigerant circuit ⇒ Heating, Air Conditioning; Rep. gr. 00: Technical data.

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2.14.5 Check pressures with air conditioning switched on for vehicles with electrically driven air conditioning compressor

Check pressures ⇒ [page 167](#)

Set points for pressures in the refrigerant circuit in vehicles without heat pump ⇒ [page 172](#)

Set points for pressures in the refrigerant circuit in vehicles with heat pump ⇒ [page 195](#)

Check pressures



Note

Work with the Air conditioning service station (check pressure at this point) on the refrigerant circuit can usually be carried out without it being necessary to establish voltage-free operation of the high-voltage system.

- In order to minimize the number of automatic engine starts when the vehicle is ready to drive during testing and measurement work, connect a charger to the 12-volt battery in backup mode. Recommended battery chargers, see ⇒ Electrical system - general information; Rep. gr. 27; battery, Chapter "battery charge".
- For test and measurement work where readiness to drive must be active or ignition must be switched on, set the selector lever to position "P", activate the parking brake, arrange the necessary tools so that they cannot come into contact with rotating engine components and do not themselves come into contact with components rotating while the engine is running.

**Note**

- ◆ *For test and measurement work where the ignition is switched on but the vehicle does not have to be ready to move, set the selector lever to position "P" and activate the parking brake.*
 - ◆ *When the vehicle is ready for operation, display the Control unit in the dash panel insert -J285- via the "PowerMeter" appropriate ⇒ Owner's Manual,*
 - ◆ *Activating and deactivating the vehicle's readiness for operation ⇒ Instruction manual(take note of the display in the Control unit in control panel insert -J285-).*
- For vehicles with a high-voltage system, switch off (deactivate) the "stand-by air conditioning" function ⇒ Owner's Manual for the Vehicle.
 - Switch off ignition.
 - Connect A/C service station ⇒ [t2.2 he A/C service station to the refrigerant circuit", page 105](#) .

**Note**

If in vehicles with two evaporators (one evaporator in the heating and air conditioning unit and one evaporator on the heat exchanger for high-voltage battery) there is an issue only with one evaporator, check pressures in the refrigerant circuit; are these OK? Check the line connection between the evaporator in question and the outlet of the line connection at the distribution point of the refrigerant lines (for cross-section constriction or blockage). If no fault can be detected, empty the refrigerant circuit and refill it with the specified quantity of refrigerant. Then check the pressures and the cooling capacity of the air conditioning system again, if the issue is still there, check the following components/replace them: if the complaint only occurs at the evaporator in the heating and air conditioning unit, check the shut-off valve upstream of the evaporator in the heating and air conditioning unit (it is open when not activated and allows the refrigerant to flow through). Replace the expansion valve on the evaporator in the heating and air conditioning unit if no fault can be detected on the shut-off valve. If the issue only occurs on the evaporator on the heat exchanger for high-voltage battery, check the activation of the shut-off valve on the expansion valve on the evaporator on the heat exchanger for high-voltage battery I (it is closed in the unactivated state and does not allow the refrigerant to flow through) ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).

Test requirements

- The AC service station is connected to the refrigerant circuit ⇒ [t2.2 he A/C service station to the refrigerant circuit", page 105](#) .
- Note the test requirements for testing pressures in the refrigerant circuit when the ignition is switched off ⇒ [page 143](#) .
- The pressures in a refrigerant circuit when the ignition is switched off correspond to the set values ⇒ [i2.14.3 n a refrigerant circuit when the ignition is switched off", page 143](#) .
- Note the test requirements for testing the refrigerating capacity ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; check cooling capacity(vehicle-specific repair guide).



Note

- ◆ *The switching pressures for the control of the electric air-conditioning compressor -V470-and the Cooling fan -V7-are vehicle-specific ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function for the air conditioning system and battery control system.*
- ◆ *The pressures must be measured at the service connectors and the location of these connections is vehicle-specific ⇒ Heating, Air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific workshop manual).*
- The engine is at operating temperature (at an ambient temperature below 25 °C).



Note

- ◆ *If the engine is not at operating temperature, test drive the vehicle.*
- ◆ *To check the cooling capacity, the engine does not have to be at operating temperature, but to draw a certain cooling capacity from the air conditioning system at an ambient temperature below 25 °C the engine must be at operating temperature if ambient temperatures are low.*
- In order to minimize the number of automatic engine starts when the vehicle is ready to drive during testing and measurement work, connect a charger to the 12-volt battery in backup mode. Recommended battery chargers, see ⇒ Electrical system - general information; Rep. gr. 27; battery, Chapter “battery charge”.
- Activate driving standby (the engine must not be running) ⇒ Owner’s Manual.
- Set air conditioner to maximum cooling capacity ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; check cooling capacity(vehicle-specific repair guide).
- The electric air-conditioning compressor -V470-is controlled and runs ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function for the air-conditioning system and battery control system as well as ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).

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Note

- ◆ *The electrically driven air-conditioning compressor is controlled by the vehicle electronics; the engine speed has no influence on the cooling capacity of the air-conditioning system*
- ◆ *The air-conditioning compressor is currently not controlled at the maximum preset speed (approx. 8500/min.) when the vehicle is stationary or moving slowly (up to a vehicle speed of approx. 45 km/h); the air-conditioning compressor speed is limited to approx. 5000 /min.*
- ◆ *The control of the electrically driven air-conditioning compressor can be ⇒ Vehicle diagnostic testermonitored via the Guided troubleshooting function in the "Guided troubleshooting" function of the air-conditioning system and the battery control system.*
- ◆ *All test requirements marked with a * are vehicle-specific and described in the vehicle repair guide ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; check cooling capacity(vehicle-specific repair guide).*

If the air-conditioning compressor is not activated when the vehicle is ready to drive:

- The cause can be identified and eliminated e.g. by querying the event memory of the air conditioning system ⇒ Vehicle diagnostic tester in the "Targeted fault-finding" function for the air conditioning system and the battery regulation.
- The radiator and condenser are clean (clean if necessary)
* ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- The thermal insulation on the expansion valve is OK and correctly installed* ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- All air ducts, covers and seals are OK and correctly installed* ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview - Air conditioning system(vehicle-specific repair guide).
- The diagnosis of the air-conditioning system shows no error (when the vehicle is ready for operation and the air-conditioning system is switched on), no compressor shutdown condition is displayed ⇒ Vehicle diagnostic testerin the measured value block in the function "Guided troubleshooting of" the air-conditioning system and battery control system.
- The various pressure/temperature sensors and temperature sensors mounted on or in the refrigerant circuit provide plausible measured values during operation of the air-conditioning system, check ⇒ Vehicle diagnostic testerin the function "Guided troubleshooting" and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioning. If no fault can be detected, aspirate refrigerant.
- The air flow through the dust and pollen filter is not affected by contamination * ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview - Air conditioning system(vehicle-specific repair guide).
- The heating and air conditioning unit does not draw any secondary air at the highest fresh air blower speed. The heating and air conditioning unit does not draw any secondary air at the highest fresh air blower speed. * ⇒ Heating, air

conditioning; Rep. gr. 00; Repair instructions; Check cooling capacity (vehicle specific workshop manual).

- The air guide dampers in the heating and air-conditioning unit, in the heating and in the evaporator reach their final position * ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; check cooling capacity(vehicle-specific repair guide).
- The fresh air intake ducts under the front flap and in the passenger compartment and the associated water drain valves are OK * ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview - Air conditioning system(vehicle-specific repair guide).
- The vehicle is not exposed to the sun's rays ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; check cooling capacity(vehicle-specific repair guide).
- The ambient temperature is higher than 15°C.
- All the dash panel vents are open.*

Settings e.g. on the Control and display unit for air conditioning system -E87-(and the Operating and display unit for rear Climatronic -E265-for vehicles with two heating and air-conditioning units) * ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; check cooling capacity(vehicle-specific repair guide) and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview - Air conditioning system.

Setting, e.g. on -E87- *:

- Pre-select operating mode “auto” (AC compressor switched on).
- Set pre-selected temperature to “cold” or “LO” for the driver’s and the front passenger’s side (and rear left and right in vehicles with two heating and air conditioning units)*.

Settings on -J301- *:

- Press the AC button and recirculation button*.
- Turn the temperature rotary switch to the stop for “cold”*.
- Put the rotary switch for fresh air blower at position “4” (maximum fresh air blower speed)*.

Then the following test conditions should be met by the system:

- The Cooling fan -V7-runs or the Cooling fan -V7-and Cooling fan 2 -V177-run (at least at level 1) * ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; check cooling capacity(vehicle-specific repair guide).



Note

On certain versions, the fan is only switched on after the pressure in the refrigerant circuit has exceeded a given value ⇒ Vehicle diagnostic tester in “Targeted fault-finding” function for the air conditioning system and battery regulation.

- The Fresh air blower -V2- (and the Fresh air blower rear -V80- for vehicles with two heating and air conditioning units) runs at maximum speed *.
- The recirculation/fresh air flap is in “recirculation mode” position (within 1 minute after starting the vehicle, the back pressure flap is closed and the recirculation flap is opened).*



- The shut-off valve for coolant is closed * ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; check cooling capacity(vehicle-specific repair guide) and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview - Air conditioning system(vehicle-specific repair guide).
- The valves of the pump-valve unit are closed and the pump for coolant circulation is not pumping * ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; check cooling capacity(vehicle-specific repair guide) and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview - Air conditioning system(vehicle-specific repair guide).



Note

- ◆ *The electrically driven air-conditioning compressor is controlled by the vehicle electronics; the engine speed has no influence on the cooling capacity of the air-conditioning system ⇒ Vehicle diagnostic tester in the "Guided troubleshooting" function of the air-conditioning system and battery control system.*
- ◆ *The air-conditioning compressor is currently not controlled at the maximum preset speed (approx. 8500/min.) when the vehicle is stationary or moving slowly (up to a vehicle speed of approx. 45 km/h); the air-conditioning compressor speed is limited to approx. 5000 /min.*
- ◆ *The control of the electrically driven air-conditioning compressor can be ⇒ Vehicle diagnostic tester monitored via the Guided troubleshooting function in the "Guided troubleshooting" function of the air-conditioning system and the battery control system.*
- ◆ *The pressures must be measured at the service connectors and the location of these connections is vehicle-specific ⇒ Heating, Air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific workshop manual).*

Set values for pressures in a refrigerant circuit

- ◆ Set points for pressures in the refrigerant circuit in vehicles without heat pump ⇒ [page 172](#)
- ◆ Set points for pressures in the refrigerant circuit in vehicles with heat pump ⇒ [page 195](#)

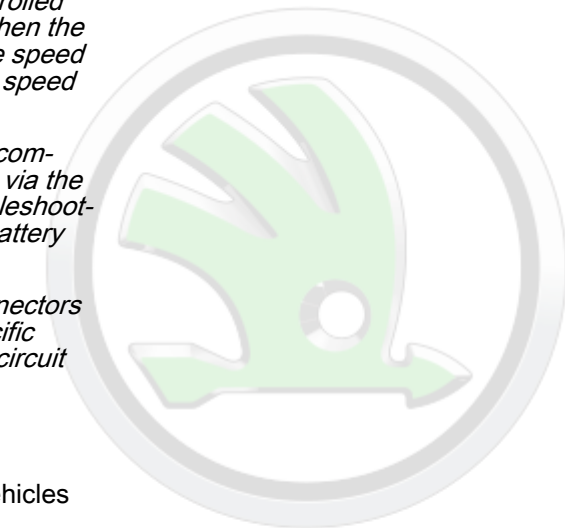


Note

- ◆ *The set point speed and actual speed for the control of the electric air-conditioning compressor -V470-and the Cooling fan -V7-are vehicle-specific ⇒ Vehicle diagnostic tester in the "Guided troubleshooting" function for the air conditioning system and battery control.*
- ◆ *The pressures must be measured at the service connectors and the location of these connections is vehicle-specific ⇒ Heating, Air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific workshop manual).*

Set points for pressures in the refrigerant circuit in vehicles without heat pump

- ◆ Observe test requirements ⇒ [page 167](#) .
- Observe the Pressure display (e.g. pressure gauge) of the Air conditioning service station.



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Note

- ◆ *The switching pressures for the control of the electric air-conditioning compressor -V470-and the -V7-/Cooling fan -V177-are vehicle-specific ⇒ Vehicle diagnostic tester in the "Guided troubleshooting" function for the air conditioning system and battery control system.*
- ◆ *The pressures must be measured at the service connectors and the location of these connections is vehicle-specific ⇒ Heating, Air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific workshop manual).*

High-pressure side

From the outlet pressure (when connecting the pressure gauges) up to a maximum of 20 bar overpressure increasing (depending on the ambient temperature and the operating conditions of the air conditioning system).

Low-pressure side

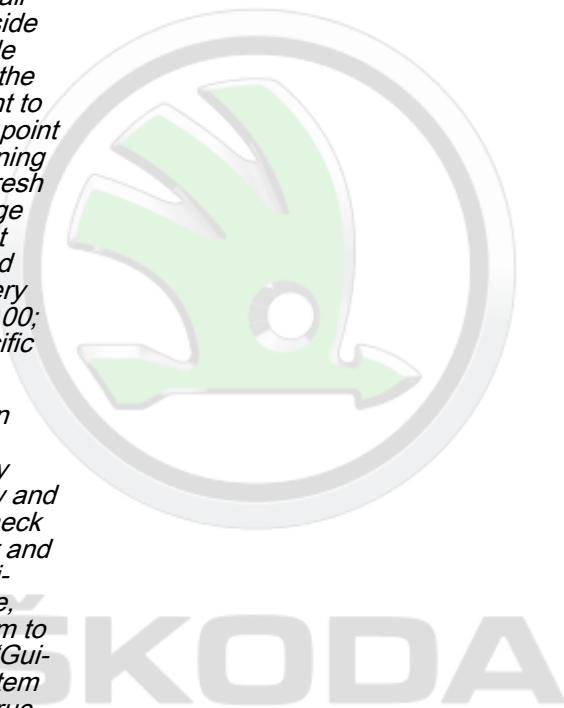
From the initial pressure (when connecting the pressure gauge) falling to a value between 1.5 and 2.3 bar absolute pressure (depending on required cooling capacity).

Speed of air conditioning compressor:

Depending on the required cooling capacity between 800 and 8500 /min (currently maximum 5000/min with stationary vehicle)


Note

- ◆ *The temperature of the air after the evaporator, the current air conditioning compressor speed and the pressure of the refrigerant on the high-pressure side are measured by various control units (e.g. the operating and display unit, the -E87-, the -J255-the Control unit for thermal management -J1024-or the Control unit for air conditioner -J301-) displayed ⇒ Vehicle diagnostic tester in the "Guided troubleshooting" function of the air conditioner and battery control system.*
- ◆ *At very high demand for cooling capacity (e.g. high outside temperature and a high fresh air blower speed), the AC compressor may not initially be able to bring the pressure on the low-pressure side to the necessary value (e.g. for a certain time after switching on the air conditioning system). The air-conditioning compressor is not controlled at the maximum preset speed (approx. 8500/min.) when the vehicle is stationary or moving slowly (up to a vehicle speed of approx. 45 km/h); the air-conditioning compressor speed is limited to approx. 5000 /min. Only at a vehicle speed of more than approx. 45 km/h is the limitation of the maximum permissible air conditioning compressor speed lifted. At an air conditioning compressor speed of 5000/min, a high outside temperature and a high fresh air fan speed (unfavourable ambient conditions), the output (the delivery volume) of the air conditioning compressor is initially no longer sufficient to reduce the pressure on the low-pressure side to the set point value. To check the control behaviour of the air conditioning compressor under these conditions, e.g. to control the fresh air blower only with approx. 40 % of the maximum voltage and to check ⇒ Vehicle diagnostic tester the pressures at reduced fresh air blower speed, use the function "Guided troubleshooting of" the air conditioning system and battery control system and ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; check cooling capacity (vehicle-specific repair guide).*
- ◆ *If the demand for cooling capacity is very high (e.g. at an outside temperature of 20 °C and a low fresh air blower speed), the pressure on the high-pressure side may only rise to a value of 6 to 7 bar (the energy exchange is low and the refrigerant is rapidly cooled in the condenser). To check the control behaviour of the air-conditioning compressor and the pressures in the refrigerant circuit under these conditions, e.g. control the fresh air fan with maximum voltage, set ⇒ Vehicle diagnostic tester the air-conditioning system to maximum heating output and recirculation mode in the "Guided troubleshooting" function of the air-conditioning system and ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; check cooling capacity (vehicle-specific repair guide).*
- ◆ *The pressure on the high-pressure side can rise to maximum 29 bar under unfavourable conditions (very high ambient temperatures, high humidity).*
- ◆ *Depending on the vehicle, the setpoint speed of the air-conditioning compressor is measured by various control units (e.g. the operating and display unit, the -E87-, -J255-or the Control unit for air conditioner -J301-) displayed ⇒ Vehicle diagnostic tester in the "Guided troubleshooting" function of the air conditioner.*
- ◆ *The one from different donors (e.g. from the High-pressure sensor -G65-from Pressure sensor for refrigerant circuit -G805-or the Sensor for refrigerant pressure and temperature -G395-) is measured as a measured value dependent on the vehicle (e.g. on the -E87-the -J301-the Control unit for thermal management -J1024-or -J255-) displayed ⇒ Vehicle*



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diagnostic tester in the "Guided troubleshooting" function of the air conditioner.

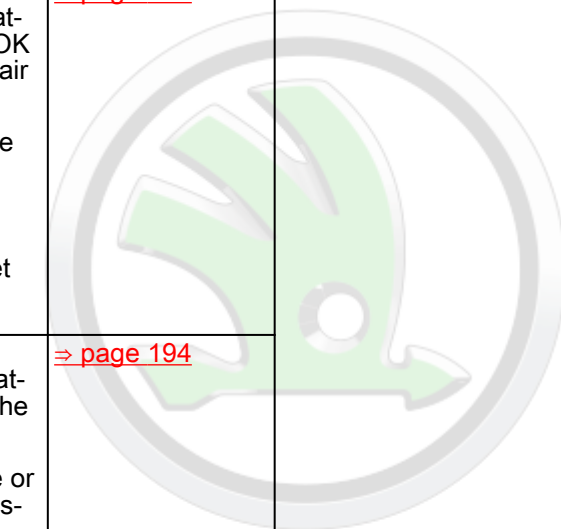
- ◆ The low pressure is set within the tolerance range (1.5 to 2.3 bar gauge pressure) depending on the speed of the air-conditioning compressor and the control characteristic curve of the expansion valve within the performance range of the air-conditioning compressor.
- ◆ For this test, the set point speed of the air conditioning compressor must be greater than 1500 /min. → Vehicle diagnostic tester in the air-condition system's "guided fault-finding" function.
- ◆ When the "maximum cooling capacity" is set, the set point speed of the air-conditioning compressor is controlled to approx. 4000 to 5000/min. This value is specific to the vehicle and is measured by the respective control unit (e.g. the operating and display unit, the -E87-, -J255- or the Control unit for thermal management -J1024-) displayed → Vehicle diagnostic tester in the "Guided troubleshooting" function of the air conditioner and battery control system.
- ◆ At absolute pressure, 0 bar corresponds to an absolute vacuum. The normal ambient pressure corresponds to 1 bar absolute pressure. On the scales of most pressure gauges, 0 bar corresponds to an absolute pressure of 1 bar (indicated by -1 bar below 0) → Vehicle diagnostic tester in the "Guided troubleshooting" function of the air conditioning system.
- ◆ If, in a vehicle with 2 evaporators (one in the heating and air conditioning unit and one for battery cooling), the measured temperature at one evaporator corresponds to the set point value or falls below the setpoint value, but the required set point value is not reached at the other evaporator, the control system behaves as follows: The respective control unit (e.g. the Battery control unit or the Control unit for thermal management) controls the control of the system via other control devices (e.g. the Power and control electronics for electrical installation and the Control unit for air conditioning compressor) the electric air-conditioning compressor at higher speed (this increases the cooling capacity of the air-conditioning system and the pressure on the low-pressure side and the evaporator temperature drop). If the set point for the temperature is then exceeded at an evaporator, the respective control device (e.g. the Battery control unit) the shut-off valves (e.g. the Shut-off valve 1 for refrigerant or the Shut-off valve 2 for refrigerant) in such a way that the evaporator, which is too cold, is → Vehicle diagnostic tester no longer filled with refrigerant in the function "Guided troubleshooting" of the air conditioning system and the battery control system, and → Heating, air conditioning; Rep. gr. 00; Repair instructions; check cooling capacity (vehicle-specific repair guide) and → Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioner (vehicle-specific repair guide).
- ◆ As the capacity of the evaporator in the battery cooling module is considerably lower than the capacity of the evaporator in the heating and air-conditioning unit, the required temperature in the battery cooling module may still be reached if the refrigerant in the circuit is too low, but the required temperature in the evaporator in the heating and air-conditioning unit is no longer reached (although the air-conditioning compressor is controlled at a higher speed). → Heating, air conditioning; Rep. gr. 00; Repair instructions; Check cooling capacity (vehicle specific workshop manual) and → Heating, air conditioning; Rep. gr. 87; Refrigerant circulation (vehicle specific workshop manual).



Possible deviations from the set value, causes and elimination	
<ul style="list-style-type: none"> ◆ The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit (and in the evaporator for battery cooling module). ◆ High pressure remains constant or increases only slightly (above the pressure while engine is not running) ◆ The low pressure drops quickly to set value or lower. 	<p>⇒ page 177</p>
<ul style="list-style-type: none"> ◆ The required cooling capacity is initially achieved in the evaporator in the heating and air conditioning unit (and in the evaporator for battery cooling), after some time or after a longer running time the cooling capacity is no longer sufficient. ◆ The high pressure and the low pressure are normal initially ◆ After a while, the high pressure rises above the set value, the low pressure is still at the set value or drops below the set value. 	<p>⇒ page 180</p>
<ul style="list-style-type: none"> ◆ The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit (and in the evaporator for battery cooling). ◆ The high pressure is at the set value ◆ The low pressure is too low (less than the set value) 	<p>⇒ page 181</p>
<ul style="list-style-type: none"> ◆ The AC compressor makes noises (especially after it is switched on) ◆ The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit (and/or in the evaporator for battery cooling). ◆ High pressure is normal or too high ◆ Low pressure too high (the set value is not always achieved) 	<p>⇒ page 183</p>
<ul style="list-style-type: none"> ◆ The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit (and in the evaporator for battery cooling). ◆ High pressure and low pressure normal (corresponds to set point) 	<p>⇒ page 185</p>
<ul style="list-style-type: none"> ◆ The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit (and in the evaporator for battery cooling). ◆ The high pressure is at the set value ◆ The low pressure is at the set value or is too low 	<p>⇒ page 187</p>

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Possible deviations from the set value, causes and elimination	
<ul style="list-style-type: none"> ◆ The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit (and in the evaporator for battery cooling). ◆ The high pressure is at the set value ◆ The low pressure drops quickly to set value or lower. 	<p>⇒ page 188</p>
<ul style="list-style-type: none"> ◆ The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit (and in the evaporator for battery cooling). ◆ The required cooling capacity is only not achieved at the evaporator in the heating and air conditioning unit (the cooling capacity is OK at the evaporator in the battery cooling module). ◆ High pressure rises only slightly (above the pressure with the engine stopped) or is equal to the set point. ◆ Low pressure drops (possibly quickly) to the set point or lower. 	<p>⇒ page 189</p>
<ul style="list-style-type: none"> ◆ The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit (and in the evaporator for battery cooling). ◆ The high pressure increases above the set value. ◆ The low pressure drops quickly to set value or lower. 	<p>⇒ page 190</p>
<ul style="list-style-type: none"> ◆ The required cooling capacity is only not achieved at the evaporator for battery cooling (the cooling capacity is OK at the evaporator in the heating and air conditioning unit). ◆ The high pressure corresponds to the set point or increases only slightly (above the pressure with the engine stopped). ◆ The low pressure drops quickly to set point or lower. 	<p>⇒ page 193</p>
<ul style="list-style-type: none"> ◆ The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit (and in the evaporator for battery cooling). ◆ The high pressure does not increase or increases only slightly above the pressure while engine is not running. ◆ The low pressure does not fall or drops only slightly. 	<p>⇒ page 194</p>



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Possible deviation from the set value during pressure testing

- ◆ The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit (and in the evaporator for battery cooling module).
- ◆ High pressure remains constant or increases only slightly (above the pressure while air conditioning is not running),
- ◆ The low pressure drops quickly to set value or lower.

Possible causes for deviation from set value and how to eliminate them

- ◆ There is too little refrigerant in the refrigerant circuit.
 - Extract the refrigerant from the refrigerant circuit ⇒ [r2.4 efrigerant circuit.”, page 109](#) .
 - If the extracted volume of refrigerant is significantly less than the specified filling volume (more than 100 g less) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data (vehicle-specific repair manual), Leak detection and repair ⇒ [11.4 eaks”, page 62](#) .
 - The amount of refrigerant extracted corresponds approximately to the specified filling quantity, check control of the air conditioning compressor and the built-in shut-off valves, if no fault is found, replace the expansion valve for the evaporator in the heating and air conditioning unit ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circulation (vehicle specific workshop manual).
- ◆ Control of the air-conditioning compressor (and/or, if available, of the faulty Shut-off valve 1 for refrigerant of the Shut-off valve 2 for refrigerant) ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function of the air conditioning system and the battery control system ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; check cooling capacity(vehicle-specific repair guide), ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioner(vehicle-specific repair guide) and ⇒ Heating, air conditioning; Rep. gr. 87; Air-conditioning compressor(vehicle-specific repair guide).
- Check control and function of the air conditioning compressor (and, if present, the shut-off valves, e.g. shut-off valve 1 for refrigerant) and repair if necessary ⇒ Vehicle diagnostic tester in the “Guided fault-finding” function for the air conditioning system and battery control. If these are OK, extract refrigerant from the refrigerant circuit ⇒ [r2.4 efrigerant circuit.”, page 109](#) .
- ◆ The expansion valve for the evaporator in the heating and air conditioning unit is defective, replace it ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- ◆ One of Shut-off valves for refrigerants(if present) is defective (locked), check function, replace ⇒ Vehicle diagnostic tester if necessary in the function “Guided troubleshooting of” the air-conditioning system and the battery control system, and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit; System overview - Refrigerant circuit(vehicle-specific repair guide).
- ◆ Blockage in the refrigerant circuit (e.g. in the refrigerant pipe between the “low-pressure side” service connection and the air-conditioning compressor) ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit; System overview - Refrigerant circuit(vehicle-specific repair guide).
 - If there is a blockage, clean the refrigerant circuit (rinse with R1234yf refrigerant) ⇒ [t1.6 he refrigerant circuit”, page 84](#) ,
 - If the hose or pipeline is bent or constricted, replace this component ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- ◆ The expansion valve for the evaporator in the heating and air conditioning unit is defective, replace it ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- ◆ One Shut-off valve for refrigerant is defective (locked), replace ⇒ Vehicle diagnostic tester in the function “Guided troubleshooting of” the air conditioning system and battery control system as well as ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#)
- Repeat check ⇒ [p2.14.5 ressure with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167](#) .



Note

- ◆ *If no diagnostic fault is found in this investigation, check the refrigerant circuit for congestion or blockage (a congestion or blockage in the refrigerant circuit may also lead to one of these issues). If nothing is found here either, clean the refrigerant circuit (rinse with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit](#), page 84 .*
- ◆ *Check the measured values of the Outflow temperature sensor for evaporator -G263-and, if available, the Temperature sensor before the evaporator for hybrid batteriesand the Temperature sensor after evaporator for hybrid batteriesas well as the control of the air-conditioning compressor via the respective control unit ⇒ Vehicle diagnostic testerin the “Guided troubleshooting” function of the air-conditioning system and the battery control system.*
- ◆ *If there is an error in the measured value of the -G263-of the Temperature sensor upstream of the evaporator for the hybrid batteryor the Temperature sensor after the evaporator for the hybrid battery(depending on the vehicle ⇒ Vehicle diagnostic testerin the “Guided troubleshooting” function of the air conditioning system and the battery control system), it can also lead to problems in the cooling capacity or the evaporator can freeze up.*
- ◆ *In the event of a fault in a temperature sensor, the evaporator may freeze even though the refrigerant quantity in the refrigerant circuit is OK.*
- ◆ *If the function of the air-conditioning system is not OK when the test is repeated, e.g. after replacing the expansion valve, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit](#), page 84 . Then replace air conditioning compressor and dryer cartridge (or collection/liquid container) ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).*
- ◆ *If the expansion valve on the evaporator in the heating and air-conditioning unit, or the shut-off valve, is defective (permanently closed or does not open far enough), the air-conditioning compressor is activated with the maximum capacity and the low pressure drops to the set value or lower (the air-conditioning compressor sucks the refrigerant out of the low pressure side). However, since no refrigerant can flow through the expansion valve, the cooling capacity is not reached and the high pressure may not increase or only slightly because there is ⇒ Vehicle diagnostic testerin the function “Guided troubleshooting of” the air conditioning system and battery control as well as ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).*
- ◆ *The evaporator in the heating and air conditioning unit has a considerably higher capacity than the evaporator for battery cooling. The Shut-off valve 2 for refrigerantat the expansion valve in the battery cooling module is used depending on the version for cooling the traction battery -A2-(depending on the vehicle, ⇒ Vehicle diagnostic testerin the “Guided troubleshooting” function of the air conditioning system and the battery control system) is currently only available from the respective control unit (e.g. from the Battery control unit), so that the energy conversion via the evaporator for battery cooling is not, or only slightly, increased, ⇒ Vehicle diagnostic testerin the “Guided troubleshooting” function of the air conditioning system and battery control as well as ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).*


Possible deviation from the set value during pressure testing

- ◆ The required cooling capacity is initially achieved in the evaporator in the heating and air conditioning unit (and in the evaporator for battery cooling), after some time or after a longer running time the cooling capacity is no longer sufficient.
- ◆ The high pressure and the low pressure are normal initially
- ◆ After a while, the high pressure rises above the set value, the low pressure is still at the set value or drops below the set value.

Possible causes for deviation from set value and how to eliminate them

- ◆ Coolant radiator or condenser contaminated or actuation of the radiator fan not OK.
 - Check that the radiator fan is being actuated; if necessary, repair ⇒ Vehicle diagnostic tester in the “Targeted fault-finding” function for the air conditioning system.
 - Check condenser for dirt and clean if necessary ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- ◆ Check control or function of the air conditioning compressor (or if available of the Shut-off valve 1 for refrigerant or the Shut-off valve 2 for refrigerant) to see if faulty.
- ◆ Humidity in the refrigerant circuit
 - Check control of the air conditioning compressor (and if available Shut-off valve 1 for refrigerant and of Shut-off valve 2 for refrigerant) and measured value of the Outflow temperature transmitter for evaporator -G263- ⇒ Vehicle diagnostic tester as part of the “Guided fault finding” function.
 - If the control of the air-conditioning compressor (and, if fitted, the shut-off valve 1 for refrigerant and the shut-off valve 2 for refrigerant) and the measured value of -G263- are OK, suck the refrigerant out of the refrigerant circuit ⇒ [r2.4 efrigerant circuit.”, page 109](#) .
- ◆ Too much refrigerant in the refrigerant circuit
- ◆ Expansion valve defective
- ◆ A shut-off valve potentially installed in the refrigerant circuit does not open or does not open correctly ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- ◆ Humidity in the refrigerant circuit
 - Extract the refrigerant from the refrigerant circuit ⇒ [r2.4 efrigerant circuit.”, page 109](#) .
 - If the extracted volume of refrigerant is significantly more than the specified filling volume (more than 100 g more) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data (vehicle-specific repair guide), there was too much refrigerant in the refrigerant circuit. Refill refrigerant circuit and repeat test.
 - If the quantity of refrigerant extracted corresponds to the specified quantity, or if this quantity is only slightly greater than the specified quantity (less than 100 g) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data(vehicle-specific repair guide), there is too much refrigerant oil in the refrigerant circuit. Clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit”](#), [page 84](#) , refill with the correct amount of refrigerant and refrigerant oil and repeat the test.
 - If present, check the function of a built-in shut-off valve ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
 - Replace expansion valve and dryer bag/dryer cartridge (or collection/liquid container/) ⇒ [c1.5 ompo-nents”](#), [page 72](#) and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”](#), [page 118](#)
- Repeat check ⇒ [p2.14.5 ressures with air conditioning switched on for vehicles with electrically driven air conditioning compressor”](#), [page 167](#) .



Note

- ◆ *If there is too much refrigerant oil in the circuit, the air conditioning compressor must be emptied and the collection/liquid container (or dryer cartridge) replaced ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide). After cleaning the refrigerant circuit (rinse with refrigerant R1234yf) ⇒ **t1.6 he refrigerant circuit”, page 84**, pour the correct amount of refrigerant oil into the refrigerant circuit ⇒ Heating, air conditioning; Rep. gr. 00; Technical data(vehicle-specific repair guide).*
- ◆ *Check the measured values of the Outflow temperature sensor for evaporator -G263-and the control of the air-conditioning compressor. If the measured value of the -G263-or the control of the air-conditioning compressor is faulty, the evaporator may freeze or cooling capacity is not achieved ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function of the air-conditioning system and the battery control system as well as ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview:⇒ Air conditioner; Rep. gr. 87; Heating, air conditioning Air-conditioning compressor(vehicle-specific repair guide).*
- ◆ *If this fault occurs, it can happen that the evaporator ices up although the volume of refrigerant in the circuit is O.K.*
- ◆ *Due to an error on the -G263- and/or, if present, on the Temperature sensor on hybrid battery evaporator, the refrigerant circuit may also freeze up. In the event of this issue, the measured value of the -G263-and the Temperature sensor after evaporator for hybrid battery(for vehicles with a battery cooling module) in ⇒ Vehicle diagnostic tester the “Guided troubleshooting” function of the air conditioning system and battery control system as well as ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioner(vehicle-specific repair guide).*

Possible deviation from the set value during pressure testing

- | |
|---|
| <ul style="list-style-type: none"> ◆ The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit (and in the evaporator for battery cooling). ◆ The high pressure is at the set value ◆ The low pressure is too low (less than the set value) |
|---|

Possible causes for deviation from set value and how to eliminate them
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Possible deviation from the set value during pressure testing

- ◆ There is too little refrigerant in the refrigerant circuit.
 - Extract the refrigerant from the refrigerant circuit ⇒ [r2.4 efrigerant circuit”, page 109](#) .
 - If the extracted volume of refrigerant is significantly less than the specified filling volume (more than 100 g less) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data (vehicle-specific repair manual), Leak detection and repair ⇒ [11.4 eaks”, page 62](#) .
 - The amount of refrigerant extracted corresponds approximately to the specified filling quantity, check control of the air conditioning compressor and the built-in shut-off valves, if no fault is found, replace the expansion valve for the evaporator in the heating and air conditioning unit ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circulation (vehicle specific workshop manual).
- ◆ Check control or function of the air conditioning compressor (or if available of the Shut-off valve 1 for refrigerant/Shut-off valve 2 for refrigerant) to see if faulty.
 - Check control and function of the air conditioning compressor and, if available, of the Shut-off valve 1 for refrigerant/of the Shut-off valve 2 for refrigerant⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function.
 - Clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit”, page 84](#) .
- ◆ Expansion valve in the heating and air conditioning unit or, if present, on the evaporator for battery cooling is defective.
 - Replace the expansion valve for the evaporator in the heating and air conditioning unit (and for the evaporator for battery cooling) and the dryer bag/dryer cartridge (or receiver/liquid container).
- ◆ AC compressor defective
 - Replace ⇒ [c1.5 omponents”, page 72](#) air conditioning compressor and ⇒ Heating, air conditioning; Rep. gr. 87; Air-conditioning compressor(vehicle-specific repair guide).
 - If there is dirt in the refrigerant circuit, clean the refrigerant circuit (rinse with refrigerant R1234yf) and replace ⇒ [c1.5 omponents”, page 72](#) expansion valve and dryer bag/dryer cartridge (or collection/liquid container) and ⇒ [t1.6 he refrigerant circuit”, page 84](#) .

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#)
- Repeat check ⇒ [p2.14.5 ressure with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167](#) .

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Possible deviation from the set value during pressure testing

- ◆ The AC compressor makes noises (especially after it is switched on)
- ◆ The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit (and/or in the evaporator for battery cooling).
- ◆ High pressure is normal or too high
- ◆ Low pressure too high (the set value is not always achieved)

Possible causes for deviation from set value and how to eliminate them

- ◆ Check control or function of the air conditioning compressor (or if available of the Shut-off valve 1 for refrigerant/Shut-off valve 2 for refrigerant) to see if faulty.
- ◆ Too much refrigerant or refrigerant oil in the refrigerant circuit
 - Check control and function of the air conditioning compressor and, if available, of the Shut-off valve 1 for refrigerant/of the Shut-off valve 2 for refrigerant ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function and repair if necessary. If no fault can be detected, extract ⇒ [r2.4 efrigerant circuit.”, page 109](#) refrigerant from the refrigerant circuit.
 - Extract the refrigerant from the refrigerant circuit ⇒ [r2.4 efrigerant circuit.”, page 109](#) .
 - If the extracted volume of refrigerant is significantly more than the specified filling volume (more than 100 g more) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data (vehicle-specific repair guide), there was too much refrigerant in the refrigerant circuit. Refill refrigerant circuit and repeat test.
 - If the quantity of refrigerant extracted corresponds to the specified quantity, or if this quantity is only slightly greater than the specified quantity (less than 100 g) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data (vehicle-specific repair guide), there is too much refrigerant oil in the refrigerant circuit. Clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit”](#), [page 84](#) , refill with the correct amount of refrigerant and refrigerant oil and repeat the test.
- ◆ Expansion valve defective
 - Replace ⇒ [c1.5 omponents”](#), [page 72](#) the expansion valve for the evaporator in the heating and air conditioning unit (and for the evaporator for battery cooling) and the dryer bag/dryer cartridge (or collection/liquid container); and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific repair guide).
- ◆ AC compressor defective
 - Replace ⇒ [c1.5 omponents”](#), [page 72](#) air conditioning compressor and ⇒ Heating, air conditioning; Rep. gr. 87; Air-conditioning compressor (vehicle-specific repair guide).
 - If there is dirt in the refrigerant circuit, clean the refrigerant circuit (rinse with refrigerant R1234yf) and replace ⇒ [c1.5 omponents”](#), [page 72](#) expansion valve and dryer bag/dryer cartridge (or collection/liquid container) and ⇒ [t1.6 he refrigerant circuit”](#), [page 84](#) .

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”](#), [page 118](#)
- Repeat check ⇒ [p2.14.5 ressure with air conditioning switched on for vehicles with electrically driven air conditioning compressor”](#), [page 167](#) .

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Note

- ◆ *This fault may be caused by too much refrigerant oil in the refrigerant circuit. Overfilling with refrigeration machine oil may occur if, for example, the air conditioning compressor has been replaced without adjusting the amount of refrigerant oil ⇒ [c1.5 omponents](#), [page 72](#) and ⇒ Heating, air conditioning; Rep. gr. 00; Technical data(vehicle-specific repair guide). If there is too much refrigerant oil in the refrigerant circuit, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit](#), [page 84](#) .*
- ◆ *If the expansion valve for the evaporator in the heating and air-conditioning unit or for the evaporator for battery cooling is defective (permanently closed or does not open far enough), the air-conditioning compressor is activated at maximum capacity and the low pressure drops to the set point value or lower (the air-conditioning compressor extracts the refrigerant from the low-pressure side). As no refrigerant can flow through the expansion valve, the cooling capacity is not achieved, the high pressure also may not increase or only increases slightly, because there is no energy exchange. The same also applies if the function or control of the Shut-off valve 1 for refrigerant or the Shut-off valve 2 for refrigerant is faulty ⇒ Vehicle diagnostic tester in the "Guided troubleshooting" function of the air conditioning system and the battery control system as well as ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).*

Possible deviation from the set value during pressure testing

- | |
|---|
| ◆ The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit (and in the evaporator for battery cooling). |
| ◆ High pressure and low pressure normal (corresponds to set point) |

Possible causes for deviation from set value and how to eliminate them
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Possible deviation from the set value during pressure testing

- ◆ Check control or function of the air conditioning compressor (and if available of the Shut-off valve 1 for refrigerant or the Shut-off valve 2 for refrigerant) to see if faulty.
- ◆ Too little refrigerant in the refrigerant circuit.
 - Check the control and function of the air-conditioning compressor and/or, if available, of the Shut-off valve 1 for refrigerant/ of the Shut-off valve 2 for refrigerant ⇒ Vehicle diagnostic tester in “Guided troubleshooting” function of the air conditioning system and battery control system and repair if necessary ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific repair guide). If no fault can be detected, extract refrigerant from the refrigerant circuit.
 - Extract the refrigerant from the refrigerant circuit ⇒ [r2.4 efrigerant circuit.”, page 109](#) .
 - If the extracted volume of refrigerant is significantly less than the specified filling volume (more than 100 g less) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data (vehicle-specific repair manual), Leak detection and repair ⇒ [11.4 eaks”, page 62](#) .
 - If the quantity of refrigerant extracted corresponds to the specified quantity, or if this quantity is only slightly smaller (max. 100 g) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data (vehicle-specific repair manual), the expansion valve for the evaporator or a built-in shut-off valve in the heating and air conditioning unit is faulty
- ◆ The expansion valve for the evaporator in the heating and air conditioning unit is defective ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific repair guide).
- ◆ One Shut-off valve for refrigerants (if present) is defective (locked), check function, replace ⇒ Vehicle diagnostic tester if necessary in the function “Guided troubleshooting of” the air-conditioning system and the battery control system, and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit; System overview - Refrigerant circuit (vehicle-specific repair guide).
 - If present, check the function of a built-in shut-off valve ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific repair guide).
 - Replace the expansion valve for the evaporator in the heating and air conditioning unit ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific repair guide).
- ◆ Too much refrigerant oil in the refrigerant circuit
 - Clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit”, page 84](#) .
 - Replace ⇒ [c1.5 omponents”, page 72](#) the expansion valve for the evaporator in the heating and air conditioning unit (and for the evaporator for battery cooling) and the dryer bag/dryer cartridge (or collection/liquid container); and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific repair guide).

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#)
- Repeat check ⇒ [p2.14.5 ressure with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167](#) .



Note

- ◆ *This fault may be caused by too much refrigerant oil in the refrigerant circuit. Overfilling with refrigeration machine oil may occur if, for example, the air conditioning compressor has been replaced without adjusting the amount of refrigerant oil ⇒ [c1.5 components](#), [page 72](#) and ⇒ Heating, air conditioning; Rep. gr. 00; Technical data(vehicle-specific repair guide). If there is too much refrigerant oil in the refrigerant circuit, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit](#), [page 84](#) .*
- ◆ *If the expansion valve for the evaporator in the heating and air-conditioning unit or for the evaporator for battery cooling is defective (permanently closed or does not open far enough), the air-conditioning compressor is activated at maximum capacity and the low pressure drops to the set point value or lower (the air-conditioning compressor extracts the refrigerant from the low-pressure side). As no refrigerant can flow through the expansion valve, the cooling capacity is not achieved, the high pressure also may not increase or only increases slightly, because there is no energy exchange. The same also applies if the function or control of the Shut-off valve 1 for refrigerant or the Shut-off valve 2 for refrigerant is faulty ⇒ Vehicle diagnostic tester in the "Guided troubleshooting" function of the air conditioning system and the battery control system as well as ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).*

Possible deviation from the set value during pressure testing

- ◆ The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit (and in the evaporator for battery cooling).
- ◆ The high pressure is at the set value
- ◆ The low pressure is at the set value or is too low

Possible causes for deviation from set value and how to eliminate them


Possible deviation from the set value during pressure testing

- ◆ Control of the air-conditioning compressor (and/or, if available, of the faulty Shut-off valve 1 for refrigerant of the Shut-off valve 2 for refrigerant) ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function of the air conditioning system and the battery control system.
- Control and function of the air conditioning compressor (and, if available, the Shut-off valve 1 for refrigerant and the Shut-off valve 2 for refrigerant) and, if necessary, repair it ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function for the air-conditioning system and battery control system. If these are OK, extract refrigerant from the refrigerant circuit.
- ◆ There is too little refrigerant in the refrigerant circuit.
 - Extract the refrigerant from the refrigerant circuit ⇒ [r2.4 efrigerant circuit.”, page 109](#) .
 - If the extracted volume of refrigerant is significantly less than the specified filling volume (by more than 100 g) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data (vehicle-specific repair manual), Find the leak and repair ⇒ [11.4 eaks”, page 62](#) .
 - If the quantity of refrigerant extracted corresponds to the specified quantity or is only slightly smaller (less than 100 g) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data (vehicle-specific repair guide) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data. Check the function of Shut-off valves ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific repair guide).
- ◆ The expansion valve for the evaporator in the heating and air conditioning unit is defective ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific repair guide).
- ◆ One Shut-off valve for refrigerant is defective (locked) ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function of the air conditioning system and battery control system as well as ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific repair guide).
 - If present, check the function of a built-in shut-off valve ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific repair guide).
 - Replace the expansion valve for the evaporator in the heating and air conditioning unit ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific repair guide).
- ◆ Too much refrigerant oil in the refrigerant circuit
 - Clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit”, page 84](#) .
 - Replace ⇒ [c1.5 omponents”, page 72](#) the expansion valve for the evaporator in the heating and air conditioning unit (and for the evaporator for battery cooling) and the dryer bag/dryer cartridge (or collection/liquid container); and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific repair guide).

Final steps

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- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#)
- Repeat check ⇒ [p2.14.5 ressure with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167](#) .


Note

Follow the instructions ⇒ [page 179](#) and ⇒ [page 187](#) .

Possible deviation from the set value during pressure testing

- ◆ The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit (and in the evaporator for battery cooling).
- ◆ The high pressure is at the set value
- ◆ The low pressure drops quickly to set value or lower.

Possible causes for deviation from set value and how to eliminate them

Possible deviation from the set value during pressure testing

- ◆ Control or function of the air-conditioning compressor is faulty.
- ◆ Constriction or blockage in the refrigerant circuit
 - Check and repair the control and function of the air-conditioning compressor ⇒ Vehicle diagnostic tester in the function “Guided troubleshooting of” the air-conditioning system and the battery control system, no fault can be detected, feel the refrigerant circuit by hand for temperature gradient ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
 - If a temperature gradient is detected on a component. If the hose or pipeline is bent or constricted, replace this component ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide). If there is a blockage, clean the refrigerant circuit (rinse with R1234yf refrigerant) ⇒ [t1.6 he refrigerant circuit”, page 84](#),
- ◆ There is too little refrigerant in the refrigerant circuit.
 - Extract the refrigerant from the refrigerant circuit ⇒ [r2.4 efrigerant circuit.”, page 109](#).
 - If the extracted volume of refrigerant is significantly less than the specified filling volume (by more than 100 g) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data (vehicle-specific repair manual), Find the leak and repair ⇒ [l1.4 eaks”, page 62](#).
 - If the quantity of refrigerant extracted corresponds to the specified quantity or if it is only slightly less (max. 100 g) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data(vehicle-specific repair guide), check the expansion valve and shut-off valves for functionality ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- ◆ The expansion valve for the evaporator in the heating and air conditioning unit is defective ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- ◆ One Shut-off valve for refrigerantis defective (locked) ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function of the air conditioning system and battery control system as well as ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
 - If present, check the function of a built-in shut-off valve ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
 - Replace the expansion valve for the evaporator in the heating and air conditioning unit ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#)
- Repeat check ⇒ [p2.14.5 ressures with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167](#).

Note

Follow the instructions ⇒ [page 179](#) and ⇒ [page 187](#).

Possible deviation from the set value during pressure testing

- ◆ The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit (and in the evaporator for battery cooling).
- ◆ The required cooling capacity is only not achieved at the evaporator in the heating and air conditioning unit (the cooling capacity is OK at the evaporator in the battery cooling module).
- ◆ High pressure rises only slightly (above the pressure with the air-conditioning compressor stopped) or is equal to the set point.
- ◆ Low pressure drops (possibly quickly) to the set point or lower.

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Possible causes for deviation from set value and how to eliminate them


Possible deviation from the set value during pressure testing

- ◆ There is too little refrigerant in the refrigerant circuit.
 - Extract the refrigerant from the refrigerant circuit ⇒ [r2.4 efrigerant circuit”, page 109](#) .
 - If the extracted volume of refrigerant is significantly less than the specified filling volume (more than 100 g more) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data (vehicle-specific repair guide), search for any leakage and repair it ⇒ [l1.4 eaks”, page 62](#) .
 - If the quantity of refrigerant extracted corresponds to the specified quantity or if it is only slightly less (max. 100 g) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data(vehicle-specific repair guide), check the expansion valve and shut-off valves for functionality ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- ◆ The expansion valve for the evaporator in the heating and air conditioning unit is defective ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- ◆ One Shut-off valve for refrigerants is defective (locked), check function, replace ⇒ Vehicle diagnostic testerif necessary in the function “Guided troubleshooting of” the air-conditioning system and the battery control, and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit; System overview - Refrigerant circuit(vehicle-specific repair guide).
 - If present, check the function of a built-in shut-off valve ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
 - Replace the expansion valve for the evaporator in the heating and air conditioning unit ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- ◆ Blockage in the refrigerant circuit (e.g. in the refrigerant pipe between the “low-pressure side” service connection and the air-conditioning compressor) ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit; System overview - Refrigerant circuit(vehicle-specific repair guide).
- ◆ Control of the air-conditioning compressor faulty ⇒ Vehicle diagnostic testerin the “Guided troubleshooting” function of the air-conditioning system and battery control system.
 - Check and repair the control and function of the air-conditioning compressor ⇒ Vehicle diagnostic testerin the function “Guided troubleshooting of” the air-conditioning system and the battery control system, no fault can be detected, feel the refrigerant circuit by hand for temperature gradient ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
 - If a temperature gradient is detected on a component. If the hose or pipeline is bent or constricted, replace this component and replace a defective expansion valve ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide). If there is a blockage, clean the refrigerant circuit (rinse with R1234yf refrigerant) ⇒ [t1.6 he refrigerant circuit”, page 84](#) ,
 - If blocked, clean the refrigerant circuit (flush with refrigerant R1234yf) Replace ⇒ [c1.5 omponents”, page 72](#) ⇒ [t1.6 he refrigerant circuit”, page 84](#) expansion valve for evaporator in heater and air conditioner (and for evaporator for battery cooling) and dryer bag/dryer cartridge (or receiver/liquid container), and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#)
- Repeat check ⇒ [p2.14.5 ressure with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167](#) .


Note

Follow the notes ⇒ [page 179](#) .

Possible deviation from the set value during pressure testing

- ◆ The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit (and in the evaporator for battery cooling).
- ◆ The high pressure increases above the set value.
- ◆ The low pressure drops quickly to set value or lower.

Possible causes for deviation from set value and how to eliminate them



Possible deviation from the set value during pressure testing

- ◆ Control or function of the air-conditioning compressor is faulty.
- ◆ Constriction or blockage in the refrigerant circuit
- ◆ Expansion valve defective
- Check and repair the control and function of the air-conditioning compressor ⇒ Vehicle diagnostic tester in the function “Guided troubleshooting of” the air-conditioning system and the battery control system, no fault can be detected, feel the refrigerant circuit by hand for temperature gradient ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- If a temperature gradient is detected on a component. If the hose or pipeline is bent or constricted, replace this component and replace a defective expansion valve ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- If blocked, clean the refrigerant circuit (flush with refrigerant R1234yf) Replace ⇒ [c1.5 omponents”, page 72](#) ⇒ [t1.6 he refrigerant circuit”, page 84](#) expansion valve for evaporator in heater and air conditioner (and for evaporator for battery cooling) and dryer bag/dryer cartridge (or receiver/liquid container), and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- ◆ There is too little refrigerant in the refrigerant circuit.
- Extract the refrigerant from the refrigerant circuit ⇒ [r2.4 efrigerant circuit.”, page 109](#) .
- If the extracted volume of refrigerant is significantly less than the specified filling volume (by more than 100 g) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data (vehicle-specific repair manual), Find the leak and repair ⇒ [l1.4 eaks”, page 62](#) .
- If the quantity of refrigerant extracted corresponds to the specified quantity or if it is only slightly less (max. 100 g) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data(vehicle-specific repair guide), check the refrigerant shut-off valve for functionality ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#)
- Repeat check ⇒ [p2.14.5 ressures with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167](#) .



Note

- ◆ *If the air-conditioning system does not function correctly when the test is repeated, replace the expansion valve and the dryer bag/dryer cartridge (or collection/liquid container) and, if present Shut-off valve 1 for refrigerant ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).*
- ◆ *If this fault occurs, it can happen that the evaporator ices up although the volume of refrigerant in the circuit is O.K.*
- ◆ *If the expansion valve on the evaporator in the heating and air-conditioning unit, or the shut-off valve 1 for refrigerant, is defective (permanently closed or does not open far enough), the air-conditioning compressor is activated with the maximum capacity and the low pressure drops to the set value or lower (the air-conditioning compressor sucks the refrigerant out of the low pressure side). However, since no refrigerant is supplied via the expansion valve (the Shut-off valve for refrigerant), the cooling capacity is not reached, and the high pressure may not increase, or only slightly, because there is ⇒ Vehicle diagnostic testerno energy conversion in the "Guided troubleshooting" function of the air conditioning system and the battery control system, as well as ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).*
- ◆ *If the expansion valve on the evaporator for battery cooling is defective (or if the function or control of the Shut-off valve 2 for hybrid battery refrigerant is faulty), does not open far enough or is permanently closed, the air conditioning compressor is also controlled at maximum power (the required temperatures in the battery cooling module are not reached). The pressure on the low-pressure side only drops to the set point or lower if no cooling capacity is required in the heating and air conditioning unit at the same time (the Shut-off valve 1 for refrigerant is controlled and is closed). The air-conditioning compressor extracts the refrigerant from the low-pressure side of both evaporators. However, since no refrigerant can flow via the expansion valve in the heating and air conditioning unit (the Shut-off valve 1 for refrigerant) and the cooling capacity for battery cooling is not reached (there is an error in the battery cooling area), the electric air-conditioning compressor is activated at a higher speed. However, since no refrigerant can flow in, the pressure on the low-pressure side drops below the set point, and the high-pressure may not rise or only slightly, since there is ⇒ Vehicle diagnostic testerno energy conversion in the function "Guided troubleshooting of" the air-conditioning system and battery control as well as ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).*
- ◆ *As the capacity of the evaporator for the battery cooling module is considerably lower than the capacity of the evaporator in the heating and air-conditioning unit, the required temperature for the battery cooling module may still be reached if the refrigerant in the circuit is too low, but the required temperature in the evaporator in the heating and air-conditioning unit is no longer reached (although the air-conditioning compressor is controlled at a higher speed).*
- ◆ *If there is too much refrigerant oil in the circuit, the air conditioning compressor must be emptied and the dryer bag/dryer cartridge or collection/liquid container replaced. After cleaning (rinse with refrigerant R1234yf) ⇒ **t1.6 he refrigerant circuit**, page 84 the refrigerant circuit, pour the correct amount of refrigerant oil into the refrigerant circuit ⇒ Heating, air conditioning; Rep. gr. 00; Technical data; Approved refrigerant oils and quantities for refrigerant oil(vehicle-specific*



repair guide) and ⇒ Heating, air conditioning; Rep. gr. 87;
 Refrigerant circuit(vehicle-specific repair guide).

- ◆ Follow further instructions ⇒ [page 179](#).

Possible deviation from the set value during pressure testing
<ul style="list-style-type: none"> ◆ The required cooling capacity is only not achieved at the evaporator for battery cooling (the cooling capacity is OK at the evaporator in the heating and air conditioning unit). ◆ The high pressure corresponds to the set point or increases only slightly (above the pressure with the engine stopped). ◆ The low pressure drops quickly to set point or lower.
Possible causes for deviation from set value and how to eliminate them
<ul style="list-style-type: none"> ◆ Control or function of the Shut-off valve 2 for hybrid battery refrigerant Check the temperature sensor in or on the battery cooling module, repair if necessary ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function of the air conditioning system and the battery control system as well as ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide). ◆ The expansion valve for the evaporator in the battery cooling module is defective. <ul style="list-style-type: none"> – Replace the expansion valve for the evaporator for battery cooling ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide). – Check ⇒ Vehicle diagnostic tester function and control of the components for battery cooling “in the guided troubleshooting” function of the air conditioning system and check the battery control system and refrigerant lines, no fault can be detected. ◆ Blockages or congestion in the refrigerant line to or from the expansion valve on the evaporator for battery cooling. <ul style="list-style-type: none"> – If blocked, clean the refrigerant circuit (flush with refrigerant R1234yf) Replace ⇒ c1.5 omponents”, page 72 ⇒ t1.6 he refrigerant circuit”, page 84 expansion valve for evaporator in heater and air conditioner (and for evaporator for battery cooling) and dryer bag/dryer cartridge (or receiver/liquid container), and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide). – If the hose or pipeline is bent or constricted, replace this component ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide). ◆ too little refrigerant in the refrigerant circuit ◆ Extract the refrigerant from the refrigerant circuit ⇒ r2.4 efrigerant circuit.”, page 109 . ◆ If the extracted volume of refrigerant is significantly less than the specified filling volume (by more than 100 g) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data (vehicle-specific repair manual), Find the leak and repair ⇒ 11.4 eaks”, page 62 . ◆ Does the quantity of refrigerant extracted correspond to the specified quantity or is this only slightly smaller (max. 100 g)? ⇒ Heating, air conditioning; Rep. gr. 00; Technical data(vehicle-specific repair guide), Shut-off valve 1 for refrigerant Check ⇒ Vehicle diagnostic tester for function in the “Guided troubleshooting” function for the air-conditioning system and battery control system as well as ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
Final steps
<ul style="list-style-type: none"> – Re-fill the refrigerant circuit with new refrigerant ⇒ t2.6 he refrigerant circuit”, page 118 – Repeat check ⇒ p2.14.5 ressures with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167 .

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Note

- ◆ *For cooling the traction battery -A2- (Hybrid battery), the Shut-off valve 1 for refrigerant is currently only activated above a certain battery temperature, e.g. from the Control unit for the battery control system. If the air conditioning system is not already activated at this time, the electric air-conditioning compressor -V470-is controlled via the Control apparatus for the air conditioning compressor -J842- e.g. from the Battery control unit. The temperature of the air (or refrigerant) before and after the evaporator for battery cooling is determined by the respective control unit (e.g. the Battery control unit). If it is found that the cooling is not sufficient, this is indicated e.g. in the Battery control unit⇒ Vehicle diagnostic tester in the "Guided troubleshooting" function of the air conditioning system and battery control system.*
- ◆ *The temperature of the air (or of the refrigerant) and thus the cooling capacity of the evaporator for battery cooling is determined via built-in temperature sensors (it cannot currently be measured with a thermometer during operation) and can therefore only be ⇒ Vehicle diagnostic tester checked via the Guided troubleshooting function in the "Guided troubleshooting" function of the air-conditioning system and the battery control system.*
- ◆ *Follow further instructions ⇒ [page 179](#).*

Possible deviation from the set value during pressure testing

- ◆ The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit (and in the evaporator for battery cooling).
- ◆ The high pressure does not increase or increases only slightly above the pressure while engine is not running.
- ◆ The low pressure does not fall or drops only slightly.

Possible causes for deviation from set value and how to eliminate them

- ◆ No control of the air-conditioning compressor⇒ Vehicle diagnostic tester in the "Guided troubleshooting" function.
- ◆ If available, Shut-off valve 1 for refrigerant defective (closed)
 - Check the control and function of the air-conditioning compressor (and the Shut-off valve 1 for refrigerant of the Shut-off valve 2 for refrigerant)⇒ Vehicle diagnostic tester in "Guided troubleshooting" function of the air conditioning system and battery control system. If no error can be detected, replace expansion valve on evaporator in heating and air ⇒ conditioning unit. ; Rep. gr. 87; Heating, air conditioning Refrigerant circuit(vehicle-specific repair guide)
- ◆ Restriction or blockage in the refrigerant circuit (e.g. in refrigerant line between "low-pressure side" service connector and the AC compressor).
 - If blocked, clean the refrigerant circuit (flush with refrigerant R1234yf) Replace ⇒ [c1.5 omponents](#), [page 72](#) ⇒ [t1.6 he refrigerant circuit](#), [page 84](#) expansion valve for evaporator in heater and air conditioner (and for evaporator for battery cooling) and dryer bag/dryer cartridge (or receiver/liquid container), and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
 - If the hose or pipeline is bent or constricted, replace this component ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- ◆ AC compressor defective
 - Replace ⇒ [c1.5 omponents](#), [page 72](#) air conditioning compressor and ⇒ Heating, air conditioning; Rep. gr. 87; Air-conditioning compressor(vehicle-specific repair guide).

Final steps

Possible deviation from the set value during pressure testing

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#)
- Repeat check ⇒ [p2.14.5 ressure with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167](#) .

Set points for pressures in the refrigerant circuit in vehicles with heat pump

Note

- ◆ *In vehicles with high-voltage systems and heat pumps, non-return valves and electrically controlled valves are installed in the refrigerant circuit, which regulate the flow of refrigerant in the refrigerant circuit depending on the current operating state. These valves are available in different versions ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide) and ⇒ Vehicle diagnostic tester in the “Guided Troubleshooting” function.*
- ◆ *In vehicles with the “heat pump” and/or “cooling” function of the high-voltage battery, high pressure is not applied to the service connection on the high pressure side under all operating conditions of the air-conditioning system. In these vehicles, the pressure in the refrigerant circuit on the high-pressure side can only be measured via the pressure/temperature sensors installed in the refrigerant circuit, depending on the operating status of the ⇒ air conditioning system ; Rep. gr. 87; Heating, air conditioning Refrigerant circuit(vehicle-specific repair guide) and ⇒ Vehicle diagnostic tester in the “Guided Troubleshooting” function.*
- ◆ *In these vehicles, the refrigerant circuit of the air conditioning system is not only used to cool the passenger compartment, but also to cool the Hybrid battery unit(via the coolant circuit for the high-voltage system) and for heating the passenger compartment (at low ambient temperatures) via the heat pump function. For these functions to operate, various valves, pressure and temperature sensors and pumps must be correctly installed in the refrigerant circuit and in the coolant circuit of the high-voltage system and must operate without faults ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide), ⇒ Vehicle diagnostic tester in the “Guided Troubleshooting” function.*
- ◆ *In order to be able to limit the possible cause of a malfunction, various routines have been stored in the default setting of the Control unit for thermal management that control ⇒ Vehicle diagnostic tester these functions: “air conditioning cooling”, “heat pump” and “cooling of components of the high-voltage system” in the “Guided troubleshooting” function.*

High-pressure side

From the initial pressure (when connecting the pressure gauge) rising up to maximum 20 bar overpressure.



Note

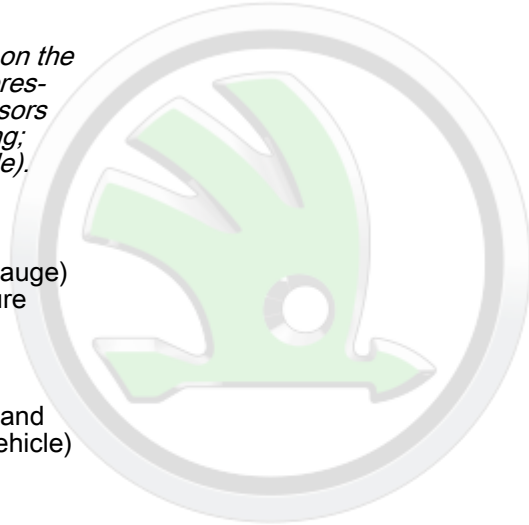
Depending on the arrangement of the service connection on the high pressure side and the operating condition, the high pressure can only be measured via pressure/temperature sensors installed in the refrigerant circuit → Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).

Low-pressure side

From the initial pressure (when connecting the pressure gauge) falling to a value between 1.5 and 2.3 bar absolute pressure (depending on required cooling capacity).

Speed of air conditioning compressor:

Depending on the required cooling capacity between 800 and 8500 /min (currently maximum 5000/min with stationary vehicle)



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Note

- ◆ *The temperature of the air downstream of the evaporator, the current air conditioning compressor speed and the pressure of the refrigerant on the high-pressure side are measured as a function of the vehicle by different control units (e.g. by the Control unit for thermal management from the Control and display unit for front air conditioner or from Control unit for Climatronic) displayed ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioner(vehicle-specific repair guide), ⇒ Vehicle diagnostic tester in the "Guided Troubleshooting" function.*
- ◆ *At very high demand for cooling capacity (e.g. high outside temperature and a high fresh air blower speed), the AC compressor may not initially be able to bring the pressure on the low-pressure side to the necessary value (e.g. for a certain time after switching on the air conditioning system). The air-conditioning compressor is not controlled at the maximum preset speed (approx. 8500/min.) when the vehicle is stationary or moving slowly (up to a vehicle speed of approx. 45 km/h); the air-conditioning compressor speed is limited to approx. 5000 /min. Only at a vehicle speed of more than approx. 45 km/h is the limitation of the maximum permissible air conditioning compressor speed lifted. At an air conditioning compressor speed of 5000/min, a high outside temperature and a high fresh air fan speed (unfavourable ambient conditions), the output (the delivery volume) of the air conditioning compressor is initially no longer sufficient to reduce the pressure on the low-pressure side to the set point value. To check the control behaviour of the air conditioning compressor under these conditions, e.g. to control the fresh air blower only with approx. 40 % of the maximum voltage and to check ⇒ Vehicle diagnostic tester the pressures at reduced fresh air blower speed, use the function "Guided troubleshooting of" the air conditioning system and battery control system and ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; check cooling capacity(vehicle-specific repair guide).*
- ◆ *The pressure on the high-pressure side can rise to maximum 29 bar under unfavourable conditions (very high ambient temperatures, high humidity).*
- ◆ *The target speed of the air conditioning compressor is displayed as a value, e.g. by the Control unit for thermal management ⇒ Vehicle diagnostic tester in the "Guided troubleshooting" function.*
- ◆ *The pressure in the refrigerant circuit (low or high pressure) measured by the various pressure/temperature sensors depending on the respective operating condition is displayed ⇒ Vehicle diagnostic tester as a measured value by the respective control unit in the function "Guided troubleshooting" and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).*
- ◆ *The low pressure is set within the tolerance range (1.5 to 2.3 bar gauge pressure) depending on the speed of the air-conditioning compressor and the control characteristic curve of the expansion valve (on the evaporator of the heating and air conditioning units) within the performance range of the air-conditioning compressor.*
- ◆ *For this test, the set point speed of the air conditioning compressor must be greater than 1500 /min.*
- ◆ *When the "maximum cooling capacity" is set, the set point speed is controlled to approx. 4000 to 5000/min. This value is vehicle-specific and is displayed ⇒ Vehicle diagnostic test-*



eras a measured value by the respective control unit in the "Guided troubleshooting" function.

- ◆ At absolute pressure, 0 bar corresponds to an absolute vacuum. The normal ambient pressure corresponds to 1 bar absolute pressure. On the scales of most pressure gauges, 0 bar corresponds to an absolute pressure of 1 bar (recognizable by the indication -1 bar below 0).
- ◆ If in a vehicle with 2 evaporators (one in the heating and air-conditioning unit and one for cooling the high-voltage components, e.g. the heat exchanger for high-voltage battery) and 2 condensers (one at the front end for the air-conditioning system and one as a heat exchanger for heat pump function), depending on the selected function, the measured temperatures or pressures on one component correspond to the set point value on another component but the specifications are not achieved, check the activation of the electrically controlled valves installed in the refrigerant circuit. It should also be noted that the pressure distribution in the refrigerant circuit depends on the non-return valves installed in ⇒ Vehicle diagnostic testerthe system "" ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- ◆ In order for the air-conditioning system to function correctly, it is also necessary that sufficient heat is supplied to or removed from the respective heat exchangers, depending on the function selected. For this reason, the integration of the heat exchangers into the respective coolant circuit of the engine and the high-voltage system and the function of the pumps and valves installed in them must be observed ⇒ Vehicle diagnostic testerin the "Guided troubleshooting" and vehicle-specific repair guide function.
- ◆ Since the capacity of the evaporator for cooling the high-voltage battery (in the battery cooling module and in the heat exchanger for high-voltage battery) is lower than the capacity of the evaporator in the heating and air-conditioning unit, the target temperature in the evaporator for cooling the high-voltage battery may still be reached if there is too little refrigerant in the circuit, but the target temperature in the evaporator in the heating and air-conditioning unit is no longer reached (although the air-conditioning compressor is controlled at a higher speed).

Possible deviations from the set value, causes and elimination	
<ul style="list-style-type: none"> • High pressure remains constant or increases only slightly (above the pressure while engine is running) • The low pressure drops quickly to set value or lower. • The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit and in the evaporator for cooling the high-voltage components. 	<p>⇒ page 200</p>
<ul style="list-style-type: none"> • High pressure is normal • Low pressure corresponds to the target value • The required cooling capacity is not reached. 	<p>⇒ page 203</p>

Possible deviations from the set value, causes and elimination	
<ul style="list-style-type: none"> • High pressure is normal • The low pressure is normal or too low (less than the set value) • The required cooling capacity is only not achieved at the evaporator in the heating and air-conditioning unit (the cooling capacity is OK at the evaporator in the cooling module for cooling the high-voltage battery). 	<p>⇒ page 204</p>
<ul style="list-style-type: none"> • High pressure is normal • The low pressure is normal or too low (less than the set value) • The required cooling capacity is only not achieved at the evaporator for cooling the high-voltage components (the cooling capacity is OK at the evaporator in the front of the heating and air-conditioning unit). 	<p>⇒ page 205</p>
<ul style="list-style-type: none"> • The high pressure does not increase or increases only slightly above the pressure while engine is not running. • The low pressure does not fall or drops only slightly. • The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit (and in the evaporator for cooling the high-voltage components). 	<p>⇒ page 206</p>
<ul style="list-style-type: none"> • High pressure increases above the specified value • Low pressure drops quickly to target value • The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit in front (and/or in the evaporator for cooling the high-voltage components). 	<p>⇒ page 207</p>
<ul style="list-style-type: none"> • High pressure and low pressure are normal initially; after a while, the high pressure rises above the set value and the low pressure falls to the set value or lower • The required cooling capacity is not, or is no longer achieved in the evaporator in the heating and air conditioning unit (and/or in the evaporator for cooling the high-voltage components). 	<p>⇒ page 209</p>
<ul style="list-style-type: none"> • High pressure and low pressure initially normal, after a longer travel time the low pressure drops below the set point (the evaporator in the heating and air conditioning unit freezes). 	<p>⇒ page 210</p>



Possible deviations from the set value, causes and elimination	
<ul style="list-style-type: none"> • High pressure is normal • Low pressure too low. • The required cooling capacity is not achieved in the evaporator in the heating and/or air conditioning unit (and in the evaporator for cooling the high-voltage components). 	<p>⇒ page 212</p>
<ul style="list-style-type: none"> • High pressure is normal or too high • Low pressure too high • The AC compressor makes noises (especially after it is switched on) • The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit in front (and/or in the evaporator for cooling the high-voltage components). 	<p>⇒ page 213</p>
<ul style="list-style-type: none"> • High pressure and low pressure is normal • The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit (and in the evaporator for cooling the high-voltage components). <p>or</p> <ul style="list-style-type: none"> • High pressure and low pressure is normal • The AC compressor makes noises (especially after it is switched on) • The required cooling capacity is not achieved in the evaporator in the heating and/or air conditioning unit (and in the evaporator for cooling the high-voltage components). 	<p>⇒ page 215</p>
<ul style="list-style-type: none"> • High pressure and low pressure is normal • The required cooling capacity is not achieved at the evaporator in the heating and air-conditioning unit at the front (and at the evaporator for cooling the high-voltage components). • The required cooling capacity is not achieved at the heat exchanger for heat pump operation. 	<p>⇒ page 216</p>



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Possible deviation from the set value during pressure testing
<ul style="list-style-type: none"> • High pressure remains constant or increases only slightly (above the pressure while engine is not running) • The low pressure drops quickly to set value or lower. • The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit and in the evaporator for cooling the high-voltage components.

Possible deviation from the set value during pressure testing

Possible causes for deviation from set value and how to eliminate them

- ◆ One of the pressure/temperature sensors or temperature sensors mounted on or in the refrigerant circuit is providing incorrect values, check ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioning.
- ◆ too little refrigerant in the refrigerant circuit
- ◆ Check the control of the air-conditioning compressor or one of the valves installed in the refrigerant circuit.
 - Check the measured values of the various pressure/temperature sensors and temperature sensors during operation of the air-conditioning system, replace ⇒ Vehicle diagnostic tester components with faulty measured values in the “Guided troubleshooting” function and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioning. If no fault can be detected, aspirate refrigerant.
 - Extract the refrigerant from the refrigerant circuit ⇒ [r2.4 efrigerant circuit.”, page 109](#) .
 - If the extracted volume of refrigerant is significantly less than the specified filling volume (more than 100 g less) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data (vehicle-specific repair manual), Leak detection and repair ⇒ [11.4 eaks”, page 62](#) .
 - The amount of refrigerant extracted corresponds approximately to the specified filling quantity, check control of the air conditioning compressor and the built-in shut-off valves, if no fault is found, replace the expansion valve for the evaporator in the heating and air conditioning unit ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circulation (vehicle specific workshop manual).
 - Depending on the result, repair the control unit or replace defective component (air conditioning compressor, shut-off valve, expansion valve) ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehic-
cle-specific repair guide).

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#)
- Repeat check ⇒ [p2.14.5 ressure with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167](#) .



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Note

- ◆ *In order to be able to limit the possible cause of a malfunction, the basic setting of the respective control unit (e.g. the Control unit for thermal management), which control ⇒ Vehicle diagnostic tester the functions "air conditioning cooling", "heat pump" and "cooling of components of the high-voltage system" in the "Guided troubleshooting" function and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).*
- ◆ *If no fault is found with this complaint, first check the control for the electrically controlled valves installed in the refrigerant circuit. If no fault can be found here, remove and check the check valves installed in the refrigerant circuit; if no fault can be found here either, clean the refrigerant circuit (flush with refrigerant R1234yf). A bottleneck or blockage in the refrigerant circuit can also lead to one of these issues ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide) and ⇒ [t1.6 he refrigerant circuit", page 84](#) .*
- ◆ *In vehicles with the "heat pump" and/or "cooling" function of the high-voltage battery, high pressure is not applied to the service connection on the high pressure side under all operating conditions of the air-conditioning system. In these vehicles, the pressure in the refrigerant circuit on the high-pressure side can only be measured via the pressure/temperature sensors installed in the refrigerant circuit, depending on the operating status of the ⇒ air conditioning system ; Rep. gr. 87; Heating, air conditioning Refrigerant circuit(vehicle-specific repair guide) and ⇒ Vehicle diagnostic tester in the "Guided Troubleshooting" function.*
- ◆ *Before starting repair work, also check the measured values of the various pressure/temperature sensors installed in the refrigerant circuit. An error in the measured value of a pressure/temperature sensor can also lead to problems in the cooling capacity or the evaporator in the front of the heating and air conditioning unit can freeze up ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide), ⇒ Vehicle diagnostic tester in the "Guided troubleshooting" function and ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.*
- ◆ *When testing the various functions (heat pump or cooling of the high-voltage battery), also consider the control and function of the components of the coolant circuit which are connected to these functions ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).*
- ◆ *If the function of the air conditioning system is not OK when the test is repeated after replacing the expansion valve, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit", page 84](#) . Then replace the AC compressor and fluid reservoir/dryer cartridge.*
- ◆ *If a fault occurs on the temperature sensor, it can happen that the evaporator ices up although the volume of refrigerant in the circuit is O.K.*
- ◆ *If the expansion valve on the evaporator in the heating and air-conditioning unit is defective (permanently closed or does not open far enough), the air-conditioning compressor is activated with the maximum capacity and the low pressure drops to the diagram value or lower (the air-conditioning compressor sucks the refrigerant out of the low pressure side). However, since no refrigerant can flow through the expansion valve, the cooling capacity is not reached and the high pressure may not increase or only slightly, since*



there is ⇒ Vehicle diagnostic testerno energy conversion in the function "Guided troubleshooting" and ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; check cooling capacity(vehicle-specific repair guide).

- ◆ *The evaporator in the heating and air-conditioning unit has a higher capacity than the evaporator for cooling the high-voltage battery. The expansion valve upstream of this evaporator (the heat exchanger for the cooling of the components of the high-voltage system) is used, depending on the design, for cooling the traction battery/ Hybrid battery unit(hybrid battery) is currently only controlled by the respective control unit from or up to a certain battery temperature, so that the energy conversion via this evaporator is not increased at all or only insignificantly, ⇒ Vehicle diagnostic testerin the "Guided troubleshooting" function of the air conditioning system and ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; check cooling capacity(vehicle-specific repair guide).*
- ◆ *If there is too much refrigerant oil in the circuit, you must also empty (flush) the air-conditioning compressor and replace the liquid container/dryer cartridge. After cleaning (flushing with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit](#), page 84 the refrigerant circuit, pour the correct amount of refrigerant oil into the circuit (into the air-conditioning compressor) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data(vehicle-specific repair guide).*

Possible deviation from the set value during pressure testing
<ul style="list-style-type: none">• High pressure is normal• Low pressure corresponds to the target value• The required cooling capacity is not reached.
Possible causes for deviation from set value and how to eliminate them

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Possible deviation from the set value during pressure testing

- ◆ One of the pressure/temperature sensors or temperature sensors mounted on or in the refrigerant circuit is providing incorrect values, check ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioning.
- ◆ too little refrigerant in the refrigerant circuit
- ◆ Shut-off valve upstream of the expansion valve for the evaporator in the heating and air conditioning unit defective at the front.
- ◆ One of the other valves installed in the refrigerant circuit is defective or is not working properly ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- ◆ Expansion valve for the evaporator in the heating and air conditioning unit at the front is defective.
- Check the measured values of the various pressure/temperature sensors and temperature sensors during operation of the air-conditioning system, replace ⇒ Vehicle diagnostic tester components with faulty measured values in the “Guided troubleshooting” function and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioning. If no fault can be detected, aspirate refrigerant.
- Extract the refrigerant from the refrigerant circuit ⇒ [r2.4 efrigerant circuit.”, page 109](#) .
- If the extracted volume of refrigerant is significantly less than the specified filling volume (more than 100 g less) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data (vehicle-specific repair manual), Leak detection and repair ⇒ [11.4 eaks”, page 62](#) .
- The amount of refrigerant extracted corresponds approximately to the specified filling quantity, check control of the air conditioning compressor and the built-in shut-off valves, if no fault is found ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circulation (vehicle specific workshop manual).
- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#) .
- Repeat check ⇒ [p2.14.5 ressure with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167](#) .
- Via the pressure distribution in the refrigerant circuit, check ⇒ Vehicle diagnostic tester the function and control of the various valves installed in the refrigerant circuit in the function “Guided troubleshooting” and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- Depending on the result, repair the control unit or replace a defective component (shut-off valve, expansion valve) ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#)
- Repeat check ⇒ [p2.14.5 ressure with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167](#) .


Note

Follow the notes ⇒ [page 202](#) .

Possible deviation from the set value during pressure testing

- High pressure is normal
- The low pressure is normal or too low (less than the set value)
- The required cooling capacity is only not achieved at the evaporator in the heating and air-conditioning unit (the cooling capacity is OK at the evaporator in the cooling module for cooling the high-voltage battery).

Possible causes for deviation from set value and how to eliminate them

Possible deviation from the set value during pressure testing

- ◆ One of the pressure/temperature sensors or temperature sensors mounted on or in the refrigerant circuit is providing incorrect values, check ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioning.
- ◆ too little refrigerant in the refrigerant circuit
- ◆ Control of air conditioning compressor faulty.
- ◆ Expansion valve for the evaporator in the heating and air conditioning unit at the front is defective.
- ◆ Shut-off valve upstream of the expansion valve for the evaporator in the heating and air conditioning unit defective at the front.
- ◆ One of the other valves installed in the refrigerant circuit is defective or is not working properly.
- Check the measured values of the various pressure/temperature sensors and temperature sensors during operation of the air-conditioning system, replace ⇒ Vehicle diagnostic tester components with faulty measured values in the “Guided troubleshooting” function and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioning. If no fault can be detected, aspirate refrigerant.
- Extract the refrigerant from the refrigerant circuit ⇒ [r2.4 efrigerant circuit.”, page 109](#) .
- If the extracted volume of refrigerant is significantly less than the specified filling volume (more than 100 g less) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data (vehicle-specific repair manual), Leak detection and repair ⇒ [11.4 eaks”, page 62](#) .
- The amount of refrigerant extracted corresponds approximately to the specified filling quantity, check control of the air conditioning compressor and the built-in shut-off valves, if no fault is found ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circulation (vehicle specific workshop manual).
- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#)
- Repeat check ⇒ [p2.14.5 ressures with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167](#) .
- Via the pressure distribution in the refrigerant circuit, check ⇒ Vehicle diagnostic tester the function and control of the various valves installed in the refrigerant circuit in the function “Guided troubleshooting” and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- Depending on the result, repair the control unit or replace a defective component (shut-off valve, expansion valve) ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#)
- Repeat check ⇒ [p2.14.5 ressures with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167](#) .

Note

Follow the notes ⇒ [page 202](#) .

Possible deviation from the set value during pressure testing

- High pressure is normal
- The low pressure is normal or too low (less than the set value)
- The required cooling capacity is only not achieved at the evaporator for cooling the high-voltage components (the cooling capacity is OK at the evaporator in the front of the heating and air-conditioning unit).

Possible causes for deviation from set value and how to eliminate them


Possible deviation from the set value during pressure testing

- ◆ One of the valves installed in the refrigerant circuit is defective or is not working properly ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- ◆ One of the pumps or one of the valves in the coolant circuit of the high-voltage system is defective or is not working properly ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- ◆ One of the pressure/temperature sensors or temperature sensors mounted on or in the refrigerant circuit is providing incorrect values, check ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioning.
- ◆ Blockages or congestion in the refrigerant line to or from the expansion valve on the evaporator for the cooling of the high-voltage components cooling.
 - Check the measured values of the various pressure/temperature sensors and temperature sensors during operation of the air-conditioning system, replace ⇒ Vehicle diagnostic tester components with faulty measured values in the “Guided troubleshooting” function and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioning.
 - Via the pressure distribution in the refrigerant circuit, check ⇒ Vehicle diagnostic tester the function and control of the various valves installed in the refrigerant circuit in the function “Guided troubleshooting” and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
 - Check function and control of the components for cooling the high-voltage components ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function (air conditioning, air conditioning compressor and battery control system).
 - Depending on the result, repair the control unit or replace defective component (shut-off valve, expansion valve, pump for coolant, shut-off valve for coolant) ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide) and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
 - Check the lines of the refrigerant circuit, replace this component if the hose or pipe is bent or narrowed.
 - If no fault can be detected, clean refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit”, page 84](#) .

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#)
- Repeat check ⇒ [p2.14.5 ressure with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167](#) .


Note

Follow the notes ⇒ [page 202](#) .

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Possible deviation from the set value during pressure testing

- The high pressure does not increase or increases only slightly above the pressure while engine is not running.
- The low pressure does not fall or drops only slightly.
- The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit (and in the evaporator for cooling the high-voltage components).

Possible causes for deviation from set value and how to eliminate them



Possible deviation from the set value during pressure testing

- ◆ No control of the air-conditioning compressor, the air-conditioning compressor is not being driven.
- ◆ One of the valves installed in the refrigerant circuit is defective or is not working properly ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- ◆ Restriction or blockage in the refrigerant circuit (e.g. in refrigerant line between “low-pressure side” service connector and the AC compressor).
 - Check control and function of the air conditioning compressor and repair ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function
 - Via the pressure distribution in the refrigerant circuit, check ⇒ Vehicle diagnostic tester the function and control of the various valves installed in the refrigerant circuit in the function “Guided troubleshooting” and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
 - Depending on the result, repair the control unit or replace defective component (air conditioning compressor, shut-off valve, expansion valve) ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
 - Check the lines of the refrigerant circuit. If the hose or pipeline is bent or constricted, replace this component ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
 - During operation, feel the refrigerant circuit by hand for temperature drops (point of a blockage). If there is a blockage, clean the refrigerant circuit (rinse with R1234yf refrigerant) ⇒ [t1.6 he refrigerant circuit”, page 84](#) ,
 - If a fault is detected in the air-conditioning compressor, replace the air-conditioning compressor ⇒ [c1.5 oponents”, page 72](#)
 - If no fault can be detected, clean refrigerant circuit (flush with refrigerant R1234yf) ⇒ [t1.6 he refrigerant circuit”, page 84](#) .

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#)
- Repeat check ⇒ [p2.14.5 ressure with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167](#) .

Note

Follow the notes ⇒ [page 202](#) .

Possible deviation from the set value during pressure testing

- High pressure increases above the specified value
- Low pressure drops quickly to target value
- The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit in front (and/or in the evaporator for cooling the high-voltage components).

Possible causes for deviation from set value and how to eliminate them


Possible deviation from the set value during pressure testing

- ◆ Control or function of the air-conditioning compressor is faulty.
- ◆ One of the valves installed in the refrigerant circuit is defective or is not working properly ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- ◆ Constriction or blockage in the refrigerant circuit
- ◆ Expansion valve defective
- Check control and function of the air conditioning compressor and repair ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function
- Via the pressure distribution in the refrigerant circuit, check ⇒ Vehicle diagnostic tester the function and control of the various valves installed in the refrigerant circuit in the function “Guided troubleshooting” and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- Check the lines of the refrigerant circuit. If the hose or pipeline is bent or constricted, replace this component ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- During operation, feel the refrigerant circuit by hand for temperature drops (point of a blockage). If there is a blockage, clean the refrigerant circuit (rinse with R1234yf refrigerant) ⇒ [t1.6 he refrigerant circuit”, page 84](#) ,

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#)
- Repeat check ⇒ [p2.14.5 ressurees with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167](#) .

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Note

- ◆ *If this fault occurs, it can happen that the evaporator ices up although the volume of refrigerant in the circuit is O.K.*
- ◆ *If the expansion valve on the evaporator in the heating and air-conditioning unit, or the purpose-installed shut-off valve, is defective (permanently closed or does not open far enough), the air-conditioning compressor is activated with the maximum capacity and the low pressure drops to the set value or lower (the air-conditioning compressor sucks the refrigerant out of the low pressure side). However, since no (or too little) refrigerant can flow through the expansion valve, the cooling capacity is not reached and the high pressure may not increase or only slightly, since there is ⇒ Vehicle diagnostic testerno energy conversion in the function "Guided troubleshooting" and ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; check cooling capacity(vehicle-specific repair guide).*
- ◆ *If the expansion valve upstream of the evaporator for cooling the high-voltage components is defective (or the function and control are faulty), constantly closed or it does not open far enough, the air-conditioning compressor is also controlled at maximum capacity (the required temperatures in the heat exchanger are not reached). The pressure on the low-pressure side only drops to the set point or lower if no cooling capacity is required at the front of the heating and air-conditioning unit at the same time. The air-conditioning compressor extracts the refrigerant from the low-pressure side of both evaporators. However, since no refrigerant can flow through the expansion valve in the front of the heating and air-conditioning unit and the cooling capacity in the evaporator for cooling the high-voltage components is not achieved (there is a fault in the evaporator area for cooling the high-voltage components), the electric air-conditioning compressor is controlled at a higher speed. However, since no refrigerant can flow in, the pressure on the low-pressure side drops below the set point, and the high-pressure may not rise or rise only slightly because there is no energy conversion. The same applies if a valve in the refrigerant circuit is not OK, if there is a fault in the integration of the evaporator for cooling the high-voltage components in the refrigerant circuit of the high-voltage system, or if a pump or valve installed there is not OK. The heat exchanger for the high-voltage battery is then cooled down, but the cooled coolant reaches the high-voltage components that are to be cooled down, not ⇒ Vehicle diagnostic testerin the "Guided troubleshooting function " and ⇒ Heating, air conditioning; Rep. gr. 87; Coolant circuit(vehicle-specific repair guide).*
- ◆ *Further information ⇒ [page 202](#) .*

Possible deviation from the set value during pressure testing

- | |
|---|
| <ul style="list-style-type: none"> • High pressure and low pressure are normal initially; after a while, the high pressure rises above the set value and the low pressure falls to the set value or lower • The required cooling capacity is not, or is no longer achieved in the evaporator in the heating and air conditioning unit (and/or in the evaporator for cooling the high-voltage components). |
|---|

Possible causes for deviation from set value and how to eliminate them
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Possible deviation from the set value during pressure testing

- ◆ One of the pressure/temperature sensors or temperature sensors mounted on or in the refrigerant circuit is providing incorrect values, check ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioning.
- ◆ Control of the air-conditioning compressor faulty ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function.
- ◆ One of the valves installed in the refrigerant circuit is defective or is not working properly ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific repair guide).
- ◆ Humidity in the refrigerant circuit
 - Check the measured values of the various pressure/temperature sensors and temperature sensors during operation of the air-conditioning system, replace ⇒ Vehicle diagnostic tester components with faulty measured values in the “Guided troubleshooting” function and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioning.
 - Check control and function of the air conditioning compressor and repair ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function
 - Via the pressure distribution in the refrigerant circuit, check ⇒ Vehicle diagnostic tester the function and control of the various valves installed in the refrigerant circuit in the function “Guided troubleshooting” and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific repair guide).
 - If no fault can be detected, clean refrigerant circuit (flush with refrigerant R1234yf ⇒ [t1.6 he refrigerant circuit”, page 84](#)).

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#)
- Repeat check ⇒ [p2.14.5 ressure with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167](#) .


Note

Follow the notes ⇒ [page 202](#) .

Possible deviation from the set value during pressure testing

- High pressure and low pressure initially normal, after a longer travel time the low pressure drops below the set point (the evaporator in the heating and air conditioning unit freezes).

Possible causes for deviation from set value and how to eliminate them

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Possible deviation from the set value during pressure testing

- ◆ One of the pressure/temperature sensors or temperature sensors mounted on or in the refrigerant circuit is providing incorrect values, check ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioning.
- ◆ Control of the air-conditioning compressor faulty ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function.
- ◆ One of the valves installed in the refrigerant circuit is defective or is not working properly ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific repair guide).
- ◆ One of the pressure/temperature sensors or temperature sensors mounted on or in the refrigerant circuit is providing incorrect values, check ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioning.
- ◆ Humidity in the refrigerant circuit
 - Check the measured values of the various pressure/temperature sensors and temperature sensors during operation of the air-conditioning system, replace ⇒ Vehicle diagnostic tester components with faulty measured values in the “Guided troubleshooting” function and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioning.
 - Check control and function of the air conditioning compressor and repair ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function
 - Via the pressure distribution in the refrigerant circuit, check ⇒ Vehicle diagnostic tester the function and control of the various valves installed in the refrigerant circuit in the function “Guided troubleshooting” and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific repair guide).
 - If no fault can be detected, replace dryer bag/dryer cartridge (or collection/liquid container) and evacuate refrigerant circuit for at least 3 hours.

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#)
- Repeat check ⇒ [p2.14.5 ressure with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167](#) .

Note

- ◆ *First of all, it is not required to clean the refrigerant circuit for this complaint (to flush with refrigerant R1234yf ⇒ [t1.6 he refrigerant circuit”, page 84](#)), as normally only a small amount of humidity is present in the system which can be removed through a longer period of evacuation.*
- ◆ *If problems arise due to moisture in the refrigerant circuit only after a long period of operation or only occasionally (the low pressure falls below the set point and the evaporator freezes), it is sufficient to replace the dryer (installed in the liquid container) (adjust refrigerant oil quantity). Subsequently the refrigerant circuit must be evacuated for at least 3 hours.*
- ◆ *If this fault occurs, it can happen that the evaporator ices up although the volume of refrigerant in the circuit is O.K.*
- ◆ *Due to an error on the Evaporator outlet temperature sensor -G263- and/or a pressure/temperature sensor can also cause the refrigerant circuit to freeze. For this reason, the measured values of the various pressure/temperature sensors in the refrigerant circuit must therefore also be taken into account ⇒ Vehicle diagnostic tester in the function “Guided troubleshooting” and ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; check cooling capacity (vehicle-specific repair guide).*
- ◆ *Further information ⇒ [page 202](#) .*



Possible deviation from the set value during pressure testing
<ul style="list-style-type: none"> • High pressure is normal • Low pressure too low. • The required cooling capacity is not achieved in the evaporator in the heating and/or air conditioning unit (and in the evaporator for cooling the high-voltage components).
Possible causes for deviation from set value and how to eliminate them
<ul style="list-style-type: none"> ◆ too little refrigerant in the refrigerant circuit ◆ Control or function of the air-conditioning compressor faulty ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function. ◆ One of the valves installed in the refrigerant circuit is defective or is not working properly ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide). ◆ One of the pressure/temperature sensors or temperature sensors mounted on or in the refrigerant circuit is providing incorrect values, check ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioning. – Check the measured values of the various pressure/temperature sensors, replace ⇒ Vehicle diagnostic tester components with faulty measured values in the “Guided troubleshooting” function and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioning. If no fault can be detected, aspirate refrigerant. – Extract the refrigerant from the refrigerant circuit ⇒ r2.4 efrigerant circuit.”, page 109 . – If the extracted volume of refrigerant is significantly less than the specified filling volume (more than 100 g less) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data (vehicle-specific repair manual), Leak detection and repair ⇒ 11.4 eaks”, page 62 . – The amount of refrigerant extracted corresponds approximately to the specified filling quantity, check control of the air conditioning compressor and the built-in shut-off valves, if no fault is found ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circulation (vehicle specific workshop manual). – Re-fill the refrigerant circuit with new refrigerant ⇒ t2.6 he refrigerant circuit”, page 118 – Repeat check ⇒ p2.14.5 ressures with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167 . – Check control and function of the air conditioning compressor and repair ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function – Via the pressure distribution in the refrigerant circuit, check ⇒ Vehicle diagnostic tester the function and control of the various valves installed in the refrigerant circuit in the function “Guided troubleshooting” and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide). – Depending on the result, repair the control unit or replace defective component (air conditioning compressor, shut-off valve, expansion valve, pressure/temperature sensor) ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide). – If no fault can be detected, clean refrigerant circuit (flush with refrigerant R1234yf ⇒ t1.6 he refrigerant circuit”, page 84).
Final steps
<ul style="list-style-type: none"> – Re-fill the refrigerant circuit with new refrigerant ⇒ t2.6 he refrigerant circuit”, page 118 – Repeat check ⇒ p2.14.5 ressures with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167 .



Note

- ◆ *In the event of a “High pressure normal, low pressure too low” error, please note the following: This error may cause the evaporator in the heating and AC system to freeze even though the amount of refrigerant in the circuit is OK.*
- ◆ *If the fault is in the air conditioning compressor (the air conditioning compressor is controlled by the Control unit for the air conditioning compressor at too high a speed), it is not necessary to clean the refrigerant circuit (rinse ⇒ [1.6 he refrigerant circuit](#), page 84 with refrigerant R1234yf). If this fault occurs, you only need to replace the AC compressor (note the volume of refrigerant oil in the AC compressor and adjust if necessary).*
- ◆ *If the expansion valve upstream of the evaporator for cooling the high-voltage components is defective (or the function and control are faulty), constantly closed or it does not open far enough, the air-conditioning compressor is also controlled at maximum capacity (the required temperatures in the heat exchanger are not reached). The pressure on the low-pressure side only drops to the set point or lower if no cooling capacity is required at the front of the heating and air-conditioning unit at the same time. The air-conditioning compressor extracts the refrigerant from the low-pressure side of both evaporators. However, since no refrigerant can flow through the expansion valve in the front of the heating and air-conditioning unit and the cooling capacity in the evaporator for cooling the high-voltage components is not achieved (there is a fault in the evaporator area for cooling the high-voltage components), the electric air-conditioning compressor is controlled at a higher speed. However, since no refrigerant can flow in, the pressure on the low-pressure side drops below the set point, and the high-pressure may not rise or rise only slightly because there is no energy conversion. The same applies if a valve in the refrigerant circuit is not OK, if there is a fault in the integration of the evaporator for cooling the high-voltage components in the refrigerant circuit of the high-voltage system, or if a pump or valve installed there is not OK. The heat exchanger for the high-voltage battery is then cooled down, but the cooled coolant reaches the high-voltage components that are to be cooled down, not ⇒ Vehicle diagnostic tester in the “Guided troubleshooting function” and ⇒ Heating, air conditioning; Rep. gr. 87; Coolant circuit (vehicle-specific repair guide).*
- ◆ *Due to an error on the Evaporator outlet temperature sensor -G263- and/or a pressure/temperature sensor, this issue can also occur. Therefore, the measured values of the various pressure/temperature sensors in the refrigerant circuit must therefore also be taken into account ⇒ Vehicle diagnostic tester in the function “Guided troubleshooting” and ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; check cooling capacity (vehicle-specific repair guide).*
- ◆ *Further information ⇒ [page 202](#).*

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Possible deviation from the set value during pressure testing

- High pressure is normal or too high
- Low pressure too high
- The AC compressor makes noises (especially after it is switched on)
- The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit in front (and/or in the evaporator for cooling the high-voltage components).

Possible causes for deviation from set value and how to eliminate them

- ◆ Control of the air-conditioning compressor faulty ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function.
- ◆ One of the valves installed in the refrigerant circuit is defective or is not working properly ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- ◆ One of the pressure/temperature sensors or temperature sensors mounted on or in the refrigerant circuit is providing incorrect values, check ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioning.
- ◆ too little refrigerant in the refrigerant circuit
- ◆ Too little refrigerant oil in the refrigerant circuit.
 - Check the measured values of the various pressure/temperature sensors and temperature sensors during operation of the air-conditioning system, replace ⇒ Vehicle diagnostic tester components with faulty measured values in the “Guided troubleshooting” function and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioning.
 - Check control and function of the air conditioning compressor and repair ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function
 - Via the pressure distribution in the refrigerant circuit, check ⇒ Vehicle diagnostic tester the function and control of the various valves and pressure/temperature sensor installed in the refrigerant circuit in the function “Guided troubleshooting” and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
 - If no fault can be detected, extract refrigerant from the refrigerant circuit.
- The volume of refrigerant suctioned out is considerably more than the specified filling capacity:
 - Refill refrigerant circuit, repeat test.
- The volume of refrigerant suctioned out corresponds approximately to the specified filling capacity:
 - Check ⇒ Vehicle diagnostic tester the control and function of the air-conditioning compressor and the valves installed in the refrigerant circuit (shut-off valves and expansion valves) in the “Guided troubleshooting” function
 - Depending on the result, repair the control unit or replace a defective component (shut-off valve, expansion valve or the liquid container/dryer) ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
 - If no fault can be detected, there may be too much refrigerant oil in the refrigerant circuit, clean the refrigerant circuit (flush ⇒ [t1.6 he refrigerant circuit”, page 84](#) with refrigerant R1234yf).

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#)
- Repeat check ⇒ [p2.14.5 ressures with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167](#) .

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Note

- ◆ *This fault may be caused by too much refrigerant oil in the circuit. Over-filling with refrigerant oil can occur if, for example, the AC compressor has been replaced without matching the volume of refrigerant oil.*
- ◆ *Further information ⇒ [page 202](#) .*

Possible deviation from the set value during pressure testing

- High pressure and low pressure is normal
 - The required cooling capacity is not achieved in the evaporator in the heating and air conditioning unit (and in the evaporator for cooling the high-voltage components).
- or
- High pressure and low pressure is normal
 - The AC compressor makes noises (especially after it is switched on)
 - The required cooling capacity is not achieved in the evaporator in the heating and/or air conditioning unit (and in the evaporator for cooling the high-voltage components).

Possible causes for deviation from set value and how to eliminate them

- ◆ One of the pressure/temperature sensors or temperature sensors mounted on or in the refrigerant circuit is providing incorrect values, check ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioning.
- ◆ Control of the air-conditioning compressor faulty ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function.
- ◆ One of the valves installed in the refrigerant circuit is defective or is not working properly ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- ◆ too little refrigerant in the refrigerant circuit
- ◆ Expansion valve for the evaporator in the heating and air conditioning unit at the front is defective.
- ◆ Too little refrigerant oil in the refrigerant circuit.
- Check the measured values of the various pressure/temperature sensors and temperature sensors during operation of the air-conditioning system, replace ⇒ Vehicle diagnostic tester components with faulty measured values in the “Guided troubleshooting” function and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioning.
- Check control and function of the air conditioning compressor and repair ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function
- Via the pressure distribution in the refrigerant circuit, check ⇒ Vehicle diagnostic tester the function and control of the various valves and pressure/temperature sensor installed in the refrigerant circuit in the function “Guided troubleshooting” and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- If no fault can be detected, extract refrigerant from the refrigerant circuit.
- The volume of refrigerant suctioned out is considerably more than the specified filling capacity:
 - Refill refrigerant circuit, repeat test.
- The volume of refrigerant suctioned out corresponds approximately to the specified filling capacity:
 - Clean the refrigerant circuit (flush with refrigerant R1234yf ⇒ [t1.6 he refrigerant circuit](#)”, [page 84](#) .
 - Add the correct amount of refrigerant oil to the circuit (see note).

Final steps


Possible deviation from the set value during pressure testing

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit", page 118](#)
- Repeat check ⇒ [p2.14.5 ressure with air conditioning switched on for vehicles with electrically driven air conditioning compressor", page 167](#) .


Note

- ◆ *Over-filling with refrigerant oil can occur if, for example, the AC compressor has been replaced without matching the volume of refrigerant oil.*
- ◆ *If, for example, the expansion valve for the evaporator in the heating and air-conditioning unit or for the evaporator for cooling the high-voltage components is defective (permanently open), the evaporator temperature is no longer controlled in such a way that only gaseous refrigerant leaves the evaporator. Under certain operating conditions, liquid drops can then be sucked into the AC compressor, this then leads to noises (liquid cannot be compressed).*
- ◆ *If there is too much refrigerant oil in the circuit, the air-conditioning compressor must be emptied and the liquid container replaced. After cleaning (rinse with refrigerant R1234yf ⇒ [t1.6 he refrigerant circuit", page 84](#)) the refrigerant circuit, pour the correct amount of refrigerant oil into the circuit ⇒ Heating, air conditioning; Rep. gr. 00; Technical data(vehicle-specific repair guide).*
- ◆ *Further information ⇒ [page 202](#) .*

Possible deviation from the set value during pressure testing

- High pressure and low pressure is normal
- The required cooling capacity is not achieved at the evaporator in the heating and air-conditioning unit at the front (and at the evaporator for cooling the high-voltage components).
- The required cooling capacity is not achieved at the heat exchanger for heat pump operation.

Possible causes for deviation from set value and how to eliminate them



Possible deviation from the set value during pressure testing

- ◆ One of the pressure/temperature sensors or temperature sensors mounted on or in the refrigerant circuit is providing incorrect values, check ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioning.
- ◆ One of the pumps or one of the valves in the coolant circuit of the high-voltage system or the engine is defective or is not working properly ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- ◆ Control of the air-conditioning compressor faulty ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function.
- ◆ One of the valves installed in the refrigerant circuit is defective or is not working properly ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- Check the measured values of the various pressure/temperature sensors and temperature sensors during operation of the air-conditioning system, replace ⇒ Vehicle diagnostic tester components with faulty measured values in the “Guided troubleshooting” function and ⇒ Heating, air conditioning; Rep. gr. 87; Installation location overview: Air conditioning.
- Check the integration of the heat exchanger into the coolant circuit of the engine as well as the function and control of various pumps and valves ⇒ Heating, air conditioning; Rep. gr. 87; Coolant circuit(vehicle-specific repair guide).
- Check control and function of the air conditioning compressor and repair ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function
- Via the pressure distribution in the refrigerant circuit, check ⇒ Vehicle diagnostic tester the function and control of the various valves and pressure/temperature sensor installed in the refrigerant circuit in the function “Guided troubleshooting” and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit(vehicle-specific repair guide).
- Check function and control of the components for cooling the high-voltage components ⇒ Vehicle diagnostic tester in the “Guided troubleshooting” function (air conditioning, air conditioning compressor and battery control system).
- If no fault can be detected, extract refrigerant from the refrigerant circuit.
- Extract the refrigerant from the refrigerant circuit ⇒ [r2.4 efrigerant circuit.”, page 109](#) .
- If the extracted volume of refrigerant is significantly less than the specified filling volume (more than 100 g less) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data (vehicle-specific repair manual), Leak detection and repair ⇒ [11.4 eaks”, page 62](#) .
- The amount of refrigerant extracted corresponds approximately to the specified filling quantity, check control of the air conditioning compressor and the built-in shut-off valves once more, if no fault is found ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circulation (vehicle specific workshop manual).
- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#)
- Repeat check ⇒ [p2.14.5 ressure with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167](#) .

Final steps

- Re-fill the refrigerant circuit with new refrigerant ⇒ [t2.6 he refrigerant circuit”, page 118](#)
- Repeat check ⇒ [p2.14.5 ressure with air conditioning switched on for vehicles with electrically driven air conditioning compressor”, page 167](#) .



Note

- ◆ *If the required cooling capacity at the evaporator in the heating and air-conditioning unit at the front (and at the evaporator for cooling the high-voltage components) is OK and there is a complaint due to a lack of heating capacity at the heat exchanger for heat pump operation, the cause may be in the coolant circuit of the high-voltage system or in the coolant circuit of the engine. If the pumps and valves in the coolant circuit of the high-voltage system are not properly controlled or if their function is not OK, the evaporator (heat exchanger) cannot absorb sufficient heat energy from the coolant for the components of the high-voltage system. If the pumps and valves in the coolant circuit of the engine are not properly controlled or if their function is not OK, the heat energy absorbed cannot be transferred to the coolant flowing to the heat exchanger in the heating and air conditioning unit via the heat exchanger for heat pump function in the "Guided troubleshooting" and ⇒ Heating, air conditioning; Rep. gr. 87; Coolant circuit(vehicle-specific repair guide).*
- ◆ *Further information ⇒ [page 202](#).*



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3 Test equipment and tools

⇒ [a3.1 nd materials available from the distribution centre or the importer”, page 219](#)

⇒ [a3.2 nd materials, which are commercially available”, page 220](#)

⇒ [t3.3 hat can be made instead of purchasing”, page 220](#)

3.1 Tools and materials available from the distribution centre or the importer

Tools and materials can be purchase using the ⇒ Electronic Catalogue of Original Parts “ETKA”.

Overview
AC service station with flushing device – with integrated program to flush the refrigerant circuit with refrigerant R1234yf and applicable flushing device – with integrated analyser to identify contamination in refrigerant R1234yf
Refrigerant R1234yf ⇒ Electronic Catalogue of Original Parts “ETKA”
Extraction unit (for refrigerant R1234yf) - dry icebox
Adapter case of motor car set -VAS 6338/1- – to connect the AC service station to the refrigerant circuit for flushing and to bridge certain components when flushing – to connect certain components to a pressure hose for blowing through with compressed air or nitrogen
Leak detector for R1234yf
Combination fine filter unit for the compressed air system, oil, dirt and moisture trap as typical for paint shop systems
Seals (various types; check which is correct) ⇒ Electronic Catalogue of Original Parts “ETKA”
Refrigerant oil (different types; check which is correct) ⇒ Electronic Catalogue of Original Parts “ETKA”
Leak detection system with the following: ◆ Cleaning agent ◆ UV leak detection lamp ◆ Replacement bulb for leak detection lamp ◆ Protective goggles ◆ Sticker ◆ Protective gloves ◆ Case for system
Tracer refill cartridge
Release tools for refrigerant lines with quick couplers
Removal tool for quick couplers of the refrigerant lines
Sockets for removing and installing valves



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3.2 Tools and materials, which are commercially available

**Note**

This list provides an overview of the test equipment, tools and materials required for the professional repair of the refrigerant circuit.

Overview
Fin comb
Filling hoses 5/8"-18 UNF
Cylinder connector for pressurised cylinder for refrigerant and sealing ring with quick coupler or threaded connector
Valve caps 5/8"-18 UNF
Pressure gauge battery with pressure reducer for nitrogen
for service connectors (2 are included with the AC service station)
Open ring spanner; the spanner sizes correspond to the bolted connections on the refrigerant lines
Valve opener for filling hoses
Connecting nipple for conical surface seal 5/8"-18 UNF
Compressed air pistol with rubber mouthpiece
Manual shut-off valve 5/8"-18 UNF
Recycling bottle for refrigerant R1234yf
Digital thermometer
Protective gloves
Protective goggles
Dry ice as pellets

3.3 Tools that can be made instead of purchasing

**Note**

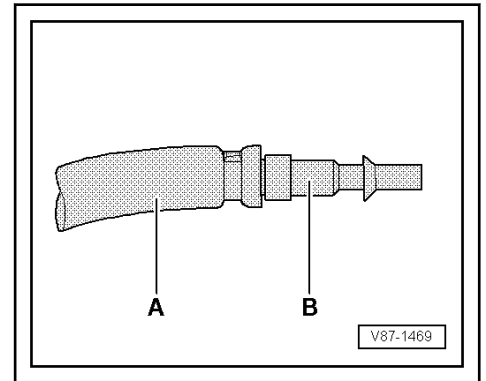
This list provides an overview of the test equipment, tools and materials required for the professional repair of the refrigerant circuit.

Overview	Page
Filling hose with connection for workshop compressed air system	not shown

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Filling hose with connection for workshop compressed air system



A - Filler hose 5/8" - 18 UNF* (version with large inner diameter)

B - Connection for workshop compressed air** (only operate with filter)

* Tools and materials that are commercially available.



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